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OPTIMIZED CHARGING STATION SEARCH BASED ONAVAILABILITY USING IOT WITH SLOT BOOKING SYSTEM

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Abstract. The vehicle will send the driver to the slot booking webpage, which will list all available slots. As the world's supply of fossil fuels runs out, every country is turning to green energy sources that are sustainable, acceptable, reliable, and efficient. The technology that supports Electric Vehicles (EVs) is rapidly improving as the cost of EV components falls. Electric cars (EVs) are becoming more popular as traditional vehicles have a negative impact on the environment. The State of Charge (SoC) of the EVs battery is constantly presented in the suggested work, as well as the nearest charging stations on the screen. The screen in the construct an efficient slot booking system from a list of proposed charging stations closest to the EV driver, as the charging procedure can be time consuming and the demand for more stations would be high. The proposed booking system paradigm is intended to be both cost-effective and efficient.

INTRODUCTION

A charging station, also known as an electric powered automobile charging station, an electric powered recharging factor, a charging factor, a price point, a digital charging station (ECS), or an electric powered automobile supply equipment (EVSE), is a device that supplies electric power to charge plug-in electric vehicles such as cars,neighbourhood electric vehicles, vans, buses, and other types of vehicles. On-board converters in certain electric vehicles hook into a conventional electric socket or a higher voltage outlet.Others rely on their own charging stations.Others rely on their own charging stations

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Connectors that meet a variety of specifications are available at charging stations. Chargers are provided with a handful of adaptors, including blended Charging Machine (CCS), and AC fast charging, for typical direct current fast charging. Avenue-aspect charging stations, as well as retail shopping centres, government offices, and parking lots, are common places to find public charging stations. Multiple charging era standards have been established to allow interoperability among carriers. Nomenclature, energy, and connectors all have standards. Tesla has evolved proprietary technology in these areas, which is significant. AC Type 1 / Type 2 plugs are utilised even when charging.A vehicle that transports the charger to the car is required for cell charging. Inductive charging mats that rate without a connected connection are used in wi-fi charging and can be implanted in parking stalls or even on motorways. A battery switching station allows cars to replace a drained battery for a charged one, removing the cost of the c programme language period. A battery switching station is a location where an electric car may drive over and an automatic (or perhaps even manual) system can open up the bottom of the vehicle, remove the exhausted battery, and replace it with a fully charged battery. To implement this era, the car must be made so that it can be stretched out usinga chamber on the bottom and by unexpectedly starting up the bolts beneath the car. The following advantages are claimed: battery swapping takes less than five minutes, refuelling takes less than five minutes, the driver can stay in the car while the battery is switched, and spare batteries could participate in vehicle to grid electricity transfers.

Car charging cables, like cellphone charging cords, usually have two connectors: one that goes into the car socket and the other that plugs into the fee element itself. The type of connector you'll require depends on the vehicle and the rate point's strength score ("speed").A type 2 socket is found in the majority of the slow/fast rate factors. As an alternative, they will occasionally have a cable connected. A cable with a CHAdeMO and a CCS connector is commonly attached to all DC rapid charging stations

A. CRITICISM OVER CHARGING STATION

Charging stations can be placed anywhere there is access to electricity and suitable parking. Charging stations have been criticised for being inaccessible, difficult to locate, out of order, and slow, all of which have slowed EV adoption. Charging an electric vehicle takes longer. It is difficult for customers to reach a very lengthy destination on a single charge during extended journeys. Because there are fewer charging stations available than there are fuel stations, it is more difficult for users to locate charging stations. When compared to a regular car, the range of an electric vehicle is limited. Customers are compelled to rely on the charging point network while taking trips that are longer than the vehicle's single charge range. Although the number of charging stations is growing, it still pales in comparison to the convenience and geographic density of gas stations. Another difficulty is charging time, which might be addressed by so-called quick chargers, which can extend the range of a vehicle in less than an hour. However, they are becoming increasingly rare in today's world. The next issue arises when the user does not know the exact position of the charging station; the user may use up all of the battery's charges while looking for the charging station. This creates apprehension among EV consumers. The use of proprietary battery changing solutions has been challenged. By establishing a monopoly over the ownership of batteries and the firms' patent-protected technologies, the market is fragmented, reducing the likelihood of widespread battery swapping.

LITERATURE SURVEY

1.“IoT Based Charging Slot Locator at Charging Station” by Jyoti M. Kharade; Mangesh P. Gaikwad;Saurabh P. Jadhav; Parag D. Kodag; Sweta P. Pawar; Supriya T. Yadav(2020 5th International Conference on Communication and Electronics Systems(ICCES))

Electrical energy is stored in batteries in electric vehicles. The time it takes to charge an electric vehicle is longer. Electric vehicle charging facilities play a significant role in this. People are now unclear of the number of charging stations along the route. As a result, extra time will be lost looking for a charging station and slot availability, as well as inconvenience. The study proposes a method for saving time and avoiding inconvenience forEV users. This method will display the number of charge slots available at each charging station along our route. It will also show how long the vehicle has been hooked into the charging station. When a user schedules a trip and discovers that their vehicle has just a few percent of its charge capacity remaining, leaving them unable to reach their destination, the user will look for a charging station and a charging slot. However, if the user is aware that there are some charging stations located along the journey route and decides to charge the vehicle at the last available charging station, and after arriving at that station discovers that there are no slots available for charging, the user must return to the previous station. Meanwhile, the electric car may be discharged during this operation. It will be more convenient for the user if he or she is aware of the slot availability in charging stations along his or her journey route. This would save persons time. As a result, we propose a system that displays the availability of charging slots, including slot availability data and the timing of the preceding connected automobile to the charging slot. Between our journeys, we stop at a charging station, which also displays the amount of time left for charging if a car is already attached to that charging slot. The Node MCU is used to control the proposed system. With the help of Wi- Fi.ion, this device is connected to the Cloud so that we can plan our travel properly.

2. EV CHARGING STATION LOCATOR WITH SLOT BOOKING SYSTEM Rahul George, Srikumar Vaidyanathan, K Deepa Department of Electrical and Electronics, Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Bengaluru, India

Because the globe is running out of fossil fuels, every country is turning to green energy sources that are sustainable, acceptable, reliable, and efficient. The technology that supports Electric Vehicles (EVs) is rapidly improving as the cost of EV components falls. Electric cars (EVs) are becoming more popular as traditional vehicles have a negative impact on the environment. The State of Charge (SoC) of the EVs battery is constantly presented in the suggested work, as well as the nearest charging stations on the screen. The LCD in the vehicle will guide the driver to the slot booking website, which will display all available slots, from a list of suggested charging stations near the EV driver. As electric vehicles become more popular, a more effective slot booking system will be required, as the charging procedure can be time consuming and the demand for more charging stations will grow. The proposed booking system paradigm is intended to be both cost-effective and efficient.

3. Prediction of Availability and Charging Rate atCharging Stations for Electric Vehicles Can Bikcora,NazirRefa, Lennart Verheijenand Siep Weiland
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To enable better smart charging solutions, this paper investigates the day- ahead probabilistic forecasting of the availability and the charging rate at charging stations for plug-in electric vehicles.Generalized linear models withlogistic link functions are at the core of both forecast scenarios. Moreover, the availability forecast at a charging point. These two scenarios are evaluated on real data collected from two representatives of the most occupied charging points in the Netherlands, with the focus of the analysis kept at the selection of essential repressors. Based on the ranked probability scores associated with the day-ahead forecasts generated for the last nine months of 2015, it is concluded that the usefulness of predictive models depends highly on the charging station. When contributing substantially to performance, such models possess a simple structure with a few basic lagged and indicator variables.

EXISTING SYSTEM

When you utilise the map feature of the most widely known smart phone application Google Maps, it displays the slot availability of nearby charging stations. The feature is now available on PCs, iOS, and Android. Google confirms this in a blog post in which they detail all of the requirements for users.
Google Maps will show you how many charging stations are currently accessible for you to use to recharge your vehicle. This is a fantastic feature because, while Maps already shows how many charge points a location has, it couldn't tell you if it was worth the effort to visit when all of the charge points were in use until now. Google Maps will also provide you with other useful information, such as the location of an EV charging station and the different sorts of ports. You'll be able to see information about the station from other drivers, such as images, ratings, reviews, and queries, just like you would on aconventional Google Maps listing.

PROBLEMS FACED IN THE ALREDY AVAILABLE SYSTEM

Many electric vehicle charging stations are accessible to charge electric vehicles, and many of them can be located on map programmes such as Google Maps, which also shows the number of charging slots available. It's excellent, however if the charging station's slots are all taken, they simply display "0 slots available." What if all of the charging stations in the area are full? How will we be able to distinguish between them and choose one? Also, if a user goes to a charging station and discovers that there are no charging slots available, the user will be inconvenienced, and time will be wasted in the process. The usermust then either wait for a charging slot to become available or proceed to the next charging station if thecar has sufficient charge.
Another issue that consumers confront is interference between two users when they arrive at the chargingstation. For example, if user A and user B both learn that a slot is available for their vehicle at the same time, they will both arrive at the same charging station and one of them will be tricked.
However, if the user is already aware of local charging stations and the slot availability at such charging stations, they will save time. So, to address the aforementioned issue, we designed a system that displaysthe charging slot availability at that specific charging station.

PROPOSED SYSTEM

SLOT LOCATION IN CHARGING STATION

Except when all of the slots in the charging station are occupied, the suggested system works similarly to the current approach. We made a few improvements to the existing system and introduced aslot booking system to address issues with the previous system.

In this system, the charging station not only transmits information about available slots to the database, but it also sends the time required to charge the vehicles to the database via IoT if all of the slots in the station are occupied. We've utilised Firebase to store data from the stations in this case. The availability and charging times of the individual slots are submitted to the database over the internet. Users can access this data using a smart phone application, where it is processed and displayed, allowing them to learn about the charging station's current status in real time. This smart phone application will also be able to display the position of the charging station as well as directions, assisting users in finding the charging station of their choice. When the station's slots are completely taken, the traditional system will simply say "0 slots available." When there are two or more charging stations with "0 slots available," this does not aid the user. This causes confusion and wastes time as people try to figure out where to go and where not to go. This may cause users to completely empty their vehicle by jumping from one station to the next. Because the user can choose to go to any charging station, this approach does not equally divide the vehicles between charging stations and can cause traffic jam charging stations. If the user prefers to travel there, the application we designed displays the amount of time he or she will have to wait. The availability and charging times of the individual slots are submitted to the database over the internet. This allows users to save time by making informed selections and planning their route accordingly. People don't have to leap from one charging station to the next, which saves battery power and money for users. Nobody wants to make a bad decision and waste their time and money. This system evenly distributes electric vehicles around charging stations, preventing a large concentration of electric vehicles at a single charging station.

The slot booking mechanism was created to prevent large groups of people from converging on a single charging station at the same time. When the user arrives at the station, he or she must scan the QR code for the specific slot that the user has reserved in order to verify whether the user who booked and the user who arrives at the station are the same.

This booking system only allows users to schedule a charging station session if they are within a 10-kilometer radius of the charging station. This is to prevent people from abusing the system by booking charging station slots and then not showing up, wasting other people's time by making them wait. If the user does not arrive at the station within 15 minutes, or if the user schedules another station, the booking becomes invalid, and the opportunity to charge the car is handed to the next person in line. This is to handle the circumstance where the user's vehicle is unable to reach the charging station or the user has landed at another charging station, resulting in the user failing to arrive to the charging station where he or she has reserved a slot. This makes it easier forthe other user to obtain their turn.

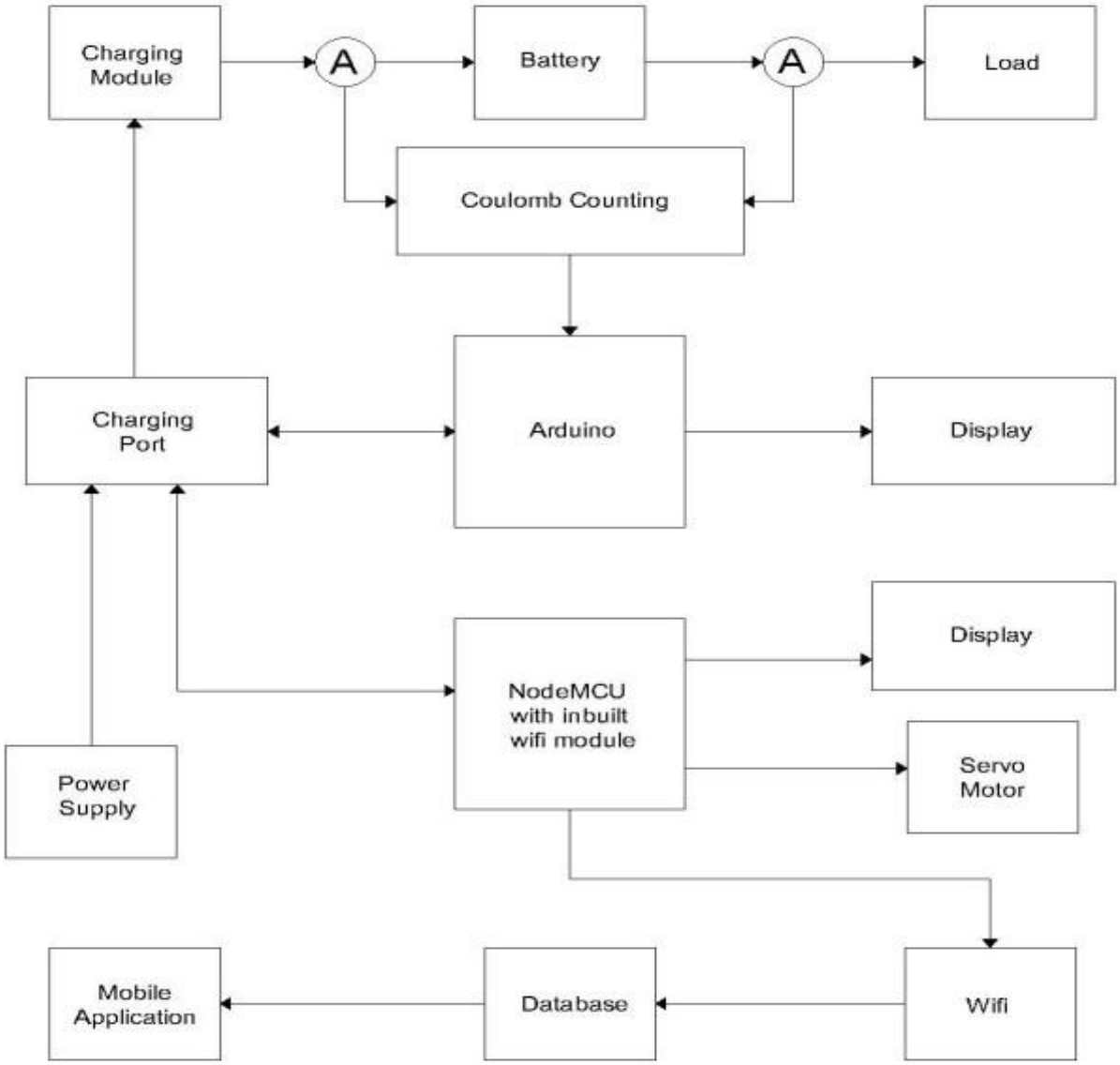


fig 1 :block diagram

HARDWARE IMPLEMENTS

The hardware circuit block diagram is provided below. It is made up of a charging module with a battery protection circuit, a battery, a load, a Coulomb counting circuit, a charging port, an Arduinomicrocontroller, a display, a 5V power supply, a NodeMCU with an embedded wifi module, a servo motor, wifi, a database, and a mobile app. The coulomb counting technique, which counts how many Ah are moving in and out of the battery to determine the state of charge (SOC), is implemented using the Arduino microcontroller. The SOC level of the battery is sent serially by Arduino to NodeMCU via the charging connector. The NodeMCU calculates the time required to charge the battery based on the battery's SOC level and sends the information to the database over wifi. This time value is derived from the database for the application we created and used for additional calculations The battery is charged andall other components of the charging station with one slot for charging electric vehicles are powered by a 5V power source.

Figure depicts a circuit schematic for a hardware circuit. It includes a charging module with a battery protection circuit, a battery, a load, a charging port, an Arduino microcontroller, an LCD display, a seven-segment display, a 5V power supply, a NodeMCU with an integrated wifi module, a servo motor,wifi, a database, and a mobile application. The charging station side circuit and the vehicle side circuit areseparated in this circuit schematic. During charging, these two circuits are connected via the charging port. The charging station side circuit's

job is to compute charging time and store it in a database. The vehicle side circuit's job is to estimate the battery's SOC using the coulomb counting algorithm. For this, an Arduino microcontroller is utilised, which counts how many Ah are moving in and out of the battery toestimate the state of charge (SOC). The SOC level of the battery is sent serially by Arduino to NodeMCUvia the charging connector. The NodeMCU calculates the time required to charge the battery based on thebattery's SOC level and sends the information to the database over wifi. This time value is retrieved from the database and entered into the application we created for further calculations. A 5V power supply is utilised to charge the battery and power all of the circuit's other components.

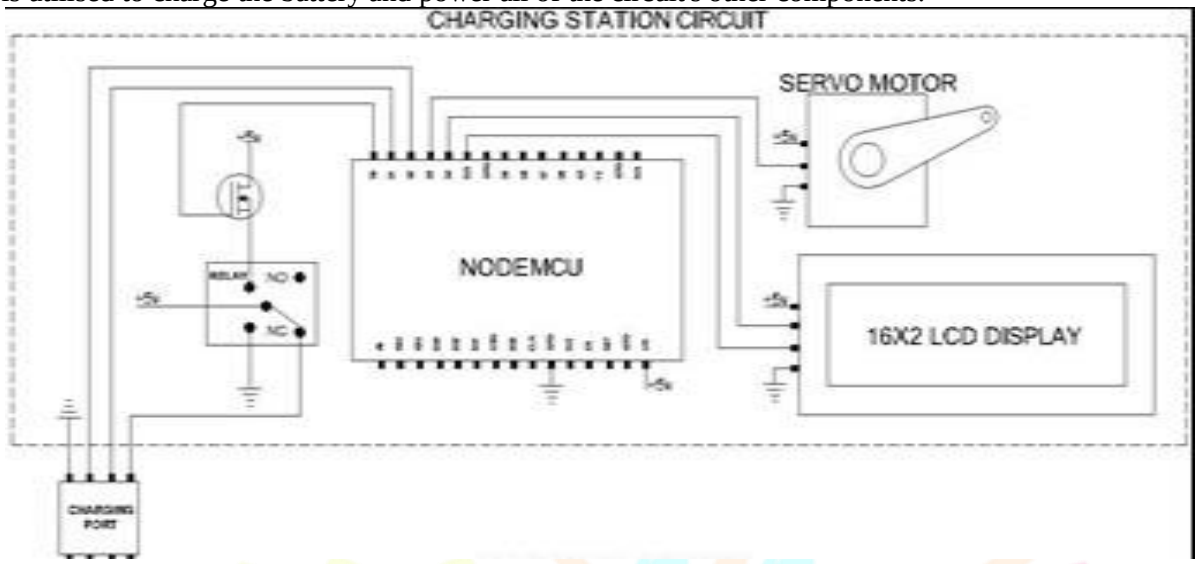


Fig : Charging station point

Arduino microcontroller is used for coulomb counting algorithm where it counts how many Ah are going in and outof the battery to estimate the state of charge (SOC) of the battery. Arduino communicates serially with NodeMCU through charging port to send the SOC level of the battery. NodeMCU is used to calculate the time required to charge the battery using the SOC level of the battery and sends it to the database through wifi. This value of time is fetched from the database to the application that we have built and used

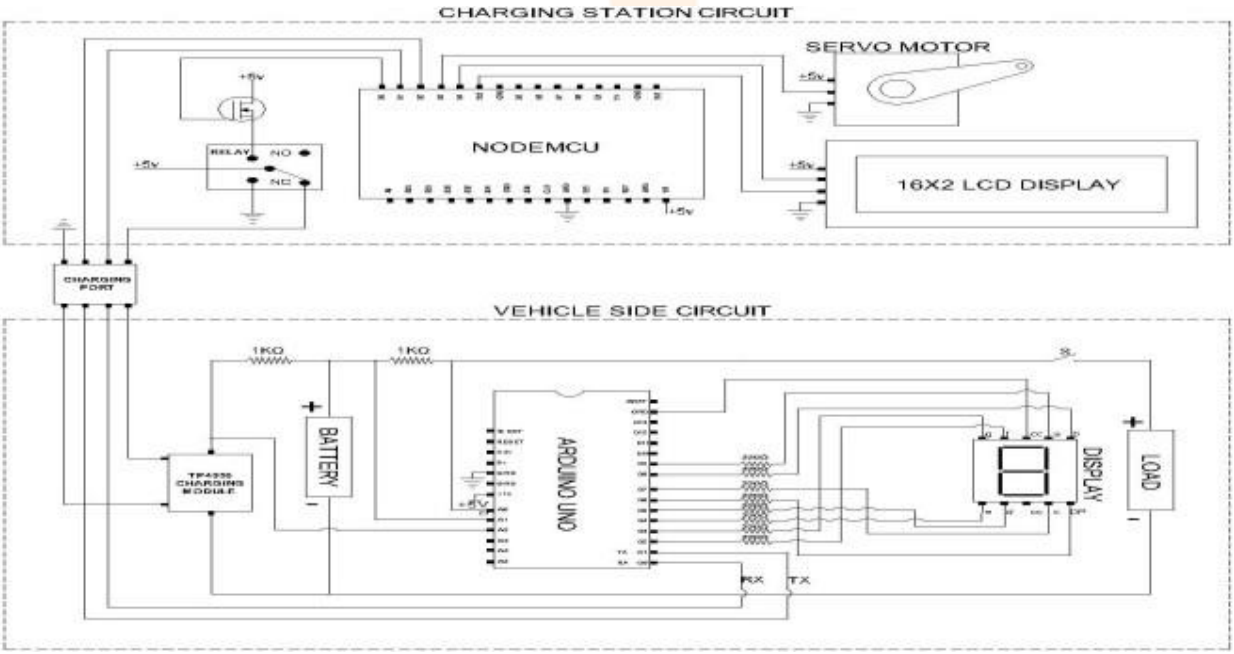
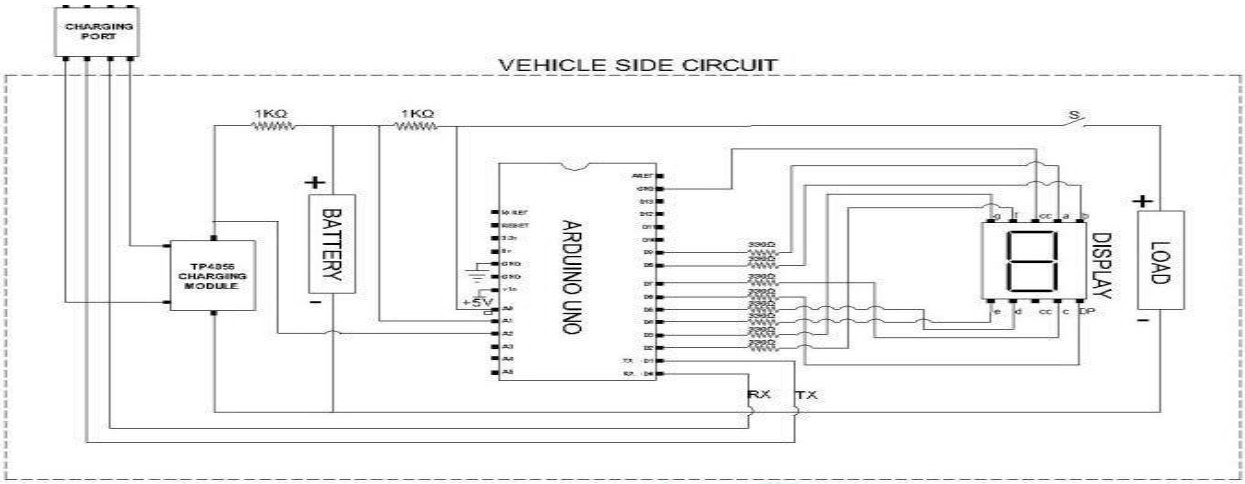


fig : charging station circuit

B. VEHICLE SIDE CIRCUIT

The vehicle side circuit is responsible for the estimation of the SOC of battery using coulomb counting algorithm. For this, an Arduino microcontroller is utilised, which counts how many Ah are moving in and out of the battery to estimate the state of charge (SOC). The SOC level of the battery issent serially by Arduino to NodeMCU via the charging connector.

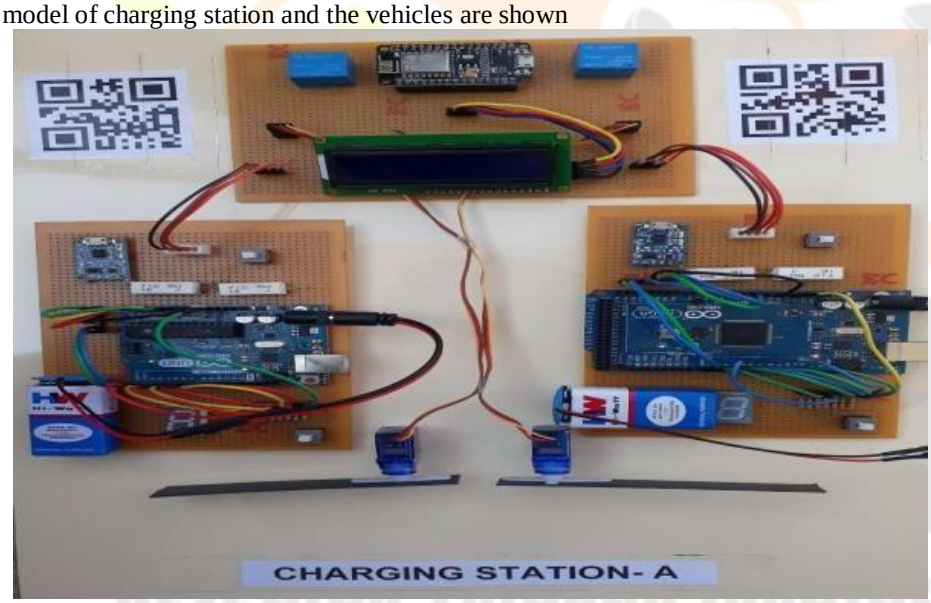


C. CHARGING PORT

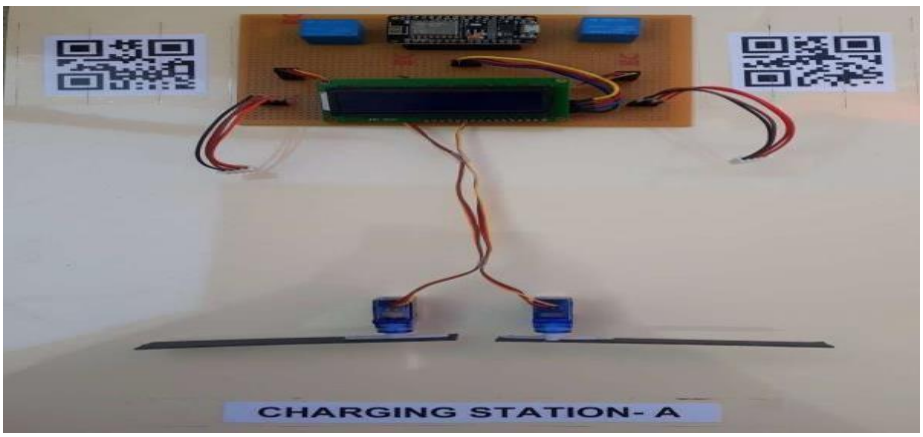
A commercial vehicle's charging port is made up of power supply pins, safety pins, ground pins, and communication pins. Because each vehicle requires different rated input charging currents, the communication pins are typically utilised to convey the values of the battery pack's rated input charging current. The signal is then issued when the battery reaches its rated voltage limit, and the charge is switched from constant current to constant current charging. These communication pins are used to send all of these messages. These pins were utilised in our project to send the SOC level of the vehicle's batteryto the charging station. The charging station then uses this SOC value in future computations.

HARDWARE RESULT

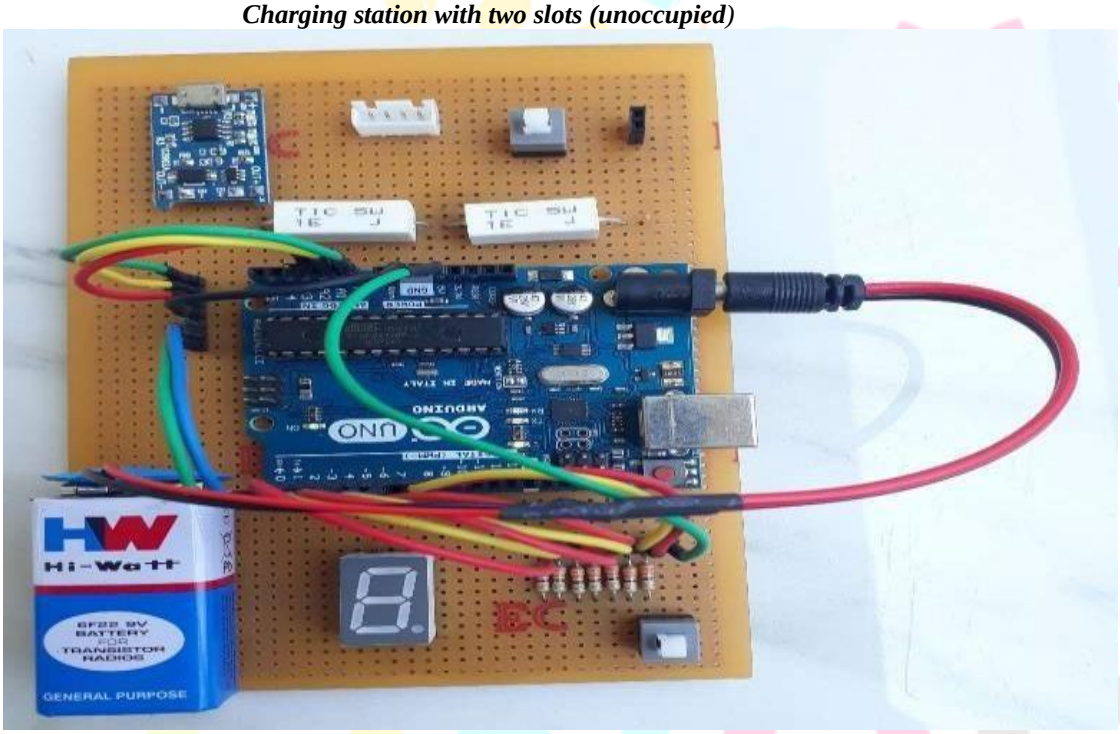
The prototype model of charging station and the vehicles are shown



Charging station with two slots (occupied)



Charging station with two slots (unoccupied)



vehicle side circuit

CONCLUSION

With the help of NodeMCU, Arduino UNO, and an Android application, we can comprehend the majorscope of this project.

As a result of this effort, the following advantages have been introduced:

• The Android App assists the user in locating charging outlets in their immediate vicinity.

• The hardware kit is simple to set up and operate, and it can be done by anyone.

• The charging slot availability and unavailability status, as well as the time from which the charging slotis available or unavailable, can be displayed, allowing the user to schedule EV charging and save time searching for a charging station.

EVs working together can help the environment by reducing carbon emissions.

While EV cooperation can help the environment by reducing carbon emissions, many academics are also interested in the economic benefits for charging providers, EV owners, and power grid companies. If charging is required, the EV driver may quickly determine this and reserve a time slot. The page lists all of the plug-in kinds that are

available for various electric vehicles. When the user's EV battery is fully charged, a V2G (Vehicle to Grid) system can be established, in which part of the extra power can be transmitted back to the grid. This method prevents power loss and allows the user to earn money by charging excessively. In addition, charging time can be greatly reduced to ensure a more efficient system.Separate maps to locate charging stations can be implemented in the future.

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