

WIRELESS CHARGING AND MOTION TRACKING SYSTEM FOR ELECTRIC VEHICLE

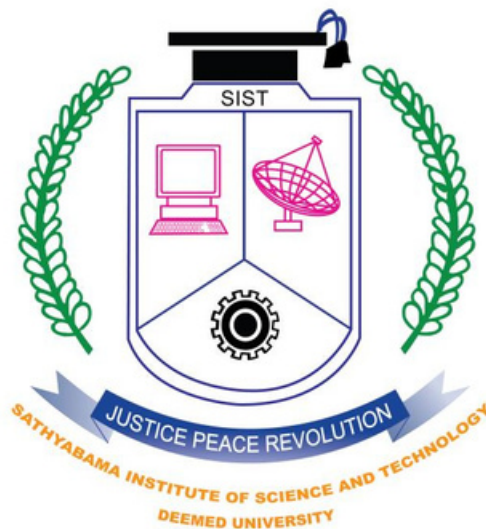
Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering

by

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

APRIL 2023



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BONAFIDE CERTIFICATE

This is Certify that this Project report is Bona fide work of **A. POOJA** (Reg. No. 39140039) and **G. POOVARASI** (Reg. No. 39140040) who carried out the project entitled "**WIRELESS CHARGING AND MOTION TRACKING SYSTEM FOR ELECTRIC VEHICLE**" under our supervision from October 2022- May 2023.

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ABSTRACT

The ability to wirelessly charge electric vehicle batteries could substitute plugged-in chargers, which have their own set of mechanical and electrical issues because of wires and power connections. Although the technological breakthrough for relatively close non-contact transmitting power is well known and several achievements have been described in scientific articles, the issues with charging time, energy transfer efficiency, system stability under realistic circumstances, and EMC-related issues still hold a significant amount of weight. This study offers a novel localization strategy based on wireless energy transfer for recharging electric cars (EVs) (WPT). Using the recommended method, the wireless charge controller may choose the most efficient coil to transmit power at the EV's placement depending on the detectors the EV's tyres have activated. We utilize a mechanism that determines which transmitting coil should be used based on monitoring the transmission rate of each one to ensure adequate recharge. By selectively activating the coils with the highest transfer efficiency on their own, this improves both recharging efficiency and power loss. The results show that the recommended method can locate the coil with the best transmission efficiency without analyzing documented effectiveness or utilizing real power transfer.

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LIST OF SYMBOLS AND ABBREVIATIONS

EV - Electric Vehicle

WPT - Wireless Power Transfer

RFID - Radio Frequency Identification

V2G - Vehicle to Grid

AF - Active Filter

DC - Direct Current

AC - Alternating Current

PWM - Pulse Width Modulation

DBC - Dynamic Battery Charger

GPS - Global Positioning System

RFUAV - R-adio Frequency Unmanned Aerial Vehicle

COTS - Commercial off the Shelf

GV - Gasoline Vehicle

DWT - Discrete Wavelet Transform

LCC - Leadless Chip Carrier

ICSP - Microcontroller

USB - Universal Serial Bus

DOF - Degree of Freedom

MMPC - Modified Model Predictive Control

CHAPTER 1

INTRODUCTION

GENERAL

People are experiencing challenges with rising pollution and a lack of electricity globally. The primary source of the mentioned issues is the extensive extraction and consumption of fossil fuels. Compared to cars that run on conventional fossil fuels, electric cars, which are propelled by batteries, are emerging as a significant energy and environmental problem-solver. Due to its adaptable design and straightforward operation, wireless power transfer is also emerging as a viable Electric Vehicle (EV) charging option. To enable "charging while driving," the wireless Power Transfer technology for EVs blends wireless charging technologies with the driving road surface. This eliminates the need to take up more lane space. The wireless charging technique of electric vehicles, as opposed to static wireless charging, makes Unavoidably, a conversation between plug-in and wirelessly EV battery charges was started by the recent technological breakthroughs and improvements in electric cars (EV) and even autonomous vehicles. Wireless chargers are becoming more and more popular even though plug-in infrastructure is becoming more connected globally and that any connector from an office or home could serve as a plug-in charging source. These benefits include complete human protection (there is no human operator), dependability and ease of use, unrestricted mobility, and potential accessibility across parking lots, gas stations, public, or domestic storage units, among others.

Additionally, according to some articles, the dynamic charging concept (charging a car while it is travelling) already exists emergency power (EP). Compatibility with wireless EV chargers is a significant problem that is still up for dispute. The Society of Automotive Engineers published several recommendations for best practices in wireless charging. The latest current, which was published in Nov 2017, is meant for stationary systems with achievable capacities of up to 11 kW EP efficiency, compatibility, and emission control. For the past several years, WPT technology integration into electric cars has been the focus of research. They could create a system to deliver energy to the EV using capacitive WPT and inductive WPT techniques. Power transmission in both directions is one of the advantages of

IPWT. Transmission efficiency has also changed significantly over time. The efficiency of the WPT system can already approach 96 percent, although this is largely reliant on how well the transmitter and receiver loops are aligned.

By providing a fresh method for location-based vehicle recharging, greatly contributes. Based on the active receptors under the tires the charger employs a sensing system to ascertain the direction of the car. The algorithm analyses the dimensions of the automobile when the detectors are enabled and selects the most efficient transmission loop near the current EV site. Interaction among the two is essential because the car's detectors are linked to the transmitters via its intelligent charger. The technology will instantly detect any changes and adjust the transmitter coil if the car moves. We show how the suggested location-based intelligent charger lowers the power needed to determine the loops with the highest full use of the time and area of the vehicle to recharge the vehicle, increasing the adaptivity of

wireless

charging of EVs. Efficacy, resulting in a low- power array system. Since the location of the vehicle is quickly determined without interrupting with the charging cycle, the recommended security apparatus permits a car to reduce the time.

1.2 MOTIVATION FOR THE SELECTION OF THE PROJECT

The intention of developing a system on wireless charging and motion tracking is motivated by number of the following factors;

Convenience: Wireless charging eliminates the need for messy wires that allows for a more seamless charging experience. Users can simply place their devices on a charging pad or dock, without having to worry about the plugging and unplugging of cables. Similarly, motion tracking systems provide a convenient way to interact with devices.

Mobility: Wireless charging and motion tracking enable greater mobility for devices. Users can charge their devices while on the move, without being tethered to a charging station. Motion tracking allows for hands-free operation of devices, which is particularly useful in scenarios where physical touch or control may not be feasible, such as in virtual reality (VR) or augmented reality (AR) applications.

User Experience: Wireless charging and motion tracking system aim to enhance the overall user experience. By eliminating the need for wires or physical controls, these systems provide

a more seamless and intuitive way to interact with devices. This leads to increased user satisfaction and loyalty.

Aesthetics: Wireless charging eliminates the clutter of cords, making the charging environment look cleaner and more aesthetically pleasing. Similarly, motion tracking systems can provide a sleek and futuristic look to devices, enhancing their visual appeal.

Innovation and Market Demand: Wireless charging and motion tracking are innovative technologies that are in high demand in the consumer electronics, automotive, healthcare, gaming, and industrial sectors. Companies are investing in these technologies to stay competitive and meet the growing consumer expectations for more convenient, efficient, and futuristic ways to charge and interact with devices.

Overall, the motivation behind wireless charging and motion tracking systems is to provide convenient, mobile, safe, efficient, and innovative solutions for powering and controlling devices, ultimately enhancing the user experience and driving market demand.

1.3 OVERVIEW OF THE PROJECT

The wireless charging system consists of a charging base station and a device to be charged. The charging base station is connected to a power source and generates an alternating magnetic field. The device to be charged, such as a smartphone or wearable device, is equipped with a wireless charging coil that can receive the magnetic field. When the device is placed on the charging base station, the magnetic field induces an electric current in the charging coil, which charges the device's battery wirelessly. The charging base station and the device to be charged communicate wirelessly to regulate the charging process and ensure efficient and safe charging.

The motion tracking system uses sensors or cameras to monitor the movement of objects or people in a specific area. The system can track various types of motion, such as human gestures, body movements, or object movements. The motion tracking system collects

data on the position, orientation, velocity, and acceleration of the tracked object or person in real-time, the collected motion data can be used for various applications, such as gaming, virtual reality, augmented reality, sports training, and healthcare. The motion tracking system

may use different technologies, such as infrared, ultrasound, magnetic, or optical sensors, and may require specialized hardware and software for data processing and analysis.

Integration of Wireless Charging and Motion Tracking:

The wireless charging and motion tracking system can be integrated to create a unified solution for charging and tracking the movement of devices or people. For example, wearable devices, such as smartwatches or fitness trackers, can be charged wirelessly while being tracked for motion data during physical activities. The integration of wireless charging and motion tracking can enable new applications, such as real-time tracking of sports performance, gesture-based control of devices, or immersive virtual reality experiences without the need for cumbersome wires. The system may require specific hardware and software integration, such as charging coils with embedded motion sensors, or algorithms for simultaneous data processing from both charging and motion tracking components.

Overall, the wireless charging and motion tracking system offers a convenient and efficient way to charge devices wirelessly while monitoring their movement in real-time, enabling a wide range of applications across various industries.

1.4 AIM OF THE PROJECT

The aim of a wireless charging and motion tracking system is to provide a convenient and efficient way to wirelessly charge electric vehicles while simultaneously tracking their motion or location. The system typically consists of a charging pad or station that uses electromagnetic induction or other wireless charging technologies to transfer power to compatible devices, such as smartphones, wearables, or other battery-powered devices. Additionally, the system incorporates motion tracking sensors, such as accelerometers, gyroscopes, or GPS modules, to track the movement, position, or orientation of the devices in real-time.

The wireless charging aspect of the system aims to eliminate the need for traditional wired charging methods, such as power cords or charging docks, providing a clutter-free charging experience, enhance the convenience & usability as users can simply place their devices on the charging pad or station to initiate charging, without the need for physical connections. The motion tracking aspect of the system aims to enable tracking of the devices' movements or location, which can have various applications depending on the context.

Overall, the aim of a wireless charging and motion tracking system is to provide a seamless and efficient charging experience while also enabling real-time tracking of the devices' movement or location for various applications, ranging from consumer electronics to industrial and commercial use cases.

CHAPTER 2

LITERATURE SURVEY

2.1 MAJOR FINDINGS FROM LITERATURE SURVEY

Yen Chung et al (2013) proposed design of RFID mesh network for electric vehicle smart charging infrastructure. In this, with an increased number of Electric Vehicles (EVs) on the Road charging infrastructure is gaining an ever-more important role in simultaneously meeting the needs of the local distribution grid and of EV users. This Ching paper proposes a mesh network RFID system for user identification and charging authorization as part of a smart charging infrastructure providing charge monitoring and control. The Zigbee-based mesh network RFID provides a cost-efficient solution to identify and authorize vehicles for charging and would allow EV charging to be conducted effectively while observing grid constraints and meeting the needs of EV drivers [1].

Shubham Neeraj Kumar et al., (2019) proposed a efficient scheme for wireless charging of electric vehicle using RFID with an optimal path planning. The emission of the harmful CO₂ in the environmental from the traditional Fuel based vehicles is one of the major factors for the rise and popularity of electric vehicles (EVs) in the modern smart cities in the recent years. In this context, EVs provide an eco-friendly environment in the modern smart city. But there Exists many challenges (such as smart charging, path planning, information dissemination for the usage of EVs in the modern smart city. So, there is a need for the new techniques and solutions to improve the efficiency of the existing charging system of the EVs. Keeping focus on these points, this project proposes a new technique for the electric vehicle wireless charging using RFID tags along with an optimized path planning to have an optimal charging cost. the application of RFID tags located at various points across the city is used to have an efficient payment system during EVs charging [2].

Dylan Dah-Chun Lu et.al., (2019) proposed a modified model prediction control for bidirectional four-quadrant EV chargers with extended set of voltage vectors. This paper

presents a modified model predictive control (MMPC) for bidirectional power flow control between the electric vehicle (EV) chargers and the main grid. In contrast to the conventional finite control set MPC which selects an optimal switching state from eight possible voltage vectors, the proposed MMPC is based on the application of an optimal voltage vector chosen from an extended set of 20 modulated voltage vectors with a fixed duty ratio. To reduce the computational burden introduced by [3].

Mauricio Restrepo et al., (2018) proposed a Modeling and testing of a Bidirectional smart charger for distribution system EV integration. This project proposes a model of a single-phase bidirectional electric vehicle (EV) charger with capability of operating in all four quadrants of the P–Q plane. The steady-state and step responses of the proposed model are used to validate it based on the actual responses of a bidirectional charger prototype for different P–Q requests. The model can be used efficiently in time-domain simulations that require models of a number of EV chargers, such as EV integration studies in low-voltage (LV) distribution networks. A practical case study is presented to demonstrate and test the proposed smart charger and model, investigating the provision of vehicle-to-grid (V2G) for active and reactive power in an LV residential distribution network. These results demonstrate the advantages of the presented charger model for developing V2G strategies in distribution networks. [4].

R. Logesh Srinivasan et al., (2021) proposed a solar based fast tag charger for electrical vehicle. In this, Photovoltaic frameworks are quite possibly the most inexhaustible Framework

which is being utilized nowadays, and it is a green and clean well spring of energy. The photo voltaic cells create the force from the daylight changing over it into power by the assistance of sun-based cells present in it. Here we are building up a sun-oriented-based quick tag charging station for an electric vehicle. Charging for the batteries of light electric vehicles requires charging focuses. Here we build up a modest charging and proficient charging station for EV vehicles. Here ARDUINO UNO goes about as a Heart of the whole circuit. This Order the whole piece of the circuit and progresses the program. So, the ARDUINO perceives a substantial card detected by RFID and afterward flags the information to the Arduino for further action. Then it flags the Arduino and it begins the charging component from the giving stock through a force supply area to the EV. Various factors like cost, compactness and Efficiency Was considered as the major requirement for the proposed system. The Arduino

begins a converse commencement clock to which shows the charging time. Out in the open places, this can be utilized for shrewd charging for EV vehicles. The design challenges and future work also discussed in detail. This card depends on the charging framework. This will supply enough measure of charge to the EV [5].

Yun Zhang Jian Fang Gao et al., (2020) proposed a Second harmonic ripple voltage suppression of integrated single – phase pulse width modulation rectifier charging system for EV. in single-phase ac battery chargers, pulsating power at twice of the line frequency is delivered by the ac source resulting in second-harmonic ripple voltage on the dc-link if additional passive or active filter (AF) circuits are not used. In this article, an inductance-based AF using the leakage inductance of the machine windings along with a current compensation control method is proposed. No additional passive components are required. The machine used in this article has a double-layer winding with a center tap in each phase and the winding structure of the machine is special in that the pulsating magnetomotive force of the whole phase winding can be cancelled when currents flow into the central tap. In this article, the operating principle and control strategy of the AF with the inductive energy storage are analyzed. Finally, a 400-W experimental prototype is developed and the experimental results are used to validate the performance and feasibility of the proposed converter and control strategy [6].

Giulia di Capua et al., (2021) proposed a optimal coils and control matching in wireless power transfer dynamic battery chargers for electric vehicles. In this, Wireless Power Transfer (WPT) is a key enabling technology towards the transportation electrification, able to overcome some limits of the plug-in charging of the Electric Vehicle (EV). In this frame, a special attention is paid to the dynamic WPT systems, where the EV is recharged during motion. This project presents a model and a resultant method for the system level design of a series-series WPT Dynamic Battery Charger (WPT-DBC) for EVs. The model allows analyzing the joined influence of coil pair characteristics and power converter stages controls on the global performances of WPT-DBCs. The design method provides general guidelines for system level optimization, matching the characteristics of the power and control elements of a series-series WPT-DBC, to achieve the desired efficiency, receiver power loss and battery charge [7].

Jian Zhang Xian et al,(2019) introduced a Robust RFID based 6-dof localization for unmanned aerial vehicles. Although Unmanned Aerial Vehicles (UAV) are usually deploy outdoors, there is increasing interest in applying UAVs for indoor applications. It is a highly attractive and challenging task to precisely localize a UAV in an indoor environment where Global Positioning System (GPS) service is absent. In this project, we present RFUAV, a Radio-frequency Identification (RFID) enhanced UAV system that provides a precise 6 degrees of freedom (6-DoF) pose for UAVs. With RFUAV, three or more Ultra high frequency (UHF) RFID tags are attached to the UAV and are interrogated by a Commercial Off-The-Shelf (COTS) RFID reader with multiple antennas. Based on phase measurements of the RFID tag responses, the RFID tracker of RFUAV, a Bayesian filter-based algorithm, was employed to track the position of the tags in a global coordinate system. The pose estimator of RFUAV computes the 6-DoF pose of the UAV from tag positions. We tested the performance of RFUAV in a representative, structure-rich, indoor environment, where 0.04 m position error and 2.5 degrees orientation error were achieved with the development of EVs, many studies have begun for layout and technology of public charging stations. global coordinate system. The pose estimator of RFUAV computes the 6-DoF pose of the UAV from tag positions. We tested the performance of RFUAV in a representative, structure-rich, indoor environment, where 0.04 m position error and 2.5 degrees orientation error were achieved with the development of EVs, many studies have begun for layout and technology of public charging stations controller and identifier of the EV users, respectively. It has desired features for electric vehicle from renewable energy resources grid connected with solar panel [8].

N. Kalyani et al. (2014) have developed RFID based secured access system using AVR micro controllers and is very commonly used in offices, institutes, homes, etc. by referring this paper we have understand the interfacing of RFID with AVR [9].

Hail et al., (2018) developed a wireless charging station for electric vehicle controlled by RFID tag. The charging was very easy because the power transfer method is wireless [10].

Wen Jing et al. (2017) investigated the effect of the location of BEVs public charging facilities on a network with mixed conventional gasoline vehicles (GVs) and BEVs [11].

2.2 PROBLEM IDENTIFICATION

A literature listed in the References section and the works cited in the listed papers were reviewed thoroughly. All these literatures reported using a conventional EV WPT charger. The transmitter loop is placed below the electric vehicle, and thus the receiver loop is attached to the bodywork. The parking lot is set up to offer plenty of parking spot and a secure exit for the driver. The WPT transmitter design has a challenge in terms of parking lots' spatial flexibility. Consequently, the WPT charger able to transfer power effectively regardless of where the car resides. Several strategies for enhancing the geographic flexibility of WPT chargers are discussed. It is reported that a capacitor that provides an energy reserve is attached to the power transmission system and a multi-loop transmitter integrates two or even more loop into a single emitter. The transmission outcomes are the focus of the calculation loop utilized to supply power to the receivers. Power may be transferred constantly and as effectively as feasible using this method. By regulating the recharging power using a DC-DC converter and optimizing the transmission efficiency with a Half Active Rectifier, literature suggested a unique secondary-side control approach for power management and efficiency optimization.

The development of Dynamic Wireless Power Transformer (DWPT) system characteristics regarding performance for the segmented transmitters array D-WPT system was examined in the literature. Additionally, they suggested using a double-spiral repeater to increase efficiency, transmission distance, and misalignment tolerance. The Life Cycle Cost (LCC) compensating network was first presented to WPT systems in literature with an application focused on dynamic wireless EV charging. A unique dynamic WPT technology that combines the benefits of a segmental long coil coupler with a pads array was published in literature. Solution for increasing power and efficiency is suggested in the literature by using a multi-excitation device in the charging process.

CHAPTER 3

INVESTIGATION AND METHODOLOGY

3.1 SCOPE OF THE PROJECT

Electric vehicle charging infrastructure is moving towards utilizing renewable sources of energy like solar and wind, and vehicle to grid (V2G) or Bidirectional chargers are steps in this direction. On the other hand, to reduce range anxiety among EV owners and to make using EV chargers easier, wireless charging of electric vehicles is also creating a buzz in the automotive market space. With the electric vehicle infrastructure falling in place, the industry is looking forward to delivering e-mobility solutions that are not restricted to automobiles and develop capabilities to energize our highways, industrial fleets, and businesses, cities, and utilities. In this project, the scope of work carried out is limited to the indication of battery level and location identification of the nearest charging station using Global System for Mobile communication (GSM) alert to the user over mobile communication due to timing constraints.

3.2 CONSTRAINTS OF THE PROJECT

When designing a wireless charging motion and tracking system for electric vehicles (EVs), there are several constraints that need to be considered to ensure effective and safe operation. Some of these constraints include:

Efficiency: Wireless charging systems typically have lower efficiency compared to traditional wired charging systems. Therefore, it's essential to design the system to minimize energy losses during wireless charging, both during motion and tracking. This includes optimizing the alignment and distance between the charging coils to minimize energy wastage and maximize charging efficiency.

Range and Alignment: The wireless charging system needs to be designed to accommodate the motion and tracking requirements of the EV. This includes determining the appropriate range or coverage area for the wireless charging system, so that the EV can be charged effectively even when in motion or changing direction. Ensuring proper alignment between

the charging coils and the EV's receiving coil is critical to maintain efficient charging during motion.

Safety: Safety is a paramount consideration in wireless charging systems for EVs. The system must be designed to prevent potential hazards, such as overheating of charging coils, electromagnetic interference, or unintended charging of nearby objects or people. Safety features, such as thermal sensors, current and voltage monitoring, and fault detection mechanisms, should be incorporated into the system to mitigate risks.

3.3 OBJECTIVE

The main objective is to novel wireless charging technique that combines a charging system with wireless communication technology was presented. The system may function as that of the ZigBee and interact without the intervention of a human thanks to wireless communication technology. With the use of a transmitter coil and a receiver coil in Dynamic wireless power transfer, wireless charging enables the electric car battery to be charged wirelessly (SWPT). In this single transmission, a single receiver coil is utilized to transmit electricity.

3.4 RISK ANALYSIS DONE FOR THE PROJECT

When conducting risk analysis of wireless charging and motion tracking system, there are several factors to consider,

Technology Risks:

Wireless Charging Technology: Risks related to the performance, reliability, and safety of wireless charging technology, such as charging efficiency, electromagnetic interference, and compatibility with various devices.

Motion Tracking Technology: Risks related to the accuracy, precision, and reliability of motion tracking technology, such as sensor accuracy, data processing algorithms, and potential errors in tracking human motion.

Integration Risks: Risks associated with integrating wireless charging and motion tracking technologies, such as compatibility issues, communication protocols, and software integration challenges.

Safety Risks: Electromagnetic Radiation: Risks associated with potential health hazards from electromagnetic radiation emitted by wireless charging system components.

Electrical Safety: Risks related to electrical hazards, such as short circuits, overheating, and electrical fires, in the wireless charging system components.

Motion Tracking Hazards: Risks related to potential injuries or accidents resulting from inaccurate motion tracking, such as incorrect motion detection leading to wrong actions or commands.

Reliability and Maintenance: Risks related to the reliability and maintenance of the wireless charging and motion tracking system, such as system downtime, component failures, and maintenance costs.

User Acceptance: Risks associated with user acceptance and adoption of the wireless charging and motion tracking system, such as user resistance to new technologies, lack of training, and usability challenges.

Data Privacy and Security: Risks related to the privacy and security of data collected by the wireless charging and motion tracking system, such as data breaches, unauthorized access, and data leakage.

In summary, for each identified risk, a risk assessment should be conducted to evaluate the likelihood of occurrence, the potential impact, and the severity of consequences. Risk mitigation strategies should be developed, including risk avoidance, risk transfer, risk reduction, and risk acceptance, as appropriate. Regular monitoring and review of risks throughout the project lifecycle should be carried out to ensure that risk mitigation measures are effective and updated as needed.

3.5 IEEE STANDARDS FOR THE PROJECT

There are several IEEE standards that relate to motion and tracking systems for electric vehicles. Here are a few:

IEEE 802.11p: This standard defines wireless access in vehicular environments (WAVE) for communication between vehicles and between vehicles and roadside infrastructure. This can be used for vehicle-to-vehicle communication to aid in motion and tracking systems.

IEEE 1801: This standard defines a low-power design specification for electronic systems, which can be used in electric vehicles to improve energy efficiency and extend battery life.

IEEE 2030.1.1: This standard defines a communication framework for electric vehicles and their charging infrastructure, which can be used for tracking and managing vehicle charging and battery health.

IEEE 1547.8: This standard defines requirements for interconnecting distributed energy resources, such as electric vehicles, to the electric power grid. This can aid in managing the power output of electric vehicles and integrating them into the grid.

IEEE 1588: This standard defines a precision clock synchronization protocol for use in distributed control systems, which can aid in coordinating motion and tracking systems for electric vehicles.

These are just a few examples of IEEE standards that can be relevant to motion and tracking systems for electric vehicles. Other standards may also be applicable depending on the specific system being developed.

3.6 METHODOLOGY

A new method has been outlined and illustrated for implementing, modelling, and measuring in-motion wireless power transfer for a wireless The electric vehicle charger. Transmission coils are used to charge the electric vehicle wirelessly. principle used to charge the electric vehicle is inductive coupling. Transmitter side which has to transmit power to electric vehicle and receiver side which is attached to the vehicle to receive power wirelessly. In transmitter we interface RFID reader to Arduino which acts as input. The output of the Arduino is connected to relay as well as the transmitter coil. Here when RFID tag is swiped

against the RFID Reader, the Relay will ON which is interfaced with Wireless transmitter Coil. Then the power is transmitted to receiver coil. On receiving the charge, it is given to the battery. The Receiver coil voltage is uploaded to cloud server and can be viewed in think speak server. Same RFID tag should be read again to stop the charging.

3.7 APPLICATIONS

- Commercial charging station
- Electric vehicles
- Autonomous Vehicles

CHAPTER 4

PROJECT DESCRIPTION

4.1 EXISTING BLOCK DIAGRAM OF RFID BASED EV CHARGING

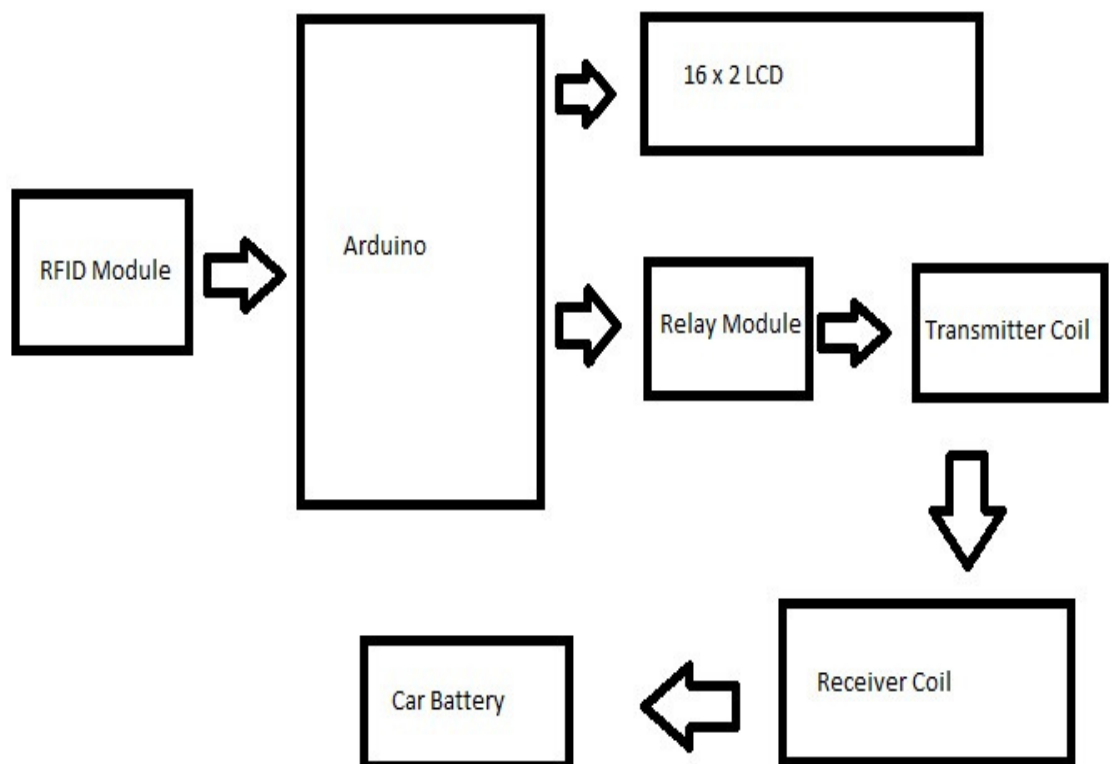


Fig 4.1 RFID Based EV Charging

In this system, the battery that powers the electrical vehicle gets electricity from the wireless power transfer coil of the road system and transmits it to the wireless power reception coil as shows in Fig.4.1 Battery gets electricity from the existing solar panel in addition to the wireless power transfer coil. Here, the car's mobility is controlled by an Arduino board. The RFID reader is connected to the Arduino. After parking at the allotted place for wireless charging, the user swipes RFID tag to the RFID reader

then charging starts automatically. The principle used to charge the vehicle wirelessly is inductive coupling. Based on the code integrated into Arduino when user swipes RFID, Arduino allows power through relay to transmitter coil and that power is transmitted to vehicle through receiver coil through the principle of inductive coupling. Inductive coupling between two coils is a basic principle that is described for wireless power transfer and wireless communication.

4.2 DISADVANTAGE OF EXISTING SYSTEM

- Initial installation cost is very high
- Replacing the battery is expensive
- Compatibility of electric vehicles from different manufactures towards a wireless charging station.

4.3 PROPOSED BLOCK DIAGRAM OF WIRELESS CHARGING WITH TRACKING SYSTEM FOR EV

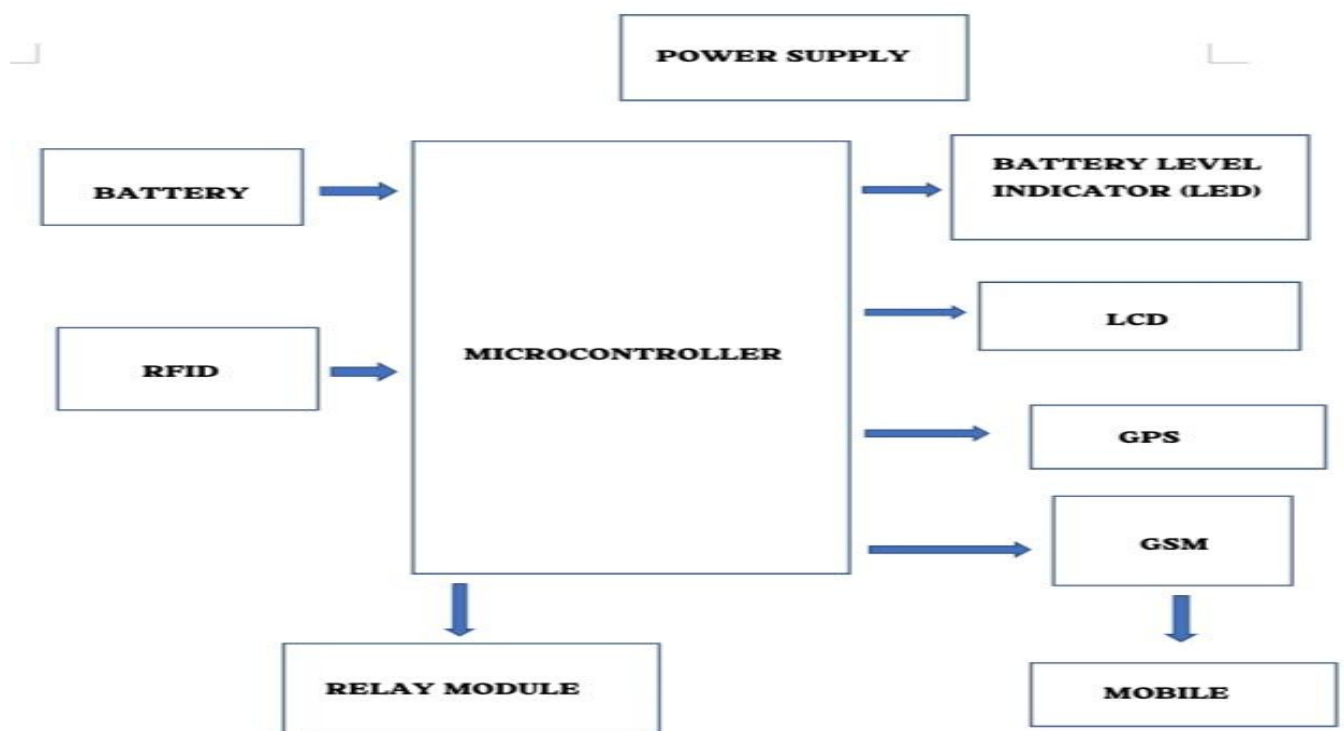


Fig 4.2 Wireless Charging with Tracking System for EV

Fig.4.2 shows that to the Estimated results are Arduino generates PWM signals transfer to H-bridge Flip the AC voltage provide by the power Unit. The PWM signals in the form of PWM signal wave voltage applied to the transmitter coil on a time. Relay with RFID reader also gave the better part in this analysis the power transmission though they are Unified. In consequence of this RFID reader monitor the location of the EV without interrupting the charging with in Every junction and starting in the wireless charging enabled road. After the mutual induction simulation, the capacity is formed which manifest the deviation of magnetic flux. After measuring the Mutual - inductance of transmitting coil and Receiving coil the receiving coil receives the power radiated outward form transmitting coil and stores in the Battery. Based on this EV battery charging system represented dynamic charging means charging while in motion is holds good paralleled to static charging. The EV can drive for long time because battery is capable to store necessary or sufficient charge required for the EV operation because it is dynamically charging also capable of recognizing car id through RFID and able to Turned off using app.

The Transmission coils are 5V & 2A Wireless Charging Module. The module of Transmitter-Receiver Charging Coil is prepared by a variety of basic electronic devices which is used for wireless charging application, the power supply circuit design is built with a lesser size which is easy to use, high efficiency, low price characteristics. Wireless charging coils are modest but important components of the wireless charging system. Power efficiency Transfer is highly dependent on the Q factory of main and secondary coils, their sizes and materials, and the distance between the coils. To achieve minimal power transmission losses, the parameters of the transmitter and receiver coils are critical. The location of the transmission and reception coils has a significant impact on the efficiency of energy transfer. 8266 micro controller is used in the receiver section of the car to report the battery voltage to the cloud while charging. Using resistor divider circuit, it will reduce the battery voltage to 5v and using analog pin we can be able to read the voltage up to 5v and it can be mapped into 12v. That can be uploaded to think speak server. The voltage can be mapped through mapping function in the code integrated into the node MCU.

4.4 WORKING PRINCIPLE

Whenever battery gets draining, we will get alarm and indicators will indicate that if battery is full, it will indicate green light, if battery is medium, it will indicate yellow, if battery is low it will indicate red. With use of GPS we can find the nearest location of wireless EV station which is used charging by RFID reader. The working principle Starts with RFID reader which is connected to the Arduino. After parking at the marked place for wireless charging, the user swipes RFID tag to the RFID reader then charging starts automatically. The principle used to charge the vehicle wirelessly is inductive coupling. Based on the code integrated into Arduino when user swipes RFID, Arduino allows power through relay to transmitter coil and that power is transmitted to vehicle through receiver coil through the principle of inductive coupling. Power transmission in inductive coupling technique is shown in Fig.3.3 Inductive coupling. In the instance of inductive coupling, a pair of coils is utilized to transport energy from the transmitter coil to the reception coil in the form of magnetic fields. Alternating currents cycling inside a closed loop form a magnetic field in the transmitter coil. Inductive coupling between two coils is a basic principle that is described for wireless power transfer and wireless communication.

4.5 WIRELESS CHARGING OF A CAR USING RFID TAG

RFID stands for radio frequency identification. RFID used for automatic identification and data capture. This tag uses radio waves to accomplish. Instead of swiping your card and providing one's information through magnetic strip on the back, RFID can be used for easy accessing. With a wave with RFID tag one can access something without entering a pin or waiting for it. In this project RFID tags are used to identify the vehicle numbers and to enable charging. RFID details are stored at electric vehicle charging stations. So that when user waves RFID at charging station after parking at the right place to charge, if the RFID details are found then Arduino allows to charge. If the details are not found, then charging doesn't takes place.

4.6 HARDWARE REQUIREMENTS

- Arduino
- Bluetooth
- RFID Module
- Motors
- Wireless Power Receiver

4.6.1 Arduino

The Microcontroller board, Arduino UNO with ATmega328P. It has 6 analogue signals, a 16 MHz ceramic resonator, 14 digital I/O pins (six of those are PWM output), a USB port, a power connector, a reset Button, and an ICSP header. Everything that you need to operate the micro controller is included; all you need to do to get going is plug it into a computer through USB, an AC-to-DC converter, or a battery.

4.6.2 Bluetooth

The effective communication for the wireless component is handled using Bluetooth connectivity. Bluetooth devices allow for wireless data transmission and reception between two devices. The Bluetooth module may collect and send data from a host operating system via the host controller interface. This is used to help the car steer.

4.6.3 RFID Module

These drivers act as a conduit connecting control circuits and motors. The controller circuit utilizes reduced current signals to drive the motor, which demands a high current. Motor drivers transform low-current control signals into higher-current signals that can operate motors.

4.6.4 Motors

A motor is a useful device that converts electrical energy into mechanical energy. Motors are now found in both household and industrial environments. Ultimately, the motor you select will be determined by your individual requirements.

4.6.5 Wireless Power Receiver

This coil is employed to receive the power through the wireless power transfer coil from the road system.

4.7 ADVANTAGE OF PROPOSED SYSTEM

- Avoid the manpower
- Lower maintenance cost than Gas power vehicles
- Height weight vehicles
- Charging is convenient
- 80% reduced operating cost than equivalent gas power vehicles
- Zero recharging time and unlimited range (when operating a grid road)

CHAPTER 5

SIMULATION AND HARDWARE IMPLEMENTATION

5.1 FULLY CHARGED CONDITION

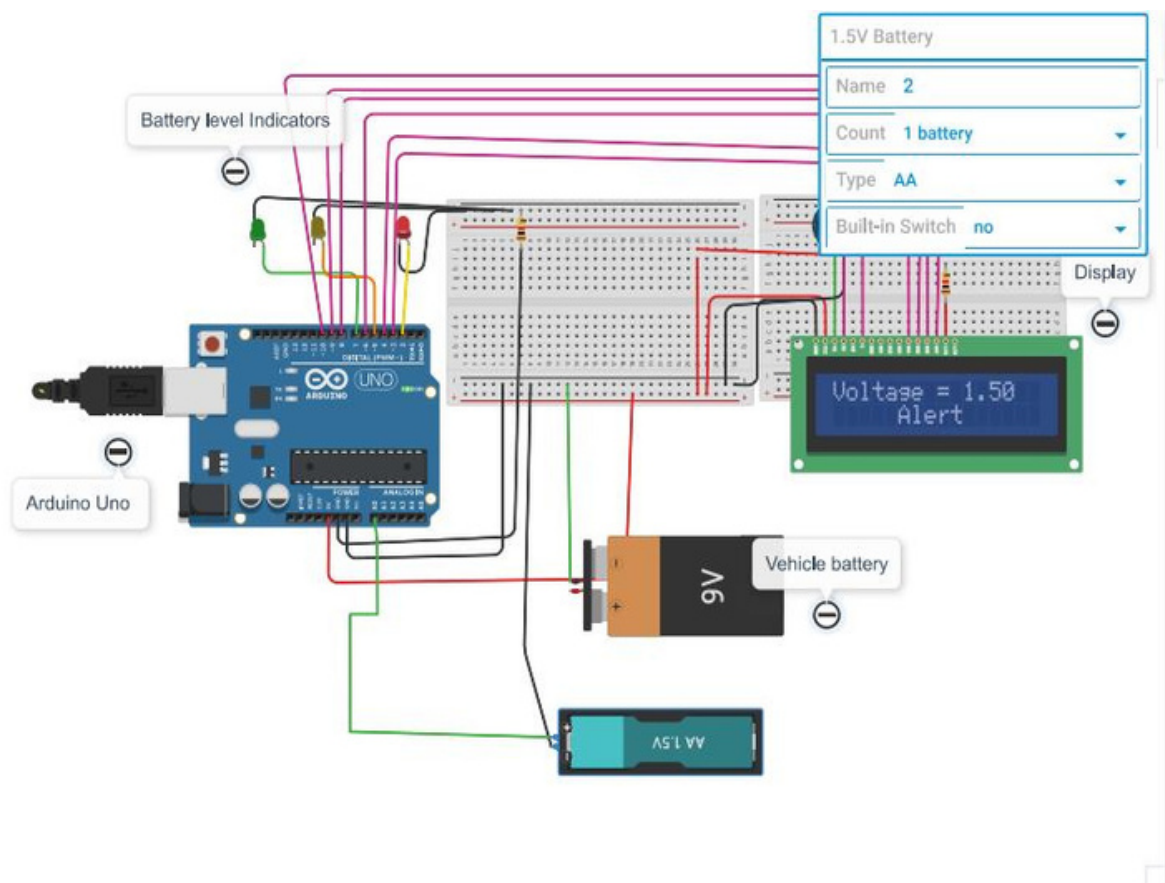


Fig 5.1 Fully Charged Condition

We will receive an alarm if the battery starts to deplete, and indications will show whether the battery is full, medium, or low: green for a full battery, yellow for a medium

battery, and red for a low battery. Fig 5.1 shows the result for full level of battery. Battery is full so display output is voltage range of the battery level with “Battery Full or just Alert” and LED light indication is Green.

5.2 LOW LEVEL BATTERY INDICATION

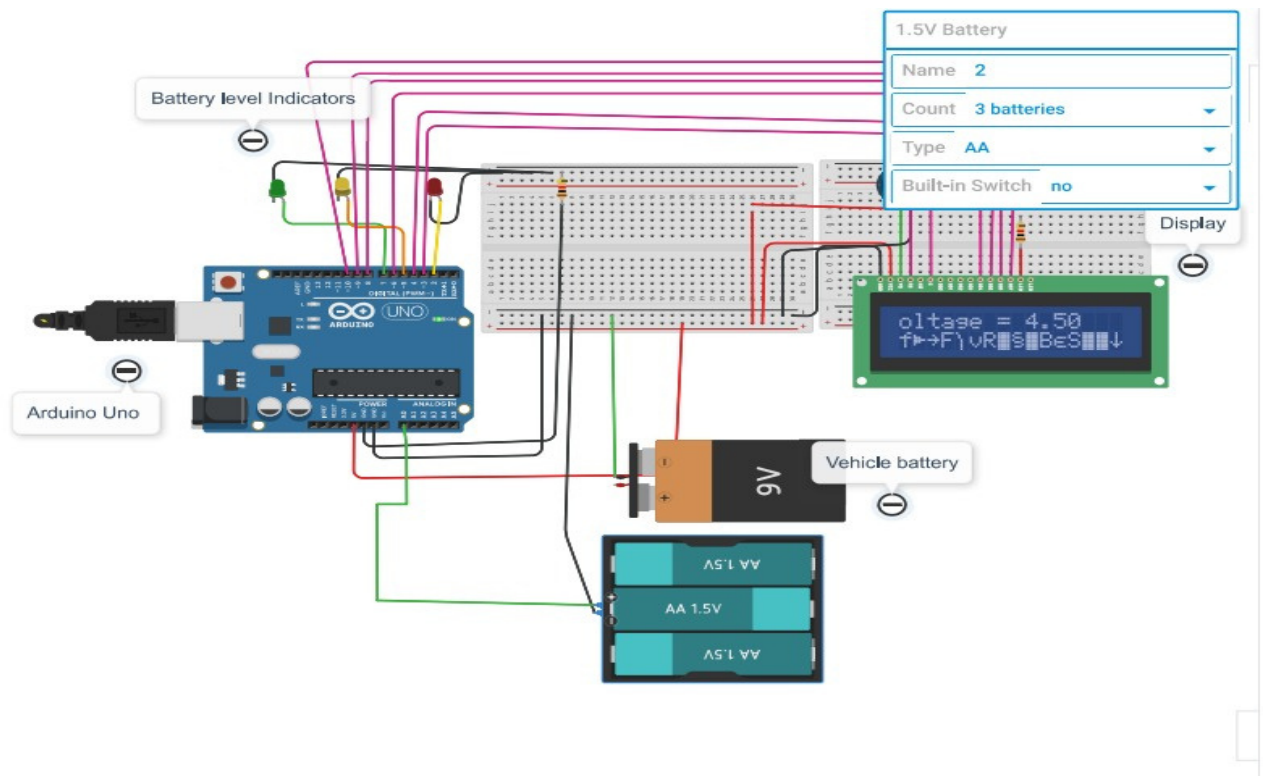


Fig 5.2 Low Level Battery Indication

We will receive an alarm if the battery starts to deplete, and indications will show whether the battery is full, medium, or low: yellow for a full battery, green for a medium battery, and red for a low battery. Fig 5.2 shows the result for low level of battery.

Battery is low so display output is voltage range below 5V of the battery level with “Battery Low” and LED light indication is Red.

5.3 PROGRAM CODE

```
#include <LiquidCrystal_I2C.h>
#include <SPI.h>
#include <MFRC522.h>

int analogInput = 0;
int f=2;
int c=5;
int a=7;
int s=13;

#define RST_PIN 9
#define SS_PIN 10
#define RELAY 3
byte readCard[4];
String MasterTag = "32BCF21"; // REPLACE this Tag ID with your Tag ID!!!
String tagID = "";

// Create instances
MFRC522 mfrc522(SS_PIN, RST_PIN);
LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup()
{
    // Initiating
    SPI.begin(); // SPI bus
    mfrc522.PCD_Init(); // MFRC522
    pinMode(RELAY, OUTPUT);
    lcd.init(); // LCD screen
    lcd.backlight();
    lcd.clear();
    lcd.setCursor(0,0);
```

```

    lcd.print("  Welcome  ");
    Serial.begin(9600);
    pinMode(analogInput, INPUT);
    pinMode(s, OUTPUT);
    pinMode(a, OUTPUT);
    pinMode(c, OUTPUT);
    pinMode(f, OUTPUT);
    digitalWrite(s, LOW);
    digitalWrite(a, HIGH);
    delay(500);
    digitalWrite(c, HIGH);
    delay(500);
    digitalWrite(f, HIGH);
    delay(500);
    digitalWrite(a, LOW);
    digitalWrite(c, LOW);
    digitalWrite(f, LOW);
    lcd.clear();

}

void loop()
{

    int value = analogRead(analogInput);
    float vin = value * ( 5.0 / 1023.00)*2;
    Serial.println("Input Voltage = ");
    Serial.println(vin);
    lcd.setCursor(0,0);
    lcd.print("Voltage = ");
    lcd.print(vin);

```

```

        lcd.clear();
    if(vin>6.50)
    {

        lcd.setCursor(0,1);
        lcd.print("Battery Full");
        digitalWrite(a,HIGH);

    }
    else
    {

        digitalWrite(a,LOW);

    }
    if(vin<=6.45 && vin>4.00)
    {
        lcd.setCursor(0,1);
        lcd.print("Please Charge");
        digitalWrite(c,HIGH);

    }
    else
    {
        digitalWrite(c,LOW);

    }
    if(vin<=4.00)
    {
        lcd.setCursor(0,1);
        lcd.print("Alert-Scan Card");
    }

```

```

    lcd.backlight();
    digitalWrite(RELAY, HIGH);
    lcd.print("    Access    ");
    lcd.setCursor(0, 1);
    lcd.print("    Denied    ");

}

delay(2000);

    lcd.clear();
    lcd.print("Voltage = ");
    lcd.print(vin);
    digitalWrite(RELAY, HIGH);
}
}

//Read new tag if available
boolean getID()
{
    // Getting ready for Reading PICCs
    if ( ! mfrc522.PICC_IsNewCardPresent()) { //If a new PICC placed to RFID reader continue
        return false;
    }
    if ( ! mfrc522.PICC_ReadCardSerial()) { //Since a PICC placed get Serial and continue
        return false;
    }
    tagID = "";
    for ( uint8_t i = 0; i < 4; i++) { // The MIFARE PICCs that we use have 4 byte UID
        //readCard[i] = mfrc522.uid.uidByte[i];

```

```

    digitalWrite(f,HIGH);
}

else {
    lcd.clear();
    digitalWrite(f,LOW);
}

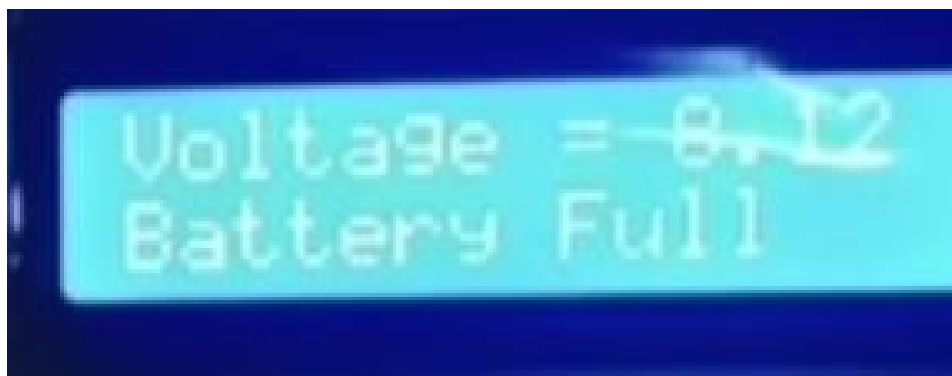
//Wait until new tag is available
while (getID())
{
    if (tagID == MasterTag)
    {
        lcd.print("    Access    ");
        lcd.setCursor(0, 1);
        lcd.print("    Granted!    ");
        digitalWrite(RELAY, LOW);
        lcd.clear();
        lcd.print(" Vehicle Battery ");
        lcd.setCursor(0, 1);
        lcd.print("    is Charging    ");
        delay(2000);
    }
    else
    {
        lcd.clear();
    }
}

```

5.4 FULLY CHARGED CONDITION



5.3 Fully Charged Condition



5.4 Display Output For Fully Charged Condition

We will receive an alarm if the battery starts to deplete, and indications will show whether the battery is full, medium, or low: green for a full battery, yellow for a medium battery, and red for a low battery. Here we have the result for full level of battery [Fig 5.3]. Battery is full so Fig[5.4] shows the display output is voltage range of the battery level with “Battery Full” and LED light indication is Green.

5.5 LOW LEVEL BATTERY INDICATION

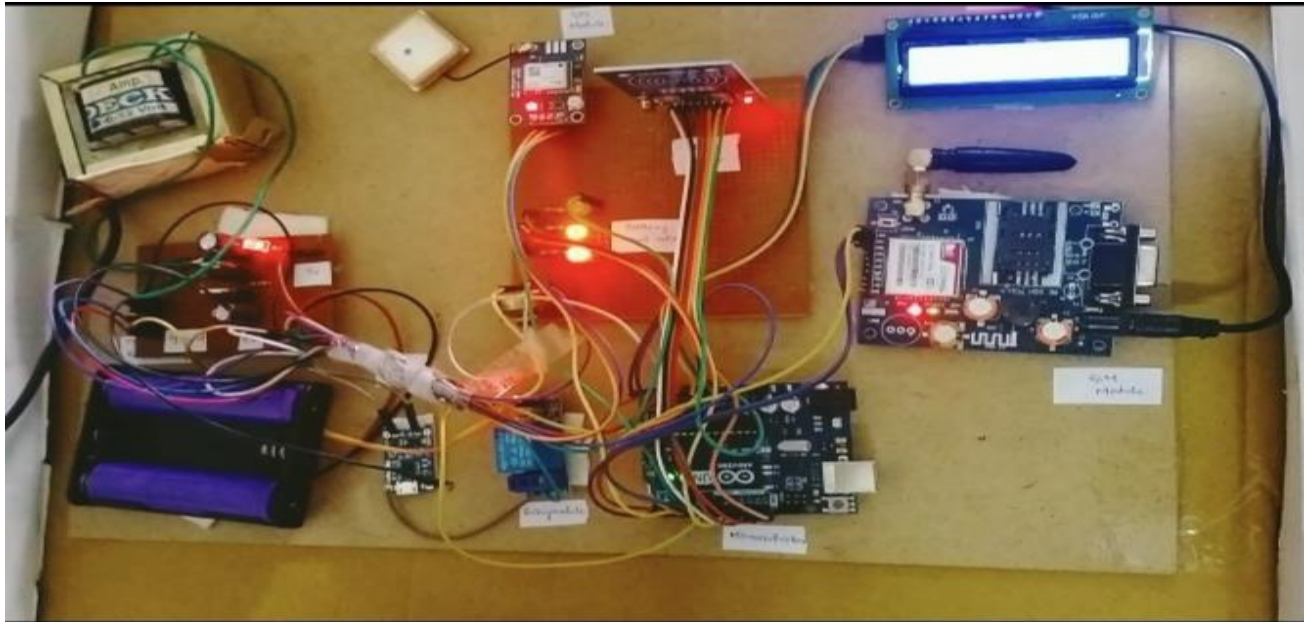


Fig 5.5 Low Level Battery Indication

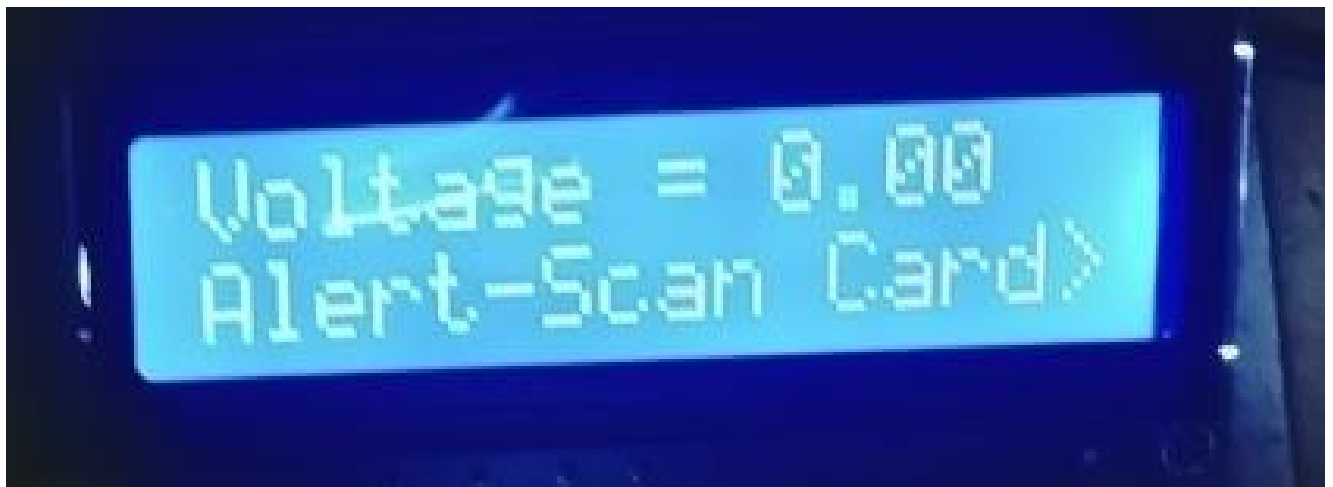


Fig 5.6. Display Output For Low Level Battery Indication

We will receive an alarm if the battery starts to deplete, and indications will show whether the battery is full, medium, or low: yellow for a full battery, green for a medium battery, and red for a low battery. Here we have the result for low level of battery[Fig

5.5]. Battery is low so Fig[5.6] shows the display output is voltage range below 5V of the battery level with “Battery Low” and LED light indication is Red.

5.6 RFID BASED EV CHARGE

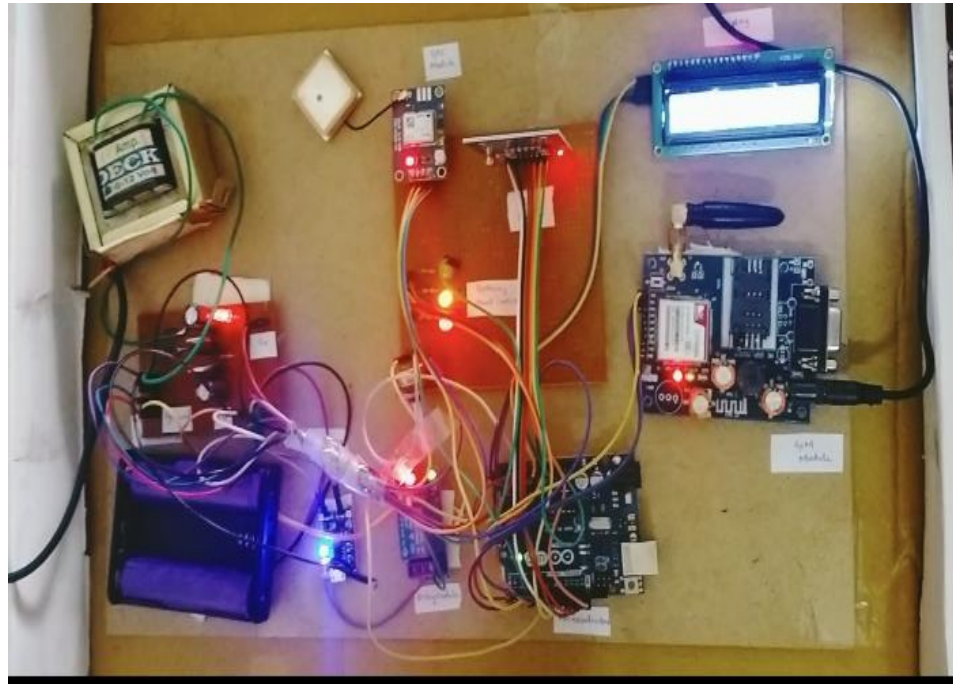


Fig 5.7 Activation of Access and Denial conditions

GPS can be used to locate the closest spot for a wireless EV charging station that uses an RFID reader. Fig 5.7 shows the connection of RFID based charging and tracking system of EV. The electric vehicle is charged using the inductive coupling concept. We connect an RFID reader to an Arduino, which serves as the input, in the transmitter. The Receiver coil voltage is uploaded to cloud server and can be viewed in think speak server. Same RFID tag should be read again to stop the charging. Fig 5.6 shows the display output while vehicle is charging. Fig 5.7 shows the result for denial after completion of the charging. RFID-based EV charging with monitoring and tracking system is a project that involves using Radio Frequency Identification (RFID) technology to enable EV drivers to access charging stations and also to monitor and track the usage of the charging stations. The system involves installing an RFID reader at the EV charging station which will read the information stored on the RFID tag of the EV driver. The RFID tag is a small device that contains information about the EV driver and the EV itself. When the EV driver brings their vehicle to the charging

station, they will swipe their RFID tag on the reader. The RFID reader will then read the information on the tag and allow the driver to access the charging station. The system also involves monitoring and tracking the usage of the charging station. The RFID reader will record the time, date, and duration of the charging session. This data can be used to generate reports on the usage of the charging station, including the number of EV drive.



Fig 5.8 Charging Condition

Fig 5.8 shows the display output while vehicle is charging. The RFID reader is the main hardware component that reads the information stored on the RFID tag of the EV driver. The reader is installed at the charging station and communicates with the RFID tag using radio waves. The RFID tags are small devices that contain information about the EV driver and the EV itself. The tags are attached to the EV and can be read by the RFID reader at the charging station. The EV charging station is the hardware component that provides the electrical power to charge the EV battery. The charging station is connected to the electrical grid and can provide either AC or DC power to the EV. The electricity meter is used to measure the amount of electrical energy consumed by the EV during the charging session. This information is used to calculate the cost of charging the EV. The communication module is used to transmit the data collected by the RFID reader and electricity meter to a central monitoring and tracking system.

The module can use various communication protocols such as Wi-Fi, Ethernet, or cellular networks.

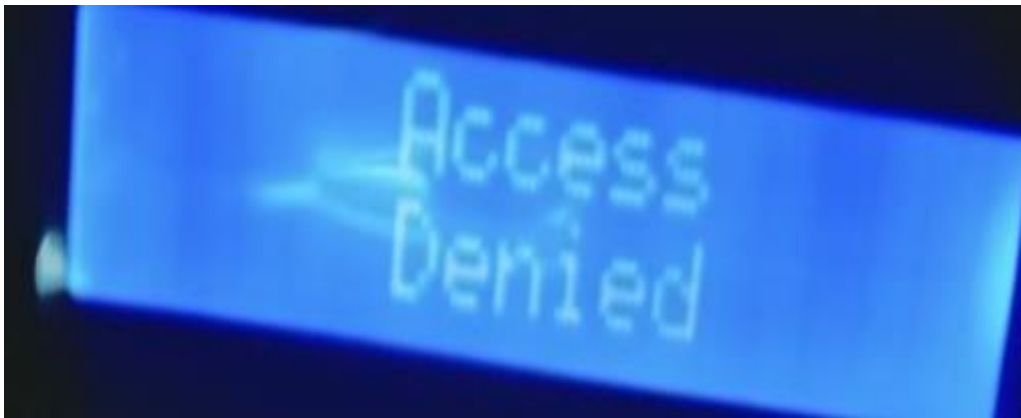


Fig 5.9 Denial condition

Fig 5.9 shows that the denial condition of charging after the completion. The monitoring and tracking system is the central hardware component that receives and stores the data collected by the RFID reader and electricity meter. The system can be accessed using a web-based interface and provides real-time monitoring and tracking of the charging station usage. The power supply provides the electrical power required to operate the RFID reader, communication module, and monitoring and tracking system. Electric Vehicle Supply Equipment (EVSE): The EVSE is responsible for providing electrical power to the EV during the charging session. The EVSE is connected to the power grid and provides power to the EV through the charging cable. The electricity meter is installed at the charging station to measure the amount of electrical energy consumed during the charging session. Central Monitoring and Tracking System,

The central monitoring and tracking system collects and stores data on the usage of the charging station. The system is connected to the RFID reader, the electricity meter, and the payment system. The system provides real-time monitoring and tracking of the charging sessions and alerts the charging station operator if there are any issues with the charging station. Payment System, the payment system is integrated with the central monitoring and tracking system and is responsible for processing payments for the charging sessions. The hardware components of the RFID-based EV charging with monitoring and tracking system work together to provide a seamless charging experience for EV drivers, while also providing valuable data on the usage of the charging station to charging station operators.

The RFID system ensures that only authorized users can access the charging station, while the EVSE and electricity meter measure the amount of electrical energy consumed during the charging session. The monitoring and tracking system collects data on the charging station usage and provides real-time monitoring and tracking of the charging sessions, while the payment system processes payments for the charging sessions. The RFID reader is the main hardware component that reads the information stored on the RFID tag of the EV driver. The reader is installed at the charging station and communicates with the RFID tag using radio waves. RFID Tags, The RFID tags are small devices that contain information about the EV driver and the EV itself. The tags are attached to the EV and can be read by the RFID reader at the charging station. EV Charging Station.

The EV charging station is the hardware component that provides the electrical power to charge the EV battery. The charging station is connected to the electrical grid and can provide either AC or DC power to the EV. Electricity Meter, the electricity meter is used to measure the amount of electrical energy consumed by the

EV during the charging session. This information is used to calculate the cost of charging the EV. Communication Module, the communication module is used to transmit the data collected by the RFID reader and electricity meter to a central monitoring and tracking system.

The module can use various communication protocols such as Wi-Fi, Ethernet, or cellular networks. Monitoring and Tracking System, the monitoring and tracking system is the central hardware component that receives and stores the data collected

by the RFID reader and electricity meter. The system can be accessed using a web-based interface and provides real-time monitoring and. Tracking of the charging station usage. Power Supply, the power supply provides the electrical power required

to operate the RFID reader, communication module, and monitoring and tracking system. In summary, the hardware components required for the RFID-based EV charging with monitoring and tracking system include an RFID reader, RFID tags, EV charging station, electricity meter, communication module, monitoring and tracking system, and power supply.

CHAPTER 6

CONCLUSION

6.1. SUMMARY

This study introduced a brand-new method of wireless charging that integrates a charging system with wireless communication technologies. Thanks to wireless communication technology, the system can operate like the ZigBee and communicate without a human being being involved. The electric car battery can be wirelessly charged through the employment of a transmitter coil and a receiver coil in dynamic wireless power transfer (SWPT). A single receiver coil is used to transmit electricity in this single transmission. We will receive an alarm if the battery starts to deplete, and indicators will show whether the battery is full, medium, or low by flashing green, yellow, or red, respectively. GPS can be used to locate the closest wireless EV charging station that uses an RFID reader to provide power. Inductive coupling is the charging method utilised for electric vehicles. We connect an RFID reader to an Arduino in the transmitter, which serves as the input. The Receiver coil voltage is sent to a cloud server and is accessible through the Think Speak server. To stop the charge, a second read of the same RFID tag is required.

6.2 FUTURE SCOPE

The project can be implemented with Internet of Things (IoT) in which information about battery management and the charging outlet locations can be saved. The payment system can be automatised using IoT by way of variety of payment methods such as prepaid cards, credit cards, and mobile wallets.

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