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Solar based EV Charging Station using RFID

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Abstract: *A new and emerging technology in the electricity and transportation industries, electric vehicles offer numerous advantages from both an economic and environmental standpoint. This study provides a thorough analysis of different types of electric vehicles, as well as the accessories that go with them, including battery chargers and charging stations. Comparing the electric range, battery size, charger power, and charging time of commercial and prototype electric vehicles is done. The different kinds of electric car charging stations and industry standards have been described, and the effects of electric vehicle charging on utility distribution networks have also been covered.*

Keywords: Battery charger, charging station, electric vehicle, standards

I. INTRODUCTION

1.1 Background

The prevalence of charging stations in both public and private garages will rise as the number of electric vehicles (EVs) on the road rises. These stations will be in charge of fulfilling the demands of EV owners, parking structure operators, and the distribution grid. User permission, authentication, and billing are just a few of the many tasks that these charging stations will carry out for security and monetary reasons. For the same reason, other commercial charging stations like Coulomb and Blink demand a short-range RFID card. Both situations require further steps from the user in order to approve charging. To authorize, assign, and enable charging, the authors in suggest employing ordinary RFID tags within EVs and RFID readers on parking garage access gates along with middleware and an aggregate charging controller. However, this method is not as versatile as would be hoped and still needs user input. The suggested changes allow charging authorization to occur automatically at numerous charging stations in a particular geographic area without any user intervention. Vehicle Monitoring/Identification Modules (VMMs), which are found in EVs, function as RFID tags to identify the vehicle and authorize charging.

The term "Internet of Things" (also known as "thingslinked internet") describes a particular type of network that uses RFID (radio frequency identification) to enable the linkage between any objects and the information can be exchanged and communicated via the internet.The purpose of this study is to examine the technological advantages of RFID technology in the identification of electric vehicles and the centralized administration of the battery charging compartment. It also discusses the use of RFID technology in battery charging stations. Here, SMPS (switching mode power supply) is employed for the output power supply.

1.2 Problem Statement

The goal of an RFID-based EV charging station is to take advantage of connection and big data processing options (because we utilizeGoogle Sheets to store the data). First, a source of data that can be used to define use cases for driving patterns and functionality. Second, utilizing big data and cloud computing allows for the optimization of EV energy, resulting in eco-driving, eco-routing, as well as cutting-edge features like smart fast charging and ensured charging.

III. LITERATURE REVIEW

1. RFID (Radio Frequency Identification) technology is commonly used in Electric Vehicle (EV) charging stations to authenticate and authorize users. A literature survey of RFID-based EV charging station research is provided below:
2. "Design of an RFID-based Electric Vehicle Charging System" by Chen et al. (2018) proposes an RFID-based

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EV charging system with an improved communication protocol for authentication and authorization of users. The proposed system is tested on a hardware platform and shows promising results.

3. "An RFID-based Secure Electric Vehicle Charging System" by Zhou et al. (2019) presents an RFID-based secure charging system that includes secure communication and user authentication using a cloud server. The proposed system is tested on a hardware platform and shows improved security.
4. "A Comprehensive Review on Electric Vehicle Charging Station Technologies" by Saravanan et al. (2019) provides an overview of different EV charging station technologies, including RFID-based systems. The authors highlight the benefits and drawbacks of RFID-based systems and suggest future research directions.
5. "An Intelligent Electric Vehicle Charging System Based on RFID Technology" by Liu et al. (2019) proposes an intelligent EV charging system that uses RFID technology for user identification and payment. The proposed system is tested on a hardware platform and shows improved efficiency and user-friendliness.
6. "A Smart RFID-Based Electric Vehicle Charging System Using Renewable Energy Sources" by Hamid et al. (2020) proposes a smart EV charging system that uses RFID technology for user identification and renewable energy sources for power generation. The proposed system is simulated and shows improved sustainability.
7. "Design and Implementation of an RFID-based Electric Vehicle Charging System" by Alotaibi et al. (2021) proposes an RFID-based EV charging system that includes user authentication, billing, and monitoring features. The proposed system is implemented on a hardware platform and shows improved reliability and user-friendliness.

In conclusion, RFID-based EV charging systems have been widely researched in recent years, and the proposed systems show improved efficiency, security, and user-friendliness. However, more research is needed to address the challenges of scalability and interoperability in RFID-based EV charging systems.

IV. METHODOLOGY

The methodology of an RFID-based EV charging station typically involves the following steps:

- User authentication: The RFID reader installed at the charging station communicates with an RFID tag or card carried by the user. The tag contains a unique identifier that is verified by the charging station to authenticate the user.
- User authorization: Once the user is authenticated, the charging station checks whether the user is authorized to use the charging station. This can be based on factors such as the user's subscription status or account balance.
- Charging process: After the user is authenticated and authorized, the charging process can begin. The charging station communicates with the electric vehicle to establish the charging parameters, such as the charging rate and time.
- Billing and payment: Once the charging process is complete, the charging station calculates the amount to be charged based on the charging parameters and the user's account details. The user can then make payment using a variety of methods, such as a credit card or a mobile payment app.
- Monitoring and maintenance: The charging station can also be equipped with sensors and monitoring systems to detect any issues or anomalies during the charging process. This data can be used to ensure that the charging station is functioning properly and to schedule maintenance as needed.
- The methodology of an RFID-based EV charging station can vary depending on the specific implementation and the requirements of the system. However, the general approach involves user authentication and authorization, charging process management, billing and payment, and monitoring and maintenance.

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The components of an RFID-based EV charging station typically include the following:

- RFID reader: This component reads the RFID tag or card carried by the user and communicates with the charging station to authenticate the user and authorize the charging process.
- RFID tag or card: This component is carried by the user and contains a unique identifier that is used for user authentication.
- Charging station: This component manages the charging process and communicates with the electric vehicle to establish the charging parameters, such as the charging rate and time.
- Billing and payment system: This component calculates the amount to be charged based on the charging parameters and the user's account details. The user can then make payment using a variety of methods, such as a credit card or a mobile payment app.
- Communication network: This component enables communication between the various components of the charging station and with external systems, such as the user's account management system or a monitoring system.
- Sensors and monitoring systems: These components can be used to detect any issues or anomalies during the charging process and provide data for monitoring and maintenance purposes.
- Power supply: This component provides the electrical power necessary for charging the electric vehicle.
- The specific components of an RFID-based EV charging station can vary depending on the specific implementation and the requirements of the system. However, the general components include an RFID reader, an RFID tag or card, a charging station, a billing and payment system, a communication network, sensors and monitoring systems, and a power supply.
- The calculation of components for an RFID-based EV charging station can depend on several factors, such as the expected usage rate, the type of electric vehicles being serviced, and the available power supply. However, some general calculations for the main components are:
- RFID reader: The number of RFID readers required will depend on the number of charging points and the expected usage rate. For example, if there are 10 charging points and the expected usage rate is 50% (i.e., 5 charging sessions per hour), then at least 5 RFID readers would be required.
- RFID tag or card: The number of RFID tags or cards required will depend on the number of users and the expected frequency of usage. For example, if there are 100 regular users and each user charges their vehicle twice a week, then at least 200 RFID tags or cards would be required.
- Charging station: The number and type of charging stations required will depend on the number and type of electric vehicles being serviced, as well as the available power supply. For example, if there are 10 electric vehicles being serviced and each requires a Level 2 charging station (7.2 kW), then at least 72 kW of power would be required.
- Billing and payment system: The billing and payment system will depend on the desired payment options and the expected usage rate. For example, if users can pay using a credit card or a mobile payment app, then the system will need to be set up to handle those payment methods. The expected usage rate can also influence the required processing power and network bandwidth.
- Communication network: The communication network will depend on the size of the charging station and the expected usage rate. For example, if there are 10 charging points and the expected usage rate is high, then a high-speed communication network may be required to handle the traffic.
- Sensors and monitoring systems: The sensors and monitoring systems will depend on the desired level of monitoring and maintenance. For example, if the charging station is in a remote location, then more sensors and monitoring systems may be required to ensure that any issues are detected and addressed in a timely manner.
- Power supply: The power supply will depend on the number and type of charging stations being installed. For example, if there are 10 Level 2 charging stations (7.2 kW), then a minimum of 72 kW of power will be required, although additional power may be necessary to account for peak demand.

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V. DESIGN MODEL

- RFID Reader: An RFID reader is used to scan the RFID tag or card carried by the user. The RFID reader reads the unique identifier on the tag and sends it to the charging station's software for authentication and authorization.
- Charging Station: The charging station hardware includes the power electronics required to convert AC power from the power grid to DC power required by the electric vehicle. The charging station also includes a communication module to communicate with the electric vehicle, the RFID reader, and the network.
- RFID Middleware: The RFID middleware software is responsible for processing the RFID tag data, authenticating the user, and authorizing the charging process. The middleware software communicates with the charging station software to initiate the charging process.
- Charging Station Software: The charging station software manages the charging process, including setting the charging rate, monitoring the charging status, and communicating with the electric vehicle. The software also calculates the cost of the charging session based on the charging rate and the duration of the session.
- Billing and Payment Software: The billing and payment software calculates the total amount to be charged to the user's account based on the charging session cost. The software communicates with the user's account management software to deduct the charges from the user's account.
- User Management Software: The user management software manages the user's account, including their balance, charging rate preferences, and RFID tag information. The software communicates with the RFID middleware and the billing and payment software to ensure that the user is authorized to initiate the charging process and that the charges are deducted from their account.
- Monitoring and Maintenance Software: The monitoring and maintenance software is responsible for monitoring the performance of the charging station, detecting any issues or faults during the charging process, and notifying maintenance personnel and users as needed.
- Network Management Software: The network management software manages the communication network between the charging station and other components, including the RFID reader, the electric vehicle, and the billing and payment system.

Overall, an RFID-based EV charging station model would consist of hardware and software components working together to provide a reliable and efficient charging solution for electric vehicles.

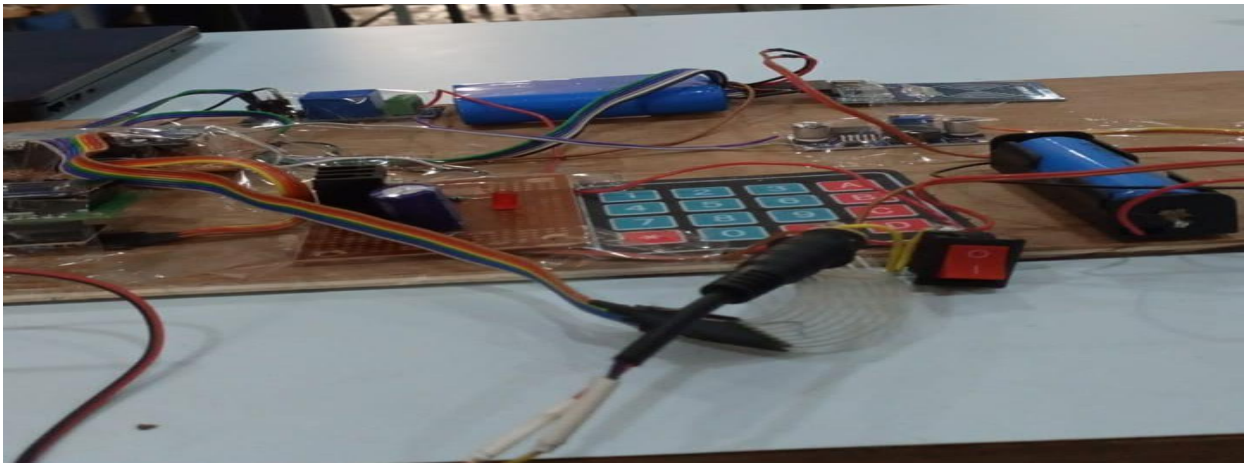

Fig 1.1

VI. WORKING

An RFID-based EV (Electric Vehicle) charging station works by using radio-frequency identification (RFID) technology to enable a user to authenticate their identity and access the charging services.

The charging station is equipped with an RFID reader that communicates with an RFID tag or card that the user possesses. When the user approaches the charging station, they can scan their RFID tag or card to start the charging

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process. The RFID reader then verifies the user's identity and confirms that they have the necessary permissions to use the charging station.

Once the user's identity is verified, the charging station initiates the charging process. It communicates with the electric vehicle through a wired or wireless connection to begin charging the battery. The charging station can also monitor the progress of the charging process and alert the user when the charging is complete.

RFID-based EV charging stations are a convenient and secure way to charge electric vehicles. By using RFID technology, they ensure that only authorized users can access the charging services, and they can provide users with real-time information about their charging progress. Additionally, RFID-based EV charging stations can also help operators to manage and monitor the usage of their charging infrastructure, enabling them to optimize the performance of their EV station.

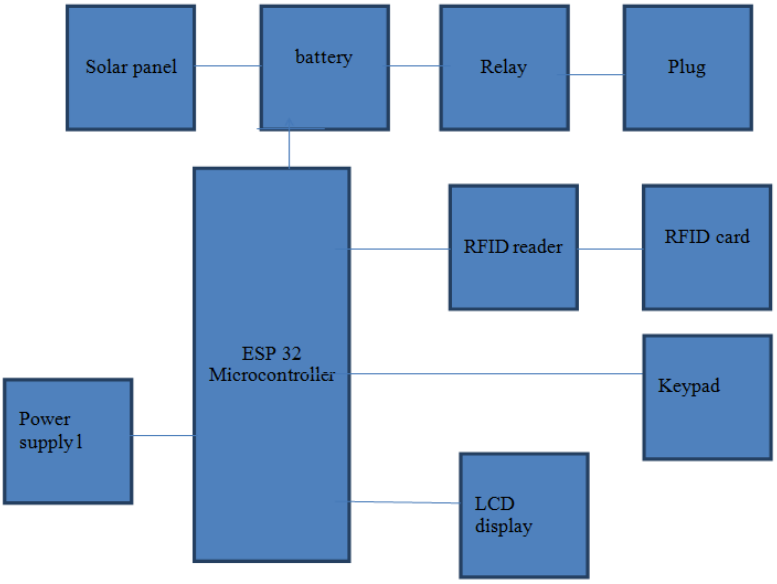

Fig 1.2

VII. CONCLUSION

The future looks more decisive in the direction of development of an electric car. What could we predict for the development of electricity, the future may hold vehicle. In any case, factors such as installation costs are different. The proposed system is more flexible in many way, more possibilities replace the entire conventional system with the proposed system. When deploying the proposal system to the business model. If properly supported, this field will grow significantly Government and financial support from industry. Rear you can expect a lot of network expansion in terms of time during the trial period. Direct investment Electric vehicle manufacturer for proposed business Planning helps you reach your sustainability goals Earth's environment in a very short time. Through use this way, the availability of electric charging stations.. Here we use a pricing design. The world will become simpler, and the use of electricity will also become simpler. Vehicles become more common than other commercial vehicle. And it also encourages buyers to buy electricity Vehicles in future transportation. It is also decreasing promote pollution and shipping. Innovative technology Further improving the proposed system by improving efficiency, Reduced energy consumption costs and portable.

Although the future of the proposed system looks very promising, Put it into a business model and create something huge Demand for electric vehicles. The project demonstrates how we can use Google Sheets to create an accounting system for EV charging stations. The accounting process runs more smoothly with the aid of a microcontroller and RFID module. Programming for microcontrollers, designing power supplies, and designing PCBs are the project's main takeaways. This procedure makes it simple to understand how the coupler functions when there is a high and low voltage separation. Consequently, this project implements the prototype of an EV charging station utilizing standard components.

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VIII. RESULT AND DISCUSSION

	A	B	C	D	E	F
1	December 5, 2022 at 12:04PM	rfid			5	
2	December 5, 2022 at 12:04PM	rfid		4995		
3	December 5, 2022 at 12:05PM	rfid	ID2			
4	December 5, 2022 at 12:05PM	rfid		4995		
5	December 5, 2022 at 12:05PM	rfid			5	
6	December 5, 2022 at 12:23PM	rfid	ID1			
7	December 5, 2022 at 12:23PM	rfid		4995		
8	December 5, 2022 at 12:23PM	rfid			5	
9	December 5, 2022 at 12:25PM	rfid	ID1			
10	December 5, 2022 at 12:25PM	rfid		4993		
11	December 5, 2022 at 12:25PM	rfid			7	
12	December 5, 2022 at 12:25PM	rfid	ID2			
13	December 5, 2022 at 12:25PM	rfid		4994		
14	December 5, 2022 at 12:26PM	rfid			6	
15	December 5, 2022 at 03:20PM	rfid	ID1			
16	December 5, 2022 at 03:20PM	rfid		4995		
17	December 5, 2022 at 03:20PM	rfid			5	
18	December 5, 2022 at 03:22PM	rfid	ID1			
19	December 5, 2022 at 03:22PM	rfid		4995		
20	December 5, 2022 at 03:22PM	rfid			5	
21	December 5, 2022 at 03:23PM	rfid	ID2			
22	December 5, 2022 at 03:23PM	rfid		4996		
23	December 5, 2022 at 03:23PM	rfid			4	
24	January 5, 2023 at 09:04AM	rfid	ID2			
25	January 5, 2023 at 09:05AM	rfid		4990		
26	January 5, 2023 at 09:05AM	rfid			10	
27	January 5, 2023 at 09:06AM	rfid	ID1			
28	January 5, 2023 at 09:06AM	rfid		4980		
29	January 5, 2023 at 09:06AM	rfid			20	
30	January 5, 2023 at 09:12AM	rfid	ID2			
31	January 5, 2023 at 09:12AM	rfid		4980		
32	January 5, 2023 at 09:13AM	rfid			20	
33	January 13, 2023 at 07:18PM	rfid	ID1			
34	January 13, 2023 at 07:18PM	rfid		4990		
35	January 13, 2023 at 07:18PM	rfid			10	
36	January 13, 2023 at 07:21PM	rfid	ID2			
37	January 13, 2023 at 07:21PM	rfid		4992		
38	January 13, 2023 at 07:21PM	rfid			8	
39	January 13, 2023 at 07:23PM	rfid	ID2			
40	January 13, 2023 at 07:23PM	rfid		4987		
41	January 13, 2023 at 07:23PM	rfid			5	
42	January 13, 2023 at 07:34PM	rfid	ID2			
43	January 13, 2023 at 07:34PM	rfid		4992		
44	January 13, 2023 at 07:34PM	rfid			8	
45	January 13, 2023 at 07:51PM	rfid		4995		
46	January 13, 2023 at 07:51PM	rfid			5	
47	January 14, 2023 at 10:40AM	rfid	ID1			
48	January 14, 2023 at 10:40AM	rfid		4980		
49	January 14, 2023 at 10:40AM	rfid			10	
50	January 14, 2023 at 10:42AM	rfid	ID2			
51	January 14, 2023 at 10:42AM	rfid		4980		
52	January 14, 2023 at 10:42AM	rfid			20	
53	February 16, 2023 at 04:02PM	rfid	ID1			
54	February 16, 2023 at 04:02PM	rfid		4990		
55	February 16, 2023 at 04:02PM	rfid			10	
56	March 18, 2023 at 03:32PM	rfid		4990		
57	March 18, 2023 at 03:32PM	rfid			10	
58	March 24, 2023 at 01:22PM	rfid	ID1			

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