JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

IOT BASED PREPAID ELECTRIC VEHICAL CHARGING STATION

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Abstract: ***We are seeing the increasing use of Electric Vehicles (EVs) now a days which is connected to the power grid generates challenges in the EV charging coordination and operation cost management. Prepaid electric vehicle (EV) charging involves users paying in advance for the electricity they plan to use to charge their EVs. This model allows for better cost management and control over charging expenses. Users typically load a prepaid amount onto their charging account, and the charging stations deduct the cost as the vehicle charges. It can be convenient for budgeting and may offer discounts or incentives for prepayment. The mobile application manages the user authentication mechanism to initiate the electric vehicle charging process, where a sensor is used to measure the current and voltage based on the microcontroller, the device makes a communication with data with the mobile application. A user interface has been developed to visualize this process happening, which show the various sensor data to the user and also send alerts messages. And after charging user see the charging status on their phone. Their data will remain safe and secure as data will be stored on cloud.***

I. INTRODUCTION

Whether you as of now drive an electric vehicle (EV) or are considering getting one, charging assumes a basic part in driving an EV. With the mass reception of electric vehicles not too far off, the significance of brilliant electric vehicle charging will become fundamental for both the charging point network administrators, and the public power matrix. One of the significant difficulties while entering the electric vehicle (EV) market is the charging system, where the primary issues are connected with the absence of appropriate framework in private (high rises) because of their ineptness for this new reality. The loft has a common power issue, which doesn't meet the prerequisites of EV proprietors. In light of new advances in the Web of Things (IoT) and related sensors and correspondence stages, frameworks can possibly make new answers for these issues. One more part of this challenge is connected with rental lodging and the chance of requiring electric vehicle charging help with these conditions. In condos, sadly, there is an overall hesitance to introduce EV charging stations, which might be utilized by a couple of proprietors. Furthermore, there is likewise an issue connected with the security of the electrical frameworks, as they are not effectively worked to help EV charging stations, and the change of the electrical foundation of the loft won't just requires agreement among a greater part of proprietors, which can be troublesome, yet can likewise be hard to get, from government building wellbeing specialists. Taking into account the way that most private structures have normal spaces with shared electrical establishments and are not ready for the establishment of new EV charging frameworks, this is a boundary to reception. A review recognized four key trouble spots with regards to sharing electric vehicle charging arrangement structures, charging framework inaccessible, building limits, administrative issues, and accessibility of the parking garage.

II. LITERATURE SURVEY

As the number of EVs on the roads increases, charging stations in both parking structures and private garages will become more prevalent. These stations will be responsible for meeting the requirements of the distribution grid, EV owners, and parking structure operators. For security and financial reasons, among the many functions these charging stations will perform are user authorization, authentication, and billing. Basic, networked, charging stations such as Leviton[1] and ClipperCreek[2] require a point of sale (POS) device to authorize and enable charging. Other commercial charging stations, such as Coulomb [3] and Blink [4] require a short range RFID card for the same purpose. In both cases, extra steps on the part of the user must be taken to authorize charging. The authors in [5] propose using conventional RFID tags inside EVs and RFID readers on parking garage access gates together with middleware and an aggregate charging controller to authorize, assign, and enable charging. However, this system still requires action from the user and is not as flexible as may be desired. The UCLA SmartGrid Energy Research Center (SMERC) has developed a software-based EV monitoring, control, and management system that employs multiplexed charging stations capable of providing varying power to several EVs from one circuit, called WINSmartEVTM[6][7][8]. This system centers on a server-based aggregated charging controller and utilizes a user database together with a smart-phone interface for charging authorization. In order to simplify the charging authorization process and make it

more convenient for users, an authentication system based on an RFID mesh network is proposed as an additional capability for the existing WINSmartEVTM framework. The proposed improvements allow charging authorization to take place seamlessly at multiple charging stations in a single geographic location without any action on the part of the user. Vehicle Monitoring/Identification Modules (VMMs), located in EVs, act as RFID tags for vehicle identification and charging authorization. Unlike the layered architecture for managing a variety of automatic identification hardware proposed in [9], the VMMs communicate directly with a network coordinator and charging control server through a ZigBee mesh network, thus simplifying the architecture. The paper is structured in the following way: first, the existing WINSmartEVTM architecture is outlined. Then the architecture of new Zigbee-based RFID charging authentication system is presented and each component of the system is described in detail. Last, the results of the implementation are presented and discussed. With an increased number of Electric Vehicles (EVs) on the roads, charging infrastructure is gaining an ever-more important role in simultaneously meeting the needs of the local distribution grid and of EV users. This paper proposes a mesh network RFID system for user identification and charging authorization as part of a smart charging
infrastructure providing charge monitoring and control. The Zigbee-based mesh network RFID provides a cost-efficient solution to identify and authorize vehicles for charging and would allow EV charging to be conducted effectively while observing grid constraints and meeting the needs of EV drivers. The Internet of Things, also known as things-linked internet, is a network that connects any object to the internet via RFID (radio frequency identification), infrared sensors, and other sensing devices, allowing data exchange and communication. This paper discusses the technical advantages of RFID technology for identifying electric vehicles and managing the entire battery charging compartment, as well as how RFID technology is used in battery charging stations. Because of these advantages, RFID technology can better serve the electric vehicle industry and support effective battery charging compartment management. Electric vehicle charging stations have begun to be installed in many areas, but they are not yet complete.

Jagnyashini Debadarshini ,Sudipta Saha Indian Institute of Technology, Bhubaneswar entitled “Efficient Coordination among Electrical Vehicles: An IoT-Assisted Approach”on 20 June 2022 Higher refueling time of the Electric-Vehicles (EVs) is one of the major concerns in their wide-spread use for transportation. A well-planned charge scheduling of the EVs, hence, is extremely important for proper utilization of the limited charging infrastructure and also limit the size of the waiting queue in the Charging Stations (CSs). Almost all the existing works on this topic are theoretical and assume the availability of global data of the EVs and the CSs. In this work, we take an endeavor to derive a practically useful solution to this problem through efficient EV-CS coordination.

N. Sankar Department of Electrical and Electronics Engineering, National Institute of Technology Puducherry, Karaikal, India M. M. Rajan Singaravel Department of Electrical and Electronics Engineering, National Institute of Technology Puducherry, Karaikal, India entitled “Solar Powered Off-board Electric Vehicle Charger with Reconfigurable Power Electronic Interface” on 21-22 January 2022 The growth and usage of the electric vehicle is on the rise over the past few years. Demerits of conventional IC engine vehicles like depletion of fossil fuel, increase in fuel price and negative impacts on the environment made us to shift to electric vehicles. The fuel for electric vehicle is electrical energy which is extracted from the power grid through charging station. In the power grid, the energy share from conventional energy sources are high, that too coal, which again leads to the same negative impacts as like IC engine vehicles.

Sangeetha R.G , Hemanth. C School of Electronics Engineering, Vellore Institute of Technology-Chennai, Chennai, India Naveen Kumar Marati Wipro Limited, Bengaluru, India entitled “Remote Electric Vehicle Battery Monitoring & Life Cycle Management System” on 10 October 2022 The Internet of things (IoT) is one of the most revolutionary technologies leading experts have created today. The ever-increasing number of devices and embedded systems has made it a necessity for IoT to be implemented in every corner of the world. The latest technology for electric vehicles uses IoT monitoring and life cycle management. Even though there is a sophisticated battery management system in the present Electric Vehicles, there is always a chance of battery damage due to numerous instances caused by battery overcharge and exposure to high/low temperatures.

Manoj Basnet ,Subash Poudyal ,Mohd. Hasan Ali ,Dipankar Dasgupta Department of Computer Science, University of Memphis, Memphis, TN, USA The Supervisory control and data acquisition (SCADA) systems have been continuously leveraging the evolution of network architecture, communication protocols, next-generation communication techniques (5G, 6G, Wi-Fi 6), and the internet of things (IoT). However, SCADA system has become the most profitable and alluring target for ransomware attackers. This paper proposes the deep learning-based novel ransomware detection framework in the SCADA controlled electric vehicle charging station (EVCS) with the performance analysis of three deep learning algorithms, namely deep neural network (DNN), 1D convolution neural network (CNN), and long short-term memory (LSTM) recurrent neural network.

Lucas Zenichi Terada , Juan Camilo López ,Cindy P. Guzmán ,Marcos J. Rider ,Luiz C. P. Da Silva Department of Energy Systems (DSE), State University of Campinas (UNICAMP), Campinas, SP, Brazilentitled “An IoT-based Smart Charging Algorithm Considering Local Distributed Energy Resources and V2G Technology”on 28 September 2022International Journal of Research Publication and Reviews, Vol 4, no 1, pp 1479-1484, January 2023 1484 The integration of distributed energy resources (DERs), such as electric vehicle charging stations (EVCSs), photovoltaic units (PVs), and battery energy storage systems (BESSs) is a key component towards decarbonization. In this context, the development of smart charging control strategies to encourage the usage of renewable energy sources (RESs) for EV charging has become a topical research subject. This paper proposes a smart charging algorithm executed through an internet of things (IoT) platform to control DERs, locally integrated through an aggregated system.

Ankita Nagpal (2020) attempts to uncover consumer perceptions of electric vehicles in the Indian setting in her study. The study's goal is to look at the elements that influence consumer purchasing intent. Low carbon levels, lower maintenance costs, and government measures to incentivize consumers all contribute to higher purchase intent. Other components that have an impact on the consumer are television advertisements, after-sales service, and the wealth of knowledge and information available on the internet.
Increased disposable money, as well as the availability of charging stations and systems, are variables that impact people's decisions to acquire electric vehicles. Beena and Rakesh (2020) investigated current and future trends in electric vehicle production and sales in India, as well as emission standards for India, vehicle standards based on light duty vehicle energy consumption, emission reduction based on global warming for light duty vehicles, and an examination of the EV market. According to the survey, there are numerous
barriers to overcome for EV adoption, and customers are eager to reduce pollution and accept the possibilities, but the various costs are significant, so a cost-effective car is expected in India.

Consumer purchasing intentions of battery electric vehicles in China are identified by Jiang Q WeiW. (2021) and others. Their research aims to investigate the elements that impact consumers' decision to purchase electric vehicles and to construct a theoretical model of these aspects. Brand identity, brand image, and perceived risk are all factors that influence consumer purchase intentions for electric automobiles. Brand image is influenced by brand recognition, brand awareness, and perceived risk. Brand awareness and identification will have an effect on risk perception. Brand awareness will be influenced by brand identity, but purchasing decisions will not be influenced directly by brand awareness. Essential hurdles and insufficient charging facilities are addressed for a growing country like India, according to a research article published by Goel and colleagues (2021). They discuss the market penetration rates for electric vehicles, hybrid electric vehicles, plug-in hybrid electric vehicles, and battery electric vehicles. When compared to regular automobiles, hybrid, plug-in hybrid, and electric automobiles can improve fuel economy while significantly increasing the cost of ownership. Purchasers, society, automakers, and governments all profit from their lower petroleum use and increased productivity in the long run. When conventional energy sources are unavailable, the new vehicle-to-grid concept can be used to either deliver power to the grid or charge the battery.

Krishna (2021) attempted to find impediments to EV adoption and consumer perception in his research. According to the study, the following factors influence consumer perception: 1. inability to convert sales: i. vehicle supply and choice, and ii. dealer role. 2. lack of trust in technology: i. autonomous driving, ii. unsafe, iii. unfriendly to the environment, iv. unreliability, v. technological immaturity; 3. adapting to technology: i. purchase and ownership costs, ii. infrastructure, iii. range, and iv. recharge time; 4.wantability: i. the vehicle's soul and personality, ii. repair, iii. culture, iv. a lack of fun, v. the vehicle's appearance and futuristic concept, vi.presentation, vii. sound, viii. emotional attachment, ix. negative image

In his study, Saiful Hasan (2021) attempted to predict consumer intent to repurchase electric vehicles. Consumer satisfaction with EV benefits, such as cost, range, recharge, policy measure, environmental qualities, symbolic attributes, and model availability motivate consumers to repurchase EVs, according to the study. In their paper “Customer Perception of Electric Vehicles,” researchers Parmar and Pradhan (2021) identify consumer knowledge and decision criteria for purchasing an electric vehicle. According to their research, the majority of customers are aware of the internet as a key source of information in addition to television and newspapers. Consumers are motivated by a variety of considerations, including environmental awareness, minimal noise, pricing, and new trends. Electric vehicles should be provided at a lower cost to consumers. Because consumers are less aware of government subsidies, they must be advertised more.

Singh, Sharma (2021) and others list the benefits and drawbacks of marketing electric vehicles in India. The following are some of the benefits: When compared to internal combustion engines, electric vehicles are more environmentally friendly. Electricity is less expensive than fuel. In comparison to internal combustion engines, electric vehicles require less maintenance. Electric car challenges include electricity supply, electric vehicle cost is higher than regular vehicles, unavailability of charging stations,and shorter range after charging causes consumers to be afraid of long driving. The high cost of electric vehicles is one issue that deters consumers from purchasing them. To address this, the government has promoted the use of electric vehicles in commercial vehicles by offering incentives. However, electric automobiles are still at least 30% more expensive due to imported batteries.

Monica and Mifzala (2019) investigated customer perceptions in Banglore by learning about their attitudes, feelings, and perceptions. The researchers discovered the level of EV knowledge and the elements that influence client purchase decisions. The majority of buyers are aware of the environmental benefits of electric vehicles. As a result, half of the customers were environmentally sensitive and may like to adopt it. They believe that installing charging stations will aid in the growth of EV sales. In their study, researchers Helmus and van den Hoed (2019) focused on charging infrastructure with the goal of better understanding important performance indicators for public charging infrastructure. Stakeholder concerns about public charging are considered, using objective and result indicators in their study for charging infrastructure. Over the course of various specified goals, result indicators, performance indicators, and various possibilities are assessed. The formulation of key result indicators and key performance indicators, which provide ideas for communicating with stakeholders and implementing, are required for charging infrastructure performance monitoring.

Based on consumer behavior and consumption trends, this article examines a market research study on consumers' understanding of and buying intentions for electric automobiles. Consumers are less aware of most electric autos, according to researchers Yuhang Shang and Yi Feng (2019), and their purchase intents are rather plain. When it comes to purchasing an electric vehicle, the most significant factors they examine are design, price, and dependability, and in the changing circumstances, they also anticipate good
design, a fashionable look, and high-quality service.

The problems for electric vehicles in India were investigated by authors Rakesh Kumar and Dr. Sanjeevikumar (2019). Customers will have range anxiety as a result of a lack of charging infrastructures at regular intervals on the streets, as the vehicle may not be able to run for long. The battery cell is the most fundamental component of an electric vehicle's battery pack. A battery pack is made up of numerous modules, while a module is made up of several battery cells. The batteries are the most expensive component in electric vehicles. They cost around half of electric vehicles. The electronics that tie the cells of a battery pack together and constantly check the status of each cell is known as the battery management system (BMS). A BMS monitors each cell's temperature, charge-discharge state, and short circuit protection.

Selva and Arunmozhi (2020) set out to determine customer perceptions of electric vehicles and the global market, as well as the effectiveness of electric vehicles and their global market. Currently, BEVs (all-electric vehicles) account for 66% of the global EV market. Sales of BEVs are growing faster than those of plug-in hybrids (PHEV). Organizations are working on electric autos to improve consumer awareness and develop new goods. Customers trust their friends and family more than corporation marketing; therefore, this strategy is low-cost and has a greater impact on customers.

Garling and Thogersen’sessay (2020), “Marketing of Electric Vehicles,” discusses how substituting electric vehicles for traditional ones could reduce local pollutants and greenhouse emissions from the transportation system. They contend that the user of an electric vehicle pays a hefty price for these societal benefits in terms of pricing, availability, speed, and acceleration. The authors believe that to finish the diffusion process, supportive national policies and skilled marketing are required. Based on a consideration of current and future expected qualities of electric vehicles, as well as a review of data on early adopters, the article outlines a two-phrase strategy for marketing electric automobiles. Afroz (2015) and his colleagues published a study to investigate how individual values and attitudes

influence consumers' purchasing intentions for electric vehicles. Customers from Malaysia are the focus of the study. Individual consequences (ICNs), such as measures of convenience, product size range, and perceived utility, were found to be adversely connected to green purchasing intention in the study (PIN). While consumers consider fuel efficiency, consumption, and comfort of a car when making a purchasing decision, they may choose an electric vehicle if the manufacturer offers a battery recycling facility. PIN has no statistically meaningful link with ECN's environmental impacts.

Craig Morton (2016) and co-authors observed the impact of consumer innovation as well as perceptions of electric vehicle functional capabilities on customer demand for electric vehicles in their study on consumer preferences for electric vehicles. The study proposes a framework for analyzing the impact of consumer innovation and attitudes on electric car functional qualities.

III. DRAWBACKS OF THE EXISTING SYSTEMS

1.It requires man power
2.More time consming
3.Transaction delays
4.Uncertain Costs

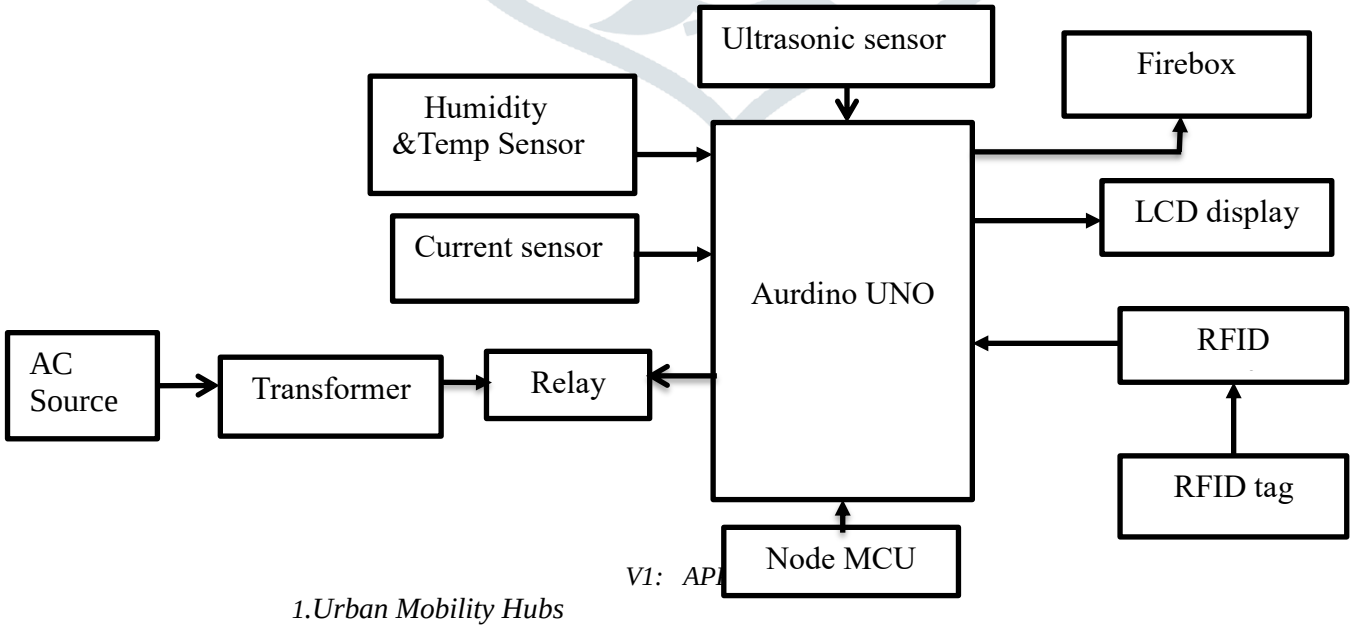
IV. OBJECTIVES OF THE PROPOSED METHOD

1. Cost Control
2.Convenience
3.accessibility
4.Efficiency
5.User-Friendly Experience

V. PROPOSED METHOD

This is the operation have to present in the charging station.In the proposed method the Arduino and Node MCU are the key players for the interface of customer and OEM's (Original Equipment Manufacture's) Charging station. With the help of switches present in between the ports and Aurdino will communicate the availability of port to the Aurdino UNO and it will display the information on LCD(Liquid Crystal Display). Those switches will make the relay module and then the servo motor will open and close the gates of the ports. By Node MCU (Micro Controller Unit), the 12C(Inter Integrated Circuit) Serial Communication will come in to the action and interface with the cloud data for prepaid charging of the vehicle.The RFID (Radio Frequency Identification) Reader module is placed in the charging station and the RFID card is with the customer. With the help of this RFID module the timely based prepaid charging will done for the vehicle.The Node MCU part will calculate the total price with the time utilized to charge the vehicle and unit cost information based on the location of charging station and the nearest power grid. Due to various grid connection tarrif prices, the can implement prepaid charging station technology.

Figure1: Block diagram



V1: API

1.Urban Mobility Hubs
2.Corporate Campus Charging
3.retail and shopping centre
4.Public infrastructure

V11: RESULT

An IoT-based prepaid electric vehicle charging station offers enhanced user control and billing efficiency. Users can remotely monitor and manage charging sessions, check real-time availability, and pay for services in advance, promoting a seamless experience. Additionally, it enables better load management, cost optimization, and data-driven insights for operators, fostering a more sustainable and economical electric vehicle infrastructure.

V111: CONCLUSION

An IoT-based prepaid electric vehicle charging station offers enhanced user control and billing fficiency. Users can remotely monitor and manage charging sessions, check real-time availability, and pay for services in advance, promoting a seamless experience. Additionally, it enables better load management, cost optimization, and data-driven insights for operators, fostering a more sustainable and economical electric vehicle infrastructure.

VI. REFERENCES

[1] Patel, MD, Aush, MG, Mahadik, YV, Kamble, SG, Patil, SV, Kharade, JM. Energy management between electric vehicle charging stations and electric distribution system considering quality of service using IACSO-MPA approach. Int Trans Electra Energy Syst. 2021

[2] Manoj D. Patel , Rutuja V. Nerlekar , Ankita S. Patel , Namrata M. Raut, Ankita M. Virbhakt, "Wireless Charging of Battery in Electrical Vehicle using Solar Energy," International Journal of Engineering Research & Technology (IJERT), Volume 09, Issue 03, pp. 394-397, March 2020

[3] 2022 TEMPOS: QoS Management Middleware for Edge Cloud Computing FaaS in the Internet of Things IEEE Access

[4] 2022 Cloud of Things (COT): Cloud-Fog-IoT Task Offloading for Sustainable Internet of Things IEEE Transactions on Sustainable Computing

[5] Connected and Autonomous Electric Vehicles Charging Reservation and Trip Planning System 2021 International Wireless Communications and Mobile Computing (IWCMC)

[6] 2020 Collaborate Edge and Cloud Computing With Distributed Deep Learning for Smart City Internet of Things IEEE Internet of Things Journal

[7] Internet of Things Experiment Platform Based on Open Source Ecosystem 2023 International Conference on Smart Grid and Electrical Automation