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"Electric Vehicles Charging Station with Security"

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ABSTRACT

When transportation shifts from fossil fuel-powered to zero and ultra-low tailpipe emissions cars, the world as a whole undergoes a huge transformation. An infrastructure of information-technology-enabled charging stations (CSs), to facilitate the switch to electric vehicles, innovative distributed energy producing units and encouraging public policies are required. To facilitate the switch to electric vehicles, innovative distributed energy producing units and encouraging public policies are required. This research covers the primary factors to be taken into account while building the infrastructure for charging electric vehicles. This paper provides information on planning and technological developments to improve the infrastructure for charging stations' design and execution. Along with EVs' effects on grid integration and provisioning for EV optimum allocation, the current state of the electric car scenario is thoroughly analyzed. Research on infrastructure, particularly as it relates to issues with charging stations and efforts to standardize infrastructure in order to facilitate future research, is examined in this study. Both the financial benefits and the impact on the grid influence the optimal sites for rapid charging stations.

KEYWORDS

Multi-level charging stations; power grid network; electric vehicle; fast charging techniques; fast charging converter.

INTRODUCTION

A vehicle that is propelled by one or more electric motors is called an electric vehicle (EV). It can run on a battery (which is occasionally charged by solar panels, or by turning gasoline into electricity using fuel cells or a generator), or it can run on a collector system that draws electricity from sources outside of the vehicle. Road and rail cars, surface and underwater watercraft, electric airplanes, and electric spacecraft are examples of electric vehicles (EVs) [1]. In 2012, the Indian government unveiled its National Electric Mobility Plan.Six to seven million EVs and HEVs are anticipated to be produced by 2020; this was only the case in 2017. it was declared that gasoline-powered cars would be outlawed by 2030. Many Indian cities have excessive levels of air pollution caused by nitrogen and carbon oxides.Around 51% of India's air pollution is caused by the transportation industry, and this percentage rises to 75-80%. EVs and alternative fuel vehicles lessen the damaging effects of the transportation industry on the environment.EVs have not been generally embraced by customers in the past. However, because to advancements in battery technology and technology, EVs are becoming more enticing [2]. Consumer interest in electric vehicles is growing due to technological advancements on a global scale. It is projected that a large-scale adoption of non-combustion engine vehicles will occur in order to address CO_2 emissions and environmental concerns. These vehicles can be classified as pure electric vehicles (EV) (EREV), plug-in hybrid electric vehicles (PHEV), or extended-range electric vehicles (EREV). With the growing popularity of electric vehicles, it is imperative that safe and reliable public charging stations be developed and implemented. However, because these stations are computerized and connected through interoperable network technologies, they are classified as the vulnerable fraction, which has implications for data privacy and security [3].

Like a smart grid that has experienced a major technological change, there are certain hazards that could allow a bad actor to increase privilege. These risks include, but are not limited to, compromising user and system data integrity, confidentiality, and availability. Malicious use of the actual physical interfaces linking the electric car to the wireless communication link for metering or billing systems, or to the charging station, is possible.

LITERATURE REVIEW

The article "Electric Vehicle Charging Infrastructure in India: Viability Analysis" by Khan, Wajahat & Ahmad, Furkan & Ahmad, Aqueel & Alam, Mohammad & Ahuja, Akshay was published in 2018. Given the background mentioned above, it is becoming increasingly important to address the best location for EV charging stations. EVs not only use less energy and emit less pollution, but they also smooth the load curve by reducing peak loads, improving the facility system's economics and safety. This is accomplished by coordinating with intermittent renewable energies like wind that takes into account the restrictions of the power system and thus the transportation power. However, incorrect placement and sizing of EV charging stations may have a negative influence on EV usage, the traffic network design, and ultimately, the comfort of EV drivers.Moreover, it can worsen some nodes' voltage profiles and increase network losses [4].

The article "India's charging infrastructure is the biggest single point impediment in EV adaptation in India" was published in the IEEE Transportation Electrification Conference (ITEC-India) in 2017 by S. Nair, N. Rao, S. Mishra, and A. Patil. Today's academic and industrial communities strongly emphasize the need of placing EV charging stations strategically. The design of EV charging stations is influenced by various factors that are analyzed, such as the energy delivery mechanism, performance and charging time of batteries, charging requirements, charging stations' locations, and charging station settings.The 2017 publication.

"Air pollution due to road transportation in India: A review on assessment and reduction strategies" was written by Shrivastava RK, Neeta S, and Geeta. There are three phases for EV charging stations: the public marketing stage, the demonstration stage, and the business use stage. The viability of optimally utilising the Ontario grid's potential for charging plugin hybrid EVs (PHEVs) is analysed for off-peak load periods. Next, an improvement model for the planning of EV charging stations is planned using a simplified zonal model of the province's electrical transmission network and a zonal pattern of EV charging stations. This model includes the interval distance magnitude relation, charging capability redundancy, and charging power redundancy.Using a robust optimization method framework sector, the ecologically and economically beneficial property integration of PHEVs into an influence system is self-addressed.

"Electric Vehicle Charging Station Security Enhancement Measures" was published in the 2020 Fifth IEEE Workshop on the Electronic Grid (eGRID) by Shahriar Saadat, Samantha Maingot, and Sahba Bahizad. As the market for electric vehicles grows, manufacturers and consumers are becoming more concerned about security issues with public charging stations. A robust, standardized method is needed to assess and enhance the current security measures and offer an implementable mitigation strategy [5]. As a result of advances in technology and the installation of numerous parts into the infrastructure of electric vehicles and charging stations without proper security consideration, security evaluations of possible vulnerability analysis should be done more often. This study covers the implementation of multi-layer authentication using Loop and ANPR technologies to supply electric vehicle charging stations with comprehensive security and reduce the risks of cyberattacks [6].

PROBLEM STATEMENT

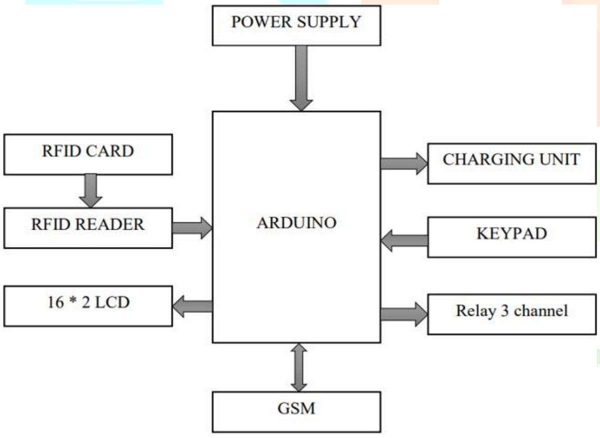
• An ecosystem and charging station are not universal. By providing the threshold amperes for each car, we will supply the charge fuelling for each vehicle.

• There will be different charging ports for different vehicles and we will look on to it and maintain all the vehicles charging plugs in a single station.

• Electric cars get a specific charging port (CCN-2), electric two and three wheelers should maintain a similar standard to achieve the mass adoption of electric vehicles.

• The batteries that power grid-tied electric automobiles are the primary focus, together with the efficiency of the infrastructure that uses them.Additionally, to retrieve the methods for optimizing a car battery's ability to power the system and recharge itself as effectively as possible.

OBJECTIVE



• To minimize the overall expenses related to EV charging stations while simultaneously enhancing the voltage profile.

• To implement charging for multiple ports in a single station.

• To reduce the time of charging of an electric vehicle using multi-ports.

• To implement low power direct current stations (15kW-45kW) for passenger vehicles and motorcycles.

• To provide a model and methodology that can offer a sensible EV charging station planning scheme, as well as lower network loss and enhance voltage profile.

• In order to minimize the overall costs of the proposed EV charging stations, including the costs of investments, operations, maintenance, and network loss during the planning phase.

METHODOLOGY

This study aims to educate policymakers on cooperative charging practices. To investigate the different aspects of cooperative behaviour, a survey is currently being designed. The focus of the survey is on the first four cooperative behaviour components because they call on respondents to take measurable activities [7]. Due to the complexity of group selection mechanisms, surveys are not a suitable method for doing research on this topic. In addition to announced evidence of cooperative behaviour, this research provides insight into revealed cooperative behaviour. This offers an opportunity to clarify the frequency of such behaviour requirements and the degree to which reported behaviour is also seen in practice. The prototype is designed to mount at street light bases [8]. Everything that travels through the power lines at the street lighting to get to our homes. This plan calls for charging EVs outside using 220 volts. There's also a solar panel included, which converts solar energy into electrical power that may be used. The amount of voltage that enters the battery is managed by the solar charge controller on the panel [9].

The project's functioning model is shown in the block diagram. Our Arduino is linked to an RFID reader, a keypad, a three-channel relay, a two-way GSM, an output 16 by two LCD, and

Fig 1. Block diagram of EV

a charging device. The model operates using integrated general mechanisms after power is given. The Arduino handles the most of the system's functions, while the RFID Card provides input for the RFD Reader. The charging unit will operate on the integrated Arduino principle, and Relay 3 Channel will receive data from Arduino. When the battery of an electric car runs low, the driver uses his phone to find the nearest charging station.There is a unique location tag attached to the charging stations that enables GPS positioning. The NEO 6M GPS module actively tracks 24–30 satellites and sends the coordinates to the phone. When the coordinates have been decrypted, the exact position is then shown on a map. When the vehicle comes to a stop in the designated parking space, the EVCS is found there.

An electric car's driver uses his phone to find the nearest charging station because the battery is running low. The charging stations come with a unique position identifier that allows for GPS installation [10]. The NEO 6M GPS module sends the coordinates to the phone while continuously tracking 24–30 satellites.After interpreting the coordinates, the precise location is displayed on a map. When the car stops at the designated parking spot, the EVCS is located there. After interpreting the coordinates, the precise location is displayed on a map. When the car stops at the designated parking spot, the EVCS is located there.

Fig. 2: Electric vehicle charging infrastructure overview

Although fuel-powered vehicles rank among the greatest innovations in history, their detrimental effects on the environment have opened the way for the development of electric automobiles.These EVs require charging stations, just as gasoline pumps. Infrastructure and charging station maintenance are provided by this work. As of right now, charging stations can be found all over the world [11].

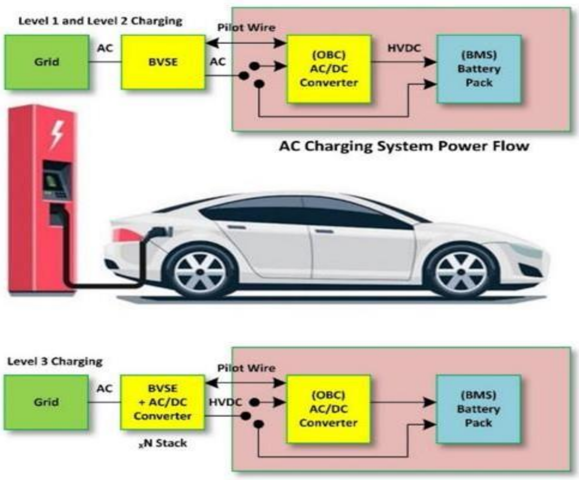


Figure 3: Charging modes at varying levels.

Figure 2 illustrates the locations of Level 1, Level 2, and fast EV charging stations, respectively. Installation and maintenance records for the infrastructure must be detailed. To operate effectively, any EV charging station needs maintenance.The frequency of use, the climate, and the exposure of the charging unit to the atmosphere are some of the elements that affect the efficiency of charging stations. The best charging stations for the Indian market are maintained and a thorough explanation of the various power alternatives, technologies, and energy management strategies are provided in this work.

RESULT AND DISCUSSION

The end result achieves a multi-objective function that includes optimising customer pleasure while decreasing power usage at charging stations and battery-swapping stations. Concurrently, the coordinates of the construction nodes of each charging station and battery-swapping station were collected. the desire for the quantity of battery swaps that occur at each battery-swapping location as well as the quantity of charging sessions that occur at each fast- and slow-charging location each day.And equally distributed to each battery-swapping station and charging station.Furthermore, the user satisfaction exceeds the minimum level, and the enterprise's maximum investment value is satisfied by the total construction cost of the battery-swapping and charging stations. The charging station's power usage and the overall number of vehicles using the battery-swapping stations each day are discovered to be the ideal values.67% of those who responded said they had ever moved their car at the request of another EV motorist [12].If another driver asked to use the charging station, it was granted in 39.5% of instances on average. Nonetheless, the distribution of how frequently people move their cars shows a wide range of motivations.

• Connect the Arduino Uno to the GSM module, RFID reader, relay, and keypad.

• Write the code to control the charging station.

The code should be able to do the following:

• Read the RFID card.

• Check if the RFID card is authorized to use the charging station.

• If the RFID card is authorized, turn on the relay.

• If the RFID card is not authorized, turn off the relay.

• Upload the code to the Arduino Uno. • Test the charging station.

Existing Methods

• RFID card read: The RFID card reader will read the RFID card within a few milliseconds.

• GSM communication: The GSM module will send a text message to the owner of the RFID card within a few seconds.

• Relay activation: The relay will activate within a few milliseconds after receiving a signal from the GSM module.

• Keypad input: The keypad will allow the user to enter a PIN code within a few seconds.

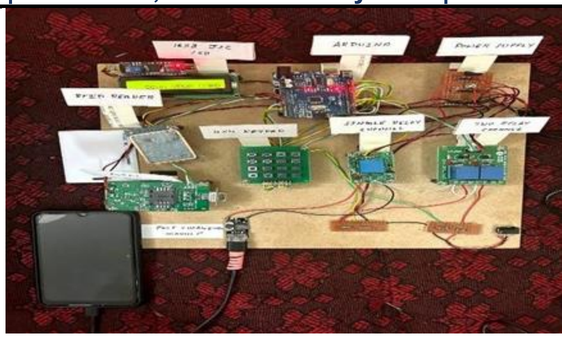
• Charging start: The charging station will start charging the electric vehicle within a few seconds after the user enters a valid PIN code.

Future Implementations

• Smartphone App: A smartphone app could be developed that allows users to control their electric vehicle charging station remotely. This would allow users to start, stop, and monitor the charging process from anywhere.

• Automatic Payment: A system could be implemented that automatically charges users' credit cards when they use an electric vehicle charging station. This would eliminate the need for users to carry RFID tags or enter their credit card information manually.

• Charging start: The charging station will start charging the electric vehicle within a few seconds after the user enters a valid PIN code.



Scanning RFID Card

OTP on registered Mobile Number

CONCLUSION

Due to advancements in technology, improved infrastructure for charging, and grid integration, the popularity of electric vehicles is anticipated to increase significantly over the next ten years.For EVs with distributed generators to reap the greatest benefits, more technological advancements like intelligent charging infrastructure, dependable communication systems, and coordinated charging systems are necessary.With the help of cutting-edge energy management systems, the electrical grid could one day be totally automated thanks to grid technology Llied on the Energy Internet.This article presents a discussion of EV charging and grid interconnection architecture. To succeed on the market, EVs and the infrastructure that supports their charging must adhere to consistent global rules and regulations. The specification criteria for EV charging and grid interconnection will be made obvious to upcoming researchers.Pertaining to our discussion of the very important requirements.The pros and cons of various components of the current charging and grid integration infrastructure, including as power, communication, control, and coordination, are also thoroughly explored.This paper offers insights on addressing current difficulties to recommendations for future research. The discussion regarding the future of EVs makes it clear to be reviewed. Researchers and engineers will have a thorough knowledge of the state of EV charging and grid integration research after reading this paper.

FUTURE DEVELOPMENTS

By considering of the debate above, the following future study trends have been identified. By the result of technology improvements, current grids are becoming "smart grids," which securely store and analyse data to increase system efficiency. Smart grids will allow EV users to lower their capital outlay and generate a second source of income from the V2G technology by utilising the bidirectional power flow.By assisting EV users, this V2G technology aids service providers in maintaining the network's scalability, enhancing its dependability, and decreasing blackouts, system degradation, and overload-related losses. For improved EV adoption, range anxiety must be reduced by increasing battery capacity or RCS penetration in the current grid.

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