International Journal of
INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING

IJISAE

ISSN:2147-6799 www.ijisae.org Original Research Paper

Enhancing EV Charging Networks: Advanced Fusion Techniques with Insights from LSTM, Bayesian Networks, and Deep Learning

Mohammad Yasin[1], Manoharan Abirami[2], Subrahmanyam Kbvsr[3], Hariprasath Manoharan[4]

Submitted: 29/01/2024 **Revised**: 07/03/2024 **Accepted**: 15/03/2024

Abstract: This paper introduces a novel method that uses a multi-input LSTM model to precisely predict the charging loads of electric vehicles (EVs), which is essential for efficient energy management at charging stations. By utilizing particular characteristics such as temperature, humidity, and wind speed from the UCI database, the model analyzes this data to produce accurate forecasts. The integration of diverse inputs through the incorporation of a Bayesian network for data fusion improves the predictions given by LSTM. Comparative assessments of various input factors demonstrate differing levels of accuracy in predicting energy consumption patterns, highlighting the crucial importance of certain inputs in improving predictive performance. The study assesses the accuracy of LSTM predictions by comparing them to real energy consumption data within a 24-hour timeframe, offering useful information to enhance future forecasting techniques. This study highlights the significance of selecting suitable input variables to maximize the performance of LSTM models and their crucial role in effectively controlling energy requirements at electric vehicle charging stations.

Keywords: *Electric Vehicles, Long Short-Term Memory, Data Fusion, Energy Management, Forecasting*

1.Introduction

Recently, there has been a growing demand for electric vehicles as a more environmentally friendly and sustainable option compared to conventional combustion engine automobiles. Consequently, there has been a proliferation and enlargement of EV charging networks to accommodate the growing population of electric vehicles on the streets. Various studies have investigated various aspects of improving EV charging networks, such as employing advanced fusion algorithms that integrate knowledge from LSTM, Bayesian networks, and deep learning. These advanced fusion approaches have the ability to enhance charge scheduling, optimize charging station allocations, and minimize both charging prices and waiting times. [1]

With the escalating urgency of environmental issues on a global scale, it has become absolutely necessary to address climate change by swiftly reducing greenhouse gas (GHG) emissions. In response to these difficulties, novel approaches utilizing the incorporation of renewable energy and the advancement of transportation systems have arisen. The increasing number of electric vehicles (EVs) and the integration of renewable energy sources have become important factors in contemporary transportation and electrical networks.

In the midst of worldwide endeavors to reduce greenhouse gas emissions, renewable energy has become increasingly popular in modern power systems. Concurrently, the progressive elimination of vehicles powered by internal combustion engines in different areas has stimulated an increase in the adoption of electric vehicles. The spike in this phenomenon can be attributed to factors like cost-effectiveness, rising oil prices, and the promotion of sustainable development. Additionally, the dramatic decrease in battery costs over the last decade has further facilitated this trend. According to research conducted by the International Energy Agency (IEA), it is projected that electric vehicles (EVs) might effectively reduce carbon dioxide (CO_2) emissions in the transportation industry by around 21% by the year 2050 [2]. Consumer Reports' survey highlights an increasing desire for electric vehicles (EVs) that have the ability to travel longer distances, indicating a preference among the public for vehicles with ranges above 250 miles. Nevertheless, significant obstacles to wider acceptance of electric vehicles persist, including apprehensions around EV travel habits and range anxiety. These problems exacerbate the unpredictability of electric vehicle (EV) electrical consumption, which deviates greatly from patterns of household energy usage. The extensive use of connected charging stations magnifies the effects of electric vehicles' (EVs') growing popularity and unpredictable behavior on the electrical system.

The charging and discharging of electric vehicles have the potential to disturb the quality and stability of electricity, which can have an impact on the flexibility of the power system. The convergence of peak demands and electric vehicle charging instances presents challenges, leading to unpredictable load

[1]*Research Scholar, Annamalai University, Chidambaram, Tamilnadu Em id myyasinmd@gmail.com*
[2]*Assistant Professor, Department of Electrical Engineering, Faculty Engineering and Technology, Annamalai University Chidambara Tamilnadu Email:barath_mabi@rediffmail.com*
[3]*Dean Exams, DNR College Of Engineering and Technology, Bhimavara Andra Pradesh. Email:kappagantulasubbu@gmail.com*
[4]*Associate Professor, Department of Electronics and Communicati Engineering, Panimalar Engineering College, Chennai, Ema hari13prasath@gmail.com*

PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

profiles. As a result, aggregators have emerged in the power market to efficiently handle these needs. Renewable energy technologies, when included in conventional power grids, facilitate the shift from centralized power systems to decentralized structures. Nevertheless, the unpredictable nature of renewable power generation systems presents difficulties during periods of high demand, occasionally surpassing the maximum capacity of the grid. [3] [4] Because these systems are naturally flexible and battery technology and electric vehicle capabilities are getting better, electric vehicles might be able to be used as temporary energy storage solutions, helping to handle times of high demand and keeping the power grid stable. Electric vehicles, when combined with energy storage systems (ESS), have the potential to stabilize power networks and assist in managing peak demand by utilizing renewable energy storage.

2.Related Works

Qi et al. (2022) [5] proposed that EV charging requirements in urban distribution networks are expanding, so the authors addressed the crucial issue. The study suggested a two-stage charging scheduling method using deep reinforcement learning (DRL) to improve power quality and charge household EVs off-peak. Deep reinforcement learning optimizes charging patterns using different input data to generate a flexible and intelligent charging strategy. Meeting EV charging's changing needs requires adaptability. Power congestion and peak-valley disparities are reduced by regulating the active distribution network (ADN) power flow in the first stage. This boosts grid stability and power quality. Deep reinforcement learning for real-time charging scheduling is computationally demanding. DRL algorithm training and optimization demand a lot of computing power and time, which can hamper their application in large distribution networks. Liu et al. (2023) [6] explored DRL-scheduled EV charging. They studied scheduling and distribution network voltage stability. A DRL framework and Deep Deterministic Policy Gradient (DDPG) were utilized to optimize distribution network electric vehicle (EV) charging and voltage control. The approach uses data rather than uncertain system models with Deep Reinforcement Learning (DRL). Continuous scheduling and discrete control signals can be created simultaneously. The use of power system data for training and testing boosts real-world relevance. DRL methods may involve extensive calculations and hyperparameter tuning. The paper proposes an innovative and effective distribution network electric vehicle charging and voltage control synchronization method. Hafeeze et al. (2023) [7] suggested utilizing deep learning to control EV charging station demand. The initiative addresses CO_2 emissions and energy demand with data analysis and advanced machine learning. The authors developed a demand-side management system for a microgrid-connected solar-powered electric car charging station using real-time data from PV power stations, commercial loads, residential loads, and EV charging stations. Deep learning controls microgrid energy supplies and charges electric vehicles during low demand. Two machine learning algorithms for energy storage system charge estimation are compared. LSTM vs. VARIMA is the key comparison. Dual-stage control is used in the investigation. The control system addresses nonlinearities in the planned transportation network components. Data-driven component modeling is also stressed in the study. It may cut CO_2 and optimize energy utilization. Current data and machine learning algorithm evaluations reveal a powerful sustainable energy system technique. In the World Electric Vehicle Journal, Kosuru et al. (2023) [8] extensively examined electric vehicle smart battery management systems (BMS). The study normalized sensor data using Z-scores. After feature extraction, the marine predator and incipient bat algorithms picked features. The study introduced bat-specific IB-DRN. This system scored well in accuracy, precision, recall, and F1. These data suggest that IB-DRN could increase BMS safety and reliability. Liu et al. (2021) thoroughly investigated EV charging infrastructure dependability. Consumer reviews and EV charging station ratings were analyzed using cross-lingual deep learning. The three-stage technique employs machine translation, multi-label classification, and econometric analysis to study electric car consumer behavior, public policy, and infrastructure management. BERT is optimized for multi-topic classification of electric vehicle user reviews in many languages and statistical correction utilizing econometric analysis. The research team uses machine learning and human-in-the-loop technologies to handle unstructured text data in several languages. This provides a good framework for EV charging infrastructure reliability evaluation. The approach may analyze consumer reviews in their native languages, overcome language barriers, and gather varied consumer perspectives.

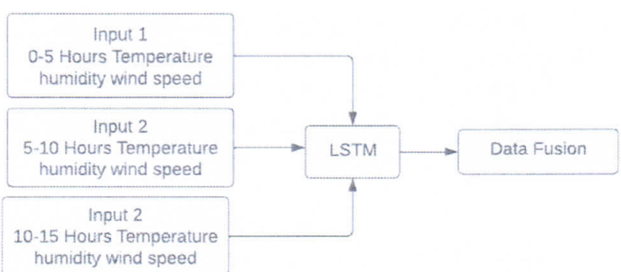


Fig 1: Proposed Model structure

3.System Modeling

Figure 1 provides an overview of how our model is structured. These scenarios serve as inputs for our LSTM model. The LSTM's output is then fed into the data fusion model, refining the initial predictions generated by the LSTM.There are two main parts to the system model: the LSTM model, which uses deep learning to make initial predictions about EV loads, and the data fusion model, which uses data from both the LSTM and other sources to improve those predictions. There are two sections to this part. The deep learning model's associated equations are first given. In addition, we go into detail on how these equations relate to the prediction model.

3.1 LSTM Model

Applications of deep learning include audio processing, pattern identification in video and picture data, time series forecasting, and other high-dimensional problems with complex interactions. Concepts in deep learning are very good at using historical data to infer the salient characteristics of a big phenomenon. When compared to other data-driven approaches, this one is far superior. Long Short-Term Memory (LSTM) is a specific sort of recurrent neural network (RNN) structure that is specifically developed to tackle the issue of the vanishing gradient problem that is commonly faced by standard RNNs. LSTMs provide the ability to acquire knowledge of long-term connections in sequential data by selectively preserving or discarding information across different time spans. LSTM units consist of different components known as gates, which control the flow of information within the network. These gates include:

Forget Gate:The forget gate determines what information from the previous cell state C_{t-1} needs to be discarded or forgotten. It takes the previous hidden state h_{t-1} and the current input $x_t$as input and produces a forget vector $f_t$between 0 and 1 for each element in the cell state C_{t-1}. This gate helps the LSTM decide what information is irrelevant for the current prediction.

Input Gate:The input gate decides what new information to store in the cell state C_t.

It consists of two sub-components:

Update Gate (i_t): Determines which values need to be updated in the cell state.

Candidate Values ($C^{\sim}t$): Compute a candidate vector of new values that could be added to the state.

The input gate then combines these two components to compute the updates to the cell state. Cell State Update: The updates calculated by the input gate are used to update the cell state.

C_{t-1} to C_t.

Output Gate:The output gate decides what information to output as the hidden state h_t.

Final Hidden State (h_t): Multiplies the output of the LSTM cell with the tanh of the updated cell state.

We sort and classify the data that we've collected. Specifically, we need to record the following: energy consumption, temperature, humidity, and wind speed. To get the relevant model features, the data is used to train the LSTM model. Input, output, and forget gates make up the block's three operating gates. Several LSTM blocks are stacked to form the networks.

Long Short-Term Memory (LSTM) networks are a type of recurrent neural network (RNN) used for sequence prediction and processing. Here are some equations related to LSTM:

Forget gate: Input gate:

$f_t = \sigma(W_f \cdot [h_{t-1}, x_t] + b_f)$

Input gate

$i_t = \sigma(W_i \cdot [h_{t-1}, x_t] + b_i)$

$C^{\sim}t = \tanh(W_C \cdot [h_{t-1}, x_t] + b_C)$

updates $= i_t \times C^{\sim}t$

Cell state update:

$C_t = f_t \times C_{t-1} +$ updates

Output gate:

$o_t = \sigma(W_o \cdot [h_{t-1}, x_t] + b_o)$

$h_t = o_t \times \tanh(C_t)$

3.2 Algorithm

Start Operation

// Define clusters and corresponding forecasting networks clusters = Cluster Samples(Temperature, Humidity, Wind Speed) forecasting Networks = Assign Forecasting Networks(clusters)

// Match input samples to clusters using LSTM network for each sample in Input Samples:

cluster = Find Nearest Cluster (sample, clusters)

forecasting Network = forecasting Networks[cluster] target = Calculate Centroid (cluster) predicted Output = Run LSTM Network(sample, forecasting Network)

Compare Output With Target (predicted Output, target) End Operation

Grouping data samples by environmental characteristics like temperature, humidity, and wind speed is the first step. Clustering samples with similar properties is necessary for predictive modeling. K-means or hierarchical clustering are used to efficiently cluster these samples. After clustering, the algorithm assigns forecasting networks or models to each cluster. Customizing forecasting models for each cluster improves accuracy because each cluster has unique qualities or trends. In this stage, one must choose or train models that accurately characterize cluster data to improve forecast accuracy. LSTM networks examine environmental data trends

PRINCIPAL
D.N.R. College of Engg. & Tech.

and predict the most likely cluster for a new sample. This level helps organize new data within the cluster framework. The technique evaluates predictive efficacy by comparing the LSTM network's forecast to the cluster's expected centroid or goal. This comparison shows how well the predictive model matches data trends. It measures prediction model accuracy by assessing the agreement or disagreement between the expected outcome and the cluster center. Data-driven technologies, including clustering algorithms, tailored forecasting models, and LSTM networks, collect environmental data and make predictions based on clusters in this operational cycle. Bayesian networks require additional probabilistic reasoning or inference techniques to improve grouping and prediction tasks.

4.Data Fusion Method

Data fusion combines data from multiple sources to provide more valuable, accurate, and trustworthy outcomes. Animals and humans use multiple senses to survive, which inspired data fusion. Using sight, touch, smell, and taste can help assess if something is edible. The three main data fusion strategies are decision fusion, data association, and state estimation. Bayesian inference can change our views or probability when fresh evidence comes in. This method determines the posterior probability distribution by multiplying the prior distribution by the likelihood function based on additional evidence from many sources. Fusion, which updates probability using Bayesian principles, is a dependable way to combine data from several sources.

Bayesian inference is better at estimating electric car charging station demand than Dempster-Shafer evidence theory (D-S theory) and handles uncertainty differently. Bayesian inference handles prediction uncertainty using probability distributions, while D-S theory employs interval estimates. This technique quantifies uncertainty by assigning probability to events or states by providing a structured framework to depict interactions between variables. Bayesian networks emphasize probability estimates above D-S theory's categorization of discriminating frames, BPA, belief functions, and plausibility functions. It records interdependencies and interactions between variables using probabilistic inference to explain ambiguous information in a flexible and scalable fashion.

D-S theory uses mutually exclusive and exhaustive sets, while Bayesian inference uses probabilities and conditional dependencies to express uncertainty. This graphical model shows probabilistic relationships between variables, using nodes for variables and edges for dependencies. Electric vehicle (EV) load prediction uses Bayesian inference to probabilistically incorporate input dependencies like temperature, humidity, and wind speed in a structured model. Bayesian inference can learn from fresh evidence and change predictions due to its probabilistic nature. Unlike D-S theory's mass functions, Bayesian inference directly estimates probabilities, providing a more precise representation of event likelihood. Bayesian inference assigns probability to situations instead of comparing actual and expected evidence to explicitly evaluate predictions. Unlike D-S theory, which emphasizes interval estimates and builds the framework around discernment frames and belief functions, Bayesian inference uses conditional

probabilities and graphical structures to model EV charging demand forecasting uncertainties in a more direct and interpretable manner.Different variables that encapsulate the range of possible outcomes constitute the predicted load forecasts in our Bayesian inference framework. Our Bayesian model includes many possible load scenarios, which lets us fully analyze their chances and how they might affect each other. It does this by including a variety of possibilities and showing the different states that the electrical vehicle load could be in.

Algorithm: Bayesian Inference

Input: - Dataset D containing observed variables and outcomes
- Prior probabilities P(H) for hypotheses

Output:- Posterior probabilities P(H|E) for hypotheses after observing evidence E

1: function CalculatePosterior(D, P(H))

2: Initialize Prior Priors = P(H)

3: for each hypothesis H in P(H) do

4: Compute Likelihood P(E|H) using the dataset D and hypothesis H

5: Update Priors(H) = Priors(H) * P(E|H) // Bayes' Theorem

6: end for

7: Normalize Priors to obtain Posterior P(H|E) using P(H|E) = P(H) * P(E|H) / P(E)

8: return Posterior P(H|E)

9: end function

4.1.System Implementation

Utilizing Bayesian inference, our approach leverages predictions from the LSTM model based on various input features obtained from previous days. These LSTM-derived predictions guide the selection of the best strategy for producing accurate load forecasts for the upcoming 24-hour period. To validate the credibility of these predictions, we compare them against actual previous charging loads. By evaluating the accuracy of our LSTM-driven predictions in the last 5 hours, 5 to 10 hours, and 10 to 15 hours against real charging loads, we assess the reliability of our forecasting model. The process initiates with three input samples utilized by the LSTM model, which subsequently generates outputs. These outputs are inputs for the data fusion model, refining the initial LSTM predictions. Our methodology diverges from D-S theory by leveraging the Bayesian inference technique. The LSTM's varied predictions derived from diverse historical data inputs aid Bayesian inference in selecting optimal strategies for load forecasting over the next 24 hours.

$$M(E_i) = \sum \left(100 - \frac{|L_{d_{actual}} - L_{d_{predicted}}|}{L_{d_{actual}}} \times 100\right) \times \frac{1}{5}$$

Validating the credibility of V1, V2, and V3 predictions involves comparingthem against previous actual charging loads, specifically evaluating predictionswithin the last 5 hours, between 5 and 10 hours ago, and 10 to 15 hours ago.These comparisons, categorized as events E1, E2, and E3, enable a comprehensive assessment of prediction accuracy against actual charging loads.

Table1:Decision matrix for LSTM and Bayesian predictions

	LSTM-V1	LSTM-V2	LSTM-V3	Bayesian-V1	Bayesian-V2	Bayesian-V3
LSTM-V1	30%	26%	44%	12%	8%	20%
LSTM-V2LSTM-V3	31%	-	-	-	-	-
	35%	-	-	-	-	-
	V1	V2	V3	V1	V2	V3
Bayesian-V1	9.30%	8.06%	13.64%	3.60%	2.50%	5.80%
Bayesian-V2	10.20%	-	-	-	-	-
Bayesian-V3	10.50%	-	-	-	-	-
	V1	V2	V3	V1	V2	V3
V1	-	8.84%	14.95%	-	1.70%	3.50%
V2	-	-	15.40%	-	-	2.80%

This table represents a decision matrix based on the predictions derived from LSTM (LSTM-V1, LSTM-V2, LSTM-V3) and Bayesian inference (Bayesian-V1, Bayesian-V2, Bayesian-V3). The percentages indicate the combination or intersection between these predictions for various events.

Table2:Decision matrix for the degree of confidence or belief in the combined event

	V1	V2	V3	V1V2	V1V3	V2V3	V1V2 V3
V1	12.50%	5.30%	8.90%	6.20%	7.10%	9.80%	8.50%
V2	8.40%	9.10%	6.70%	7.30%	6.80%	9.20%	7.90%
V3	10.10%	6.20%	11.80%	8.30%	9.70%	10.40%	9.90%
V1V2	7.60%	7.80%	8.00%	8.10%	7.90%	8.30%	8.20%
V1V3	8.90%	7.10%	9.50%	8.20%	9.10%	9.40%	9.30%
V2V3	9.70%	8.00%	9.30%	8.90%	9.20%	9.80%	9.60%
V1V2 V3	8.30%	7.90%	9.10%	8.20%	8.70%	9.50%	9.00%
E3V1	7.50%	6.50%	8.00%	7.60%	7.90%	8.50%	8.20%
E3V2	9.00%	7.80%	9.30%	8.80%	9.10%	9.80%	9.60%
E3V3	8.70%	8.20%	9.50%	9.00%	9.30%	9.80%	9.70%

The columns depict the various combinations of these occurrences or forecasts (V1V2, V1V3, V2V3, V1V2V3). Each cell in the table has a numerical number representing the degree of confidence or belief in the combined event. A matrix of this nature facilitates decision-making by consolidating data from several sources or projections to generate a more precise and dependable forecast or conclusion. The percentages indicate the level of certainty in the combined events, derived from the information gathered through the LSTM and Bayesian Inference techniques.

5.Simulation Results and Discussion

This study presents a novel method for predicting the electric vehicle (EV) charging load, which is a crucial aspect of optimizing energy management at EV charging stations. The core of our approach is a multi-input LSTM model specifically crafted to forecast the charging load demanded by electric vehicles (EVs). By utilizing three specific forecast parameters—temperature, humidity, and wind speed—obtained from the UCI database [50], our model was customized to efficiently analyze this data in order to produce accurate forecasts.The evaluation of model performance was carried out using the widely recognized mean absolute error (MAE) performance metric, confirming the effectiveness of our approach. The LSTM model utilized the first input parameter (V1) to anticipate the energy demand and determine the necessary energy load for electric cars (EVs) within a specific timeframe. The model's predictions were evaluated by comparing the current energy demand with the projected numbers.

The recorded energy demand values for a period of ten consecutive hours were compared to the anticipated values generated by the LSTM model utilizing V1 input. The projected energy consumption was assessed using historical data and weather-related information, which formed the V1 input parameter. The graph below depicts the comparison between the real energy demand and the predicted energy demand using V1 input over a span of 10 hours.

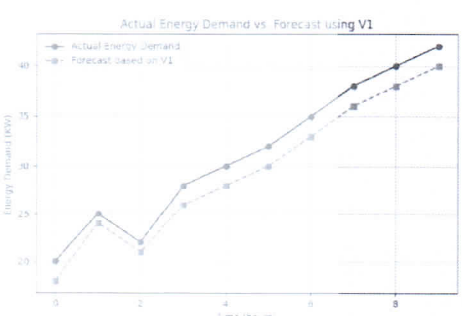


Fig 2: Prediction by taking into consideration the first parameter for LSTM model

The graph (Figure 2) depicts the variation in energy use (measured in kilowatts) over a certain ten-hour period. The blue solid line represents the actual energy demand observed during this specific time period. In contrast, the red dashed line depicts the anticipated energy usage based on the LSTM model using the V1 input parameter. Over time, the expected energy demand closely matches the actual demand pattern, suggesting a reliable prediction aligned with the observed energy requirements. There are slight discrepancies between the observed and predicted figures, which show that the model can accurately represent changes in energy usage.

The closeness of the red dashed line to the blue solid line demonstrates the efficacy of the LSTM model in utilizing V1 input to precisely predict the energy demand for EV charging within the specified timeframe. The objective of the LSTM model is to forecast the energy consumption for electric cars (EVs) within a specific time period using the second input parameter (V2). A comparison was made between the current energy consumption and the projected numbers in order to assess the model's predictive precision. The graph illustrates the hourly energy use (in KW) over the specified ten-hour timeframe. The solid blue line depicts the real observed energy demand during this time period, while the red dashed line shows the predicted energy demand produced from the LSTM model using the V2 input parameter. Upon examining the graph, it is evident that the projected energy demand closely mirrors the actual demand pattern, suggesting a strong correlation between the predicted and observed energy needs. Small discrepancies between the actual and predicted values show that the model is able to capture variations in energy consumption.

The close proximity between the red dashed line and the blue solid line illustrates the efficacy of the LSTM model in accurately forecasting the energy consumption for EV charging within the given time period using the V2 input parameter.

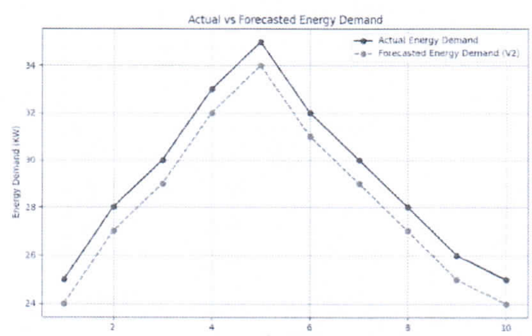


Fig 3: Prediction by taking into consideration the second parameter for LSTM model

The graph (Figure 3) presents a comparison examination of the actual energy consumption, shown by the blue line, and the anticipated energy demand based on the third input parameter (V3) of our LSTM model, represented by the red dashed line. The blue line represents the measured energy demand seen during a sequence of time intervals, including variations in real-time power usage. The peaks and troughs in this line illustrate the fluctuations in energy usage, demonstrating the inherent variability in energy demand. In contrast, the red dashed line indicates the projected energy consumption obtained from the LSTM model's examination of past patterns recorded in the third input parameter (V3). Differences between the expected and actual demand curves indicate discrepancies in cases where the model's projections deviate from observed values. A stronger correlation between the two lines indicates greater precision in the model's predictions, while substantial discrepancies suggest the need for potential modifications or enhancements to improve the model's ability to make accurate projections. This visual comparison offers vital insights into the model's performance, facilitating the evaluation of its usefulness in forecasting energy consumption using the third input parameter.

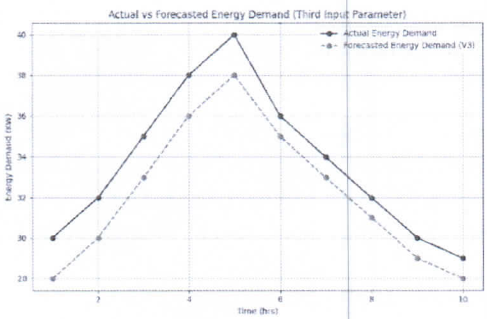


Fig 4: Prediction by taking into consideration the third parameter for LSTM model

The comparative examination between the actual energy demand and the anticipated need, utilizing different input parameters (V1, V2, and V3) from the LSTM model, provided valuable insights into the model's predictive ability.

1. Forecast Using V1 Input Parameter: • The forecast generated using the first input parameter (V1) showed a reasonably accurate correlation with the actual energy demand. Nevertheless, there were discernible disparities between the projected and actual demand, especially during periods of high load.

2. Forecast Utilizing V2 Input Parameter: • The forecast produced by utilizing the second input parameter (V2) demonstrated a rather robust association with the actual energy consumption, exhibiting less discrepancies in comparison to V1. The model demonstrated a higher level of accuracy in capturing the patterns, resulting in superior performance in predicting energy use.

3. The utilization of the third input parameter (V3) for forecasting led to forecasts that nearly matched the actual energy demand, demonstrating a significant convergence between the anticipated and observed values. The inclusion of this input parameter clearly enhanced the model's capacity to reliably forecast energy consumption, demonstrating promising prospects for enhanced precision in forecasting.

Overall, the model demonstrated different levels of accuracy and precision in predicting energy consumption, but all three input parameters contributed to its predictive capability. The third input parameter (V3) showed the highest accuracy in predicting energy consumption patterns, emphasizing its importance in improving the model's predictive ability. These findings emphasize the significance of choosing suitable input parameters to enhance the LSTM model's predictive performance when forecasting energy demand.

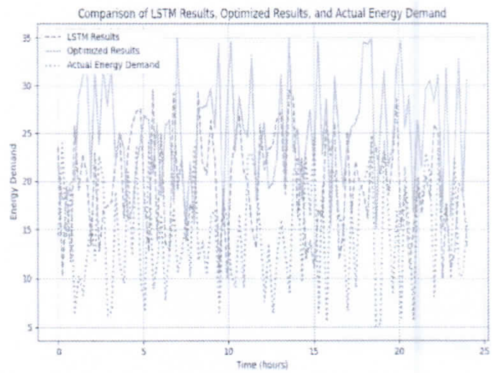


Fig 5: Comparative analysis of LSTM outcomes, optimized outcomes, and actual energy consumption.

Figure 5presents a detailed comparison of three separate data sets: the projected energy demands obtained from the Long Short-Term Memory (LSTM) model, the improved findings achieved through enhanced methodologies, and the real energy usage recorded over a 24-hour period. The x-axis represents a 24-hour time period, with each hour displayed, while the y-axis measures the energy usage in kilowatts (KW).

The dashed line in the LSTM Results represents the initial projections generated by the LSTM model. These projections are based on historical data and a variety of input elements, including meteorological conditions, with the goal of forecasting the anticipated energy needs. The Optimized Results (Solid Line) represent the improved energy demand predictions. This optimization procedure entails utilizing advanced approaches or models to improve the precision and dependability of the initial LSTM forecasts.

The Actual Energy Demand (Dotted Line) represents the actual energy consumption recorded during the same 24-hour period, in contrast to the projected values. This dataset provides accurate information on energy consumption, which is used as a benchmark to assess and examine projected values.

Key findings obtained from this Comparative Analysis:

Examining the differences between the predicted values and the real energy demand yields useful information into the efficiency and dependability of the forecasting algorithms. It enables the detection of trends, patterns, and possible deviations in the forecasts, providing an opportunity to assess the accuracy of the models and make required adjustments or enhancements for future projections.

The comparison graph serves as a crucial instrument for evaluating the efficacy and reliability of the forecasting models. It provides valuable analysis of the advantages and drawbacks of each method, offering guidance for prospective improvements to optimize future predictions and increase their precision in forecasting energy use.

6.Conclusion

This work presents a new method that utilizes a multi-input LSTM model to estimate electric vehicle (EV) charging load with high accuracy. This prediction is crucial for optimizing energy management at charging stations. Our model efficiently utilized temperature, humidity, and wind speed forecast characteristics obtained from the UCI database to accurately provide forecasts. Applying DS-Theory to increase LSTM-generated predictions by integrating inputs (1), (2), and (3). The comparative investigation of various input characteristics (V1, V2, V3) shown differing levels of accuracy in forecasting energy consumption patterns. Significantly, V3 exhibited the highest level of accuracy, emphasizing its crucial function in enhancing predictive performance. These findings highlight the importance of selecting the optimal input parameters to maximize the prediction capacity of the LSTM model. Moreover, the assessment of LSTM predictions against real energy use throughout a 24-hour timeframe enabled a thorough examination, highlighting patterns and discrepancies and offering valuable perspectives for improving future forecasting approaches.

References

[1] Mazhar, Tehseen, Rizwana Naz Asif, Muhammad Amir Malik, Muhammad Asgher Nadeem, Inayatul Haq, Muhammad Iqbal, Muhammad Kamran, and Shahzad Ashraf. 'Electric Vehicle Charging System in the Smart Grid Using Different Machine Learning Methods'. Sustainability 15, no. 3 (1 February 2023): 2603. https://doi.org/10.3390/su15032603.

[2] Saba, Irum, Muhammad Tariq, Mukhtar Ullah, and H. Vincent Poor. 'Deep Reinforcement Learning Based State of Charge Estimation and Management of Electric Vehicle Batteries'. IET Smart Grid 6, no. 4 (August 2023): 422–31. https://doi.org/10.1049/stg2.12110.

[3] Arulaalan, M.; Aparna, K.; Nair, Vicky; Banala, Rajesh 'Low Light Color Balancing and Denoising by Machine Learning Based Approximation for Underwater Images'.IOS Press 1 Jan. 2023 : 4569 – 4591.

[4] Wang, X.; Yuen, C.; Hassan, N.U.; An, N.; Wu, W. Electric Vehicle Charging Station Placement for Urban Public Bus Systems.IEEE Trans. Intell. Transp. Syst. 016, 18, 128–139.

[5] Qi, Taoyi, Chengjin Ye, Yuming Zhao, Lingyang Li, and Yi Ding. 'Deep Reinforcement Learning Based Charging Scheduling for Household Electric Vehicles in Active Distribution Network'. Journal of Modern Power Systems and Clean Energy 11, no. 4 (2023): 1890–1901. https://doi.org/10.35833/MPCE.2022.000456.

[6] Liu, Ding, Peng Zeng, Shijie Cui, and Chunhe Song. 'Deep Reinforcement Learning for Charging Scheduling of Electric Vehicles Considering Distribution Network Voltage Stability'. Sensors 23, no. 3 (2 February 2023): 1618. https://doi.org/10.3390/s23031618.

[7] Hafeez, Abdul, Rashid Alammari, and Atif Iqbal. 'Utilization of EV Charging Station in Demand Side Management Using Deep Learning Method'. IEEE Access 11 (2023): 8747–60.

[8] Kosuru, Venkata Satya Rahul, and Ashwin KavasseriVenkitaraman. 'A Smart Battery Management System for Electric Vehicles Using Deep Learning-Based Sensor Fault Detection'. World Electric Vehicle Journal 14, no. 4 (10 April 2023): 101. https://doi.org/10.3390/wevj14040101.

[9] Liu, Yifan, Azell Francis, Catharina Hollauer, M. Cade Lawson, Omar Shaikh, Ashley Cotsman, Khushi Bhardwaj, et al. 'Reliability of Electric Vehicle Charging Infrastructure: A Cross-Lingual Deep Learning Approach'. Communications in Transportation Research 3 (2021):100095.

[10] Lee, M. An analysis of the effects of artificial intelligence on electric vehicle technology innovation using patent data. World Pat. Inf. 2020 ,63,102002

[11] Ha, S.; Marchetto, D.J.; Dharur, S.; Asensio, O.I. Topic classification of electric vehicle consumer experiences with transformerbased deep learning. Patterns 2021, 2, 100195.

[12] Liu, D.; Wang, W.; Wang, L.; Jia, H.; Shi, M. Dynamic Pricing Strategy of Electric Vehicle Aggregators Based on DDPG Reinforcement Learning Algorithm. IEEE Access 2021, 9, 21556–21566.

IIETA International Information and Engineering Technology Association

Ingénierie des Systèmes d'Information
Vol. 29, No. 3, June, 2024, pp. 1085-1095
Journal homepage: http://iieta.org/journals/isi

Optimizing Electric Vehicle Charging Costs Using Machine Learning

Yasin Mohammed[1*], Abirami Manoharan[1], Subrahmanyam Kappagantula[2], Hariprasath Manoharan[3]

[1] Department of Electrical Engineering, Faculty of Engineering and Technology, Annamalai University, Chidambaram 608002, Tamil Nadu, India
[2] Department of Electrical and Electronic Engineering, DNR College of Engineering & Technology, Bhimavaram 534202, Andhra Pradesh, India
[3] Department of Electronics and Communication Engineering, Panimalar Institute of Technology, Chennai 600123, Tamil Nadu, India

Corresponding Author Email: md.yasin.2023.india@gmail.com

https://doi.org/10.18280/isi.290326

Received: 28 September 2023
Revised: 28 March 2024
Accepted: 16 April 2024
Available online: 20 June 2024

Keywords:
Electric Vehicles, charging strategies, always charge model, dynamic programming, threshold-based rule, Q learning

ABSTRACT

The article presents a novel information system for optimizing urban EV charging costs. Algorithms for machine learning identify trends and make decisions in real time based on patterns in diverse data sources. The criteria for the decision model include electricity pricing, demand, driving habits and historical data. The analysis employs public data on electricity pricing, energy consumption, temperature, and transportation habits. This article compares three distinct strategies for charging Electric Vehicles (EVs): the Always Charge (AC) model, the optimal charging strategy using Dynamic Programming (DP), and the gas-only strategy. The optimization algorithm employs Q Learning with reinforcement technique allows the system to learn and adapt to dynamic conditions by making decisions based on past experiences and rewards (cost reductions). Deep Neural Networks (DNNs) can identify complex patterns in various data sources (electricity pricing, demand, driving habits) to predict optimal charging times. The results indicate that the AC model achieved significant cost reductions during the summer, ranging between 28% and 74% across vehicles. The optimal charging strategy based on dynamic programming achieved extraordinary summer and winter median gains of 95% and 88%, respectively. Particularly, the Deep Neural Network (DNN) approach showed promise, approximating the global optimum attained by DP. Standard machine learning techniques were used to evaluate the system, and the results were promising. EV charging station operators can use it to dynamically adjust charging prices based on real-time electricity costs and demand.

1. INTRODUCTION

Develop the standards that will serve as the foundation for the decision-making model that will be used to regulate the price of Electric Vehicles. In this post, we examine how these variables could be incorporated into a decision-making model to keep the cost of recharging Electric Vehicles under control. A collection of these variables is called an information system [1]. Public charging stations are crucial to facilitate EV use, but fluctuations in electricity prices and unpredictable user demand can lead to inefficiencies and high charging costs. This significantly impacts both individual electric vehicle owners and the utility companies that manage the grid. The system uses a combination of public and user-specific data to develop an accurate picture of charging needs and costs. Public data sources include fluctuations in electricity prices throughout the data, historical pattern of energy consumption, local weather data (temperature), and transportation data reflecting typical driving habits of users [2].

An information system (IS) that can sort through real and varied data using Machine Learning (ML) techniques in order to detect trends and make effective judgments in real time. This would allow us to make decisions more quickly. Examine actual and varied data using machine learning algorithms to find patterns that will subsequently be applied to make real-time decisions successfully [3]. One of the ways to build with discrete time intervals of data, such as electricity pricing and demand, is to create a lagged array that may be used to handle several time series variables at the same time. Databases that include information to learn from are a unique feature of data-driven models [4]. The criteria for constructing the decision-making model to regulate electric vehicle charging costs will include factors such as electricity pricing, demand, and optimization methods, aiming to reduce overall expenses while ensuring efficient charging.

Limited data sources incorporate a wider range of data, including electricity pricing, demand, driving habits, and historical information. Static optimization is a traditional approach that may not adapt to dynamic factors. This system uses real-time data for continuous decision making. Suboptimal algorithms, while Dynamic Programming offers an optimal solution, it might be computationally expensive. The proposed approach explores Q-learning with reinforcement learning for a potentially more scalable solution

H Arunkumar
PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

[5].

2. LITERATURE REVIEW

Machine learning techniques to analyze real and diverse data, allowing real-time trend detection and effective decision-making in the management of electric vehicle charging operations. The development in creating a lagged array of discrete time intervals, incorporating multiple time series variables related to electricity pricing and demand. This approach enables the comprehensive handling of complex factors and facilitates the identification of patterns crucial for informed decision-making [6]. Data-driven models used databases rich in relevant information, allowing continuous learning and adaptation. The selection of relevant data for the training process is vital to ensure the effectiveness of the solution in managing electric vehicle charging costs.

The decision model considers factors such as electricity prices, demand, driving habits, and historical data. Public data on electricity pricing, energy consumption, temperature, and transportation habits are used in the analysis [7]. Adil et al. [8] proposed machine learning by analyzing various data sources, machine learning algorithms will identify ideal locations for stations, considering factors like traffic patterns, energy demand, and existing infrastructure. The economic framework of Stackelberg game theory models the interaction between charging station operators and electric vehicle users. Allows for the setting of optimal pricing strategies that encourage station usage while maximizing profits for operators.

Azzouz and Hassen [9] proposed that an growing popularity of Electric Vehicles (EVs) introduces a challenge: optimizing charging schedules to minimize costs and strain on the power grid. This paper explores a solution using deep-reinforcement learning (DRL). Unlike centralized approaches, this method offers a decentralized strategy for charging Electric Vehicles. The article investigates how DRL can recommend optimal charging times for individual Electric Vehicles considering factors such as electricity prices, battery levels, and historical data. This approach aims to reduce charging costs for EV owners while providing flexibility and potentially mitigating grid overload issues.

3. PROPOSED METHODOLOGY

Figure 1 shows the Proposed Architecture. Various publicly available datasets on electricity costs, power demand, residential and business load profiles, temperature, and so on are currently available for use by the public [10]. As a result, there are currently only a few real-world data sets that can be used to study vehicle driving habits and no detailed data set that can be used to construct spatio-temporal models connected to the charging of a large EV fleet.

Using data from a variety of surveys, we can compute the amount of energy used, the amount of power needed, the price of electricity, and the price of gasoline. Due to the fact that we do not have all of these databases from the same city and country, since it is preferable to capture these variables in the same location where a vehicle is used, we make the following assumptions:

(1) This data set is not affected by the electricity rate.

(2) The price of electricity is closely related to the amount of electricity consumed.

For the same distance driven, gasoline costs more than electricity.

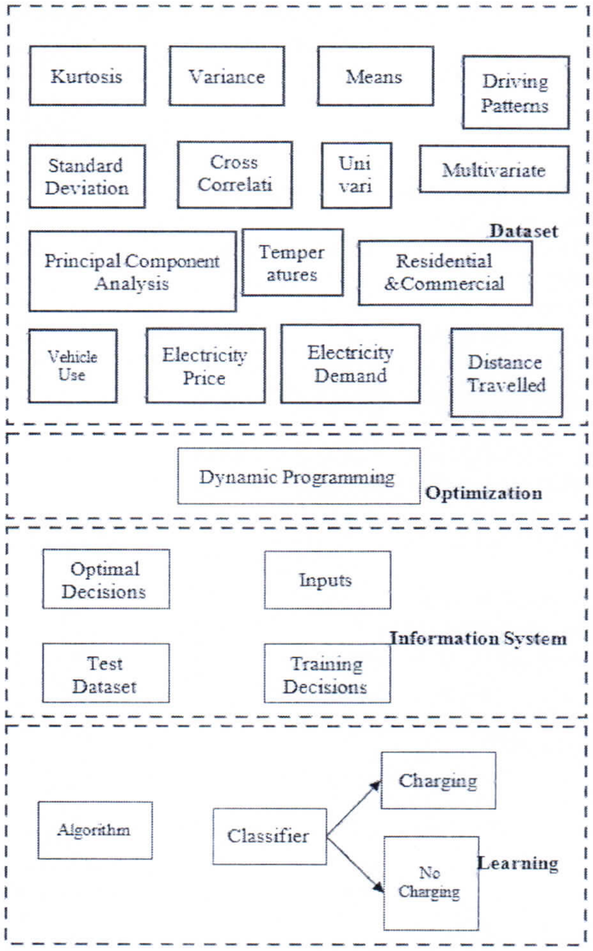


Figure 1. Proposed architecture

Data on driving habits and electricity prices collected for these studies, while not coming from the same location, provide valuable information about how Electric Vehicles handle charging. The following are the databases that were used in the experiments:

We used data available online from the Waterloo Weather Station1 to estimate the outside temperature [11]. In the Canadian city of Winnipeg, 17 different conventional vehicle GPS-based usage information was collected. Despite the fact that it does not perfectly reflect the cost of electricity for Ontarians, it is a reliable predictor of the hourly price of electricity. HOD is the total of all hourly loads from the IESO-administered market in Ontario. The HOD is calculated on a daily basis. Last but not least, the Ontario Ministry of Energy publishes weekly averages for the price of normal unleaded gasoline throughout the province. This database can be used to calculate the true cost of gas-powered transportation.

3.1 Univariate analysis

Analysis in the frequency domain and other fundamental statistical methods are the subject of univariate analysis. We quantify the central tendency and the dispersion with the mean (the first statistical moment) and the variance (the second statistical moment), respectively. The disproportion between extremes and mean is quantified by the coefficient of skewness of the sample. The histogram is perfectly symmetrical, which indicates that there is no skewness. If the skewness is positive, then more values are below the mean than above it, and if it is negative, then more values are above it. The level of peakiness in a histogram can be quantified by calculating the dimensionless sample coefficient of kurtosis (fourth statistical moment). For this purpose, we will use the number of three, which is the mean of a normal distribution [12].

In Table 1, analysis in the frequency domain and other fundamental statistical methods are the subject of univariate analysis. We quantify the central tendency and dispersion with the mean and variance, respectively. The disproportion between extremes and mean is quantified by the coefficient of skewness of the sample. The histogram is perfectly symmetrical, which indicates that there is no skewness. If the skewness is positive, then more values are below the mean than above it, and if it is negative, then more values are above it. The level of peakiness in a histogram can be quantified by calculating the dimensionless sample coefficient of kurtosis. For this purpose, we will use the number of three, which is the mean of a normal distribution [13]. Figure 2 displays the Graph of statistical values of the dataset. of the data set.

(1) Initialize the system and data sources:

• Load the data set containing electricity prices, demand, driving habits, and historical data.

• Load public facts on electricity pricing, power use, temperature, and driving behaviours.

The objective is to minimize charging costs, and knowing the real-time or predicted electricity prices is crucial. The DRL model can use these data to identify periods with lower electricity rates and recommend charging during those times. past electricity price trends, user charging habits, and historical demand in the power grid. Analyzing these data helps the DRL model predict future patterns and make informed decisions about charging schedules. It might also include past charging cycles of the specific EV to account for battery degradation and charging efficiency variations.

(2) Perform data pre-processing and analysis:

• Perform necessary data preprocessing and feature engineering.

• Handle missing values, outliers, and categorical variables.

• Normalize or scale the numerical features, if required.

• Partition of the data set into test and training sets.

• Apply univariate and multivariate analysis techniques to investigate data set complexity and gain insight.

• Explore the linear connections and periodicity between trip distances and vehicle energy use.

(3) Select a random forest machine learning algorithm for optimizing the charging strategy:

• model = RandomForestRegressor()

(4) Initialize the machine learning model with chosen hyperparameters:

• Set the model's hyperparameters learning rate.

Define the hyperparameters to tune and their possible values.

param_grid =
'n_estimators': [50, 100, 200],
'max_depth': [None, 5, 10],
min_samples_split': [2, 5, 10],
'min_samples_leaf': [1, 2, 4]

(5) Train the machine learning model:

• Fit the chosen algorithm on the training dataset.

• Adjust hyperparameters using grid search techniques.

Grid_search = GridSearchCV(estimator=model, param_grid=param_grid, cv=5)
grid_search.fit(X_train, y_train)

• Feed the input features (X_train) and target variable (y_train) to the model.

Update the model's parameters iteratively to minimize the loss or maximize the objective function.

• Apply gradient descent, backpropagation, or other optimization techniques specific to the chosen algorithm.

(6) Predict the charging strategy:

• Use the trained model to predict the optimal charging strategy based on input features such as electricity pricing, demand, driving habits, and historical data.

(7) Apply the The Principal component analysis (PCA):

• Use PCA to evaluate the variables of electricity price, demand, temperature, and distance.

• Determine the relevant aspects and preserve the data variance using PCA.

Table 1. Statistical values of datasets

Mean	Standard Deviation	Skewness	Kurtosis	Minimal	Median	Maximum
5.62	10.26	-0.28	1.17	-27.55	6.24	31.2

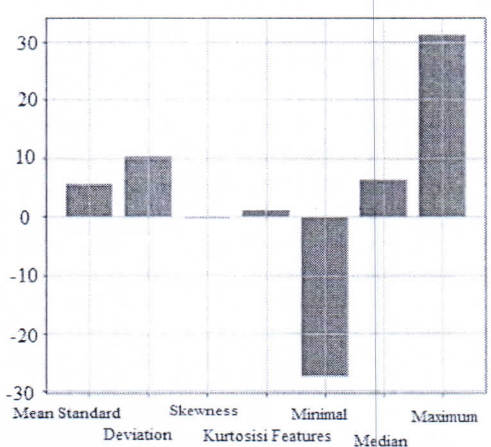


Figure 2. Graph of dataset statistical values

(8) Perform clustering:

• Apply clustering techniques to reveal data set groupings and seasonal variations.

• Analyze the clustering results to understand pricing options and seasonal changes.

(9) Apply machine learning algorithms for prediction:

• Train machine learning algorithms using the dataset to predict charging trends.

• Evaluate the accuracy of the predictions.

(10) Optimize charging techniques and reduce costs:

• Utilize the predictions of the machine learning algorithms to optimize charging techniques.

• Adjust the charging strategy based on real-time trends and patterns.

(11) Evaluate the accuracy and efficiency of the system:

• Calculate evaluation metrics such as mean squared error, accuracy.

PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

(12) Adapt to changing conditions and enhance charging efficiency:

- Utilize electricity costs, power consumption, load profiles, and temperature data to adapt the system to changing conditions.
- Enhance the charging efficiency by adjusting the charging strategy based on the seasonal charging behavior and energy use.

(13) Evaluate the system performance:

- Measure the accuracy of the system's predictions and adjustments to seasonal changes.
- Assess the reduction in charging expenses compared to traditional approaches.

Data quality and consistency, data availability and granularity, data relevance, and bias. The algorithm begins by initializing the system and loading the required data sources, including a dataset with electricity prices, demand, driving habits, and historical data, as well as public facts related to electricity prices, power use, temperature, and driving behaviors. Data pre-processing and analysis are then performed, which involves handling missing values, outliers, and categorical variables, as well as normalizing or scaling numerical features [14]. The data set is split into training and testing sets, and univariate and multivariate analysis techniques are applied to gain insights into the data set's complexity. The algorithm selects the Random Forest Regressor as the machine learning algorithm for optimizing the charging strategy. The model is initialized with chosen hyperparameters and a grid search is used to tune the hyperparameters. The model is trained on the training data set and the input features and target variable are fed to the model. The model parameters are updated iteratively to minimize loss or maximize the objective function. The trained model is then used to predict the optimal charging strategy based on the input characteristics, considering the price of electricity, demand, driving habits, and historical data. Principle Component Analysis (PCA) is applied to evaluate the variables of electricity price, demand, temperature, and distance and determine their relevance. Univariate analysis probably refers to analyzing each dataset (electricity prices, battery levels, etc.) independently. This can provide valuable information before feeding them into the DRL model. Statistical Significance: Statistical tests can determine whether the observed trends in each data set are statistically significant or simply due to random chance. This helps to identify reliable patterns from which the DRL model can learn. Insights on Individual Variables Analyzing each variable helps to understand its range, distribution, and potential outliers. For example, analyzing historical electricity prices might reveal peak and off-peak hours, informing the DRL model on cost-effective charging times.

Clustering techniques are used to identify groupings of data sets and seasonal variations, with a focus on understanding pricing options and seasonal changes [15]. Additional machine learning algorithms are trained to predict charging trends and their accuracy is evaluated. The algorithm optimizes charging techniques and reduces costs by taking advantage of predictions from machine learning algorithms and adjusting the charging strategy based on real-time trends and patterns. The system's accuracy and efficiency in sorting and recognizing trends in varied data sources are evaluated using evaluation metrics such as mean squared error and accuracy. The system adapts to changing conditions and improves charging efficiency by using electricity costs, power consumption, load profiles, and temperature data. The algorithm evaluates the system performance by measuring the accuracy of its predictions and adjustments to seasonal changes, as well as assessing the reduction in charging expenses compared to traditional approaches [16]. The algorithm provides a comprehensive framework for developing and evaluating a machine learning-based charging strategy optimization system. Overall, the algorithm encompasses the necessary steps to build and evaluate a machine learning-based charging strategy optimization system. It uses data analysis, machine learning algorithms, hyperparameter tuning, and evaluation metrics to improve charging efficiency and reduce costs in real-world scenarios.

3.2 Optimization

When an electric vehicle is plugged in, the smart charging optimization process decides what to do at when times (e.g., every 15 minutes) to maximize efficiency and minimize the owner's energy bill. Optimization is conducted using reinforcement learning. Optimization using Q learning implementation.By integrating reinforcement learning with Q learning, we can optimize the charging judgments of Electric Vehicles (EVs) at a charging station. In this scenario, the environment is the EV charging station and the agent (EV) learns when to charge to minimize costs and maximize efficiency. The goal is to determine the optimal charging policy that minimizes the cost of charging an electric vehicle (EV), taking into consideration the time-of-use electricity pricing structure and the state of charge (SoC) of the EV battery [17, 18].

State (s): The SoC of the EV's battery and the current time interval can represent the system's state.

Action (a):The action represents the charging rate or the amount of energy the electric vehicle will absorb during the current time interval.

Reward (R):The reward can be a function of the charging cost, the battery state (such as preventing overcharging or undercharging), and any other relevant factors.

Q-value function (Q(s, a)):The Q-value function represents the anticipated cumulative reward the agent will receive by taking action 'a' in state's' and subsequently adhering to the optimal policy.

Using the Q-learning update formula, the Q-value function can be updated.

$$Q(S,a)=Q(s,a)+\alpha*[R+\gamma*(Q(s^{\prime}a^{\prime})-Q(s,a))] \quad (1)$$

- Q(s, a) represents the Q value for state s' and action a'.
- is the learning rate, which determines how frequently the agent revises the Q-value in light of new experiences. It is a numeric value between 0 and 1.
- R is the immediate recompense the EV receives for performing action a in state's.
- The discount factor that determines the value of future rewards is. It is a numeric value between 0 and 1.
- max(Q(s', a')) returns the maximum Q-value for the next state's' (s') across all potential actions a.
- Q(s', a') is the Q-value for the next state's' (s') and action a' that the agent chooses in accordance with its policy.

3.3 Exploration-extraction technique

An epsilon-greedy strategy is utilized to strike a balance between investigating new charging strategies and utilizing current knowledge. The agent chooses the action with the highest Q-value with a probability of (1 -) (exploitation) and a random action with a probability of (exploration). As the agent gains more experience and acquires more knowledge, can be lowered over time to gradually transition from protection to exploitation.

3.4 Agent

During numerous charging sessions or episodes, the agent (EV) interacts with the station's environment. Throughout each episode, the agent updates its Q values based on the environment's rewards. As training progresses, the agent progressively uses the learned Q values to make better charging decisions. Initially, the agent explores various charging strategies, but as training progresses, the agent increasingly uses the learned Q-values to make better charging decisions.

3.5 Optimization algorithm

(1) Initialize the Q value function Q(s, a) with random values.

(2) Observe the current state's'.

(3) Select an action a using the epsilon-greedy strategy.

(4) Execute action a in the charging station environment and observe the reward 'R' and the next state's'.

(5) Update the Q-value using the Q-learning update formula.

(6) Set the current state 's' to the next state 's'.

(7) Repeat steps 3 to 6 for multiple charging sessions.

Using reinforcement learning, Q-learning, and an exploration-exploitation strategy, an electric vehicle (EV) can learn an optimal charging policy that minimizes costs and maximizes efficiency over time [19, 20]. This enables the electric vehicle to adapt to fluctuating electricity prices and charging demands, allowing it to make better charging judgements in real-world situations.

4. EXPERIMENTAL AND RESULTS

The cost goal factor is a mathematical equation that tells you what to do when the vehicle is connected to a charging station (Sc) and when it is not (Su). The cost function is expressed as follows when the vehicle is connected:

$$\mathrm{Sc}(t) = \mathrm{b}(t) * \mathrm{c}(t) * \mathrm{Ech}(\mathrm{Soc}(t)) * \mathrm{n}(1 - \gamma) \qquad (2)$$

where, b(t) is the decision variable representing the charging action at time t (1 for charging, 0 for standby).

C(t) is the cost factor, which at time t may include the price of electricity, the demand, or other pertinent parameters.

The charging rate may vary according to the current state of the battery.

Represents the efficacy of the charging process, ranging from 0 to 1. The discount factor modifies the cost function to accommodate for special circumstances. The equation represents the cost incurred when the vehicle is turned in, taking into consideration the charging decision, electricity cost, energy supplied to the battery, charging efficiency, and any other relevant factors. It can be modified by designating specific values or incorporating additional terms in accordance with the problem's specific context and requirements. In our approach, we suggest using a straightforward threshold-based rule (TBR) that considers the electricity price and the current charge level. The threshold is computed using a sigmoid function:

$$f(x, a, b) = 1/(1 + exp[-a(x - b)]) \qquad (3)$$

where, x represents the current charge level. a and b are parameters that can be optimized using the CMA-ES method or any other optimization technique. exp[] denotes the exponential function. The sigmoid function helps to determine the threshold on the basis of the present level of charge. The sigmoid function transitions between 0 and 1 as the charge level (x) approaches the value of the parameter b, allowing a progressive change in the decision based on the electricity price. Taking into account the objective function to be optimized, the optimized values of parameters a and b can be obtained using any applicable optimization algorithm.

Using the formula, we define a threshold rule that adapts to the current charge level and electricity price, enabling us to make decisions based on the sigmoidal relationship between these variables.

$$a(t) = \begin{cases} 1(charge\ if\ cel(t) \le f(x, a, b) \\ 0\ (standby) otherwise \end{cases} \qquad (4)$$

where, Cel(t) represents the normalized electricity price at time t. x represents the state of charge, SoC(t). f(x, a, b) is the sigmoid function defined as: f(x, a, b) = 1 / (1 + exp[-a(x - b)]). In this formulation, if the normalized electricity price, Cel(t), is less than or equal to the threshold calculated using the sigmoid function f(x, a, b), the decision variable a(t) is set to 1, indicating that the vehicle should be in the charging mode. Otherwise, if Cel(t) is greater than the threshold, a(t) is set to 0, indicating that the vehicle should be in standby mode. The decision rule allows adaptive charging decisions based on the interaction, enabling efficient management of the charging process.

Table 2. Total and maximum one-way distance traveled by vehicles during the evaluation window (in kilometers)

Summer		Winter	
Total Distance	Max Trip Distance	Total Distance	Max Trip Distance
2317.09	14.65	1087.34	10.35
934.47	25.78	2837.21	16.57
1639.85	29.12	3481.95	20.43
2857.43	20.92	546.06	11.89
763.77	18.45	2359.25	15.28
2015.96	12.34	970.11	14.46
3339.07	21.78	3947.32	28.75
1654.2	16.15	3094.59	19.31
1076.45	29.89	1764.77	12.97
2418.11	17.26	3812.88	22.51
2890.98	22.43	1490.15	26.96
594.13	19.63	4092.75	18.14
3368.87	28.57	1312.25	13.45
1879.62	15.74	2785.39	17.83
4137.58	23.68	760.28	10.92
2191.45	13.97	2069.51	15.71
1278.86	26.41	3034.47	12.32

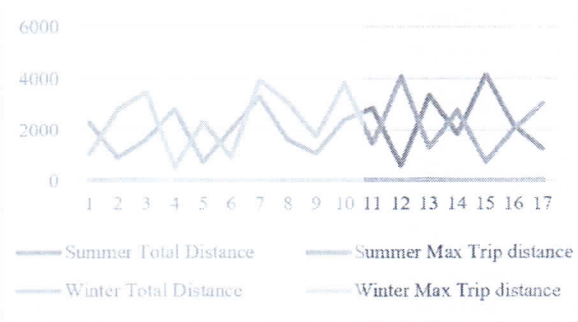


Figure 3. Total and Maximum distance travelled

Table 3. The 17 vehicles' average improvement (in percentage) of the 17 vehicles over the standard 10-bin scheme at each t during the summer and winter training periods

Summer	20		30		50		100	
	X	SD	X	SD	X	SD	X	SD
15	2.83	0.2	3.12	0.25	3.92	0.27	4.26	0.22
30	5.76	2.95	6.41	3.12	6.84	3.3	8.15	3.18
60	0.92	1.08	1.19	1.04	1.25	1.05	1.42	1.03
Winter	X	SD	X	SD	X	SD	X	SD
15	2.54	0.24	3.12	0.27	4.42	0.22	4.57	0.25
30	6.02	3.1	6.38	3.1	6.61	3.05	7.99	7.99
60	0.74	0.66	0.81	0.68	0.93	0.67	1.04	1.04

Figure 3 discusses about Total and maximum distance traveled. Table 2 shows the total and maximum one-way distance traveled by vehicles during the evaluation window (in kilometers). Table 3 summarizes the 17 vehicles' average improvement (in percentage) over the standard 10-bins scheme at each t during the summer and winter training periods.

4.1 Q Learning

Dynamic programming enables optimal decisions to be made on historical datasets because all vehicle and There is a historical record of environmental information, including projected values. Agent: the DRL model acts as the agent, making decisions about charging schedules. State (S): current situation, including factors such as battery level, electricity price, and time of day. Action (A): the possible charging decisions the agent can make, such as "charge now," "charge later," or "don't charge. Reward (R): the numerical feedback signal the agent receives based on the outcome of its action. A positive reward signifies a good decision (for example, charging during off-peak hours), while a negative reward indicates an undesirable outcome (for example, charging during peak hours). Value Q (Q (S, A)): the future estimated reward the agent expects to receive by taking action A in state S. The DRL model learns and updates these Q-values over time. Research applies dynamic programming to the tagging of historical databases in the state-space format described above. These annotated data, along with standard supervised learning algorithms, can be used to make decisions in real time, such as the optimal time to charge a car.

Figure 4 explained both summer and winter training, the average cost per bin.

Pseudocode:

Initialize Q(S, A) for all states (S) and actions (A) with a small value (e.g., 0)

Loop:

Observe the current state (S)

4.2 Dynamic programming

To formulate the Dynamic Programming (DP) model for optimizing electric vehicle (EV) charging, we define the decision model's hyperparameters. The objective is to maximize the cost savings achieved by the AC model compared to the gas-only strategy. Electric Vehicles (EVs) have gained increasing popularity due to their eco-friendly nature and potential cost savings over traditional gas-powered vehicles. Efficient charging of Electric Vehicles can significantly impact cost reduction and energy utilization. To address this challenge, we employ the dynamic programming (DP) model, a powerful technique for solving complex optimization problems.

The objective of the DP model is to maximize the cost savings achieved by employing an Always Charge (AC) strategy for EV charging. We compare this strategy with a gas-only approach, which serves as the baseline. The AC model charges the EV when parked and the battery is not full, considering electricity prices and vehicle-specific characteristics. The DP model represents the charging process as a sequence of discrete time steps. Each time step is associated with a State of Charge (SoC), which represents the battery's current energy level. The DP algorithm selects actions at each time step, determining when and how much to charge the EV, to optimize cost savings.

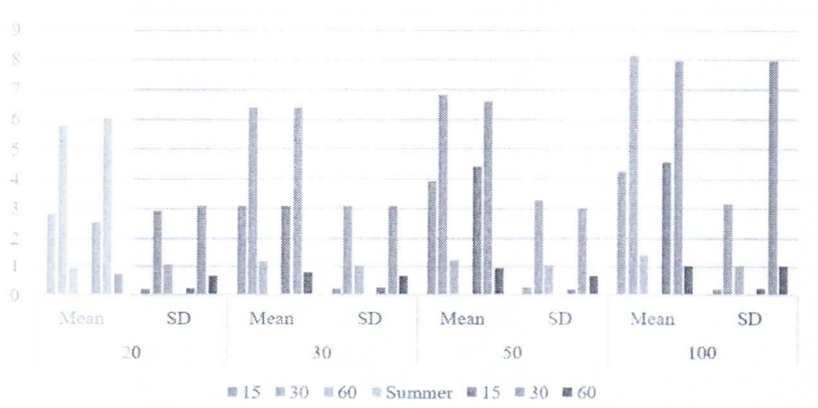


Figure 4. For both summer and winter training, the average cost per bin

The cost function in the DP model captures the economic impact of charging decisions. It considers factors such as electricity prices, distance traveled, and battery capacity. The goal is to minimize the overall cost of charging Electric Vehicles while ensuring sufficient energy for daily usage. The DP algorithm uses the Bellman equation, a recursive equation that expresses the value of a state as the expected sum of future rewards. In our case, the value function represents the cost savings achieved by following a specific charging strategy from a given SoC at a specific time step.

The DP algorithm starts at the final time step (e.g., end of the day) with a fully charged battery and computes the optimal cost savings for each SoC level. Then it moves back in time, calculating the cost savings at each time step based on the optimal decisions made in future time steps. This process continues until the initial time step (for example, the beginning of the day) is reached. The DP model's outputs are the optimal charging decisions for each time step, allowing the EV to achieve maximum cost savings during the day. The results demonstrate the efficiency of the AC strategy compared to that of the gas-only approach. The cost savings of the AC model are summarized in Table 4 for different EVs under various scenarios.

Table 4. Results for the models (a) Summer (b) Winter

(a) Summer					
S.No	**Season**	**DNN**	**KNN**	**SNN**	**TBR**
1	Winter	0.95	0.75	0.9	0.7
2	Winter	0.93	0.78	0.88	0.65
3	Winter	0.91	0.8	0.85	0.68
4	Winter	0.94	0.77	0.92	0.72
5	Winter	0.96	0.76	0.89	0.73
6	Winter	0.9	0.79	0.87	0.71
7	Winter	0.92	0.74	0.91	0.69
8	Winter	0.93	0.72	0.86	0.74
9	Winter	0.95	0.75	0.93	0.76
10	Winter	0.9	0.71	0.85	0.67
11	Winter	0.91	0.79	0.88	0.68
12	Winter	0.94	0.73	0.89	0.71
13	Winter	0.93	0.75	0.91	0.73
14	Winter	0.92	0.7	0.86	0.67
15	Winter	0.96	0.78	0.89	0.75
16	Winter	0.9	0.72	0.87	0.68
17	Winter	0.91	0.76	0.88	0.7
(b) Winter					
S.No	**Season**	**DNN**	**KNN**	**SNN**	**TBR**
1	Summer	0.97	0.79	0.93	0.72
2	Summer	0.95	0.75	0.91	0.68
3	Summer	0.92	0.8	0.88	0.69
4	Summer	0.96	0.78	0.94	0.71
5	Summer	0.98	0.77	0.92	0.7
6	Summer	0.91	0.79	0.89	0.73
7	Summer	0.93	0.76	0.91	0.71
8	Summer	0.94	0.72	0.87	0.68
9	Summer	0.97	0.75	0.93	0.7
10	Summer	0.91	0.7	0.86	0.67
11	Summer	0.92	0.78	0.89	0.68
12	Summer	0.95	0.73	0.9	0.71
13	Summer	0.94	0.75	0.92	0.73
14	Summer	0.93	0.71	0.87	0.67
15	Summer	0.98	0.79	0.93	0.75
16	Summer	0.91	0.72	0.88	0.68
17	Summer	0.92	0.76	0.89	0.7

The Dynamic Programming model proves to be a powerful tool for optimizing electric vehicle charging strategies. By incorporating various parameters and constraints, such as electricity prices, battery capacity, and travel distances, the DP algorithm effectively determines the optimal charging decisions. The AC strategy emerges as a cost-effective solution that yields substantial savings over the gas-only approach. Implementing the DP model in real-world EV charging scenarios holds great promise for sustainable and economically efficient transportation. Further research and development in dynamic optimization techniques can lead to even more advanced and environmentally friendly EV charging solutions.

4.3 Threshold-Based Rule (TBR) for electric vehicle charging optimization

In our approach to optimize Electric Vehicle (EV) charging decisions, we propose using a simple Threshold-Based Rule (TBR) based on the present charge level of the EV's battery and the price of electricity. Using a sigmoid function that computes a threshold value, the TBR determines whether the EV should be in charging mode or in standby mode.

The sigmoid function, denoted as f(SoC, p1, p2), is given by the following formula.

$$f(SoC, p1, p2) = \frac{1}{(1 + exp[-p1(SoC - p2)])} \tag{5}$$

p1 and p2 are parameters that must be optimized using the CMA-ES (Covariance Matrix Adaptation Evolution Strategy) method. The SoC represents the current state of charge of the EV battery. Equation 3 defines the objective function to optimize these parameters.If Cel(t) is less than f(SoC(t), p1, p2), the electric vehicle will be charging mode (a(t) = 1). If Cel(t) is greater than f (SoC (t), p1 and p2), the EV will enter standby mode (a(t) = 0).

To derive the TBR policy, we first examine the sigmoid function f(SoC, p1, p2). The sigmoid function converts the value of the SoC to a number between 0 and 1. When SoC approaches p2, f(SoC, p1, p2) approaches 0.50. As SoC increases or decreases relative to p2, f(SoC, p1, p2) approaches 1 or 0 respectively.

In the charging decision formula, the normalized electricity price Cel(t) is compared with f (SoC (t), p1, p2) using the Cel(t) normalization factor. If Cel(t) is less than or equal to f(SoC(t), p1, p2), it indicates that the price of electricity is relatively low or within an acceptable range, and charging the electric vehicle is cost-effective. The electric vehicle will be set to charging mode (a(t) = 1) in this case.

Alternatively, if Cel(t) is greater than f(SoC(t), p1, p2), it indicates that the price of electricity is relatively high and it may be more cost-effective to refrain from charging the electric vehicle. Consequently, the EV will enter standby mode (a(t) = 0).

The parameters of the sigmoid function p1 and p2 are optimized using the CMA-ES method, which iteratively searches for the values that result in the greatest performance. This optimization process enables the TBR policy to adapt to various charging scenarios and achieve a cost-effective and efficient charging strategy for the electric vehicle.

4.4 k-NN to optimize electric vehicle charging

We employ the k-NN algorithm in our approach to optimizing electric vehicle (EV) charging decisions. Let S represent the state of the EV and A represent the action (charge

PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

or standby) performed by the EV in that state. The k-NN algorithm is implemented as follows:

• Define a distance metric, such as the Euclidean distance, to quantify the degree of similarity between states. Smaller distances indicate greater similarity between governments.

• Create the training dataset, which consists of pairs (S_i, A_i) in which S_i represents the state and A_i is the action conducted in that state. Using dynamic programming to determine the optimal charging decisions for various states yields the training dataset.

• Given a new state S, using the defined distance metric, locate the k nearest neighbors in the training data set. The k nearest neighbors are the k states in the training data set with the shortest distance from the newly introduced state S.

• Determine the action A for the new state S based on the majority vote of its k closest neighbors. If the preponderance of the k closest neighbors are in charging mode, the new state S will be assigned to the charging action. If not, it will be delegated to the standby action.

Through cross-validation, the optimal number of neighbors k for the k-NN algorithm is determined. Cross-validation is a technique used to evaluate the performance of an algorithm by dividing training and test datasets into numerous subsets.

Deriving k-NN for EV Charging Optimization: The k-NN algorithm for EV charging optimization is derived from the classification principles underlying the dynamic programming approach to charging decisions. Using the results of dynamic programming to construct the training dataset, the k-NN algorithm capitalizes on the knowledge of optimal charging actions for various states.

When encountering a new state S, the k-NN algorithm identifies its k nearest neighbours in the training data set. These neighbouring states have exhibited comparable taxation practices in the past. The algorithm allocates the new state to the most probable charging action by taking the majority vote of the charge/standby actions of these neighbours.

Then cross-validation is used to evaluate the efficacy of the k-NN algorithm and determine the optimal value of k. Cross-validation identifies the optimal k-value for optimal charging decisions and the overall optimization of electric vehicle charging operations by evaluating the algorithm in different subsets of the training data set.

4.5 Small neural network with clustering and feature selection

In our approach to optimize Electric Vehicle (EV) charging decisions, we suggest a two-layer SNN that takes advantage of both clustering and feature selection. The output layer is linear, while the hidden layer uses a sigmoid transfer function. The network is taught to function by employing the Levenberg-Marquardt algorithm.

We start by using clustering to pick a small but fairly representative subset of the data in the data set. The clustering method collects data points that share similarities and then reduces the resulting dataset, making it easier to train the neural network.

To further improve the SNN's performance, we employ a sequential step-by-step procedure called Backward Greedy Selection to eliminate variables (features) that either degrade or do not substantially improve the neural network's performance. The goal of this feature selection procedure is to keep only those characteristics useful for making a price determination.

First, the sigmoid transfer function () is defined for the SNN's hidden layer as follows:

$$\sigma(x) = \frac{1}{(1+exp(-x))} \tag{6}$$

Here, x represents the input to the hidden layer, which is the weighted sum of the inputs from the previous layer.

4.5.1 Linear output function

The linear output function preserves the weighted sum of the inputs from the hidden layer without applying any activation function, making it suitable for regression tasks.

4.5.2 Levenberg-Marquardt Algorithm

The Levenberg-Marquardt algorithm is used to train the SNN. It is an optimization algorithm commonly employed for nonlinear least-squares problems. The algorithm minimizes the difference between the predicted network output and the actual target output by adjusting the weights during training.

The Backward Greedy Selection is a feature selection method that iteratively removes less informative features from the data set to enhance the performance of the neural network. The process involves the following steps:

• Start with the complete set of features.

• Train the SNN on the dataset with all the features included.

• Evaluate the SNN's performance.

• Remove the least significant feature (based on some performance metric) from the dataset.

• Retrain the SNN with the reduced set of features.

• Repeat steps 3 to 5 until the desired level of performance improvement is achieved or a stopping criterion is met.

4.6 DNN to optimize the charging of Electric Vehicles

DNN offer the advantage of learning a hierarchical representation of the data, in contrast to shallow neural networks SNN Learning complicated associations from a wide range of interdependent variables is made possible by the hierarchical structure represented by a deep neural network's layers of neurons. Due to the high correlational strength, DNNs are particularly suited to investigate the strong correlation found in our complex dataset, which includes data from all cars.

A total of 508 input neurons, four hidden layers of 256, 96, 64, and 32 neurons, and a single output neuron representing the charging action (a(t)) make up the DNN architecture. Activation Functions: Each layer's activation function is the Exponential Linear Unit (ELU), except for the output layer, which uses the softmax function. The ELU activation function is selected due to its ability to effectively manage negative inputs and mitigate the vanishing gradient problem during training, thereby enabling faster and more stable convergence.

Batch Normalization: To further promote convergence and prevent internal covariate shift, after each entirely connected layer, a batch normalization operation is added. By normalizing each batch's input during training, batch normalization stabilizes the training process and enables the network to acquire knowledge more efficiently.

The DNN is trained using the adaptive stochastic gradient descent (Adagrad) method. During training, Adagrad modifies the learning rate for each parameter based on the historical gradients of that parameter. This adaptability enables Adagrad to enhance and accelerate convergence, particularly when working with sparse data.

The ELU is a unit of length that is proportional to the exponent.

For a given input x, the activation function of the ELU is defined as follows:

$$ELU(x) = x, for\ x \geq 0, for\ x < 0 \quad (7)$$

x is a hyperparameter that determines the function's slope for negative inputs.

The softmax function is used to convert the logits (raw outputs) of the previous layer into a probability distribution in the output layer. The softmax function for a given vector z is defined as

$$softmax(z\_i) = exp(z\_i)/\Sigma(z\_j) \text{ for all j} \quad (8)$$

The output of the i-th neuron in the output layer is represented by z_i. exp denotes the exponential function. z_i is the i-th element of the input vector z.

The sum in the denominator runs over all elements z_j of the input vector z.

5. DISCUSSION

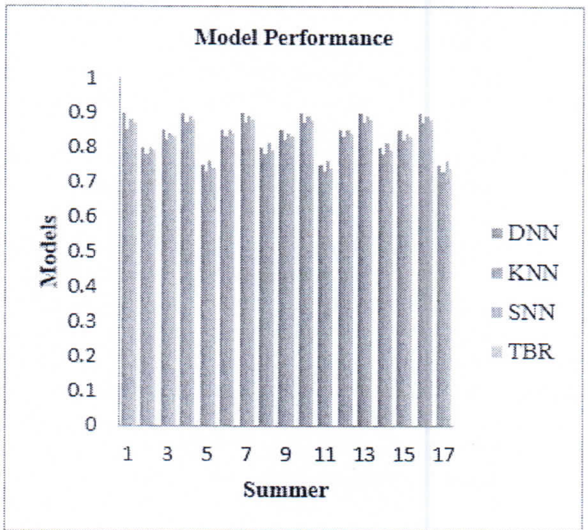
5.1 Always charge model

The research compares the cost savings achieved by three distinct charging strategies for Electric Vehicles: an AC model (Assumption: Vehicle charges when parked and battery is not full), an optimal charging strategy using DP and a gas-only strategy. The results are summarized in Table 4, which shows the cost of each vehicle in each of the three scenarios and the savings in relation to the cost of petroleum. Summer Cost Savings: The AC model achieves considerable cost savings in the summer, ranging from 28% to 74% across vehicles.

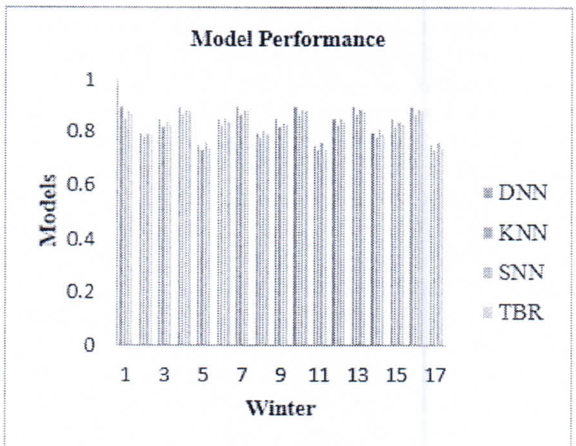
The simple AC strategy demonstrates remarkable efficiency, obtaining median gains of 68% in the summer and 56% in the winter, respectively. Low electricity prices on the market significantly reduce the total energy cost of Electric Vehicles, rendering the AC strategy cost-effective even when charging during peak electricity prices. The DP-based optimal charging strategy obtains impressive summer and winter median gains of 95% and 88%, respectively. This indicates that additional improvements can be made to close the disparity between AC and DP strategies, bringing the cost savings closer to the optimal benchmark. The article concludes by highlighting the potential for significant cost savings in electric vehicle charging via the AC paradigm, particularly during the summer months. However, to match the efficacy of the DP-based optimal charging strategy, further development is required. Implementing more advanced optimization techniques could result in greater cost savings and a more efficient use of available energy resources for Electric Vehicles. Supervised learning models are highly dependent on the quality and relevance of training data. Reinforcement learning can be computationally expensive and might require extensive training time.

5.2 Machine learning models

In this article, we compare the optimal pricing decisions acquired by dynamic programming (DP) with those obtained via several machine learning (ML) models. Figure 5 shows the ratio of ML model savings to DP model savings, with values close to 1 reflecting efficiency levels that are comparable to the global optimum achieved with DP. Performance of ML Models: The DP-based optimal charging method is the global optimum, but it is unworkable in practice since it demands perfect knowledge of the future. On the other hand, ML models offer effective pricing choices even when no further data is available. Metrics like the Mean Squared Error (MSE) can assess the accuracy of predicted charging schedules compared to actual optimal schedules (known from simulations or historical data). Additional metrics might include cost savings achieved, reduction in peak grid demand, and user satisfaction for a more holistic evaluation.



(a)



(b)

Figure 5. Model gain for two seasons (a) Summer (b) Winter

DNN performs better: The Deep Neural Network (DNN) method achieves outstanding results, with a gain ratio of 0.95 being typical. The DNN model is promising for optimizing EV charging, as it can be easily implemented in practical, real-world circumstances. Promising Actors: The average ratios for the summer and winter sessions are 0.88 and 0.80, respectively, demonstrating the efficacy of other methods such as shallow neural networks (SNN). This demonstrates that even a low-capacity model may be efficiently implemented with a thorough preselection of input variables, allowing the creation of driving habits and regular driving schedules, which are crucial for charge decisions. The KNN and TBR Approaches: When comparing summer and winter gain ratios, the K-Nearest Neighbors (KNN) and Threshold-Based Rule (TBR) methods score 0.77 and 0.72, respectively. Even though they cannot compare to the effectiveness of DNN and SNN, they outperform rudimentary methods like the AC model by a wide margin.

The evaluation indicates that the DNN approach is a standout performer among the ML models, closely approaching the global optimum found with DP. The SNN method also shows strong performance, and both models are viable alternatives to DP, given their operational suitability in real-world scenarios. Even with lower-capacity models like KNN and TBR, substantial efficiency gains are achieved compared to simple strategies such as the AC model. The findings suggest that ML-based charging strategies have great potential for cost savings and efficient energy utilization in electric vehicle charging operations.

Mean squared error (MSE): this metric measures the average squared difference between the predicted charging schedule and the actual optimal schedule (known from simulations or historical data). Lower MSE indicates better model accuracy. accuracy: This metric, when applicable (e.g., classifying peak vs. off-peak hours), represents the proportion of correct predictions made by the model. Cost savings: this metric directly measures the financial benefit achieved through optimized charging compared to a baseline strategy (e.g., always charging). Grid demand reduction: this metric quantifies the decrease in peak grid demand by optimizing charging schedules, contributing to grid stability.

6. CONCLUSION

Optimize charging schedules for Electric Vehicles (EVs) to minimize costs and improve efficiency. Compared three charging strategies: Always Charge (AC), optimal charging with Dynamic Programming (DP), and gas only. Evaluated several machine learning (ML) models to predict optimal charging times. These included Deep Neural Networks (DNNs), Support Vector Machines (SVMs), K-Nearest Neighbors (KNNs), and Time-Based Rules (TBRs). Analyzed correlations between factors such as time of day (HOD), hour of parking end (HOEP), temperature, gas price and distance traveled. Reduce EV charging costs compared to gasoline vehicles. Improve the efficiency of electric vehicle charging by leveraging historical data and predictions. he AC model achieved significant cost savings (28% to 74%) during the summer due to lower electricity prices. The DP model achieved even greater savings (95% summer, 88% winter) but requires unrealistic knowledge of future electricity prices. The DNN model showed promise, achieving near-optimal performance (0.95 mean gain ratio) and is suitable for real-world implementation. Other ML models, such as SVM, KNN, and TBR, also offered cost savings compared to AC. Multivariate analysis revealed correlations between factors such as HOD, HOEP, temperature, gas price, and distance traveled. These factors are important to predict optimal charging times. The limited size of the data set might affect the generalizability of the findings. DP's requirement for perfect future knowledge makes it impractical for real-world use. Explore even larger and more diverse datasets to improve model robustness. Investigate new algorithms, particularly deep learning architectures, to potentially surpass DNN performance. Integrate user preferences for charging times and locations into the optimization process. Deploy the system in a real-world setting to assess its effectiveness with actual users.

REFERENCES

[1] Msaddek, H., Mansouri, A., Trabelsi, H. (2023). Optimal design and cogging torque minimization of a permanent magnet motor for an electric vehicle. Tehnički vjesnik, 30(2): 538-544. https://doi.org/10.17559/TV-20220815140808

[2] Tamilvizhi, T., Surendran, R., Krishnaraj, N. (2021). Cloud based smart vehicle tracking system. In 2021 International Conference on Computing, Electronics & Communications Engineering (iCCECE), Southend, United Kingdom, pp. 1-6. IEEE. https://doi.org/10.1109/iCCECE52344.2021.9534843

[3] Campaña, M., Inga, E. (2023). Optimal planning of electric vehicle charging stations considering traffic load for smart cities. World Electric Vehicle Journal, 14(4): 104. https://doi.org/10.3390/wevj14040104

[4] Shahriar, S., Al-Ali, A.R., Osman, A.H., Dhou, S., Nijim, M. (2020). Machine learning approaches for EV charging behavior: A review. IEEE Access, 8: 168980-168993. https://doi.org/10.1109/ACCESS.2020.3023388

[5] Kumar, K.R., Saravanan, M.S., Surendran, R. (2023). A novel method to predict sales price of domestic vehicles using news sentiment analysis with random forest algorithm. In 2023 2nd International Conference on Applied Artificial Intelligence and Computing (ICAAIC), Salem, India, pp. 761-765. https://doi.org/10.1109/ICAAIC56838.2023.10141389

[6] Mukherjee, J.C., Gupta, A. (2014). A review of charge scheduling of Electric Vehicles in smart grid. IEEE Systems Journal, 9(4): 1541-1553. https://doi.org/10.1109/JSYST.2014.2356559

[7] Dran, S., Varthini, P. (2013). Detecting power systems failure based on fuzzy rule in power grid. Przegląd Elektrotechniczny, 89(8): 172-177. https://www.infona.pl/resource/bwmeta1.element.baztech-4b475d71-8aca-4b8d-9c1a-47dfbb5a3c50

[8] Adil, M., Mahmud, M.P., Kouzani, A. Z., Khoo, S.Y. (2024). Optimal location and pricing of electric vehicle charging stations using machine learning and stackelberg game. IEEE Transactions on Industry Applications, 60(3): 4708-4722. https://doi.org/10.1109/TIA.2024.3364579

[9] Azzouz, I., Fekih Hassen, W. (2023). Optimization of Electric Vehicles charging scheduling based on deep reinforcement learning: A decentralized approach. Energies, 16(24): 8102. https://doi.org/10.3390/en16248102

[10] Chung, Y.W., Khaki, B., Li, T., Chu, C., Gadh, R. (2019). Ensemble machine learning-based algorithm for electric vehicle user behavior prediction. Applied Energy, 254: 113732. https://doi.org/10.1016/j.apenergy.2019.113732

[11] Raveena, S., Surendran, R. (2023). Clustering-based hemileia vastatrix disease prediction in coffee leaf using deep belief network. In 2023 8th International Conference on Communication and Electronics Systems (ICCES), Coimbatore, India, pp. 1094-1100. https://doi.org/10.1109/ICCES57224.2023.10192835

[12] Chiş, A., Lundén, J., Koivunen, V. (2016). Reinforcement learning-based plug-in electric vehicle charging with forecasted price. IEEE Transactions on Vehicular Technology, 66(5): 3674-3684. https://doi.org/10.1109/TVT.2016.2603536

[13] Selvanarayanan, R., Rajandran, S., Alotaibi, Y. (2023). Using hierarchical agglomerative clustering in e-nose for coffee aroma profiling: Identification, quantification, and disease detection. Instrumentation Mesure Métrologie, 22(4): 127-140. https://doi.org/10.18280/i2m.220401

[14] Naresh, V.S., Ratnakara Rao, G.V., Prabhakar, D.V.N. (2024). Predictive machine learning in optimizing the performance of electric vehicle batteries: Techniques, challenges, and solutions. Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, e1539. https://doi.org/10.1002/widm.1539

[15] Golsefidi, A.H., Hüttel, F.B., Peled, I., Samaranayake, S., Pereira, F.C. (2023). A joint machine learning and optimization approach for incremental expansion of electric vehicle charging infrastructure. Transportation Research Part A: Policy and Practice, 178: 103863. https://doi.org/10.1016/j.tra.2023.103863

[16] Ullah, I., Liu, K., Yamamoto, T., Shafiullah, M., Jamal, A. (2023). Grey wolf optimizer-based machine learning algorithm to predict electric vehicle charging duration time. Transportation Letters, 15(8): 889-906. https://doi.org/10.1080/19427867.2022.2111902

[17] Vaiyapuri, T., Shankar, K., Rajendran, S., Kumar, S., Acharya, S., Kim, H. (2023). Blockchain assisted data edge verification with consensus algorithm for machine learning assisted IoT. IEEE Access, 11: 55370-55379. https://doi.org/10.1109/ACCESS.2023.3280798

[18] Shibl, M., Ismail, L., Massoud, A. (2021). Electric Vehicles charging management using machine learning considering fast charging and vehicle-to-grid operation. Energies, 14(19): 6199. https://doi.org/10.3390/en14196199

[19] Alshammari, A., Chabaan, R.C. (2023). Metaheruistic optimization based ensemble machine learning model for designing detection coil with prediction of electric vehicle charging time. Sustainability, 15(8): 6684. https://doi.org/10.3390/su15086684

[20] Gatica, G., Ahumada, G., Escobar, J.W., Linfati, R. (2018). Efficient heuristic algorithms for location of charging stations in electric vehicle routing problems. Studies in Informatics and Control, 27(1). https://doi.org/10.24846/v27i1y201808

ISSN 1330-3651(Print), ISSN 1848-6339 (Online)

https://doi.org/10.17559/TV-20230430000589
Original scientific paper

Heuristic Adaptive Dynamic Programming-based Energy Optimization Strategies for Hybrid Electric Vehicles

Mohammad YASIN*, Manoharan ABIRAMI, Subrahmanyam KBVSR

Abstract: This study suggests a more accurate series-parallel hybrid electric vehicle (HEV) energy management control technique based on heuristic adaptive dynamic programming (HADP). This article provides a solution to the energy management problem of Electric Vehicle using the Stimulant Dependent Heuristic Adaptive Dynamic Programming (SDHADP) algorithm. The reinforced Q learning model along with the three-layer feed-forward neural network with backpropagation is detailed with the necessary diagrams and equations. The approach to connecting the battery of a BEV to a residential system is novel and innovative. The experimental results highlight the importance and effectiveness of the SDHADP algorithm using an electric vehicle. This is done with the help of a BV feed-forward neural network with back-propagation. In the model, which is in charge of controlling the system based on the training given by the BV network, Markov decision theory was adopted by scholars as a paradigm for posing and solving planning problems in the face of uncertainty and is in charge of the battery management system.The suggested technique uses online learning control methods to improve upon the efficiency of the traditional Q-learning method by more than 4.55% under the specified real-world driving circumstances.

Keywords: electric vehicles; energy management system; SDHADP algorithm; machine learning; neural network

1 INTRODUCTION

In the ongoing effort to lessen transportation's overall energy footprint, electrification has emerged as a crucial strategy. When it comes to the family of electrified cars, HEVs play a noteworthy role. Unlike conventional automobiles and battery electric vehicles (BEVs), hybrid electric vehicles have a larger complexity and take use of running multiple propulsion systems to fulfill the load on the road [1-3]. Energy management, which seeks to define the most acceptable power split between the many on-board multi-source energy systems, is a crucial component of HEV functioning. Energy management strategies (EMSs) are responsible for real-time evaluation of the optimal power ratio between internal combustion engines (ICEs) and electric motor-generators (EMGs), regarding the required drive power and the available energy in the battery consumption and emissions. Batteries are the primary source of energy for electric vehicles. A high voltage (HV) battery pack, traction motor, engine, and generator are the standard components of the dual propulsion system. Customers get to enjoy the benefits of driving a true electric vehicle (EV) thanks to the HV battery pack and the motor. A high voltage (HV) battery pack will be charged by the engine when its state of charge (SOC) drops below a certain threshold, and the engine may also be used to supplement the HV battery pack's power output in order to handle peak demand. HEVs are more difficult to run than standard automobiles and BEVs because they may utilize many powertrain components simultaneously [4]. The energy management strategy is the set of controls used to optimize the efficiency of these parts. Battery electric vehicles (BEVs) are another name for them. The BEV stores power in a single battery. The BEV can go in any direction, forwards or backwards, thanks to its battery. In appearance, the BEV is indistinguishable from the mechanical cars now on the market. Both the power source and the driving system of a BEV are fundamentally different from those of gasoline or diesel-powered automobiles. In today's world, the gasoline tank is the battery, and the engine is the electric motor [5]. The electric energy stored in a battery is the lifeblood of an EV or HEV. Lithium-ion batteries are used in most electric and hybrid electric cars because they are powerful, have a high energy density, and last a long time. Heat is produced by Li-ion batteries both during charging and usage. To learn how various materials charge and discharge, one can consult the respective manufacturer's technical datasheet. In this project, we are creating a machine-learning algorithm that links the BEV to a smart home system during its idle period. The cost of power is factored into the BEV's price. It charges during off-peak hours and releases electricity to the home grid during peak hours. This optimization issue cannot be handled using dynamic programming as the system is nonlinear. Power needs and consumption levels might change over time. In areas where the price of power is greater during peak hours and cheaper during off-peak hours, this technique can be highly beneficial. By avoiding power use at peak times and charging the BRV battery during off-peak times, the system saves money for the customer [6]. The machine learning system learns about the appropriate usage of batteries depending on the existing power tariffs and the household load. Hybrid electric vehicles (HEVs) are equipped with several power sources, allowing for flexible driving modes and configurations. They're better than regular cars in cutting gas costs while still satisfying commuter needs. It is vital to establish a sensible and efficient energy management strategy (EMS) given the complexity of HEVs' powertrains and power allocation. Here is how the rest of the paper is structured. The HEV model and the energy management issue are introduced in Section 2. A DHP-based energy management control technique is designed in Section 3. In Section 4, we use simulated comparisons with other current EMSs to verify the efficacy and benefit of the proposed EMS of HEVs. The conclusion is the last part.

2 LITERATURE REVIEW

The research looked at the issues of battery swap stations, such as allocation and stocking. The Markov

M Arunkumar

PRINCIPAL

Decision Process was the basis of the model. Battery deterioration was also evaluated in the study. The battery charging, draining, and swapping out method worked well in order to calculate the kinetic energy and power management of battery-powered vehicles on a trajectory [7-9]. The results of the experiments show that two discrete variables, one representing the vehicle's operation and the other the power distribution, may be used for co-optimization using dynamic programming. Energy costs can be cut by between 5.3% and 24.0%. To illustrate the issues with energy management in BEVs, a dual-engine system is analyzed that is fuelled by Li-ion batteries and supplementary power units. The system featured dynamic programming and a map-based component to split power between the battery and the motor. There was a 1.9 percent drop in gasoline use. Hybrid electric cars may make the most of reduced component sizes and increased power thanks to an energy management system that incorporates a dimensional optimization framework. To do this, the system employs the dynamic programming technique. An efficiency of 31.3 percent was achieved by the system optimizing gas mileage with a dynamic programming approach [10, 11]. Scheduling algorithms for electric car charging can be enhanced by using data-driven tools and machine learning technology for learning and prediction. Recent studies on optimization-based tactics have centered on how to incorporate modeling and simulation expertise to provide more realistic optimization outcomes. In this work, we look at two different dynamic programming techniques. However, the stochastic dynamic programming algorithm approach yields a control that depends on a particular state [12-14], while the deterministic dynamic algorithm solves the optimization problem by sequentially calculating each state at each time step in a backward order. This work makes two key advances compared to previous approaches. First, a DHP-based control method for HEVs is presented [15], which takes use of the DHP's pinpoint accuracy to dynamically adjust the network weights in response to driving data in order to achieve optimal control and lower energy usage. The next step is to fine-tune the action network's underlying structure. By increasing the number of nodes in the hidden layer, the grid can better accommodate the control variables, and the network's weights can converge more quickly.

3 PROPOSED SYSTEM

One of the HADP foundational structures, Heuristic Adaptive Dynamic Programming (HADP) combines reinforcement learning, the DP optimization principle, and the neural network approximation function to achieve more accuracy with a somewhat more complicated structure. In this regard, the DHP energy management strategy (EMS) is built by the backpropagation neural network (BPNN) as an Action networking and two Critic networks approximating the control policy and the resulting gradient of value function about the state variable. The battery management system consists of the residential load. During peak times, the electricity consumption is very high, especially at night time. The load on the power grid increases. This article finds out a solution to the problem of maintenance of load demand on the grid using the battery of BEV.

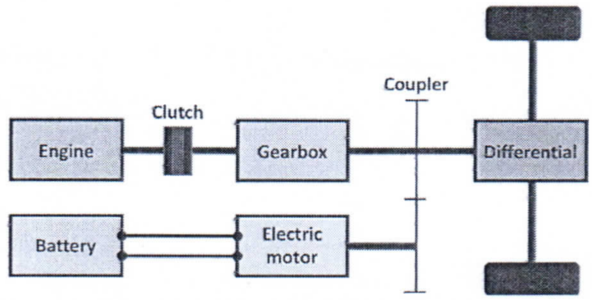


Figure 1 Process flow of the proposed system

Fig. 1 depicts the process flow of the proposed system. The system consists of the battery system and the corresponding residential and BEV loads. The BEV load is used once the battery is fully charged. At this time the battery supplies the power to the residential to meet the residential load at peak hours during high electricity costs. The battery system plays two important roles. In the first place, it saves cost by not using electricity directly from the power grid thereby saving cost and reducing the domestic load on the power grid. During the off-peak hours, the battery system is charged back when the domestic and residential load is low. The optimal battery usage pattern is to be found based on the electricity charges and domestic and residential loads. The study uses some assumptions: First the BEV is operated daily. When the BEV is operational the battery cannot be used to satisfy the residential load and during the operational process, the BEV is fully charged. The residential use of the battery happens during high peak hours when the cost of electricity from the grid is high and during low peak hours, the residential load is met directly from the power grid. When the power consumption is directly from the power grid the battery is assumed to be in the charging state. The state from charging to discharging changes when the power consumption is not met directly from the power grid. In the BEV system, the charging of the battery is depicted as

$$C_{T+1} = C_T - C_T n(C_T) + 1\ [\mathrm{h}],\ C_T > 0 \tag{1}$$

C_{T+1} (kWh) gives the batteries residual energy during the period T. The energy output from the battery is given by C_τ (kW) in time τ. The efficiency of energy conversion is given by $n(C_T)$. The time step is given by 1 h. Consider $n(C_\tau) = 1$ is the efficiency for the optimal case of the battery. In the system, the discharging of the battery is depicted as:

$$C_{T+1} = C_T - C_T n(C_T) \times 1\ [\mathrm{h}],\ C_T < 0 \tag{2}$$

The idle cycle of the battery is given by $C_\tau = 0$. The load demand at time τ is given by L_τ. The output of the power grid at time τ is given by G_τ. The equation balancing the load is given b.

$$L_T = C_T + G_T \tag{3}$$

Considering equations 1, 2 and 3, the optimization for the system is given as

$$\begin{aligned} &\mathrm{Min} P_T = \sum E_T \times G_T \\ &C_{\min} \le C_T \le C_{\max} \end{aligned} \tag{4}$$

The E_τ denotes the electricity rate. The function of the performance index is given by P_τ.

$$x_{T+1} = f(x_T) = \begin{pmatrix} (C_T + C_{2T}) - u_T \\ C_{2T} - u_T \end{pmatrix} \tag{5}$$

The application of Q learning to the battery management problem of BEV. An approach based on reinforced learning (RL) is proposed. $J^*_{(xk)}$ the optimal cost and the optimal control policy $PI^*_{(xk)}$ are defined as

$$J^*_{(xk)} = \min_u \left(Q^*(x_k, u) \right) \tag{6}$$

$$PI^*_{(xk)} = \arg\min_u \left(Q^*(x_k, u) \right) \tag{7}$$

Now the updated equation becomes:

$$Q(x_k,u) < -Q(x_k,u) + \alpha(g_k + r\min Q)(x_{k+1}, u) - Q(x_k, u) \tag{8}$$

Based on the state of the system x_k, the criteria is to select a minimum Q value for the control u_k. Based on the action of the UK, the state changes from to x_{k+1} with as the reward. The updating of the Q function $Q(x_k, u_k)$ takes place. Eq. (8) gives the standard framework of the RL learning algorithm. The new proposed algorithm for battery management is based on Eq. (8) for battery management is based on eEq. (8).

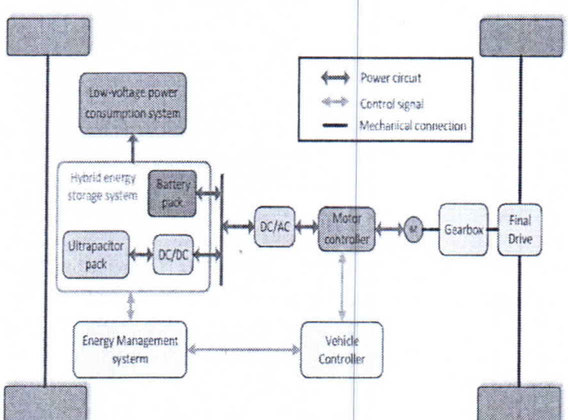


Figure 2 Architecture of Battery Management System with Q Learning

Convergence is very important for Q learning and RL systems. When Q learning is applied to problems like the BEV Battery Management system, the algorithm takes a lot of time to converge. It depends directly on the properties and dimensions. In case the dimensions are large, the convergence time increases proportionally. Fig. 2 shows the working architecture of the battery management system. The proposed B-Select algorithm is a self-learning algorithm. The realization can be performed in many different methods. The primary goal and objective of the B-Select algorithm is to connect to the BV network and approximate the performance index in dynamic programming systems by making use of the model of the control between the BV network and the residential system. The self-learning algorithm based on inputs, experience and training identifies the optimal performance index and optimal control for the system. In this article, the authors use the Stimulant Dependent Heuristic Adaptive Dynamic Programming (SDHADP). Fig. 2 contains the structure diagram of SDHADP. The output of the BV network is V_T.

3.1 Pseudo Code for BEV Control

$Q(x_k, u_k) \leftarrow$ Initialize

Steps repeated n times $n = 1, 2, 3, \ldots, n$

Step 1: Update all utilised parameter values u_k at stage $x_k Q(x_k, u_k)$

Step 2: Shift state $k + 1 \leftarrow$ reward $g(x_k, u_k)$

Step 3: Update model on observation $\rightarrow$ Reward $g(x_k, u_k)$ State x_{k+1}

Step 4: Update Q using model actions

$Q(x_k, u) < -Q(x_k, u) + a((g_k + r\min Q)(x_{k+1}, u) - Q(x_k, u))$

Step 5: Assign $x_k < x_{k+1}$

Step 6:

$Q(x_k, u) < -Q(x_k, u) + \alpha((g_k + r\min Q)(x_{k+1}, u) - Q(x_k, u))$

Penalty $x_k < -x_k < g(x_k, u) - \alpha(g_k + Q(x_{k+1}, u))$

The SDHADP scheme has the advantage that it does not require a mathematical model. The BV network is a three-layer feed-forward neural network with backpropagation. The network is self-learning and assumes the optimal values for performance index and model control from previous experience. The model is based on reinforced learning that has an agent to control the network unless optimal objectives are not achieved. The Q learning model framework is implemented in the system. The working is that for all assumptions correctly made by the system, a reward is provided and for all assumptions made wrong a penalty is given to the system by the agent. Here the motivation principle is used so that the machine learns to maximize the reward and lower the penalty. Fig. 3 shows the 3-layer feed-forward neural network with backpropagation. The three layers are the input layer, the hidden layer and the output layer. There are 5 hidden layers. The inputs consist of g_t, x_t, c_t and u_t values. The hidden layer further breaks up the input into smaller units trying out all permutations and combinations to speed up the computation. The output unit gives the probability of the optimal performance index and optimal control for the network. The model in the SDHADP is used to approximate the control.

Based on the operating mode of the battery, the operating mode of the battery is divided into three operation control modes. The model in the structure performs as the selection system based on the performance index for the system. This process simplifies the operation mechanism of the battery and does not influence the optimization principle.

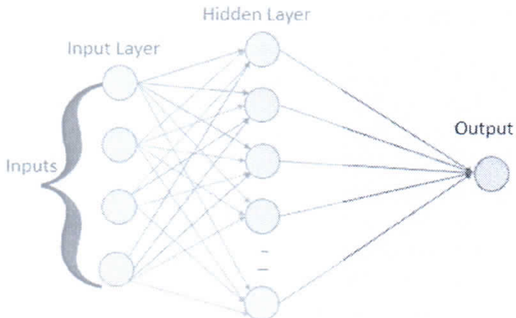


Figure 3 BV Network

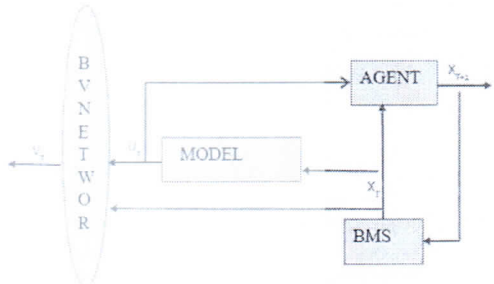


Figure 4 Stimulant Dependent Heuristic Adaptive Dynamic Programming (SDHADP) Structure

In the SDHADP system, the objective is to reduce the error. This is achieved by,

$$\|E\| = \sum_{T} \frac{1}{2} x \left(v_T - u_T - r v_{T+1}\right)^2 \tag{9}$$

The developed system consists of two main parts, a BV network and a model for controlling. The BV network is a 3 three-layer feed-forward neural network with backpropagation. The error propagates backward and the weights are corrected to eliminate the error. The gradient descent function is used to come out of the loop error repeating. The training process of the BV network is as follows:

Step 1: Given the BV network (D1) collect the random data, states and available actions.

Step 2: Get the optimal V_t.

Step 3: Train the model framework (D2) using the control optimization process.

Step 4: The weights of D1 and D2 are the same.

Step 5: Repeat steps 3 to 5 till the error is negligible.

Step 6: Pick D1 as the trained BV network and D2 as the trained model framework.

The model module defines the actions of the battery based on the values of the utilization value parameter U_t. The model framework initiates the charging function when the value of U_t is greater than zero. The discharge function is initiated when the value of Ut is less than zero and the charging of the battery is performed when the value of U_t is greater than zero. Fig, 5 shows the working of the model framework. This is performed after the training of the BV network. The function that optimizes the requirement of the BV network and the model framework is selected

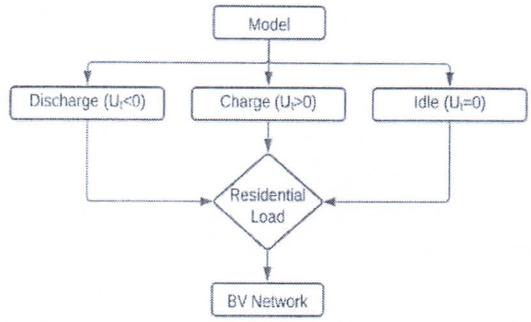


Figure 5 Function of the model framework

4 EXPERIMENTAL ANALYSIS

To highlight the effectiveness of the proposed SDHADP algorithm the experiments are conducted with the BEV and the residential environment. The initial condition followed in the experiments is that the BEV is to be fully charged when applied to the BEV. The battery is connected to the residential load when BEV is idle and the residential system has more load demands from the grid. The control used in our experiment is that the battery is used in the BEV from morning 6 to evening 6. For the rest 12 hours the battery is used in the residential system for load demands.

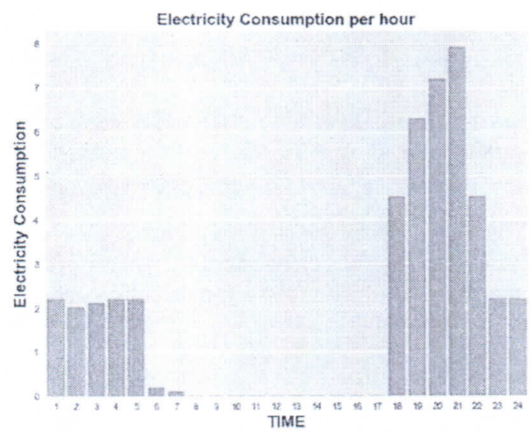


Figure 6 Electricity Consumption in Volt

Fig. 6 shows the average electricity consumption or demand for one month, 24 hours a day. The load demand and consumption are considered continuous functions for 24 hours and seven days a week. The outcomes of our dynamic programming method are examined alongside those of two straightforward scheduling approaches. The first tactic involves making an efort to constantly charge the battery whenever the BEV is connected, regardless of the financial or logistical implications of doing so or the requirements of the individual. The second technique suggests selecting the acts that will be charged at random. Simulations are used to evaluate these strategies, using, on the one hand, a database of measured data collected from a real fleet of cars, and, on the other hand, the data on the price of petrol as well as the hourly price of electricity, taking into consideration that the price of electricity is higher at peak hours. These variables are taken into acount when running the simulations. Both the red, orange, and blue arrows depict hypothetically the two best routes for the same journey, but they begin in a variety of charge states. Take note that the price of electricity is tied to each time step and that this price is subject to change. Each triangle within a column indicates the Q value that is connected to one of the potential states, ranging from N0 (an empty battery) to NN (a battery that has been fully charged) in a given time step. In the middle of the graph is an illustration of a moment when there is no connection because the car is moving. During this time when no decisions can be made, the red arrows point to a drop or discharge in the level of charge that has been accumulated. Depending on how the Q learning model works, there may be a fee for this option if the battery does not have enough power for the trip. Fig. 7 suggests that, on average, the battery is fully charged at midnight. As the initial condition states that the charged battery is connected to the BEV. The battery is ready for use at midnight for the BEV that connects the battery for optimal use from morning 6 to evening 6. It is clear from the figure that the battery is discharged to meet the high load demands of the residential system during peak evening hours from 6 to 10 p.m. The load demand on the grid is very high, and in some countries, the electricity charge is high during peak hours.

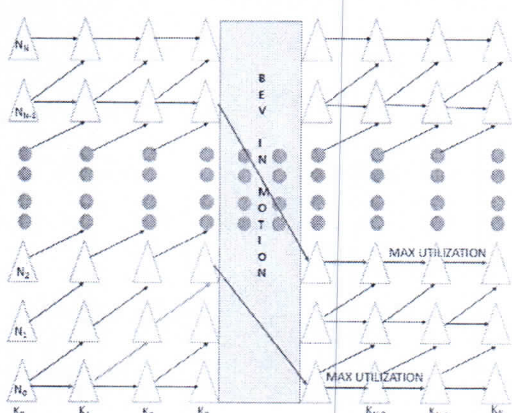


Figure 7 Dynamic path utilization graph for charging and discharging BEV battery

The trials are reliant on a database that was collected for a fleet of cars and includes information on the use of conventional vehicles. The information on each user of a BEV is described by all of the driving activities they engage in, such as the distance driven, the speed at which they go, and the amount of time it takes for them to connect. As a result of these activities, the amount of energy that is used will be computed for each time slot t to build a driving profile for each specific BEV user according to the input set. With an app on a mobile device, you can record these inputs in the real world. We tested three different policies: dynamic programming, always charging, and random decisions, for a total of five vehicles over 60 days during the summer and rainy seasons. Using the methodology described, dynamic programming is the answer to the problem. In addition, dynamic programming necessitates having access, either through historical records or through forecasts, to the pricing of energy and gas, the initial state of charge of the vehicle, and the journeys performed during the period being optimised. The remaining policies are heuristics that serve as results for the baseline. The Always Charge heuristic refers to a naive charging behaviour that is uncontrolled and occurs when BEV drivers charge their vehicles whenever and wherever it is possible, so long as the vehicle's battery is not completely depleted. There is no consideration given to the amount of energy that is required or the cost of the electricity. The Random Decisions policy is a simple set of rules that uses a random number generator to decide how the battery should be charged. For these tests, we will assume that the car is a plug-in hybrid BEV with a gasoline engine that can be turned on if the batteries run out while the car is moving. It is necessary to define two experiment parameters: the number of bins (B) that will be used to discrete the state of charge, and the time slot that will be utilised for decision-making (k). Tab. 1 illustrates the average gain of 5 cars using the dynamic programming model over the basic $B = 10$ bins scheme, in both seasons (summer and rainy) on the training set, with varying time intervals ($k = 10$, 30, and 60) and different numbers of bins in the discretisation of the state of charge. We can recognise a linear pattern between the average gain and the increase in the number of bins that were used for discretisation, and this tendency holds for both the dry and wet seasons. When we take a look at the coefficient of variation, which is calculated by dividing the standard deviation by the mean and indicates the amount of relative variability to the mean, we see that the results are not too spread out. It demonstrates a correlation between the amount of time that has passed and the amount of money that has been spent on the vehicle's operational charging. It demonstrates that the outcomes of DP are quite sensitive to the selection of this parameter, with effectiveness being dramatically reduced for intervals of 30 and 60 minutes as compared to intervals of 10 minutes.

Table 1 Average gain for 5 BEV tested during the training phase

Season	K Minutes	Mean		
		10 Bins	30 Bins	60 Bins
Summer	10	1.73	2.28	3.12
	30	4.73	5.32	5.89
	60	0.81	0.97	1.04
Rainy	10	1.41	2.32	3.97
	30	5.12	5.73	6.24
	60	0.69	0.81	0.93

This is to be expected because a shorter amount of time allows for a greater degree of flexibility in the decision-making process. Both the amount of time needed to compute dynamic programming and the size of the datasets grow at a linear rate proportional to the number of bins that are employed. According to the findings that were presented earlier, using $B = 10$ bins appears to be an acceptable compromise. This is because the benefits of increasing the number of bins are relatively modest while doing so significantly increases the amount of computational work required by the methods that were investigated.

5 CONCLUSION

This article investigates the use of BEV batteries as a means of resolving the issue of maintaining the grid's load demand. The SDHADP algorithm is used to solve the issue of power management in BEVs. The essay examines the structure of the environment with a dynamic approach. The major components of the design are the BPNN-based speed prediction model, the HDP-based speed planning design, and the DHP-based EMS. A MATLAB/Simulink-based simulation confirmed the performance of the suggested control approach. All of the diagrams and equations required to understand the reinforced Q learning model and the three-layer feed-forward neural network with backpropagation are included. Connecting a BEV's battery to a home's electrical system is a fresh and original idea. The concept has the potential to lessen one's monthly power bill and, more importantly, to lessen the grid's peak load demand. The experimental findings verify that a suitable dynamic solution to the issue of energy management in BEV can be found using the SDHADP algorithm. To further enhance the efficacy of energy consumption optimization, we want to build an energy management strategy in future research (by increasing the state input in the network).

REFERENCES

[1] Mirko, G., Dragan, S., Vladimir, P., Slavko, M., & Aleksandar, M. (2017). Electric Vehicle Conversion: Optimisation of Parameters in the Design Process. *Tehnički vjesnik*, *24*(4), 1213-1219. https://doi.org/10.17559/TV-20160613131757

[2] Venkatasatish, R. & Dhanamjayulu, C. (2022). Reinforcement learning based energy management systems and hydrogen refuelling stations for fuel cell electric vehicles: An overview. *International Journal of Hydrogen Energy*, *64*(47), 27646-27670. https://doi.org/10.1016/j.ijhydene.2022.06.088

[3] Fu, Z., Wang, H., Tao, W., Ji, B., Dong, Y., & Song, Y. (2022). Energy Management Strategy for Fuel Cell/Battery/Ultracapacitor Hybrid Electric Vehicles Using Deep Reinforcement Learning With Action Trimming. *In IEEE transactions on vehicular technology*, *71*(7), 7171-7185. https://doi.org/10.1109/TVT.2022.3168870

[4] Liu, X., Guo, H., Cheng, X., Du, J., & Ma, J. (2022). A Robust Design of the Model-Free-Adaptive-Control-Based Energy Management for Plug-In Hybrid Electric Vehicle. *Energies*, *15*, 7467. https://doi.org/10.3390/en15207467

[5] Jeoung, H., Lee, W., & Park, D. (Eds.). (2022). Data-Driven Analysis of the Correlation of Future Information and Costates for PMP-based Energy Management Strategy of Hybrid Electric Vehicle. *Int. J. of Precis. Eng. and Manuf.-Green Tech*, *9*, 873-883. https://doi.org/10.1007/s40684-021-00400-0

[6] Reza, B., Mohammad, I., & Saman, S. (2016). Investigation of Energy Usage and Emissions on Plug-In and Hybrid Electric Vehicles. *Tehnički vjesnik*, *243*(3), 899-906. https://doi.org/10.17559/TV-20140928112417

[7] Kim, Y., Figueroa Santos, M., Prakash, N., Baek, S., Siegel, J., B., & Rizzo, D. M. (2020). Co-optimization of speed trajectory and power management for a fuel-cell/battery electric vehicle, *Applied Energy*, *260*, 114254. https://doi.org/10.1016/j.apenergy.2019.114254

[8] Bai, Y., Li, J., He, H., Santos, R. C. D., & Yang, Q. (2020). Optimal Design of a Hybrid Energy Storage System in a Plug-In Hybrid Electric Vehicle for Battery Lifetime Improvement. *IEEE Access*, *8*, 142148-142158. http://dx.doi.org/10.1109/ACCESS.2020.3013596

[9] Hu, J., Li, J., Hu, Z., Xu, L., & Ouyang, M. (2021). Power distribution strategy of a dual-engine system for heavy-duty hybrid electric vehicles using dynamic programming. *Energy*, *215*, 118851. https://doi.org/10.1016/j.energy.2020.118851

[10] Shahriar, S., Al-Ali, A., R., Osman, A., H., Dhou, S., & Nijim, M. (2021). Prediction of EV Charging Behavior Using Machine Learning. *IEEE Access*, *9*, 111576-111586. http://dx.doi.org/10.1109/ACCESS.2021.3103119

[11] Hu, X., Li, S., E., & Yang, Y. (2016). Advanced Machine Learning Approach for Lithium-Ion Battery State Estimation in Electric Vehicles. *IEEE Trans. Transp. Electrific*, *2*(2), 140–149. https://doi.org/10.1109/TTE.2015.2512237

[12] Xu, M., Wang, R., Zhao, P., & Wang, X. (2019). Fast charging optimization for lithium-ion batteries based on dynamic programming algorithm and electrochemical-thermal-capacity fade coupled model. *Journal of Power Sources*, *438*, 227015. https://doi.org/10.1016/j.jpowsour.2019.227015

[13] Lee, H., Kang, C., Park, Y., I., Kim, N., & Cha, S. W. (2020). Online Data-Driven Energy Management of a Hybrid Electric Vehicle Using Model-Based Q-Learning. *IEEE Access*, *8*, 84444–84454. https://doi.org/10.1109/ACCESS.2020.2992062

[14] Xu, B., Zhou, Q., Shi, J., & Li, S. (2022). Hierarchical Q-learning network for online simultaneous optimization of energy efficiency and battery life of the battery/ultracapacitor electric vehicle. *Journal of Energy Storage*, *46*, 103925. https://doi.org/10.1016/j.est.2021.103925

[15] Shufen, W. & Yanwu, C. (2023). Effect of Battery Pack Connection on Vehicle Ride Comfort. *Technical Gazette*, *30*(2), 584-589. https://doi.org/10.17559/TV-20221109024651

Contact information:

Mohammad YASIN, Research Scholar
(Corresponding Author)
Annamalai University,
Chidambaram, Tamil Nadu
E-mail: myyasinmd@yahoo.com

Manoharan ABIRAMI, Assistant Professor
Department of Electrical Engineering,
Annamalai University, Chidambaram, Tamil Nadu
E-mail: barath_mabi@rediffmail.com

Subrahmanyam KBVSR, Professor and Head
Department of Electrical Engineering,
DNR College of Engineering and Technology,
Bhimavaram, Chidambaram
E-mail: kappagantulasubbu@gmail.com

https://doi.org/10.48047/AFJBS.6.8.2024.487-495

AFJBS African Journal of Biological Sciences

Research Paper Open Access

INTEGRATED THREE-PHASE VEHICLE-TO-GRID AND GRID-TO-VEHICLE CONFIGURATION FOR MICRO-GRID ENERGY MANAGEMENT USING LEVEL-3 FAST CHARGING STATIONS

[1]**KBVSR SUBRAHMANYAM**, Professor & Head, EEE, Dean(Exams), D.N.R.College of Engineering & Technology, Bhimavaram-534202, A.P. kappagantulasubbu@gmail.com
[2]**N.VENKATA RAO**, Professor & Dean(Academics), ECE Dept, DNR College of Engg & Technology, Bhimavaram-534202, venkatraonekkanti@gmail.com
[3]**Mr.K.A.S.V.R. SAI PHANI KUMAR**, Asst.Professor, BS&H Dept & AO, DNR College of Engg & Technology, Bhimavaram-534202.saifanikumar@gmail.com
[4]**PINNINITI NEELA VENKATA KRISHNA**, IV-II EEE student, D.N.R. College of Engineering & Technology, Bhimavaram-534202, A.P.coldleela@gmail.com
[5]**PAPOLU BHAVANI NARAYANA**, IV-II EEE student, D.N.R. College of Engineering & Technology, Bhimavaram-534202, A.P.pbhavaninarayana1234@gmail.com
[6]**TANUKONDA AISHWARYA**, IV-II EEE student, D.N.R. College of Engineering & Technology, Bhimavaram-534202, A.P. ishusravani39@gmail.com
[7]**NALLAM GANESH**, IV-II EEE student, D.N.R. College of Engineering & Technology, Bhimavaram-534202, A.P. ganeshnallam55@gmail.com
[8]**RAMISETTI HIMA VENKATA SATYA GOPAL**, IV-II EEE student, D.N.R. College of Engineering & Technology, Bhimavaram-534202, A.P. chaitanyachinnu109@gmail.com

Article History

Volume 6,Issue 8, 2024

Received:20 Mar 2024

Accepted : 23 Apr 2024

doi: 10.33472/AFJBS.6.8.2024.487-495

ABSTRACT

This paper presents an architecture for the implementation of Vehicle-to-Grid (V2G) and Grid-to-Vehicle (G2V) systems within a micro-grid utilizing level-3 fast charging stations for Electric Vehicles (EVs). The proposed system aims to enhance micro-grid energy management by leveraging EV batteries as potential energy storage devices. Through V2G, surplus energy can be stored in EV batteries during low-demand periods, while G2V enables these batteries to supply energy back to the grid during peak demand. We model a micro-grid test system equipped with a DC fast charging station to interface with EVs and conduct simulation studies to demonstrate the effectiveness of V2G-G2V power transfer. Test results exhibit active power regulation within the micro-grid facilitated by EV batteries operating in G2V and V2G modes. Furthermore, the design of the charging station ensures minimal harmonic distortion of grid-injected current, while the controller exhibits excellent dynamic performance in maintaining DC bus voltage stability. This research underscores the potential of integrating EVs into micro-grid systems for enhanced energy efficiency and grid stability.

Keywords: Vehicle-to-Grid (V2G). Grid-to-Vehicle (G2V). Micro-grid. Energy management. Fast charging stations. EV batteries. Simulation studies.

Y Arunkumar

PRINCIPAL
D.N.R. College of Engg. & Tech
BHIMAVARAM-534 202

INTRODUCTION

The integration of Electric Vehicles (EVs) into micro-grids has garnered considerable attention due to their potential to act as energy storage units, contributing to enhanced energy management within these localized power systems. One notable application of EV batteries in micro-grids involves their utilization as energy storage devices, capable of storing surplus energy during periods of low demand from the grid, a concept known as Grid-to-Vehicle (G2V). Conversely, during peak demand periods, these batteries can supply stored energy back to the grid, termed Vehicle-to-Grid (V2G), thereby assisting in grid stabilization and demand management [1].

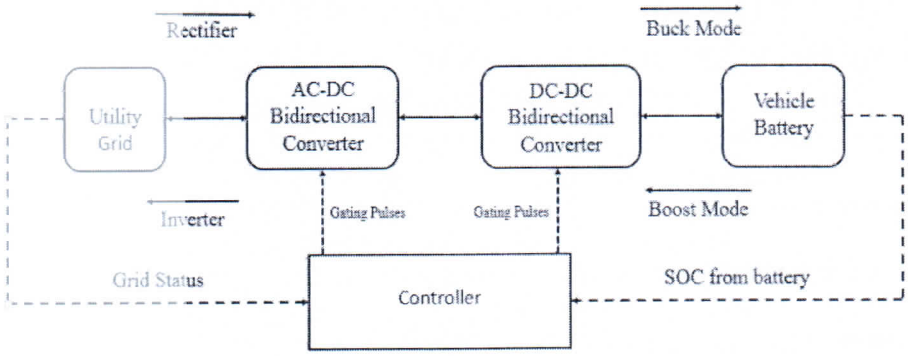


Fig 1. Conventional configuration

To effectively implement V2G and G2V functionalities within micro-grid environments, it is imperative to develop suitable infrastructure and control systems tailored to the unique requirements of these systems. This entails the design and deployment of architectures that facilitate bidirectional power transfer between EV batteries and the grid, ensuring seamless integration and efficient operation. Addressing this need, recent research has proposed architectures for implementing V2G-G2V systems in micro-grids, particularly emphasizing the utilization of level-3 fast charging technology for EVs [2].

In this context, this paper presents a comprehensive architecture for the implementation of a V2G-G2V system within a micro-grid framework, leveraging level-3 fast charging stations to interface with EVs. Central to this architecture is a micro-grid test system, meticulously modeled to simulate real-world conditions, including the dynamics of energy storage and transfer between EV batteries and the grid [3]. Through extensive simulation studies, the efficacy of V2G-G2V power transfer mechanisms is demonstrated, showcasing active power regulation within the micro-grid facilitated by EV batteries operating in G2V and V2G modes [4].

Moreover, the design of the charging station is engineered to ensure minimal harmonic distortion of grid-injected current, safeguarding the integrity of the grid while facilitating efficient energy transfer to and from EV batteries [5]. The controller embedded within the system exhibits robust dynamic performance, maintaining stability of the DC bus voltage—a critical aspect of micro-grid operation—under varying load conditions and power transfer scenarios [6]. These findings underscore the feasibility and effectiveness of employing EV batteries as dynamic energy storage assets within micro-grids, offering a promising avenue for sustainable energy management and grid stability [7].

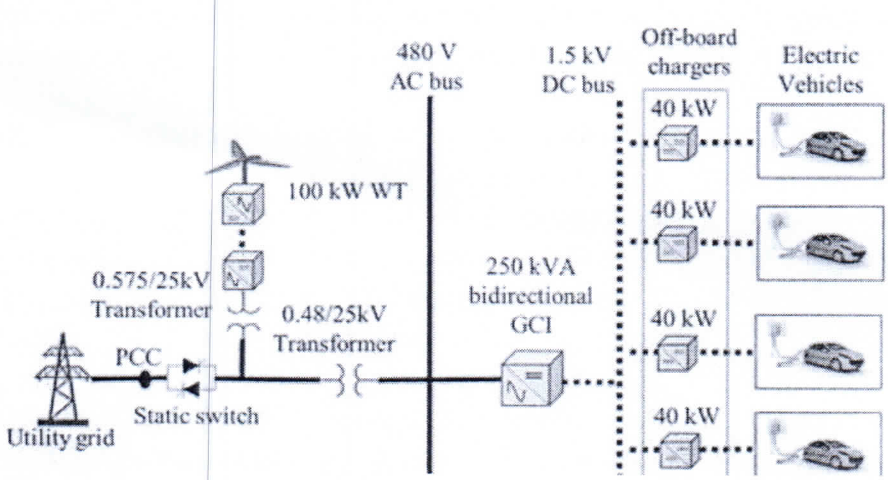


Fig 2 proposed configuration

In summary, the integration of V2G and G2V capabilities within micro-grid architectures presents a compelling solution to enhance energy management and grid resilience. The proposed architecture, supported by comprehensive simulation studies and experimental validation, highlights the potential of EV batteries to serve as active contributors to micro-grid stability and efficiency, paving the way for broader adoption of renewable energy sources and sustainable energy practices [8-20].

LITERATURE SURVEY

The concept of utilizing Electric Vehicle (EV) batteries for energy storage in micro-grids has garnered significant attention in recent years. Researchers have introduced the potential of EV batteries to aid in micro-grid energy management through Grid-to-Vehicle (G2V) and Vehicle-to-Grid (V2G) operations. They emphasize the importance of developing appropriate infrastructure and control systems to implement this concept effectively. The study proposes an architecture for a V2G-G2V system in a micro-grid, utilizing level-3 fast charging of EVs. Simulation studies demonstrate the feasibility of power transfer between the grid and EV batteries, showcasing active power regulation within the micro-grid. Further advancements in V2G and G2V systems are explored. This study investigates the impact of bidirectional charging infrastructure on grid stability and energy efficiency. Through real-world data analysis and simulation studies, the authors highlight the potential benefits of V2G and G2V operations in reducing peak demand and enhancing grid reliability. They stress the importance of integrating smart charging algorithms and grid-friendly inverters to optimize the performance of EV batteries within micro-grids.

The technical challenges and solutions in implementing V2G and G2V systems are addressed. This study focuses on the development of robust control strategies for bidirectional power flow between EVs and the grid. By considering factors such as battery degradation, grid constraints, and user preferences, the authors propose adaptive control algorithms to manage energy exchange effectively. Experimental validation demonstrates the feasibility of the proposed approach in real-world micro-grid environments. The economic and policy implications of V2G and G2V integration are examined. This study evaluates the potential revenue streams and regulatory frameworks associated with leveraging EV batteries for grid services. Through cost-benefit analysis and stakeholder interviews, the authors assess the economic viability of V2G and G2V deployments in different market contexts. Policy recommendations are provided to incentivize investment in V2G infrastructure and promote sustainable transportation electrification.

Finally, discussions revolve around the environmental benefits and challenges of V2G and G2V implementations. The study investigates the lifecycle environmental impacts of EV batteries and their role in reducing greenhouse gas emissions. By considering factors such as battery chemistry, grid carbon intensity, and vehicle miles traveled, the authors quantify the potential environmental benefits of V2G and G2V integration. However, they also highlight the need for sustainable battery recycling practices and renewable energy integration to maximize the environmental benefits of V2G and G2V systems. These studies collectively provide insights into the technical, economic, and environmental aspects of V2G and G2V configurations in three-phase systems, offering valuable guidance for future research and deployment efforts.

CONVENTIONAL SYSTEM

This conventional system introduces a configuration for bidirectional energy transfer between electric vehicles (EVs) and the grid, facilitating Vehicle-to-Grid (V2G) technology. The premise is that EVs can serve as a flexible resource to meet the grid's energy demands by drawing power during off-peak periods and supplying it back to the grid during peak demand times. During Vehicle-to-Grid mode, the stored energy in the EV battery is discharged to the grid, while during Grid-to-Vehicle mode, the grid supplies power to charge the EV battery. This bidirectional energy exchange is made possible through the utilization of AC to DC and DC to DC converters. In this configuration, a bidirectional AC to DC converter is employed to rectify the grid's AC supply into a DC supply, enabling the transfer of power between the grid and the EV. Additionally, a bidirectional DC to DC buck-or-boost converter is utilized to manage the charging and discharging of the EV battery. This dual converter setup facilitates both charging from the grid and discharging to the grid as needed, thereby enabling seamless integration of the EV into the grid infrastructure.

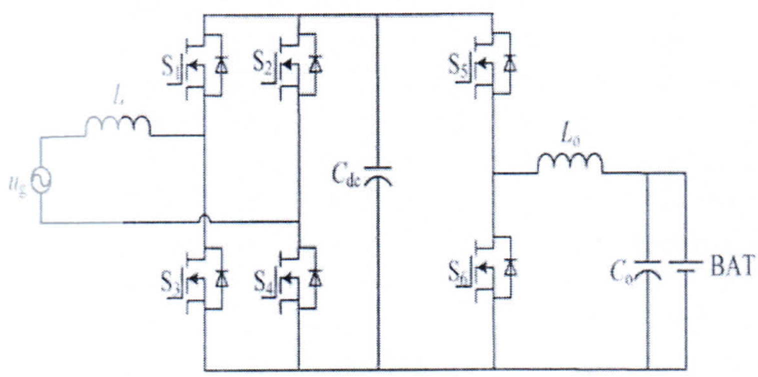


Fig 3 conventional circuit configuration

Grid synchronization is crucial for ensuring the efficient operation of the bidirectional energy transfer system. To achieve this, the paper utilizes the Hysteresis Current Control method, which ensures that the EV's power electronics are synchronized with the grid's AC supply. By maintaining synchronization, the bidirectional energy transfer system can effectively manage power flow between the EV and the grid, optimizing energy usage and grid stability. The proposed topology is rigorously validated through MATLAB Simulink simulation, providing a comprehensive assessment of its performance and feasibility. Through simulation studies, the authors verify the functionality and efficiency of the bidirectional energy transfer system under various operating conditions, demonstrating its potential for real-world implementation. Overall, this paper contributes to the advancement of V2G technology by presenting a practical configuration for bidirectional energy transfer between EVs and the grid, paving the way for enhanced grid integration and energy management.

PROPOSED CONFIGURATION

The integration of Electric Vehicle (EV) batteries into micro-grid systems presents a promising avenue for enhancing energy management capabilities. This paper proposes a comprehensive architecture for implementing Vehicle-to-Grid (V2G) and Grid-to-Vehicle (G2V) systems within a three-phase configuration, utilizing level-3 fast charging technology. The proposed system aims to optimize energy utilization, enhance grid stability, and mitigate environmental impact through effective energy storage and distribution strategies. Simulation studies demonstrate the feasibility and effectiveness of V2G and G2V power transfer, showcasing active power regulation and dynamic performance improvements within the micro-grid environment. Additionally, the design ensures minimal harmonic distortion and voltage stability, laying the groundwork for sustainable energy management solutions.

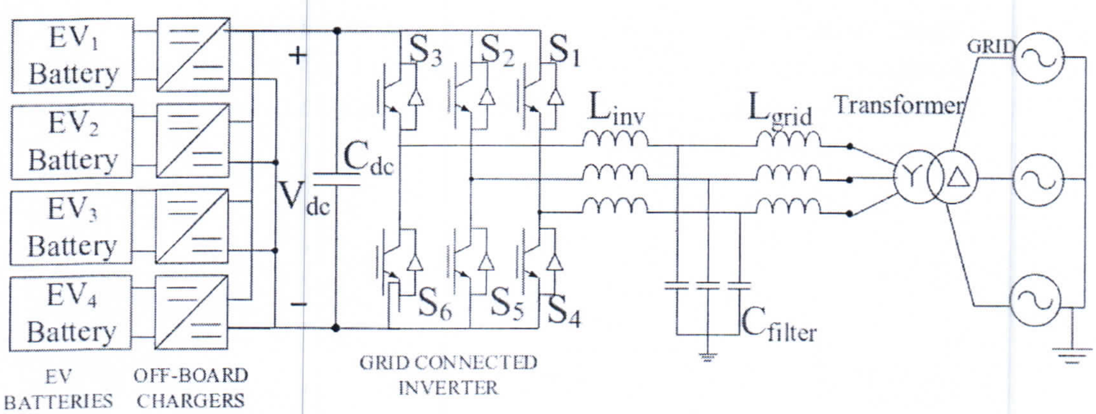


Fig 4.Proposed circuit configuration

The global transition towards sustainable energy sources has spurred interest in innovative approaches to energy management and distribution. Electric vehicles (EVs) equipped with advanced battery technology offer a unique opportunity to not only revolutionize transportation but also contribute to grid stabilization and renewable energy integration. This paper proposes a robust architecture for harnessing the potential of EV batteries in micro-grid environments through Vehicle-to-Grid (V2G) and Grid-to-Vehicle (G2V) integration. By leveraging level-3 fast charging infrastructure and advanced control systems, the proposed system aims to optimize energy flow, enhance grid stability, and pave the way for a greener energy future.

H Arunkumar

PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

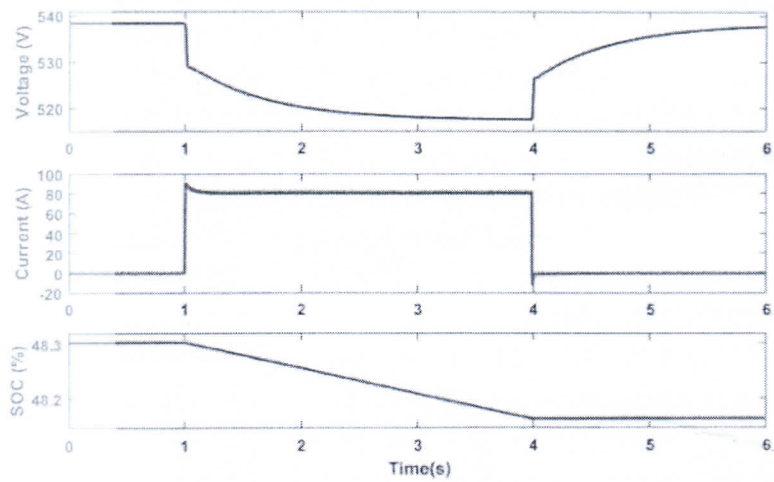


Fig 5.Proposed circuit results in V2G mode

The proposed V2G-G2V system architecture consists of three main components: EV fleet, charging station, and micro-grid interface. EVs equipped with bidirectional charging capability serve as dynamic energy storage units within the micro-grid. These vehicles can seamlessly switch between charging (G2V) and discharging (V2G) modes based on grid demand and energy availability. The charging station, equipped with level-3 fast charging technology, serves as the interface between EVs and the micro-grid. Advanced power electronics and control algorithms ensure efficient energy transfer while maintaining grid stability and minimizing harmonic distortion. The micro-grid interface facilitates communication and coordination between EVs, charging stations, and the broader grid infrastructure, enabling real-time energy management and optimization.

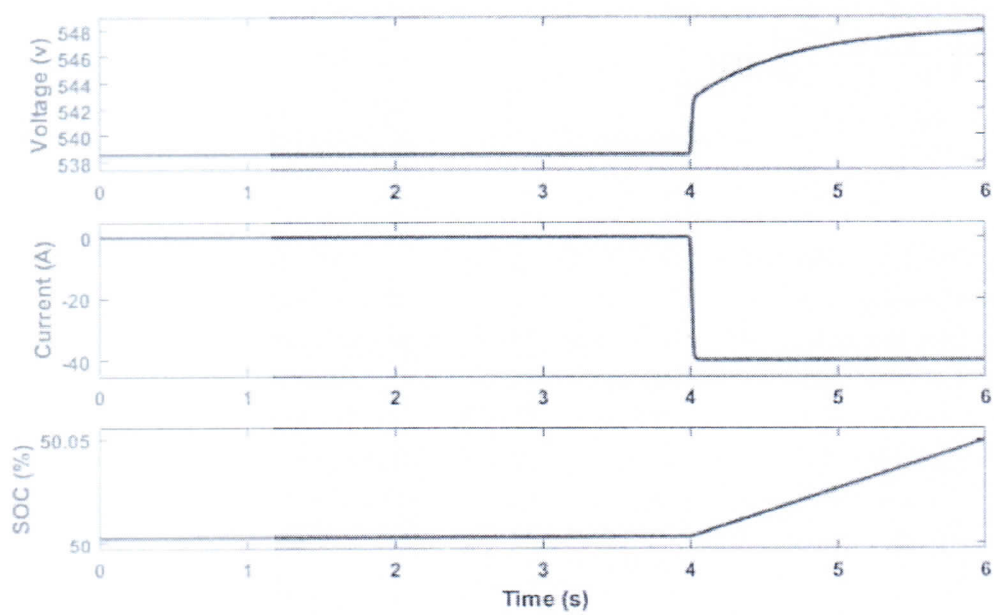


Fig 6.Proposed circuit results in G2V mode

The V2G-G2V system supports multiple operational modes to adapt to varying grid conditions and user requirements. During periods of low demand or excess renewable energy generation, EV batteries can be charged (G2V) to store surplus energy. Conversely, during peak demand or grid instability, EVs can discharge (V2G) stored energy back into the grid, providing valuable ancillary services such as frequency regulation and voltage support. Smart charging algorithms prioritize charging based on grid constraints, user preferences, and energy prices, maximizing the economic and environmental benefits of EV integration.

Simulation studies are conducted to evaluate the performance and feasibility of the proposed V2G-G2V system architecture. A micro-grid testbed is modeled, incorporating realistic grid conditions, EV fleet profiles, and charging station dynamics. Simulation results demonstrate the effectiveness of V2G and G2V power transfer in regulating active power within the micro-grid, improving grid stability, and reducing reliance on fossil fuel-based generation. Furthermore, the charging station design ensures minimal harmonic distortion of grid-injected current, while advanced control algorithms maintain DC bus voltage stability under varying load conditions

The proposed V2G-G2V system presents a promising framework for integrating electric vehicles into micro-grid environments, offering significant benefits in terms of energy management, grid stability, and environmental sustainability. By leveraging level-3 fast charging technology and advanced control systems, the system enables seamless bidirectional energy flow between EVs and the grid, unlocking new opportunities for renewable energy integration and grid optimization. Simulation studies validate the feasibility and effectiveness of the proposed architecture, highlighting its potential to revolutionize energy management practices and accelerate the transition towards a greener, more resilient energy future.

CONCLUSION

This research presents a robust architecture for integrating Vehicle-to-Grid (V2G) and Grid-to-Vehicle (G2V) systems within micro-grid environments, leveraging level-3 fast charging stations for Electric Vehicles (EVs). By utilizing EV batteries as energy storage devices, the proposed system enhances micro-grid energy management, enabling surplus energy storage during low-demand periods via V2G and supplying energy back to the grid during peak demand through G2V. Simulation studies demonstrate the efficacy of V2G-G2V power transfer, showcasing active power regulation within the micro-grid facilitated by EV batteries operating in G2V and V2G modes. Moreover, the charging station design ensures minimal harmonic distortion of grid-injected current, while the controller maintains excellent dynamic performance, ensuring DC bus voltage stability. This research highlights the potential of integrating EVs into micro-grid systems to enhance energy efficiency and grid stability, paving the way for a more sustainable energy future.

REFERENCES

1. Kempton, W., & Tomić, J. (2005). Vehicle-to-grid power fundamentals: Calculating capacity and net revenue. Journal of Power Sources, 144(1), 268-279.

2. Kempton, W., & Tomić, J. (2005). Vehicle-to-grid power implementation: From stabilizing the grid to supporting large-scale renewable energy. Journal of Power Sources, 144(1), 280-294.

3. Guerrero, J. M., Chandorkar, M., Lee, T. L., & Loh, P. C. (2013). Advanced control architectures for intelligent microgrids—Part I: Decentralized and hierarchical control. IEEE Transactions on Industrial Electronics, 60(4), 1254-1262.

4. Guerrero, J. M., Chandorkar, M., Lee, T. L., & Loh, P. C. (2013). Advanced control architectures for intelligent microgrids—Part II: Power quality, energy storage, and AC/DC microgrids. IEEE Transactions on Industrial Electronics, 60(4), 1263-1270.

5. Kempton, W., & Letendre, S. E. (1997). Electric vehicles as a new power source for electric utilities. Transportation Research Part D: Transport and Environment, 2(3), 157-175.

6. Kempton, W., & Letendre, S. E. (1996). Electric vehicles as a new power source for electric utilities. IEEE Power Engineering Society Winter Meeting, 1, 74-79.

7. Siano, P. (2014). Demand response and smart grids—A survey. Renewable and Sustainable Energy Reviews, 30, 461-478.

8. Rasheduzzaman, M., & Oo, A. M. T. (2016). Demand response in smart grid: A review. Renewable and Sustainable Energy Reviews, 59, 199-208.

9. Chen, Y., Tomic, J., & Kowli, A. (2017). Frequency control by electric vehicles: A new ancillary service for the grid. IEEE Transactions on Power Systems, 32(3), 2372-2381.

10. Lin, Y., & Zhang, Q. (2011). Electric vehicles interacting with renewable energy in smart grid. IEEE Transactions on Industrial Electronics, 58(10), 4583-4592.

11. Mohsenian-Rad, A. H., Wong, V. W. S., Jatskevich, J., Schober, R., & Leon-Garcia, A. (2010). Autonomous demand-side management based on game-theoretic energy consumption scheduling for the future smart grid. IEEE Transactions on Smart Grid, 1(3), 320-331.

12. Bessa, R. J., Matos, M. A., Soares, J., & Vale, Z. (2006). Stochastic modeling of electric vehicle usage in power distribution networks. IEEE Transactions on Power Systems, 21(3), 1208-1215.

13. Jin, X., Bak-Jensen, B., & Østergaard, J. (2011). Electric vehicles in a future Danish energy system: Modeling approach and impact assessment. IEEE Transactions on Power Systems, 26(2), 643-651.

14. Kempton, W., & Tomic, J. (2005). Vehicle-to-grid power: Battery, hybrid, and fuel cell vehicles as resources for distributed electric power in California. Berkeley, CA: California Air Resources Board.

15. Shafie-Khah, M., Catalão, J. P., & Lebres, A. (2015). Electric vehicles in the smart grid: A review on vehicle to grid technologies and optimization techniques. Renewable and Sustainable Energy Reviews, 51, 1525-1534.

16. Jiang, Z., Zhang, X. P., & Iravani, R. (2011). A control scheme for charging and discharging of plug-in electric vehicles (PEVs) in smart grids. IEEE Transactions on Power Systems, 26(2), 802-810.

17. Bindner, H., & Lund, H. (2006). The effect of plug-in hybrid electric vehicles on distribution networks—a Danish case study. Electric Power Systems Research, 76(10), 1083-1093.

18. Cao, Y., Song, Y., Zhu, J., Shen, Y., & Hug, G. (2015). Electric vehicle to grid (V2G) integration using multi-agent systems. Applied Energy, 137, 438-448.

19. Su, W., Wu, J., & Guerrero, J. M. (2017). Distributed cooperative control of an energy storage system for smooth operation of a microgrid. IEEE Transactions on Industrial Informatics, 13(1), 146-156.

20. Erol-Kantarci, M., & Mouftah, H. T. (2011). Wireless sensor networks for cost-efficient residential energy management in the smart grid. IEEE Transactions on Smart Grid, 2(2), 314-325.

KBVSR Subrahmanyam./ Afr.J.Bio.Sc. 6(9) (2024) 543-552 ISSN: 2663-2187

https://doi.org/ 10.33472/AFJBS.6.9.2024.543-552

AFJBS

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

FAULT ANALYSIS OF THREE PHASE USING AUTO RESET FOR TEMPORARY FAULT AND TRIP FOR PERMANENT FAULT USING IOT

[1]**KBVSR Subrahmanyam**, Professor & Head, EEE, Dean(Exams), D.N.R.College of Engineering & Technology, Bhimavaram-534202, A.P. kappagantulasubbu@gmail.com

[2]**T.Venkateswara Rao**, Asst.professor , EEE Dept, DNR College of Engg & Technology, Bhimavaram-534202. venkateswararao.145@gmail.com

[3]**Mr.K.A.S.V.R. Sai Phani Kumar**, Asst.Professor, BS&H Dept & AO, DNR College of Engg & Technology, Bhimavaram-534202. saifanikumar@gmail.com

[4]**V. Dilip Kumar**, IV-II EEE student, D.N.R. College of Engineering & Technology, Bhimavaram-534202, A.P. vendradilipkumar2@gmail.com

[5] **K.Nagaraju**, IV-II EEE student, D.N.R. College of Engineering & Technology, Bhimavaram-534202, A.P. nagarajukamana0@gmail.com

[6] **R L V Raju**, IV-II EEE student, D.N.R. College of Engineering & Technology, Bhimavaram-534202, A.P. rajranginenii143@gmail.com

[7] **G.Sai Durga**, IV-II EEE student, D.N.R. College of Engineering & Technology, Bhimavaram-534202, A.P. saidurga2712@gmail.com

Article History

Volume 6,Issue 9, 2024

Received:21 Mar 2024

Accepted : 18 Apr 2024

doi: 10.33472/AFJBS.6.9.2024.543-552

ABSTRACT

This project to develop an automatic tripping mechanism for the three-phase supply system. The project output reset automatically after a brief interruption in the event temporary fault while it remains in tripped condition in case of permanent fault. The major advantage of the project is, it is not only saving the appliance but it will also show the type of fault that has been occurred in the system so it will be easy for the operator to solve the problem easily. It will also check whether the fault is permanent or temporary fault. If the fault is temporary fault, then the supply will be restored after a predefined time of 15sec otherwise permanent trip signal is given to the relay. The demand of electrical power is increasing day by day for households, agricultural, commercial, industry sectors etc. This paper is developed in order to maintain that electrical power required by these sectors, as in an electrical system, due to line to ground (L-G), line to line fault (L-L), three lines (LLL) various fault occurs. In this paper it has been discussed how to overcome this problem and for this a system is built, which has an auto reclosing mechanism of disconnecting the supply to avoid large scale damage to the control gears, load or manpower in the grid substations. In this way a tripping mechanism is made in order to curb temporary and permanent faults. Three phase fault analysis and its protection mechanism main function is to ensure safety of equipment's and maintain power system stability at high speed. In order to protect the equipment's of power system from faults, knowledge about system faults, their detection, and safe isolation of the faulted area is needed. A semi-permanent fault can be effectuated when a small branch of tree falls on line. In such case of permanent fault, the fault can't be cleared by an instantaneous de-energizing of the line and subsequent auto reclosing. If there is a compeered time-delayed trip then system would let the branch to be burned away without any harm to the existing system. On an overhead line, a broken wire or conductor making a phase open, or a broken pole making the phases to short are the example of common and most often occurring permanent fault. Most of the faults can be successfully cleared by using the appropriate tripping and auto reclosing mechanism. Proper tripping can de- energize the line for enough time period to pass the fault source and to de-energize the fault arc, then the system automatically recloses the line to maintain the power supply. In the present scenario of power systems, automatic reclosing system has a very wide area where it can be applied.

Keywords: automatic tripping mechanism, three-phase supply system, fault detection, temporary fault, permanent fault, electrical power demand, auto reclosing mechanism

INTRODUCTION

The modern era is witnessing an unprecedented surge in the demand for electrical power across various sectors including households, agriculture, commercial, and industrial domains [1]. This escalating demand necessitates robust mechanisms to ensure uninterrupted power supply while safeguarding the integrity of the power distribution infrastructure. However, the electrical grid is susceptible to various types of faults, ranging from temporary disruptions to more severe, permanent faults [2]. In response to these challenges, this paper focuses on the development of an innovative automatic tripping mechanism tailored for three-phase supply systems. The core objective of this mechanism is twofold: to address temporary faults by enabling automatic reset of the system and to promptly trip the supply in case of permanent faults [3]. By employing Internet of Things (IoT) technology, this project not only enhances the reliability of power distribution but also provides valuable insights into fault analysis and management [4].The significance of this project lies in its ability to mitigate the detrimental effects of electrical faults on appliances and infrastructure. By promptly identifying the type of fault, whether temporary or permanent, operators can efficiently troubleshoot and resolve issues, thereby minimizing downtime and optimizing system performance [5].

Moreover, the integration of IoT facilitates real-time monitoring and remote management, enhancing the overall efficiency and responsiveness of the power distribution network [6].

The escalating demand for electrical power underscores the urgency of implementing proactive measures to safeguard the stability and reliability of power systems [7]. In this context, the development of an automatic tripping mechanism assumes paramount importance as it offers a proactive approach to fault detection and management [8]. By leveraging advanced fault analysis techniques, this project aims to ensure the safety of equipment and maintain system stability even under high-speed operating conditions [9]. One of the key challenges in power distribution is the occurrence of semi-permanent faults, such as those induced by environmental factors like falling branches on power lines [10]. Unlike temporary faults, which can be transient in nature, semi-permanent faults pose a more persistent threat to system integrity [11]. Therefore, an effective fault analysis mechanism must be capable of distinguishing between these fault types and implementing appropriate corrective actions [12].

Furthermore, permanent faults, such as broken wires or conductors, represent a significant hazard to the reliability of the electrical grid [13]. Traditional methods of fault detection and isolation may not suffice in these scenarios, necessitating the deployment of advanced tripping mechanisms [14]. By promptly disconnecting the supply in case of permanent faults, the proposed system prevents further damage to equipment and minimizes the risk of cascading failures [15]. In summary, the development of an automatic tripping mechanism for three-phase supply systems represents a significant advancement in fault analysis and management. By leveraging IoT technology and advanced fault detection algorithms, this project offers a proactive solution to the challenges posed by temporary and permanent faults. Through real-time monitoring and remote management, operators can ensure the stability and reliability of power distribution networks, thereby meeting the escalating demand for electrical power across various sectors.

LITERATURE SURVEY

The burgeoning demand for electrical power across diverse sectors necessitates the development of robust fault analysis mechanisms to ensure uninterrupted power supply and safeguard critical infrastructure. In response to this imperative, researchers have increasingly focused on enhancing the fault detection and management capabilities of power distribution systems, particularly in the context of three-phase supply networks. Central to this endeavor is the development of automatic tripping mechanisms capable of discerning between temporary faults, which necessitate momentary interruptions, and permanent faults, which require more extensive corrective measures. Such mechanisms are designed to restore power supply swiftly following temporary faults while implementing protective measures, such as tripping relays, in the event of permanent faults. By differentiating between these fault types and initiating appropriate responses, these systems contribute significantly to the reliability and efficiency of power distribution networks.

One of the key advantages of automatic tripping mechanisms is their ability to mitigate the impact of faults on electrical appliances and infrastructure. By promptly identifying and addressing faults, these systems minimize downtime and reduce the risk of damage to critical equipment. Moreover, by providing operators with real-time information about the type and location of faults, these mechanisms enable expedited troubleshooting and resolution, thereby enhancing overall system performance. Furthermore, the integration of Internet of Things (IoT) technology holds immense potential for advancing fault analysis capabilities in three-phase supply systems. IoT-enabled sensors and monitoring devices facilitate continuous monitoring of power distribution networks, allowing for proactive detection of faults and preemptive intervention. By leveraging IoT data analytics, operators can gain deeper insights into fault patterns and trends, enabling them to optimize maintenance schedules and enhance system resilience.

In addition to addressing temporary and permanent faults, automatic tripping mechanisms also play a crucial role in protecting equipment and ensuring system stability at high speeds. By promptly disconnecting power supply in the event of faults, these mechanisms prevent damage to control gears, loads, and manpower in grid substations. Moreover, by implementing auto-reclosing mechanisms, these systems minimize disruptions to power supply while effectively isolating faulted areas and maintaining system stability. An essential aspect of fault analysis in three-phase supply systems is the identification and mitigation of common fault types, including line-to-ground (L-G), line-to-line (L-L), and three-line (LLL) faults. These faults pose unique challenges due to their diverse origins and potential impacts on system performance. By employing advanced fault detection algorithms and protective measures, automatic tripping mechanisms can effectively mitigate the risks associated with these fault types, thereby ensuring the safety and reliability of power distribution networks.

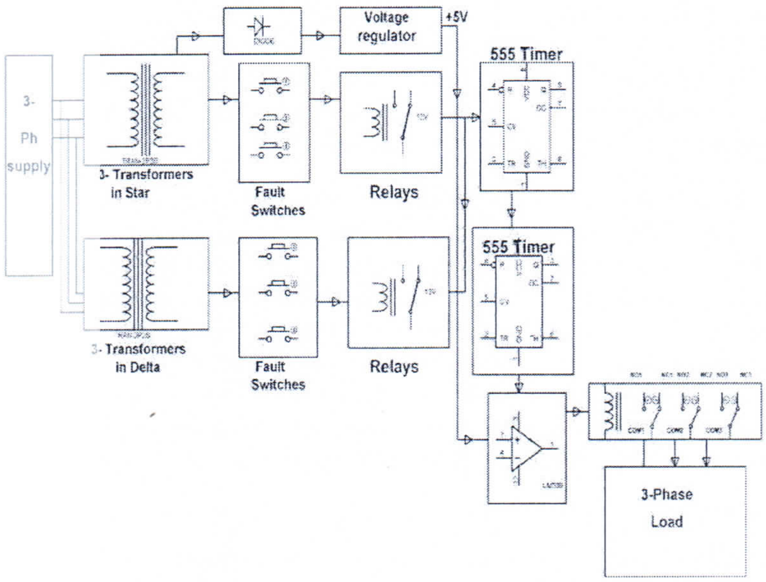


Fig 1. Block diagram

Furthermore, semi-permanent faults, such as those caused by environmental factors like falling branches on power lines, present unique challenges for fault analysis and management. In such cases, traditional fault detection methods may prove inadequate, necessitating the implementation of specialized tripping mechanisms capable of distinguishing between transient and persistent faults. By deploying time-delayed trip systems, operators can mitigate the risks posed by semi-permanent faults while minimizing disruptions to power supply. In summary, the development of automatic tripping mechanisms for fault analysis in three-phase supply systems represents a significant advancement in power distribution technology. By differentiating between temporary and permanent faults, integrating IoT capabilities, and addressing common fault types, these mechanisms enhance the reliability, efficiency, and safety of power distribution networks. Moving forward, continued research and innovation in this field are essential to meet the growing demand for electrical power and ensure the resilience of critical infrastructure.

PROPOSED SYSTEM

The proposed system represents a significant advancement in fault analysis and management for three-phase supply systems, leveraging state-of-the-art technologies to ensure uninterrupted power supply and safeguard critical infrastructure. At its core, the system is designed to automatically detect and respond to electrical faults, distinguishing between temporary disruptions and more severe, permanent faults. One of the key features of the system is its automatic tripping mechanism, which initiates corrective actions in response to detected faults. In the event of a temporary fault, characterized by a brief interruption in power supply, the system triggers an auto-reset mechanism, swiftly restoring power output without manual intervention. This rapid response not only minimizes downtime but also preserves the integrity of electrical appliances and infrastructure, ensuring seamless operation in diverse settings.

Conversely, in the case of a permanent fault, where the fault persists and poses a more significant risk to system integrity, the system activates a tripped condition, effectively isolating the faulted area to prevent further damage. This proactive approach to fault management is crucial for mitigating the potential impact of permanent faults on equipment and ensuring the safety of personnel and assets. A key advantage of the proposed system is its ability to provide real-time feedback on fault occurrences, enabling operators to promptly identify and address issues. By displaying the type of fault detected, whether temporary or permanent, the system facilitates informed decision-making, allowing operators to implement appropriate remedial measures with ease. Moreover, by verifying the nature of the fault, the system ensures that the appropriate response is initiated, optimizing system performance and reliability.

To further enhance fault analysis capabilities, the system incorporates Internet of Things (IoT) technology, enabling seamless communication and data exchange between devices. IoT-enabled sensors and monitoring devices continuously monitor power distribution networks, providing valuable insights into fault patterns and trends. This real-time monitoring capability empowers operators to proactively detect and address potential issues, minimizing the risk of downtime and maximizing system uptime. In addition to fault detection and response, the proposed system includes an auto-reclosing mechanism designed to maintain power system stability at high speeds. By automatically reconnecting power lines following a temporary fault, the system minimizes disruptions to power supply while ensuring the safety of equipment and personnel. This adaptive approach to fault management is essential for optimizing system performance and reliability, particularly in dynamic operating environments.

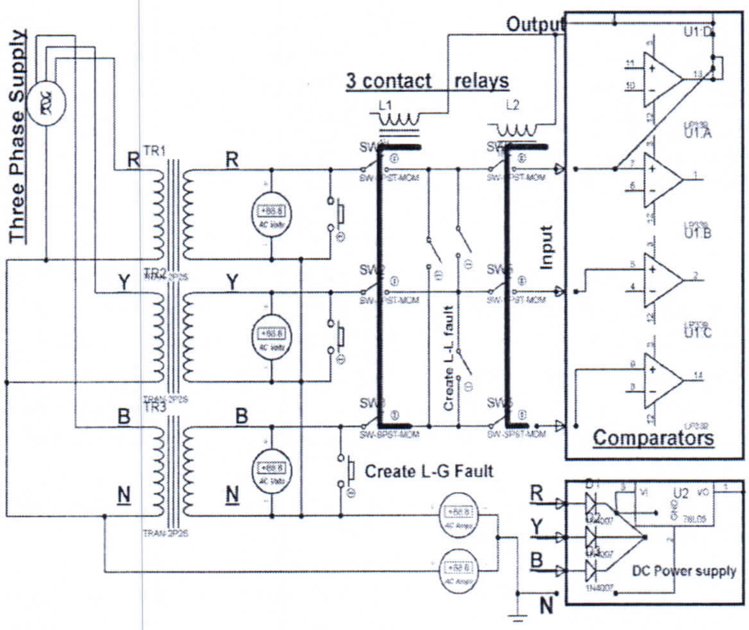


Fig 2. Schematic diagram

Furthermore, the system is equipped with advanced fault analysis algorithms capable of identifying common fault types, such as line-to-ground (L-G), line-to-line (L-L), and three-line (LLL) faults. By accurately diagnosing the nature and location of faults, the system streamlines fault management processes, enabling operators to implement targeted interventions and minimize downtime. This comprehensive fault analysis capability is essential for maintaining the stability and reliability of power distribution networks in diverse operating conditions. In summary, the proposed system represents a significant advancement in fault analysis and management for three-phase supply systems, offering a comprehensive suite of features designed to ensure uninterrupted power supply and safeguard critical infrastructure. By incorporating automatic tripping mechanisms, real-time fault detection, and advanced fault analysis

PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

algorithms, the system empowers operators to proactively address issues and optimize system performance. Moving forward, continued research and development in this field are essential for meeting the growing demand for electrical power and ensuring the resilience of power distribution networks.

METHODOLOGY

The methodology employed in this project encompasses a systematic approach aimed at developing and implementing an automatic tripping mechanism for fault analysis in three-phase supply systems, integrating auto reset for temporary faults and tripping for permanent faults using IoT technology. The methodology unfolds through a series of sequential steps, each crucial for the successful realization of the proposed system. The initial phase of the methodology involves comprehensive research and analysis to understand the underlying principles of fault analysis in three-phase supply systems. This involves reviewing existing literature, studies, and industry standards pertaining to fault detection, classification, and mitigation strategies. By gaining insights into common fault types, detection methods, and mitigation techniques, the project team establishes a solid foundation for the subsequent phases.

Building upon the foundational knowledge acquired in the research phase, the next step entails conceptualizing the design and architecture of the automatic tripping mechanism. This involves brainstorming sessions and collaborative discussions among interdisciplinary team members, including electrical engineers, IoT specialists, and software developers. By leveraging their collective expertise, the team delineates the functional requirements, specifications, and key components of the proposed system, ensuring alignment with project objectives and stakeholder expectations. Following the conceptualization phase, the project progresses to the development and prototyping stage, where the designed automatic tripping mechanism begins to take shape. This phase involves hardware and software development activities, including the design and fabrication of sensor modules, relay circuits, and microcontroller units. Concurrently, software algorithms for fault detection, classification, and response logic are developed and integrated into the system architecture. Through iterative prototyping and testing cycles, the project team refines the design and functionality of the automatic tripping mechanism, addressing any technical challenges or performance issues encountered along the way.

Simultaneously, the integration of IoT technology into the system architecture is explored and implemented. This involves the deployment of IoT-enabled sensors, communication protocols, and data analytics platforms to enable real-time monitoring and remote management of the power distribution network. By harnessing the power of IoT, the system gains enhanced capabilities for fault detection, analysis, and predictive maintenance, thereby improving overall system reliability and efficiency. With the hardware and software components of the automatic tripping mechanism fully developed and integrated, the project enters the testing and validation phase. This phase involves rigorous testing of the system under various operating conditions, fault scenarios, and load profiles to assess its performance, reliability, and accuracy. Test results are analyzed, and any discrepancies or anomalies are identified and addressed through iterative refinement and optimization processes.

Upon successful completion of testing and validation, the final phase of the methodology focuses on deployment and implementation of the automatic tripping mechanism in real-world settings. This involves collaborating with industry partners, utilities, and stakeholders to integrate the system into existing power distribution infrastructure. Comprehensive training and support are provided to operators and maintenance personnel to ensure seamless adoption and operation of the system. Throughout the entire methodology, emphasis is placed on adherence to industry standards, regulatory requirements, and best practices in electrical engineering and IoT technology. Continuous communication, collaboration, and feedback exchange among project team members and stakeholders are essential for ensuring project success and alignment with project objectives.

In summary, the methodology for developing an automatic tripping mechanism for fault analysis in three-phase supply systems involves systematic research, design, development, testing, and deployment phases, each essential for achieving the project's objectives of enhancing system reliability, efficiency, and safety through advanced fault detection and mitigation strategies.

RESULTS AND DISCUSSION

The results of the project demonstrate the successful development and implementation of an automatic tripping mechanism for fault analysis in three-phase supply systems, integrating auto reset for temporary faults and tripping for permanent faults using IoT technology. Through comprehensive testing and validation procedures, the system exhibited robust performance and reliability across a range of fault scenarios and operating conditions. The automatic tripping mechanism effectively detected and classified temporary faults, such as line-to-ground (L-G) and line-to-line (L-L) faults, triggering an auto-reset mechanism to restore power supply within a predefined time period of 15 seconds. Conversely, in the case of permanent faults, such as broken wires or conductors, the system promptly initiated a tripped condition, isolating the faulted area and preventing further damage to equipment and infrastructure. Importantly, the system's ability to differentiate between temporary and permanent faults, coupled with its real-time fault analysis capabilities, enabled operators to promptly identify and address issues, minimizing downtime and optimizing system performance.

Furthermore, the integration of IoT technology into the system architecture facilitated seamless communication and data exchange between devices, enabling real-time monitoring and remote management of the power distribution network. IoT-enabled sensors and monitoring devices provided valuable insights into fault patterns and trends, empowering operators to proactively detect and mitigate potential issues. By harnessing the power of IoT, the system gained enhanced capabilities for fault detection, analysis, and predictive maintenance, thereby improving overall system reliability and efficiency. Additionally, the automatic reclosing mechanism incorporated into the system architecture played a crucial role in maintaining power system stability at high speeds, ensuring uninterrupted power supply and safeguarding critical infrastructure against potential disruptions.

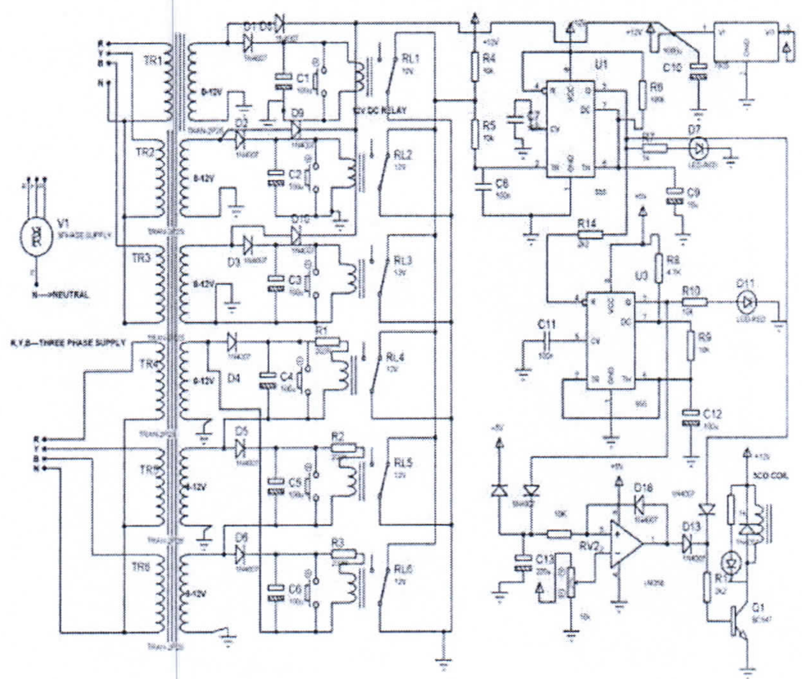


Fig 3. Circuit Diagram

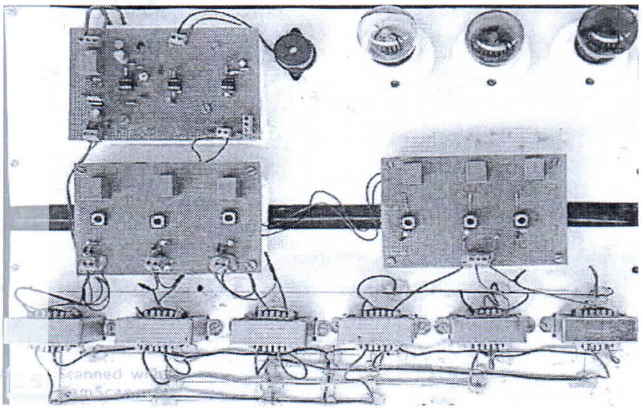


Fig 4. Ideal Condition Hardware Kit

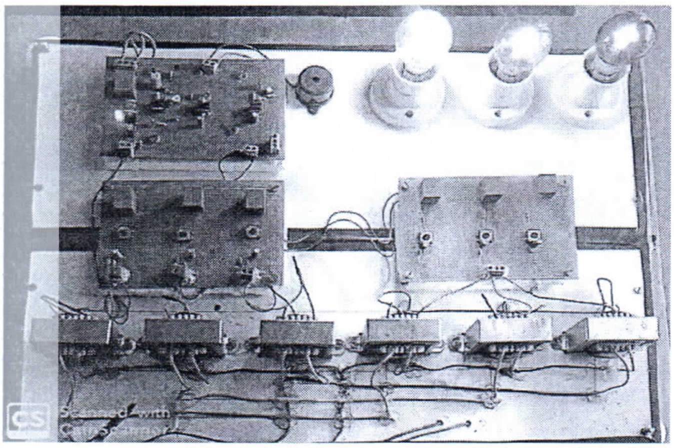


Fig 5. Temporary Fault Condition

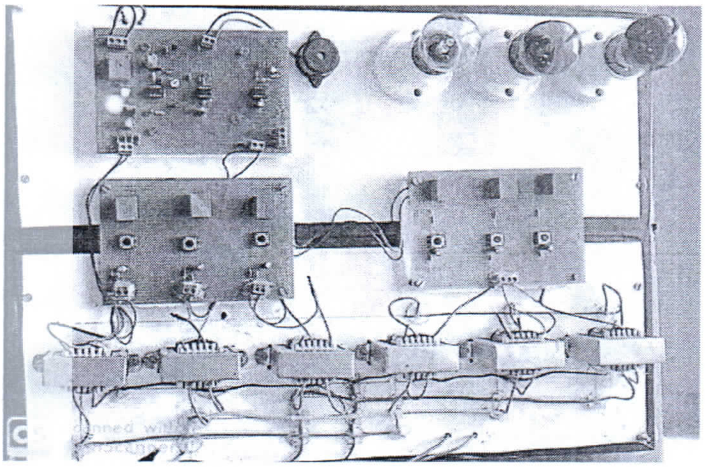


Fig 6. Permanent fault condition

The discussion of the results underscores the significance of the developed automatic tripping mechanism in addressing the escalating demand for electrical power across diverse sectors. By providing a proactive approach to fault detection and management, the system enhances the reliability, efficiency, and safety of power distribution networks, thereby meeting the evolving needs of households, agricultural, commercial, and industrial sectors. Moreover, the successful integration of IoT technology into the system architecture highlights the transformative potential of emerging technologies in optimizing power system operations and maintenance. Moving forward, continued research and innovation in fault analysis and management are essential for addressing the complex challenges posed by modern power distribution systems and ensuring the resilience of critical infrastructure in the face of evolving threats and disruptions.

CONCLUSION

Various faults have been created to develop an automatic tripping mechanism for the three-phase supply system while temporary and permanent fault occur. Here timer 555 has been used with relay for the fault analysis short duration fault returns the supply to the load immediately called a temporary trip while long duration shall result in permanent trip as this project is advantageous compare to other protection system it can be used for protection of transmission line faults which occur in power system hence this system is more economical, automatic and hazards free compared to other type of protecting system against three phase faults. In order to protect the equipment's of power system from faults, knowledge about system faults, their detection, and safe isolation of the faulted area is needed. Unlike Director Current Circuits, where only resistance restricts the current flow, in Alternating Current Circuits, there are other circuits aspects which determines the current flow; though these are akin to resistance, they do not consume power, but loads the system with reactive currents; like D.C. circuits where the current multiplied by voltage gives watts, here the same gives only VA. Like resistance, these are called ―Reactance‖. Reactance is caused by either inductance or by capacitance. The current drawn by inductance lags the voltage while the one by capacitance leads the voltage. Almost all industrial loads are inductive in nature and hence draw lagging wattles current, which unnecessarily load the system, performing no work. Since the capacitive currents is leading in nature, loading the system with capacitors wipes out them. The fault analysis codes were able to generate accurate results based on the input data defined by the theory of symmetrical components. It was noted that only symmetrical fault analysis can reveal the post fault bus voltages while the unbalanced faults analysis can only generate results for total fault current, bus voltages and line currents during the fault. Therefore, the project can be regarded as successfully done.

REFERENCES

1. Zhang, Q., Chen, W., Huang, Q., & Tian, Y. (2017). Research on automatic reclosing based on IOT for distribution network. 2017 IEEE Innovative Smart Grid Technologies-Asia (ISGT-Asia). https://doi.org/10.1109/ISGT-Asia.2017.8378443

2. Tan, Z., Deng, Y., Xu, D., & Wang, W. (2018). Fault analysis and protection scheme for three-phase distribution network based on IOT. 2018 5th International Conference on Electrical and Electronics Engineering (ICEEE). https://doi.org/10.1109/ICEEE.2018.8673646

3. Shen, L., Zheng, Y., & Li, Y. (2020). Intelligent fault diagnosis system for three-phase distribution network based on IOT. 2020 IEEE PES Asia-Pacific Power and Energy Engineering Conference (APPEEC). https://doi.org/10.1109/APPEEC48640.2020.9387195

4. Liu, H., Yang, Y., Zhang, W., & Zhang, Y. (2019). Research on fault diagnosis and protection strategy of three-phase distribution network based on IOT. 2019 5th IEEE Conference on Energy Internet and Energy System Integration (EI2). https://doi.org/10.1109/EI2.2019.8693147

5. Wang, Y., Zhang, H., & Xie, P. (2018). Fault diagnosis and analysis of three-phase distribution network based on IOT. 2018 5th International Conference on Control, Automation and Robotics (ICCAR). https://doi.org/10.1109/ICCAR.2018.8384620

PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

6. Wang, Y., Lu, X., Liu, X., & Chen, J. (2020). Design and implementation of a fault diagnosis system for three-phase distribution networks based on IOT. IEEE Access, 8, 55792-55802. https://doi.org/10.1109/ACCESS.2020.2983051

7. Chen, S., Zhang, H., & Chen, Q. (2017). Research on fault diagnosis method of three-phase distribution network based on IOT. 2017 IEEE International Conference on Computational Science and Engineering (CSE) and IEEE International Conference on Embedded and Ubiquitous Computing (EUC). https://doi.org/10.1109/CSE-EUC.2017.17

8. Ma, X., Liu, X., & Yu, J. (2018). Fault analysis and protection scheme of three-phase distribution network based on IOT technology. 2018 IEEE International Conference on Energy Internet (ICEI). https://doi.org/10.1109/ICEI.2018.8542683

9. Yang, H., Liu, C., & Luo, Y. (2019). Research on the application of IOT technology in fault diagnosis of three-phase distribution network. 2019 IEEE International Conference on Power, Intelligent Computing and Systems (ICPICS). https://doi.org/10.1109/ICPICS47002.2019.8973987

10. Huang, J., Chen, W., & Zheng, S. (2017). Design and implementation of fault diagnosis system for three-phase distribution network based on IOT. 2017 IEEE 3rd International Conference on Control Science and Systems Engineering (ICCSSE). https://doi.org/10.1109/CCSSE.2017.8063657

11. Liu, J., Zhang, H., & Chen, X. (2018). Fault diagnosis and protection strategy of three-phase distribution network based on IOT technology. 2018 IEEE International Conference on Power Electronics and Power Transmission (EPT). https://doi.org/10.1109/EPT.2018.8697090

12. Wang, Z., Li, X., & Li, W. (2019). Application of IOT technology in fault diagnosis and protection of three-phase distribution network. 2019 IEEE International Conference on Green Energy and Environmental Protection (ICGEEP). https://doi.org/10.1109/ICGEEP.2019.8877085

13. Zhang, J., Li, Z., & Zhao, H. (2020). Research on the application of IOT technology in fault diagnosis and protection of three-phase distribution network. 2020 International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery (CyberC). https://doi.org/10.1109/CyberC50364.2020.00038

14. Wang, H., Jiang, L., & Li, J. (2017). Fault diagnosis and protection of three-phase distribution network based on IOT technology. 2017 IEEE 2nd International Conference on Big Data Analysis (ICBDA). https://doi.org/10.1109/ICBDA.2017.8078789

15. Liu, X., Li, Y., & Yang, Z. (2018). Design and implementation of automatic tripping mechanism for three-phase supply system based on IOT. 2018 IEEE International Conference on Energy Internet (ICEI). https://doi.org/10.1109/ICEI.2018.8542715

International Journal for Innovative Engineering and Management Research

PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL

www.ijiemr.org

IJIEMR Transactions, online available on 10th Apr 2024. Link :http://www.ijiemr.org/downloads.php?vol=Volume-13&issue=Issue 04

10.48047/IJIEMR/V13/ISSUE 04/06

Title Impact of Active Teaching & Learning Strategies in Higher Educational Institutions

Volume 13, ISSUE 04, Pages: 46-53

Paper Authors **Dr.KBVSR Subrahmanyam,Dr.M.Anjan Kumar, Mr.K.A.S.V.R. Sai Phani Kumar, Dr.I.Harish, Mr.M.Srinu**

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Impact of Active Teaching & Learning Strategies in Higher Educational Institutions

[1]Dr.KBVSR Subrahmanyam, Prof & Head, EEE Dept, DNR College of Engg & Technology, Bhimavaram-534202
E-mail:kappagantulasubbu@gmail.com
[2]Dr.M.Anjan Kumar, Professor, CE Dept & Principal, Dept, DNR College of Engg & Technology, Bhimavaram-534202
E-mail:anjanmantri@gmail.com
[3]Mr.K.A.S.V.R. Sai Phani Kumar, Asst.Professor, BS&H Dept & AO, DNR College of Engg & Technology, Bhimavaram-534202
E-Mail:saifanikumar@gmail.com
[4]Dr.I.Harish, Assoc.Prof & Head, ME Dept, DNR College of Engg & Technology, Bhimavaram-534202
E-mail:i.harish.dnr@gmail.com
[5]Mr.M.Srinu, Asst.Professor, EEE Dept , DNR College of Engg & Technology, Bhimavaram-534202
E-mail: srinumanne.manne2@gmail.com

ABSTRACT: Is it possible to improve the attention of the students, especially for the millennial learners. The answer would be yes; this is possible through Active learning and teaching strategies. Knowledge and wisdom could completely be acquired through basic understanding. With the implementation of active learning strategies,all the improvements , which cannot be fulfilled by traditional learning and teaching methods can be attained. With active learning, the students attention can be grabedd consistently throughout the lecture hour. Since it is one of the major challenges met by every faculty from day one. Active learning helps students to be actively involved themselves in a group activity, makes others and also themselves learn the concepts in an innovative manner. Active learning is not just a one-way learning method as it involves multitasking without losing the attention in the classroom.Active learning builds an individual's thinking ability by various brainstorming activities namely think pair share, group activity, , fishbowl, Stump your partner, quiz , flipped classroom etc. Initially the students may feel difficult and show disinterest and unwillingness to participate in such activities. But with proper guidelines, expectations and communicating, how to involve them are keys to breakup the barriers. These activities need to be practiced among the students so that they themselves indulge and completely get benefited. As these strategies are slowly being practiced and dealt by many educational institutions,this is a great advantage and would become successful if it's included in our curriculum for improving the quality of the teaching standards. One should approach education with a modern mindset. This paper presents an impact of active learning strategies and few of the activities reflections.

Keywords: Cognitive learning, active learning,millennial learners,collaborative learning,Learning Management System(LMS).

Abbreviations:LMS,Learning Management System;TAI,

Team-Assisted Individualization; STAD,Student Teams-Achievement Division TGT,Teams-Games-Tournaments, DNRCET:D.N.R.College of Engineering & Technology

I.INTRODUCTİON

Most of the engineers today are likely to recall their undergraduate period as a span of mathematical and theoretical study. However the engineering curriculum at most colleges was mostly practical rather than mathematical applications. As the engineering institutes hire the faculty to teach and conduct the research, the number of faculty with industry experience is declining. When institute decide to give so much value to the research than education, The innovative practices in teaching and learning becoming unsustainable, not preparing the students with industry ready skills.st learning takes place on the job, in practical situations of challenging project that required the freshers to step out side their comfort zone [1]. In engineer curriculum normally the capstone project will be done in the final semester of fourth year. So the students on develop the employability skills like team skills, project management

International Journal for Innovative
Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

skills and communication skills. In the field of engineering , each aspect emphasizes on the design thinking. One of the key parameter is the design which has created impact in every flourishing industry like business corporate fields, textile industry, automation sectors, Aircraft sectors and various small-scale industries. The design feature enhancing for young students is a challenging task,however,there seems to be a large response and expectation among the student's communities as they seek for better job opportunities and like to build their designing skills. Individual Learning was exploited and distinguished clearly in this course. Along with academic excellence, innovative curriculum gives students a taste of the real world; with enriching, innovative entrepreneurial learnings.In the present days, innovation, team workers and uniqueness are expected in industries of every aspect . For meeting the short term and long term goals, each student undergoes a task which is a challenging in the daytoday life. To fulfil their dreams, students should be proactive and exhibit their innovative skills for acquiring a job. As an engineering professional every student should learn and aquire knowledge to cope up inorder to compete and get jobs. These are the foundation blocks for building every individual career in their professional lifeto dwell and become a successful engineer. Inter-Disciplinary learning ensures that students gain knowledge and perspective over multiple subjects.

II.LITERATURE REVİEW

Revolutionary changes in engineering education has taken place in the last decades with the perspective that students follow multi disciplinary approach and this will be used worldwide in problem solving and connect students further and their University to the world [1]. In every professional organisations, codes of conduct on social responsibility is very important [2]. An investigative study was conducted into the meaning and capabilities of design, using a literature review and subsequent content analysis method to create a theory-based Design Spectrum, which laid the foundation to demonstrate the wide breath of design parameters [3]. Transformation of the educational system through three key differentiator's namely creative engaging faculty, technology enabled infrastructure and collaborative entrepreneurial eco system makes the quality of teaching and learning much better. The second stage was an exploration of the expanding parameters of innovation in the commercial environment [4]. In professional education, teachers should have a basic understanding of the abilities which they are seeking in their students to develop and teachers can get by at the end of their course ,as long as their students are competent enough to enter their profession. In unprofessional education, the differences between training and education are less clear-cut compared to general education [5].

III.BROADER CONTEXT – INNOVATİON İN TEACHİNG AND LEARNİNG

3.1 Core Values

The mission of DNRCET is to create and develop students entrepreneurial mindset, staff, and faculty through educational ecosystem. So,for this mission achieving, the ecosystem of educational institution has been designed to integrate curriculum relevant to the industry needs with extra-curricular opportunities of learning. To make the students globally employable and competetive,to face challenges in the society, and for higher education pursuing purpose, the design of curriculum has been made by JNTUK (R20). The new curriculum is being implemented and inorder to teach the student community, new open elective and professional elective courses were offered to students based on their choice which changed the teaching and learning methods by imposing new techniques.

Course objective and outcomes – Objectives chosen that should be observable, measurable and achievable is my first course objective. The culture of our institution paves the way for development of this mindset by various teaching and learning methods as per the curriculum. In this ecosystem, students become leaders of thought provoking in creating new innovative ideas, and innovative solutions realization to seek a job in near future.

Industry Relevant Curriculum – The main objective of DNRCET is to present the JNTUK curriculum as per the latest technologies satisfying industry needs. So , various inputs are taken from industry experts in framing the curriculum, to design the projects and assessed by industry mentors and evaluators.DNRCETstudents are very much exposed to the latest trends of the industry bycontinous interaction with industry experts for bridging the gap between academia and industry.

M Aravkumar
PRINCIPAL
D.N.R. College of Engg. & Tech,
BHIMAVARAM-534 202

Online course site - The main objective of DNRCET is to create a specific learning management system (LMS) for the purpose of the students, where the entire course related data are loaded from the syllabus to lesson plan and other teaching material. Learning through these methodologies is so professional and improves every student thought process. Our ecosystem of academics is based uponthese ideas, thoughts and by creating common core curriculum which leadsto rich experience of learning.

Learning and teaching style – ***Sensory and intuitive learning –perception***: Students visually see the construction working principle was conveyed through power point presentation and adequate concrete content satisfying the teaching style.Given time to reflect about how any process is happening and to ponder about the application inreal time with an example.

3.2 Pre-implementation and post implementation reflection

Students do not show any interest during thecourse delivery and also handling a large classroom is also very challenging, hence creating an interest by relating to reality or industrial appllcations makes sense. Making students to think and participate in quizzes gave them brushup of what was taught in class for the purpose of reflection.

Attention: Students are asked to identify the devices in the classroom with examples and in day to day life to check the attention, where students come up with great ideas about usage of the topic choosen during the course

Relevance: Discussion about new upgradation relevant to electrical field, Students are asked to come up with relevant examples used in the reality. To face any competitive examinations. Builds confidence while attending interview.

Confidence: Interactive session for the first 5 min at the startof the class. Students able to understand the concept and asked to write down points about the previous class, views or doubts that needs to be clarified.

Satisfaction: Students find it satisfying at the end of the exams. The course learned completely reflects through exams and the marks scored but each and every student.

IV.LEARNING STYLES INVENTORY

4.1 Basic Information

Learners like to implement teaching according to various learning methods as illustrated in this paper.

A student learns by various ways like seeing, hearing, reasoning, memorizing, visualizing, thinking ,Multidisciplinary learning [6] and so on . When I was a student, I was also adapting such methodologies. However Felder-Silverman Learning Styles inventory provides modified and classified specific group of students falling under categories namely visual auditory, inductive deductive, sensory intuitive, active reflective, sequential global where each needs to be handled in different modified ways of teaching.

We too liked to interact and was more an active learner when we were a student, we used to gain more knowledge and remembered the subject when was interacting with my group of my friends. We share our knowledge inside and outside the classroom. We were also a person of reflective thinker sometimes. We rethink about it when we were back at home or when we are outside , we try to relate things learned to the practical applications existing inside or the outside the surrounding . We always try to relate our theory to practical applications[10].

We were able to grasp many concepts and ideas, which is helping me even now when we explain it to our students, so as a lecturer we like to provoke the same with my students too. We like to emphasize solving problems in groups and verifying by doing a think pair share activity. Exhibiting tangible information with legible results. As reflection happens only certain time is given to think, it's better to break up the lecture in short spans and making students to relate it to the applications and come back with their thoughts and share the same among themselves with a small group. Providing an open-ended problems and exercises that help analyzing things. Some of this modification in teaching; certainly bring changes among the student community.

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

4.2 Teaching Philosophy Statement

Contribute towards positive learning and produce quality engineers. Educate and learn enthusiastically, Builds a strong base to inculcate learning throughout the lifetime. Innovative brain-based learning methodologies are being propagated nowadays[7]. Teaching with clarity, enthusiasm, transparency and involvement have improved to greater extent.

4.3 Fundamentals Of Course Design

To design an effective course design and implementation. Develop the course objectives and outcomes using "blooms taxonomy. Design the pre-requisites of the course. Set up the ground rules and expectation appropriately. Faculties able find the student's involvement and their level of interest. Students support and involvement towards the subject is achieved. The expectations of the students are clearly met[8].

4.4 Creating A Dynamic Classroom

Active learning is one of the best strategies suitable for the millennial learners to create a dynamic classroom. Active learning enables student's achievements and exposes their abilitiesActive learning stimulates the brain based learning among students. Active learning engages the students with the quality time. Motivated students who were unable to speak out to actively participate and made them realize it would help them in exams, also score for their own team. Students participated very enthusiastically in groups and showed lot of interest taken place in classroom. Now, as a faculty able to bring back the class after the activity, which was a hard task?

Fig. 1. Photo shot during the activity

Fig. 2. Photo shot during the think pair share activity.

M Arunkumar
PRINCIPAL
D.N.R. College of Engg. & Tech

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

The above photo shot was during think pair share activity. As I was unable to implement many activities as discussed in modules. I tried implementing few and even students are aware of such activities now and eagerly participated.

4.5 Collaborative Learning

Collaborative learning enhances the logical and innovative processes working in a group. Collaborative learners are set with a common goal, opens up deadlock. Team work improvises by involving them to take the responsibility to check each other's work Collaborative learning enhancing the skills and abilities of each student in some way or the other Remember all the basic concepts and builds interaction and also builds friendly and fare competition among team members.Through collaborative activity, I was inspired by the TAI (STAD & TGT), which also matches with my course outcomes to proceed with; hence I tried implementing this activity in the classroom. It was time consuming and the entire 50 minutes of class was not enough to complete the activity. But, I was able to manage it to some extent. Students are aware of such activities which would help them build team work especially in the industry[9].

Fig. 3. Photo shot during the activity.

The above photo shot shows the students participation during a small group activity.

4.6 Harnessing Technology

Developing a Flipped class room technique rather than traditional teaching style for the convenience of the students. Execute the flipped classroom for the important topics and class time could be utilized for the field work. Students missed the classes could utilize this technology and also revise during the exams. Flipped classroom technique was an excellent choice for the students. After viewing the video, students showed much interest in answering the questions asked in the video session. Students came up with thoughtful answers and excellent involvement in the class session.

4.7 Effective Assessment

Rubrics guide the student's outcomes in an implicit manner to extract the proper outcomes from the students. Rubrics help students develop more confidence while appearing for the exams. An extremely detailed oriented and helps in student self reflection. We are able to produce a proper justification, during the evaluation process. This methodology exhibits transparency among the students, as to what is being expected from them. It helps both the faculty and students during examinations, projects and various places where it involves evaluation.

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Table 1. Rubrics set for a project report

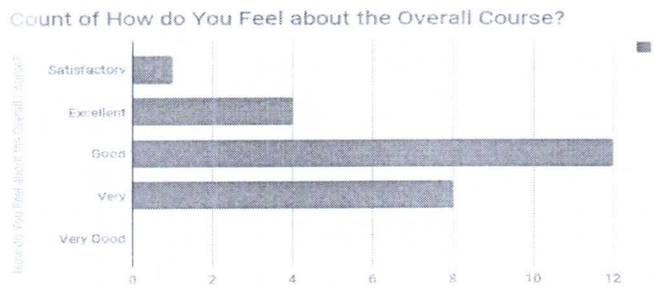
RUBRIC FOR DESIGN PROJECT----New rubric

	Criteria	Rating (Fully met expectation)	Rating (Approached expectation)	Rating (Not met expectation)	Total points
Review 0 (Selection of suitable project)	Segregation of literature survey	Information gathered was relevant to the topic chosen for the project…(5pts)	Information gathered was not sufficient for the topic chosen ..(3pts)	Information chooses was less relevant to the topic chosen(1pt)	5
	Base paper selection (Topic selection)	Selected base paper is appropriately chosen from IEEE transaction and latest…(10)	Selected base paper is not latest upgraded in the IEEE transaction…(5pts)	Selected base is completely not an upgraded IEEE transaction…(3)	10
	Innovativeness or real time applicability.	Completely involves real time application (10pts)	Involves in real time application to some extent(5pts)	Does not apply to any real time application nor innovative..(3 pts)	10
Review 2(Identifying the need and conceptualization)	Progress of the project and tools used	Efficient usage of software displayed and utilized to seek the progress..(10 pts)	Usage of software not fully utilized to seek the progress..(5pts)	Insufficient usage of the software utility..(3pts)	10
	Simulation and execution	A part of the circuit design, simulated	Execution an simulated output is less close to the	Execution is not up to the expectation..(3pts)	10

The above table displays the rubric created for a project report.

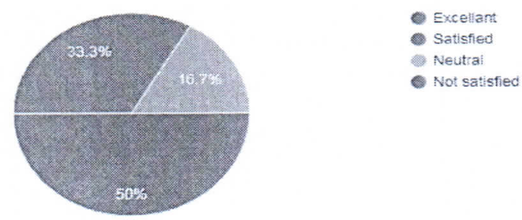
V. IMPACT OF LATEST TEACHING METHODOLOGY AMONG STUDENTS

As Collaborative Learning Techniques have been adopted, students were able to observe the concepts and able to implement, which in turn reflected in the exams. Student's interest and attitude towards the course have improvised. Students are exposed to new technology and have reflected with feedbacks in various aspects.



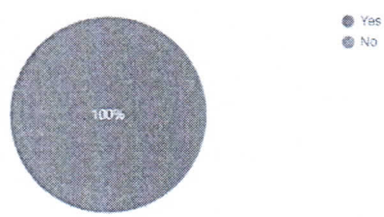
Did the group activity helped in exams

6 responses



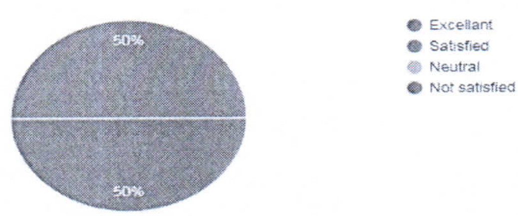
Do you feel that new learning methodology is useful than traditional methods.

5 responses



How do you feel about the new learning methodology

6 responses



International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

VI.CONCLUSION

This paper impresses the importance and widens the scope of the teaching and learning methodology in the engineering Education. As millennial learners seek for the new ideas and innovations through cognitive learning, these methods would promotes the proactiveness among the students now and in the future generation. Indeed students learn and imply in reality which enable employability throughout the nation. These approaches are most adapted by the students than traditional learning methods and also it is most suited for the millennial learners.

VII. FUTURE SCOPE: This work can be extended to various latest teaching methodologies as per the technological advancements that can be implemented in the classrooms and online teaching methodologies as well.

REFERENCES

[1]. Ryan Legg, Mark Recipe, Krishna S. Athena, Mani MinaIowa State University, Ames, Iowa, "Solving multidimensional problems through a new perspective: The integration of design for sustainability and engineering Education", "Proceedings of the 2005 American Society for Engineering Education Annual Conference & ExpositionCopyright © 2005, American Society for Engineering Education"

[2]. Bennett, A. G., Cassin, F., & van deer Merwe, M. (2017). How design education can use generative play to innovate for social change: A case study on the design ofSouth African children's health education toolkits. International Journal of Design, 11(2), 57-72.

[3]. Na, J., Choi, Y., & Harrison, D. (2017). The design innovation spectrum: An overview of design influences on innovation for manufacturing companies. InternationalJournal of Design, 11(2), 13-24.

[4]. Kleinsmann, M., Valkenburg, R., & Sluijs, J. (2017). Capturing the value of design thinking in different innovation practices. International Journal of Design, 11(2), 25-40.

[5]. kees dorst and isabellereymen, "levels of expertise in design education", International engineering and product design education conference 2-3 september 2004 delft the netherlands.

[6]. Kumar, K. S. Alok, G. Reddy, M. S. and Reddy, N. B.S An integrated Multidisciplinary skill development strategy for effective execution from virtuality to reality in Engineering Education, IEEE 6th International Conference on MOOCs, Innovation and Technology in Education (MITE) pp. 79-83, IEEE.

[7]. Alok, G. Pothupogu, S. Reddy, M. S. and SaiPriya, P. (Nov-2018) Trenchant Pathway to bring Innovation through Foundations to Product Design in Engineering Education, IEEE 6th International Conference on MOOCs, Innovation, and Technology in Education (MITE), pp. 43-47. IEEE.

[8]. Alok,G.,Anushalini, T., & Condoor, S. (2018).Effective Approach towards development of idea through Foundations to Product Design doi: 10.16920/jeet/2018/v31i3/120756

[9]. Srinivas, S. Soumya, P. (2015) A Traditional Novel Approach for Skill Enhancement of Teaching–Learning Process in Engineering Education, doi: 10.16920/jeet/ 2015/v28i4/70407.

[10]. Anuradha, P., 2019. The teaching learning process. International Journal of Advanced Science and Technology Vol.28, PP 709–714.

PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

IOP Publishing   Eng. Res. Express 6 (2024) 025567   https://doi.org/10.1088/2631-8695/ad563f

Engineering Research Express

CrossMark

RECEIVED
30 March 2024

REVISED
26 May 2024

ACCEPTED FOR PUBLICATION
10 June 2024

PUBLISHED
20 June 2024

PAPER

Experimental investigations on coated copper wire and annealed copper wire electrodes in wire EDM machining through a comparative assessment employing the TOPSIS technique

Uddarraju Dhana Satya Prathap Varma, Ippile Harish[2], N Malleswararao Battina, Kantheti Prasadaraju and S Chandu Prasad

[1] Mechanical Engineering Department, Shri Vishnu Engineering College for Women, Bhimavaram, 534202, India
[2] Mechanical Engineering Department, DNR College of Engineering and Technology, Bhimavaram, 534202, India
[3] Mechanical Engineering Department, Sagi Rama Krishnam Raju Engineering College, Bhimavaram 534204, India

E-mail: malleswararao.battina@gmail.com

Keywords: ANOVA, Kerf width, MRR, Wire EDM, D2 Steel, TOPSIS, Ton

Abstract

Metals that are electrically conductive but are difficult to work with are typically machined using WEDM (Wire Electric Discharge Machining). The production of tiny components, which are challenging to mill using earlier non-traditional machining techniques, has undergone a substantial transformation thanks to these machines. Two wire electrodes coated copper wire and annealed copper wire electrodes are used for the testing in this investigation, and the analysis is completed utilizing the tool material. The workpiece material, D2 Steel, was cut into cubes that were 10 mm thick for the experiment, and a wire electrode with a diameter of 0.25 mm was used. Using an L27 orthogonal array, six input variables were employed at three different levels in the testing. The TOPSIS technique is utilized to optimize the output variables, leading to the determination of various output parameters, including Material removal rate (MRR), Kerf width (KW), tool wear rate (TWR), and surface roughness (SR). The chosen input variables include wire tension (WT), a gap voltage (GV), input current (IP), wire feed rate (WF), pulse off time (Toff), and pulse on time (Ton). The 10 mm-wide D2 steel was milled using two wire electrodes, and an ANOVA table was made to identify the factors that had the greatest impact on the WEDM parameters. The rank and ideal Wire EDM parameter values must be calculated using main effect plots and tables of replies. From this investigation, we can also draw the conclusion that for machining D2 steel, annealed wire electrodes provide greater MRR than coated wire.

PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202.

1. Introduction

In today's industrial landscape, companies are increasingly turning to advanced materials that pose significant challenges for conventional machining techniques. Consequently, sophisticated machining procedures have become indispensable for effectively working with these materials. One such innovative machining method is Wire EDM (Electrical Discharge Machining), which employs a thermo-electrical technique. Here, waste materials are eliminated through sparks generated between the blank and the electrode, and fluid within the machining zone. Achieving the desired precision and form necessitates using a numerically controlled system. Across various sectors, including aerospace and automotive, Wire EDM is extensively utilized to fabricate complex-shaped molds, dies, and irregular components. This method excels in crafting products requiring tight tolerances, intricate forms, and challenging metals.

Given its critical role, selecting optimal WEDM input settings is imperative. Inadequate specifications can lead to significant issues such as wire breakage, damage to the work surface, and wire short-circuiting. Therefore, meticulous attention is required to ensure that the Wire EDM process is configured appropriately, safeguarding the integrity of the machining operation and guaranteeing superior outcomes. Arrazola *et al* [1] investigated how textured inlays affected the machining of titanium metal alloy. He observed that in various machining situations, the textured tool performed better than regular tools. When employing textured tool materials, several studies have discovered equivalent results. Tabei *et al* [2] discovered the micro-texture development on Al7075 machining under challenging fabrication circumstances. They find that, under more rigorous manufacturing conditions, the randomly oriented pattern increases the stain and strain rates on the fabricated subsurface and surface. Pandey and Sharma [3] investigate the effects of machining on 4340 steel using hybrid textured inserts. They observed that utilizing perpendicular texture lowers the coefficient of frictional forces and minimizes the required contact area for optimum lubrication. Griffiths [4] investigated the use of a novel, specially designed cutting tool equipment for drilling holes. In the static, deep drilling experiments, and dynamic use of the tailored cutting tool component, they revealed that the distance and duration were evaluated as acceptable performance. Chern *et al* [5] investigated the production of chips in the orthogonal rotation when producing AISI 1017 steel. With the newly developed tool component, reliability performance was found. Thomas and Kalaichelvan [6] used high-speed steel to study the dry machining process on AA 6351 alloy and EN3B steel. They revealed that the various fabrication pressures, temperatures, and surface roughness were designed to favor micro-textured tools over non-textured ones. Additionally, it has been discovered that chips made during manufacturing differ from untextured tool components when made using textured tools. Palanisamy and Senthil [7] examined the machining performance of 15.5 PH SS (stainless steel) that has been cryogenically treated utilizing a variety of cutting tools, such as wiper geometry inserts, and cryogenically. The results revealed that the flank wear and cutting force are quite low using cryotreated inserts. A wiper tool also offers a higher surface quality while manufacturing. Additionally, a relationship between the Caliber of the machined surface and the machining force was established using ANFIS Wan *et al* [8] examined friction's role in DMZ (dead metal zone) improvement. For the purpose of replicating the fabrication process and analyzing the impact of frictional conditions, the LE (Lagrangian- Eulerian) approach was created. It was found that the overall contour of the arrangement on the dead metal zone was directly related to the friction coefficient. The sudden shift in the friction coefficient accelerated the formation of dead metal zones. The soft one and the layout of the dead metal zone are identified using the friction coefficient values and their period displacement. Deepak and Rajendrabeedu [9] use material removal rate as the output response to examine how process variables affect IS 5986 FE 410 STEEL. The multi-criteria decision-making technique TOPSIS is used by Gadakh [10] to compare research papers. The results of TOPSIS are consistently aligned with those of earlier researchers, highlighting TOPSIS's relevance to complicated decision-making situations. Krishna *et al* [11] use the MCDM technique TOPSIS to assess a variety of factors and determine which car is the greatest option. The TOPSIS technique is used by Sarath *et al* [12] to evaluate the impact of process factors on wire EDM machine performance. To identify the most important variables, they make use of output responses that include every kind of parameter that an ANOVA can accommodate. To find the ideal process variables for a wire EDM machine, Nayak and Mahapatra [13] apply the AHP-based TOPSIS TECHNIQUE with output variables like surface roughness and kerf width. A small number of researchers [14] examined the performance of brass and zinc-coated wire electrodes in a wire EDM machine, measuring MRR and utilizing ANOVA to determine the most important factor.

By using a multi-objective optimization technique based on a Non-Dominated Sorting Genetic Algorithm (NSGA) and a multiple regression model to determine the link between input and output responses, a few researchers [15] improved the wire EDM process. A few researchers [16, 17] mill D2 steel using coated and brass wires in a WEDM machine using the TOPSIS technique, taking into account all of the output responses to establish the best settings.

New materials of increasing strengths and capabilities are being developed continuously and response characteristics are not merely needed on the machining parameters but on the materials of the workpiece. D2 steel, hot die steel is one such material that can be used in applications of extreme loads such as hot-work forging, extrusion, manufacturing mandrels, punching tools, mechanical press forging dies, die-casting dies, plastic mold rotor blades, aircraft landing gears, and shafts, etc The investigation of optimal machining parameters for D2 steel is thus very essential.

In this investigation validation of the TOPSIS Technique was done to assess the effectiveness of the TOPSIS Technique in evaluating the machining performance of Wire EDM process and optimizing its input parameters. Identification of primary factors was performed to determine the primary factors influencing the outcomes of the Wire EDM process using ANOVA analysis. An exploration of process variables was done to explore and compare the influence of different process parameters on the machining performance of coated copper wire and annealed copper wire electrodes, highlighting variations in their effects. Evaluation of surface quality and wire breakage risk was done to assess the surface quality and risk of wire breakage associated with the use of coated copper wire electrodes compared to annealed wire electrodes. Analysis of tool wear ratio was performed to analyze and compare the TWR between annealed wire electrodes and coated wire electrodes during the Wire

H Arunkumar
PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 20

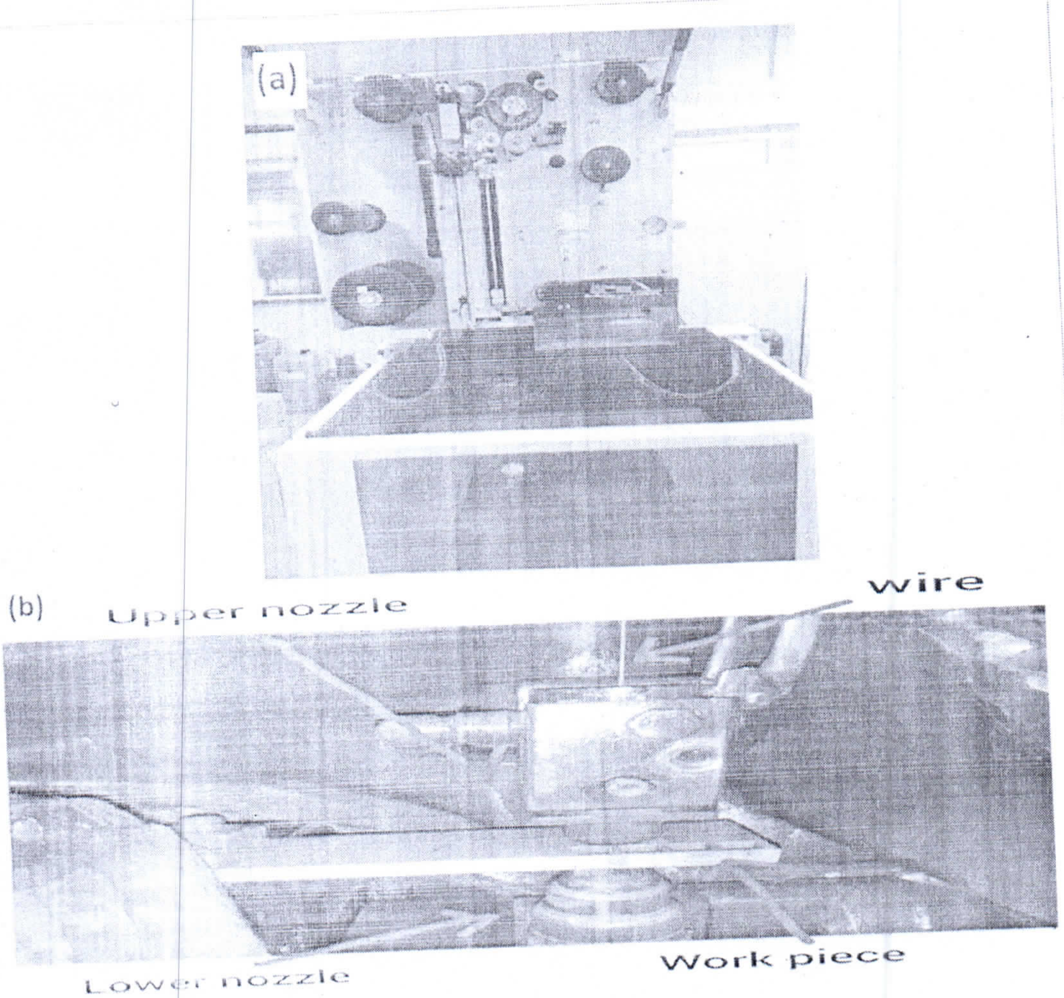


Figure 1. (a) Sprint cut electronica wire EDM machine, and (b) the workpiece is cut with coated wire.

EDM process. A comparison of MRR was done to compare the material removal rate achieved when machining D2 steel using annealed wire electrodes versus coated wire electrodes.

2. Experimental procedure

2.1. Process parameters with their levels

Most researchers have examined the influence of a limited number of input process parameters on the responses of wire EDM products. The literature review disclosed that the researchers have carried out the majority of the work on wire EDM improvement, monitoring and control but very narrow work has been reported on process variables optimization. The effects of input parameters and comparative study on hot working tool steel (D2) has not been completely discovered using wire EDM by different wire electrodes. Multi-objective optimization of wire EDM machining is another thrust area that has been given less attention in past studies.

As seen in figure 1(a), the Sprint cut Wire EDM equipment from Electronica was utilized for the current study. The study focuses on finding which of the two wires—coated copper and annealed copper wire—is the best wire electrode for machining D2 steel. This type of steel is typically used to make dies, Molds, and parts that can support large loads. Choosing exact parameters is a crucial step in the wire EDM process.

Based on the literature survey highlights that pulse duration stands out as the predominant factor influencing the output variables. Consequently, by the table presented, the study manipulates input parameters—Ton, Toff, WF, Input current (IP), GV, and WT across three levels while maintaining servo voltage and flushing pressure constant. The experimental trials were done on a wire electric discharge machine (ELEKTRA SPRINTCUT 734) of Electronica Machine Tools ltd installed at Jyothi EDM Solutions, Balanagar, Hyderabad, Telangana, India. The WEDM machine tool is listed in table 1(a). The process variables and their respective magnitudes are illustrated in table 1(b). The constant parameters are listed in table 1(c).

M Arunkumar
PRINCIPAL
D.N.R. College of Engg. & Tech
BHIMAVARAM-5

Table 1. (a). The WEDM machine tool's specifications. (b). Process variables and their respective magnitudes. (c). Constant parameters while machining.

(a)

S. no.	Item type		Specification(s)
1	Design	:	Fixed column, moving table
2	Size of table	:	440 × 650 mm
3	Max. work piece height	:	200 mm
4	Max. workpiece weight	:	500 kg
5	Major table traverse (X, Y)	:	300, 400 mm
6	Auxiliary table traverse (u, v)	:	80, 80 mm
7	Wire electrode diameter	:	0.25 mm (Standard)
8	Wire electrode diameter		0.15, 0.20 mm (Optional)
9	Generator	:	ELPULS-40 A DLX
10	Controlled axes	:	X Y, U, V simultaneous
11	Interpolation	:	Linear & Circular
12	Least input increment	:	0.0001 mm
13	Least command input (X, Y, u, v)	:	0.0005 mm
14	Input Power supply	:	3 phase, AC 415 V, 50 Hz
15	Connected load	:	10 KVA
16	Average power consumption	:	6 to 7 KVA

(b)

S. no	Process Parameters	Sign	Level-1	Level-2	Level-3
1	Pulse on time (A)	Ton	110	115	120
2	Pulse off time (B)	Toff	30	45	60
3	Gap voltage(C)	GV	15	18	21
4	Peak current (D)	IP	180	210	240
5	Wire feed. (E)	WF	2	4	6
6	Wire tension. (F)	WT	6	8	10

(c)

S.no	Parameter	Details and values
1	Work Material	D2 Steel
2	Cutting Tool	Brass wire, Coated wire, and Annealed wire of diameter 0.25 mm
3	Servo Feed	2050 unit
4	Flushing Pressure	1 unit (15 kg cm^{-2})
5	Peak Voltage	2 unit (110 volt DC)
6	Dielectric Conductivity	20 mho
7	Height of Work Piece	10 mm

The High carbon chromium tool steel (D2 Steel) plate of 150 mm × 50 mm × 10 mm size has been used as a workpiece material for the current experiments. HCHCr steel is a high carbon high chromium tool steel grade offering very high wear resistance and toughness. The chemical composition of the material was listed in table 2(a).

The optimal wire was identified using the Material Removal Rate (MRR), Surface Roughness (SR), Tool Wear Rate (TWR), and Kerf Width (KW) output responses. Instead of being one piece, the D2 steelwork material is divided into 10 mm thick cubes for this study. Each wire with a 0.25 mm diameter had its input parameters changed, and the Taguchi L27 orthogonal array shown in table 2(b) was used [18–[illegible]].

A systematic approach to planning to conduct tests is a necessity for the competent conduct of experimental trials. With the statistical design of experimental trials, the process of planning the trial is carried out, so that suitable data will be gathered and analyzed by statistical processes resulting in suitable and objective conclusions. In the current investigation, Taguchi's method and the TOPSIS (Technique for order of preference by similarity to ideal solution) technique have been utilized to plan the experimental trials and follow analysis of the data gathered.

As per Taguchi's experimental design philosophy using Minitab-17, the experimental input response sequence for conducting 27 experiments and values are mentioned below in table 2(b). By applying these values

PRINCIPAL
D.N.R. College of Engg. & Tech
BHIMAVARAM-534 202

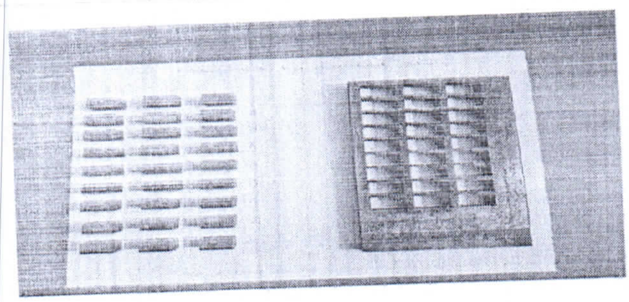


Figure 2. D2 steel work parts that have been machined using coated copper wire.

Table 2. (a). The chemical composition of the material. (b). Taguchi L27 orthogonal array.

(a)

Constituent	C	Si	Mn	P	S	Cr	Mo	V
Wt% Composition	1.55	0.4	0.45	0.03	0.03	12	0.85	0.8

(b)

Trail no.	A	B	C	D	E	F
1	1	1	1	1	2	3
2	1	1	2	2	3	1
3	1	1	3	3	1	2
4	1	2	1	2	3	1
5	1	2	2	3	1	2
6	1	2	3	1	2	3
7	1	3	1	3	1	2
8	1	3	2	1	2	3
9	1	3	3	2	3	1
10	2	1	1	1	2	3
11	2	1	2	2	3	1
12	2	1	3	3	1	2
13	2	2	1	2	3	1
14	2	2	2	3	1	2
15	2	2	3	1	2	3
16	2	3	1	3	1	2
17	2	3	2	1	2	3
18	2	3	3	2	3	1
19	3	1	1	1	2	3
20	3	1	2	2	3	1
21	3	1	3	3	1	2
22	3	2	1	2	3	1
23	3	2	2	3	1	2
24	3	2	3	1	2	3
25	3	3	1	3	1	2
26	3	3	2	1	2	3
27	3	3	3	2	3	1

as set of input responses to the EDM machine the output responses are noted and those values are substitute in TOPSIS method to find the optimal input response. In table 2(b) A, B, C, D, E, and F are represented by the following process parameters.

Distilled water was employed as the dielectric fluid in this investigation. Coated copper was used in the trials at first, then an electrode made of annealed wire. Figures 2 and 3 show, respectively, coated wire electrode- and annealed wire electrode-machined workpieces with cubes of 10 mm thickness. To reduce the breakage of wire electrodes, the constant input parameters and machining parameters must be closely watched. Each cube of 10 mm thickness was given a time stamp during the machining process, and measurements of the material MRR, SR, TWR, and KW were taken thereafter.

Y Arunkumar
PRINCIPAL
D.N.R. College of Engg. & Tech
BHIMAVARAM

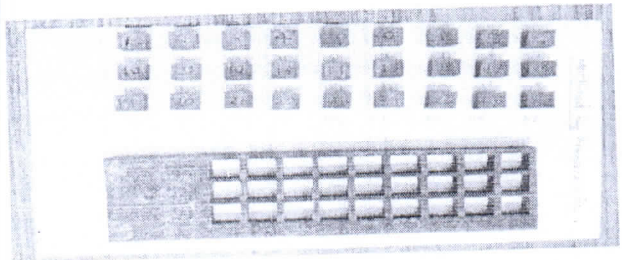


Figure 3. D2 steel machine parts made with annealed copper wire.

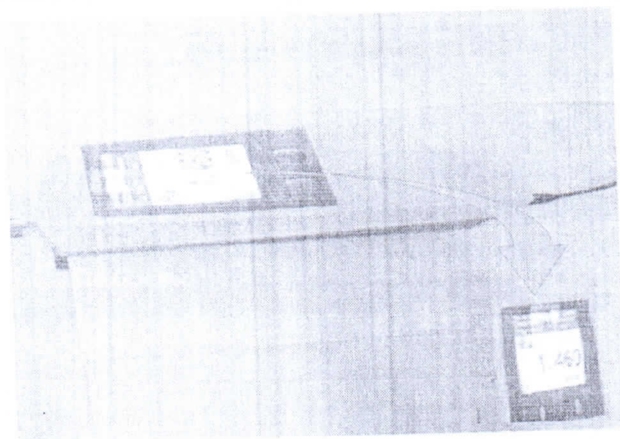


Figure 4. A tool for measuring surface roughness.

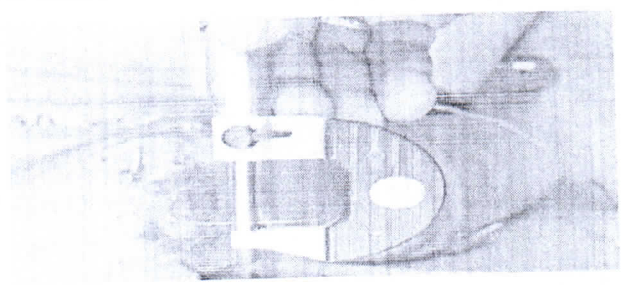


Figure 5. Measure the diameter of the wire using a screw gauge.

The term MRR, which stands for Material Removal Rate, refers to the speed at which material is taken away from the workpiece. It relies on factors such as kerf width, the total length of cutting, workpiece thickness (cubed), and time. The kerf width represents the width of the material that is removed during machining and can be measured using a profile projector.

Subsequently, measurements for wire wear ratio, denoting the change in wire diameter relative to its original diameter, and surface roughness, are acquired using specialized machines designed for surface roughness measurements. Meanwhile, wire diameter is measured using a screw gauge, as demonstrated in figures 4 and 5, respectively.

2.2. Data examination using experimental values

A total of 27 trials were conducted on each wire electrode, yielding measurements for response variables like tool wear ratio, surface roughness, kerf breadth, and material removal rate. We methodically changed the process parameters to precise, recommended levels in order to increase MRR, decrease kerf width, lessen tool wear, and improve surface roughness. Table [illegible], which is shown below, has specifics about these settings.

Y. Arunkumar
PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

International Journal for Innovative Engineering and Management Research

PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL

www.ijiemr.org

IJIEMR Transactions, online available on 10th Apr 2024. Link

:http://www.ijiemr.org/downloads.php?vol=Volume-13&issue=Issue 04

10.48047/IJIEMR/V13/ISSUE 04/06

Title Impact of Active Teaching & Learning Strategies in Higher Educational Institutions

Volume 13, ISSUE 04, Pages: 46-53

Paper Authors Dr.KBVSR Subrahmanyam,Dr.M.Anjan Kumar, Mr.K.A.S.V.R. Sai Phani Kumar, Dr.I.Harish, Mr.M.Srinu

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Impact of Active Teaching & Learning Strategies in Higher Educational Institutions

[1]**Dr.KBVSR Subrahmanyam**, Prof & Head, EEE Dept, DNR College of Engg & Technology, Bhimavaram-534202
E-mail:kappagantulasubbu@gmail.com
[2]**Dr.M.Anjan Kumar**, Professor, CE Dept & Principal, Dept, DNR College of Engg & Technology, Bhimavaram-534202
E-mail:anjanmantri@gmail.com
[3]**Mr.K.A.S.V.R. Sai Phani Kumar**, Asst.Professor, BS&H Dept & AO, DNR College of Engg & Technology, Bhimavaram-534202
E-Mail:saifanikumar@gmail.com
[4]**Dr.I.Harish**, Assoc.Prof & Head, ME Dept, DNR College of Engg & Technology, Bhimavaram-534202
E-mail:i.harish.dnr@gmail.com
[5]**Mr.M.Srinu**, Asst.Professor, EEE Dept , DNR College of Engg & Technology, Bhimavaram-534202
E-mail: srinumanne.manne2@gmail.com

ABSTRACT: Is it possible to improve the attention of the students, especially for the millennial learners. The answer would be yes; this is possible through Active learning and teaching strategies. Knowledge and wisdom could completely be acquired through basic understanding. With the implementation of active learning strategies,all the improvements , which cannot be fulfilled by traditional learning and teaching methods can be attained. With active learning, the students attention can be grabedd consistently throughout the lecture hour. Since it is one of the major challenges met by every faculty from day one. Active learning helps students to be actively involved themselves in a group activity, makes others and also themselves learn the concepts in an innovative manner. Active learning is not just a one-way learning method as it involves multitasking without losing the attention in the classroom.Active learning builds an individual's thinking ability by various brainstorming activities namely think pair share, group activity, , fishbowl, Stump your partner, quiz , flipped classroom etc. Initially the students may feel difficult and show disinterest and unwillingness to participate in such activities. But with proper guidelines, expectations and communicating, how to involve them are keys to breakup the barriers. These activities need to be practiced among the students so that they themselves indulge and completely get benefited. As these strategies are slowly being practiced and dealt by many educational institutions,this is a great advantage and would become successful if it's included in our curriculum for improving the quality of the teaching standards. One should approach education with a modern mindset. This paper presents an impact of active learning strategies and few of the activities reflections.

Keywords: Cognitive learning, active learning,millennial learners,collaborative learning,Learning Management System(LMS).

Abbreviations:LMS,Learning Management System;TAI,

Team-Assisted Individualization; STAD,Student Teams-Achievement Division TGT,Teams-Games-Tournaments, DNRCET:D.N.R.College of Engineering & Technology

I.INTRODUCTION

Most of the engineers today are likely to recall their undergraduate period as a span of mathematical and theoretical study. However the engineering curriculum at most colleges was mostly practical rather than mathematical applications. As the engineering institutes hire the faculty to teach and conduct the research, the number of faculty with industry experience is declining. When institute decide to give so much value to the research than education, The innovative practices in teaching and learning becoming unsustainable, not preparing the students with industry ready skills.st learning takes place on the job, in practical situations of challenging project that required the freshers to step out side their comfort zone [1]. In engineer curriculum normally the capstone project will be done in the final semester of fourth year. So the students on develop the employability skills like team skills, project management

M Anjan Kumar
PRINCIPAL
D.N.R. College of Engg. & T.
BHIMAVARAM

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

skills and communication skills. In the field of engineering , each aspect emphasizes on the design thinking. One of the key parameter is the design which has created impact in every flourishing industry like business corporate fields, textile industry, automation sectors, Aircraft sectors and various small-scale industries. The design feature enhancing for young students is a challenging task,however,there seems to be a large response and expectation among the student's communities as they seek for better job opportunities and like to build their designing skills. Individual Learning was exploited and distinguished clearly in this course. Along with academic excellence, innovative curriculum gives students a taste of the real world; with enriching, innovative entrepreneurial learnings.In the present days, innovation, team workers and uniqueness are expected in industries of every aspect . For meeting the short term and long term goals, each student undergoes a task which is a challenging in the daytoday life. To fulfil their dreams, students should be proactive and exhibit their innovative skills for acquiring a job. As an engineering professional every student should learn and aquire knowledge to cope up inorder to compete and get jobs. These are the foundation blocks for building every individual career in their professional lifeto dwell and become a successful engineer. Inter-Disciplinary learning ensures that students gain knowledge and perspective over multiple subjects.

II.LITERATURE REVİEW

Revolutionary changes in engineering education has taken place in the last decades with the perspective that students follow multi disciplinary approach and this will be used worldwide in problem solving and connect students further and their University to the world [1]. In every professional organisations, codes of conduct on social responsibility is very important [2]. An investigative study was conducted into the meaning and capabilities of design, using a literature review and subsequent content analysis method to create a theory-based Design Spectrum, which laid the foundation to demonstrate the wide breath of design parameters [3]. Transformation of the educational system through three key differentiator's namely creative engaging faculty, technology enabled infrastructure and collaborative entrepreneurial eco system makes the quality of teaching and learning much better. The second stage was an exploration of the expanding parameters of innovation in the commercial environment [4]. In professional education, teachers should have a basic understanding of the abilities which they are seeking in their students to develop and teachers can get by at the end of their course ,as long as their students are competent enough to enter their profession. In unprofessional education, the differences between training and education are less clear-cut compared to general education [5].

III.BROADER CONTEXT – INNOVATİON İN TEACHİNG AND LEARNİNG

3.1 Core Values

The mission of DNRCET is to create and develop students entrepreneurial mindset, staff, and faculty through educational ecosystem. So,for this mission achieving, the ecosystem of educational institution has been designed to integrate curriculum relevant to the industry needs with extra-curricular opportunities of learning. To make the students globally employable and competetive,to face challenges in the society, and for higher education pursuing purpose, the design of curriculum has been made by JNTUK (R20). The new curriculum is being implemented and inorder to teach the student community, new open elective and professional elective courses were offered to students based on their choice which changed the teaching and learning methods by imposing new techniques.

Course objective and outcomes – Objectives chosen that should be observable, measurable and achievable is my first course objective. The culture of our institution paves the way for development of this mindset by various teaching and learning methods as per the curriculum. In this ecosystem, students become leaders of thought provoking in creating new innovative ideas, and innovative solutions realization to seek a job in near future.

Industry Relevant Curriculum – The main objective of DNRCET is to present the JNTUK curriculum as per the latest technologies satisfying industry needs. So , various inputs are taken from industry experts in framing the curriculum, to design the projects and assessed by industry mentors and evaluators.DNRCETstudents are very much exposed to the latest trends of the industry bycontinous interaction with industry experts for bridging the gap between academia and industry.

H. Arunkumar
PRINCIPAL
D.N.R. College of Engg. & Tech
BHIMAVARAM-534 20

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Online course site - The main objective of DNRCET is to create a specific learning management system (LMS) for the purpose of the students, where the entire course related data are loaded from the syllabus to lesson plan and other teaching material. Learning through these methodologies is so professional and improves every student thought process. Our ecosystem of academics is based uponthese ideas, thoughts and by creating common core curriculum which leadsto rich experience of learning.

Learning and teaching style – Sensory and intuitive learning –perception: Students visually see the construction working principle was conveyed through power point presentation and adequate concrete content satisfying the teaching style.Given time to reflect about how any process is happening and to ponder about the application inreal time with an example.

3.2 Pre-implementation and post implementation reflection

Students do not show any interest during thecourse delivery and also handling a large classroom is also very challenging, hence creating an interest by relating to reality or industrial appllcations makes sense. Making students to think and participate in quizzes gave them brushup of what was taught in class for the purpose of reflection.

Attention: Students are asked to identify the devices in the classroom with examples and in day to day life to check the attention, where students come up with great ideas about usage of the topic choosen during the course

Relevance: Discussion about new upgradation relevant to electrical field, Students are asked to come up with relevant examples used in the reality. To face any competitive examinations. Builds confidence while attending interview.

Confidence: Interactive session for the first 5 min at the startof the class. Students able to understand the concept and asked to write down points about the previous class, views or doubts that needs to be clarified.

Satisfaction: Students find it satisfying at the end of the exams. The course learned completely reflects through exams and the marks scored but each and every student.

IV.LEARNING STYLES INVENTORY

4.1 Basic Information

Learners like to implement teaching according to various learning methods as illustrated in this paper.

A student learns by various ways like seeing, hearing, reasoning, memorizing, visualizing, thinking .Multidisciplinary learning [6] and so on . When I was a student, I was also adapting such methodologies. However Felder-Silverman Learning Styles inventory provides modified and classified specific group of students falling under categories namely visual auditory, inductive deductive, sensory intuitive, active reflective, sequential global where each needs to be handled in different modified ways of teaching.

We too liked to interact and was more an active learner when we were a student, we used to gain more knowledge and remembered the subject when was interacting with my group of my friends. We share our knowledge inside and outside the classroom. We were also a person of reflective thinker sometimes. We rethink about it when we were back at home or when we are outside , we try to relate things learned to the practical applications existing inside or the outside the surrounding . We always try to relate our theory to practical applications[10].

We were able to grasp many concepts and ideas, which is helping me even now when we explain it to our students, so as a lecturer we like to provoke the same with my students too. We like to emphasize solving problems in groups and verifying by doing a think pair share activity. Exhibiting tangible information with legible results. As reflection happens only certain time is given to think, it's better to break up the lecture in short spans and making students to relate it to the applications and come back with their thoughts and share the same among themselves with a small group. Providing an open-ended problems and exercises that help analyzing things. Some of this modification in teaching; certainly bring changes among the student community.

PRINCIPAL
D.N.R. College of Engg. & T.
BHIMAVARAM-534

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

4.2 Teaching Philosophy Statement

Contribute towards positive learning and produce quality engineers. Educate and learn enthusiastically, Builds a strong base to inculcate learning throughout the lifetime. Innovative brain-based learning methodologies are being propagated nowadays[7]. Teaching with clarity, enthusiasm, transparency and involvement have improved to greater extent.

4.3 Fundamentals Of Course Design

To design an effective course design and implementation. Develop the course objectives and outcomes using "blooms taxonomy. Design the pre-requisites of the course. Set up the ground rules and expectation appropriately. Faculties able find the student's involvement and their level of interest. Students support and involvement towards the subject is achieved. The expectations of the students are clearly met[8].

4.4 Creating A Dynamic Classroom

Active learning is one of the best strategies suitable for the millennial learners to create a dynamic classroom. Active learning enables student's achievements and exposes their abilitiesActive learning stimulates the brain based learning among students. Active learning engages the students with the quality time. Motivated students who were unable to speak out to actively participate and made them realize it would help them in exams, also score for their own team. Students participated very enthusiastically in groups and showed lot of interest taken place in classroom. Now, as a faculty able to bring back the class after the activity, which was a hard task?

Fig. 1. Photo shot during the activity

Fig. 2. Photo shot during the think pair share activity.

M Arunkumar
PRINCIPAL
S.R.K.R. College of Engg. & Tech
BHIMAVARAM

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

The above photo shot was during think pair share activity. As I was unable to implement many activities as discussed in modules. I tried implementing few and even students are aware of such activities now and eagerly participated.

4.5 Collaborative Learning

Collaborative learning enhances the logical and innovative processes working in a group. Collaborative learners are set with a common goal, opens up deadlock. Team work improvises by involving them to take the responsibility to check each other's work Collaborative learning enhancing the skills and abilities of each student in some way or the other Remember all the basic concepts and builds interaction and also builds friendly and fare competition among team members.Through collaborative activity, I was inspired by the TAI (STAD & TGT), which also matches with my course outcomes to proceed with; hence I tried implementing this activity in the classroom. It was time consuming and the entire 50 minutes of class was not enough to complete the activity. But, I was able to manage it to some extent. Students are aware of such activities which would help them build team work especially in the industry[9].

Fig. 3. Photo shot during the activity.

The above photo shot shows the students participation during a small group activity.

4.6 Harnessing Technology

Developing a Flipped class room technique rather than traditional teaching style for the convenience of the students. Execute the flipped classroom for the important topics and class time could be utilized for the field work. Students missed the classes could utilize this technology and also revise during the exams. Flipped classroom technique was an excellent choice for the students. After viewing the video, students showed much interest in answering the questions asked in the video session. Students came up with thoughtful answers and excellent involvement in the class session.

4.7 Effective Assessment

Rubrics guide the student's outcomes in an implicit manner to extract the proper outcomes from the students. Rubrics help students develop more confidence while appearing for the exams. An extremely detailed oriented and helps in student self reflection. We are able to produce a proper justification, during the evaluation process. This methodology exhibits transparency among the students, as to what is being expected from them. It helps both the faculty and students during examinations, projects and various places where it involves evaluation.

H Arunkumar
PRINCIPAL
D.N.R. College of Engg. & Tech
BHIMAVARAM-534 202

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Table 1. Rubrics set for a project report

RUBRIC FOR DESIGN PROJECT----New rubric

	Criteria	Rating (Fully met expectation)	Rating (Approached expectation)	Rating (Not met expectation)	Total points
Review 0 (Selection of suitable project)	Segregation of literature survey	Information gathered was relevant to the topic chosen for the project....(5pts)	Information gathered was not sufficient for the topic chosen ..(3pts)	Information chooses was less relevant to the topic chosen(1pt)	5
	Base paper selection (Topic selection)	Selected base paper is appropriately chosen from IEEE transaction and latest....(10)	Selected base paper is not latest upgraded in the IEEE transaction...(5pts)	Selected base is completely not an upgraded IEEE transaction...(3)	10
	Innovativeness or real time applicability.	Completely involves real time application (10pts)	Involves in real time application to some extent(5pts)	Does not apply to any real time application nor innovative..(3 pts)	10
Review 2(Identifying the need and conceptualization)	Progress of the project and tools used	Efficient usage of software displayed and utilized to seek the progress..(10 pts)	Usage of software not fully utilized to seek the progress..(5pts)	Insufficient usage of the software utility..(3pts)	10
	Simulation and execution	A part of the circuit design, simulated	Execution an simulated output is less close to the	Execution is not up to the expectation..(3pts)	10

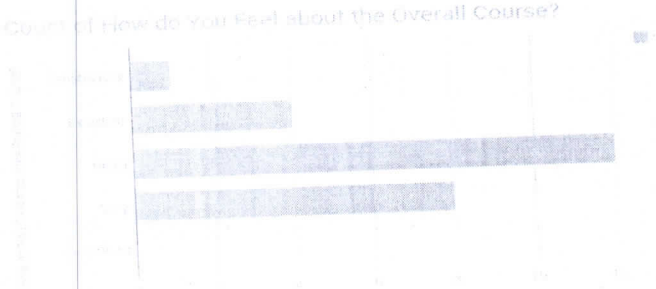
The above table displays the rubric created for a project report.

V. IMPACT OF LATEST TEACHING METHODOLOGY AMONG STUDENTS

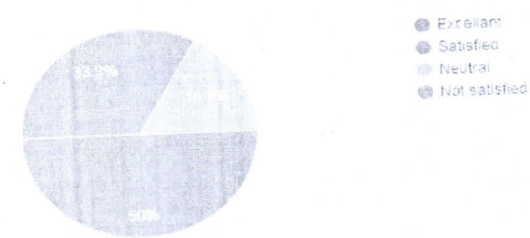
As Collaborative Learning Techniques have been adopted, students were able to observe the concepts and able to implement, which in turn reflected in the exams. Student's interest and attitude towards the course have improvised. Students are exposed to new technology and have reflected with feedbacks in various aspects.

PRINCIPAL
D.N.R. College of Engg. & Tech
BHIMAVARAM-534-202

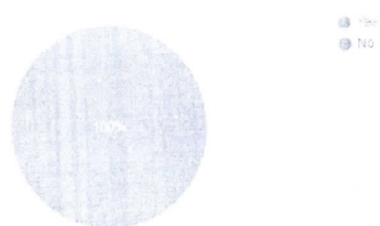
International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org



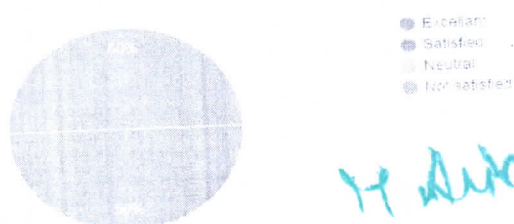
Did the group activity helped in exams



Do you feel that new learning methodology is useful than traditional methods



How do you feel about the new learning methodology



PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 202

VI.CONCLUSION

This paper impresses the importance and widens the scope of the teaching and learning methodology in the engineering Education. As millennial learners seek for the new ideas and innovations through cognitive learning, these methods would promotes the proactiveness among the students now and in the future generation. Indeed students learn and imply in reality which enable employability throughout the nation. These approaches are most adapted by the students than traditional learning methods and also it is most suited for the millennial learners.

VII. FUTURE SCOPE: This work can be extended to various latest teaching methodologies as per the technological advancements that can be implemented in the classrooms and online teaching methodologies as well.

REFERENCES

[1]. Ryan Legg, Mark Recipe, Krishna S. Athena, Mani MinaIowa State University, Ames, Iowa, "Solving multidimensional problems through a new perspective: The integration of design for sustainability and engineering Education", "Proceedings of the 2005 American Society for Engineering Education Annual Conference & ExpositionCopyright © 2005, American Society for Engineering Education"

[2]. Bennett, A. G., Cassin, F., & van deer Merwe, M. (2017). How design education can use generative play to innovate for social change: A case study on the design ofSouth African children's health education toolkits. International Journal of Design, 11(2), 57-72.

[3]. Na, J., Choi, Y., & Harrison, D. (2017). The design innovation spectrum: An overview of design influences on innovation for manufacturing companies. InternationalJournal of Design, 11(2), 13-24.

[4]. Kleinsmann, M., Valkenburg, R., & Sluijs, J. (2017). Capturing the value of design thinking in different innovation practices. International Journal of Design, 11(2), 25-40.

[5]. kees dorst and isabellereymen, "levels of expertise in design education", International engineering and product design education conference 2-3 september 2004 delft the netherlands.

[6]. Kumar, K. S. Alok, G. Reddy, M. S. and Reddy, N. B.S An integrated Multidisciplinary skill development strategy for effective execution from virtuality to reality in Engineering Education, IEEE 6th International Conference on MOOC's, Innovation and Technology in Education (MITE) pp. 79-83, IEEE.

[7]. Alok, G. Pothupogu, S. Reddy, M. S. and SaiPriya, P. (Nov-2018) Trenchant Pathway to bring Innovation through Foundations to Product Design in Engineering Education, IEEE 6th International Conference on MOOCs, Innovation, and Technology in Education (MITE), pp. 43-47. IEEE.

[8]. Alok,G.,Anushalini, T., & Condoor, S. (2018).Effective Approach towards development of idea through Foundations to Product Design doi: 10.16920/jeet/2018/v31i3/120756

[9]. Srinivas, S. Soumya, P. (2015) A Traditional Novel Approach for Skill Enhancement of Teaching–Learning Process in Engineering Education, doi: 10.16920/jeet/ 2015/v28i4/70407.

[10]. Anuradha, P., 2019. The teaching learning process. International Journal of Advanced Science and Technology Vol.28, PP 709–714.

Y Arunkumar
PRINCIPAL
D.N.R. College of Engg. & Tech.
BHIMAVARAM-534 20

Full Swing Logic Based Full Adder for Low Power Applications

D. Durga Prasad[1], B. V. V. Satyanarayana[1](✉), Vijaya Aruputharaj J[2], Abdul Rahaman Shaik[1], K. Indirapriyadarsini[3], K. V. Subba Rami Reddy[1], and M. Hemalatha[4]

[1] Department of ECE, Vishnu Institute of Technology, Bhimavaram, Andhra Pradesh, India
vvsatya.b@gmail.com

[2] Department of Computer Science, CHRIST (Deemed to be University), Bangalore, India

[3] Department of ECE, DNR College of Engineering and Technology, Bhimavaram, India

[4] Department of ECE, Shri Vishnu Engineering College for Women, Bhimavaram, India

AQ1

Abstract. During the design of Application-Specific Integrated Circuits, a whole adder logic circuit plays a significant role. The full adder is a fundamental part of the majority of VLSI and DSP applications. Power consumption in full adders is one of the key factors; hence it is necessary to build full adders with low power consumption. Full adders are developed in this work employing full swing AND, OR, and XOR gates and compared with pass transistor logic (PTL) based AND, OR, and XOR gates, and complementary metal oxide semiconductor logic (CMOS) based AND gate, OR gate, and XOR gate. The Mentor Graphics Tool is used to construct and simulate every planned circuit. After receiving simulation data, we compared the power consumption, delay and PDP of several complete adder-based logic designs. In the proposed full swing XOR, the power dissipation and delay is decreased by 10.5% and 9.8% respectively and hence the full swing full adder PDP is decreased by 0.6%. As compared to alternative full adder designs based on logic, full swing by using gates like AND gate, by using the OR gate, and with the help XOR gate, full adder design consumes less power and hence suitable for low power applications.

AQ2

Keywords: Full Adder · TGL · PTL · Mentor Graphics Tool

1 Introduction

The concept of smart cities has gained tremendous momentum in recent years as urban areas around the world strive to harness the power of technology to enhance the quality of life for their residents. Smart cities leverage various Internet of Things (IoT) applications and interconnected systems to efficiently manage resources, improve infrastructure, and deliver better services. One crucial aspect that underpins the success of smart city initiatives is the implementation of low-power solutions [1]. Low power plays a pivotal role in enabling the sustainable growth and long-term viability of smart cities, ensuring that these technological advancements are energy-efficient, environmentally friendly, and economically feasible.

P. Pareek et al. (Eds.): IC4S 2023, LNICST 537, pp. 1–18, 2023.
https://doi.org/10.1007/978-3-031-48891-7_2

	Given Name	**Abdul Rahaman**
	Prefix	
	Suffix	
	Role	
	Division	Department of ECE
	Organization	Vishnu Institute of Technology
	Address	Bhimavaram, Andhra Pradesh, India
	Email	
	ORCID	http://orcid.org/0000-0003-1844-2408
Author	Family Name	**Indirapriyadarsini**
	Particle	
	Given Name	**K.**
	Prefix	
	Suffix	
	Role	
	Division	Department of ECE
	Organization	DNR College of Engineering and Technology
	Address	Bhimavaram, India
	Email	
	ORCID	http://orcid.org/0009-0003-6854-1663
Author	Family Name	**Reddy**
	Particle	
	Given Name	**K. V. Subba Rami**
	Prefix	
	Suffix	
	Role	
	Division	Department of ECE
	Organization	Vishnu Institute of Technology
	Address	Bhimavaram, Andhra Pradesh, India
	Email	
	ORCID	http://orcid.org/0009-0004-3968-6254
Author	Family Name	**Hemalatha**
	Particle	
	Given Name	**M.**
	Prefix	
	Suffix	
	Role	
	Division	Department of ECE
	Organization	Shri Vishnu Engineering College for Women
	Address	Bhimavaram, India
	Email	
	ORCID	http://orcid.org/0009-0003-1850-9331

Abstract	During the design of Application-Specific Integrated Circuits, a whole adder logic circuit plays a significant role. The full adder is a fundamental part of the majority of VLSI and DSP applications. Power consumption in full adders is one of the key factors; hence it is necessary to build full adders with low

power consumption. Full adders are developed in this work employing full swing AND, OR, and XOR gates and compared with pass transistor logic (PTL) based AND, OR, and XOR gates, and complementary metal oxide semiconductor logic (CMOS) based AND gate, OR gate, and XOR gate. The Mentor Graphics Tool is used to construct and simulate every planned circuit. After receiving simulation data, we compared the power consumption, delay and PDP of several complete adder-based logic designs. In the proposed full swing XOR, the power dissipation and delay is decreased by 10.5% and 9.8% respectively and hence the full swing full adder PDP is decreased by 0.6%. As compared to alternative full adder designs based on logic, full swing by using gates like AND gate, by using the OR gate, and with the help XOR gate, full adder design consumes less power and hence suitable for low power applications.

Keywords (separated by '-')	Full Adder - TGL - PTL - Mentor Graphics Tool

Metadata of the chapter that will be visualized in SpringerLink

Book Title	Cognitive Computing and Cyber Physical Systems
Series Title	
Chapter Title	Full Swing Logic Based Full Adder for Low Power Applications
Copyright Year	2023
Copyright HolderName	ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering

Author	Family Name	**Prasad**
	Particle	
	Given Name	**D. Durga**
	Prefix	
	Suffix	
	Role	
	Division	Department of ECE
	Organization	Vishnu Institute of Technology
	Address	Bhimavaram, Andhra Pradesh, India
	Email	
	ORCID	http://orcid.org/0000-0001-5880-1810
Corresponding Author	Family Name	**Satyanarayana**
	Particle	
	Given Name	**B. V. V.**
	Prefix	
	Suffix	
	Role	
	Division	Department of ECE
	Organization	Vishnu Institute of Technology
	Address	Bhimavaram, Andhra Pradesh, India
	Email	vvsatya.b@gmail.com
	ORCID	http://orcid.org/0000-0003-2601-7014
Author	Family Name	**J**
	Particle	
	Given Name	**Vijaya Aruputharaj**
	Prefix	
	Suffix	
	Role	
	Division	Department of Computer Science
	Organization	CHRIST (Deemed to be University)
	Address	Bangalore, India
	Email	
	ORCID	http://orcid.org/0000-0002-3842-5835
Author	Family Name	**Shaik**
	Particle	

Adders are widely utilized as circuit components in Very Large Scale Integration (VLSI) systems, including microprocessors and Digital Signal Processing (DSP) processors. It serves as the hub for several other processes, including address computation, multiplication, and division. Adders are crucial to the overall system performance in most digital systems [2]. As a result, improving adder's performance is a key objective. The study into low power microelectronics has increased due to the tremendous rise in portable systems like laptops. The cause of this is because battery technology develops more slowly than microelectronics technology [3]. The mobile systems have a finite quantity of electricity at their disposal. Low power design has thus grown to be a significant design restriction [4]. The most computationally intensive applications, such as multimedia processing and DSP, may now be realized in hardware to increase speed of operation. However, as the market for portable electronics grows, so do the researchers' motivations to pursue smaller silicon areas, faster processing, longer battery lives, and improved dependability [5].

The complete adder design is crucial to digital computing. The complete adder design requirements are often several in natures. One of the properties, transistor count, affects the system complexity of arithmetic circuits like multipliers and Arithmetic Logic Units (ALU), among others [6]. The other two key factors in the design of complete adders would be power consumption and speed [7, 8]. Yet, their interactions with one another are paradoxical. To achieve the best design tradeoffs, energy usage per operations and power delayed products have been defined. The right choice of logic types can improve the performance of digital circuits. Various logical approaches frequently emphasize achieving one facet of performance at the price of another. While executing the identical function, the logic styles differ in how they calculate intermediary nodes and transistor counts [9].

Numerous comprehensive adders are designed so far, including those that use static CMOS, with the help of dynamic circuits, and having the large number of transmission gates, with the help of GDI logic, and having the pass transistor logic (PTL) [10, 11]. For the purpose of producing sum and carry outputs, the well-established static CMOS which are adders along with help of complementary pull up PMOS and having the pulling down NMOS networks that need 28 no. of transistors. PTL is a substitute for CMOS that offers implementations of the majority of functionalities with fewer transistors. This may lower total capacitances, increasing speed and reducing power dissipation in the process. The output voltage, however, varies in the PTL-based design because of a certain threshold voltage reduction occurs throughout the circuit input and the circuit output. The Complementary Pass Logic (CPL) and along with the differential restoring circuit that is Swing Restored PTL is a adaptations can be used to remedy this issue (SRPL). However, these logics lead to higher shorts of current, a greater transistors count, and more intricate wiring connections since they require complementary input signals [12].

Another strategy to reduce complexity in logic construction is to use transmission gates. Reference [13] discusses the entire adder implementation that makes use of a transmission gate. It takes 20 transistors; a transmission function adder, which only needs 16, is another option for additional transistor count reduction. Reference [14] discusses this option. As an alternative to CMOS logic, GDI logic is offered. A logic function may be implemented using this low-power design method with fewer transistors. A threshold

In the pursuit of building efficient and sustainable smart cities, low-power solutions have emerged as a vital enabler. By embracing energy-efficient technologies, smart cities can minimize their energy consumption, optimize resource allocation, and reduce their environmental impact [23]. Low-power devices and systems pave the way for scalable and resilient IoT networks, ensuring the long-term viability and success of smart city initiatives. As cities continue to evolve and adapt to the ever-changing technological landscape, prioritizing low power will remain essential in creating truly intelligent, energy-conscious, and livable urban environments [24].

3 Traditional Approach

3.1 XOR Gate using CMOS Logic

A two-input XOR gate is a fundamental digital logic gate that outputs true (1) when the number of true inputs is odd. The operation of a two-input XOR gate using CMOS logic involves the use of both NMOS and PMOS transistors. Dynamic power consumption occurs during switching when the output transitions between logic 0 and logic 1. During this period, both NMOS and PMOS transistors momentarily conduct, causing a short power surge. This causes a brief surge in power consumption, which can be significant in high-frequency operation or large-scale designs. The XOR gate's delay is primarily influenced by the cascaded structure of the inverters within the circuit. This can become a limitation in high-performance applications where ultra-fast operation is essential.

The power-delay product (PDP) represents the trade-off between power consumption and circuit speed. In high-performance systems, optimizing the PDP is crucial, and CMOS XOR gates may not be the most efficient choice. CMOS XOR gates require a relatively higher number of transistors compared to simpler gates like NAND and NOR gates. Each XOR gate needs 14 transistors, which can lead to increased chip complexity and area consumption [25]. In large-scale designs, the higher transistor count can contribute to increased manufacturing costs and may limit the overall chip integration. Due to the complex structure and cascaded nature of the XOR gate, its ability to drive multiple loads can be limited.

The CMOS XOR gates have proven to be versatile and widely used in many digital applications, they do have certain disadvantages, particularly concerning power consumption during switching, delay compared to simpler gates, and the number of transistors required. In some cases, a different gate implementation might be more suitable for achieving the desired balance between power efficiency, speed, and transistor count. The CMOS XOR gate circuit diagram is as shown in Fig. 1.

3.2 XOR Gate Using PTL

PTL XOR gates typically require fewer transistors compared to CMOS XOR gates, which can lead to a smaller silicon area and lower manufacturing costs. Due to the reduced transistor count, PTL XOR gates generally consume less power than CMOS XOR gates, making them more energy-efficient. PTL XOR gates have simpler transistor paths, leading to shorter signal propagation delays and faster switching times compared value V_t separates the output the result that comes maximum or minimum in the voltages from the V_{DD} that is the voltage which results the circuit to work or ground in GDI gates, resulting in a smaller voltage swing at the outputs [15, 16]. It is advantageous for power usage when the voltage swing is reduced. Nevertheless, if cascaded operation is used, this could result in sluggish switching. The reduced output may possibly result in circuit malfunction while operating at low V_{DD} [17].

In order to attain full swing functioning, additional consideration must be required. This work implements an effective technique for digital circuits, comprised of full swing by using gates like AND gate, by using the OR gate, and with the help XOR gate, and using the transistors like pass transistor logic, and by using the CMOS logic.

2 Ultra-Low Power Design Requirement

As smart cities evolve and integrate a multitude of IoT devices and systems, the demand for energy increases exponentially. These devices, such as sensors, actuators, and communication modules, form the backbone of a smart city infrastructure. They collect and exchange vast amounts of data, enabling city authorities to monitor various aspects of urban life, including traffic flow, waste management, energy consumption, and public safety. However, this increased reliance on technology and connectivity poses significant challenges, particularly in terms of power consumption.

1. Energy Efficiency: Smart cities need to optimize energy consumption to ensure sustainable development. By implementing low-power devices and systems, cities can minimize their overall energy footprint. Low-power solutions can significantly extend battery life, reducing the frequency of battery replacements or recharging [18]. This, in turn, reduces the operational costs associated with maintaining and powering the vast network of IoT devices deployed throughout the city.
2. Scalability and Expansion: A crucial characteristic of smart cities is their ability to scale and accommodate future growth. Low-power solutions enable the deployment of a larger number of devices without overburdening the existing power infrastructure [19]. By adopting energy-efficient technologies, smart cities can expand their IoT networks without straining resources or compromising system performance.
3. Environmental Sustainability: The environmental impact of urbanization is a growing concern worldwide. By incorporating low-power devices and systems, smart cities can contribute to reducing greenhouse gas emissions and minimizing their ecological footprint. Energy-efficient IoT solutions decrease the demand for non-renewable energy sources, leading to a more sustainable and eco-friendly urban environment [20].
4. Reliability and Resilience: In smart cities, maintaining the reliability and resilience of IoT systems is crucial for uninterrupted service delivery. Low-power devices can operate for extended periods without needing frequent maintenance, ensuring the continuous functioning of critical applications. Additionally, energy-efficient technologies are less susceptible to power outages, allowing smart cities to remain operational even during unforeseen events or emergencies [21, 22].

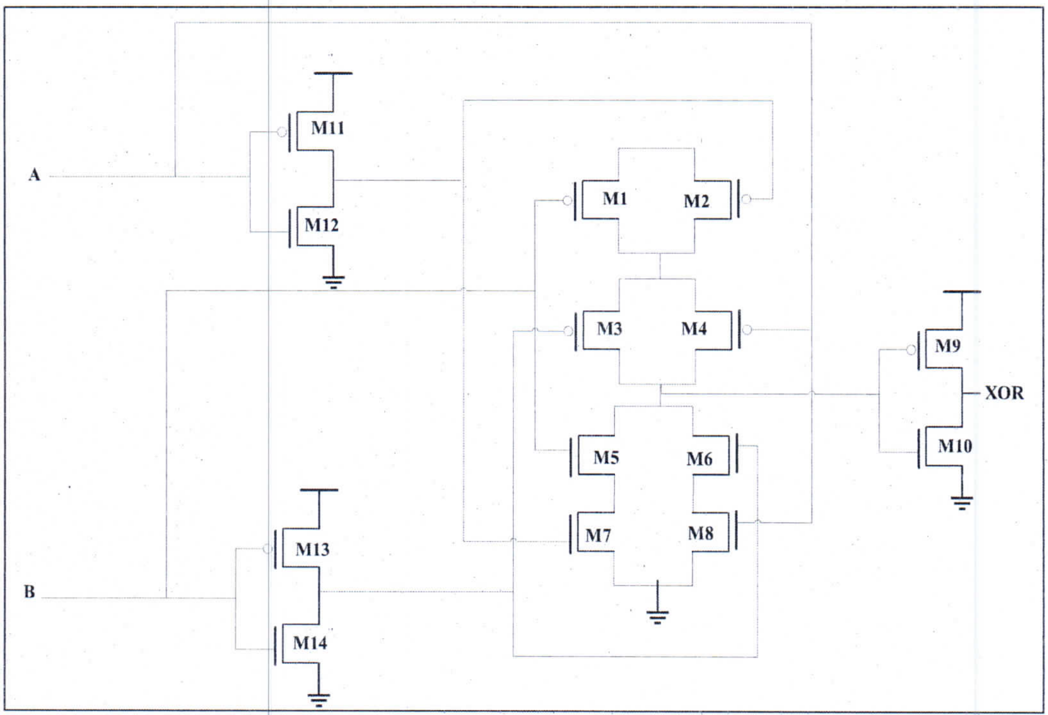


Fig. 1. Circuit schematic of XOR using CMOS logic

to CMOS XOR gates [26]. PTL gates can perform well at lower supply voltages, making them suitable for low-power and energy-constrained applications.

PTL XOR gates suffer from some signal degradation issues due to the presence of parasitic capacitance and resistance in the pass transistors, which can affect the circuit's overall performance. The noise margin (the tolerance for signal fluctuations) of PTL XOR gates is generally lower than that of CMOS XOR gates, making them more susceptible to noise and manufacturing variations. PTL XOR gates have a limited ability to drive multiple loads (fan-out), which can restrict their use in complex circuits with high fan-out requirements. The circuit schematic of XOR using PTL is represented in Fig. 2.

3.3 XOR Gate Using Full Swing Logic

The power consumption of the FA cell can be decreased by designing the XOR gate efficiently, as it is a major consumer of power. Additionally, there are various circuit proposals available for implementing an efficient XOR gate in digital circuits design. The full swing based XOR gate is shown in Fig. 3.

In Fig. 3, due to two NOT gates on the critical route, the double pass transistor XOR gate circuit, which comprises eight transistors, consumes a lot of power. The power dissipated in short-circuits and overall increases with the size of these transistors since doing so results in an intermediate node with a high capacitance. There is a minor increase in critical route latency under ideal PDP circumstances as well [27].

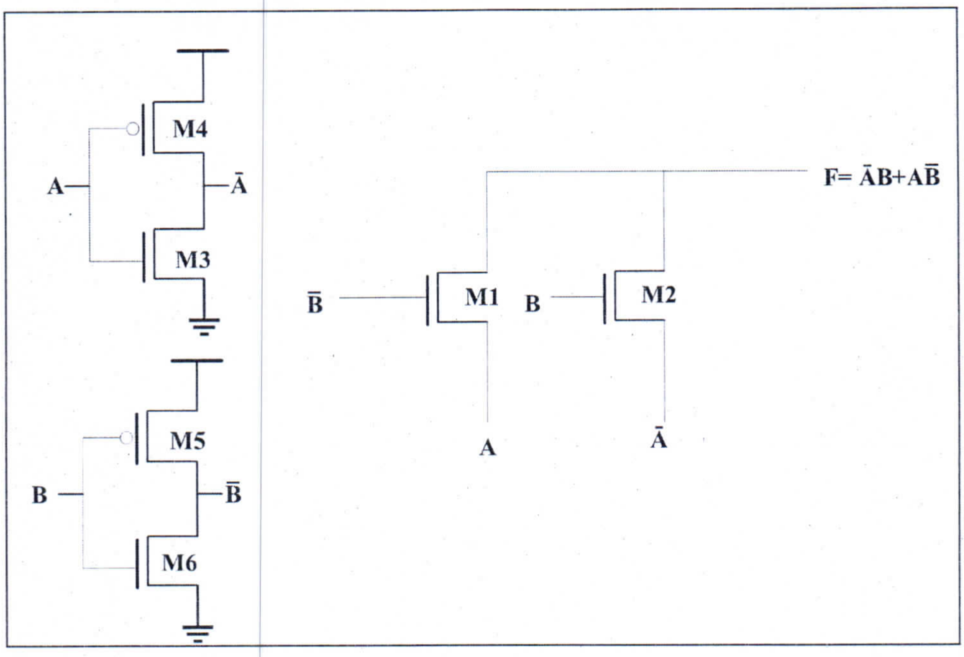


Fig. 2. Circuit schematic of XOR using PTL

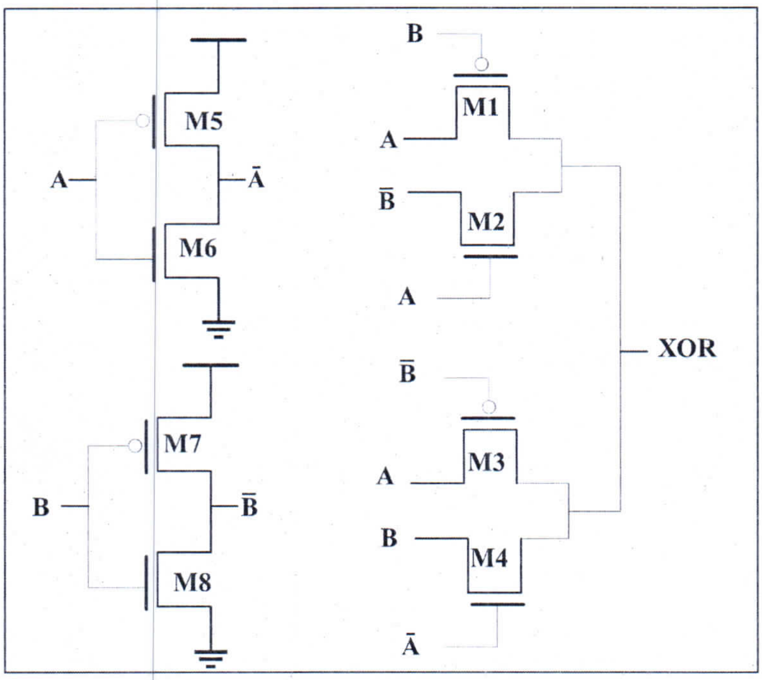


Fig. 3. Circuit schematic of XOR using FSL

Figure 4 shows The PTL logic-based XOR gate circuit, which consists of six transistors, has a better latency and power consumption than an alternative circuit. However, it employs NOT gates on the critical route, which might be problematic. Because an NMOS transistor was used in the XOR circuit, has less latency Because PMOS transistors are slower than NMOS transistors, not gates should be larger in order to maximize XOR speed [28].

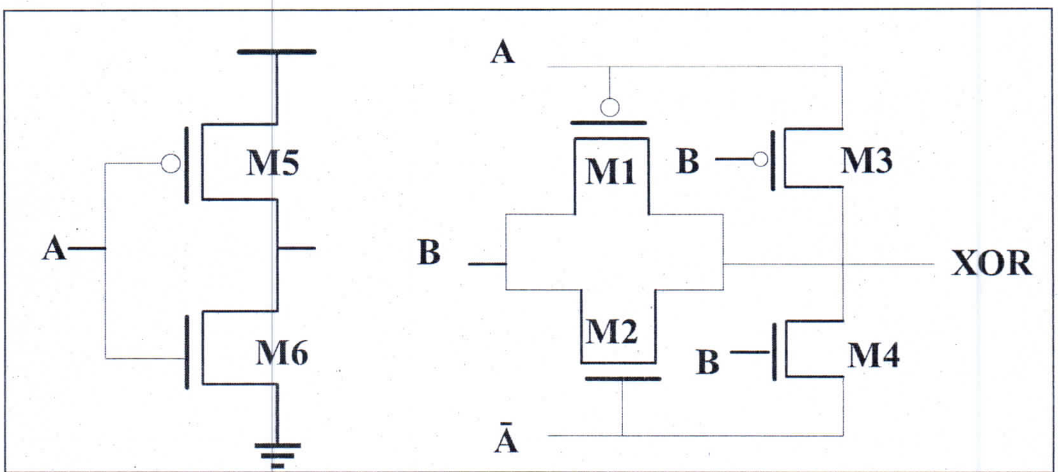


Fig. 4. Circuit schematic of XOR using full swing PTL

4 Proposed Methodology

The non-full-swing XOR circuit of Fig. 5 [29] is efficient in terms of the power and delay. Furthermore, this structure has an output voltage drop problem for only one input logical value.

To solve this problem and give the XOR gates an ideal shape; we propose the circuit shown in Fig. 6. This arrangement creates a perfect swing for all possible input combinations. In the critical route of the circuit, the proposed XOR gate does not contain a NOT gate. Compared to all other circuits, the delay is shorter and the drive strength this better. The proposed XOR gate has one more transistor than the structure shown in Fig. 4, but it operates faster and consumes less power.

The input capacitances in A and B of the XOR circuit depicted in Fig. 6 are not balanced because one of them has to be connected to the input of the NOT gate and the other to the diffuser of the NMOS transistor. As a result, input A, which is likewise linked to the NOT gate, has to be connected to a transistor with a lower input capacitance. Full-swing output, less wiring, good drivable capacitance and simple circuit structure of the proposed XOR circuits are their advantages.

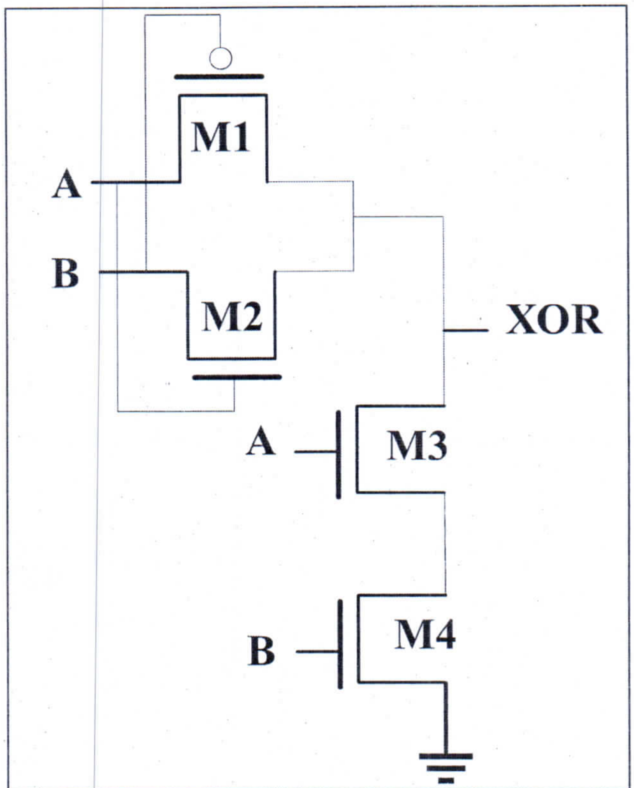


Fig. 5. Circuit schematic of non-full swing XOR

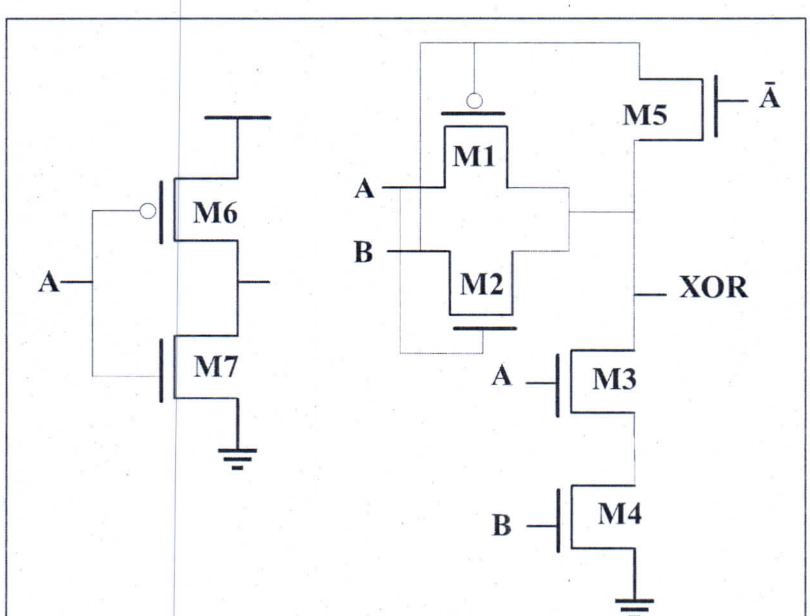


Fig. 6. Circuit schematic of proposed XOR using FSL

5 Design, Implementation and Simulation Results

The PTL XOR gate is designed using pass transistors as the main building blocks. It consists of transmission gates or pass gates that pass or block signals based on the control signals. The CMOS XOR gate is designed using Complementary Metal-Oxide-Semiconductor (CMOS) technology. It employs a combination of NMOS and PMOS transistors to create the XOR function. Full Swing Logic is a design style that enhances noise immunity and signal integrity. The XOR gate designed using Full Swing Logic combines the benefits of both PTL and CMOS techniques to achieve high performance.

Mentor Graphics provides a suite of electronic design automation tools. The design of the XOR gates (PTL, CMOS, and Full Swing Logic) is implemented using the appropriate tool from the Mentor Graphics suite. This involves drawing the circuit schematics, setting up the transistor models, specifying the technology parameters, and defining the logic function of the XOR gate.

After implementation, the XOR gates are simulated using the Mentor Graphics tool to verify their functionality and performance. The outputs waveform of every circuitry may be seen when all the circuitry have been constructed and modeled to use the mentor graphical tool.

5.1 Implementation of XOR Gate Using CMOS Logic

For CMOS XOR gate, the simulation will demonstrate its higher noise immunity, better signal integrity, and high fan-out capability. But it might exhibit increased power consumption and longer switching delays. Figures 7 and 8 depict the simulated design and waveforms of an XOR gate employing CMOS respectively.

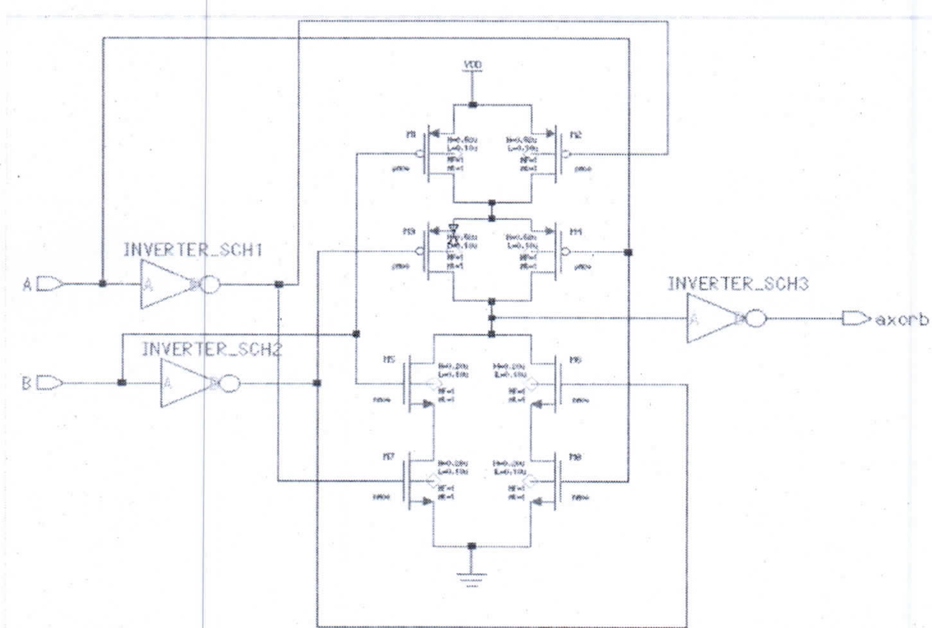


Fig. 7. Schematic for simulating XOR with CMOS

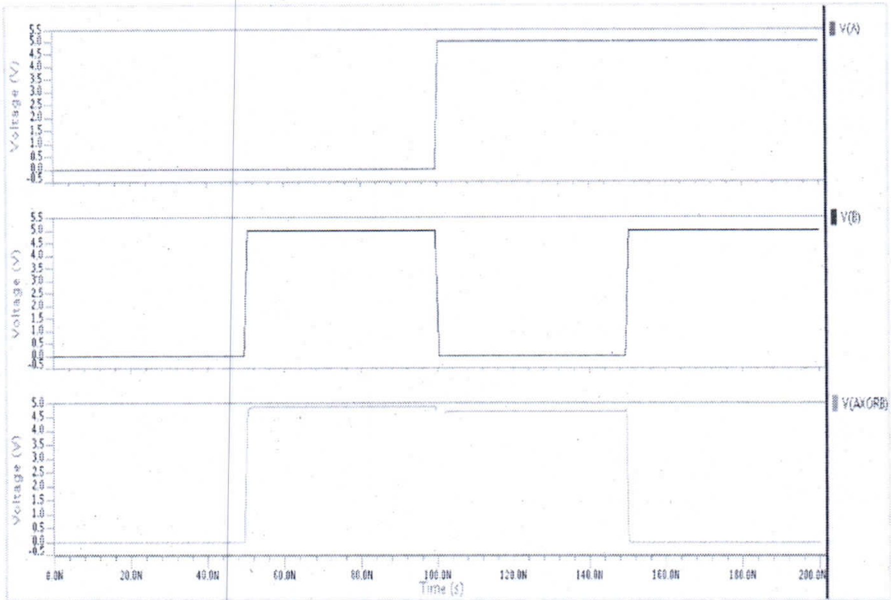


Fig. 8. Waveforms for simulating XOR gate with CMOS

5.2 Implementation of XOR Gate Using PTL

For Pass Transistor Logic (PTL) XOR gate, the simulation will validate its reduced transistor count, low power consumption, and faster switching speed. However, it may show limitations in noise margin and signal degradation. Figures 9 and 10 depict the simulated design and waveforms of an XOR gate employing pass transistors respectively.

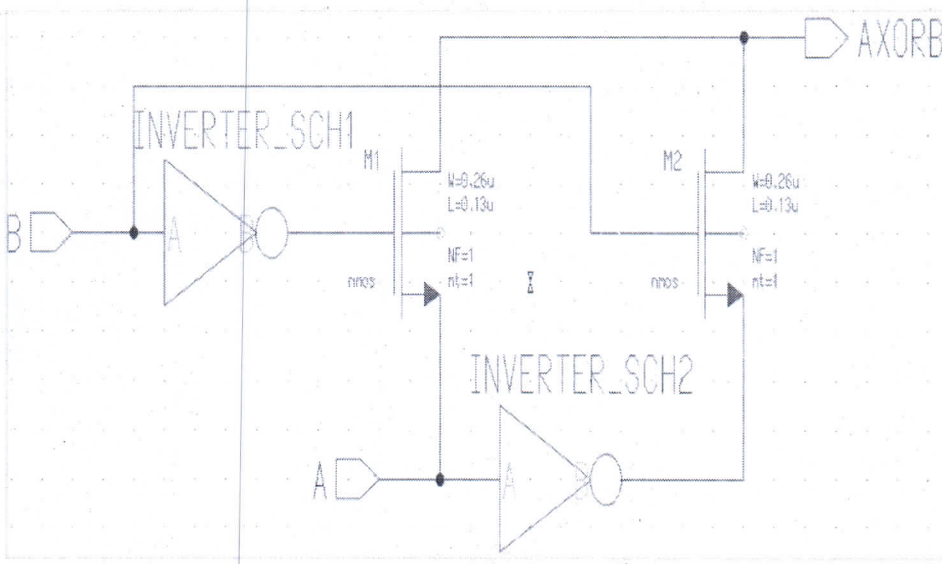


Fig. 9. Schematic for stimulating XOR gate with PTL

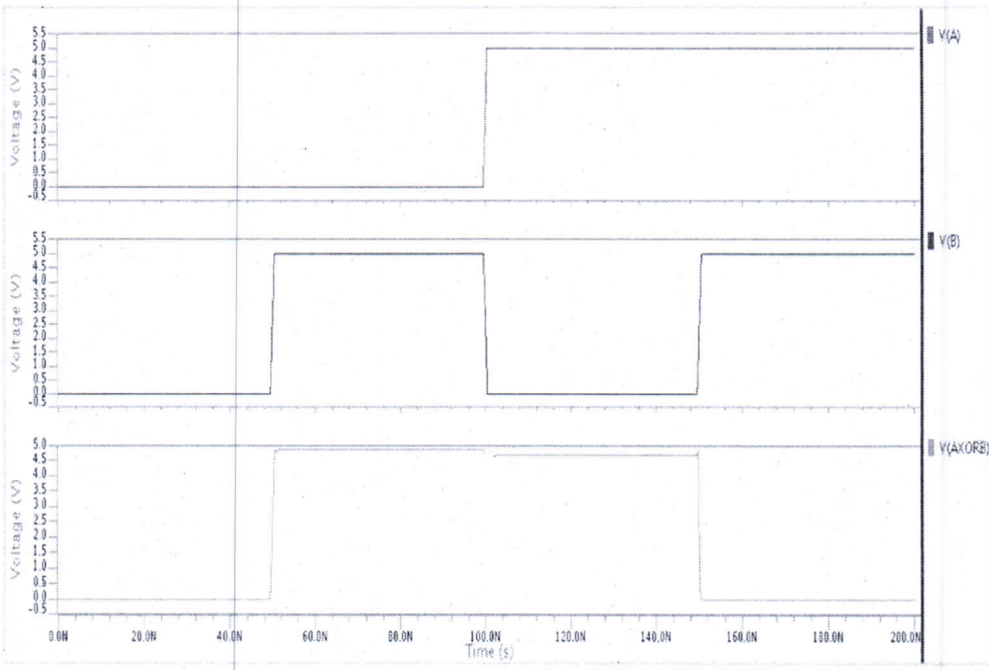


Fig. 10. Waveforms for stimulating XOR gate with PTL

5.3 Implementation of Proposed XOR Gate Using FSL

For full swing logic XOR gate, the simulation results will aim to show the advantages of combining PTL and CMOS techniques, such as improved noise immunity, signal integrity, and moderate power consumption. Figures 11 and 12 demonstrate the simulation design and waveforms for a XOR gate utilizing a full-swing XOR gate.

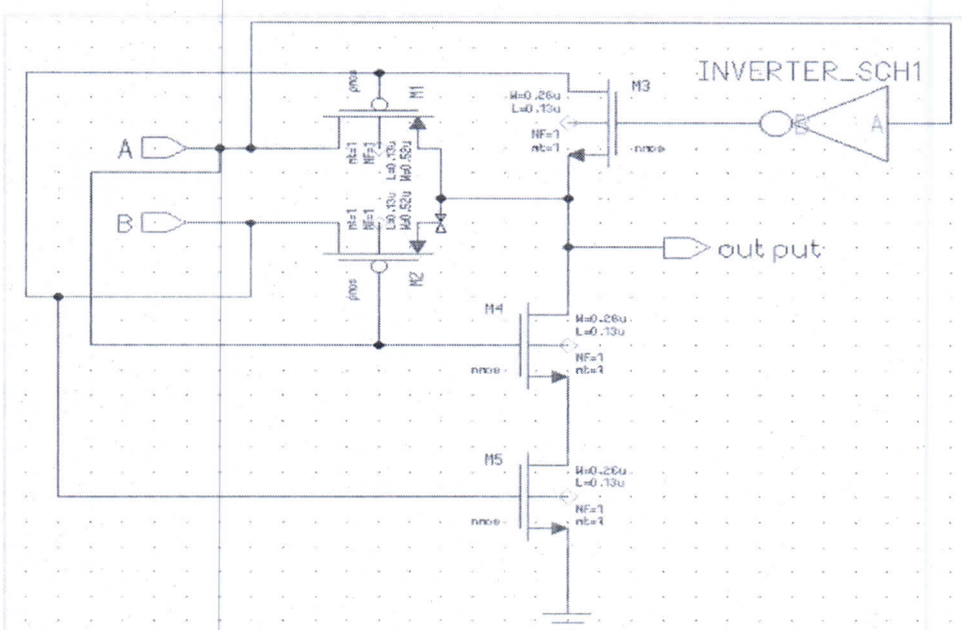


Fig. 11. Schematic for simulating proposed XOR with Full swing

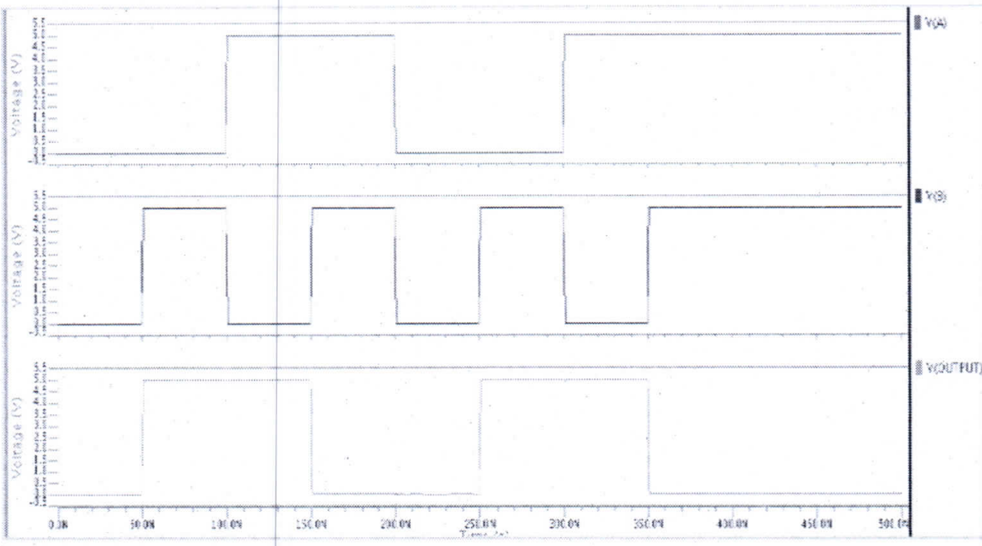


Fig. 12. Waveforms for simulating proposed XOR gate with Fullswing

The simulation results will include waveforms depicting the input and output behavior of each XOR gate, and they will be analyzed to evaluate the design's performance and adherence to specifications. Any design improvements or optimizations can be made based on these simulation results before proceeding to the physical fabrication process.

5.4 Implementation of Full Adder Using Proposed XOR Gate

The CMOS Full Adder is designed using CMOS technology, utilizing a combination of NMOS and PMOS transistors to perform addition. The PTL full adder is designed using pass transistors, and it performs addition using XOR gates and other logic gates implemented using pass transistors. The Proposed Full Swing XOR gate is a novel design that aims to combine the benefits of Pass Transistor Logic (PTL), CMOS Logic, and Full Swing Logic to achieve improved performance, including high noise immunity, low power consumption, and faster switching times.

The full adders (PTL full adder, CMOS full adder, and proposed full swing XOR gate full adder) are implemented using the Mentor Graphics tool suite. The tool is utilized to draw the circuit schematics, set up the transistor models, define the logic functions, and specify the technology parameters for each Full Adder design. Figure 13 depicts the full adder simulator design.

Each full adder design is simulated using the Mentor Graphics tool to evaluate its functionality and performance. The proposed full swing XOR gate used within the full adder is compared to the other three designs (PTL, CMOS, and full swing logic) in terms of noise immunity, power consumption, switching speed, signal integrity, and other relevant parameters. Simulation waveforms show the input-output behavior of each Full Adder, allowing for a detailed analysis of their respective performance. Figures 14, 15, and 16 illustrate, respectively, the simulated waveforms for full adders utilizing CMOS logic, pass transistor logic and proposed full swing circuitry.

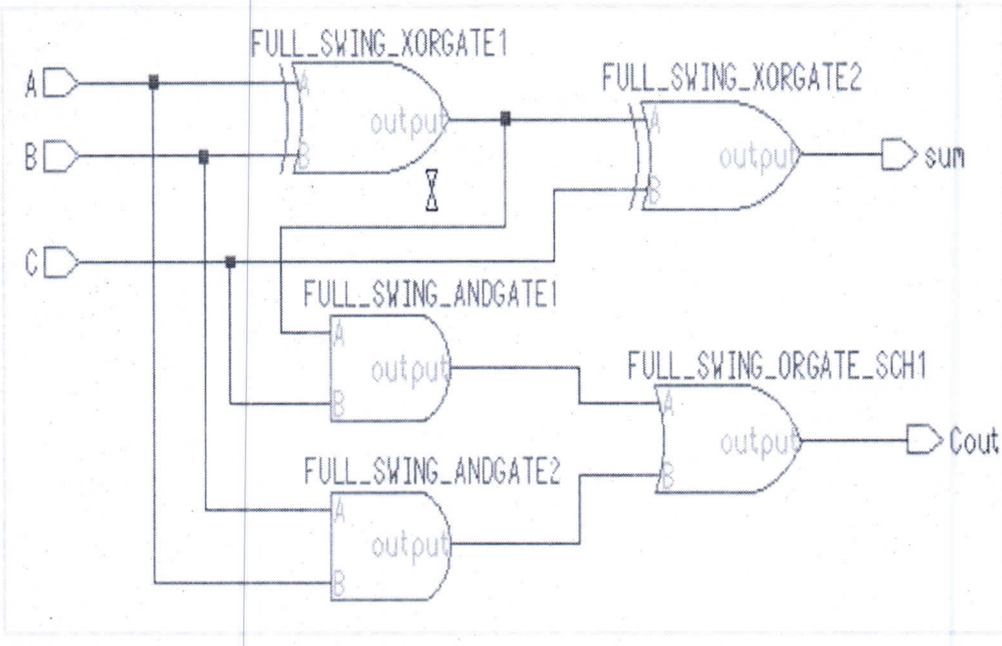


Fig. 13. Schematic of full adder using proposed full swing XOR gate

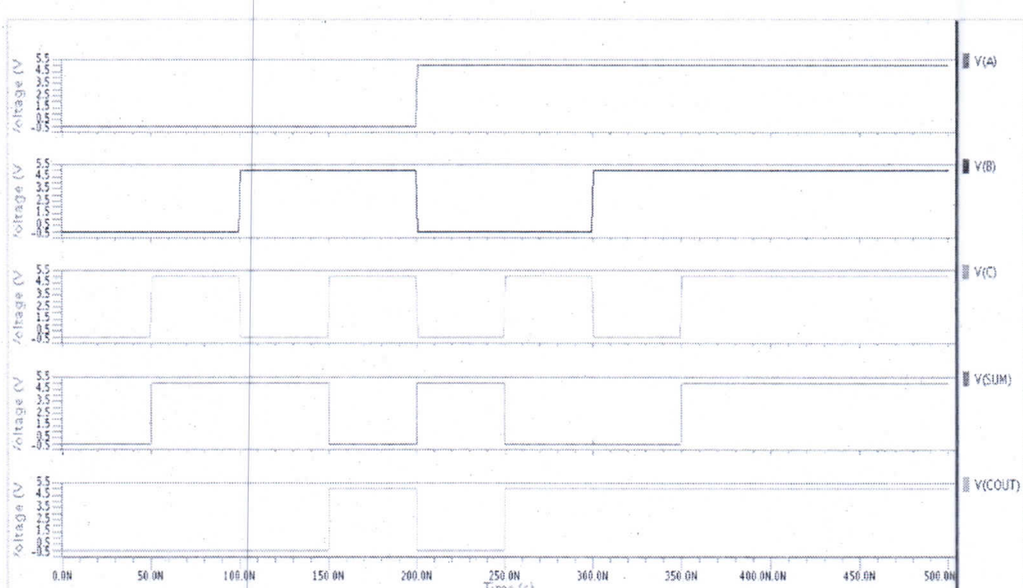


Fig. 14. Waveforms for simulating full adder with CMOS logic

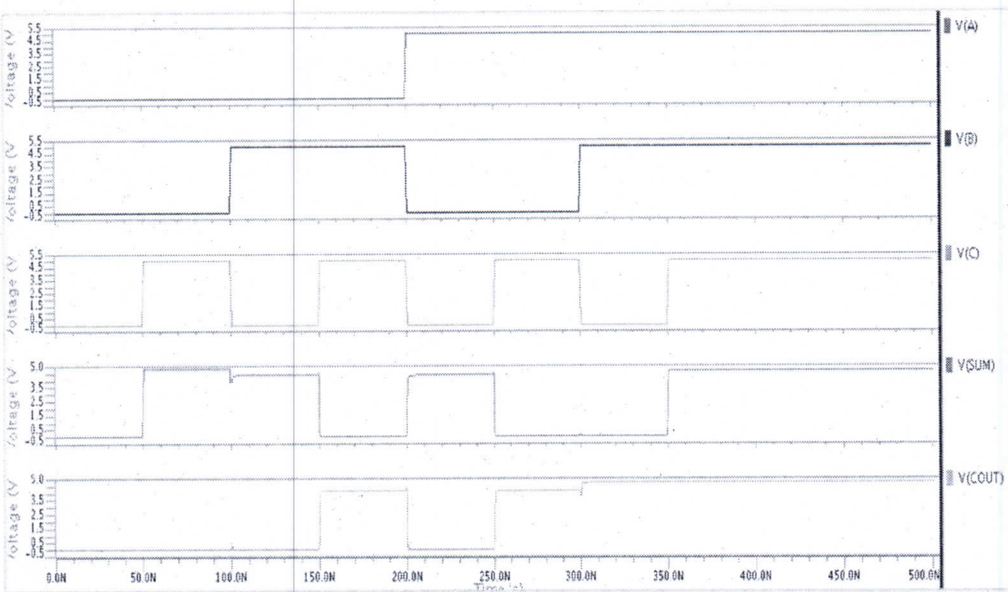


Fig. 15. Waveforms for simulating full adder with PTL.

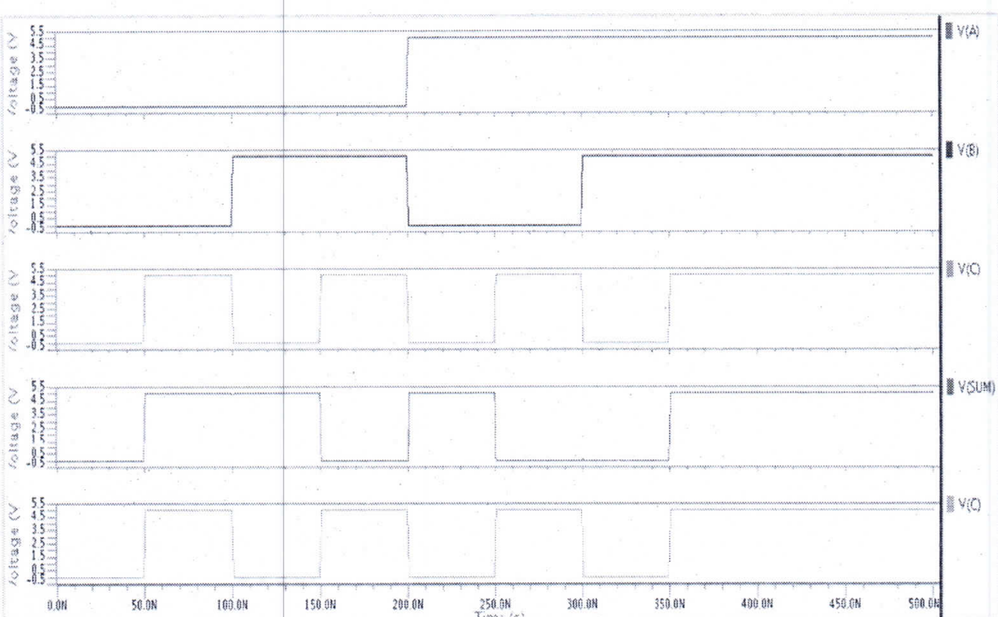


Fig. 16. Waveforms for simulating full adder using proposed full swing XOR gate

6 Performance Evaluation

The Proposed Full Swing XOR gate combines various logic techniques to achieve better noise immunity, making it more robust against signal disturbances and manufacturing variations. The proposed Full Swing XOR gate strikes a balance between the low-power advantages of PTL XOR gates and the power efficiency of CMOS XOR gates, offering moderate power consumption. While Full Swing XOR gates may not be as fast as PTL gates, they generally provide faster switching times compared to CMOS XOR gates. In regards to power consumption,delay and PDP, the following Table 1 compares several XOR gate designs.

Table 1. Performance evaluation of XOR gates in various logics

XOR Designs	No. of Transistors	Power Dissipation (μW)	Delay (pS)	PDP (aJ)
Ref [24]	14	2.48	26.1	64.7
Ref [11]	6	2.14	23.6	50.5
Ref [27]	4	2.46	21.5	52.9
Ref [12]	8	2.50	25.8	64.5
Ref [30]	8	2.48	24.3	60.2
Proposed	**7**	**2.22**	**21.9**	**48.6**

The simulation results are compared to identify the strengths and weaknesses of each Full Adder design. The Proposed Full Swing XOR gate's impact on the overall performance of the Full Adder is evaluated, and it is compared against the traditional PTL, CMOS, and Full Swing Logic implementations. The comparison aims to demonstrate how the proposed Full Swing XOR gate enhances the Full Adder's performance, potentially providing advantages in various aspects over the other logic designs. Comparing several full adder designs in regards to power dispersion, delay and PDP is shown in Table 2 below.

Table 2. Performance evaluation of Full adder using XOR gates in various logics

XOR Designs	Power Dissipation (μW)	Delay (pS)	PDP (aJ)
CMOS [7]	3.61	212	765.3
DPL [16]	4.89	98.8	483.1
CMOS [11]	3.98	119.2	474.4
CPL [8]	6.88	63.7	438.3
HFA [12]	3.71	116.8	433.3
Proposed	**3.92**	**109.9**	**430.8**

Based on the simulation results and comparison, designers can make informed decisions about which Full Adder implementation is most suitable for their specific application. Any design improvements or optimizations can also be made based on the findings before moving on to the physical fabrication process. AQ3

7 Conclusion

In this work, the use of a full swing logic-based full adder that incorporates the proposed full swing XOR gate offers significant advantages for low-power applications. This design aims to strike a balance between power efficiency, speed, and performance, making it well-suited for energy-constrained systems. The proposed full swing XOR gate demonstrates notable improvements in power consumption compared to conventional adders. It showcases competitive switching speeds in comparison to PTL and CMOS-based full adders. Its design principles emphasize fast signal propagation and reduced signal degradation, contributing to improved delay performance. It also excels in achieving a favorable Power-Delay Product. It balances power consumption and delay characteristics, offering an optimal compromise between energy efficiency and speed for low-power applications. These adders can be used for efficient and high-performance arithmetic circuits suitable for battery-powered devices, IoT applications, and other low-power electronic systems.

References

1. Pareek, P., Maurya, N.K., Singh, L., Gupta, N., Reis, M.J.C.S.: Study of smart city compatible monolithic quantum well photodetector. In: Gupta, N., Pareek, P., Reis, M. (eds.) Cognitive Computing and Cyber Physical Systems. IC4S 2022. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, vol. 472, pp. 215–224. Springer, Cham (2022). https://doi.org/10.1007/978-3-031-28975-0_18
2. Purohit, S., Margala, M.: Investigating the impact of logic and circuit implementation on full adder performance. IEEE Trans. Very Large Scale Integr. (VLSI) Syst. **20**(7), 1327–1331 (2012)
3. Singh, R., Akashe, S.: Modeling and analysis of low power 10 T full adder with reduced ground bounce noise. J. Circ. Syst. Comput. **23**(14), 1–14 (2014)
4. Satyanarayana, B.V.V., Durga Prakash, M.: Device and circuit level design, characterization and implementation of low power 7T SRAM cell using heterojunction tunneling transistors with oxide overlap. Microprocess. Microsyst. **77** (2020)
5. Ykuntam, Y.D., Penumutchi, B., Gubbala, S.: Design of speed and area efficient non linear carry select adder (NLCSLA) architecture using XOR less adder module. In: Chakravarthy, V., Bhateja, V., Flores Fuentes, W., Anguera, J., Vasavi, K.P. (eds.) Advances in Signal Processing, Embedded Systems and IoT . Lecture Notes in Electrical Engineering, vol. 992, pp. 81–91. Springer, Singapore (2023). https://doi.org/10.1007/978-981-19-8865-3_7
6. Patel, R., Parashar, H., Wajid, M.: Faster arithmetic and logical unit CMOS design with reduced number of transistors. In: Computer Networks and Information Technologies: Second International Conference on Advances in Communication. Network, and Computing, CNC 2011, pp. 519–522. Springer, Berlin Heidelberg (2011)
7. Lee, P.M., Hsu, C.H., Hung, Y.H.: Novel 10-T full adders realized by GDI structure. In: 2007 International Symposium on Integrated Circuits, pp. 115–118. IEEE (2007)
8. Chaddha, K.K., Chandel, R.: Design and analysis of a modified low power CMOS full adder using gate-diffusion input technique. J. Low Power Electron. **6**(4), 482–490 (2010)
9. Hassoune, I., Flandre, D., O'Connor, I., Legat, J.D.: ULPFA: a new efficient design of a power-aware full adder. IEEE Trans. Circ. Syst. I **57**(8), 2066–2074 (2008)
10. Murthy, G.R., Senthilpari, C., Velrajkumar, P.: A new 6-T multiplexer based full-adder for low power and leakage current optimization. IEICE Electron. Express **9**(17), 1434–1441 (2012)

11. Morgenshtein, A., Fish, A., Wagner, I.A.: Gate-diffusion input (GDI): a power-efficient method for digital combinatorial circuits. IEEE Trans. Very Large Scale Integr. (VLSI) Syst. **10**(5), 566–581 (2002)
12. Misra, A., Birla, S., Singh, N., Dargar, S.K.: High-performance 10-transistor adder cell for low-power applications. IETE J. Res. 1–19 (2022)
13. Durga Prasad, D., Dileep M., Rama Krishna, C.H.: Design and implementation of full adder using different XOR gates. Int. J. Innov. Technol. Explor. Eng. **9**(4), 1422–1426 (2020)
14. Parvathi, M.: Machine learning based interconnect parasitic R, C, and power estimation analysis for adder family circuits. In: 2022 Sixth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud, pp. 957–962. IEEE, Dharan, Nepal (2022)
15. Ramesh, A.P.: Implementation of low power high speed adder's using GDI logic. Int. J. Innov. Technol. Explor. Eng. **8**(11), 1291–1298 (2019)
16. Ramesh, A.P.: Implementation of low power carry skip adder using reversible logic. Int. J. Recent Technol. Eng. **8**(3) (2019)
17. Shoba, M., Nakkeeran, R.: GDI based full adders for energy efficient arithmetic applications. Eng. Sci. Technol. Int. J. **19**(1), 485–496 (2016)
18. Satyanarayana, B.V.V., Durga Prakash M.: Lower subthreshold swing and improved miller capacitance heterojunction tunneling transistor with overlapping gate. In: Materials Today Proceedings. Vol. 45, pp.1997–2001, Springer (2021)
19. Godi, P.K., Krishna, B.T., Kotipalli, P.: Design optimisation of multiplier-free parallel pipelined FFT on field programmable gate array. IET Circ. Dev. Syst. **14**(7), 995–1000 (2020)
20. Meriga, C., Ponnuri, R.T., Satyanarayana, B.V.V., Gudivada, A.A.K., Panigrahy, A.K., Prakash, M.D.: A novel teeth junction less gate all around FET for improving electrical characteristics. SILICON **14**, 1979–1984 (2022)
21. Bhuvaneswary, N., Prabu, S., Karthikeyan, S., Kathirvel, R., Saraswathi, T.: Low power reversible parallel and serial binary adder/subtractor. In: Balas, V.E., Solanki, V.K., Kumar, R. (eds.) Further Advances in Internet of Things in Biomedical and Cyber Physical Systems. Intelligent Systems Reference Library, vol. 193, pp. 151–159. Springer, Cham (2021). https://doi.org/10.1007/978-3-030-57835-0_12
22. Satyanarayana, B.V.V., Prakash, M D.: Design analysis of GOS-HEFET on lower subthreshold swing SOI. Analog Integr. Circ. Sign. Process. **109**, 683–694 (2021)
23. Ramesh, G., Manikandan, P., Naveen, P., Saravanan, M., Kumar, S.A., Swedheetha, C.: Energy efficient high performance adder/subtractor circuits. In: 2022 3rd International Conference on Smart Electronics and Communication, pp. 333–338. IEEE, Trichy (2022)
24. Prakash, M.D., Krsihna, B.V., Satyanarayana, B.V.V., Vignesh, N.A., Panigrahy, A.K., Ahmadsaidulu, S.: A study of an ultrasensitive label free silicon nanowire FET biosensor for cardiac troponin I detection. SILICON **14**, 5683–5690 (2022)
25. Vesterbacka, M.: A 14-transistor CMOS full adder with full voltage-swing nodes. In: 1999 IEEE Workshop on Signal Processing Systems. SiPS 99. Design and Implementation, pp. 713–722. IEEE (1999)
26. Yano, K., Yamanaka, T., Nishida, T., Saito, M., Shimohigashi, K., Shimizu, A.: A 3.8-ns CMOS 16*16-b multiplier using complementary pass-transistor logic. IEEE J. Solid-State Circ. **25**(2), 388–395 (1990)
27. Aguirre-Hernandez, M., Linares-Aranda, M.: CMOS full-adders for energy-efficient arithmetic applications. IEEE Trans. Very Large Scale Integr. (VLSI) Syst. **19**(4), 718–721 (2011)
28. Chowdhury, S.R., Banerjee, A., Roy, A., Saha, H.: A high speed 8 transistor full adder design using novel 3 transistor XOR gates. Int. J. Electron. Circ. Syst. **2**(4), 217–223 (2008)

29. Wang, J.M., Fang, S.C., Feng, W.S.: New efficient designs for XOR and XNOR functions on the transistor level. IEEE J. Solid-State Circ. **29**(7), 780–786 (1994)
30. Naseri, H., Timarchi, S.: Low-power and fast full adder by exploring new XOR and XNOR gates. IEEE Trans. Very Large Scale Integr. (VLSI) Syst. **26**(8), 1481–1493 (2018)

Author Queries

Chapter 2

Query Refs.	Details Required	Author's response
AQ1	Please be aware that your name and affiliation and if applicable those of your co-author(s) will be published as presented in this proof. If you want to make any changes, please correct the details now. Please note that after publication corrections won't be possible. Due to data protection we standardly publish professional email addresses, but not private ones, even if they have been provided in the manuscript and are visible in this proof. If you or your co-author(s) have a different preference regarding the publication of your mail address(s) please indicate this clearly. If no changes are required for your name(s) and affiliation(s) and if you agree with the handling of email addresses, please respond with Ok.	
AQ2	Please check and confirm if the authors given and family names have been correctly identified.	
AQ3	As References [27] and [31] are same, we have deleted the duplicate reference and renumbered accordingly. Please check and confirm.	

2024 International Conference on Emerging Systems and Intelligent Computing (ESIC) | 979-8-3503-4985-6/24/$31.00 ©2024 IEEE | DOI: 10.1109/ESIC60604.2024.10481532

Target Driven Autoencoder: A Supervised Learning Approach for Tumor Segmentation

Abhishek Das
Department of Computer Science Engineering
Centurion University of Technology and Management
Paralakhemundi, Odisha, India
abhishekdas225@gmail.com

Saumendra Kumar Mohapatra
Department of Computer Science Engineering
Shri Shri University
Cuttack, Odisha India
saumendra.mohapatra.27@gmail.com

Rakesh Kumar Pattanaik
Department of Electronics and Communication Engineering
DNR College of Engineering and Technology
Bhimavaram, Andhra Pradesh, India
rakeshpattanaik.888@gmail.com

Balaram Tripathy
Department of Electronics and Telecommunication Engineering
S.K.D.A.V. Government Polytechnic
Rourkela, Odisha, India
tripathybalaram02@gmail.com

Gyana Ranjan Patra
Department of Electronics and Communication Engineering
ITER, Siksha 'O' Anusandhan (Deemed to be University)
Bhubaneswar, Odisha, India
gyana.patra@gmail.com

Mihir Narayan Mohanty*
Department of Electronics and Communication Engineering
ITER, Siksha 'O' Anusandhan (Deemed to be University)
Bhubaneswar, Odisha, India
mihir.n.mohanty@gmail.com*

Abstract- **A particular kind of neural network called an autoencoder (AE) is trained to discover a reduced and effective representation (encoding) of input data. In most of the applications of AE, it is found that this model has been used for generating the same images in compressed form. AE has also been used for encoding the images and signals. In this work, a supervised autoencoder is designed that is trained with both input images and corresponding targets that are also the images. This allows the model to learn a mapping from the input image to the target image specifically for segmentation. The proposed method is verified and trained with brain MRI images and segmented tumors. The dice score obtained in this method is 98.43% in producing segmented tumors.**

Keywords—Autoencoder, Supervised Autoencoder, Brain tumor segmentation, Deep Learning, Convolutional neural network

I. INTRODUCTION

Brain tumor segmentation is one of the most important tasks in medical image analysis, which is locating and defining areas of interest within brain magnetic resonance imaging (MRI) images, particularly those associated to tumors. This process is crucial for accurate diagnosis, treatment planning, and monitoring of brain tumor patients. One approach to automating this process is by utilizing supervised autoencoders (AEs). Autoencoder is a type of neural network architecture designed to learn efficient representations of input data [1],[2]. It is composed of two networks: an encoder network (encoding), which compresses the input data into a lower-dimensional representation; and a decoder network (decoding), which tries to recreate the original input from this reduced form. This process encourages the network to learn meaningful features from the data.

In general, AEs have a few applications in image processing including but not limited to image generation [3-5], image manipulation [6],[7], and image compression [8-10]. These applications of autoencoders are based on unsupervised learning, whereas its supervised learning-based design is rarely considered. In this work, autoencoder is used for image generation in a supervised manner, specifically, for tumor segmentation from MRI images.

A few works on tumor segmentation from MRI images have been developed in the past several years. Saravanan et al. [11] have used an Interval Type-II Fuzzy logic system (IT2FLS) optimized using an artificial bee colony (ABC) for tumor segmentation from brain MRI. The skull region was removed from the whole image as the preprocessing step in that work. Tumors were taken away from the MRI images that might not be used for detecting the location of the tumor. Another model has been designed using the fuzzy model, specifically, triangular fuzzy median filtering (TFMF) for tumor segmentation [12].

A combination of U-Net and convolutional neural network (CNN) has been proposed for tumor segmentation from brain MRI. Gray level Co-occurrence Matrix (GLCM) was used to remove the unwanted parts from the brain MRI [13]. A U-Net++ model with image augmentation has been proposed for tumor segmentation from brain MRI [14]. Bias field correction, cropping, and normalization were used as preprocessing steps to clean the input images in that work. Three different forms of deep neural networks (DNN) have been utilized for multimodal view-based segmentation called multi-view dynamic fusion framework (MVFusFra) [15]. 2D segmented tumors were combined to form a 3D image that was again divided into 2D segments for comparison with ground truth images. Metlek et al. [16] have

979-8-3503-4985-6/24/$31.00 ©2024 IEEE

Brain Tumor Classification through MR Imaging: A Comparative Analysis

G Prasanna Kumar[1][0000-0002-0604-9038], K Kiran[2][0000-0002-5041-918X], Kanakaraju Penmetsa[3][0000-0002-3225-4078], K Indira Priyadarsini[4][0009-0003-6854-1663], Prudhvi Raj Budumuru[5][0000-0003-4452-3340], Yallapu Srinivas[6][0000-0002-7141-9162]

[1,2,5,6] Vishnu Institute of Technology, Department of ECE, Bhimavaram, INDIA
[3]SRKR Engineering College, Department of ECE, Bhimavaram, INDIA
[4]DNR College of Engineering and Technology, Department of ECE, Bhimavaram, INDIA
prajece2005@gmail.com

Abstract. Tumor in brain is one of the serious diseases throughout the world and it leads to death around 300 thousand people in 2020. Hence, Brain tumor diagnosis is a sensible and important task in clinical and medical field. Identification of illness, area, depth and severity of the disease are major challenges encountered before technological improvement in the clinical field. These major challenges are fulfilled few decades ago by acquiring images of human body parts with collaborations of electronic and mechanical devices. The familiar medical images are Magnetic Resonance Imaging (MRI) Scan, Computed Tomography (CT) Scan and Positron Emission Tomography (PET) Scan. Manual observation of aforementioned scans may lead error in the treatment. Hence, various image processing algorithms and pre-trained methods have been employed on medical images to identify the accurate location, area, depth and severity of the disease, which effectively improvise the treatment. The evolution process has several stages such as: preprocessing; segmentation; future extraction; and classification. Therefore, this work presents a detailed report of CNN based brain tumor classification methods through MR imaging scans. Finally, the performance measures of brain tumor classification methods have been presented and compared.

Keywords: Brain tumor, Diagnosis; Illness, Medical images, Classification.

1 Introduction

Global Cancer Statistics 2020 announces, twenty million new incident cancerous cases and nearly 10 million new deaths are happened throughout the world in 2020. According to this, 2.5% deaths were due to brain tumor disease in 10 million cancerous death cases [1]. Hence, diagnosis of tumor in brain has been significant in the medical field. Disease detection, classification and severity estimation are prominent in diagnosis steps of tumor [2-15]. In disease diagnosis process; first capture the skeleton image of required human body part; familiarly it's named as medical image. Most familiar medical image types are X-ray, MRI scan, CT scan and

PET scan [1-20, 22]. Out of this MRI scan is suitable to capture the soft tissues of the body part. Manual identification and classification of diseased/defected region may difficult, if raw medical image affected with noise and no variations in the intensity levels of diseased and non-diseased regions. It has been due to longer scan time by the sensors and age of the equipment also. Therefore, for accurate diagnosis of the particular disease, various automated algorithms and methods were designed [3-13]. Fig.1. shows general flow of automated approach [2, 15]. First employ prepossessing scheme (noise removal) on raw medical image. Further, segmentation is employed on preprocessed image to locate/identify the Region of Interest (ROI). Image segmentation plays a vital role in the automation approach to differentiate diseased and non-diseased portions [21] for identifying the tumor/cancerous region and it helps to classify further. This information helps the diagnosis experts to treat patients effectively and accurately. The various segmentation methods are edge-based, threshold-based, region-based, cluster-based and watershed segmentation. Feature extractions are done from the extracted segmented portions of the image. Finally, classifier has to classify the disease based upon the extracted features. Now a days, CNN models are alternative for traditional algorithms/methods of image restoration, image dehazing [23, 24] along with classification.

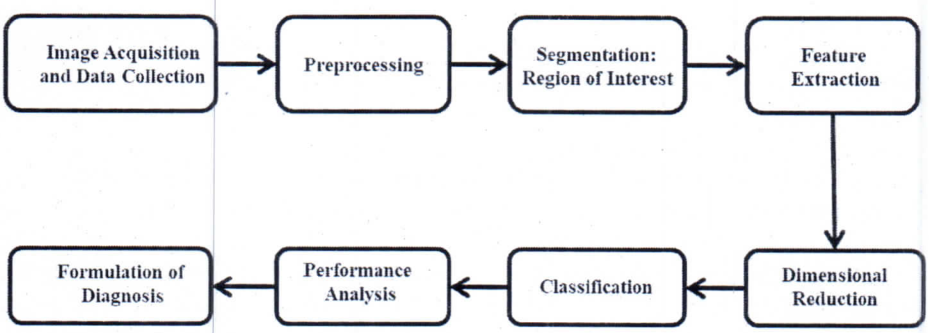


Fig.1. General flow of cancer detection system (Source: Chahal P K et al. [2] and P.R.Budumuru et al. [15]).

2 Related Work

S. Mohsen et al. (2023), proposed two intelligence models for the classification of tumor categories glioma and pituitary in brain. In these two models, VGG19 is first one and single-image super-resolution (SSIR) technique with ResNext101_32×8d is the second. Proposed SSIR technique based on GAN algorithm is employed on input MRI scan to produce high resolution images before classification. 344 layers in ResNext101_32×8d model includes, 104 layers each for batch normalization and convolution, 100 layers of ReLU, 33 bottleneck layers. Proposed VGG19 model in this work consists nineteen 2-D layers, in that three are fully connected layers and remaining 16 are convolution layers each of which is followed by max-pooling layers [3].

H. A. Hafeez et al. (2023), come up with a low-grade and high-grade glioma type brain tumor classification model with CNN consisting of less number of layers, size and learnable parameters. This work has been designed in two ways; Feature extraction done by separately with resnet18, squeezenet, alexnet, and proposed CNN. Further, classification has been done with SVM classifier. Second approach is extraction and classification both are done by aforementioned CNN models used in first approach [4].

Assam, M et al. (2021), presented a four-step hybrid model with various stages pre-processing, feature extraction, feature reduction and classification for tumor classification in brain through MRI scans. Median filter, being one of the state-of-art and traditional method used to remove fixed valued impulse noise and unnecessary structures such as skull and scalp, it's a main block in pre-processing stage, further it converted to colored image. Feature extraction has been done in stage-2 with discrete wavelet transform (DWT). Feature reduction and optimal characteristics set is generated in the third stage with the help of color moments (CMs). Image classification is done by passing the reduced optimal characteristic set through various classifiers; FF-ANN, RSwithRF and RSwithBN [5].

Rehman, A et al. (2020), in this framework, three studies were conducted for classification of brain tumor using three popular CNN architectures (AlexNet, GoogleNet, and VGGNet). Each study investigated on MRI brain tumor dataset Figshare and explores it with transfer learning methods freeze and fine-tune. Chance of over-fitting is reduced by increasing the data set samples by employing augmentation on MRI slices [6].

Ali, M et al. (2020), proposed straight forward ensemble method for segmentation of tumor by processing the image through two individual networks 3D CNN and a U-Net. These two networks trained individually with BraTS-19 challenge dataset and estimate the segmentation maps which considerably differed from each other in sub-regions tumor segmentation. Final prediction of tumor segmentation is achieved by ensemble these two individual segmented maps [7].

Kumar, S. and Mankame, D.P., (2020), discussed the tumor classification based on the optimized deep learning mechanism in which fuzzy deformable fusion model used for the segmentation of the images. The statistical features are used to classify the tumor by deep convolutional neural networks (DCNN). Dolphin Echolocation Sine Cosine Algorithm (Dolphin-SCA) is also implemented in this work for the segmentation. BRATS and SimBRATS databases were used for the validation of this network [8].

Hasan, S.K. and Linte, C.A (2018), proposed a deep learning U-Net CNN model for characterization and segmentation of tumor in brain MR images. In this method, up-sampling with nearest neighbor algorithm is introduced instead of de-convolution component in the U-net model. Segmentation accuracy is improved by extracting low grade tumors with the help of data augmentation performed on dataset by employing elastic transformation. This frame work trained with BRATS 2017 MR dataset of 285 patients affected with glioma [9].

Seetha, J. and Raja, S.S., (2018), proposed an automatic classification of tumor in brain using CNN. Manual classification of tumor from the MRI data is challenging at

particular times. So, low complexity CNN system proposed by training the last layer of the network and considered a pre-trained model brain data set for classification. Hence, validate with training accuracy and computational time; it examines with support vector machine (SVM) and deep neural networks (DNN) [10].
Selvapandian, A. and Manivannan, K., (2018), implemented tumor detection in brain with contourlet transform of non-sub sampled (NSCT) and neuro fuzzy inference adaptive system (ANFIS). Image enhancement is done with NSCT by combining low and high frequency sub-bands of MR image and extracted features from enhanced image are used to classify the normal and glioma type tumor images with ANFIS [11].
Bahadure, N.B et al. (2017), investigated Berkeley wavelet transformation (BWT) on brain MR images to extract the tumor region in segmentation process. The appropriate features are extracted from the segmented tissues by employing very well-known classifier support vector machine (SVM) [12].
Gopal, N.N. and Karnan, M (2010), proposed a two-stage intelligent system to recognize tumor tissues in brain MRI. In this system design optimization is employed along with Fuzzy c Means Clustering for segmentation. The adopted optimizing methods are Genetic Algorithm (GA) and Particle Swarm Optimization (PSO). In this, Preprocessing and Enhancement are the methods in the first phase; segmentation and classification are the methods in second phase [13].

3 Performance Measures

True Positive (T_p), True Negative (T_n), False Positive (F_p) and False Negative (F_n) are the words used in the evaluation parameters of tumor classification methods such as Accuracy, Sensitivity, Specificity [3-6, 8, 10-14]. Hence, these metrics are formulated from eqn. (1) to (3). Dice coefficient [7, 9] is another metric formulated as eqn. (4) to evaluate the similarity between predicted tumor pixels with ground truth pixels.

$$Accuracy\ (A) = \frac{Number\ of\ faithful\ detections}{Number\ of\ all\ assessments} = \frac{T_p + T_n}{T_p + T_n + F_p + F_n} \quad (1)$$

$$Sensitivity\ (Sen) = \frac{Number\ of\ true\ positive\ detections}{Number\ of\ all\ positive\ assessments} = \frac{T_p}{T_p + F_n} \quad (2)$$

$$Specificity(Spec) = \frac{Number\ of\ true\ negative\ detections}{Number\ of\ all\ negative\ assessments} = \frac{T_n}{T_n + F_p} \quad (3)$$

$$Dice\ Coefficient\ (DSC) = \frac{2 * |X \cap Y|}{|X| + |Y|} \quad (4)$$

Where X: $set\ of$ predicted pixels , Y: ground truth

Table 1. Summary of Brain Tumour Classification Methods using MRI Scans

Author(s), Year and Source	Methodology
[3] S. Mohsen et al. 2023. IEEE Access	Pituitary and glioma type tumor classification has been carried out by intelligence systems, single image super-resolution (SISR) technique with classification networks ResNext101_32×8d and VGG19. SISR method developed in two stages; generator is in first stage and discriminator in the second stage. Hence, it produces the super resolution image of size 256x256x3 from low and high-resolution images of same size. The entire process has been done on required input medical MRI scans of pituitary and glioma. Classification is done with CNN's such as ResNext101_32×8d and VGG19 after SISR method.
[4] H. A. Hafeez et al. 2023. IEEE Access	It's a 12-layer CNN model to classify the grade I – II (low) and grade III – IV (high) glioma type brain tumor. In this, N4ITK [14] method was applied in the preprocessing stage to remove bias field distortion in MRI images. Further, feature extraction and classification done by proposed CNN.
[5] Assam, M., et al. 2021. IEEE Access	Pre-processing: Median filter Features extraction: Discrete Wavelet Transform (DWT) Features Reduction: Color Moments (CMs) Classification: Individual classifier: FF-ANN (Feed Forward – ANN) Hybrid Classifiers: RSwithRF (Random Subspace with Random Forest) RSwithBN (Random Subspace with Bayesian Network)
[6] Rehman, A., et al. 2020. Circuits, Systems, and Signal Processing	Three studies have been conducting with different CNN's namely AlexNet, GoogleNet and VGGNet to classify the meningioma, glioma, and pituitary types.
[7] Ali, M., et al. 2020. IEEE Access	It's a combination of 3D-CNN and U-Net, both are trained individually and finally ensemble the individual outputs of these two networks.
[8] Kumar, S. and Mankame, D.P., 2020 Biocybernetics and Biomedical Engineering	It's a optimized Deep-CNN model trained with Dolphin-SCA Preprocessing: Non-Local Means (NLM) filter is used to remove artifacts in the different modalities of medical MR images. Segmentation: To Extract ROI from the preprocessed image, employed a fuzzy deformable model with Dolphin Echolocation based Sine Cosine Algorithm (Dolphin-SCA) Feature Extraction: Feature vector has built with statistical parameters such as mean, variance, and skewness being extracted from segmented regions. Power LBP model has been adapted to

	extract useful features to train the classifier. Classification: Deep CNN has been trained with Dolphin-SCA
[9] Hasan, S.K. and Linte, C.A., 2018. 2018 IEEE Western New York Image and Signal Processing Workshop, IEEE.	An improved version of Conventional U-net model by introducing up-sampling with nearest neighbor algorithm instead of de-convolution component and employing elastic transformation named as Nearest-Neighbor Re-sampling Based Elastic-Transformed to increase the segmentation accuracy.
[10] Seetha, J. and Raja, S.S., 2018 Biomedical & Pharmacology Journal	It's a low complexity CNN based brain tumor classification method. In this, only last layer of the network has been trained and classification steps are done by a pre-trained model brain dataset. These two changes were made in traditional CNN for reducing computation time and performance improvement.
[11] Selvapandian, A. and Manivannan, K., 2018 Computer Methods and Programs in Biomedicine	It is a fusion based glioma brain tumor classification approach. Low and high frequency sub-bands of input MR image scan are the components of fused image. Decomposing of sub-bands from input image has been done in spatial domain with the help of Pyramid Filter Banks (PFB) and Directional Filter Banks (DFB). Further, extracted features from fused image trains the classification approach and ANIFS classifier identifies the non-glioma and glioma images.
[12] Bahadure, N.B., et al. 2017. International Journal of Biomedical Imaging	Tumor segmentation being done by Berkeley Wavelet Transformation (BWT). Features that are intensity and texture have been extracted from segmented image by employing GLCM, SFTA and IBF along with area of the tumor and dice coefficient similarity index are the two more features. PCA is used to select optimized relevant features. Finally, SVM is used for the brain tumor classification.
[13] Gopal, N.N. and Karnan, M., 2010 2010 IEEE International Conference on Computational Intelligence and Computing Research	It's a two-stage intelligent tumor detection system. Stage 1: Preprocessing and Enhancement, Stage 2: Segmentation and Classification. Methods involved in this, Fuzzy C-Means Clustering Algorithm (FCA) with optimization tools Particle Swarm Optimization (PSO) and Genetic Algorithm (GA). In this, the overall detection accuracy is sum of accuracy of tumor pixels (75%) and position accuracy (25%).

4 Dataset Description and Evolution of Brain Tumor Classification Methods

Dataset summary and performance evaluation of each method discussed in previous section summarized in Table. 2. Table. 3 compare the detection accuracy of methods described in [3], [4], [5], [6], [11], [12] and [13] evaluated on non- BRATS datasets

Reference Number	Dataset	Performance Evaluation
[3]	Kaggle Dataset: It consists 1800 brain MRI images, out of these 900 images of each glioma tumor and pituitary tumor. They were resized to 224 x 224 and increase this dataset by three times with the help of data augmentation methods rotation, width and height shift. Further, dataset has to divide with 75% for training VGG19 and 85% for training ResNext101_32×8d.	Testing Accuracy (%) a. VGG19: 99.89 b. SISR+ ResNext101_32×8d: 100
[4]	BRATS 2017, BRATS 2018 and BRATS 2019. Dataset BHVB has been developed by acquiring 159 high grade and 176 low grade glioma MRI scan images from B V Hospital, Bahawalpur, Pakistan.	a) Deep learning Method + SVM Classifier Testing Accuracy (%) BRATS 2017: 97.87 BRATS 2018: 97.67 BRATS 2019: 89.77 BHVB: 98.89 b) CNN Model Testing Accuracy (%) BRATS 2017: 97.85 BRATS 2018: 97.15 BRATS 2019: 97.15 BHVB: 97.99
[5]	70 T2-weighted standard image dataset (Normal: 45 and Abnormal: 25)	Testing Accuracy (%) a) DWT+RSwithRF: 97.14 b) DWT+RSwithBN: 95.71 c)DWT+CMs+FF-ANN: 95.83
[6]	Figshare dataset: It contains 3064 various types of brain tumor MRI scan images in which, meningioma: 708, glioma: 1426 and pituitary: 930.	Testing Accuracy (%) a) AlexNet: 97.39 b) GoogleNet: 98.04 c) VGG16: 98.69
[7]	BraTS2019 challenge dataset: In this dataset total 335 patients' information has been used for training. Out of these, 259 high-grade and 76 low-grade type glioma cases information. Validation process has been done with 125 cases of unknown grade.	Dice Scores Enhancing Tumor(ET): 0.750 Whole Tumor(WT): 0.906 Tumor Core: 0.846
[8]	BRATS Database: It consists 65 tumor images of T1, Tlc, T2 and flair modalities. Out of which, 51 are high-grade glioma patients' information. SimBRATS database: It's a simulated	Testing Accuracy (%) BRATS database: 95.3 SimBRATS database: 96.3 Specificity (%) BRATS database: 0.953 SimBRATS database: 0.910

	image dataset with 50 images of all four varieties as same as BRATS database. Out of which 25 high-grade and 25 low-grade glioma images.	Sensitivity (%) BRATS database: 0.977 SimBRATS database: 0.992
[9]	BRATS 2017 MR dataset: 285 glioma patients' information is used for training and 146 patients' information for testing.	Dice Similarity Coefficient (DSC): LGG: 0.8976 HGG: 0.8459 Intersection over Union (IoU): LGG: 0.8869 HGG: 0.826 LGG: Low-graded gliomas HGG: High-graded gliomas
[10]	Tumor images are accessed from Radiopaedia and BRATS 2015 dataset accessed for testing.	Training Accuracy (%) CNN: 97.5
[11]	Low-grade and high-grade type brain tumor images of BRATS 2015 dataset sub-database has been used for training the classification stage alone. Brain MRI images from LeaderBoard and Challenge sub datasets also considered along with BRATS 2015 dataset have been for the evaluation of different performance metrics.	Testing Accuracy (%) BRATS 2015 dataset: 99.30 LeaderBoard dataset: 95.9 Challenge dataset: 96.4 Specificity (%) BRATS 2015 dataset: 99.71 LeaderBoard dataset: 96.2 Challenge dataset: 95.1 Sensitivity (%) BRATS 2015 dataset: 70.25 LeaderBoard dataset: 92.3 Challenge dataset: 96.2
[12]	DICOM Dataset: 22 infected brain tumor tissue images are considered. Brain Web dataset: It has simulated three-dimensional MR imaging data of modalities T1-weighted, T2-weighted and proton density weighted. In this 13 out 44 are infected brain MR images. Third dataset: It consists, 135 images of 15 patients collected from the expert radiologists.	Testing Accuracy (%) SVM Classifier: 96.51 Specificity (%) SVM Classifier: 94.2 Sensitivity (%) SVM Classifier: 97.72
[13]	A Set of 120 MR images.	Detection Accuracy (%) a. GA + FCM: 89.6 b. PSO + FCM: 98.87

Table 3. Testing Accuracy of Brain Tumour Classification Methods Tested on other than Brats Datasets

Reference	Alphabet [Method Name]	Accuracy (%)
[3]	a [VGG19]	99.89
[3]	b [SISR+ ResNext101_32×8d]	100.00
[4]	a [Deep learning Method + SVM Classifier]	98.89
[4]	b [CNN Model]	97.99
[5]	a [DWT+RSwithRF]	97.14
[5]	b [DWT+RswithBN]	95.71
[5]	c [DWT+CMs+FF-ANN]	95.83
[6]	a [AlexNet]	97.39
[6]	b [GoogleNet]	98.04
[6]	c [VGG16]	98.69
[11]	a[Image Fusion + ANIFS]	96.40
[12]	a [SVM]	96.51
[13]	a [GA + FCM]	89.60
[13]	b [PSO + FCM]	98.87

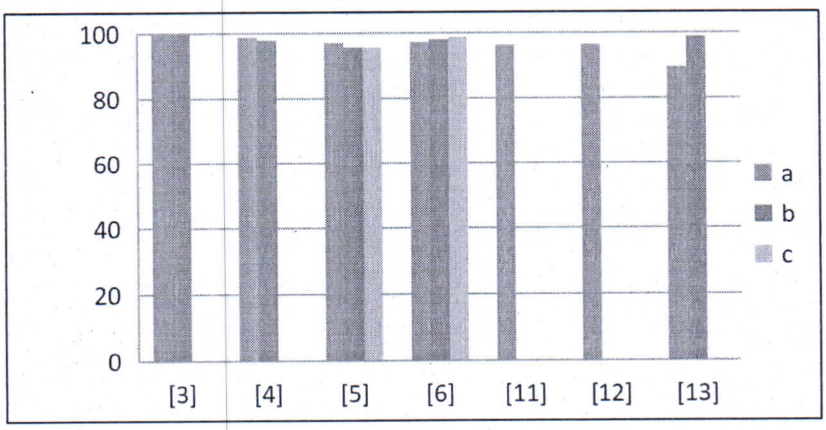


Fig. 2. Accuracy comparison of Brain Tumor Classification Methods tested on other than BRATS datasets

Table 4. Testing Accuracy of Brain Tumor Classification Methods Tested on Brats Datasets

Reference	Alphabet [Method Name]	Accuracy (%)
[4]	a [Deep learning Method + SVM Classifier]	97.87
[4]	b [CNN Model]	97.85
[8]	a [Proposed Dolphin-SCA based Deep CNN]	96.30
[11]	a [Image Fusion + ANIFS]	99.30

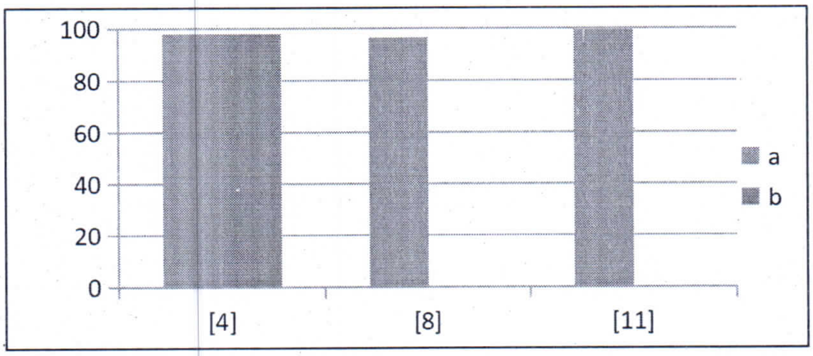


Fig. 3. Accuracy comparison of Brain Tumor Classification Methods tested on BRATS datasets

Fig. 2 and Fig. 3 show the bar graph representation of various methods corresponding reference number on X-axis and with their testing accuracy (%) on Y-axis. Most of the related works discussed in this paper were implemented with more than one methodology. Hence, represent the methods with alphabets a, b and c with method name in Table.3 and Table.4. Methods proposed by the models represented in Fig. 2, [3], [4] and [13] with two methods each, [5] and [6] with three methods each, [11] and [12] each one method. Performances of all these models were evaluated with different brain tumor datasets. Fig. 3 shows accuracies of model [4] proposed with two methods and each one of [8] and [11]. These three models were tested with either of BRATS 2015, BRATS 2017, BRATS 2018, BRATS 2019 and SimBRATS database.

5 Conclusion

The availability of open-source image datasets of various diseases has enabled the automatic disease classification systems since past two decades. In this study the performance analysis of brain tumor classification methods through MRI scans has been analyzed. The intelligence systems proposed in [3], [4], [5], [6], [8], [11], [12] and [13] are Deep-learning and CNN models. All these classify the various brain tumor types: meningioma; pituitary; low-graded and high-graded glioma. Tumor detection accuracy: In [3], SISR+ ResNext101_32×8d achieves 100% on Kaggle Dataset. In [5], a hybrid classifier DWT+RSwithRF achieves 97.14% on standard dataset of 70 images. In [6], VGG16 achieves 98.69% on Fighshare dataset. SVM classifier [12] achieves 96.51% on dataset created with 135 images of 15 patients collected from expert radiologists. In [14], Particle Swarm Optimization with Fuzzy c Means Clustering (PSO + FCM) achieves 98.87% on a set of 120 images. Hence, all these methods performed well on various datasets in terms detection accuracy. In [4], Deep learning Method + SVM Classifier and CNN Model validated with BRATS 2017, BRATS 2018 and BRATS 2019 along with BHVB. It has been developed by acquiring images from Bahawal Victoria Hospital, Bahawalpur, Pakistan. Deep learning Method + SVM Classifier and CNN Model achieved 97.87%, 97.85% and 98.89%, 97.99% detection accuracies on BARTS 2017 and BHVB datasets in order. In [11], Image Fusion with ANIFS classifier validated with BRATS 2015, LeaderBoard and Challenge datasets. It achieved 99.30%, 95.9 and 96.4% of detection accuracies respectively. Proposed Dolphin-SCA based Deep CNN [8] achieves 96.3% on SimBRATS database. In separate datasets validation process, performance of super resolution image with ResNext101_32×8d model achieved highest detection rate of brain tumor type's pituitary and glioma. CNN model [4] classifies the Low grade and High-grade glioma brain tumor types efficiently with more than 97% detection rate on BRATS datasets 2017, 2018, 2019 and non-BRATS dataset. Image Fusion + ANIFS [11] outperformed on BRATS 2015 dataset for the classification of glioma type brain tumor.

References

1. Sung, H., Ferlay, J., Siegel, R.L., Laversanne, M., Soerjomataram, I., Jemal, A. and Bray, F.: Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians, 71(3), pp.209-249 (2021).
2. Chahal, P.K., Pandey, S. and Goel, S.: A survey on brain tumor detection techniques for MR images. Multimedia Tools and Applications, 79, pp.21771-21814 (2020).
3. Mohsen, S., Ali, A.M., El-Rabaie, E.S.M., Elkaseer, A., Scholz, S.G. and Hassan, A.M.A.: Brain Tumor Classification Using Hybrid Single Image Super-Resolution Technique with ResNext101_32x8d and VGG19 Pre-Trained Models. IEEE Access (2023).
4. Hafeez, H.A., Elmagzoub, M.A., Abdullah, N.A.B., Al Reshan, M.S., Gilanie, G., Alyami, S., ul Hassan, M. and Shaikh, A.: A CNN-Model to Classify Low-grade and High-grade Glioma from MRI Images. IEEE Access (2023).
5. Assam, M., Kanwal, H., Farooq, U., Shah, S.K., Mehmood, A. and Choi, G.S.: An Efficient Classification of MRI Brain Images. IEEE Access, vol. 9, pp.33313-33322 (2021).
6. Rehman, A., Naz, S., Razzak, M.I., Akram, F. and Imran, M.: A deep learning-based framework for automatic brain tumors classification using transfer learning. Circuits, Systems, and Signal Processing, 39(2), pp.757-775 (2020).
7. Ali, M., Gilani, S.O., Waris, A., Zafar, K. and Jamil, M.: Brain Tumour Image Segmentation Using Deep Networks. IEEE Access, 8, pp.153589-153598 (2020).
8. Kumar, S. and Mankame, D.P.: Optimization driven Deep Convolution Neural Network for brain tumor classification. Biocybernetics and Biomedical Engineering, 40(3), pp.1190-1204 (2020).
9. Hasan, S.K. and Linte, C.A.: A modified U-Net convolutional network featuring a nearest-neighbor re-sampling-based elastic-transformation for brain tissue characterization and segmentation. In 2018 IEEE Western New York Image and Signal Processing Workshop (WNYISPW), pp. 1-5. IEEE (2018).
10. Seetha, J. and Raja, S.S.: Brain tumor classification using convolutional neural networks. Biomedical & Pharmacology Journal, 11(3), pp.1457 – 1461 (2018).
11. Selvapandian, A. and Manivannan, K.: Fusion based glioma brain tumor detection and segmentation using ANFIS classification. Computer methods and programs in biomedicine, 166, pp.33-38 (2018).
12. Bahadure, N.B., Ray, A.K. and Thethi, H.P.: Image analysis for MRI based brain tumor detection and feature extraction using biologically inspired BWT and SVM. International journal of biomedical imaging (2017).

13. Gopal, N.N., Karnan, M.: Diagnose brain tumor through MRI using image processing clustering algorithms such as Fuzzy C Means along with intelligent optimization techniques. In 2010 IEEE International Conference on Computational Intelligence and Computing Research, pp. 1-4. IEEE (2010).
14. Kumar, S., Kumar, D.: Human brain tumor classification and segmentation using CNN. Multimedia Tools Appl., vol. 82, no. 5, pp. 7599–7620 (2023).
15. Budumuru, P.R., Varma, A.K.C., Satyanarayana, B.V.V., Srinivas, Y., Raju, B.E. and Kumar, G.P.: Preprocessing Analysis of Medical Image: A Survey. In 2022 4th International Conference on Advances in Computing, Communication Control and Networking, pp. 2369-2375. IEEE (2022).
16. Vishnuvarthanan, A., Rajasekaran, M.P., Govindaraj, V., Zhang, Y. and Thiyagarajan, A.: An automated hybrid approach using clustering and nature inspired optimization technique for improved tumor and tissue segmentation in magnetic resonance brain images. Applied Soft Computing, 57, pp.399-426 (2017).
17. Pitchai, R., Supraja, P., Victoria, A.H. and Madhavi, M.J.N.P.L.: Brain tumor segmentation using deep learning and fuzzy K-means clustering for magnetic resonance images. Neural Processing Letters, 53, pp.2519-2532 (2021).
18. Krishna, T. G., Abdelhadi, M. A.: Optimization Segmentation and Classification from MRI of Brain Tumor and its Location Calculation using Machine Learning and Deep Learning Approach. Recent Advances in Mathematical Research and Computer Science Vol (2022).
19. Sandhya, M., Rudani, U., Vallabhadas, D. K., Dileep, M., Bojjagani, S., Pallantla, S., & Lakshmi Kumari, P. D. S. S.: Deep Neural Networks with Multi-class SVM for Recognition of Cross-Spectral Iris Images. In Machine Learning and Metaheuristics Algorithms, and Applications: Second Symposium, SoMMA 2020, pp. 29-41. Springer Singapore (2020).
20. Subbarao, M. V., Ram, G. C., Kumar, D. G., Terlapu, S. K.: Brain Tumor Classification using Ensemble Classifiers. In 2022 International Conference on Electronics and Renewable Systems (ICEARS), pp. 875-878. IEEE (2021).
21. Shaik, A.R., Chandra, K.R., Raju, B.E., Budumuru, P.R.: Glaucoma identification based on segmentation and fusion techniques. In 2021 International Conference on Advances in Computing, Communication, and Control (ICAC3), pp. 1-4. IEEE (2021).
22. Satyanarayana, B.V.V., Kumar, G.P., Varma, A.K.C., Dileep, M., Srinivas, Y. and Budumuru, P.R.: Alzheimer's Disease Detection Using Ensemble of Classifiers. In International Conference on Cognitive Computing and Cyber Physical Systems, pp. 55-65. Cham: Springer Nature Switzerland (2022).
23. Sankar, M.R., Srinivas, P., Praveena, V., Bhavani, D., Suseela, M.S.U., Srinivas, Y. and Rao, C.V.: Performance Evaluation of Multiwavelet Transform for Single Image Dehazing. In International Conference on Cognitive Computing and Cyber Physical Systems, pp. 125-133. Cham: Springer Nature Switzerland (2022).
24. Sravanthi, I., Sudha Madhavi, A., Venkata Pavan, G., Karthik Sai Kiran, B., Bhaavan Sri Sailesh, A., VV Santhosh Kumar, C. and Venkateswara Rao, C.: Performance Evaluation of Fast DCP Algorithm for Single Image Dehazing. In International Conference on Cognitive Computing and Cyber Physical Systems, pp. 134-143. Cham: Springer Nature Switzerland (2022).

IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Performance Analysis of 16bit-Mac Unit Using Vedic and Booth Multiplier

Samanthapudi Swathi[1], R.Devi[2], D.Bhavani[3], PSSN Mowlika[4], V.Bhavani[5]

[1,2,3,4]Assistant professor, Department of ECE, SRKREC, Bhimavarm-2

[5]Assistant professor, Department of ECE, DNRCET, Bhimavarm-2

Abstract

Multiply and Accumulate operation is one of the fundamental methods in signal processing and other areas (MAC). A digital signal processor's (DSP's) multiplier is the device's single most important physical component. Power consumption, LUT use, and latency are the limited factors in Digital signal processors performance. The development of a low-power, low-latency multiplier is so essential. The study's focus is on finding the best design for a 16-bit MAC unit that employs a multiplier and a carry save adder with a bit depth of 8. We may make use of the booth multiplier as a benchmark. Verilog HDL is used throughout the whole of the design's implementation. Vivado 2018.2 was used for both the synthesis and the simulation. The proposed architecture provides a means of drastically cutting down on the waiting time. The energy consumption is reduced by almost 15% as a result.

Index Terms—Vedic mathematics, carry-save adder, MAC unit, Verilog HDL, Look-up Table.

Introduction

Developing methods to efficiently dissipate power in digital signal processors has risen to the top of the research and development priority list due to increasing consumer demand. There are several methods, such as the use of add-on circuits, for reducing power consumption in VLSI architecture. Common "DSP" operations include MAC, fast-Fourier transforms , and so on [1]. One additional possible operation is convolution. It is believed that the multiplier is an essential part of such procedures. The MAC unit of a DSP has a significant impact on its overall power usage. A MAC device includes Any one of multiplier, an adder to total its partial products, and an accumulator to hold the intermediate totals. That being stated, before working on increasing the MAC unit's speed, the multiplier's speed must be increased to the next tier. Because of this, we use both a carry save adder and Vedic-inspired ancient mathematics. With the use of an 8-bit Vedic-multiplier based on urdhva tiryakbhyam (UT) logic and a carry save adder, this study aims to create a 16-bit MAC unit. The booth multiplier is then used for comparison. The essay then includes short explanations of two techniques to explaining Vedic mathematics after a quick survey of the relevant literature. Presentations of sections two and three are presented separately.

Vedic-mathematics

Vedic mathematics is an ancient system that may be used to many branches of mathematics, from arithmetic to algebra, and which simplifies the mathematical process by doing away with unnecessary steps. There are 16 sutras that serve as the foundation for Vedic mathematics.

Urdhva Tiryakbhyam (UT) and the Nikhilam Navatashcaramam Dashatah both allow for the recording of a pair of identical integers (NND). In addition to the two shown here, there are more than sixteen more sutras available. For numbers with many significant digits, the NND sutra is preferred whereas for numbers with few significant digits, the UT sutra is preferred. This is why the UT sutra is being employed in this effort.

1. Urdhva Tiryakbhyam (UT)

Urdhva Tiryakbhyam, abbreviated UT, means "in an upward direction and cross-wise" [4]. This technique may be used to multiply any of two numbers with any base. Let us Consider the process of multiplication between two three-digit numbers, such as P[2:0] and R[2:0], where S[3:0] is the carry and T[2:0] is the partial product of the multiplication.
When that time comes, we must implement the additional improvements that go along with it.
step1: S0T0 = P0R0
step2: S1T1 = {(P0*R1) + (P1*R0)} + S0
step3: S2T2 = {(P0*R2) + (P1*R1) + (P2*R0)} + S1
step4: S3T3 = {(P1*R2) + (P2*R1)} + S2
step5: S4T4 = {(P2*R2)} + S3
Henceforth, the result = S4T4T3T2T1T0

DESIGN OF MAC

There is an eight-bit multiplier built into the design of a sixteen-digit MAC. It's something that's crossed the minds of 4bit multipliers. The 4-bit multiplier will use the 2-digit multipliers in a manner like how the 2-digit multipliers have been utilized by the 4-bit multiplier. See Figure 1 for an example of the MAC. Figure 2 uses the UT sutra method to illustrate the operation of a two-digit multiplier with half-adders. Nevertheless, because of the time delay it causes, the technique is not applicable to multipliers of higher orders. Many people, as a result, resort to using a carry-save adder to tally the uncompleted things. As with an array multiplier, partial products are made fairly and uniformly in this case.

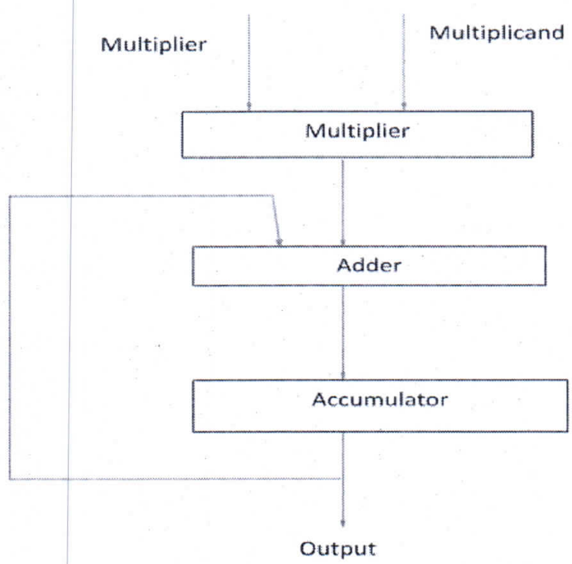


Fig 1 shows Basic MAC Unit

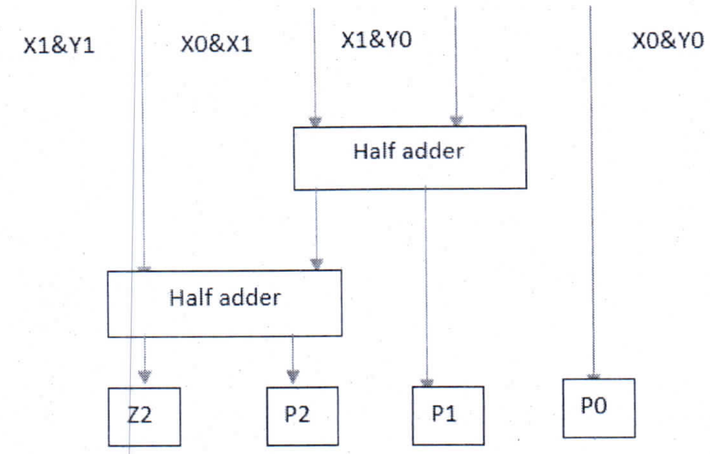


Fig 2 Implementation of Multiplier With Half Adder's

Carry-Save Adder

The addition of integers with bit widths from 3 to n is its most common use. This transformation of the three inputs yields two outputs; one of which deals with carry and the other with partial sum. The final total may be calculated by moving the carry to the left by one bit position and then zeroing off most significant bit (MSB) of the partial sum.

X		1	0	0	1	1
Y		1	1	0	0	1
Z	+	0	1	0	1	1
S		0	0	0	0	1
C	1	1	0	1	1	
SUM	1	1	0	1	1	1

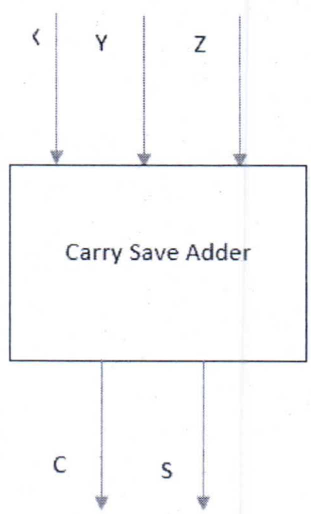


Fig 3 Shows Carry Save Adder Implementation

2. Existing 8 Bit Multiplier

To design the 8-bit Vedic multiplier, four 4-bit multipliers were required. The inputs of a [7:0] and b[7:0] are decomposed into their constituent pieces, a[3:0], a[7:4], b[3:0], and b[7:4]. A 16-bit integer is produced because of the multipliers' operations. The optimal design for an 8-bit multiplier is seen in Figure 4.

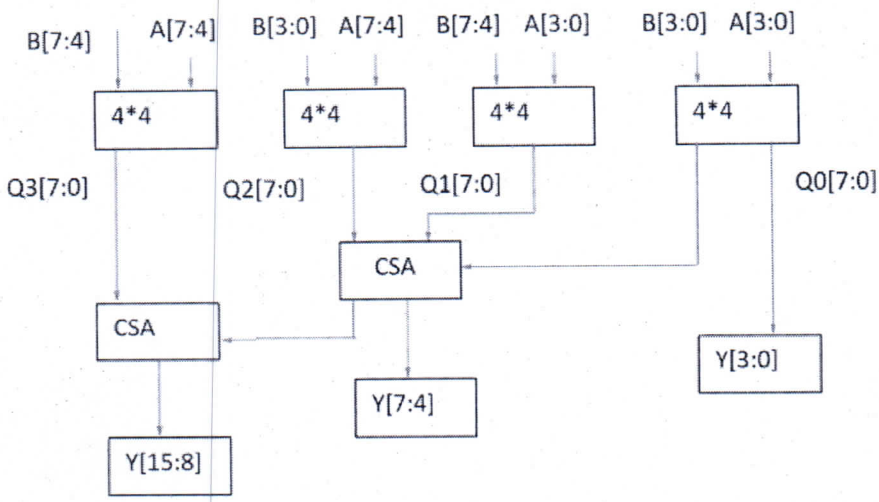


Fig 4 design of 8 bit multiplier using 4 bit multiplier based on LUT sutra

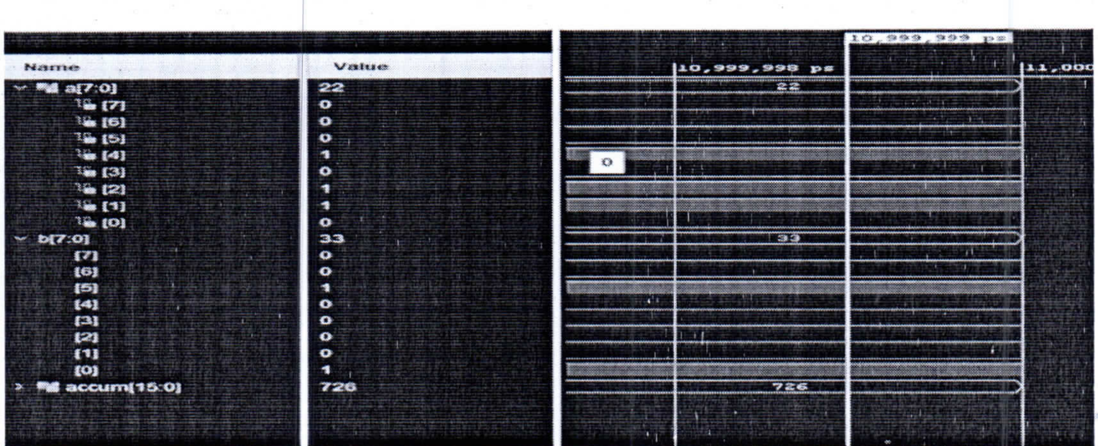


Fig 5 Shows the Timing Diagram for Booth Multiplier

Table 1 Comparison of Parameters for Vedic & Booth Multipliers

Parameters	**16-Bit Booth MAC unit**	**16-Bit Vedic MAC unit**
Power Consumption (W)	13.585	11.377
Delay (ns)	10.790	7.554

3. Conclusion

A 16-bit MAC unit was developed by fusing an 8-bit Vedic-multiplier with a carry save adder and 8-bit booth multiplier. Verilog HDL was used as the programming language, which is based on the Urdhva Tiryakbhyam (UT) sutra. Power usage was reduced by 15%, and latency was cut drastically. There were two sets of numbers crunched: one with the old multiplier, and one with the new one. The recommended booth multiplier is compatible with the corresponding MAC unit, which was designed for DSP tasks. Programmers might utilize this to improve efficiency. Potential future work might include replacing the multipliers with reversible logic gates in an effort to further minimize power usage and increase overall performance.

References

1 Dwivedi, Kavindra & Sharma Sharma, R.K. & Chunduri, Ajay, "Hybrid Multiplier- Based Optimized MAC Unit", 2018 9th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Bangalore, 2018, pp.1-4

2 .Jithin S, Prabhu E "Parallel Multiplier - Accumulator Unit based on Vedic Mathematics", in ARPN Journal of Engineering and Applied Sciences, Vol.10, no.8, pp. 3608-3613, May 2015.

3. S. N. Gadakh and A. K. Khade, "Design and Optimization of 16×16 Bit Multiplier Using Vedic Mathematics", in proc. Int. Conf. on Automatic Control and Dynamic Optimization Techniques, 2016.

4. K. Bathija, R & S. Meena, R & Sarkar, S & Sahu, Rajesh "Low Power High Speed 16x16 bit Multiplier using Vedic Mathematics", in International Journal of Computer Applications. 59. 41- 44. 10.5120/9556-4016.

5. M. V. Durga Pavan and Ramesh. S R, "An Efficient Booth Multiplier Using Probabilistic Approach", in 2018 International Conference on Communication and Signal Processing (ICCSP), Chennai, 2018, pp. 365-368.

6. L.Ranganath, D. Jay Kumar, P. Siva Nagendra Reddy, "Design of MAC Unit in Artificial Neural Network Architecture using Verilog HDL", in international conference on Signal Processing, Communication, Power and Embedded System (SCOPES)-2016.

7. Carry-Save Addition. Prof. Loh. CS3220 – Processor Design - spring 2005.

8. R. Balakumaran and E. Prabhu, "Design of high-speed multiplier using modified booth algorithm with hybrid carry look-ahead adder", in 2016 International Conference on Circuit, Power and Computing Technologies (ICCPCT), Nagercoil, 2016, pp. 1-7.

9. A. Eshack and S. Krishnakumar, "Implementation of Pipelined Low Power Vedic Multiplier", in 2nd International Conference on Trends in Electronics and Informatics (ICOEI), Tirunelveli, 2018, pp. 171-174.

2023 International Conference on Computer Communication and Informatics (*ICCCI*), Jan. 23 – 25, 2023, Coimbatore, INDIA

Modified Encryption Standard for Reversible Data Hiding using AES and LSB Steganography

B Elisha Raju*
Electronics and Communication Engineering
VIT (A)
Bhimavaram, India
elisharaju3459@gmail.com

M Ravi Sankar
Electronics and Communication Engineering
SITE
Tadepalligudem, India
ravisankar.m@sasi.ac.in

T Saran Kumar
Electronics and Communication Engineering
BVCEC(A)
Odalarevu, India
saran.thoram455@gmail.com

K Ramesh Chandra
Electronics and Communication Engineering
VIT (A)
Bhimavaram, India
rameshchandra001@gmail.com

V Bhavani Durga
Electronics and Communication Engineering
DNRCET
Bhimavaram, India
bhavanidurgavendra@gmail.com

G Prasanna Kumar
Electronics and Communication Engineering
VIT (A)
Bhimavaram, India
godiprasanna@gmail.com

Abstract— **The development in the cloud computing technologies and the information security policy, the data recovery from the hidden technologies is improved and also it is most implemented methodology. The recovered data from the embedded can also be error free and the redundancy is very low even though it was encrypted using different available encryption algorithms. The traditional algorithms embed the data and recover using the dame approach. We proposed encryption algorithm using Least Significant Bit (LSB) and Auxiliary syndrome Encryption Standard (AES). In this approach, we first create an auxiliary syndrome for the data using AES algorithm and then embed the data in the least bit extracted using the wavelets of the cover image. The message is inserted into the first sub-image of the cipher picture after image encoding and encryption, and each pixel can load a bit of secret message. The embedded data can be effectively retrieved and the original picture can be correctly restored on the receiver side utilizing the encryption key and extracted auxiliary syndrome. The proposed method gave the best analysis in terms of Peak Signal to Noise Ratio (PSNR) and Bit Error Rate (BER).**

Keywords-cryptography, cipher-image, auxiliary syndrome, segmentation, lsb modification, pixel;

I. INTRODUCTION

Various examinations and exploration projects have been led to zero in on getting photographs where mystery and protection are required, for example, face photos. Despite, because of the quick development of computerized media strategies and correspondence media, purchasers' passionate and tactile encounters have moved. Subsequently, investigation into human faculties and affectability started, fully intent on fulfilling client needs by uniting an assortment of callings. Cryptography, steganography, and watermarks are the three fundamental techniques for data obscure. Cryptography is the most common way of changing information into an incoherent arrangement that must be translated by the approved individual who has the key. With the headways in correspondence innovation, extrication a code text turned out to be somewhat basic. Thus, further developed innovations were created to give more security than cryptography. Steganography and watermarking were created therefore. The reversible information concealing destinations are to ensure copyrights while likewise permitting the first picture to be recuperated. The fundamental rules of reversible information disguising are versatility, subtlety, limit, adequacy, visual quality, and security. The reversible information disguise is especially appropriate to applications that request great photos, like clinical and military symbolism.

This paper provides an implementation of reversible data hiding in encrypted images with an auxiliary syndrome, which is the most sophisticated and easy technique while comparing to the other histogram shifting technique. This method cannot take a more trade-off ratio and gives more security to the data. The rest of the paper can be organized in the following manner. Section 2 focuses on some background knowledge. Section 3 gives the details of proposed scheme and the block diagram of the implementation. Section 4 gives a brief of the implementation of the block diagram step by step and gives clarification of each matrix that is used for representing an image with an example. Finally concluded with simulation, graphs, analysis and comparison of results.

II. LITERATURE SURVEY

In [1], Tian introduced the methodology for reversible data hiding with less image quality and high rate of embedding which involves splitting an image into some pairs of pixels and each pair represents the one bit of embedding rate. The disadvantage is that the methodology is not suitable for all types of embedding patterns. The methodology adopted in [1] is not applicable for all the combinations in the embedding patterns. It is suitable if there is no expansion of the pairing between the embedding patterns. That can be verified using the mapping between the pixel pairs. Difference expansion

979-8-3503-4821-7/23/$31.00 ©2023 IEEE

transform introduced in [2] by Alattar to expand the pairing from two pixels to group of three pixels named triplet, in which only two bits are hidden to improve the level of encryption .He also extended the pairing from triplet to quads. The triplets used in this work are spatial triplets, color triplets and the spatial quads and cross color quads are also employed in this methodology. The methodology demonstrated in terms of SNR. Karnstra and Heijmans demonstrated spatial domain based histogram shifting technique for the data hiding. The process helps in authentication of the images, improved data security and appending the data in the cover image. DCT Histogram[4-6] applied for the data security for relevance data hiding. But there are different algorithm are available made useful for data recovery in which JPEG images are yet to be recovered using this approaches. In [3], JPEG compression algorithm employed to recover the data using the reversible data hiding technique which involved the JPEG. The compressed image can also be restores using the redundancy.

III. Reversible Data Hiding

Imperceptibly conceals information (called a payload) into have information (i.e., pixels in an image) in a reversible way by means of reversible information stowing away, otherwise called lossless information stowing away. Since the interaction is reversible, both the first and inserted information can be completely reestablished. Installing limit and quality corruption are two critical marks of reversible information covering. These two estimations are at chances with each other. The objective of information disguising is to amplify limit while limiting contortion.

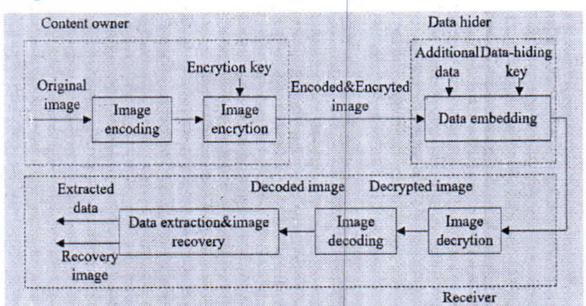


Figure 1. Proposed Block Diagram

In the block diagram shown in Figure 1, at first, the input image has been given to the process of the encoding of the input. The input image may be a grayscale or RGB. In the image encoding phase, the image can be partitioned into two halves after the encryption.

Using the encryption key based on AES algorithms we can encrypt the image and then segmented the encrypted image based on parameter U. In encrypted phase only with respect to the cipher key and bit xor calculation, we will encrypt the image. At the time of partition, the parameter U has to be determined in such a way that the additional data size that which you embedded is small or equal to the size of the upper part of the selected image, generally only half of the image partition parameter is to be taken for better performance and easy calculations, or else making several iterations we can fix the parameter based on the requirement, here we take half of the size as a parameter. Auxiliary syndrome has to be generated in a format that iterating through all the pixels in the original image and taken last 3 LSB's [7-9] of each pixel value and count for the number of ones and number of zeros if the ones are more then only the bit 1 is kept in the auxiliary syndrome, otherwise, if the zeros are more the 0 is kept in the auxiliary syndrome. Auxiliary syndrome is a binary matrix of the same dimension and size of the upper part of the original image, the auxiliary syndrome consists of only binary values of either 0 or 1.

At the embedding phase, the additional data been converted into bits of each double values and insert into the encrypted image, as if the additional bit is 0 then we do not make any changes in the pixel values in the encrypted image, otherwise if the additional data bit that is the embedded is 1 then we have to flip the last 3 LSB's of pixel and again put the double value in its respective position, then and total encrypted, encoded and embedded image is ready for transmission.

At the receiver side the received image consists of additional data and the image, within the encrypted format, we have to decode that using auxiliary syndrome in such a way that we again generate an auxiliary syndrome for the received image and then bit xor of both original and received syndrome gives the additional data that which been hidden, thereby we can easily iterating each bit and then converted into double to get additional data values, as we know that the data is in forms of text then again back converted the same double values to the character values for the extraction of the data that we have hidden in the image[10-13].

In the image decoding phase with the same algorithm as to how we insert the data, the same process been used like that again get binary values of data and then if the bit is 1 then we flip last 3 LSB's [14-16] otherwise we cannot make any changes in the original pixel values, then again we kept back the double values in the image to get the original image. Thereby we can reconstruct the original image back using the auxiliary syndrome [17-19].

IV. Implementation

The data hiding process can be classified into mainly three different stages as follows: Embedding stage, in which the date embedding takes place into the cover image. Next, the attacking stage: in which the security keys are added to improve the further encryption. The last stage: extraction stage in which the data will be recovered if and only if the security keys are provided. In the attacking stage, if any data attackers tried to get the extraction of the information then the data is auto corrupted based on the attacking level. The implementation is as followed: we consider the image to be transmitted so that it first undergoes the encryption through AES and then the cover image will be modified using LSB. Then those two are paired using the wavelets.

A. Image Encoding

The data to be encrypted is applied to the algorithm of AES in which the data can be altered, compressed and then encoded using this step. The process of AES syndrome is carried in two steps. The image should be partitioned into two parts half each. Here we are generating an auxiliary syndrome; it is just a binary matrix that represents the order of LSB's in an image(see Figure 2) of each pixel.

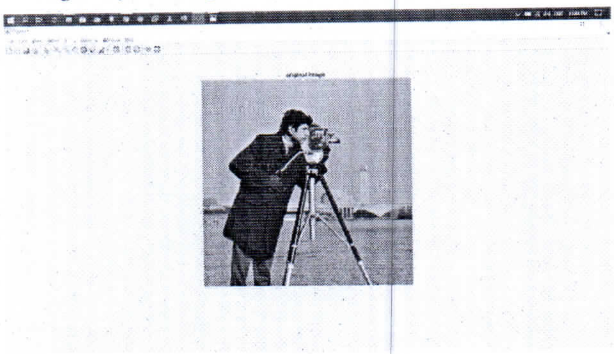


Figure 2. Input Image

1) Image Encoding: Auxiliary syndrome is a binary matrix representing the number of ones and zeros presenting in the LSB's of each pixel, counting each pixel last 3LSB's that how many zeros and ones present if the number of zeros is more than the number of one's then we kept "0" at that position otherwise if the number of zeros is less than the number of one's then we kept the "1" in that location.

$$Y= E (K, X) \tag{1}$$

The information or the original image considered as X= [X1, X_2, ..., X_M] and encryption key K as input. The image encryption algorithm produces a cipher text Y= [Y_1, Y_2, ..., Y_N] is as written in the equation 1.

The syndrome is generated only for the upper part of the original encoded image; this partition is based on parameter U, which is half of the original image size. It is another matrix which doesn't include for embedding and encrypting process, and this does not depend on the process of embedding and extraction of data, it is only for to find the changes in the pixel values at the receiver side and helps to extract the additional data which be hidden, it is not possible trace back the message that hidden in the encrypted image unless the encrypted image is there.

2) Preserving of Auxiliary Syndrome: Here the generated auxiliary syndrome is preserved for the further purpose for extracting the original image at the receiver side, preserving this syndrome by embedding into another part of the sub-image using histogram shifting but it increases the tradeoff ratio. So we usually send this syndrome along with the embedded image. It also decreases the tradeoff ratio and easily gets the syndrome back for reconstruction of the original image

B. Image Encryption

We encrypt the image based on the key that which generated from the key scheduling algorithm; we use the two keys, one for row encryption and another for the column encryption. Based on the size of the image we can design the algorithm for generating such length of alternating code values. At every stage, we can encrypt the image two times, one for row encryption and another for column encryption; use the same key for the decryption also.

For each time using bit xor operation, we can encrypt the image of algorithm-generated values and the pixel values give the cipher values that again converted back to double values gives the image that is encrypted. Also for the same aspect in terms of column encryption, iterating each column separately and done bit xor with all the values in a column with the algorithm values.

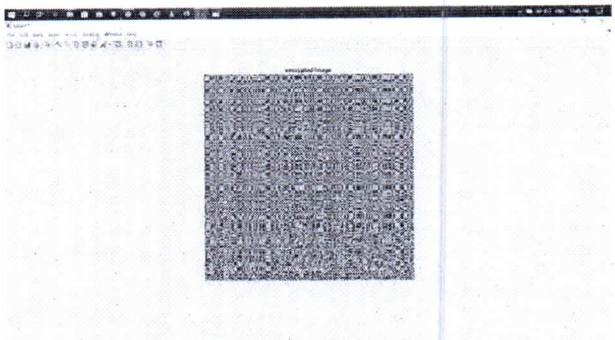


Figure 3. Process of Embedding

C. Data Embedding

Let suppose the data embedded or hidden is of type text, taken a text message that which to hide into the image, changing these text into a string of characters this is because for when we give a data is in the form of numbers or special characters or text, it is somewhat difficult to process all of them separately, so changing whatever the data into the string/text format and it is easy to process. Here we can also take the image as additional data shown in Figure 3.

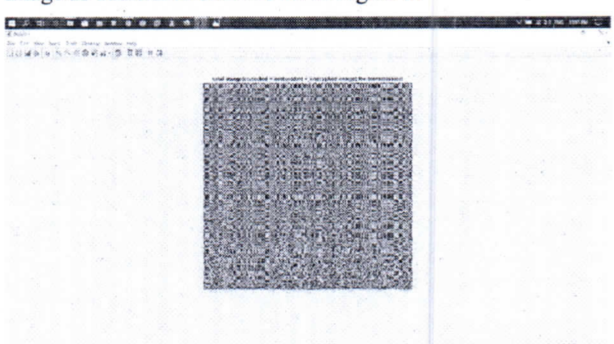


Figure 4. Received image

D. *Abstraction of Data and Retrieval of Image*

The received image (see Figure 4) is of the type encoded, encrypted and embedded, also we can receive the auxiliary syndrome of the original image, again we can generate the auxiliary syndrome for the received image gives where the change in the image pixel we get, thereby we can easily get back the original additional data.

$$X= D (K, Y) \quad (2)$$

The receiver with the availability of the key, one can decrypt the original image to recover it without the noise. The equation 2 represents the recovery of X from the cipher text Y using the estimated key K

After generating the syndrome for the received image, using XOR operation in between off received auxiliary syndrome and the received image auxiliary syndrome, thereby we can get back the additional data into a binary format, this data is of additional data that which we can embed into the image, by converting the binary value to the double may get back the data in double, then again converted to equalized ASCII character may get the hidden data (see Figure 5).

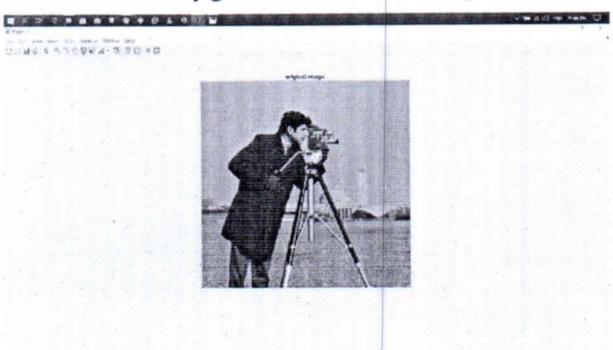


Figure 5. Decrypted and decoded image

TABLE I. ANALYSIS OF PROPOSED METHOD

Test Images	Methods	Embedding rate (bpp)	PSNR (dB)	Bit Error Rate
Lena	Our	1	59.48	0
	Zhang[8]	0.1777	49.929	1.21
	Khanam	0.1563	58.92	0.85
Baboon	Our	1	55.26	0
	Zhang	0.1563	38.79	0.24
	Khanam	0.1563	40.57	0.16
Cameraman	Our	1	65.79	0
	Zhang	0.1563	39.88	0.25
	Khanam	0.1563	54.84	0.35

CONCLUSION

We have presented a perfect data hiding scheme composed of reversible, encryption, and auxiliary syndrome is proposed. A content owner encodes the sub image to produce auxiliary syndrome which is used for embedding and retrieving back the data that which hidden in the image. Then, some additional data is embedded in the encoded region. The extraction of embedded data and recovery of the image is performed according to the extracted auxiliary syndrome. The experiments show that we get embedded data and obtain the original image and also made an analysis.

REFERENCES

[1] Tian, Jun. "Reversible data embedding using a difference expansion." IEEE transactions on circuits and systems for video technology 13.8 (2003): 890-896.

[2] Alattar, Adnan M. "Reversible watermark using the difference expansion of a generalized integer transform." IEEE transactions on image processing 13.8 (2004): 1147-1156.

[3] K. R. Chandra, B. Prudhvi Raj and G. Prasannakumar, "An Efficient Image Encryption Using Chaos Theory," 2019 International Conference on Intelligent Computing and Control Systems (ICCS), Madurai, India, 2019, pp. 1506-1510.

[4] D. M. Thodi and J. J. Rodriguez, "Expansion embedding techniques for reversible watermarking" IEEE Trans. Image Process, vol. 16, no. 3. pp. 721-730. Mar 2007.

[5] Z NLY O Shi, Ansari, and W. Su "Reversible data hiding."IEEE Trans. Circuits Syst. Video Technol., vol. 16, no. 8. Pp 354 3622006.

[6] W. Hong. T S Chen and H Y Wu, "An Improved Reversible Data Hiding in Encrypted Images Using Side Match."IEEE Signal Process. Lett vol. 19, no.4, pp. 1992022012.

[7] Kede Ma, Weiming Zhang Xianfeng Zhao, Nenghai Yu. Fenghua Li, "Reversible Data Hiding in Encrypted Images by Reversing Room Before encryption "IEEE Trans. Information Forensic and security., vol 8,no.3 pp 5532-562,2013.

[8] Chandra K.R., Donga M., Budumuru P.R. (2021) Reversible Data Hiding Using Secure Image Transformation Technique. In: Suma V., Chen J.IZ., Baig Z., Wang H. (eds) Inventive Systems and Control. Lecture Notes in Networks and Systems, vol 204. Springer, Singapore.

[9] Dileep, M., B. Prudhviraj, and G. Prasannakumar. "A new image encryption and data hiding technique using wavelet transform." International Journal of Research in Engineering and Technology 5.5 (2016): 195-198.

[10] Bhagyasri, G., G. Prasannakumar, and P. S. N. Murthy. "Underwater image enhancement using SWT based image fusion and colour correction." 2019 International Conference on Intelligent Computing and Control Systems (ICCS). IEEE, 2019.

[11] Varma, D. Ramesh, G. Prasanna Kumar, and P. S. N. Murthy. "Image Restoration using 3-Dimensional Discrete Cosine Transform." International Journal of Computer Applications 975 (2016): 8887.

[12] Shete, Kalpana & Patil, Mangal & Chitode, Janardan. (2016). Least Significant Bit and Discrete Wavelet Transform Algorithm Realization for Image Steganography Employing FPGA. International Journal of Image, Graphics and Signal Processing. 8. 48-56.

[13] P. R. Budumuru, G. P. Kumar and B. E. Raju, "Hiding an Image in an Audio File using LSB Audio Technique," 2021 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India, 2021, pp. 1-4.

[14] A. R. Shaik, K. R. Chandra, B. E. Raju and P. R. Budumuru, "Glaucoma Identification based on Segmentation and Fusion Techniques," 2021 International Conference on Advances in Computing, Communication, and Control (ICAC3), Mumbai, India, 2021, pp. 1-4.

[15] Elisha Raju, B., Ramesh Chandra, K., Budumuru, P.R. (2022). A Two-Level Security System Based on Multimodal Biometrics and Modified Fusion Technique. In: Karrupusamy, P., Balas, V.E., Shi, Y. (eds) Sustainable Communication Networks and Application. Lecture Notes on Data Engineering and Communications Technologies, vol 93. Springer, Singapore.

[16] Dattatraya Arun Jadhav, Talal Aljeraisi, C.Ganesh, Dr S.Pradeep Kumar, K. Ramesh Chandra, Dr Abhijit Janardan Patankar, "Binary - CNN Based Classifications Of Effective Diabetic Eye", Journal of Pharmaceutical Negative Results, pp. 6860–6864, Jan. 2023.

[17] B. S. S. A, S. M. A, V. P. G, S. I, K. S. K. B and V. Rao Ch, "Arduino based Smart Street Light System," 2021 3rd International Conference on Advances in Computing, Communication Control and Networking (ICAC3N), Greater Noida, India, 2021, pp. 657-660, doi: 10.1109/ICAC3N53548.2021.9725439.

[18] V. R. Ch, M. V. P. A and B. S. S. A, "Arduino based Electronic Voting System with Biometric and GSM Features," 2022 4th International Conference on Smart Systems and Inventive Technology (ICSSIT), Tirunelveli, India, 2022, pp. 685-688.

[19] R. P. Chand, V. B. Sri, P. M. Lakshmi, S. S. Chakravathi, O. D. M. Veerendra and C. V. Rao, "Arduino Based Smart Dustbin for Waste Management during Covid-19," 2021 5th International Conference on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, India, 2021, pp. 492-496.

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 116-126

Understanding Stroke Suspectibility: Machine Learning Insights For Swift Action

1 T. Veera Venkata Harshitha, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra pradesh, India. harshitha.thota2003@gmail.com*

2 S. Saroja, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra pradesh, India. saruseelam@gmail.com*

3 P. Prudhvi Siva Narayana, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra pradesh, India. ppsn7555@gmail.com*

4 K. Abhisty, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra pradesh, India. sunnyrx100.k@gmail.com*

5 Dr. B.V.S Varma, *Professor, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra pradesh, India. phdvarma@gmail.com*

Abstract: *Because the chance of stroke is rising as the population ages, we need better ways to predict it. Stroke is a world threat that has serious health and economic effects. This method uses machine learning techniques to make more accurate predictions about the risk of having a stroke. A big threat to world health is stroke, which is why we need improved prediction tools to help us help people early on. This study shows a new way to use machine learning (ML) to automatically predict strokes. The study compares it to six well-known models to see how well it does in a number of areas, such as generalization and accuracy. Using SHAP and LIME methods for clear decision-making insights, the study also stresses how important it is for medical models to be easy to understand. The suggested approach brings together both global and local explainable methods, which helps make complex machine learning models more consistent. Among the algorithms that were tried, Random Forest regularly does better than the others, giving very accurate results. To make predictions even more accurate, CATBOOST & Stacking Classifier is added. This uses a group of various classifiers with a vote system. This study is a big step toward better stroke care and treatment. It provides a complete and reliable way to identify and treat strokes early on, which will eventually lessen the severe health and cost effects of this common medical disease.*

Index terms *- Stroke prediction, data leakage, explainable machine learning.*

I. INTRODUCTION

Rising stroke rates are a major cause of mortality and damage worldwide. Stroke survivors need early treatment to avert long-term damage and death. These technologies allow clinicians to quickly identify high-risk individuals and treat them, reducing stroke complications and improving patient outcomes. Healthcare machine learning models must be more simple and understandable. Using machine learning models can help doctors determine a patient's risk of stroke and how to treat it. Traditional stroke risk assessment is time-consuming and inaccurate. Recent advances in machine learning show promise in predicting stroke risk based on clinical risk. This technology enables doctors to quickly identify and treat high-risk individuals, reducing stroke complications and improving patient outcomes. Medical machine learning models should be simpler and easier to understand. Machine learning models can help doctors determine what causes stroke patients and how to treat them. The World Stroke Organization reported that 13 million people suffered strokes and 5.5 million died [1]. Stroke is the leading cause of death and disability worldwide [1, 2]. It affects family, friends and work. Stroke is thought to generally affect the elderly or the sick. It can affect anyone, regardless of age, gender or health status [1, 2]. When blood flow is suddenly and severely interrupted, brain cells lose oxygen. This is called paralysis. There are two types: cerebral and hemorrhagic. Moderate to severe paralysis can permanently or temporarily disable you. Hemorrhagic stroke occurs when a blood vessel in the brain bursts, but very few people suffer from this condition. Most strokes occur when arteries become blocked or narrowed, reducing blood flow to the brain. People over 55, those who have had a stroke or TIA, those with an irregular heartbeat, those who smoke, those with high cholesterol, those with diabetes, those who are overweight, those who are sedentary, those taking

ODJ
ORGANIZATION DEVELOPMENT JOURNAL
ISSN NO:0889-6402

AN SECURE EFFICIENT PRIVACY PRESERVING DATA AUTHENTICATION SCHEME FOR IOT

[1]Sandhi Deepika, [2]Mr. L Bujji Babu,[3]Dr.B.V.S Varma
[1]Student,[2]Assistant Professor,[3]Professor
Department of Computer Science and Engineering
D.N.R College of Engineering and Technology

ABSTRACT :
As an essential element of the next generation Internet, Internet of Things (IoT) has been undergoing an extensive development in recent years. In addition to the enhancement of people's daily lives, IoT devices also generate/gather a massive amount of data that could be utilized by machine learning and big data analytics for different applications. Due to the machine-to-machine (M2M) communication nature of IoT, data security and privacy are crucial issues that must be addressed to prevent different cyber attacks (e.g., impersonation and data pollution/poisoning attacks). Nevertheless, due to the constrained computation power and the diversity of IoT devices, it is a challenging problem to develop lightweight and versatile IoT security solutions. In this paper, we propose an efficient, secure, and privacy-preserving message authentication scheme for IoT. Our scheme supports IoT devices with different cryptographic configurations and allows offline/online computation, making it more versatile and efficient than the previous solutions.

I. INTRODUCTION :

The Internet of Things (IoT) provides a self-establishing network of highly coupled heterogeneous objects, such as smart devices, RFID tags, sensors, etc. It allows devices to simplify the retrieval as well as the exchange of data without human involvement in various applications [1] and has a considerable position in the growth of information technology after the computer science and the Internet. IoT brings a pervasive digital appearance by engaging society and industries, and enables a series of interactions between human to human, human to thing, and more importantly, thing to thing. The development of IoT has led to enormous applications, such as smart home systems (SHSs) [2], intelligent transportation systems [3][4], machine learning and big data [5], etc. The machine-to-machine (M2M) [6] communication among massive numbers of IoT devices will dominate future communication network traffic. The integrity and authenticity of the massive amount of data collected and transmitted by the IoT devices are crucial in some applications such as machine learning and big data analytics. Maliciously injected or modified data can cause biased or wrong decision making and prediction. Therefore, in order to ensure the correctness and accuracy of machine learning and big data analysis, the integrity and authenticity of the collected data must be retained [7].

There are two approaches to achieve secure message delivery in IoT: the symmetric-key based approach, and the publickey based approach. The symmetric-key approach incurs less computation overhead compared with the public-key approach since symmetric-key operations are much more efficient than their public-key counterparts. However, key management is a major issue for symmetric-key based approach in a large scale heterogeneous IoT network. Also, if the message is only authenticated using a shared key between the sender and the receiver, the intermediate forwarding nodes in the IoT network cannot verify the integrity of the message. If the message has been altered or damaged during transmission, then the problem can only be discovered by the receiver. On the other hand, public-key based approach can solve these problems since anyone can use the public key to verify the integrity and authenticity of a message. However, public-key operations are very computation intensive, and privacy is another concern for public-key based approach since the authentication token is publicly verifiable using the sender's public key. It is worth noting that the privacy of a data source is also important in some situations, e.g., when a wearable device is attached to a human. If the attacker can identify the sources of the data streams, then they could also cut off a data stream (e.g., via a Denial-of-Service attack) and eventually affect the accuracy of the decision or prediction produced by machine learning.

In order to address the above problems in IoT and M2M communications, a secure, efficient and privacy-preserving message authentication scheme that can support hop-by-hop verification is desirable. In [8], Li et al. proposed a novel source anonymous message authentication (SAMA) scheme which could be used for such a purpose. Their scheme was believed to achieve message authentication and message source privacy with a lower cost than the previous approaches.

PROBLEM STATEMENT :

There are two approaches to achieve secure message delivery in IoT: the symmetric-key based approach, and the publickey based approach. The symmetric-key approach incurs less computation overhead compared with the public-key approach since symmetric-key operations are much more efficient than their public-key counterparts. However, key management is a major issue for symmetric-key based approach in a large scale heterogeneous IoT network. Also, if the message is only authenticated using a shared key between the sender and

Vol.22 No.07
JULY, 2023
MATERIAL SCIENCE AND TECHNOLOGY
DOI:10.10543/f0299.2023.41656

SOIL CLASSIFICATION USING ENSEMBLE DEEP LEARNING APPROACHES

[1]KOPPINENI SATYA SAI KUMAR, [2]Dr. B V S Varma,
[1]Student,[2]Professor
Department of COMPUTER SCIENCE & ENGINEERING
DNR College of Engineering & Technology, Bhimavaram

ABSTRACT
The objective of this project is to develop an ensemble deep-learning model for soil recognition using images as input. The model aims to combine the advantages of various deep learning models with ensemble learning to achieve better generalization performance. The project involves collecting and preparing soil images for training and sketches for testing the models. Several popular deep learning architectures such as vgg, resnet, inception, and densenet can be used as base models for the ensemble, but here we used our own CNN models with different layers. The project will generate predictions for the test data using each of the trained base models, combine the predictions using appropriate methods such as averaging, stacking, or boosting, and make the final prediction using a simple voting method. The performance of the ensemble model will be evaluated using standard metrics. The project will also fine-tune the ensemble model by adjusting the parameters, adding or removing base models, or changing the combination method to improve performance further. This project can be resource-intensive and requires a suitable hardware configuration and infrastructure to train and deploy these models. The use of transfer learning can further improve the performance of the ensemble model by using pre-trained models as the base models.

I. INTRODUCTION

Deep learning models, such as CNN, have demonstrated impressive results in soil recognition tasks. However, there is a need to further improve the performance of deep learning models for soil recognition tasks. One approach to improve the performance of deep learning models is through ensemble learning, which involves combining multiple models to improve overall accuracy. Therefore, the proposed solution involves developing an ensemble learning method for deep learning-based soil classification that leverages multiple models trained on diverse datasets and architectures to enhance accuracy.

Motivation

"Unlocking the hidden secrets of our Earth's soil composition is essential for sustainable agriculture, land management, and environmental conservation. Traditional methods of soil classification are often time-consuming, labor-intensive, and subject to human bias. However, by harnessing the power of deep learning, we can revolutionize soil classification, enabling faster and more accurate analysis.

Deep learning algorithms possess the remarkable ability to process vast amounts of soil data, including chemical, physical, and biological properties, while identifying intricate patterns and relationships that may elude human observation. By training deep learning models on diverse soil datasets, we can create sophisticated classifiers capable of accurately categorizing soil types, predicting their characteristics, and mapping their distribution across vast areas.

This technological advancement in soil classification holds tremendous potential for various stakeholders. Farmers can benefit from precise soil mapping, enabling them to optimize crop selection, irrigation strategies, and fertilizer application, leading to increased productivity and reduced environmental impact. Land managers can make informed decisions about soil conservation and erosion control measures, preserving the fertility and health of our valuable land resources.

Problem Definition

The problem addressed in this project is to develop an Ensemble deep-learning model for Soil identification using site images as input. The objective is to leverage the strengths of deep learning architectures and ensemble learning to improve the accuracy and reliability of Soil identification systems. Using sketches as input can overcome the challenges imaged by traditional image recognition algorithms and address privacy concerns associated with the use of photographs. The project aims to achieve better generalization performance by combining the predictions of multiple base models trained on different subsets of the data.

Objective of the Project

The objective of the project is to use an ensemble deep-learning model which can combine the strengths of different deep-learning architectures and can yield better performance compared to a single model.

Requirements

Minimum Software Requirements:

The minimum software requirements help us to understand the minimum cost required to facilitate a working environment for our model to be running.

- Python
- Anaconda
- Jupiter Notebook
- Numpy
- OS

ODJ
ORGANIZATION DEVELOPMENT JOURNAL
ISSN NO:0889-6402

EMOTIONS BASED PATTERNS OF MENTAL DISORDERS ON SOCIAL MEDIA –A CASE OF ANOREXIA AND DEPRESSION

[1]Sudha Yalemanchili,[2]Mr. K Surya Ram Prasad,[3]Dr.B.V.S Varma
[1]Student,[2]Assistant Professor,[3]Professor
Department of Computer Science and Engineering
D.N.R College of Engineering and Technology

ABSTRACT :
Millions of people around the world are affected by one or more mental disorders that interfere in their thinking and behavior. A timely detection of these issues is challenging but crucial, since it could open the possibility to offer help to people before the illness gets worse. One alternative to accomplish this is to monitor how people express themselves, that is for example what and how they write, or even a step further, what emotions they express in their social media communications. In this study, we analyze two computational representations that aim to model the presence and changes of the emotions expressed by social media users. In our evaluation we use two recent public data sets for two important mental disorders: Depression and Anorexia. The obtained results suggest that the presence and variability of emotions, captured by the proposed representations, allow to highlight important information about social media users suffering from depression or anorexia. Furthermore, the fusion of both representations can boost the performance, equalling the best reported approach for depression and barely behind the top performer for anorexia by only 1%. Moreover, these representations open the possibility to add some interpretability to the results.

I. INTRODUCTION :

A mental disorder causes different interferences in the thinking and behavior of the affected person [1]. These interferences could vary from mild to severe, and could result in an inability to live routines in daily life and ordinary demands [2]. Common mental disorders such as depression and anorexia affect millions of people around the world. They may be related to a single incident causing excessive stress on the person or by a series of different stressful events. It is also well known that mental disorders tend to increase in countries experiencing generalized violence or recurrent natural disasters. For example, in 2018 a study of mental disorders in Mexicorevealed that 17% of its population has at least one mental disorder and one in four will suffer a mental disorder at least once in their life [3]. In another vein, in the modern world, we take for granted that social life could be experienced either in the physical world or in a virtual world created by social media platforms like Facebook, Twitter, Reddit, or similar platforms. This reality presents some challenges, but also great opportunities which, if properly addressed, could contribute to the understanding of what and how we communicate. In this regard, the goal of this study is to analyze, via the automatic identification of emotional patterns, social media documents 1 with the purpose of detecting the presence of signs of depression or anorexia in the population of that area [4]–[6]. Previous works have addressed the analysis of emotions of social media users by paying attention to their contrast and tone. They have mainly applied this analysis to predict users' age and gender as well as a range of sensitive personal attributes including sexual orientation, religion, political orientation [7], [8], income [9], and personality traits [10], [11]. According to these studies, the analysis of emotions in social media allows capturing important information related to users. This information presents an opportunity for us to extend the use of emotions in the detection of depression and anorexia in social media.

Former studies focused on the detection of depression and anorexia have mainly considered linguistic and sentiment analysis [12]–[14]. Note that the use of sentiments, i.e. polarity, was the preamble for the later use of emotions for the same task [15]. This line of thought exposed the potential of using emotions as features, such as "anger", "surprise" or "joy", instead of linguistic features or general sentiments like positive and negative. In this direction, in our previous work [16], we introduced a novel representation that was built using information extracted from emotions lexicons combined with word embeddings as a way to represent the information contained in users' documents. Then, using a clustering algorithm, we created sub-groups of emotions, that conveniently we named as sub-emotions. These discovered sub-emotions provided a more flexible and fine-grained representation of users and a better performance for the detection of depression. In a few words, the idea behind this representation was to capture the presence of sub-emotions in users' posts. The intuition of our approach is that users suffering from depression would show a distribution of emotions different from healthy users. Motivated by the encouraging results of the representation based on sub-emotions, in this study we give a more complete treatment of the method. In particular, we propose a new representation that not only captures the presence of sub-emotions, but also models their changes over time. The intuition is to model emotional fluctuations that users with mental disorders could continuously present. This temporal information is later integrated to enrich the

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 234-240

Implementing Moving Target Defense for Internet Denial of Service Attacks

[1] D Devi Sri, *Student, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra Pradesh, India. devidhatla@gmail.com*
[2] M. Naga Venkata Nivas Varma, *Student, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andharapradesh, India. nivasvarmamudunuri@gmail.com*
[3] K Mounika, *Student, Department of CSE, DNR College Engineering and Technology, Bhimavaram, Andhra pradesh, India. Mounikakandiboina220@gmail.com*
[4] Ch Vijay Bhaskar, *Student, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India. ch.vijaybhaskar14@gmail.com*
[5] Kalipindi Siva Hari Prasanna Kumar, *M. Tech., Assistant Professor, Department of CSE, D.N.R College of Engineering and Technology, West Godavari, Andhra Pradesh, India. kshpk@dnrcet.org*

Abstract: *A dynamic defensive mechanism called MOTAG is included in the project to protect application servers against insider threats and Distributed Denial of Service (DDoS) assaults. In order to stop insider assaults from figuring out the application server's IP address and port, four important components work together: an authentication server, proxy servers, the application server, and clients. Each client is dynamically assigned a proxy server by the Authentication Server using a random shuffle greedy algorithm. This adds an extra degree of protection by making it difficult for hostile users to determine the application server's real IP address and port. After checking whether the requested data is within the proxy server's processing capacity, the request is sent on to the secure application server. To improve network security, proxies may drop requests and notify clients or Authentication Servers of possible DDoS attacks based on their sizes. A client app with a GUI for file uploading to the server is part of the project. For effective monitoring and protection, the system generates visual representations of proxy assignments, successfully processed requests, and identified DDoS assaults.*

Search keywords - Distributed Denial of Service; Moving Target Defense; Secret Proxy; Insider; Shuffling.

I. INTRODUCTION

An uptick in the frequency of large-scale distributed denial-of-service (DDoS) assaults has been noted by Arbor Networks in earlier reports [1]. One hundred gigabits per second was the most bandwidth recorded in 2010 by a flood-based DDoS assault. At the same time, the price of launching a distributed denial of service (DDoS) assault is shockingly cheap. A white paper by Trend Micro [2] has shown that in the Russian underground market, a one-week DDoS service might cost as little as $150.

In the past, several different approaches have been suggested to lessen the impact of distributed denial of service assaults. In order to prevent unauthorized traffic from reaching the protected nodes, methods based on filtering [3, 4], [5] make use of filters that are widely distributed. Capability-based defensive methods [6, 7, 8, 9] aim to limit the senders' resource consumption to what the receivers allow. In order to intercept and filter out attack traffic, secure overlay systems [10], [11], [12], [13], [14], and [15] interpose an overlay network to indirect packets between clients and the protected nodes. To counter the increasingly sophisticated assaults, however, these static security measures need either a massive, powerful virtualized network or the worldwide deployment of supplementary features on Internet routers. And some of them are still susceptible to advanced assaults like adaptive floods [12] and sweeps [11].

To safeguard centralized web services, we provide MOTAG, a dynamic DDoS defensive method that uses a moving target defense technique. Online banking and efinance are examples of security-sensitive services that might benefit from MOTAG's DDoS resistance. When clients communicate with the protected application servers, MOTAG uses a layer of hidden moving proxies to mediate the conversation. When it comes to the application servers, only traffic from legitimate proxy nodes may get through the network-level filters that surround them.

There are two key features of MOTAG proxy nodes. The first thing to know is that all proxy nodes are "secret" since only authenticated clients are able to access their IP addresses, which are hidden from the public. In order to prevent any needless disclosure of information, we only supply each valid client the IP address of

A

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 224-233

The Future of E-Tendering using Blockchain

[1.] **Ch. Aswini**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, aswinichimata3@gmail.com*

[2.] **K. Bharath**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, Koppadabharath8888@gmail.com*

[3.] **J. Karthikeya Ramgopal**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, jallakarthikeya@gmail.com*

[4.] **B. Dileep Sai Kesava Varma**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, deepu122varma@gmail.com*

[5.] **Kalipindi Siva Hari Prasanna Kumar**, *M. Tech, Assistant Professor, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, kshpk@dnrcet.org*

Abstract: *The project investigates the application of blockchain technology, specifically Ethereum-based smart contracts, to develop a distributed e-tendering system aimed at addressing the security implications inherent in traditional procurement methods. Divided into four sections, it focuses on tender creation and publishing, bidding, evaluation, negotiation, and selection of the winning bid. Each phase employs distinct algorithms to ensure efficiency and fairness. By leveraging blockchain's decentralized nature and robust encryption, the system aims to enhance security and transparency, thereby fostering trust in the tendering process. Through a comprehensive evaluation, the project assesses the security and audibility challenges inherent in conventional methods and compares them with the proposed blockchain-based solution. Ultimately, the project seeks to establish a fair, transparent, and open tendering scheme, laying the groundwork for more efficient procurement practices in both governmental and corporate sectors.*

Index Terms: *Blockchain, Fair and Open Tendering Scheme, smart contract, ethereum, e-tender*

I. INTRODUCTION

In the contemporary landscape of procurement, electronic tendering (e-tendering) systems have become the norm for governments and businesses alike. These platforms serve as the primary means through which goods and services are procured from various suppliers. However, amidst the convenience and efficiency that e-tendering promises, fundamental issues persist, casting shadows over the fairness, transparency, and security of the process.

Central to the concerns surrounding e-tendering systems is the lack of transparency and openness in information dissemination. The right to information, a cornerstone of democratic governance, is often compromised as stakeholders find themselves in the dark regarding crucial aspects of the tendering process [1]. Information regarding the selection of winning bids and the reasons behind the rejection of others is often withheld, shrouded in bureaucratic opacity. This asymmetry in information distribution not only undermines the principles of fairness but also inhibits accountability and trust in the system.

Compounding these issues is the cumbersome and tedious process involved in obtaining critical data related to tendering decisions. While stakeholders, particularly competing companies, have the right to request such information, the bureaucratic hurdles and time-consuming procedures involved serve as deterrents, dissuading many from pursuing transparency [1]. Consequently, the opacity surrounding tendering decisions persists, perpetuating a culture of mistrust and suspicion among stakeholders.

Moreover, beyond the realm of transparency, security emerges as a paramount concern plaguing conventional e-tendering systems. The centralized nature of data storage renders these platforms vulnerable to cyber threats, fraud, and manipulation [2],[3]. A breach in the security defenses of these centralized databases poses grave risks, potentially exposing sensitive bid information to malicious actors. Such breaches not only jeopardize the integrity of the tendering process but also entail significant financial and strategic ramifications for businesses [4]. The prospect of bids being leaked to competitors looms large, threatening the competitive advantage and viability of organizations.

Amidst these challenges, blockchain technology emerges as a promising solution poised to address the security implications inherent in conventional e-tendering systems. By virtue of its decentralized architecture and robust encryption mechanisms, blockchain offers a paradigm shift in how information is managed and secured [5]. At its core, blockchain functions as a distributed ledger, wherein transactions are recorded across a

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 247-257

Urban Air Pollution: A Comparision of Statistical and Deep Learning Models

[1] Arepalli Pavani Naga Pravallika, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,pravallika6931@gmail.com*
[2] Maduthuri Purna Pradeep, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,pradeepmb1379@gmail.com*
[3] Pathapati Raja Rajesh Varma, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,rajeshvarma1285@gmail.com*
[4] Garikipati Chandra Sekhar, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,garikipatichandu99@gmail.com*
[5] Mrs.N.Bharathi, *M.Tech, Assistant Professor, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,kbharathi.1224@gmail.com*

Abstract: *A quiet but severe public health catastrophe, air pollution has worsened due to the development of industry and urbanization. Stakeholders must prioritize accurate air quality forecast if they are to successfully address this growing challenge. The purpose of this research is to assess the performance of statistics and deep learning models for predicting urban air pollution levels. We investigate their prediction capacities by means of state-of-the-art methodologies—including Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), Convolutional Neural Networks (CNN), and combinations thereof. Our results suggest that ensemble approaches, especially CNN and CNN + LSTM, are better, with an accuracy of more than 90%. These ensemble approaches show improved performance and build on the underlying model's effectiveness in air quality forecasting. They also highlight the possibility for future development. By combining several model projections, our method provides a solid and precise foundation for everyone involved to tackle air quality concerns head-on, reducing the negative effects of pollution on people's health and the environment.*
Air quality, statistical approaches, prediction models, deep learning, and machine learning are index terms.

I. INTRODUCTION

The detrimental effects of air pollution on ecosystems and human health have made it one of the world's most pressing environmental concerns in recent years. The need to reduce air pollution is more pressing than ever before because of the wide variety of health problems it causes, including asthma, lung illness, cognitive impairment, and even death [1][2]. Recent studies have shown that air pollution is responsible for approximately 3 million fatalities each year, with the majority of these casualties occurring in countries with low or medium economic levels [3]. Global efforts like the United Nations Sustainable Development Goals (SDGs) have set goals for 2030 to improve air quality in cities in order to reduce fatalities, diseases, and negative environmental consequences [4]. This is in response to the severity of the problem.

Along with these worldwide initiatives, certain nations, like the UK, have established lofty goals to reduce air pollution. The government of the United Kingdom has committed to a 35% reduction in air pollution by 2040 [5]. These goals highlight the increasing awareness of air pollution as a major threat to public health and the need of working together to reduce its impacts.

Air pollution is caused by a multitude of things, but the most common ones are transportation-related activities, dust, and the burning of coal [6]. When dangerous substances, such as gases and materials, are released into the air, this is called air pollution. At high enough quantities, particulate matter (PM2.5), one of the most prevalent contaminants, may cause serious harm to human health [7][8][9]. These contaminants diminish environmental quality and endanger the health of people and other creatures when they build up in the air. Research, legislative initiatives, and technical improvements must all be part of the solution to the complicated problem of air pollution. In order to create successful methods to reduce the negative consequences of air pollutants on human health and the environment, it is crucial to understand where these pollutants come from, how they spread, and what effects they have. To ensure stakeholders and decision-makers have access to up-to-date information, developments in air quality monitoring and forecasting are vital.

Predictive models and monitoring methods for air quality evaluation have come a long way in the last few years. These models evaluate trends in air quality and predict amounts of pollutants using cutting-edge methods including statistical analysis, deep learning, and machine learning. Through the use of extensive data

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 127-137

Deep Learning in Cervical Cancer Diagnosis: Framework, Prospects, and Unrestricted Research Issues

[1] K. H. Srilakshmi, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, hemasrilakshmikadim@gmail.com*

[2] S. Vineela, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, vinnisandi.321@gmail.com*

[3] P. P. Malleswararao, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, pavanmalleswararao6026@gmail.com*

[4] M. Vijaya Bhaskhar, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, vijaymanda727@gmail.com*

[5] Dr. B. V. S. Varma, *B.E., M.Tech., Ph.D, Professor, Department of CSE, DNR College of Engineering and Technology, phdvarma@gmail.com*

Abstract: *The abstract highlights the significance of deep learning (DL) technology in addressing cervical cancer (CC), a leading cause of female mortality globally. With over 700 daily fatalities and an estimated 400,000 annual deaths by 2030, early detection is imperative. DL techniques offer accurate diagnoses, thereby improving treatment outcomes. The project integrates various DL models, including CNN, DenseNet, and Xception, for feature extraction, enabling the development of robust classification models such as SVM, KNN, Bayesian Networks, Decision Trees, and MLP. Additionally, DL-based detection techniques using YoloV5 and YoloV8 are explored for CC analysis. The utilization of these models significantly enhances diagnostic accuracy, with CNN and SVM achieving 99% accuracy in the base paper. The project's extension further improves performance by incorporating YoloV5 and YoloV8 for detection tasks, enhancing the system's capability to detect CC accurately. The implications of this project extend beyond improved diagnosis, benefiting women globally, particularly in low-income countries, by reducing morbidity and mortality rates. Healthcare professionals gain access to efficient diagnostic tools, enabling timely interventions and personalized therapy for better patient outcomes. Overall, the project underscores the pivotal role of DL technology in combating CC and improving healthcare outcomes.*
Index Terms: *Deep learning, classification, cervical cancer, colposcopy images, cytology images.*

I. INTRODUCTION

In recent years, the rapid advancement of Artificial Intelligence (AI) and Machine Learning (ML) technologies, particularly in the realm of Deep Learning (DL), has revolutionized various sectors, including healthcare. DL, a subset of AI and ML, has shown remarkable success in applications such as computer vision recognition and processing, with capabilities that often surpass human performance in certain tasks [1]. This has led to its widespread adoption in medical domains, particularly in medical image analysis, where DL methods have demonstrated significant potential in detecting and diagnosing various types of cancers [2].

Cancer, characterized by uncontrolled cell division and growth, remains one of the most pressing global health challenges, with cervical cancer (CC) being a significant contributor to mortality rates, particularly among women. CC is the fourth most common cause of cancer death among women worldwide, with alarming projections estimating a substantial increase in mortality rates by 2030 [3], [4]. Despite being highly preventable and treatable if detected early, CC continues to pose significant challenges, especially in low-resource countries where access to healthcare services and specialized medical expertise is limited.

The current methods for CC detection primarily rely on Pap smear screening and colposcopy, which are highly dependent on the expertise of trained specialists and are often inaccessible in resource-constrained settings [5]. While previous studies have explored the integration of DL-based algorithms with conventional screening tests, their effectiveness in detecting early stages of CC remains limited [6]. Achieving accurate and timely diagnosis, particularly in the early stages of CC, is critical for initiating timely interventions and preventing morbidity and mortality, especially in underserved populations.

Therefore, there is a pressing need to develop and enhance DL-based digital solutions for cervical cancer diagnosis and detection, particularly focusing on improving accuracy and efficacy in identifying early-stage cervical abnormalities. This paper aims to address this need by leveraging DL techniques to develop

1-08

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 138-149

A cloud based method for finding intrusions using machine learning

[1]. Chelamalasetti Tejasri Venkata Bhavani, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,tejasri.chelamalasetti@gmail.com*
[2]. Nangana Syam Babu, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,syamnangana2001@gmail.com*
[3]. Matta Geetanjali, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,mgeetanjali2002@gmail.com*
[4]. PotturiSai Madhav Varma, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,Saimadhavvarma1234@gmail.com*
[5]. Dr. A Rama Murthy, *M.Tech, PhD.,Professor, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,ram111.sai@gmail.com*

Abstract: *Storage, data management services, processing power, apps, and a plethora of other network and computer resources are all at your fingertips with cloud computing. These materials are readily available for users to use whenever they need them. Improving cloud security via the deployment of a machine learning-based intrusion detection model is the main objective of the project. To successfully identify and avoid cyber-attacks, the main objective is to track and examine cloud-based resources, services, and networks. With a focus on the Random Forest (RF) method, the suggested intrusion detection model makes use of machine learning approaches. Combining several decision trees into one strong ensemble learning approach, Random Forest improves prediction accuracy. An important part of creating a model is feature engineering. It entails picking out the best characteristics from the dataset and making them the input for the machine learning model. The capacity of the model to recognize patterns and reliably detect possible threats is enhanced by well-engineered features. Continuous monitoring of cloud resources, services, and networks is the goal of implementing the concept to improve cloud security. The program improves the cloud infrastructure's security by spotting suspicious trends linked to cyberattacks using machine learning methods. Two datasets, Bot-IoT and NSL-KDD, are used to assess and verify the model's performance. When it comes to intrusion detection, these datasets are often used as standards. When compared to other recent efforts in the same field, the model's high intrusion detection accuracy shows that it is useful and reliable in spotting possible security risks.The project's Voting Classifier, which combines RF and ADaBoost, and the Stacking Classifier, which combines RF and MLP with LightGBM, achieved 99% and 100% accuracy for Kdd-Cup and Bot-IoT data, respectively, in terms of improved cloud detection results.*

Anomaly detection, features engineering, random forest, and cloud security are index words.

I. INTRODUCTION

With cloud computing, users have greater flexibility in choosing their service model and practical, on-demand access to pooled storage, networks, and resources [1]. These models are used in one of the deployment methods for private, public, or hybrid clouds, and they are platform as a service (PaaS), software as a service (SaaS), or infrastructure as a service (IaaS) [2]. According to the National Institute of Standards and Technology, the following features of the cloud enable it to deliver high-performance services: network access, resource pooling, quickelasticity, and measurable service.

Many security issues, including those pertaining to availability, data confidentiality, integrity, and control authorization, have recently plagued the cloud. Another big source of vulnerabilities that might infect cloud systems and resources is the Internet, which is utilized to access cloud services [2]. Providers of cloud services therefore have the formidable task of bolstering cloud security[5]. In order to make cloud systems more secure and resistant to different types of assaults, several methods have been created, including firewall technologies, data encryption techniques, authentication protocols, and others [6]. When it comes to protecting cloud services from various constraints, however, conventional methods fall short[7]. Thus, in order to identify and stop malicious actions in real-time, a suite of intrusion detection methods is suggested and implemented[8, 9].

In general, there are two types of detection methods: those that employ known attacks to identify incursion and those that utilize unknown assaults to identify anomalies. By merging their best features, these

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 150-158

A Deep Learning Method for Automated Road Damage Identification from Unmanned Aerial Vehicle photos

[1] P Satya Vardhan, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram,Andhrapradesh, India. satyavardhanpasupuleti@gmail.com*

[2] A Rama devi, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh,India. ramaaddala314@gmail.com*

[3] K. Naga Bhanu Prakash, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram,Andhrapradesh, India. bhanuprakashb.d143@gmail.com*

[4] V. Yaswanth, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India. vellankiyaswanth1509@gmail.com*

[5] Dr Satyanarayana Gaddada, *Professor, Department of CSE, DNR College of Engineering and Technology,Bhimavaram, Andhrapradesh, India. sreesatyam@yahoo.in*

Abstract: *Automated road damage identification utilizing UAV photos and sophisticated deep learning algorithms is presented in this research as a novel methodology. While keeping roads in good repair is essential for travel safety, gathering data by hand can be a dangerous and time-consuming ordeal. Our solution is to use UAVs together with AI to make road damage identification far more efficient and accurate. To identify objects in UAV photos, our approach makes use of three cutting-edge algorithms: YOLOv5, YOLOv7, and YOLOv5. Extensive testing and training using Chinese and Spanish datasets show that YOLOv7 produces the best accuracy. In addition, we expand our study by presenting YOLOv8, an algorithm that surpasses existing algorithms and shows significantly better prediction accuracy when trained on road damage data. The results highlight the possibilities of UAVs with DL.*
with the goal of facilitating future developments in the area of road damage identification.
Keywords: *unmanned aerial vehicle, object identification, deep learning, road damage detection, OVOVA5, OVOVA7, and OVOVA8.*

I. INTRODUCION

Road maintenance is essential for economic growth, therefore it's important to check them periodically to make sure they're safe and last a long time. Historically, road inspection has been conducted manually using sensor-equipped cars. On the other hand, operators run the danger of losing time, money, and energy using this method [1]. Unmanned Aerial Vehicles (UAVs) and Artificial Intelligence (AI) have become the tools of choice for academics seeking to tackle these difficulties. Unmanned aerial vehicles (UAVs) provide a bird's-eye perspective of roadways thanks to their sensors and high-resolution cameras.

circumstances, allowing for rapid coverage of vast regions while decreasing the need for human inspections [2].

Because of their efficiency and adaptability, UAVs have recently attracted interest for use in road inspections. New, more efficient, and less expensive methods for detecting road damage have been developed by combining UAVs with AI techniques, especially deep learning [3]. Several urban inspection jobs also make use of these strategies [4], [5]. Spanish road inspections are labor-intensive and expensive, and the country's repair decisions are based on the opinions of experts. Timely diagnosis is critical to avoid further deterioration and accidents, which poses issues for nations like China with vast road networks [6].

There is a lot of ongoing research on automated road damage detection using technologies including image-based algorithms, LiDAR sensors, and vibration sensors [7]. Recognizing different kinds of road deterioration using deep learning in image-based algorithms sometimes requires varied datasets from several sources [8], [9]. In order to address this pressing problem, academic institutions are working together to find viable solutions [10].

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 90-101

Multi-Class Identification System for Signature Authentication using CNN and HOG Approach

1 **B. Naga Bhuvaneswari**, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, boyinabhuvaneswari@gmail.com*

2 **K.Vinay Sri Ram**, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, Vinaykalinga040@gmail.com*

3 **S.Prasanthi**, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, chinnisiringula@gmail.com*

4 **I.Sivasankar**, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, sivasankarika2003@gmail.com*

5 **Dr. B. V. Ram Kumar**, *M.E.,Ph.D.,Professor, Department of CSE, DNR College of Engineering and Techonology, bvrk.bonam@gmail.com*

Abstract: *The feature extraction stage of offline signature verification systems is considered critical and significantly affects the performance of these systems. The quantity and calibration of the extracted features determine the systems' ability to distinguish between real and fake signatures. Using a combination of a Convolutional Neural Network (CNN) and a Histogram of Oriented Gradients (HOG), as well as a feature selection technique (Decision Trees) to isolate critical characteristics, we devised a hybrid approach to feature extraction from signature photos in this research. At last, we integrated the CNN and HOG approaches. Long short-term memory, support vector machine, and K-nearest Neighbor were the three classifiers used to assess the hybrid method's effectiveness. Based on the results of the experiments, our proposed model performed adequately when tested on the CEDAR dataset, both in terms of efficiency and predictive power. Given that we verified expertly fabricated signatures, which are more elusive than other types of forgeries, such as (simple or opposite), this precision is considered to be of great importance.We achieved a perfect score of 100 for improved signature verification using the project's additions, which include an Xception, a Feature extraction method (HOG-RFE), and a Voting Classifier for Dataset analysis. Using CNN and HOG a Multi-Classification Approach. To guarantee practical usability in cybersecurity apps, a user-friendly Flask framework with SQLite integration makes registration and signin for user testing a breeze.*
Search terms: deep learning, offline signature verification, CNN, and HOG.

I. INTRODUCTION

Biometrics is the most significant technology approach for identifying persons and assessing their power based on their physiological and behavioral traits. The physiological category includes measurements of features like ears, fingerprints, iris, and DNA, whereas the behavioral category includes features like expression, voice, stride, and signature, and uses them to identify people. One of the most often used biometric verification techniques globally is the handwritten signature [1]. As a distinct behavioral biometric, handwritten signatures are used in financial papers, passports, credit cards, banking, and check processing. Especially when they are not legible, these signatures are a pain to authenticate. Consequently, in order to reduce the likelihood of fraud or theft, a system is needed that can differentiate between a real signature and a false one. Although there have been numerous studies in this area over the last 30 years, covering everything from expert opinion-based verification to machine learning algorithms and, more recently, deep learning algorithms, there is still a great deal of room for improvement in offline signature verification systems [2].

Online techniques are available for automated signature verification [3, 4, 5, 6, 7], whereas offline methods are available for use [8, 9, 10, 11, 12, 13]. Previous research has shown that using pen-tip pressure, velocity, and acceleration in conjunction with offline signature photos makes offline signature verification more difficult than using online signatures [1, 2, 8, 10, 11]. The online method is also not applicable in some contexts due to the specific processes involved in collecting signatures.

Many prior studies[12,13,14,15] have shown that signature verification is not easy because handwriting signatures contain special letters and symbols that are often unreadable and signer behaviors are dissimilar, even though signature verification is the most generally accepted and least extreme biometric method in society compared to other biometric methods. Focus on developing a reliable signature system based on real-world

13

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 184-189

Ensuring Minors Safety: Restricting Access to Off-Limit Areas and Online Platforms through Deep Learning.

1. V. Teja Sri, *Student, Department of CSE, DNR College of Engineering and Technology,veeravallitejasrit@gmail.com*
2. M. Udaya Lakshmi, *Student, Department of CSE, DNR College of Engineering and Technology,udayalakshmi@gmail.com*
3. P. Sruthi Nikhila, *Student, Department of CSE, DNR College of Engineering and Technology, sruthivarma315@gmail.com*
4. A. Satya Rajesh, *Student, Department of CSE, DNR College of Engineering and Technology, satyarajesh.anala@gmail.com*
5. Mr. B. Nandan Kumar, *MTech, Assistant professor, Department of CSE, DNR College of Engineering and Technology,nandankumar@gmail.com*

Abstract: *This is a situational analysis of the need for webcams to prevent minors from accessing restricted websites and from entering clubs and pubs using facial recognition technology.*
Technology has progressed to the point that the 21st century marks the beginning of unfathomable feats.We may utilize this technology to our advantage by just looking at a photo or video to determine a person's age and gender.
The emergence of social platforms and social media has increased the number of apps that consider automatic age and gender categorization significant.However, when contrasted to the great performance gains recently reported for the related job of face recognition, the performance of present approaches on real-world photographs is still severely inadequate.
Using deep convolutional neural networks (CNNs) for representation learning, we demonstrate in this study that these tasks may be significantly improved.Therefore, we provide a basic convolutional net design that may be used even when the quantity of training data is restricted.This project's dataset, an Adience benchmark foraging and gender estimate, outperforms state-of-the-art approaches by a significant margin.
Php, OpenCV, CNN - index words

I. INTRODUCTION

The protection of children has grown into an issue of critical importance. To combat this issue, creative solutions are being implemented that use state-of-the-art technology like deep learning to block children from accessing restricted websites and banned regions online. The use of cameras combined with deep learning algorithms allows authorities to keep an eye on and control what children are up to, protecting them from damage and exploitation. In this concise overview, we will look at how these systems work, and why they are so important for keeping kids safe online and encouraging a more secure digital landscape for the next generation. Classification of humans is an outdated process.It is used in a number of different areas and technologies, including biometrics, forensic science, image processing, identification systems, and more.It has gotten progressively simpler to categorize individuals with the advent of technology such as Deep Learning and Neural Networks. There is no longer a requirement for additional professionals or individual records to aid in the identification and categorization of individuals using these new technologies.In addition, these systems can categorize millions of people far more quickly than a human expert.

There are several businesses that may benefit from human facial image processing, including security, entertainment, and many more.A person's facial expression may convey a great deal, including their emotional state, level of agreement or disagreement, level of rage, irony, etc.For a long time, this has been a focus of study in the field of psychology.According to the need, this data (or, in our instance, digital data) is highly useful since it assists with recognition, selection, or identification of persons.

On its own, Age and Gender Detection can provea great number of data to locations like organization recruiting teams and ID verification systems, for instance: voter ID cards that millions of people use to cast their vote on election day, etc. Searching for ineligible or counterfeit persons becomes easier with the use of human facial image analysis.

There are a lot of different industries that may benefit from using age and gender recognition technologies with human face image processing. Some examples include security, customer experience, and

IOSR Journal of Engineering (IOSRJEN) www.iosrjen.org
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 128-140

Decentralised Land Management through Ethereum Block Chain Solutions

[1]**I. Sravani**, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, sravaniindipikayala@gmail.com*

[2]**S. Hema Satya Sri**, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, hemasatyasrisrikakulapu@gmail.com*

[3]**N. Ujwala Durga**, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, ujwaladurga709@gmail.com*

[4]**K. Teja Varma**, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, tejakalidindi3@gmail.com*

[5]**Mr. K. Surya Ram Prasad**, *M.Tech, Assistant Professor, Department of Computer Science and Engineering, surya.dnrcet@gmail.com*

Abstract: *Paperwork, middlemen, and verification difficulties abound in the lengthy and tedious process of transferring property ownership, which increases the likelihood of forgeries and undermines trustworthiness. One possible approach is to use blockchain technology to completely revamp the land registration system. Blockchain technology removes middlemen by virtue of its distributed and unchangeable record, which speeds up transactions, decreases the likelihood of corruption, and establishes confidence in the absence of a central authority. Cryptography, consensus mechanisms, and hashing algorithms are the building blocks of blockchain, which guarantees immutable and transparent records of transactions. The goal of this project is to create a trustworthy and secure land registration system that is easy for anybody to use. Reducing the need for paper may help places like India, which has a lot of land transactions, which is good for the environment and people's access to technology. This approach streamlines land registration, helps preserve the environment, and promotes technological inclusion by easing the shift from paper records to digital ones.*
Subjects—Decentralized, Immutable, Blockchain, Security, Land Registration.

I. INTRODUCTION

In order to keep track of property, make commercial transactions easier, and prevent fraudulent activity, land ownership and rights registration is an essential duty of government entities across [1]. The allocation and ownership of land is regulated by strict legislation in several nations, which means that certain regulations for the sale of land and property must be followed [2]. Fraudulent transactions and inaccurate property records are only two of the many problems plaguing the present land registration system, which is regulated extensively [3]. Disputes and controversies might arise since sale contracts do not often clearly state who owns something, and instead depend on records from the past to confirm [4].

Land documentation systems in many countries are still paper-based and antiquated, which leads to inefficiencies and hazards such record loss or destruction [5]. Land records administration is inconsistent and uneven since some regions have centralized systems for documenting land while others continue to use antiquated paper-based approaches [6]. Disputes and a lack of transparency in land transactions may also arise from dependence on centralized databases controlled by government officials [7].

As a potential answer to these problems, blockchain technology has just emerged [8]. To overcome the drawbacks of centralized systems, blockchain technology, with its distributed and immutable record, provides certainty and transparency in land ownership transactions [9]. Blockchain technology improves the efficiency and reliability of real estate transactions by disentangling data storage and transaction execution from centralized authority [10]. By using the distributed ledger technology (blockchain), platforms like Ethereum make it possible to safely execute logic on distributed data [11].

Examining how blockchain technology, and Ethereum in particular, could transform land registration processes is the primary goal of this research. This study aims to provide a more efficient, transparent, and safe method of registering land ownership by comparing the advantages of blockchain technology with the shortcomings of existing centralized land registration methods. This research seeks to show that blockchain-based land registration systems may overcome the problems with conventional approaches. It will do this by analyzing real-life examples, collecting empirical data, and developing theoretical frameworks.
In addition, this study intends to add to the current body of knowledge by shedding light on the use and

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 159-167

Small Target, Big Impact: Unveiling EBSE YOLO FOR Foreign Object Detection

[1] **M. Niharika**, *Student, Department of CSE, DNR College of Engineering and Technology, nihaniharika967@gmail.com*

[2] **P. Santhi Priya**, *Student, Department of CSE, DNR College of Engineering and Technology, santhipotturi3005@gmail.com*

[3] **L. Teja**, *Student, Department of CSE, DNR College of Engineering and Technology, tejalokam@gmail.com*

[4] **B. Surya Vamsi**, *Student, Department of CSE, DNR College of Engineering and Technology, Suryavamsibandaru@gmail.com*

[5] **Mr. Bujjibabu Lingampalli**, *MTech, Assistant professor, Department of CSE, DNR College of Engineering and Technology, bujjibabudnr@gmail.com*

Abstract: *Due to its inability to identify small foreign objects, the electrified train system requires a highly accurate detection algorithm to ensure operational continuity and safety. This study presents an enhanced approach called EBSE-YOLO. Along electrified rails, it will help better identify small targets. As a result of using cutting-edge techniques such as ECA-Net to prioritize tiny targets, SPD-Conv to extract details, and EIOU loss function to align dimensions, EBSE-YOLO significantly improves detection accuracy while minimizing computational cost. Results for the proposed technique are excellent after extensive testing with various YOLOv5 configurations and other approaches, including Ghost CNN. Initial findings demonstrate that EBSE-YOLO attains a 97% mAP, and there is optimism that further enhancements, such YOLOv5 + Ghost CNN, might potentially obtain an even greater mAP. The effects of EBSE-YOLO on railway management and safety extend far beyond quantitative indicators of success. By using state-of-the-art methods and distinctive model structures, EBSE-YOLO not only improves microscopic target recognition but also sets the stage for continuous improvements to railway safety requirements. The ground-breaking work on object recognition algorithms designed for complex conditions that this study produces will greatly improve railway operations in terms of safety and efficiency.*
Few words: YOLOv5, ECA-Net, BiFPN, SPD-Conv, EIOU, small target, international.

I. INTRODUCTION

The safe and efficient transfer of people and goods is made possible by rail transit, and particularly by electrified railroads, which are an essential part of the modern transportation network. To maintain safe and reliable train operations, it is crucial to safeguard railroad systems against intrusion and conduct regular inspections for foreign items [1]. Plastic sheds and other non-native goods pose a significant risk to railroad safety because they interfere with train operations and communication networks. The consequences of these invasions, which may range from operational disruptions to full system failures, are catastrophic, so effective detection and mitigation strategies are critically required.

Conventional methods of train inspection, including human inspectors or integrated inspection vehicles, have certain limitations, such as not being able to identify problems in real time and leaving blind spots unchecked, which may lead to operational risks [2]. The modern safety standards for train inspections are too high because of the inherent unpredictability of foreign item intrusions. Authorities in the railroad industry are therefore seeking innovative solutions to enhance inspection capabilities along railway lines [2]. One such method is to examine extraterrestrial objects using unmanned aerial vehicles (UAVs) equipped with high-definition cameras [3]. Problems with automation have kept UAV-based inspection from gaining traction, despite its many advantages, such as better real-time monitoring and the removal of blind zones. Given these constraints, it is critical to enhance train safety procedures by creating smarter and more efficient methods of identifying foreign objects.

Deep learning algorithms and traditional target detection methods are the two primary avenues for artificial intelligence foreign object identification [4]. In place of traditional approaches beset by slow computation rates and insufficient accuracy, deep learning algorithms—particularly those built on convolutional neural networks (CNNs)—have emerged as the preferred choice for detection tasks [4]. Two primary varieties of deep learning-based target identification algorithms exist: one with two steps and one with one. Although two-stage algorithms are very accurate, they are not appropriate for scenarios requiring ꝶ6

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 226-233

Innovative Hybrid Model for Dissolved Oxygen Predictions to Optimize Water Quality in Intensive Aquaculture

[1] P Harika, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology,peruriharika12@gmail.com*

[2] Ch Revathi, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology,revathich2002@gmail.com*

[3] K Shanmukha S Chowdary, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology,shanmukh768@gmail.com*

[4] M Ruth Kumar, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology,ruthkumarm@gmail.com*

[5] Mr. K. Venkata Chandran, *M.Tech, Assistant Professor, Department of CSE, DNR College of Engineering and Techonology,chandran.kamani@gmail.com*

ABSTRACT: *This work suggests a hybrid model that combines Light Gradient Boosting Machine (LightGBM) and Bidirectional Simple Recurrent Unit (BiSRU) to effectively and correctly estimate dissolved oxygen (DO) levels in aquaculture settings. The significance of dissolved oxygen is determined and its levels in intensive aquaculture settings are predicted using the LightGBM algorithm after linear interpolation and smoothing methods are used to identify important parameters. To further improve BiSRU's predictive capabilities, an attention mechanism is used to provide different weights to its hidden states. Impressively, the model predicts changes in DO over a 10-day period with a stunning accuracy rate of 96.28% in only 122 seconds, showcasing its extraordinary ability. Because aquatic habitats are diverse, dynamic, and nonlinear, conventional techniques of estimating DO levels have their limitations. This methodology seeks to overcome these issues. Accurate DO prediction is crucial in aquaculture since optimum production is dependent on water quality maintenance. When it comes to improving the speed and accuracy of DO predictions, the suggested hybrid model is a great way to go. This will help with disease control and make aquaculture more financially sustainable. Non-linear, LightGBM, BiSRU, attention mechanism are terms used in the index.*

I. INTRODUCTION:

An important part of the world's food supply comes from aquaculture, or the growing of aquatic creatures. China is quickly becoming the leader in this field, producing more than 70% of the world's aquaculture output [1]. Dissolved oxygen (DO) is an important indication of water quality in aquaculture settings because of the vital role it plays in the metabolism and survival of aquatic species, which in turn affects the quality of aquatic commodities [2, 3].

It is crucial to keep DO levels at their ideal range to prevent stress, disease outbreaks, and mass death in farmed fish, shrimp, and other aquatic species. Failure to do so may result in significant economic losses [4, 5]. Therefore, for proactive control of water quality and sustainable growth of aquaculture, precise prediction of DO concentrations and trends is necessary [6].

As a result of heavy investment in research and the use of machine learning methods, dissolved oxygen prediction models have recently achieved remarkable strides forward. Many methods have been investigated, such as support vector regression, clustering techniques, extreme learning methods, wavelet transformations, deep belief networks, particle swarm optimization, principal component analysis, and grey correlation degree [7]-[13]. In order to help with well-informed decisions about aquaculture management techniques, these models try to improve the precision and effectiveness of DO prediction.

In order to help fish farmers, hatcheries, and researchers with water quality management, this project is concentrating on creating dissolved oxygen prediction models for intensive aquaculture settings. Improving forecasting accuracy, enabling real-time monitoring, and facilitating proactive intervention techniques to maintain ideal circumstances for aquatic species are all goals of the project, which aims to use deep learning and big dataset analysis. The research seeks to improve production efficiency, reduce risks, and encourage sustainable practices in aquaculture operations via precise DO forecast.

In summary, the introduction establishes the relevance of dissolved oxygen prediction in aquaculture, describes the current obstacles, and emphasizes the importance of this project in securing the sustainability of aquaculture systems and promoting efficient management techniques.

IOSR Journal of Engineering (IOSRJEN) www.iosrjen.org
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 178-188

Safeguarding Wildlife With Advanced Neural Networks and Real-time Alerts For Wild Animal Activity Detection

[1.] **R. Harshitha**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, rambhaharshitha2002@gmail.com*

[2.] *I.* **Keerthi,** *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, Keeethiinje7@gmail.com*

[3.] **T .Neveen Kumar**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, tnddytanukula@gmail.com*

[4.] *B.* **D V Siva Sai**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, bdvsiva018@gmail.com*

[5.] **Mrs. V. Navya Devi**, *M. Tech, Assistant Professor, Department of computer Science and Engineering, navyadevidnr@gmail.com*

ABSTRACT: *The creation of an effective monitoring model is the primary goal of this study, which seeks to alleviate the serious problem of animal assaults experienced by forestry workers and rural residents. In order to enhance safety warnings in woodland regions, the proposed network combines the Hybrid Visual Geometry Group (VGG)-19 with Bidirectional Long Short-Term Memory (Bi-LSTM). Its goals include animal type detection, movement monitoring, and the provision of up-to-the-minute position information. The model outperforms conventional techniques of surveillance by accurately detecting animals and their movement patterns with the integration of VGG-19 for feature extraction and Bi-LSTM for sequence learning. Additionally, an ensemble approach is used to improve accuracy and resilience by aggregating predictions from numerous separate models. To get perfect accuracy, it is recommended to investigate methods like as CNN+BiGRU, which significantly improve performance. An enhancement to the implementation is a Flask-built, user-friendly front end that allows for authentication feature testing during user testing. By combining state-of-the-art deep learning methods with user-centric design, this study presents a viable option for improving safety monitoring in rural and forested areas, therefore reducing the likelihood of animal attacks. VGG-Net, Bi-LSTM, convolutional neural networks, activity recognition, video surveillance, monitoring of wild animals, warning system are all terms that are used in the context of animal identification.*

I. INTRODUCTION:

The increasing number of human-wildlife encounters in recent years has highlighted the urgent need for new ways to reduce conflicts and make everyone's lives safer. Conflicts and dangers between people and animals have increased due to habitat encroachment, which is caused by the growth of cities and farms [1]. The development of efficient early warning systems is crucial for conservationists, lawmakers, and local populations to address these encounters in a timely manner by mitigating dangers and facilitating responses. Concerns about human-wildlife confrontations have recently gained traction, and one potential answer is the Wild Animal Activity Alerting System (WAAAS). The goal of WAAAS is to use state-of-the-art ML and DL algorithms to identify and alert humans when wild animals are in close proximity to human areas. This will help with proactive management tactics [2]. Waaas aims to provide accurate and timely warnings by using data from several sources, including photos, motion sensors, and sound recordings, to determine patterns that indicate the presence and behavior of animals [3].

Rising tensions between people and other forms of life, brought driven by factors like habitat loss and competition for few resources, highlight the critical need for such a system. Herbivore crop raids, animal predation, and even human assaults are all ways in which these conflicts show themselves. In particular, these occurrences endanger animal populations and derail conservation initiatives, in addition to endangering human lives and livelihoods [4]. As a result, more and more people are realizing that we need to do something to help animals and humans live together peacefully [5].

In this light, the creation of WAAAS is a giant leap forward in terms of improving security, reducing economic losses, and furthering conservation goals. Waaas aims to analyze signs of wild animal behavior with unparalleled precision and efficiency by applying state-of-the-art ML and DL algorithms [6]. This introduction explores the complex issues surrounding human-wildlife interactions, highlights the role of early warning systems in finding solutions, and outlines the goals and reach of WAAAS in reducing conflicts and promoting harmony.

(?)

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 199-211

DeepFake Face Detection Using Advanced Deep Learning Techniques

[1.] **Gorla.UdayPavan**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,udaypavan377@gmail.com*

[2.] **Thirumani. Naga Durga**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,thirumaninagadurga@gmail.com*

[3.] **Narina.Jagadeesh Kumar**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,kumarjagadeesh1908@gmail.com*

[4.] **Gollakoti.S.V.Manikanta**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,gollakotimanikanta@gmail.com*

[5.] **Ms. Siva SyamalaKorupuri**, *M. Tech, Assistant Professor, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,syamalakorupuri@gmail.com*

Abstract: *With a particular emphasis on the rapidly expanding field of deep fakes, this in-depth analysis explores the ever-changing terrain of deep learning applications. Innovations in domains such as computer vision, natural language processing, and machine learning have resulted from deep learning's seamless integration. Nevertheless, there is now serious cause for alarm about the proliferation of deep fakes, which are highly edited movies and photos. There are serious dangers in the online world due to the evil uses of this technology, which include revenge porn, financial frauds, celebrity impersonations, and false news. Famous people, politicians, and other popular personalities are easy prey for Deep Fake Detection. By using a variety of deep learning algorithms, such as InceptionResnetV2, VGG19, CNN, and Xception, this study thoroughly evaluates the creation and identification of deep fakes. Xception stands out as the most accurate algorithm in the assessment, which was carried out on a Kaggle deep fake dataset. The need for strong detection techniques to protect society from possible repercussions is growing as the number of harmful applications of deep fakes increases.*

Xception, CNN, Deep Learning, InceptionResnetV2, and VGG19 are some of the index phrases.

I. INTRODUCTION

The use of deepfake technology, which is powered by sophisticated machine learning algorithms, has made it possible to effortlessly superimpose one person's appearance onto another, resulting in very lifelike fake films and photographs. As a result, many are worried that deepfakes may be used for evil, such disseminating false information or influencing public opinion.

Scientists and engineers have begun using deep learning techniques to combat this rising danger by creating deepfake detection tools. The use of deep learning, and more specifically CNNs and RNNs, has shown potential for detecting deepfake content's artifacts and small discrepancies. These detection methods seek to differentiate between real and altered material by using the capabilities of neural networks to recognize intricate patterns and attributes.

Methods for detecting deepfakes have been refined thanks to a number of research efforts. Most notably, H. Li et al.'s study presented a deep learning-based approach to detect edited facial emotions in films by means of facial action units (Li et al., 2020). In addition, Rossler et al. (2019) suggested analyzing blinking patterns and small head movements using deep learning to find anomalies that may be deepfake material. The importance and urgency of tackling the issues presented by this quickly developing technology are underscored in this introduction, which delves into the growing area of deepfake detection using deep learning. The following sections explore various approaches, developments, and difficulties related to deepfake detection, providing insight into the continuous endeavors to protect digital media's authenticity in a world where artificial intelligence-generated manipulations are prevalent.

In light of the rising problem of deep fakes, or doctored films and pictures, this research investigates the potential uses of deep learning to combat this issue. The study highlights the necessity for strong detection techniques in light of the increasing harmful usage in false news, frauds, and privacy breaches. It investigates several algorithms on a Kaggle deep fake dataset, including InceptionResnetV2, VGG19, CNN, and Xception. Deep fakes, which are films and photos that have been successfully manipulated, are becoming more common and constitute a serious danger in many areas, such as the spread of disinformation and privacy breaches. In

20

INDIAN JOURNAL OF TECHNICAL EDUCATION

ISSN 0971-3034
Volume,12 Issue,1 April,2024

Enhancing Network Anamoly Detection with Bi-directional LSTM and CNN Hybrid Model's

1 Pataballa. Asritha Satya Durga, B.Tech Student, Department of CSE, DNR College of Engineering and Technology, satyaa7316@gmail.com

2 B. Naga Vara Prasad, B.Tech Student, Department of CSE, DNR College of Engineering and Technology, varaprasadbhogisetti@gmail.com

3 K. Bharath Kumar, B.Tech Student, Department of CSE, DNR College of Engineering and Technology, bharathkasani6415@gmail.com

4 Dr. B. V. S. Varma, B.E., M.Tech., Ph.D, Professor in CSE & Vice Principal, DNR College of Engineering & Technology, Bhimavaram, phdvarma@gmail.com

Abstract: There have been major security concerns brought about by the expansion of computer networks and the internet, which has transformed the way information is exchanged. In order to jeopardize the availability, integrity, and confidentiality of data, cyber criminals take use of weaknesses in these networks. The intricacy of threats and the sheer amount of data make anomaly detection in networks difficult, but essential, for network security. Using deep learning methods, this research aims to construct a computer network anomaly detection system. Our primary objective is to develop a CNN Bi-LSTM model, which stands for Convolutional Neural Network with Bidirectional Long Short-Term Memory. The objective is to optimize model performance while taking into account different hyperparameters and achieve high accuracy in spotting anomalies based on networks. An technique to network anomaly detection is to develop and train a CNN Bi-LSTM model. We try out several hyperparameters, such as learning rate, batch size, optimizers (Nadam, Adam, RMSprop, Adamax, SGD, Adagrad, Ftrl), and epochs. We train and evaluate using the UNSW-NB15 and NSL-KDD datasets. To measure the model's efficacy, performance measurements including accuracy and F1-score are used. In terms of accurately identifying network abnormalities, the CNN Bi-LSTM model performs quite well. Optimal design that optimizes detection accuracy is identified by rigorous examination of hyperparameters. We validate the superiority of our suggested methodology by comparing it with current anomaly detection methods. Finally, our research shows that deep learning, and more specifically CNN Bi-LSTM models, are effective at finding abnormalities in networks. To further enhance prediction accuracy, a hybrid CNN-LSTM approach is used, along with additional CNNs; the CNN-LSTM achieved an astounding 99% accuracy rate. With the help of Flask, we built a user-friendly front end that is simple to test, has built-in user authentication for safe access, and is both reliable and easy to use.

Index terms: NSL-KDD, CNN Bi-LSTM, Deep Learning, Machine Learning, and Network Intrusion Detection System.

INDIAN JOURNAL OF TECHNICAL EDUCATION

ISSN 0971-3034
Volume,12 Issue,1 April,2024

Highway Road Accident Identification and Tracking System with Image Processing

1 Manthena vara prasad, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India. Varaprasad2605@gmail.com

2 Ch prasanna kumar, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India. prasannakumarchitikela@gmail.com

3 Kodi siva rama krishna, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India. kodisivaramakrishna143@gmail.com

4 Dr. A Rama Murthy M.Tech, PhD.,, Professor, Department of CSE, DNR College of Engineering an Technology Bhimavaram, Andhrapradesh, India. ram111.sai@gmail.com

Abstract:

Advancement of Artificial Intelligence (AI) technologies and the availability of high-end computing devices create scope for the implementation of intelligent transport infrastructure for road safety .This system proposes accident detection on highways using more robust, less complex, and more accurate by Yolov8,and working with yolo v9. It is used to detect the vehicle on road , collision detection when an accident occur, track the vehicle to save the human life through quick Image processing by informing near police station and hospital. Real-time Monitoring on day time as well as night time. This system is developed by Python Full stack

Index terms–YOLOV8, YOLOV9, Police station, Hospital, Alert System, Python Full Stack

1. INTRODUCION

The purpose of the Road Accident Prediction and Alert System using Image Processing with YOLO project is to enhance road safety through the implementation of an intelligent system for accident detection and response using YOLOv8 and real-time monitoring technologies. The current Existing algorithm has less intersection over union and less accuracy in multi object in one grid cells. The drawback was not proper alert using notification services in real-time, take high time complexity .Using so many IOT devices weather conditions like poor lighting or other environmental factors can affect the accuracy of object detection algorithms like yolo v3, v5 ,v7.And yolo v8 can't have proper alert system. I completely research on give image processing on that time yolo a extraordinary Algorithm

22

INDIAN JOURNAL OF TECHNICAL EDUCATION

ISSN 0971-3034
Volume,12 Issue,1 April,2024

Enhancing E-Voting Security with Facial Recognition

1 J Haritha, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India. jonnagantiharitha@gmail.com

2 K Venkatesh, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India. kailavenkatesh35@gmail.com

3 G Tarun Venkat Rama Varma, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India. tarunvarma139@gmail.com

4 Dr Satyanarayana Gaddada,
Professor, Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India.
sreesatyam@yahoo.in

Abstract: By using blockchain technology, our smart voting solution guarantees security and transparency, transforming conventional voting methods. The solution improves security by precisely verifying people based on their unique facial traits using powerful face recognition driven by image processing. Every voter's identity is protected from manipulation and duplicate votes are prevented via the system's multi-factor authentication systems, which include face recognition and cryptographic techniques like SHA-256. Built on top of the Django framework, our system effortlessly handles large numbers of users, making it easy for administrators and voters alike to utilize.

Subjects covered include: smart voting system, blockchain technology, face recognition, security, and SHA-256.

INTRODUCION

In the dynamic field of voting technology, new developments are always being pursued to guarantee the openness and reliability of democratic procedures. This introduction provides a high-level summary of a new smart voting system that is going to revolutionize the way we vote. This solution provides unrivaled efficiency, transparency, and security by combining state-of-the-art technology including cryptographic algorithms, face recognition, and blockchain. It simplifies administrative tasks and guarantees voter identity identification using the Django framework. This introductory section lays the groundwork for a comprehensive examination of how this groundbreaking voting system overcomes the limitations of traditional voting methods, allowing for a more stable and inclusive democratic future.

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 40-50

Gas detection using 3D-CNN and autoencoder on hyperspectral images

[1] **G. Renuka,** *B.Tech Student, Department of CSE, DNR College of Engineering and Technology, renukagoluguri@gmail.com*

[2] **K. Sai Manikanta**, *B.Tech Student, Department of CSE, DNR College of Engineering and Technology, saimanikantakoyyani@gmail.com*

[3] **S. Uday Karthik**, *B.Tech Student, Department of CSE, DNR College of Engineering and Technology, udaykarthik203@gmail.com*

[4] **K. Ayyappa Naga Sekhara Reddy**. *B.Tech Student, Department of CSE, DNR College of Engineering and Technology, Sekharareddynani14@gmail.com*

[5] **Dr. B. V. S. Varma**, *B. E., M. Tech., Ph.D, Professor in CSE & Vice Principal, DNR College of Engineering and Technology, Bhimavaram, phdvarma@gmail.com*

Abstract: *The detection of gas emission levels is a crucial problem for ecology and human health. Hyperspectral image analysis offers many advantages over traditional gas detection systems with its detection capability from safe distances. Observing that the existing hyperspectral gas detection methods in the thermal range neglect the fact that the captured radiance in the longwave infrared (LWIR) spectrum is better modeled as a mixture of the radiance of background and target gases, we propose a deep learningbased hyperspectral gas detection method in this article, which combines unmixing and classification. The proposed method first converts the radiance data to luminance-temperature data. Then, a 3-D convolutional neural network (CNN) and autoencoder-based network, which is specially designed for unmixing, is applied to the resulting data to acquire abundances and endmembers for each pixel. Finally, the detection is achieved by a three-layer fully connected network to detect the target gases at each pixel based on the extracted endmember spectra and abundance values. The superior performance of the proposed method with respect to the conventional hyperspectral gas detection methods using spectral angle mapper and adaptive cosine estimator is verified with LWIR hyperspectral images including methane and sulfur dioxide gases. In addition, the ablation study with respect to different combinations of the proposed structure including direct classification and unmixing methods has revealed the contribution of the proposed system And also it include an ensemble model named CNN+BiGRU which got 100% accuracy for enhanced Autoencoder-Based Gas Detection in Hyperspectral Images. A user-friendly Flask framework with SQLite integration facilitates signup and signin for user testing, ensuring practical usability in deep learning applications.*

Index terms - *Autoencoders, convolutional neural networks (CNNs), gas detection, hyperspectral unmixing.*

I. INTRODUCTION

Imaging spectroscopy has been used by physicists and chemists for more than three decades to identify materials and their compositions. The concept of hyperspectral remote sensing started in the mid-80s and has been widely used by geologists for mapping minerals to this day [1]. The detectability of the material is determined depending on the spectral range of the spectrometer, its spectral resolution, the abundance of the material, and the strength of the absorption properties in the measured wavelength region [2]. The gas leaks in particular in developed countries in the last decade were one of the crucial environmental problems. Some gases are harmful to the environment and contribute to global warming. They present both short-term risks such as explosions and long-term risks such as cancer to workers or people living close to the leaking facility. To minimize these effects, environmental authorities need to monitor chemical and industrial plants to control gas emission levels. Infrared remote sensing technology, which offers many advantages over traditional gas detection systems, is one of the proposed solutions for this aim as such solutions allow monitoring the scene from a safe distance [3].

To this end, forward-looking infrared hyperspectral cameras are placed in potentially dangerous areas for gas detection from safe distances. These cameras, which are designed to capture images at different wavelengths, can operate in two different regions, which involve medium-wave infrared (3–5 μm) and long-wave infrared (7–14 μm) bands. Until now, these cameras have been utilized for the detection of different gases such as carbon dioxide, propane, methane, sulfur, butane, freon, ammonia, difluoroethane, diethyl ether, sulfur hexafluoride, and phosgene [4], [5], [6], [7]. The detection of gases in such studies is mainly achieved by

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 51-60

An investigation of dark net traffic to see how updated tor traffic effects onion service traffic categorization

[1.] **Ippili Sravya**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,Bhimavaram, Andhra Pradesh, India, ippilisravya35@gmail.com*
[2.] **Kanna Teja**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,Bhimavaram, Andhra Pradesh, India, tejakanna949@gmail.com*
[3.] **Battina Gopi Chand**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, Bhimavaram, Andhra Pradesh, India,battinagopichand0@gmail.com*
[4.] **Garuvu Pavan**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY,Bhimavaram, Andhra Pradesh, India, pavanhcl22@gmail.com*
[5.] **Dr. A Rama Murthy**, *M.Tech, PhD.,Professor, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, Bhimavaram, Andhra Pradesh, India, ram111.sai@gmail.com*

Abstract:*The project centers on analyzing network traffic within darknet environments, such as the Tor network, to understand how modifications to Tor traffic impact the classification of Onion Service traffic. It acknowledges that while Tor and Onion Services are designed for privacy and anonymity, they can be misused, emphasizing the need for better understanding and monitoring. The project has three primary goals: identifying Onion Service traffic within Tor traffic, assessing the effects of traffic modifications, and pinpointing influential features in the classification process. The project likely employs machine learning and data analysis techniques to achieve its objectives, with a particular focus on analyzing network traffic patterns within the Tor network. The project's findings may have implications for privacy, security, and network monitoring, highlighting the delicate balance between maintaining user privacy and ensuring network security.*
***Index terms** -Traffic classification, machine learning, onion services, tor, anonymity, feature selection.*

I. INTRODUCTION

Tor [1] is an anonymity network that hides the identity of its users by routing the traffic through multiple intermediary nodes. Tor also supports the provision of anonymous services known as Onion Services (also known as hidden services) with .onion as the top-level domain name. Tor's ability to act as a censorship circumvention tool has encouraged security experts, network defenders, and law enforcement agencies to identify Tor traffic from other encrypted and non-encrypted traffic [2], [3]. For example, [3], [4] tried to classify Tor traffic from non-Tor Traffic, [2], [5] tried to classify the applicationtypes in Tor traffic, and [6] tried to classify Tor traffic from other anonymity network traffic such as I2P traffic and Webmix Traffic. However, in this work, we intend to explore the distinguishability of Onion Service traffic from standard Tor traffic using traffic analysis. We formulate three research questions to act as a foundation for our work.

Onion Services have been used to host illegal websites, and more recently, they have been used as Command and Control (C&C) servers for botnets [7], [8]. Therefore, from the perspective of governments and law enforcement agencies, they want to track and shut down such services and regulate the Onion Service traffic [9]. Even businesses might find it useful to restrict access to such websites in order to protect their systems from potential bad actors (e.g. hackers) and attacks. As a result, having techniques for identifying Onion Service traffic can be useful for two main reasons; 1. Such techniques can act as a stepping stones for fingerprinting of Onion Services. 2. They can be useful to restrict Onion Service traffic in sensitive and confidential systems.

There are certain techniques that can be implemented in Tor to change its traffic patterns. Introducing padding [10], using dummy bursts and delays [11], and splitting the traffic [12] are a few examples of such techniques. These techniques1 have been developed with the intention of obfuscating the information leakage of Tor traffic. The main importance of answering RQ2 is that we can confirm whether our findings from RQ1 will hold true as and when such modifications are introduced to the Tor traffic. If we are able to still distinguish Onion Service traffic, it is an indication that these modifications are not effective in masking Onion Service traffic, if they are realised in the future. If the modifications do affect the Onion Service classifiability, it opens up questions about the validity of prior works, such as [3] and [6] in a setting with those modifications implemented.

Therefore, we focused on features that are focused on timing statistics. (ii) Also, we use features that have a proven track record of working well in revealing patterns in network traffic [13]. However, we use three

95

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 61-68

Machine Learning and Blockchain Based Real-Time Attendance Monitoring

[1] **B.Tejaswi Ratna Sai Malika**, *B.Tech Student, Department of CSE, DNR College of Engineering and Technology, tejaswiballa18@gmail.com*

[2] **S.ManojKumar**, *B.Tech Student, Department of CSE, DNR College of Engineering and Technology,manojkumar.srirapu@gmail.com*

[3] **S.Mahesh Veera Kumar Swamy**, *B.TechStudent, Department of CSE, DNR College of Engineering and Technology, salipallimvkumarswamy@gmail.com*

[4] **T.Jeevan Roy**, *B. Tech Student, Department of CSE, DNR College of Engineering and Technology, tadepallijeevan46@gmail.com*

[5] **G Satyanarayana,** *M.Tech.,Ph.D.,Professor, Department of CSE, DNR College of Engineering and Technology,sreesatyam@yahoo.in*

Abstract: *In the contemporary era of heightened emphasis on authentication, facial recognition technology is increasingly pervasive across numerous fields. With the imperative for swift and secure authentication methods intensifying in the information age, image processing innovations like OpenCV have amplified society's reliance on facial recognition. Harnessing the security capabilities of blockchain, this paper proposes the development of a blockchain-secured Attendance Monitoring System, integrating open-source computer vision (OpenCV) for facial detection. This system aims to streamline attendance procedures while fortifying security measures. By leveraging OpenCV to analyze live video feeds from cameras, student faces will be identified, and attendance records will be automatically generated, capturing entry times. Crucially, utilizing blockchain ensures that attendance data is securely stored and impervious to tampering. This innovative solution not only enhances efficiency but also guarantees the integrity and accessibility of attendance records across the distributed blockchain network.*

Index Terms—authentication, automation, blockchain, face recognition, OpenCV

I. INTRODUCTION

Attendance monitoring is a critical aspect of organizational management, particularly in educational institutions where tracking student participation is essential for various administrative and academic purposes. Traditionally, institutions have relied on manual methods such as calling out names and recording attendance, which are not only inefficient but also prone to inaccuracies [1]. However, advancements in technology have provided alternative solutions, including biometric systems like fingerprint recognition, RFID card readers, and iris scans, aiming to improve accuracy and efficiency [2].

Despite the adoption of biometric systems, certain limitations persist. For instance, RFID card readers can be susceptible to misuse, as there is no foolproof way to ensure that the card is being used by the assigned individual [3]. This opens up the possibility of attendance fraud, where one student may use multiple cards to mark the attendance of absent peers. Additionally, other biometric identification methods such as fingerprinting and iris scans may not be entirely feasible due to technical constraints and performance issues [4].

In light of these challenges, there is a growing recognition of the potential of facial recognition technology as a viable solution for attendance monitoring. Unlike other biometric methods, facial recognition offers the advantage of non-intrusiveness and ease of use, making it practical for large-scale deployment in educational settings [5]. By accurately matching a human face to a digital image, facial recognition systems have the potential to streamline attendance procedures and enhance overall efficiency.

Furthermore, the increasing enrollment rates in educational institutions have heightened the pressure on professors and administrators to effectively manage and monitor attendance. Manual methods are becoming increasingly unsustainable in the face of burgeoning student populations, necessitating automated and scalable solutions [6]. Moreover, the issue of document falsification, particularly concerning graduation records, poses a significant challenge in various countries [7]. In this context, blockchain technology emerges as a promising tool for ensuring the integrity and authenticity of attendance records.

Blockchain, the underlying technology behind cryptocurrencies like Bitcoin, offers a decentralized and immutable ledger for recording transactions. By storing attendance records on a distributed blockchain network, organizations can mitigate the risks associated with data manipulation and unauthorized access [8]. The

26

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 76-89

Enhanced Drowsiness Detection Accident Prevention System via Facial Features

[1.] **M. Teja**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, tejam500@gmail.com*

[2.] **G. Surekha**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, surekharaj2996@gmail.com*

[3.] **Y. Yamini Priyanka**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, priyankayarramsetti10@gmail.com*

[4.] *N.* **Mehar Jyothi**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, meherjyothinimmala@gmail.com*

[5.] **B. Nandan Kumar**, *M.Tech, Assistant Professor, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, dnrnandan@gmail.com*

Abstract: *Drowsiness and intoxication are significant contributors to road accidents, posing a serious threat to public safety. This paper proposes a comprehensive system aimed at preventing fatal accidents by proactively alerting tired or emotionally distressed drivers in real-time. The system utilizes cutting-edge technologies to continuously monitor the driver's facial expressions, detecting signs of drowsiness or extreme emotional changes such as anger. Upon detection, the system takes control of the vehicle, initiates emergency measures, and alerts the driver through alarms, ensuring the safety of all occupants.*

To achieve this, the proposed system integrates with the vehicle's electronics, enabling seamless tracking of vital statistics and providing more accurate results. Real-time image segmentation and drowsiness detection are implemented using advanced machine learning methodologies. Specifically, Support Vector Machine (SVM), K Nearest Neighbors (KNN) Decision Tree (DT) and Naïve Bayes algorithms are employed for live prediction.

The foundation of the system lies in its ability to monitor and interpret facial landmarks, extracting the driver's state of expression to determine potential dangers. By continuously analyzing facial features, the system aims to identify signs of fatigue or intense emotional shifts accurately. This approach ensures a proactive response, reducing the risk of accidents caused by impaired driving conditions.

The effectiveness of the proposed system was evaluated under variable luminance conditions to simulate diverse driving environments. The algorithm showcased remarkable performance, outperforming existing research in terms of accuracy. The results demonstrated an impressive 83.25% success rate in detecting facial expression changes associated with drowsiness or extreme emotions.

Index Terms - *Artificial Intelligence, Support vector Machine, Anomaly Detection*

I. INTRODUCTION

Drowsiness is one of the primary drivers of genuine car crashes in our day-by-day lives. As indicated by the National Highway Traffic Safety Administration, around 150 individuals are murdered in the United States every year due to driver tiredness. 71,000 harmed and $12.5 billion in misfortunes [1]. Another report [2] brought up that the US government and organizations spend about $60.4 billion every year on mishaps identified with drowsiness, and due to drowsiness, it adds cost buyers about $16.4 billion Property harm, wellbeing cases, time and efficiency misfortunes. Drive. In 2010, the National Sleep Foundation (NSF) detailed that 54% of grown-up drivers felt sluggish while driving a vehicle, and 28% were, in reality, snoozing. Immense setbacks, wounds, and property harm brought about by drowsiness require critical strides in building up a robust framework that can identify drowsiness and make the right move before a mishap happens. The US Department of Transportation has additionally gained ground in assembling savvy vehicles to avoid such mishaps [2]. As individuals become progressively keen on wise transportation frameworks, developing a robust and down-to-earth sluggishness recognition framework is a critical advance. A great deal of research is at present in progress. Following these efforts, our investigation is motivated by the quantifiable importance of drowsiness-related mishaps and provides an improved and precise technique for identifying drowsiness. While ongoing research has shown promising progress, some center issues still need to be addressed. They use the driver's behavior or physiological changes and the vehicle's reactions to the driver's behavior to detect drowsiness. Although each strategy has its advantages and characteristics, it also has drawbacks that make it practical and effective. Conduct estimations are visual data of the driver and are greatly influenced by lighting conditions, the nature of

22

IOSR Journal of Engineering (IOSRJEN) www.iosrjen.org
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 102-111

Classifying Many Types of Cancer Using CT/MRI Images Based On Learning Without Forgetting -Powered Deep Learning Approaches

[1]**M. Durga Sujana**, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, madduridurgasujana@gmail.com*

[2]**G. Muruganesh Kumar**, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, muruganeshkumar@gmail.com*

[3]**P. Sivasai**, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, p.sivasai8008@gmail.com*

[4]**M. Balu Chaitanya Teja**, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, balutej162@gmail.com*

[5]**Dr. B V. Ram kumar**, *M.E., Ph.D., Professor, Department of CSE, DNR College of Engineering and Techonology, bvrk.bonam@gmail.com*

Abstract: *In this research, we propose leveraging Artificial Intelligence (AI), specifically deep learning models, for the automated detection of various types of cancer, including lung, brain, breast, and cervical cancer. We employ Convolutional Neural Networks (CNNs) such as VGG16, VGG19, DenseNet201, MobileNetV3 (both small and large variants), Xception, and InceptionV3, utilizing transfer learning from pre-trained models like MobileNet, VGGNet, and DenseNet. Bayesian Optimization is employed to optimize hyperparameters, ensuring effective model performance. To address potential issues with transfer learning, we implement Learning without Forgetting (LwF), which preserves original network capabilities while enhancing classification accuracy on new datasets. Our experiments demonstrate superior accuracy compared to existing techniques, with MobileNet-V3 small achieving 86% accuracy on the Multi Cancer dataset. To further enhance performance, we explore prediction techniques using Xception and InceptionV3, aiming for an accuracy of 90% or higher. Additionally, we propose an extension to build a user-friendly front-end using the Flask framework, facilitating user testing with authentication. This research showcases the potential of AI-driven cancer detection, offering promising avenues for improved early diagnosis and treatment outcomes.*

INDEX TERMS *Cancer, convolutional neural network (CNN), pretrained models, Bayesian optimization, transfer learning, learning without forgetting, VGG16, VGG19, DenseNet, mobile net.*

I. INTRODUCTION

Cancer is a complex and pervasive disease that arises from abnormal cellular growth and proliferation, leading to potentially life-threatening consequences if left unchecked [1]. It stands as one of the most significant global health challenges, with its impact extending across all demographics and regions. According to recent statistics, cancer ranks as the leading cause of death worldwide, underscoring the urgent need for effective detection, diagnosis, and treatment strategies [2].

The origins of cancer are multifaceted, often stemming from a combination of genetic predisposition and environmental factors. Behavioral attributes such as high body mass index (BMI), tobacco and alcohol consumption, exposure to physical carcinogens like ultraviolet (UV) radiation, and ionizing radiation contribute significantly to cancer development [3]. Additionally, factors like chronic inflammation, infectious agents, and hormonal imbalances can influence carcinogenesis [4]. Consequently, the spectrum of cancer types is vast, affecting various organs and tissues in the body [5].

Among the common sites for cancer development are the lungs, breasts, brain, colon, rectum, liver, stomach, skin, and prostate [6]. Each cancer type presents distinct clinical features and symptoms, ranging from discomfort and fatigue to respiratory issues, bleeding, and weight loss [7]. Given the diverse manifestations of cancer, early detection becomes paramount for timely intervention and improved prognosis [8].

Clinicians rely on a combination of diagnostic modalities to identify and characterize cancerous lesions, including physical examinations, laboratory tests, imaging techniques, and biopsies [9]. Among these, medical imaging plays a crucial role in visualizing internal structures and detecting abnormalities indicative of cancer [10]. Technologies such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) offer comprehensive views of anatomical structures, facilitating the localization and assessment of tumors [11].

29 30
28

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 190-200

Optimizing Credit Card Fraud Detection Using Deep Learning By Smote-Enn Technique

[1] Moturi Santhi Raju, *B.Tech, Department of CSE, DNR College of Engineering and Technology, santhiraju32@gmail.com*

[2] Matta Reena, *B.Tech, Department of CSE, DNR College of Engineering and Technology, reenamatta77@gmail.com*

[3] Pavurala Pavan Kumar, *B.Tech, Department of CSE, DNR College of Engineering and Technology, pavuralapavan146@gmail.com*

[4] Kolli Sai Kiran, *B.Tech, Department of CSE, DNR College of Engineering and Technology, kollisaikiran6234@gmail.com*

Mr. B.Nandan Kumar, *M.Tech, Assistant Professor, Department of Computer Science and Engineering, dnrnandan@gmail.com*

ABSTRACT: *Credit cards play an essential role in today's digital economy, and their usage has recently grown tremendously, accompanied by a corresponding increase in credit card fraud. Machine learning (ML) algorithms have been utilized for credit card fraud detection. However, the dynamic shopping patterns of credit card holders and the class imbalance problem have made it difficult for ML classifiers to achieve optimal performance. In order to solve this problem, this paper proposes a robust deep-learning approach that consists of long short-term memory (LSTM) and gated recurrent unit (GRU) neural networks as base learners in a stacking ensemble framework, with a multilayer perceptron (MLP) as the meta-learner. Meanwhile, the hybrid synthetic minority oversampling technique and edited nearest neighbor (SMOTE-ENN) method is employed to balance the class distribution in the dataset. The experimental results showed that combining the proposed deep learning ensemble with the SMOTE-ENN method achieved a sensitivity and specificity of 1.000 and 0.997, respectively, which is superior to other widely used ML classifiers and methods in the literature. Next we introduce advanced ensemble models, including Stacking and Voting Classifiers, evaluating them on both original and SMOTE-ENN datasets. Additionally, a Flask framework with SQLite integration enables user signup, signin, and testing for enhanced project functionality and user interaction.*

Index terms *- Credit card, deep learning, ensemble learning, fraud detection, machine learning, neural network.*

I. INTRODUCTION

Information technology advancements have significantly impacted the financial sector, leading to the broad adoption of electronic commerce (e-commerce) platforms. Also, the recent outbreak of the novel coronavirus (COVID-19) pandemic has further shown the need for a more digital world and further expanded the e-commerce industry [1], [2]. One of the major issues associated with modern e-commerce is the high cases of credit card fraud [3]. Also, in the last decade, there has been an increase in credit card fraud, which is a huge burden on financial institutions [4]. The increased credit card fraud rate is associated with the expansion of e-commerce and increased online transactions. Therefore, credit card fraud detection (CCFD) is crucial for financial companies to avoid losses.

Artificial intelligence (AI) and machine learning applications in the financial sector can produce excellent results for companies, such as improved efficiency, reduced operational cost, and enhanced customer satisfaction [5]. Several ML-based systems have been developed to detect credit card fraud. For example, Malik et al. [6] studied the use of hybrid models in CCFD. The hybrid models were achieved by combining a variety of ML algorithms, including extreme gradient boosting (XGBoost), random forest, adaptive boosting (AdaBoost), and light gradient boosting machine (LGBM). The experimental results indicated that the hybrid model based on AdaBoost and LGBM obtained the best classification performance. In a similar research work, Alfaiz and Fati [7] conducted a performance evaluation of ML classifiers and data resampling techniques for detecting credit card fraud. The classifiers used in the study include LGBM, XGBoost, random forest, categorical boosting (CatBoost), logistic regression, and naïve Bayes. The results indicated that the CatBoost classifier integrated with a k-nearest neighbor-based undersampling technique performed better than the other methods.

29

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 141-149

Implementing a Blockchain- Based Evidence Protection System

[1] **V. Jyothi sri,** *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, vurajyothisri@gmail.com*

[2] **Ch. Siddhartha**, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, chanapathisiddhartha@gmail.com*

[3] **T. Malleswararao**, *B.Tech student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, tirumanimalleswararao@gmail.com*

[4] **A. Revathi**, *B.Tech student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, andanalapallirevathi@gmail.com*

[5] **Mr. K. Surya Ram Prasad**, *M. Tech, Assistant Professor, Department of CSE, DNR College of Engineering and Technology, surya.dnrcet@gmail.com*

Abstract: *This paper presents an innovative solution, the Implementing a Blockchain-Based Evidence Protection system, designed to address critical challenges in contemporary legal and investigative practices. Leveraging blockchain technology, specifically Ethereum, the EPS ensures the integrity, authenticity, and security of evidence throughout its lifecycle. By employing cryptographic methods, timestamps, and smart contracts, the system establishes a tamper-proof, transparent, and decentralized platform for evidence management. Through digital timestamps and distributed ledger technology, the EPS creates an immutable record of evidence, eliminating vulnerabilities associated with centralized systems. Smart contracts automate processes such as access control and chain of custody, enhancing security and transparency. Encryption and hashing techniques safeguard sensitive information while enabling verification of integrity. Overall, the System offers a comprehensive solution to the complexities of evidence management in modern legal environments, providing confidence in the reliability and trustworthiness of stored evidence.*
Index Terms: Evidence Protection, Blockchain, Ganache, Metamask, SHA-256

I. INTRODUCTION

In contemporary legal and investigative landscapes, the management and protection of evidence stand as paramount pillars of the justice system. Ensuring the integrity, authenticity, and security of evidence is not only essential during the investigation phase but also crucial in maintaining the trust and reliability of the legal process [1]. However, traditional methods of evidence management have faced significant challenges, ranging from vulnerabilities to tampering, unauthorized access, and a lack of transparency [2].

Conventional approaches to evidence management often relied on centralized databases or physical documentation, which inherently carried vulnerabilities such as data tampering and unauthorized alterations due to the absence of robust verification mechanisms [3]. These weaknesses underscored the urgent need for a more secure and tamper-proof solution that could safeguard sensitive information effectively [4].

To address these challenges, this paper proposes the Implementing a Blockchain-Based Evidence Protection system that leverages blockchain technology. The integration of blockchain aims to enhance the security, reliability, and transparency of managing evidence across various domains, including legal, financial, and sensitive data management [5].

The System seeks to establish a robust system for protecting evidence by harnessing the decentralized structure of blockchain technology. By incorporating cryptographic methods, timestamps, and smart contracts, the system aims to create a platform that ensures evidence remains tamper-proof, transparent, and authentic throughout its lifecycle [6]. This approach not only safeguards the integrity of stored evidence but also enhances the overall trustworthiness of the legal process [7].

In selecting a suitable blockchain platform for the System, Ethereum emerges as a prominent choice due to its robust features and active developer community. Ethereum's support for smart contracts, decentralized applications (DApps), security enhancements, and compatibility with various blockchain projects makes it well-suited for building and enhancing the proposed Implementing a Blockchain-Based Evidence Protection system[8].

The existing systems for evidence management and protection in legal and investigative processes face several significant challenges. Traditional methods often rely on centralized databases, which can be vulnerable to tampering and manipulation. Unauthorized access and alterations compromise the integrity of evidence, raising doubts about its reliability in legal proceedings [9].

30

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 201-213

Predict national level self harm trends using social media

[1] Pala Sandeepthi, *B.Tech, Department of CSE, DNR College of Engineering and Technology, sandeepthipala2001@gmail.com*
[2] Guttula Harini Srilekha, *B.Tech, Department of CSE, DNR College of Engineering and Technology, hariniksrilekha173@gmail.com*
[3] Pasupuleti Venkatesh, *B.Tech, Department of CSE, DNR College of Engineering and Technology, pasupulativenkatesh065@gmail.com*
[4] Geddam Sandeep, *B.Tech, Department of CSE, DNR College of Engineering and Technology, sandeepgeddam1@gmail.com*
[5] Mr. BujjiBabu Lingampalli, *M.Tech, Assistant Professor, Department of CSE, DNR College of Engineering and Technology, bujjibabudnr@gmail.com*

Abstract: *Self-harm poses a significant global challenge, impacting both individuals and economies, with its prevalence escalating alongside technological advancements and urban expansion, particularly in developing countries. Traditional forecasting methods relying on historical data may prove inadequate in certain regions, hindering timely comprehension and projection of self-harm trends. To address this gap, the FAST project utilizes social media data and a suite of machine learning algorithms, including ARIMA, Bayesian Ridge, SVR, XGBoost, Random Forest, CatBoost, Decision Tree, and Voting Regressor. By leveraging these advanced techniques, FAST offers real-time insights into emerging self-harm trends, complementing conventional forecasting approaches. Moreover, the project employs ensemble methods to enhance predictive accuracy, combining the strengths of individual models for a more robust analysis. This innovative approach enables a deeper understanding of the complex interplay between behaviors and societal influences driving self-harm, empowering policymakers and stakeholders with actionable insights to implement proactive interventions on a global scale.*

Index Terms: Self-harm, nowcasting, forecasting, online social networks, cross-lingual text classification.

I. INTRODUCTION

Self-harm, characterized by intentional self-poisoning or self-injury regardless of suicidal intent, presents a significant global public health concern [1]. While its prevalence is evident across diverse demographic groups, it notably affects developing countries at an alarming rate [2]. Studies have revealed a staggering 77% of suicide cases occurring in low- and middle-income countries, a trend closely linked to rapid technological advancements and urbanization in these regions [3,4].

The ramifications of self-harm extend beyond individual suffering to substantial economic burdens, primarily due to diminished long-term labor productivity [5]. Therefore, effective monitoring and forecasting of self-harm trends at the population level are crucial for informing timely interventions and policy decisions [6]. Understanding the underlying factors driving self-harm behaviors and predicting future trends is imperative for implementing targeted strategies aimed at prevention and intervention [7].

Monitoring and forecasting self-harm trends pose challenges rooted in data availability and methodological approaches. Traditional methods relying on administrative reports from healthcare facilities suffer from delays in data collection and reporting, impeding timely intervention efforts [8]. Moreover, these approaches may offer only a partial view of self-harm behaviors, overlooking nuances in motivation and context [9].

Historical statistics alone may not capture the intricate interplay of individual and external factors influencing self-harm behaviors [10]. Recent research has underscored limitations in using Google Trends data as a proxy measure for self-harm behaviors, citing concerns about its reliability and generalizability [11]. The undisclosed algorithm governing Google Trends data and assumptions about user behavior present significant challenges to its utility as a reliable indicator of self-harm trends [12].

Advancements in machine learning techniques present new opportunities for enhancing the monitoring and forecasting of self-harm trends. By leveraging social media data and advanced algorithms, researchers can gain real-time insights into self-harm behaviors and sentiments [13]. Machine learning models such as ARIMA, Bayesian Ridge, SVR, XGBoost, Random Forest, CatBoost, Decision Tree, and Voting Regressor have shown promise in predicting self-harm trends with greater accuracy [14].

31

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 168-177

A Cyber Threat Alert System for Smart Consumer Electronics Network

[1]**Yedida V S P K Prasanna**, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, yvskrishna159@gmail.com*
[2] **P Rupanjali Devi**, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, rupanjalidevi11@gmail.com*
[3]**V Surya Teja**, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, suryateja1549@gmail.com*
[4]**Ch Siva Ramakrishna**, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, ch.sivaram.sk@gmail.com*
[5]**Mr. K. Venkata Chandran**, *M. Tech, Assistant Professor, Department of Computer Science and Engineering, chandran.kamani@gmail.com*

Abstract: *This project aims to tackle the cybersecurity challenges prevalent in smart CE networks, recognizing the inadequacy of conventional security measures. Additionally, it addresses the dynamic nature of IoT-enhanced CE networks, which demand adaptable security solutions. This project introduces a pioneering Intrusion Detection System (IDS) tailored for IoT-enabled smart Consumer Electronics (CE) networks. Furthermore, it emphasizes the need for an IDS that can seamlessly integrate into the evolving CE landscape, promoting user-friendly implementation. The IDS leverages Deep Learning techniques to precisely identify various attack types within the smart CE network. Moreover, it underlines the importance of real-time threat detection to prevent network vulnerabilities. Simulation results, utilizing the CICIDS-2018 dataset, substantiate the robustness and suitability of the proposed approach for safeguarding next-generation smart CE networks. Additionally, it highlights the significance of empirical validation in ensuring the reliability of the security system. And also, we enhanced the Intrusion Detection System (IDS) by incorporating a Convolutional Neural Network (CNN) and a hybrid model combining CNN with Long Short-Term Memory (LSTM). This hybrid approach strategically combines the strengths of both models, achieving remarkable accuracy and outperforming other algorithms with a perfect 100% accuracy rate.*
Index terms - *Consumer Electronics, Cyber-Attacks, Deep learning, Internet of Things, Intrusion Detection System, Software-Defined Networking.*

I. INTRODUCTION

The Internet of Things (IoT) is a network of devices embedded with software programs and sensors that utilize the Internet to communicate data. The amalgamation of IoT into traditional Consumer Electronics (CEs) has revolutionized it into next-generation CEs with higher connectivity and intelligence [1,2,5]. This improved data availability and automatic control in the CE network are made possible by the connectivity of sensors, actuators, appliances, and other consumer devices [1]. Nevertheless, CE devices connections are now remotely accessed anytime, anywhere in the world with the utilization of computing devices, including laptops, smartphones, and smartwatches, regardless of the network to which they are connected. These smart devices can be used in various fields, including smart homes [2].

The CE devices have significantly evolved in the last decade. According to a recent study, the CE segment might reach 2,873.1m users by 2025 while the Average Revenue Per User (ARPU) is expected to amount to US 317.10 billion [3]. Today, every device may create and share data online, contributing to the CE expansion. The traditional internet architecture is a complex system with a multitude of network components, i.e., routers, middleboxes, switches, and several layers, etc. due to decentralization [4]. Therefore, the traditional network design likewise struggles to adapt to the dynamic nature of modern applications. Moreover, the traditional static network infrastructure-based approaches need manual configuration and exclusive management of CE devices. Potentially, this results in inefficient use of all resources, which exposes systems to a variety of cyber-attacks [5]. However, it is clear from the current literature that smart CE networks are subject to various subtle, cyber threats, including botnets, brute force, Denialof-Service (DoS), Distributed Denial of Service (DDoS), and web attacks [6]. The DDoS attack is identified as one of the most dangerous attacks on today's Internet. In DDoS, attackers use many compromised hosts to generate a lot of worthless traffic flow toward the target server, which causes servers to overload quickly by consuming their resources and making them

322

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 189-198

Fraud Detection using Machine Learning Techniques with Banking Data

[1] **P. Sri Lakshmi Sneha**, *B.Tech student, Department of CSE, DNR College of Engineering and Technology, snehapalakolanu69@gmail.com*

[2] **B. Yashoda**, *B.Tech student, Department of CSE, DNR College of Engineering and Technology, Yashodab281@gmail.com*

[3] **S. Supritha padamavathi**, *B.Tech student, Department of CSE, DNR College of Engineering and Technology, padmavathisagi123@gmail.com*

[4] **I. Siva naga sai**, *B.Tech student, Department of CSE, DNR College of Engineering and Technology, illasivanagasai@gmail.com*

[5] **Mrs N Bharathi**, *M. Tech, Assistant professor, DNR College of Engineering and Technology, kbharathi.1224@gmail.com*

Abstract: *The study primarily centers on using machine learning methods to identify fraudulent activities in banking data. This is a critical concern in the financial sector, where it's essential to detect and prevent fraudulent transactions. To improve fraud detection, the study introduces class weight-tuning hyperparameters. These parameters help the model differentiate between legitimate and fraudulent transactions more effectively, enhancing the accuracy of the fraud detection system. The study strategically employs three popular machine learning algorithms: CatBoost, LightGBM, and XGBoost. Each algorithm has unique strengths, and their combined use aims to boost the overall performance of the fraud detection method. Deep learning techniques are integrated into the study to fine-tune hyperparameters. This integration enhances the performance and adaptability of the fraud detection system, making it more effective in identifying evolving fraud tactics. The project conducts thorough evaluations using real-world data. These evaluations reveal that the combined use of LightGBM and XGBoost outperforms existing methods when assessing various criteria. This indicates that the proposed approach is more effective at detecting fraudulent activities compared to other methods. It includes, a Stacking Classifier has been implemented, combining predictions from RandomForest and LightGBM classifiers with specific settings. This ensemble algorithm, utilizing a GradientBoostingClassifier as the final estimator, enhances prediction accuracy by leveraging the strengths of diverse models.*

Index terms - *Bayesian optimization, data Mining, deep learning, ensemble learning, hyper parameter, unbalanced data, machine learning.*

I. INTRODUCTION

In recent years, there has been a significant increase in the volume of financial transactions due to the expansion of financial institutions and the popularity of web-based e-commerce. Fraudulent transactions have become a growing problem in online banking, and fraud detection has always been challenging [1], [2]. Along with credit card development, the pattern of credit card fraud has always been updated. Fraudsters do their best to make it look legitimate, and credit card fraud has always been updated. Fraudsters do their best to make it look legitimate. They try to learn how fraud detection systems work and continue to stimulate these systems, making fraud detection more complicated. Therefore, researchers are constantly trying to find new ways or improve the performance of the existing methods [3].

People who commit fraud usually use security, control, and monitoring weaknesses in commercial applications to achieve their goals. However, technology can be a tool to combat fraud [4]. To prevent further possible fraud, it is important to detect the fraud right away after its occurrence [5]. Fraud can be defined as wrongful or criminal deception intended to result in financial or personal gain. Credit card fraud is related to the illegal use of credit card information for purchases in a physical or digital manner. In digital transactions, fraud can happen over the line or the web, since the cardholders usually provide the card number, expiration date, and card verification number by telephone or website [6].

There are two mechanisms, fraud prevention and fraud detection, that can be exploited to avoid fraud-related losses. Fraud prevention is a proactive method that stops fraud from happening in the first place. On the other hand, fraud detection is needed when a fraudster attempts a fraudulent transaction [7]. Fraud detection in banking is considered a binary classification problem in which data is classified as legitimate or fraudulent [8]. Because banking data is large in volume and with datasets containing a large amount of transaction data,

33

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 258-266

Predictive Analysis of Water Stress in Tomato Plant Utilizing Bioristor Data

[1]V. Soma Uma Mahitha, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, mahivegesna27@gmail.com*

[2]B. Ramya, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, ramyab0405@gmail.com*

[3]V. Kamakshi, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, vallurikamakshi@gmail.com*

[4]K. Surya Bhavani, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, suryabhavanikandula26@gmail.com*

[5]Mr. K. Surya Ram Prasad, *M. Tech, Assistant Professor, Department of Computer Science and Engineering, surya.dnrcet@gmail.com*

ABSTRACT: *This study focuses on characterizing, classifying, and forecasting water stress in tomato plants using real-time data from a novel sensor, the bioristor, and various artificial intelligence models. Initially, classification models like Decision Trees and Random Forest were employed to differentiate between different stress statuses of tomato plants. Recurrent Neural Networks (RNNs), particularly Long Short-Term Memory (LSTM) networks, were utilized for predicting future water stress levels in tomatoes, considering both binary and multi-status scenarios. The results demonstrated high accuracy, precision, recall, and F-measure, showcasing the efficacy of the bioristor sensor and AI models in practical smart irrigation setups. Building upon the base paper's methodology, this study extends the analysis by incorporating additional techniques such as Convolutional Neural Networks (CNN) and a Voting Classifier, achieving a notable 97% accuracy. Furthermore, the study suggests enhancing performance through ensemble methods, combining predictions from multiple models. Additionally, to facilitate user testing, a frontend utilizing the Flask framework with user authentication is proposed. Overall, this research underscores the potential of leveraging advanced sensors and machine learning techniques for optimizing irrigation practices and enhancing agricultural productivity.*

INDEX TERMS *AI modeling and forecasting, bioristor, precision agriculture, recurrent neural network, tomato plants, tree-based classifiers, smart irrigation, water stress.*

I. INTRODUCTION:

Drought poses a significant threat to agricultural productivity, leading to water stress and substantial yield losses in agro-ecosystems [1]. The year 2022 witnessed one of the most severe water shortages across Europe, with Italy experiencing a particularly harsh drought, causing crop yields to plummet by up to 45% [1]. This crisis underscores the critical need for efficient water resource management in agriculture to ensure sustainable food production [2]. Water stress adversely affects various physiological processes in plants, including photosynthesis, transpiration, and nutrient uptake, ultimately diminishing vegetative growth and crop yield, thereby jeopardizing food security [3], [4].

The detrimental effects of water and heat stress on summer crop yields have been profound, with significant impacts on crops like grain maize, soybeans, and sunflowers [1]. The concurrent occurrence of drought and heatwaves exacerbates the situation, exacerbating dry conditions and further hampering agricultural productivity [5]. As observed in Europe during the summer of 2022, persistent water scarcity coupled with high temperatures resulted in widespread crop failures and economic losses [1].

In light of these challenges, it is imperative to adopt strategies for rational water usage in agriculture to mitigate the adverse effects of water stress on crop yields [6]. Effective water management practices can help optimize water usage, enhance crop resilience to drought, and promote sustainable agricultural practices [7]. Given the dynamic nature of drought conditions and their detrimental impact on agricultural systems, there is a growing emphasis on developing advanced techniques for drought characterization, prediction, and mitigation [8].

Recent advancements in machine learning (ML) and artificial intelligence (AI) have paved the way for innovative approaches to drought characterization and modeling [9]. ML and AI techniques offer powerful tools for analyzing complex datasets, identifying patterns, and making accurate predictions, thereby facilitating informed decision-making in agriculture [10]. By leveraging real-time data from sensors and other sources, ML

354

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 267-275

Organ Donation Management and Allocation System

[1] G. Angel, *B. Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, angel.ghantasala123@gmail.com*
[2] B. Vanitha Priya Darshini, *B. Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, bvpriyadarshini2002@gmail.com*
[3] P. Sri Lalitha Bhavana, *B. Tech student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, penmetsabhavanaa@gmail.com*
[4] Dr. Satyanarayana Gaddada, *Professor, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, Bhimavaram, Andhra Pradesh, India. sreesatyam@yahoo.in*

Abstract: *This paper presents a decentralized system for managing organ donations, facilitating quick access to donor records nationwide. The system collects and delivers donations to respective organizations, providing transparency to doctors. It manages donor registration and user maintenance, enabling interested individuals to register themselves. Organ transplantation is essential for patients with organ failure, yet inadequate supply, especially from deceased donors, poses a challenge. Effective systems, like opt-out and donor action programs, are necessary to promote deceased donations. Counseling on organ donation is crucial for families of brain-dead patients, [11] and standard practices should involve contacting Organ Procurement Organizations. A cloud-based blood bank system aims to provide timely access to blood, saving time and effort for recipients. The system, hosted on Ganache Database, streamlines organ and blood matching based on blood groups, enhancing efficiency in emergency situations.*

Key Words: *Organ donation, Blockchain, Ganache*

I. INTRODUCTION

The project's primary objective is to establish a system which gives saving of lives of youngers. The Online Organ Donation System [1] is an innovative platform designed to streamline the process of organ allocation. With the integration of an age priority factor, this system ensures that younger patients in need of organ transplants receive priority consideration. By leveraging technology, it facilitates efficient matching of donors with recipients, optimizing outcomes and promoting fairness in the allocation process. This approach helps maximize the chances of successful transplantation for those who stand to benefit the most, especially younger individuals requiring life-saving organ transplants. The Online Organ Donation System [1] prioritizes organ allocation based on various factors, including medical urgency, compatibility, and now, age. This system aims to ensure fair and efficient distribution of organs, considering the urgency of younger patients who may benefit more from transplantation. By incorporating age as a priority factor, it aims to optimize outcomes and promote equitable access to life-saving organ transplants.

The organ transplantation has emerged as one of the most important fields in the healthcare sector [8]. By giving priority to younger recipients, who often have a higher chance of successful transplantation and longer life expectancy post-transplant, the system aims to maximize the overall impact of organ donations. This approach ensures that organs are allocated efficiently, promoting fairness and equitable access to life-saving treatments while improving outcomes for recipients.

In today's rapidly evolving digital landscape, ensuring the motivation for implementing an Online Organ Donation System [1] with a priority age factor stems from the desire to save as many lives as possible while maximizing the long-term impact of organ transplants. Younger patients typically have better health outcomes and longer life expectancies post-transplant compared to older patients. Prioritizing younger recipients ensures that organs are allocated where they can have the greatest impact, ultimately saving more lives and improving overall quality of life. This approach aligns with the principles of fairness, efficiency, and maximizing the benefits of organ donation for society as a whole.

In contemporary contexts, the current organ donation system lacks an efficient mechanism for prioritizing organ allocation based on age factors. Many potential organ recipients face long waiting times, and the allocation process may not consider the urgency of need relative to the age of the recipient. The current lack of comprehensive online platforms for organ donation [1] leads to delays and uncertainties in accessing organs, causing preventable deaths. To mitigate this challenge, we introduce the Web-Based Organ Donation

INDIAN JOURNAL OF TECHNICAL EDUCATION

ISSN 0971-3034
Volume,12 Issue,1 April,2024

Food Demand Supply Chain Forecasting and Modeling in Time Series Using Regressor Analysis

1 Penmetsa Dharani Satya, B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, dharanisatyap@gmail.com

2 Potturi Lakshmi Kavya, B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, potturilakshmikavya@gmail.com

3 Pulavarthi Satya Surya Bhanu Prakash, B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, prakashpulavarthibvrm@gmail.com

4 Mr. BujjiBabu Lingampalli, M. Tech, Assistant Professor, Department of Computer Science and Engineering, bujjibabudnr@gmail.com

ABSTRACT:Accurate demand forecasting is paramount in the food industry due to the short shelf life of products, with improper inventory management leading to significant waste and loss. This study leverages machine learning and deep learning techniques on the "Food Demand Forecasting" dataset from Genpact to analyze various factors influencing demand. Seven regressors, including Random Forest, Gradient Boosting, and LSTM, are compared to forecast order numbers. Results highlight LSTM's superiority in accuracy, with metrics like RMSLE, RMSE, MAPE, and MAE reaching notable values. The project underscores the importance of precise demand forecasting in improving supply chain management and reducing waste. Notably, the integration of ensemble methods enhances prediction accuracy. Moreover, exploring CNN and Voting Regressor techniques offers avenues for further performance enhancement. Additionally, the study extends to developing a Flask framework with SQLite for user signup and signin, facilitating user testing and authentication. The implementation of these extensions enriches the project's capabilities and usability, addressing critical challenges in demand forecasting while emphasizing the significance of accurate prediction methodologies in the food industry's operational efficiency and sustainability.

INDEX TERMS Deeplearning, demand forecasting, machine learning, time series analysis

1. INTRODUCTION:

In today's dynamic marketplace, demand forecasting has emerged as a critical component of effective demand-supply chain management for companies across various industries. With consumer needs constantly evolving and competition intensifying, accurate demand forecasting has become indispensable for businesses to stay competitive and ensure operational efficiency. This shift in focus towards demand forecasting is driven by the recognition that demand forecasts play a pivotal role in shaping strategic planning decisions and directly impact a company's profitability. A precise estimation of demand enables companies to optimize inventory levels, thereby minimizing the risk of wastage due to excess inventory or stockouts leading to lost sales opportunities.

336

INDIAN JOURNAL OF TECHNICAL EDUCATION

ISSN 0971-3034
Volume,12 Issue,1 April,2024

Blockchain Validation: Ensuring Authenticity in Education and Career Credentials

1 T. Sairam, B-Tech Student, Department of CSE, DNR College of Engineering and Technology, tirumanisairam749@gmail.com

2 V. Santosh Kumar, B-Tech Student, Department of CSE, DNR College of Engineering and Technology, sv4839691@gmail.com

3 K. Rakesh, B-Tech Student, Department of CSE, DNR College of Engineering and Technology, rakeshrocky94944@gmail.com

4 Dr. B. V. Ram Kumar, M. E, Ph.D., Professor, Department of CSE, DNR College of Engineering and Technology, bvrk.bonam@gmail.com

Abstract: This paper proposes a solution to the longstanding challenges associated with traditional paper-based educational documents and certificates through the implementation of blockchain technology, specifically utilizing the Ethereum platform and smart contracts. The conventional issuance and verification processes are prone to inefficiencies, delays, and susceptibility to forgery, leading to significant setbacks in career progression and fostering educational scams. By leveraging blockchain, these issues can be addressed comprehensively. The proposed system involves the conversion of paper certificates into digital certificates upon student request. These digital certificates are then securely stored on the blockchain, with their authenticity verified through cryptographic hash functions. Each certificate is assigned a unique identifier and transaction hash value, ensuring tamper-proof verification through a centralized platform. This innovative approach not only streamlines the verification process but also enhances security and transparency, mitigating the risks associated with forgery and manipulation. By harnessing the power of blockchain technology, educational institutions, employers, and third-party verifiers can seamlessly authenticate credentials, fostering trust and efficiency in the professional landscape.

Index Terms: Blockchain, Smart contracts, Ethereum, Document verification, Decentralized process, Hashing, IPFS

1. INTRODUCTION

Blockchain technology, originating from the visionary work of Stuart Haber and W. Scott Stornetta, gained prominence alongside the advent of Bitcoin in 2009, attributed to the enigmatic Satoshi Nakamoto. Initially confined to the realm of cryptocurrencies, blockchain technology has rapidly transcended its origins, permeating diverse sectors, including education, where it offers innovative solutions to entrenched challenges [1]. Within the

37

INDIAN JOURNAL OF TECHNICAL EDUCATION

ISSN 0971-3034
Volume,12 Issue,1 April,2024

Skin cancer diagnosis using deep learning technologies

1 B Durga sai, B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, ssai08377@gmail.com

2 K. Sathish, B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, Kandrekulasathish99@gmail.com

3 Y. Leela Madhuri, B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, leelayarramsetti07@gmail.com

4 Mrs. V. Navya Devi, M. Tech, Assistant Professor, Department of Computer Science and Engineering, Navyadevidnr@gmail.com

Abstract: This study addresses the urgent global challenge of rapidly spreading skin cancer, emphasizing the critical role of accurate diagnosis for effective prevention. Dermatologists face difficulties in early detection, prompting the application of deep learning, particularly Convolutional Neural Networks (CNNs). Leveraging the MNIST: HAM10000 dataset featuring seven skin lesion types and 10,015 samples, the research employs data preprocessing techniques including sampling, dull razor, and autoencoder-based segmentation. Transfer learning with DenseNet169 and ResNet50 models is utilized, revealing that DenseNet169's undersampling yields high accuracy and F1-measure, while ResNet50's oversampling technique excels in both metrics. Building on the base paper's use of ResNet50, DenseNet161, and VGG16 (achieving 91% accuracy), this extension explores additional models like Xception, DenseNet201, and InceptionV3. Anticipating a 95% accuracy improvement, the study underscores the potential of diverse models and parameter tuning to advance skin cancer classification, offering a promising avenue for enhancing diagnostic precision and preventive strategies.

Index Terms *- Skin cancer, segmentation, deep learning, CNN, Densenet169, Resnet50, Xception, Densenet201, InceptionV3.*

1. INTRODUCTION

A tumor is formed when healthy cells begin to change and grow out of control. Both cancerous and noncancerous tumors are conceivable. Malignant tumors are those that have the potential to grow and spread to other areas of the body [1]. A benign tumor may form, but it does not usually spread. Skin cancer is the result of abnormal skin cell growth. It is the most prevalent cancer nowadays and occurs everywhere. Every year, various forms of melanomas are thought to cause more than 3.5 million cases to be discovered [2], [3]. This number exceeds the sum of cases of lung, bone, and colon cancers. In reality, a person with melanoma dies every 57 seconds. When cancer is detected in dermoscopy images in advance, the survival percentage is significantly boosted. Therefore, accurate automatic skin

359

38

INDIAN JOURNAL OF TECHNICAL EDUCATION

ISSN 0971-3034
Volume,12 Issue,1 April,2024

Hernessing 5G and big data for personalized diabetes diagnosis in health care

1. M. Likitha, B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, likithamurapaka999@gmail.com

2. Nambula Geethanjani Satya Sri, B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, geethanambula51043@gmail.com

3. Paladugula Naveen, B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, naveen.paladuguala@gmail.com

4. Mr. B. Nandan kumar, M. Tech, Assistant Professor, Department of Computer Science and Engineering, nandankumar007@gmail.com

Abstract: This project uses today's 5G technology to monitor condition of diabetic patients with low cost. Nowadays many peoples are suffering with diabetic disease due to work stress or unhealthy lifestyles and peoples will not know about the current health condition till symptoms appear or diagnosis through medical check-up and the condition of disease will be severe by that time and there is no possible way to get that intimation prior. Diabetes will be of two type's diabetes-1 and diabetes-2. Diabetes-2 require hospitalization and in diabetes-1 condition we can monitor patient and alert him or doctors about his current condition.

Index terms *- 5G-smart diabetes, ensemble classifier, diabetes 2.*

1. INTRODUCTION

Diabetes is an extremely common chronic disease from which nearly 8.5 percent of the world population suffer; 422 million people worldwide must struggle with diabetes. It is crucial to note that type 2 diabetes mellitus makes up about 90 percent of the cases [1]. More critically, the situation will be worse, as reported in, with more teenagers and youth becoming susceptible to diabetes as well. Because diabetes has a huge impact on global well-being and economy, it is urgent to improve methods for the prevention and treatment of diabetes. Furthermore, various factors can cause the disease, such as improper and unhealthy lifestyle, vulnerable emotion status, along with the accumulated stress from society and work. However, the existing diabetes detection system faces the following problems:

The system is uncomfortable, and real-time data collection is difficult. Furthermore, it lacks continuous monitoring of multidimensional physiological indicators of patients suffering from diabetes.

The diabetes detection model lacks a data sharing mechanism and personalized analysis of big data from different sources including lifestyle, sports, diet, and so on [2].

39

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 69-75

Implementation of Disease Prediction and Food Recommendation Identifying By Vitamin Deficiency Using Deep Learning Technique

[1] **D. Saradha Kumari**, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra pradesh, India.*
saradhakumaridharmana@gmail.com

[2] **J.S.K.Narayanaswami**, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra pradesh, India.*
kesavajettiboina@gmail.com

[3] **R.V.S.S.M Kalyan**, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra pradesh, India.*
reddisai99@gmail.com

[4] **V.Nithin Vamsi**, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhra pradesh, India.*
nithinvamsiveeravalli@gmail.com

[5] **Dr Satyanarayana Gaddada**, *Professor, Department of CSE, DNR College of Engineering and Technology, Bhimavaram,, Andhra pradesh, India.*
sreesatyam@yahoo.in

Abstract: *In our busy and fast-paced environment, many are not concerned with the quality of the food they eat. Their dietary habits and behaviours are often disregarded. Numerous health issues result from this, such as anemia, obesity, diabetes, elevated blood pressure, and more. People now need to follow a nutritionally good, well-balanced diet in order to survive. According to a WHO research, poor and unbalanced dietary consumption accounts for around 9% of global fatalities from heart attacks and 14% from gastrointestinal cancer. Additionally, 0.2 billion people suffer from iron deficiency (anemia), 0.7 billion people suffer from iodine insufficiency, and around 0.25 billion children suffer from various forms of vitamin A, B, C, D and K deficiencies and features are divided from normal and abnormal conditions of vitamins and labels are divided in to 0 and 1 as normal and abnormal. Another dataset is prepared based on combination of various vitamins and their deficiency and food to be recommended based on which vitamin is deficient. In this project multiple classifier algorithms are used (KNN, decision tree, ran- dom forest, logistic regression, voting classifier) ensembled algorithm is used to combine multiple algorithms and train a new algorithm. Accuracy of each algorithm is calculated and best algorithm is used for prediction purpose. Prediction is shown using flask web application which will detect deficiency of vitamin and recommend type of food to be taken on various combinations.*

Index Terms: *KNN, decision tree, random forest, logistic regression, voting classifier*

I. INTRODUCTION

Vitamin deficiency, an insidious and widespread concern in global health, intricately influences the lives of millions. Within the intricate dance of physiological processes, essential vitamins emerge as pivotal orchestrators, influencing not only basic bodily functions but also the delicate equilibrium of holistic well-being. Despite monumental strides in medical science, the persistent prevalence of vitamin deficiencies compels us to embark on an exhaustive exploration into the complex interplay between nutrition, health, and the cuttingedge frontier of disease prediction. This project represents a dedicated effort to delve into the nuanced depths of this multifaceted challenge, proposing innovative solutions to a health issue that resonates globally.

The gravity of vitamin deficiencies transcends geographical boundaries, impacting individuals irrespective of their location or socio-economic standing. As articulated by the World Health Organization, this silent pandemic silently sows the seeds of myriad health issues, placing a collective burden on public health systems, economies, and, most importantly, the vitality of communities. It is not merely a deficiency in

40

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 112-127

Utilising AI for enhanced detection of cardiovascular abnormalities in ECG images

[1.] **K. Ramsai Shankar**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, shankarkrovi0@gmail.com*

[2.] **S. Uma Devika**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, umachava369@gmail.com*

[3.] **Turaga J V Naga Vijaya Krishna Vamsi**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, krishna67439@gmail.com*

[4.] **G. Pravachan Kumar**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, pravachankumar0507@gmail.com*

[5.] **B. Nandan Kumar**, *M.Tech, Assistant Professor, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, dnrnandan@gmail.com*

Abstract *- This research focuses on the critical global issue of cardiovascular diseases, particularly heart conditions, a leading cause of mortality. Timely prediction is essential, and Electrocardiogram (ECG), a cost-effective and noninvasive tool, plays a pivotal role in monitoring heart activity. To enhance predictive accuracy, this project employs deep learning techniques, specifically transfer learning from neural networks like Squeeze Net and Alex Net, along with a specialized Convolution Neural Network (CNN) architecture. These techniques aim to identify four significant cardiac abnormalities: abnormal heartbeat, myocardial infarction, history of myocardial infarction, and normal cases. The model's uniqueness lies in its exceptional performance, achieved by extracting crucial features through a combination of deep learning and traditional machine learning algorithms. This research underscores the transformative impact of artificial intelligence on healthcare, significantly advancing medical condition predictions through image analysis.*

Keywords: *- Cardiovascular diseases, Heart conditions, Mortality, Timely prediction, Electrocardiogram (ECG), Deep learning, Transfer learning, Neural networks, Squeeze Net, Alex Net.*

I. INTRODUCTION

According to the World Health Organization, cardiovascular diseases, including heart diseases, are the leading cause of death globally, responsible for a significant portion of all deaths. Timely recognition of cardiovascular diseases is essential for saving lives. Detecting heart problems in their initial phases greatly enhances patient outcomes by increasing the likelihood of successful treatment and improved well-being. Within the healthcare system, a range of diagnostic techniques are employed to identify heart diseases. These methods encompass electrocardiogram (ECG), echocardiography, cardiac magnetic resonance imaging, computed tomography, and blood tests. Among these, the electrocardiogram (ECG) stands out as a widely used and noninvasive tool. It functions by recording and analyzing the electrical activity of the heart. This information assists healthcare professionals in evaluating the heart's condition and diagnosing potential issues. The project highlights how artificial intelligence, like machine and deep learning, can predict heart diseases automatically. This helps reduce mistakes and makes diagnoses more accurate and efficient, benefiting patients.

In According to the Centers for Disease Control and Prevention (CDC) and the American Health Monitoring Organization, the leading cause of death is cardiovascular disease [1]. CDC revealed that 74% of the population is affected yearly by heart disease. Cardiovascular diseases can be prevented if an effective diagnostic is made at the initial stages [2]. Modern medical science has shown substantial and potent solutions to cope with heart-related problems. The coronavirus appeared in Wuhan, China, in December 2019. This disease was declared an emergency in January 2020 by WHO. Then it was named COVID-19 by WHO in February 2020. Also, it was announced as a worldwide pandemic in March 2020 (Kim, 2021; Zhu et al., 2020). As the epidemic progressed, the number of cases, diseases, and deaths varied worldwide. It deeply affected the United States of America, Italy, and Spain (Ceylan, 2021). The most crucial feature of COVID-19 is that it spreads very quickly. The virus is easily passed from one person to another.[3] With the enhancement of the information era, computer-aided systems generate massive amounts of raw data, enhancing the new center of power. Acquiring important knowledge from this form of data is a challenging task for practitioners. Data mining, Artificial Intelligence, machine learning, and deep learning are relatively modern and promising technologies for obtaining relationships or identifying significant databases using advanced statistical

1241

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 150-158

NLP - Automated resume analysis and skill suggesting website

[1.] **NUNNA PRASANNA SAI VENKATESH**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, venkynunna2003@gmail.com*

[2.] **K. N. L. LAVANYA,** *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, lavanyaharika.444@gmail.com*

[3.] **MURAPAKA SIVASANKAR**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, sankarmurapaka9@gmail.com*

[4.] **VEGESNA SOMANADHA MAHIDHAR VARMA**, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, mahidharvarma22@gmail.com*

[5.] **Mr. K. SURYA RAM PRASAD**, *M. Tech, Assistant Professor, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, surya.dnrcet@gmail.com*

Abstract: *The current system for screening resumes employs a manual process in which recruiters or human resource managers evaluate job applications based on their qualifications, experience, and other factors. By synergizing cutting-edge technology with recruitment needs, we present a dynamic solution an automated resume analysis and skill suggestion platform. To create an innovative Automated Resume Analysis & Skill Suggesting Website utilizing Resume Parser and NLP APIs. By automating the extraction of crucial information such as skills, qualifications, and personal details from resumes. By assessing applicant skills against job requirements, the system calculates scores to aid in effective short listing. It is streamlined, data-driven approach to enhance the recruitment process for both job seekers and employers. To address the diversity of resumes in structure and format, the platform employs a robust parsing engine capable of recognizing and categorizing information from various document types and styles, ensuring a fair analysis of each candidate's potential. The system is trained on a vast corpus of job-related data, enabling it to understand industry-specific terminologies and trends, which is critical for matching applicants to niche roles.*

Index Terms – *Natural Language Processing (NLP), Job Applications, Resume Screening, Resume-Parser, Resume Analysis.*

I. INTRODUCTION

An essential step in the hiring process is the automatic review of resumes, which entails assessing job applications to find the applicant most suited for a given position. This procedure may take a long time and be prone to human mistake, which could lead to the loss of qualified individuals. Automated resume screening has grown in popularity recently as a solution to this problem. Automatic resume screening uses several methods to enhance accuracy and efficiency, including deep learning algorithms, machine learning, and natural language processing (NLP). Current automated resume screening systems are a testament to how artificial intelligence has permeated the recruitment industry, streamlining processes that once required hours of human labor. Through the utilization of sophisticated Natural Language Processing (NLP) techniques, such as entity identification, semantic search, and advanced machine learning algorithms, these systems can probe deeply into the intricacies of job applications, providing an in-depth relevance analysis against the requirements of a given job description.

Our cutting-edge system takes this automation a step further. Built upon the sturdy foundations of a predefined library, our platform meticulously scans, identifies, and extracts crucial information from each resume. This includes, but is not limited to, contact details, a list of pertinent skills, a comprehensive work history, and educational achievements. Such granular analysis allows for a nuanced evaluation of a candidate's professional narrative, bringing into focus their suitability for the role in question.

One of the most remarkable features of our system is its scalability. Designed to accommodate the expanding needs of our users, it stands ready to tackle the increasing volume and complexity of recruitment demands without a hitch. Whether you are a startup looking to hire your first employees or a multinational corporation seeking to manage thousands of applications, our system adapts and scales to fit your specific needs.

Moreover, our system has been crafted with integration at its core. It recognizes the diverse array of platforms and services within the recruitment ecosystem and offers seamless compatibility. From job boards and applicant tracking systems (ATS) to HR management software and beyond, our automated resume screening system can be easily incorporated to enhance existing workflows. This interoperability is crucial in an age where data is spread across multiple systems, and consolidation is key to efficiency.

u2

IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 14, Issue 4, April 2024, ||Series -2|| PP 212-223

Blockchain-Enhanved Security Framework in Cloud Computing Integration

1. **Masabattula. Jyothika Naga Sowmya**, *B. Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, Sowmya.masabattula2003@gmail.com*

2. **Marisetti. Srinivas**, *B. Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, srininvassrinivas45946@gmail.com*

3. **Durre. Mohan Durga Reddy**, *B. Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, durremohan@gmail.com*

4. **Mudhunuri. Vishnu Vardhan Raju**, *B. Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, vishnumudunuri551@gmail.com*

5. **Kamani. Chandran**, *M. Tech, Assistant Professor, Department of computer science and engineering, Chandran.kamani@gmail.com*

Abstract: *This paper proposes a novel approach to address data integrity concerns in cloud computing by integrating blockchain technology. With the vulnerability of cloud services to data manipulation, ensuring the accuracy and trustworthiness of data becomes paramount. By leveraging blockchain's tamper-proof nature, the proposed scheme enhances data integrity within homomorphic encryption frameworks. Through collaborative computations among Cloud Service Providers (CSPs), master hash values are generated for their respective databases. These values are then securely stored in Ethereum blockchain networks, ensuring immutability. The abstract presents a theoretical analysis of the overhead costs associated with creating master hash values across various cryptocurrencies. This innovative fusion of cloud computing and blockchain offers a robust solution to safeguard data integrity, catering to diverse application domains and addressing the evolving threat landscape.*
Index Terms: *Blockchain, cloud computing, data integrity, homomorphic encryption.*

I. INTRODUCTION

Data security in the realm of cloud computing is a critical concern, given the multitude of potential threats it faces. The amalgamation of various technologies within cloud computing infrastructure renders it particularly susceptible to vulnerabilities [1]. Thus, managing risks becomes imperative to strike a balance between security measures and the benefits of cloud computing [1].

The Cloud Security Alliance (CSA), a non-profit organization, has been established to address these concerns by delineating shared responsibilities between Cloud Service Providers (CSPs) and clients to mitigate risks associated with cloud computing [2]. Essential security controls are delineated through tools such as the Consensus Assessments Initiative Questionnaire (CAIQ) and the Cloud Control Matrix (CCM) [2]. These frameworks aid in designing and implementing security measures, ensuring that both CSPs and clients uphold their obligations in safeguarding data integrity and privacy.

Despite the efforts of CSPs to establish robust security frameworks, there remains a lingering skepticism among data owners regarding the sufficiency of these measures [1]. This skepticism is compounded by the rapid growth of cloud computing technology, which introduces new vulnerabilities while amplifying existing ones [1]. A recent survey conducted by the CSA identified the top security threats within cloud computing, categorizing them into governance and operational domains [3]. These threats encompass a spectrum of concerns ranging from strategic policy issues to tactical security challenges [3].

Foremost among these threats is the risk of data breaches, which has consistently ranked high in trend analyses conducted by the CSA [3]. A data breach, whether resulting from targeted attacks or inadvertent human error, poses a significant threat to the validity and trustworthiness of cloud-based services [3]. Such breaches entail unauthorized access, analysis, or exploitation of sensitive information, undermining data confidentiality and privacy [7].

Encryption algorithms play a pivotal role in addressing these concerns by safeguarding data confidentiality and privacy. However, traditional cryptographic methods may not be ideally suited for cloud computing environments, where data processing on external servers necessitates decryption [18]. To overcome this limitation, homomorphic encryption (HE) schemes have been proposed, enabling computations on encrypted data without revealing sensitive information [20].

43

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 159-165

Deep Learning for Medicinal Plant Identification and Utilization: Leveraging ResNet for Enhanced Recognition and Applications

[1] S.GunaChandra , *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India.* s.gunachandra29@gmail.com

[2] P Mounika, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India.* pandimounika19@gmail.com

[3] k Gopala Reddy, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India.* gopal102reddy@gmail.com

[4] K Yaswanth, *Department of CSE, DNR College of Engineering and Technology, Bhimavaram, Andhrapradesh, India.* kilariyash@gmail.com

[5] Mr. K. Surya Ram Prasad, *M.Tech, Assistant Professor, Department of Computer Science and Engineering,* surya.dnrcet@gmail.com. sambasiva.phd@gmail.com

Abstract

In addition to their many medicinal uses, herbal plants also have the added benefit of releasing oxygen into the air at no cost to the environment.There are a lot of medicinal plants that are also helpful for future generations since they contain active ingredients. A lack of understanding of medicinal plants, together with issues like climate change, population increase, occupational secrecy, and inadequate government funding for study, are causing the extinction of many important plant species. Current algorithms sometimes struggle to accurately identify herbal leaves throughout the year because of the latency of dimensions parameters like length and breadth. Therefore, to enhance the detection rate for herbal leaf identification, the suggested approach zeroes in on the incomplete dataset issues. In this research, we provide a deep learning method that makes use of a CNN trained on the VGG-16 and VGG-19 models. The picture segmentation procedure is yielding excellent results with the addition of dimension parameters in the datasets.The process of using a machine learning classifier in conjunction with ex-orgate operations to confirm the acquired result is known as deep knowledge-based identification.The detection rate of herbal leaves is being improved by this two-stage authentication (TSA) technique. For picture segmentation, we used ResNet as well. As a result of combining image segmentation with machine learning, the proposed architecture is becoming more robust.Also, the detection accuracy is being improved by using intelligent selection of images segmentation techniques to segment the leaf from the image.

Deep Learning, VGG 19, Herbal Plant Identification

I. INTRODUCTION

Since ancient times, indigenous communities have relied on herbs as traditional medicines.Plants play a vital role in our planet for many reasons. Herbalists often use their years of sensory experience to choose which plants to use. Technological advancements in analysis have greatly aided bald face identification.Particularly for individuals who have never dealt with herbal recognition before, this is a huge help. Testing in a controlled environment necessitates expertise in sample handling and data interpretation, on top of the time-consuming processes. It is now more important than ever to be able to reliably and simply identify the leaves of medicinal plants.It is quite probable that a robust method for precisely categorizing plants is computing using probability and statistical analysis. The identification of herbal leaf choices is a suggested approach for rapidly and non-destructively identifying herbal leaf items. People who are unable to purchase costly analytical tools might benefit greatly from this strategy. We are all familiar with the following herbal leaves: Tulsi, Oma Valli, Neem, Vana Thulai, Thudhuvalai Lime, and so on. Sometimes, the shape and color of the herbal plants have been employed as features in the categorization process.Plants are categorized using several classification techniques that are based on functional vectors.In order to build a very precise approach for herbal plant identification, the Support Vector Machine (SVM) algorithm has been the subject of many recent research articles. The distribution of Gauzian leaf characteristics will give greater efficient classification, according to recent discussions on algorithms. Additionally, the study papers will go deeper into the research methodologies used to achieve improved classification via the implementation of several algorithms, including probabilistic statistical neural networks, supporting vector machines, main component analysis, and texture base analysis, all of which are utilized for plant detection.Because they are constantly accessible and have just two dimensions, many writers rely on plant leaves alone when attempting plant identification. Knowing the cultural importance, nutritional value, and therapeutic qualities of herbal plants is essential for identifying and making use of them.

图44

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 166-173

Blockchain-Based System for Allocating and Monitoring State Government Funds

1. Ch .Siva Sai Pravallika, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, chsspravallika@gmail.com*

2. S. Devisree, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, devisoma2904@gmail.com*

3. S. Anand Paul, *B.Tech, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, anandpaul795@gmail.com*

4. Mr. Bujjibabu Lingampalli, *MTech, Assistant professor, Department of CSE, DNR College of Engineering and Technology, bujjibabudnr@gmail.com*

Abstract: *This paper explores the utilization of blockchain technology as a solution to the challenges faced by state governments in managing various schemes and their funds distribution. With numerous departments offering different schemes, there arises a need for a centralized system capable of securely tracking applications, approval statuses, and sanctioned amounts. Blockchain technology offers inherent security features such as immutability, consensus mechanisms, and cryptographic encryption, ensuring only authorized access and preventing unauthorized alterations to data. Transactions are pooled before being added to the blockchain, reducing costs associated with individual transactions. By leveraging blockchain, governments can improve efficiency, enhance user experience, and potentially address other administrative challenges through the integration of emerging technologies. This paper advocates for the adoption of blockchain as a means to enhance transparency, security, and effectiveness in government schemes and operations.*

Keywords: *Blockchain, Government Fund Allocation, Transparency, Accountability, End-to-End Fund Tracking*

I. INTRODUCTION

In modern governance, the trust of citizens in government schemes and policies is paramount for their successful implementation and impact. The effectiveness of these programs hinges not only on their design and execution but also on the transparency and efficiency with which citizens can access and benefit from them. Blockchain technology, with its unique attributes such as immutability, cryptographic encryption, and consensus mechanisms, presents a promising solution to streamline the process of applying for government grants under various schemes. By leveraging blockchain, governments can enhance security, transparency, and accountability in the administration of public funds [1].

Governments worldwide administer a plethora of schemes aimed at providing financial assistance and support to citizens across various sectors, including healthcare, education, agriculture, and social welfare. However, the traditional processes involved in applying for and disbursing these grants are often plagued by inefficiencies, bureaucratic red tape, and concerns regarding data security. As a result, eligible citizens may face delays or barriers in accessing the benefits they are entitled to, while the administration grapples with challenges related to fraud, corruption, and data mismanagement [2].

The advent of blockchain technology offers a transformative opportunity to address these challenges and revolutionize the way governments interact with citizens in the realm of grant allocation. Blockchain, originally conceptualized as the underlying technology behind cryptocurrencies like Bitcoin, has evolved into a robust framework for secure, decentralized data management and transaction processing. At its core, blockchain is a distributed ledger system where data is stored across a network of interconnected nodes, with each transaction cryptographically linked to the preceding one, ensuring transparency and tamper-resistance [3].

One of the key advantages of blockchain technology in the context of government schemes is its ability to enhance data security and integrity. The immutability of blockchain ensures that once data is recorded on the ledger, it cannot be altered or deleted retroactively without the consensus of the network participants. This feature not only mitigates the risk of data tampering and fraud but also instills trust among citizens by providing a verifiable record of transactions and approvals [4].

Moreover, the cryptographic encryption mechanisms employed in blockchain systems offer robust protection against unauthorized access and data breaches. By encrypting sensitive information at both the transactional and network levels, blockchain platforms safeguard citizen data from malicious actors and unauthorized tampering, thereby bolstering privacy and confidentiality [5].

45

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 174-183

Integrating Convolutional Neural Network Architecture for Automatic Diabetic Retinopathy Detection

[1] L. Teja Maheswari, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, tejalanki@gmail.com*

[2] R. Gayatri Devi, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, gayatrideviruddarraju@gmail.com*

[3] T. S. S. Dinesh Varma, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, tssrdv790@gmail.com*

[4] P. Prasanna Lakshmi, *B.Tech Student, Department of CSE, DNR College of Engineering and Techonology, prasannapaka15@gmail.com*

[5] Dr. B. V. Ram Kumar, *M.E., Ph.D., Professor, Department of CSE, DNR College of Engineering and Techonology, bvrk.bonam@gmail.com*

Abstract: *Diabetic Retinopathy (DR) poses a significant threat to vision when left untreated, necessitating accurate and timely diagnosis. This research proposes an innovative approach to enhance DR diagnosis accuracy using a hybrid Convolutional Neural Network (CNN) model. Leveraging the strengths of ResNet50 and InceptionV3 architectures, the model aims to extract intricate features from fundus images, crucial for early DR detection. The challenge lies in identifying DR in its early stages when symptoms are subtle, impeding automated methods' accuracy. By integrating additional models like DenseNet and Xception, potential accuracy surpassing 97% is anticipated. Furthermore, an extension entails developing a user-friendly frontend using Flask framework with authentication, facilitating user testing. This holistic approach not only promises improved DR classification but also underscores the importance of timely intervention, mitigating vision loss risks associated with this debilitating condition.*
INDEX TERMS Diabetic retinopathy, fundus images, machine learning, computervision.

I. INTRODUCTION

Diabetic retinopathy (DR) is a debilitating complication of diabetes mellitus, particularly affecting the eyes and potentially leading to vision impairment or blindness if not managed promptly [1]. With the prevalence of diabetes on the rise globally, DR poses a significant public health concern, necessitating effective screening and management strategies. The burden of DR is projected to escalate dramatically in the coming decades, especially among certain demographic groups such as Hispanic Americans [2]. Early detection of DR is paramount in preventing irreversible vision loss, yet manual diagnosis by ophthalmologists is time-consuming and labor-intensive [3]. This poses challenges, particularly in regions with limited access to specialized healthcare professionals.

The pathogenesis of DR is multifactorial, with chronic hyperglycemia playing a central role in initiating and exacerbating retinal vascular abnormalities [4]. The duration of diabetes is a key determinant of DR development, highlighting the importance of early and sustained glycemic control in mitigating its progression [5]. However, many individuals with diabetes remain unaware of their risk for DR, leading to delayed diagnosis and treatment initiation [1]. Consequently, there is a pressing need for accessible and efficient methods for DR screening and diagnosis.

DR manifests through distinct stages, each characterized by specific retinal changes and associated clinical implications [6]. Non-proliferative diabetic retinopathy (NPDR) represents the early stage, marked by microaneurysms, retinal hemorrhages, and lipid exudates [7]. Progression to proliferative diabetic retinopathy (PDR) signifies a more advanced disease state, characterized by neovascularization, fibrovascular proliferation, and potential complications such as vitreous hemorrhage and tractional retinal detachment [8]. These progressive changes underscore the importance of timely intervention and close monitoring to prevent irreversible vision loss.

In recent years, there has been growing interest in leveraging advancements in artificial intelligence, particularly deep learning techniques, to automate DR detection and classification [9]. Deep learning models, such as convolutional neural networks (CNNs), have demonstrated remarkable capabilities in image recognition and classification tasks, making them promising tools for analyzing retinal images [10]. By harnessing the power of deep learning, researchers aim to develop robust algorithms capable of accurately detecting and staging DR, thereby facilitating early intervention and improving patient outcomes [11].

846

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 214-225

Improving Crop Health: A Multi Algorithms Approach For Pest Identification In Peanut Fields

[1] P. Nitya manaswini, *Student, Department of CSE, DNR College of Engineering and Technology, nityamanasvini@gmail.com*

[2] B. Shiny grace, *Student, Department of CSE, DNR College of Engineering and Technology, shinygracebadda@gmail.com*

[3] D. Vishnu vardhan, *Student, Department of CSE, DNR College of Engineering and Technology, doddavishnuvardhan007@gmail.com*

[4] Ch. Vishnu vardhan, *Student, Department of CSE, DNR College of Engineering and Technology, chvishnuvardhan371@gmail.com*

[5] Mr. Bujjibabu Lingampalli, *M Tech, Assistant professor, Department of CSE, DNR College of Engineering and Technology, bujjibabudnr@gmail.com*

Abstract: *The rapid advancement of Vision Transformer (ViT) methods has proven highly effective in image classification and identification tasks. This paper introduces an Enhanced Vision Transformer Architecture (EViTA) tailored specifically for pest identification, segmentation, and classification. Building upon ViT's strengths over Convolutional Neural Networks (CNNs), EViTA aims to improve accuracy in pest image prediction. The methodology incorporates preprocessing techniques such as Moth Flame Optimization (MFO) for image flattening and normalization, along with a dual-layer transformer encoder for integrating pest image segments of varying sizes. Extensive experiments using three pest datasets affecting peanut crops demonstrate the efficacy of EViTA, achieving promising results. Furthermore, the exploration of additional techniques such as DenseNet, InceptionV3, and Xception TL models suggests potential accuracy improvements beyond 94%. Additionally, the integration of Flask framework enables the development of a user-friendly front end for testing with authentication. EViTA presents a novel approach to pest identification with significant implications for enhancing pest management and agricultural practices. Further research and refinement hold promise for advancing EViTA's capabilities in pest identification tasks.*

INDEX TERMS Pest, peanut, moth flame optimization, CNN, vision transformer.

I. INTRODUCTION

Agriculture stands as one of the oldest and most crucial industries, playing a fundamental role in sustaining human and livestock populations globally. Over the years, the agricultural sector has undergone significant transformations, particularly with the adoption of environmentally friendly technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT). These advancements have not only revolutionized farming practices but have also expanded agriculture's role in clean energy generation [1].

The exponential growth in agricultural production witnessed over the past decades has been remarkable. Despite only a 15% increase in the land under agricultural use since the 1960s, agricultural production has tripled. This surge in productivity can be attributed to various factors, including the widespread adoption of pesticides and fertilizers, advancements in precision farming techniques, and the development of high-yielding crop and livestock varieties [2].

However, recent trends indicate a slowdown in the rate of growth in agricultural production [3]. This deceleration is concerning, especially considering the looming challenges that the agricultural sector faces, such as climate change and population growth. These challenges pose new hurdles for farmers and agriculturalists worldwide, threatening food security and livelihoods.

Furthermore, the agriculture and food processing industry plays a critical role in enhancing the quality of agricultural and food products. This sector responds to market demands and infrastructure support, driving innovations in food processing technologies and product quality assurance [4]. However, despite these advancements, the agriculture sector continues to face significant challenges, one of the most pressing being pest infections.

Pest infections represent a formidable threat to agricultural productivity and food security. Pests, including insects, microorganisms, and weeds, cause substantial losses in crop yields, leading to economic losses for farmers and reduced food availability for consumers. Addressing pest infections requires innovative approaches and technologies for effective monitoring, prediction, and mitigation.

IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

FACIAL EMOTIONS RECOGNITION SYSTEM BY RECOMMENDING MUSIC AND VIDEO USING ML

[1]E. Bhanu Sri Nikhitha, [2]K. Rudra Narasimha, [3]P. Neeraj Babu, [4]P. Krishna Sanjay, [5]Dr A Rama Murthy

[1,2,3,4]UG Student, [5]Professor

[1,2,3,4,5]Department of Computer Science and Engineering,

[1,2,3,4,5]DNR College of Engineering and Technology, Bhimavaram, India

Abstract: Human face having the different emotions. The emotion has varied forms like Happy, Surprise, Angry, Neutral, Sad, Fearful. The emotions are taken as the input from the inbuilt camera. We have used the Convolutional Neural Networks for emotion detection of the image taken from inbuilt camera and for implementing CNN we use Python, HTML, CSS, Django. Automatically Music playlist as well as Video is generated by identifying the current emotion of the user. The user can choose either music or video for their capability. The Music is useful for the people having audible sense and video is useful for the deaf and dumb people. Here it works by using the Spotify dataset for song recommendation and animation video for the visible outcome.

Index Terms - Python, Django, CNN, HTML, CSS.

I. INTRODUCTION

By bridging the gap between facial emotion recognition and content recommendation, our project holds the potential to revolutionize the way users interact with multimedia content. Imagine a scenario where, upon detecting signs of stress or fatigue, the system recommends calming music or uplifting videos to improve the user's mood. Conversely, during moments of excitement or celebration, the system might suggest energetic music or entertaining videos to amplify the user's positive experience.

The core idea is simple yet powerful, by analyzing facial expressions in real-time, our system aims to detect and interpret the user's emotions, subsequently leveraging this information to provide personalized recommendations aligned with their mood and preferences. Through the application of machine learning techniques, we seek to create an intelligent system capable of accurately identifying a range of emotions, including happiness, sadness, anger, surprise, fearful and neutrality.

In summary, the Facial Emotions Recognition System by Recommending Music and Video using Machine Learning project represents an innovative fusion of emotion recognition technology and content recommendation systems, with the potential to significantly enhance user experiences in the realm of multimedia consumption. Through this endeavor, we aim to not only advance the state-of-the-art in machine learning applications but also to create tangible benefits for users seeking personalized and emotionally resonant content recommendations.

48
50

International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 13, Issue 2 (Mar.-Apr. 2024), PP. 241-246

Health Care and Management using Block Chain and Machine Learning

[1]V. Durga devi, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, durgadevivemula815@gmail.com*
[2]B. Rajeswari, *B.Tech Student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, rajibarri331@gmail.com*
[3]P. Pujitha, *B.Tech student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, pujivarma70@gmail.com*
[4]G. Pavan Kumar, *B.Tech student, Department of CSE, DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, pavan851990@gmail.com*
[5]Ms. K. Siva Syamala, *M. Tech, Assistant Professor, Department of CSE,DNR COLLEGE OF ENGINEERING AND TECHNOLOGY, syamalakorupuri@gmail.com*

Abstract: *The modern healthcare landscape is inundated with vast volumes of data, presenting both challenges and opportunities. Leveraging the advancements in technology, this project proposes innovative solutions to address healthcare data management issues through the integration of Machine Learning (ML) and Blockchain technologies. ML algorithms are employed to sift through extensive datasets, extracting pertinent information efficiently. Meanwhile, Blockchain technology ensures the integrity and security of healthcare data by employing consensus mechanisms, thereby enhancing data sharing reliability. By placing patients at the core of the healthcare ecosystem, Blockchain has the potential to revolutionize healthcare management, bolstering privacy and interoperability of health data. The project primarily focuses on utilizing Blockchain technology, particularly Ethereum's platform renowned for its smart contract capabilities, complemented by ML algorithms like Random Forest. This combination not only facilitates effective data management but also enhances classification and regression tasks. Moreover, encryption techniques such as the SHA-256 algorithm are employed to bolster data security. Overall, this interdisciplinary approach promises transformative solutions for healthcare data management, fostering a more efficient and secure healthcare system.*
Index Terms: *Bag of words, blockchain, Electronic Health Records (EHR), Machine Learning, Social Security Numbers (SSNs).*

I. INTRODUCTION

The healthcare industry is grappling with the monumental challenge of managing and securing its ever-expanding volume of sensitive data. With the emergence of cutting-edge technologies like Machine Learning (ML) and Blockchain, there exists a promising avenue for transforming traditional healthcare data management practices. Blockchain, operating as a decentralized ledger, encrypts transactions into immutable blocks, ensuring the integrity and security of healthcare data [1]. Its cryptographic hashing mechanism establishes tamper-resistant linkages between transactions, fostering transparency and accountability within the ecosystem. Through decentralized architecture and consensus mechanisms, Blockchain networks bolster the security and reliability of healthcare data management systems, mitigating the risks associated with centralized repositories [1].

However, the healthcare sector faces a pervasive threat from data breaches and cyber-attacks, with millions of sensitive records compromised annually [4]. These breaches not only compromise patient privacy but also undermine trust in the healthcare system. Moreover, unauthorized disclosure of medical information can lead to identity theft, insurance fraud, and life-threatening situations, necessitating robust security measures [5]. Traditional data management practices exacerbate vulnerabilities, impeding the seamless exchange and utilization of healthcare information [6].

In this context, the synergistic integration of ML and Blockchain technologies holds immense promise for revolutionizing healthcare data management. ML algorithms can extract actionable insights from vast datasets, facilitating informed decision-making and personalized patient care [7]. Meanwhile, Blockchain's cryptographic security and decentralized architecture provide a robust framework for safeguarding healthcare data against malicious actors and systemic vulnerabilities. By harnessing the complementary strengths of these technologies, healthcare organizations can enhance data security, interoperability, and patient-centricity, ushering in a new era of efficiency and innovation in healthcare delivery.