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IOT ENABLED SMART CHARGING STATION FOR ELECTRICAL VEHICLE

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Abstract: The need for a cleaner environment has prompted the development of green vehicle technology, such as electric automobiles, which are also cost effective. Because the number of electric vehicles (EVs) on the road is increasing, charging stations is becoming increasingly crucial. We have introduced RFID (radio frequency identification) technologies in this research, which allows people to be automatically identified. Electromagnetic waves are used to transmit and receive information from users in this technology. With an increased number of Electric Vehicles (EVs) on the road's, charging infrastructure is gaining an ever-more key role in addressing the needs of both the local distribution grid and EV consumers at the same time. As part of the smart charging platform that supports charge monitoring and control, this study presents a mesh network RFID system for user identification and charging authorization. The IOT-based mesh network RFID provides a cost-efficient solution to identify and authorize vehicles for charging.

INTRODUCTION:

Over the past few years, Electric Vehicles (EV) have gained importance because of their appeal as a credible alternative to gas-powered vehicles. With electric vehicles (EVs) projected to become a major mode of transportation in the future, there has been much debate about their adoption, notably among legislators. EVs, on the other hand, require a charging station that allows them to "recharge" their batteries in the same way that gasoline-powered vehicles do. While EVs are pollution free, the electricity used to charge their batteries may be drawn from traditional power plants, decreasing their appeal as an environment-friendly mode of transport. Many countries currently use coal, oil and natural gas for its energy. Fossil fuels are non-renewable; they bring on finite resources that will become too expensive or too environmentally damaging to retrieve. Solar energy is never exhausted since it is constantly replenished. Solar energy is renewable energy and it is mostly called "clean energy" or "green power" because it doesn't pollute the air does not result in carbon emission. There has recently been a push to create solar-powered EV charging stations that generate clean electricity. Our paper is all about the charging station design, working and uses with the disadvantages of the system. Every station is composed of a plug that becomes attached to a vehicle, supplying it with electric power to charge the vehicles. Solar-powered EV charging stations present a great opportunity to greenify our transportation needs, making electric vehicles end-to-end environmentally positive. With the reduction in solar costs and improvements in solar efficiency building, solar-powered EV charging stations present a great opportunity to greenify our transportation needs, making electric vehicles end-to-end environmentally positive. Charging stations are also called electric vehicle supply equipment and are provided in municipal parking locations by electric utility companies. Currently, the deficiencies of the electric vehicles are the cost of buying and operating the vehicle and also the limited distance capacity of one-time charging. Within the next few years, Electrified vehicles are destined to become an important component of the transport field. Therefore, the charging infrastructure should be developed at the same time. Among this substructure, charging stations PV-assisted are attracting a substantial interest due to increased environmental consciousness, reduced cost and rise in efficiency of the photovoltaic module. As the number of EVs on the road's increases, charging stations in both parking structures and private garages are likely to become more prevalent. The distribution grid, EV owners, and parking structure operators will all have standards that these stations must meet. User authorization, authentication, and payment are just a few of the many activities these charging stations will do for security and financial reasons.

LITERATURE SURVEY PAPERS:

IOT Enabled smart charging stations for Electric Vehicle: Batteries have become the popular form of electrical energy storage in EVs. The evolution in city transportation has boosted over the last few decades which in turn increased the growth of societies and industry. Since battery is a commonly used device for storage of energy, calculation of Status of Charge plays a vital role in the future. Nowadays, vehicles are essential in the day-to-day life and for industrial use as well. Sufficient effort is being done to withdraw the combustion engines by electric motors. Due to the increase in carbon dioxide (CO2) caused by the industries and transportation, the Kyoto treaty was signed. This treaty was aimed to reduce the level of CO2 and has boosted the findings for new cleaner energy solutions. As a finding, Electrical Vehicles (EVs)

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appeared as a solution to reduce CO2 emissions. Electric Vehicles are increasing day by day across the globe. When the number of Electric vehicles is increasing, there is a need to implement Electric Vehicles Charging system in parking systems or grid. Automobile major Nissan produced a vehicle-to-grid (V2G) project with Enel, a multinational power company, in the United Kingdom. Nissan has been exploring and doing researches based on V2G systems and this project is the first of its kind in the UK and one of the company's biggest to date. The Vehicle-to-grid system function as two-way chargers and Electric Vehicle (EV) owners will have the facility to charge the vehicle or sell the excess energy (surplus) stored from their vehicle battery back to the Grid. They will earn a profit from the energy sold back to the grid, while making a markable role in grid stability. In this wide range of array of ideas, these EVs can definitely assure some gains to the energy management, eminently to supply major and important loads like manufacturing shops during power failures and any emergencies. EVs bring benefits to city services and provide indemnity for the viable energy sources intermittency. This new method is effective and more relevant owing to the fact that most of the electric vehicles are halted on an average of 91-95 percentage of their usage period, and most of the Electric vehicles are parked at home amid 9 pm and 6 am. When the EVs are plugged to the power grid, the power can discharge to or from the EV batteries (G2V and V2G). In the truancy of power grid or Electric disruption, the EV can operate as voltage parent to supply the necessary loads. This work describes the measurement and performance of EV battery in a smart grid. IoT makes smart grid to contribute the information between multiple users and thus amplifies connectivity by the help of infrastructures. Cloud storage is used for the data storage where the data is sent through Internet gateway. Fig1 shows the V2G architecture and Fig2 Shows the IoT architecture. This Paper is discussing about the involvement of IoT in V2G and G2V.

Optimal Dispatching of Electric Vehicles Based on Smart Contract and Internet of Things: Power grid energy is gradually diversifying as the Internet and new energy technology continues to develop. Distributed energy shares the power supply of the power grid and reduces environmental pollution, but because of its dependence on the environment, it increases the instability of power system. As the use of EVs increases, the large-scale charging of EVs will also have a significant impact on the stable operation and planning of the power system. This impact is particularly evident when a large number of users select fast charging modes. Such modes are different from diffusive and low-power residential charging, which is more suitable for long-distance and energy-consuming residential charging. Because of the need for specific charging facilities, vehicle charging mainly occurs at fixed commercial charging stations, which results in increased centralization and scale of the charging station load. The associate editor coordinating the review of this manuscript and approving it for publication was Jun Wu. Faced with the increasing number of charging piles, user privacy protection and transaction security of decentralized power transactions must also be urgently solved. Block-chain technology provides a new solution for distributed resource storage, data protection and historical traceability, which can ensure the storage security and traceability of all historical data. To reduce the deviation between predicted load and actual load, users sign intelligent contracts with charging stations. By using block-chain intelligent contract technology, contracts are saved on block-chain in the form of computer code and automatically triggered to execute, providing a simple and effective settlement process.

A Review on IoT based Electric Vehicle Charging and Parking System:

Now-a-days Electrical vehicle is a trending topic and it is also an important part of this smart world. Drawback of electric vehicles is cruising range is typically limited. So, it requires frequent recharging. Not only for electric vehicle but Population is increasing exponentially and the problem is due to this is, increasing traffic volume. All we know that we have limited stock of the fuel on our earth so it is need of time that we must switch to another way and electricity is the best option for it and electric vehicle is example of it. For charging the electric vehicles, Now-a-days mostly used charging method is plug in charging, this method consists of a plug which needs to be connected to the vehicle for start charging. In wireless charging there is no need to ON-OFF the plug. Hence there will be less human interaction; it reduces risk of electric shock due to wired connections. Plug-in EVs have limited travel range and need large and heavy batteries. The wireless charging technology has main advantages is, it increases the traveling range, reduces the battery size and waiting time for charging the vehicle will mitigate. Such advantages will increase the economic and environmental benefits as well as the adoption rates of EVs [16]. Electrical vehicles require a charging station similar to current fuel car require a petrol pump and obviously charging takes some time so it is better to charge the car when it is parked, therefore it is efficient to combine both the charging and parking system which is based on the IoT technology which makes the system user friendly. One can upload information on cloud and simultaneously on smart phones. Car safety while parking is one of the issues faced by people. The internet of things (IoT) is best platform for monitoring the status of WPT system which is able to provide the wider connectivity, modified sensing, information processing and greater flexibility [17]. So, With the help of IoT, it is easy to monitor vehicle parking as well as charging of vehicles when they are parked at the same time that means it helps in synchronized parking. Another important factor of using IoT is we can store data on cloud that we can access anytime from anywhere, which makes life easy and simple [15] Give an idea about, for charging the car we will need some station where the car can be charged, so we can merge the parking concept as an electric station where the car can be parked as well as it will get charged. Thus, there are many advantages

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of this system. [1] also mentioned that, the current transportation infrastructure and parking facilities are unable to cope with the influx of vehicles on the road, leading to high ecological and economic damage caused due to time spend in searching for parking spots, for instance. Thus, approaches to support electric vehicles and their charging demands are needed which should be able to use parking and charging infrastructures as efficiently as possible.

Crowd sourced smart EV charging station network using ML:
With the rising adoption of electric vehicles, the automobile industry is undergoing rapid change. This necessitates the construction of a massive infrastructure of electric charging stations. According to Business Standard research published in 2021, India will require 4,00,000 charging stations by 2026 to accommodate an anticipated 4 million electric vehicles [1]. The installation of an electric charging station is an expensive process, with an average cost of 25,00,000 INR. The majority of the costs are related to obtaining land cover and maintaining a steady supply of electricity. Setting up charging stations in residential areas could be a viable solution for providing cheaper land [2]. Using renewable energy to generate power can result in lower electricity costs [3]. Connecting charging stations to the internet and establishing a smart charging station allows consumers to schedule a charging station through a website or mobile app [4]. While smart charging stations have their advantages in this situation, automating the charging process and estimating the number of consumers on any given day is a hassle [5]. To address these issues, an IoT-based interconnected electric charging station is proposed, consisting of a network of automated charging stations that can be booked online. To effectively manage the charging station's energy source, an algorithm based on the ARIMA model is utilized to estimate daily sales for the charging station.

Implementation of Charging Station for E-Vehicle using Solar Panel with IOT:
According to the International Energy Agency (IEA), Renewable will be the fastest-growing source of electricity, in which wind and solar PV are technologically mature and economically affordable. But still there is increase in world's demand for energy. Adopting Renewable Energy technologies is one advance way of reducing the environmental impact. Solar energy is widely available throughout the world and can contribute to minimize the dependence on energy imports. The Internet of Things (IoT) is a system of related computing devices, mechanical and digital machines, objects, people or animals that are provided with unique identifiers and also the potential to transfer data over a network without requiring human -to-human or human-to-computer interaction. Smart devices, Smart phones, Smart cars, Smart homes, Smart cities. A smart world.
"Smart" objects play a key role in the IoT vision, since embedded communication and information technology would have the potential to revolutionize. With the growing presence of WIFI and 4G-LTE wireless Internet access, the evolution toward omnipresent information and communication networks is already evident. As more countries are moving towards pollution free traffic, E-vehicles are gaining more popularity across the globe. As the number of E-Vehicles Increases-Vehicle charging infrastructure will be also a basic need. A system with IoT will definitely streamline the performance of E-Vehicle charging and looks the impacts. This method is helpful for transportation systems. This proposed system will improve the city planning and makes the city life easy. The working costs linked by means of these diesel generators might be incorrectly high due to economical fossil energy costs jointly by means of complexities in petroleum deliverance plus safeguarding of generators. Numerous hybrid systems have been installed across the world, and the expanding renewable energy industry has now developed reliable and cost competitive systems using a variety of technologies. Using the Internet Of Things Technology for controlling solar photovoltaic energy production can considerably improve the performance, monitoring, and preservation of the plant. With the development of technologies, the price of renewable energy apparatus is going down worldwide attractive huge amount solar photovoltaic fitting. The analysis in this report is foundation on the implementation of a new cost-effective tactic based on iot to distantly observe a solar photovoltaic plant for presentation costing. This will assist in protective preservation, error finding, chronological examination of the plant in calculation to real-time monitoring. With the improvement of wired and wireless network technologies, internet-connected mobile devices such as smartphones and tablets are now in general use. Thus ensuing in a new theory, the Internet of Things (IoT) was introduced and has received knowledge more than the precedent a small number of years. In common, iot is an data distribution surrounding wherever objects in daily living are related to wired and wireless networks. Recently, it is utilized not just for the field of customer electronics and applications nevertheless moreover in additional different fields such as a smart city, healthcare, smart home, smart car, power system, and industrial safety.

On the Optimization Strategy of EV Charging Station Localization and Charging Piles Density: Background and Motivation. Electric vehicle (EV) has gradually played a pivotal role in the people's life due to the rapid development of EV and the Internet of Things (IoT)technology. The first half of 2020 was attacked by theCOVID-19 virus, causing unprecedented deciles for vehicle sales. We can find that the number of global EV reached more than two hundred million in 2019, which is 9% higher than for 2018 [1]. Therefore, the construction of EV infra-structure has a crucial impact on the experience of EV consumers. The distributed charging station localization and charging pile density are two important

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issues in the fundamental infrastructure construction [2, 3]. Obviously, it affects the construction cost and user service quality. Most of the state-of-art estimation location approach for EV charging stations depends on the distribution of vehicles [4]. Unfortunately, area EV density is changing at any time due to the movement of EV. Therefore, the static EVs' distribution can-not effectively reflect the effect of the charging station localization strategy. Deploying many charging stations can improve the user experience to some extent, but it will lead to increased construction costs. Conversely, it will increase the charging queue time of users. Thus, the traditional sys-thematic approach usually discusses the solution to balance the requirements between the customers' experience and economic efficiency [5]. As the IoT technology evolves, rea-sonable charging pile layout will greatly benefit the development of intelligent transportation [6]. For such reason, we propose the development strategy of charging stations under the change of EV density in urban areas. Besides, we give a calculation approach of the number of charging piles for each charging station.

IoT-Based Supervisory Control of an Asymmetrical Nine-Phase Integrated On-Board EV Battery Charger: Due to fossil fuel depletion and CO2 emissions, the reliance on electric vehicles (EVs) has been globally expanding ate rapid pace [1]. On the other hand, charging time and the availability of charging points constitutes the main challenges that affect the widespread adoption of electrically driven automobiles [2]. Many countries have adopted governmental initiatives to replace conventional internal combustion engine (ICE) vehicles with EVs such as China, the United States. The associate editor coordinating the review of this manuscript and approving it for publication was Jun Wu. of America (USA), Norway, and Germany [3]. The battery electric vehicles (BEVs) market has witnessed a substantial increase in sales reaching 87% in 2014 compared to 54%reached in 2012 [4]. China has the largest market share with over one million EVs in 2018 [3]. Generally, EV chargers can be either mounted on the vehicle (known as on-board chargers) or installed in charging stations (known as off-board chargers). Although the off-board charging infrastructure supports fast three-phase charging, it represents a more sophisticated and high-cost option [5]. On-board battery chargers (OBCs) allow the direct connection between the vehicle and the accessible power outlets, either single or three-phase mains. However, the limited power transfer capability is considered a notable demerit of OBCs [6]. In order to mitigate the drawbacks of OBCs, integrated onboard battery charger technology has recently been proposed. Whereas, all the drivetrain elements, namely the electric machine and the inverter, are employed in charging mode. The machine winding is used as a filter inductor and/or isolation transformer, while the propulsion converter serves as a bidirectional ac-dc converter. This technology can, therefore, minimize the weight, volume and cost of both EVs and associated infrastructure. An integrated charger was initially introduced in 1985. In propulsion mode, the machine is driven using a three-phase inverter. Whereas, a single-phase outlet is connected between the machine star point and a fourth inverter leg during charging. This stands as the main disadvantage of this topology since the current rating of this additional leg is three times the others. The converter cost is, therefore, quite high. On the other hand, the average torque and the pulsating torque components can both be kept at zero. A high-power integrated charger that supports fast three-phase charging has been described in [10]. It links the ac three-phase mains to the mid-points of each winding of a three-phase machine. During the charging process, current flows in each winding of the employed machine are equally split in two opposite directions. Consequently, the magnetomotive forces (MMF)due to the coil currents cancel each other eliminating stator MMF. Thus, no torque is produced during the charging process.

Real-Time Forecasting of EV Charging Station Scheduling for Smart Energy Systems:
There is currently a focus on electric vehicles due to their eco-friendly benefits such as low CO2 emissions and decreased demand for fossil fuels and gases. It emerges that for the transportation system to concentrate on EVs attention must be paid to the power network to utilize economies of scale in their energy consumption. Unlike traditional vehicles, EVs don't require such high maintenance costs [1,2] and moreover, they have great potential advantages such as cost, convenience, travel range and charging infrastructure. A compact, mid-family size car battery-based 22–32 kWh package runs the EV for about 40–100 miles. The Toyota RAV4 electric cars with a rated battery size of 41.8 kWh provides driving range of 113 miles with a full energy charge. Hybrid electric vehicles utilize the combination of an internal combustion engine (ICE) and an electrical propulsion system to achieve a speed range of29.93 kilometres per hour. The Chevrolet Volt officially unveiled an 18.4 kWh battery with fuel cell usage, to improve the driving range from 38 to 53 miles/charge. A 120 V single phase system charging outlet with on board charging technology requires 11–36 h to charge a 16–50 kWh battery system fora driving range of 40 miles. Commercial public or private charging systems use 208–600 V systems to charge a 20–50 kWh battery in 0.2–0.5 h [1]. The global EV manufacturers have concentrated on developing the zero carbon emission vehicles with improved performance characteristics, driving the demand for EVs with compact energy efficient and low cost cut off [2]. The compactness of the current EV power train only provides the capability for a short driving range. The researchers concentrating on the enhancement of the power train capability are focused on increasing the driving range to 500 km with a rated battery capacity of 75 kWh. The enhancement makes the system exceedingly complex with an added increase in the cost. Figure 1 gives an idea about the relation between the propulsion system and battery packages.

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Flexible Charging of Electric Vehicles: Results of a Large-Scale Smart Charging Demonstration: Electric vehicles (EVs) are no longer only a niche market and will increasingly define passenger mobility with a market growth of over 30% for the last five years and an accumulated amount of 5 million EVs on the roads in 2019 [1]. The electrification of transport and the need for more and faster charging is expected to add a considerable load on the electricity infrastructure in the near future [2]. Because the timing of the peaking demand of EV charging coincides largely with the peak in household consumption, the total peak load will increase directly with the addition of more EVs and the limits of the grid capacity may be reached [3–5]. As such, electric mobility provides a substantial challenge to grid operators to provide sufficient capacity while maintain grid stability and security without having to carry out expensive and disruptive grid reinforcements. The city of Amsterdam has set the ambitious target of achieving local zero emission transport by2030 for all transport modalities (including buses, city logistics, taxis, shared vehicles, and private vehicles). The required expansion of charging stations will increase the load on the local electricity grid. Smart charging of EVs offers opportunities for better managing and incorporating this additional electricity demand within the boundaries of the existing grid. Smart charging research in recent years has mainly been focused on simulation anodizing to investigate the impact on the grid [5–7], energy market prices and matching of renewable energy profiles [10]. The results show that smart charging can give significant advantages in reducing grid load during peak moments but the extent to which depends on the specific details of the profiles and assumptions used in the models The simulation work is valuable for exploring the feasibility and optimizing the impact of various smart charging strategies, but often, the suggested architectures are based on complicated communication schemes between vehicles and a centralized management system and are not suitable for short-term implementation [3]. Moreover, simulation studies include many assumptions on charging behaviour based on start time distributions, charge volume distributions, average power level of charging equipment and the potential of rescheduling charging sessions [12–15] but lack real-world data on actual charging power and will underestimate several practical effects such as differences in the charging characteristics of different EV models, state of charge (SOC) and battery degradation effects, local circumstances such as the number of sockets per station or the maximum current level of the internal safety fuses, and other effects. As a result, the results may deviate significantly from real-world implementations. Empirical cases are needed to validate simulated results and fine-tune assumptions before applying the insights in practice.

Enhancing with EV Charging Station Functions a Residential RES based Network:
The world is undergoing a transition from internal combustion engines cars to electric vehicles, EVs. Increased pollution, especially CO2 emissions and, to some extent, the fossil fuel sources depletion pushed governments and car manufacturer to promote EVs. Therefore, since 2013 EV global sales increased by 400.This change is only the beginning. Due to governments' incentives and policies, such as zero-emission regulations, decrease of production costs with the scale effect consequences and arise public interest, the global EV market is increasing rapidly. According to IEA, (IEA, 2011): "Assessments of country targets, original equipment manufacturer (OEM) announcements and scenarios .... the electric car stock will range between 9 million and 20 million by 2020 and between 40 million and 70 million by 2025." The increase in EV number will subject the electric grid to a great strain. Transportation consumes (uses) about 33 % of the total energy production in EU and about 30 % at world from this 33 %, more than half is consumed by cars. That means about 17-18 % from all energy is consumed by cars, which is oil based. To make the change and replace this amount of fossil fuel-based energy to electricity, moreover, the useful one (letting aside the losses in the production and distribution) is an enormous task.

Electric Vehicle Smart Charging Reservation Algorithm: Over the last few decades, there has been an alarming increase in the unsustainable exploitation of natural resources and environmental degradation. Nonetheless, a shift to-ward environmental protection has been registered, with regulation policies being enforced and public awareness steadily increasing. On a global scale, we are currently witnessing a transition towards low-emission mobility, and it is safe to assume that this process is accelerating. Considering the Paris Agreement, the 2030 Agenda for Sustainable Development and the European Strategy for Low-Emission Mobility [1], governments and industry manufacturers have begun to take consistent steps in implementing these regulations and transitioning to an electro-mobility concept and way of life. Nonetheless, there are several factors that hinder the large-scale adoption of electric vehicles (EV), from the purchasing costs, the battery operating range, insufficient charging infrastructure and long charging times to psychological fac-tors. When studying the challenges and opportunities in adopting electric vehicles, Faizal et al. [2] identified range anxiety, the long queuing time, and the uncertainty of finding an available charging point, when necessary, as some of the factors that negatively impact the consumers' purchasing intensions. In this context, we propose a solution to enable the EV owner to create charging station reservations for upcoming days, especially for longer trips that require multiple charging operations, and to ensure a positive user experience that will ultimately stimulate EV adoption. To this end, we have structured the present paper into several sections. Following the introduction, the second chapter constitutes a brief overview of the current state of the art concerning the use of reservation algorithms as an extension of the OCPP protocol.

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After having presented the work methodology, we thoroughly describe the custom reservation algorithm and its advantages, compared with the existing OCPP reservation possibilities. To further illustrate the algorithm workflow, we have provided, in section 5, an overview of the Smart EVC platform case study. Finally, we analysed the results, stated the conclusion we reached after having conducted this study, as well as future work envisaged to take the proposed solution one step further.

CONCLUSION:

Here we have designed a simple charging station for electric vehicle using microcontroller, relays and RF module that can enable charging for user's vehicle. This RFID charging station authorization system provides a convenient method for a user to enable charging at charging station. The proposed system represents an improvement over the existing system as it allows charging authorization to take place seamlessly at the moment of EV arrival and does not require any other people to involvement. This method will save the operation time by introducing RFID system at charging station as automatic authorization of user can be involved in this system. RF transmitter and Receiver will give a huge operation range to this system.

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