IJITCE

ISSN 2347- 3657

International Journal of
Information Technology & Computer Engineering

www.ijitce.com

Email : ijitce.editor@gmail.com or editor@ijitce.com

ISSN 2347–3657

Volume 13, Issue 1, 2025

IOT-ENHANCED ELECTRIC VEHICLES WITH OPTIMIZED PERFORMANCE ALGORITHMS

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ABSTRACT

Autonomous automation is becoming an essential part of modern technological advancements, particularly in the automotive industry. This paper explores the evolution of self-driving car technology, highlighting the advancements in vehicle communication systems. The primary focus is on enhancing the communication infrastructure between remote-controlled bots and vehicles. Using a relay device (Raspberry Pi) as a network repeater, the connection between the remote control and the vehicle is extended. The Wi-Fi adapter serves as a signal extender, boosting connectivity and range for live video feeds and data transmission, including face recognition capabilities. This IoT-based system leverages advanced network configurations and encryption methods to enhance security and reliability. Additionally, the relay chain method improves remote connection range and makes data transmissions more secure, enabling the detection of obstacles and suspicious activities, which can be communicated to military bases

I. INTRODUCTION

The automotive industry has undergone significant transformations with the push towards smart vehicles. These vehicles, particularly electric ones, are replacing older fossil-fuel-based systems, contributing to more eco-friendly alternatives. Electric vehicles (EVs) are now designed to offer similar performance to traditional cars, with advantages such as longer range, battery optimization, and more efficient energy usage. The integration of IoT devices, including wireless sensors, has replaced traditional GPS systems, enhancing vehicle monitoring and charging efficiency.

The primary goal of this study is to propose an IoT-based solution for managing electric vehicle charges and improving safety by predicting potential issues based on real-time data from the vehicles. By transmitting data to extensive contingents, the planned study analyses its utilization in outdoor locations with the goal of building an IoT based solution for controlling the charges in automobiles. The objective of this suggested technology is to protect individual lives since there is a potential that the system may create a brief trail that would thereafter seriously affect human life. In order to evaluate the upper bounds of charge capacity under voltage set restrictions, the suggested work's key conclusions are as follows. A gradient boosting technique with lower prediction error will be used to generate these parameters.[1]

II. LITERATURE SURVEY

In order to create an Iot based solution for managing the charges in autos, the proposed study analyses its applicability in outdoor settings by transferring data to large detachments. The goal of the proposed technology stop reserve personal lives because there is a chance that it may leave a temporary footprint that would later have a significant negative impact on human existence. To assess the upper bounds of conveyor with voltage set restrictions, the key findings of the suggested research are as follows. A gradient boosting approach with low classification error will be used to give these parameters. This technique takes into account a transmitting data system where the data that has been examined will be sent to a control centre. However, the competitive validation of various methods has not been compared in making it difficult to determine the precise benefit. An intelligent technology is presented for widespread operation in order to transform all regions into ones that are rapidly developing [2]. The researchers emphasize four key elements for transitioning cities into smart ones: production, transport, marketing, and retailing. The writers have also examined the significance of solar and wind energy as well as its unique benefits for incorporating it into the smart grid process. It becomes difficult to apply the precise technical procedure in this situation since the authors have not compared the two processes.

It is crucial to put in places u per charger stations with decentralized electric systems in addition to making cities smarter. The integration of residential structures into smart charging processes was proposed as a novel way to achieve various states of charge with lower power costs. The main drawback, though, is that there's not an intelligent gadget to analyze important fault situations. However, an IoT approach has been used to satisfy the enormous demand brought on by changes in daily activities. Following the introduction of several advance techniques like the Internet of Things, technological innovation for encryption technology is now incorporated to determine an exact battery level and to indicate charging locations. To monitor thebattery level, however, employing blockchain based is not necessary. Blockchain may be applied if the developed scheme examines crucial factors like security.[3]

II. OBJECTIVE

The primary goal of the proposed work is to examine how electric vehicle utilization may be improved by the integration of IoT, hence achieving

the following goals: optimization of I capacity, (ii) battery life over long distances, and reduction of I cost and (ii) temperature. A gradient boosting technique is also used to meet the goals, and maximum effectiveness is realized.

OPTIMIZATION ALGORITHM

The optimization technique must be integrated into the suggested model in order for the battery performance to be estimated automatically while the electric vehicle's range is being tracked. This optimization method is crucial to the IoT process since it makes data collecting and aggregation considerably easier. Additionally, data will be delivered quickly from the source to the destination if an effective algorithm is included. As a result, a powerful classification algorithm [4] is chosen and integrated with goal function. The Extended Gradient Boosting Technique (EGBA), a decision tree method, is one sort of machine learning algorithm that is applied in the suggested study.

ISSN 2347–3657

Volume 13, Issue 1, 2025

While there are other optimization algorithms usedto determine EV charges, EGBA is recommended since it is based on the guiding concept of choosing the perfect answer by adding it to outputs from earlier states. The suggested system predicts values for each case study and stores them in a centralised database. It is only feasible to connect to thedatabase if the prior values are known if someone needs authorisation to do so. Additionally, EGBA hasavastlylargerpredictionspeedthanthatofother algorithms, and the suggested technique has a high likelihood of mistake at each stage since there are several possible solutions. Therefore, EGBA is strongly favoured over other algorithms in order to decrease the forecast error at each stage's output.The nominal charge capacitance is used to rectify errors even if a minute changes occur during the prediction process. Additionally, by minimising the inaccuracies in the charging process, EGBA has the potential to bring the anticipated results nearer than the goal values (voltage sets). The decision tree approach was used because it considers several solutions for all EVs before sending the consumers the optimum parameter value. Figure 1 depicts the EGBA flowchart (Extended Gradient Boosting Algorithm) [5]operating voltages, and Things Speak may track this time by using Equation (3).[6]

Vi=VdcVmaxVmin(3)

where Vmax and Vmin indicate the highest and lowest voltages that may be attained at the output, and Vdc denotes the input voltage that is converted to5Vusingthevoltageconverterson theinputside. The level of the voltage shouldn't go beyond 0.5Vfor safe functioning. As a result, the minimum voltage must always be between 4V and 6V. The configuration utility should be informed straight away if a discharge on the battery is detected so that the required remedies may be provided. Ifconsumers choose to charge their cars at house, the following restriction must be met. ni = 1 Vdc Vmax (vehicle, others) (4) According to equation (4), the voltage output that may be delivered to the car and other electrical devices must be less than 230V. The maximum voltage provided to the car might be limited to 120V because it is more challenging to turn on additional loads when the battery of something like the vehicle is receiving 230V charging.[7]

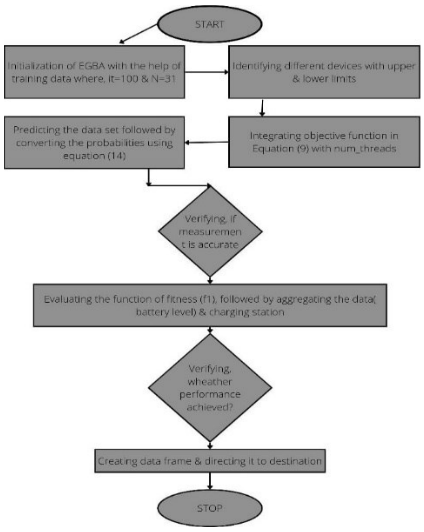

Fig1.FlowchartofEGBA

International Journal of Information Technology & Computer Engineering
ISSN 2347–3657
Volume 13, Issue 1, 2025

PROBLEM FORMATION

In this part, a brand-new IoT-connected electric car type has been developed. Knowing the battery's conditioniscrucialforanelectriccarsinceitdefines the vehicle's state using Equation (1): b(i)=i,n=1CiCn(1), whereby Ci is the current capacity being discussed, which is seen at the exit, and Cn is the minimum capability to be preserved. The limitations in equation (1) specify the shift in capacity that may be seen at various points in time. Consequently, Equation (1) may be used to specify the monitoring of a number of characteristics, including temperature, network lifespan, and battery consumption. Equation (1) can thus be changed as follows: b(i) = b (i io) Cn(2) Calculate the ratio in Equation (2), where b(i io) is the shift in current to nominal charge capacity vehicles. In order to stopthe self-discharge that happens within electric vehicles, this is done. A warning is provided to the individualpersondrivingthevehiclewhenanumber on the variables change since this self-discharge might seriously hurt that user. Therefore, in order to preventsuchdamage,theuserneedsbeawareofthe

RESULT

The system's performance was evaluated using **ThingSpeak**, a cloud-based platform for monitoring and controlling IoT devices. MATLAB was used for offline data analysis, and real-time data from EVs was captured and displayed for daily usage analysis. Four different scenarios were tested to evaluate the efficiency of the IoT system in real-world conditions. The results showed that the integration of IoT-based solutions significantly improved the efficiency and reliability of the electric vehicle system.

A. Temperature and Range Measurement

Temperature regulation plays a critical role in maintaining the longevity of electric vehicles. The system effectively monitors the vehicle’s operating temperature and issues warnings when it exceeds safe limits. Additionally, the relationship between voltage levels, speed, and temperature was tested, revealing that the new method can maintain lower temperatures compared to existing systems. This helps prevent damage to the vehicle’s electronic components.

B. Charging Efficiency

The range of electric vehicles was analyzed in different conditions. The IoT-enabled system demonstrated that the vehicle could travel longer distances compared to traditional methods of monitoring charge levels. For example, the range was improved by 10–15% in various test conditions, indicating a significant increase in operational efficiency.

c. Expanseoftemperature

It is very important to analyze the influence of temperature in electric cars, since if the temperature level is higher than the recommended level, all electrical and electronic components will be

International Journal of Information Technology & Computer Engineering
ISSN 2347–3657
Volume 13, Issue 1, 2025

damaged.Therefore,whenthe engineheatexceedsa certain temperature, a warning is sent to the user to shut the engine off. As a result, this scenario was evaluated utilising both of the electric vehicle's pase and the current battery rising voltage level (from lowest to highest). For instance, if the car is travelling at a speed of 70 km/h, the appropriate voltage level would be 1220 V, and the appropriate highest temperature would be 70 degrees. The existing method [12] generated a temperature equivalenttothemaximumtemperature, butthenew method was capable of maintaining a far lower temperature of 50 degrees. This showed that the vehicle's powerplant should be shut down for a specified time The graph between voltage and speed is shown below in fig 2[13]

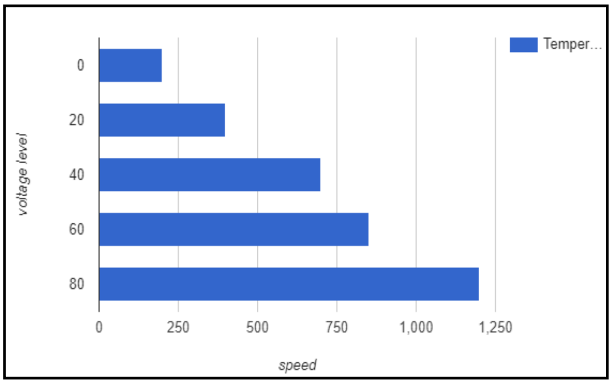

Fig.2.Reflectionoftemperature

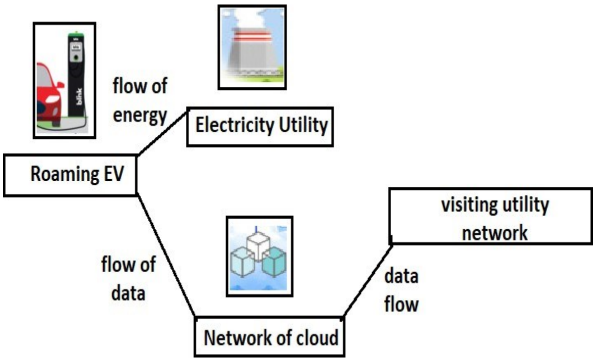

Figure3.Architectureforchargingtheroaming electric vehicles.

D.*Measurementonrange*

Afterexaminingtheassociatedvoltagelevels,which change over time, the electric vehicle's range was examined. This scenario's potential range was examined. [14] The same 10 hours beginning at 8 AM. It was noted that electric cars' range was compared to the current approach, in the suggested method was much greater. For instance the car's engine fired up at eight and covered two hours of distance was 40 km, but the current approachwas only able to do this at the same pace both 32 and 34 kilometres.

Conclusion

The integration of IoT in electric vehicle management has proven to be effective in improving vehicle performance, battery life, and operational efficiency. The use of EGBA for optimization allows for precise monitoring and prediction of critical parameters, enhancing both vehicle range and safety. The implementation of an online monitoring system provides real-time feedback, helping users make informed decisions regarding vehicle maintenance and charging. Future work will explore the incorporation of advanced encryption techniques for enhanced security, particularly for the protection of vehicle data and charging stations. The proposed system lays the foundation for more reliable and secure EV infrastructure and could be scaled to incorporate additional smart grid and IoT features.

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