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IOT BASED SMART ELECTRIC VEHICLE WIRELESS CHARGING WITH REAL TIME LOCATION TRACKING

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Abstract: The system would likely involve multiple components, such as charging stations equipped with wireless charging technology, EVs that are outfitted with compatible hardware and software, and a central system that manages and tracks the charging and location data. The wireless charging would allow EVs to recharge their batteries without physical connections or cables, which could make charging more convenient and efficient for users. The real-time location tracking would enable the central system to check the location of each EV, which could be useful for managing charging demand, identifying trends in usage patterns, and optimizing the distribution of charging resources.

Overall, this paper would likely require a combination of hardware and software expertise,as knowledge of wireless charging and location tracking technologies. Additionally, there may be regulatory and safety considerations to the use of wireless charging systems in public areas, which would need to be carefully managed and addressed.

I. INTRODUCTION

The introduction to an IoT-based smart electric vehicle charging technology with real-time location tracking would likely provide some context for the project, outlining the current state of the EV charging industry and the potential benefits of a wireless charging technology with location tracking capabilities. It might begin by discussing the growing popularity of electric vehicles as a more environmentally-friendly alternative to traditional gasoline-powered vehicles, and the challenges associated with charging these vehicles. the key issues is the limited range of EVs, which means they need to be recharged more frequently than traditional cars.

There are many public EV charging stations available, the introduction could the process of connecting a charging cable to a vehicle can be cumbersome and time-consuming, and the availability of charging stations can be limited.

This is where the proposed wireless charging system comes in. By eliminating the need for physical cables and connections, wireless charging could make charging an EV more convenient and efficient for drivers. And by incorporating real-time location tracking, the system could also help manage charging demand and optimize the distribution of charging resources. The introduction might also mention some of the key technologies that would be involved in the project, such as IoT sensors, wireless charging technology, and location tracking systems. Finally, it could outline the objectives of the project and what the expected outcomes and benefits would be

II. OBJECTIVES

The objective of an IoT-based smart electric vehicle charging technology with real-time location tracking would likely be to create a more efficient and convenient method for charging EVs while also optimizing the charging resources.

Specifically, some of the objectives could include:

1. Developing wireless charging technology a that is compatible with a range of EV models and is capable of efficiently recharging EV batteries.
2. Creating a network of stations that are equipped with IoT sensors and communication technology, which can check charging demand in real-time.
3. Incorporating real-time location tracking technology that enables the system to monitor the location of each EV and direct drivers to the nearest available charging station.
4. Developing a central management system that can analyze charging and location data to optimize the distribution of charging resources and anticipate future demand.

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5. Enhancing the user experience by providing real-time updates on charging availability and estimated wait times, as well as enabling remote monitoring and control of charging sessions.

Overall, the goal of this project create a more efficient and user-friendly EV charging system that reduces wait times and maximizes the use of charging resources, ultimately encouraging more people to adopt EVs as a viable mode of transportation.

III. METHODOLOGY

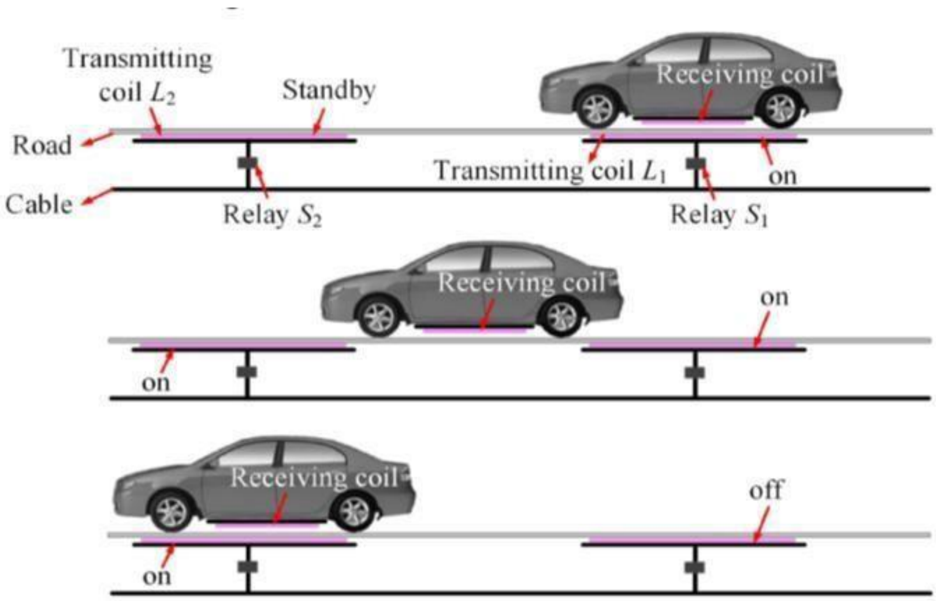

Fig 1. Fundamental diagram of selective on/off transmitting coil

The charging of an electric system is stated into three types based on its operating system. i.e., capacitive, permanent magnetic gear and inductive charging. In this project, we will be using inductive wireless charging mechanism in which primary and secondary coils will used to ensure the wireless power transmission.

The steps are discussed as follows:

1. Two different systems for transmitter (primary coil) and receiver (secondary) will be equipped in the model parking lane prototype in such condition that the transmitter will be in the ground whereas the receiver will be in the bottom portion of electric vehicle.
2. The transmitter will be connected to normal frequency AC source which will be first converted to high frequency AC source.
3. These moving charges will produce a magnetic field in the primary coil which will be kept fluctuating, by controlling of input current.
4. This produces magnetic field EMF in the secondary coil by the mutual induction phenomenon, which indeed will be connected to the battery management system of our electric vehicle.
5. A GPS module will be used to know the exact location of the vehicle, and once the vehicle reaches the parking place, the AC supply will be made ON at that particular place where the vehicle is parked.
6. Next, the secondary coil or the receiver section will start experiencing the electric flux, which will be always gets connected to the system of the vehicle.
7. This AC current will be converted to DC current, so as to start the charging of vehicle.

Block Diagram

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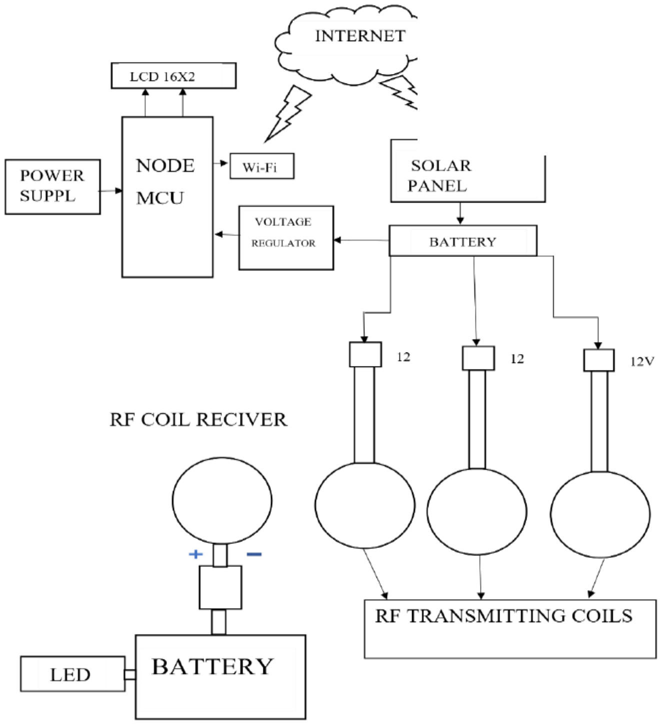

Fig 2. Block Diagram of the charging system.

The suggested system's overview is shown in Fig. 2 Shows. Here, electromagnetic induction is the underlying basis of wireless charging. Whenever electric current passes through a coil, it produces a magnetic field that, in turn, causes another electrical charge to flow through a second, farther-away coil. Without making physical touch, electricity may be transported this way from one gadget to another. Normal induction charging techniques still require the charger and receiving device to be close to one another. These charging methods are frequently referred to as "near field" because of this. The TP4056 chip, a lithium-ion battery charger for a single cell battery, then receives the output and guards against overcharging and overcharging the battery. Its input voltage spans the range of 4.5 - 5.5 V and produces a 5 V output. It features two status outputs that show charging is ongoing and charge is finished. Additionally, it features a 1A maximum configurable charging voltage.

Therefore, it is linked to a battery, which charges the battery. The battery's condition, including voltage, charging level, and temperature, are then collected using a DHT 22. The ESP82266 Wi-Fi module receives the data it has gathered, processes it, and then transmits the results to the OLED display and our smartphone via the Blynk server. Blynk displays all the metrics on your Android device so you can see the state of your EV's battery at a glance and sends you notifications as needed.

Hardware Requirements

1. Arduino UNO

Fig 3. Arduino UNO

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Arduino Uno is a microcontroller board works on the ATmega328P microcontroller. It is one of the most popular development boards in the Arduino family and is widely used in various DIY projects and prototyping. The board has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, and a reset button.

2. Primary and secondary coil

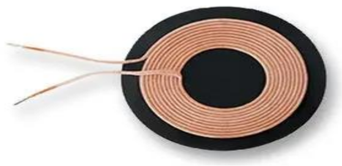

Fig 4. Primary and secondary coil

The primary and secondary coils are two components of an electrical transformer.
The primary coil is the coil of wire that is connects to the input voltage source, and it is wound around a magnetic core. When an alternating current (AC) is passed through the primary coil, it creates a magnetic field that changes direction with the alternating current. This magnetic field induces an alternating current in the secondary coil, which is the output of the transformer.

3. 16x2 LCD

Fig 5. LCD

LCD(liquid crystal display). It is a flat panel display technology that uses liquid crystals to control the transmission of light. An LCD panel consists of two polarizing filters with a layer of liquid crystal between them. The liquid crystal layer is made up of molecules that can be aligned by an electric field. When an electric current is applied to the liquid crystal layer, the molecules align in a specific direction and change the polarization of the light passing through them. This causes some light to be transmitted through the second polarizing filter and some to be absorbed, creating an image on the screen.

4. GSM Module

Fig 6. GSM

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GSM (Global System for Mobile) Communications. It is a digital cellular communication system used to transmit voice and data services on mobile phones.

GSM is the most widely used mobile phone system in the world and is used by over 80% of the world's mobile networks. It operates on a frequency range of 850-1900 MHz or 900-1800 MHz depending on the region. GSM uses Time Division Multiple Access (TDMA) technology, which divides the frequency band into time slots to transmit multiple calls simultaneously on the same frequency.

5. Battery

Fig 7. Li-on Battery

A battery is a device that stores chemical energy and converts it into electrical energy. It typically consists of one or more electrochemical cells, which consist of two electrodes (a positive and a negative) and an electrolyte. When a load is connected to the battery, a chemical reaction occurs between the electrodes and the electrolyte, creating an electric current that can be used to power electrical devices. There are more types of like batteries, including lead-acid, nickel-cadmium (NiCad), nickel-metal hydride (NiMH),

6. IR Sensor

Fig 8. IR Sensor

The IR (Infrared) sensor Is an electronic device that detects the IR in its surrounding environment. IR sensors work by detecting the radiation emitted by objects in the form of thermal energy. The sensor contains an infrared-sensitive element that converts the radiation into an electrical signal, which can be then processed by a microcontroller or other electronic device.IR sensors are available in a range of different types, including passive, active, and thermal.

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7. Voltage Regulator

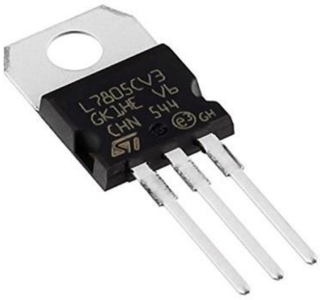

Fig 9. Voltage regulator

A voltage regulator is an electronics device that is used to maintain a constant voltage level in a circuit. It works by controlling the amount of voltage that is supplied to a load, ensuring that it recives a steady and stable voltage regardless of any fluctuations in the input voltage. Voltage regulator can be used in a variety of electronic devices, including power supplies, microprocessors, and other digital circuits. They are also used in automotive systems and other applications where a stable voltage is critical to the operation of the system. There are two types of voltage regulators: linear and switching. Linear voltage regulators work by dissipating excess voltage as heat, while switching voltage regulators use a more efficient method of regulating the voltage by switching the input voltage on and off at a high frequency.

8. Node MCU

Fig 10. Node MCU

NodeMCU is an open-source firmware and development kit is based on the ESP8266 Wi-Fi chip. It gives an easy way to develop and prototype Wi-Fi enabled projects using the Lua scripting language. The NodeMCU firmware allows developers to program the ESP8266 using Lua, a lightweight scripting language that is easy to learn and use.The NodeMCU development board integrates the ESP8266 chip with a USB-to-serial converter and a voltage regulator, making it easy to connects to a computer and start programming. The board also includes a number of GPIO pins, which can be used to interface with other sensors and devices.

9. Charging Module

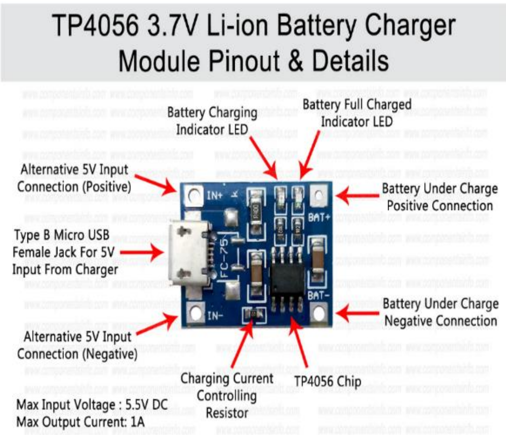

Fig 11. Charging Module

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The TP4056 is a lithium-ion battery charging module that is commonly used in small electronic devices such as smartphones, tablets, and portable power banks. The module is designed to charge a single lithium-ion battery with a maximum charging current of 1A. The TP4056 module includes a micro USB input port for connecting to a power source, a battery input port for connecting to a lithium-ion battery, and a set of LED indicators that indicate the charging status. The module also includes a number of safety features, including overcharge protection, over-discharge protection, short circuit protection, and reverse polarity protection.

Software Requirements

1. Arduino IDE

Arduino IDE is an open-source software development environment used to program Arduino boards. Arduino IDE provides a simplified interface for writing, compiling, and uploading code to Arduino microcontroller boards. It is available for Windows, Mac OS X, and Linux operating systems. Arduino IDE is designed to be user-friendly, even for those who have little or no programming experience. It includes a number of built-in functions and libraries that make it easy to control various components and sensors, such as LEDs, motors, and temperature sensors. The code is written in C or C++ programming languages.

2. Multisim

Multisim is a software application developed by National Instruments used for electronic circuit design and simulation. It provides a virtualy where users can design and test circuits before building them in real life. Multisim includes a vast library of components, such as resistors, capacitors, diodes, transistors, and integrated circuits, which can be used to build electronic circuits. It also provides a user-friendly interface circuits and connect components together using wires.

Things Speak IOT Interface

ThingSpeak is an Internet of Things (IoT) platform it allows users to collect, analyze, and visualize data from connected devices. It provides a web-based interface it allows users to easily create IoT applications and dashboards. ThingSpeak provides the open API that enables developers to connect their IoT devices and sensors to the platform. Once connected, data can be sent to ThingSpeak using HTTP or MQTT protocols. The platform then stores the data in a database, which can be accessed and analyzed using a different of tools and applications. One of the key features of ThingSpeak is its ability to create real-time dashboards that display data from connected devices. The dashboard can be customized to display data in various formats, such as graphs, charts, and gauges.

Output obtained on thinks speak IOT

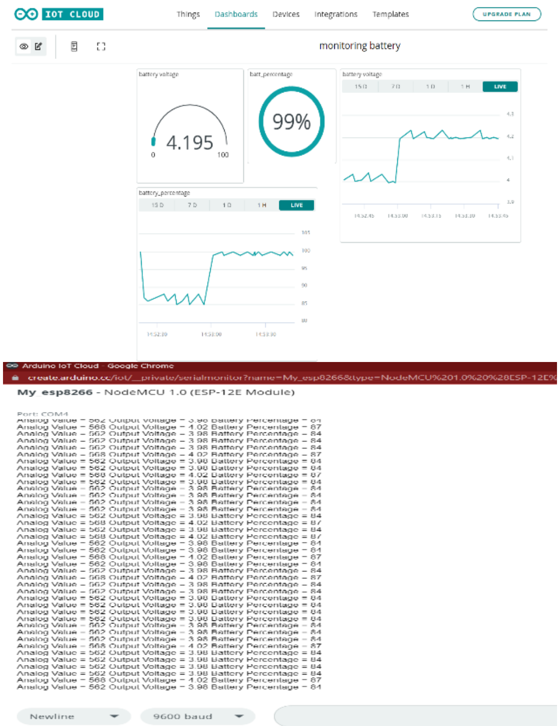

Fig 12. Output on things speak IOT

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IV. RESULT

Fig 13. Working model

- We will be designing a prototype model for the implementation of EV wireless charging lane. The use of hardware and software along with the android app also will be studied.
- Using Node MC microcontroller with designed in-built Wi-Fi technology, the final prototype project will be transferred to an app for monitoring and controlling charging of EV battery's as well.
- The prototype will also have a inbuilt GPS module so that the automatic positioning and charging of EV battery could be monitored based on the position of vehicle.

CONCLUSION

The IoT-based smart electric vehicle wireless charging lane is an innovative solution to the problem of charging electric vehicles. By using wireless charging technology and real-time location tracking, this system enables EVs to charge automatically and efficiently, without the need for physical connections. The system is built around a network of primary and secondary coils, which are used to transfer power wirelessly from the charging lane to the EV. The charging process is managed by a TP4056 charging module and a voltage regulator, which ensure that the battery is charged safely and efficiently.

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