EV-EV MOBLITITY WIRELESS CHARGING FOR ELECTRIC VEHICLES WITH APPLICATION PORTAL

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***Abstract*-The project focuses on revolutionizing electric vehicle charging through innovative vehicle-to-vehicle wireless charging technology, facilitated by GPS technology. Users can seamlessly request charging assistance via a dedicated portal, triggering the precise tracking of their EV's current location. This location data is then transmitted to a service web portal, enabling the deployment of wireless charging services. Notably, the integration of wireless charging lanes distinguishes this project from traditional static charging methods. As users approach their designated charging location, the wireless charging process automatically activates, enhancing the driving range of electric vehicles and reducing their reliance on stationary charging infrastructure. This approach promises increased charging accessibility and convenience, ultimately advancing the adoption and viability of electric vehicles.**

Keywords — Wireless power transfer, Mobility charging, Hassle free, V2V Communication.

I. INTRODUCTION

The project at hand is centered around the groundbreaking concept of vehicle-to-vehicle (V2V) wireless charging facilitated by GPS technology, which allows electric vehicles (EVs) to charge dynamically while on the move. This innovative approach seeks to address the growing need for efficient and accessible charging solutions for the expanding EV market. The project envisions a user-friendly system that enables EV owners to request charging assistance through a dedicated application, with real-time location tracking ensuring precise service deployment. The integration of wireless charging lanes further distinguishes this proposal from conventional static charging methods, promising extended driving ranges, diminished battery reliance, and heightened charging accessibility for electric vehicles. In this comprehensive introduction, we will explore the wireless charging principle, the necessity for such a system, its advantages, and the key protocols involved. Wireless charging for electric vehicles operates on the principle of inductive power transfer. It relies on electromagnetic fields to transfer energy between two coils, one installed in the EV and the other embedded in the charging infrastructure on the road. This technology eliminates the need for physical connectors and cables, offering a more convenient and seamless charging experience for EV owners. The core components of wireless charging systems include:The transmitting coil is installed in the charging infrastructure, typically in the form of coils embedded in the road surface or charging lanes. When power is supplied to this coil, it generates an alternating magnetic field. The receiving coil is integrated into the electric vehicle. When the EV is positioned over the transmitting coil, the alternating magnetic field induces an electric current in the receiving coil, which is then converted into electrical energy to charge the vehicle's battery. To ensure efficient and safe wireless charging, control and communication systems are essential. These systems manage the power transfer process, monitor the charging progress, and facilitate communication between the EV and the charging infrastructure. This communication is critical for safety and efficiency, allowing for real-time adjustments to charging parameters and the exchange of important data. Wireless charging technology has been advancing rapidly, with different standards and power levels emerging to accommodate various vehicle types and charging needs. This technology forms the foundation of the proposed project's dynamic wireless charging system. The growing adoption of electric vehicles is a promising step toward reducing greenhouse gas emissions and achieving a more sustainable transportation sector. However, the widespread use of electric vehicles also presents challenges, most notably related to charging infrastructure. The necessity for a dynamic V2V wireless charging system is driven by several key factors:Traditional electric vehicle charging infrastructure, which relies heavily on static charging stations, has limitations. The availability of charging stations can be sparse in some areas, leading to range anxiety and inconvenience for EV owners. Furthermore, these stations often require specific connectors and adapters, creating compatibility issues. Range anxiety, the fear of running out of battery power before reaching a charging station, is a significant barrier to EV adoption. Dynamic wireless charging can help alleviate this anxiety by providing continuous and on-the-go charging, effectively extending the driving range of electric vehicles. One of the primary advantages of electric vehicles is their convenience. Dynamic wireless charging adds another layer of convenience by eliminating the need for manual charging, making it as effortless as refueling a conventional vehicle.

II. LITERATURE SURVEY

In thework by Shital R. Khutwad,Shruti Gaur, and colleagues ("International Conference on Signal Processing Communication Power and Embedded System (SCOPES), 2016), The paper overviews novel technique for wireless charging system of electric vehicle in which verifies the developed theory using battery charger application of electric vehicle. In electric vehicle charging of battery through charger and wire is inconvenient, hazardous and expensive. The existing gasoline and petrol engine technology vehicles are responsible for air, noise pollution as well as for greenhouse gases. The implemented wireless charging system of battery for Electric vehicle by inductive coupling method has been presented in this paper. The driving circuit is used between the transmitter coil & receiver coil where MOSFET is used for switching operation. The transmitter coil circuit is turn ON and OFF whenever the vehicle is present and absent respectively. The system achieves 67% efficiency level while providing safety, reliability, low maintenance and long product life.

Mohammad Abdullah Al Mamun,MohammadIstiak,Khandakar Abdulla Al Mamun,Sharifa Akter Rukaia, ("IEEE Region 10 Symposium (TENSYMP),"2020) ,Wireless power transfer (WPT) using magnetic resonance, the technology which could set human free from the annoying wires. At present different researches have been taken place and are going on to increase the efficiency of the wireless power transfer. Researcher are trying to increase the distance between the transmitter and the receiver with a greater transfer power efficiency. This project implemented WPT innovation to charge the battery of electric vehicle. In this investigation, the distance level between transmitter and receiver circuit has been optimized, and at the same time the different power level at different distances between transmitter and receiver examined. Henceforth, different conditions of current and voltage levels from input to output circuit for delivering power to the battery which is completely took place without using any wire between transmitter circuits of charging station to receiver circuit of the electric vehicle for finding its output efficiency. Finally, its costs and other factors have been discussed to implement this wireless technology among electric vehicles. Several output levels in accordance with its input levels during the charging time has been recorded this empirical findings helps to solve several problems appears in wired technology such as electric shocks, cost, hassles due to wire, charging procedure.

Pedro Lopes,Pedro Costa,Pinto(International Young Engineers Forum (YEF-ECE),2021), Wireless charging of Electric Vehicles (EV) is a trending research topic. In this paper, a wireless power transfer system (WPTS) is designed and a prototype is built to analyze the wireless charging process. A first analysis is made on the operating principles of wireless power transfer supported on the state of the art of currently used technologies. A Resonant Inductive Power Transfer (RIPT) charging system is selected as the best candidate for a prototype model based on physical and power demands. A controller for the RIPT is proposed along with the sizing of the power converter and compensation networks. Simulation results are obtained, and a prototype is built to scale. Experimental tests are carried out to validate the proposed topology and controller. The obtained waveforms are analyzed, and conclusions are drawn regarding the resonant inductive chargeru2019s overall performance.

Werachet Khan-ngern,HeinzZenkner Considering a future scenario in which a driverless Electric Vehicle (EV) needs an automatic charging system without human intervention. In this regard, there is a requirement for a fully automatable, fast, safe, cost-effective, and reliable charging infrastructure that provides a profitable business model and fast adoption in the electrified transportation systems. These qualities can be comprehended through wireless charging systems. Wireless Power Transfer (WPT) is a futuristic technology with the advantage of flexibility, convenience, safety, and the capability of becoming fully automated. In WPT methods resonant inductive wireless charging has to gain more attention compared to other wireless power transfer methods due to high efficiency and easy maintenance. This literature presents a review of the status of Resonant Inductive Wireless Power Transfer Charging technology also highlighting the present status and its future of the wireless EV market. First, the paper delivers a brief history throw lights on wireless charging methods, highlighting the pros and cons. Then, the paper aids a comparative review of different typeu2019s inductive pads, rails, and compensations technologies done so far. The static and dynamic charging techniques and their characteristics are also illustrated. The role and importance of power electronics and converter types used in various applications are discussed. The batteries and their management systems as well as various problems involved in WPT are also addressed. Different trades like cyber security economic effects, health and safety, foreign object detection, and the effect and impact on the distribution grid are explored. Prospects and challenges involved in wireless charging systems are also highlighting in this work. We believe that this work could help further the research and development of WPT systems.

CIRCUIT AND METHODOLOGY

The fig. 1 shows the block diagram of proposed system and fig.2 represents the proposed circuit diagram for simulation.

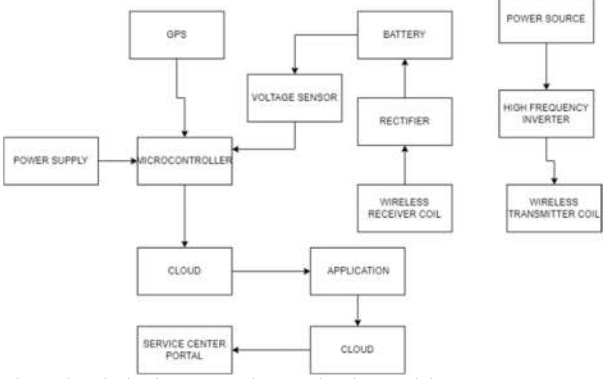


Fig.1. The Block Diagram For the EV Charging Module

The proposed wireless charging project aims to revolutionize electric vehicle (EV) charging by implementing a two-system approach: the power transfer system (transmitter) and the receiver system. The receiver system, integrated into the EV, consists of GPS technology, a receiver coil, a voltage sensor, and a Wi-Fi integrated controller. On the other hand, the transmitter system is housed within the service team's vehicle and comprises a high-frequency inverter, a transmitter coil, and a battery. This comprehensive methodology provides a detailed insight into the development, implementation, and operation of this innovative dynamic wireless charging system.

1.GPS Technology: The receiver system incorporates GPS technology to precisely determine the current location of the electric vehicle. This location data is critical for enabling dynamic wireless charging, as it ensures that the charging process is initiated when the EV reaches its designated charging location.

2.Receiver Coil: The receiver coil is an essential component of the system and is integrated into the electric vehicle. This coil is designed to receive the electromagnetic energy generated by the transmitter coil in the service team's vehicle(sender). The induced electric current in the receiver coil is then used to charge the electric vehicle's battery.

3. Voltage Sensor: A voltage sensor is employed to monitor the battery's state of charge and voltage level. This data is crucial for ensuring safe and efficient charging. When the voltage drops to a predetermined level, indicating a low voltage in battery, the system triggers the charging process.

4. Wi-Fi Integrated Controller: The Wi-Fi integrated controller serves as the central hub for managing the receiver system. It is responsible for communication with the service portal, which allows users to request charging assistance via a mobile web application. When a user initiates a charging request for the electric vehicle, the controller transmits the vehicle's current location and user details to the service portal.

5. Battery: The transmitter system in the service team's vehicle is equipped with a high-capacity battery. This battery stores the energy required for wireless charging. It serves as the energy source to power the transmitter coil and the high-frequency inverter.

6. High-Frequency Inverter: The high-frequency inverter plays a critical role in generating the alternating magnetic field required for wireless charging. It converts the stored energy from the battery into high-frequency alternating current (AC) to power the transmitter coil.

7. Transmitter Coil: The transmitter coil in the service team's vehicle is responsible for generating the electromagnetic field that will transfer energy to the receiver coil in the electric vehicle. It is strategically positioned within the vehicle to maximize the efficiency of power transfer.

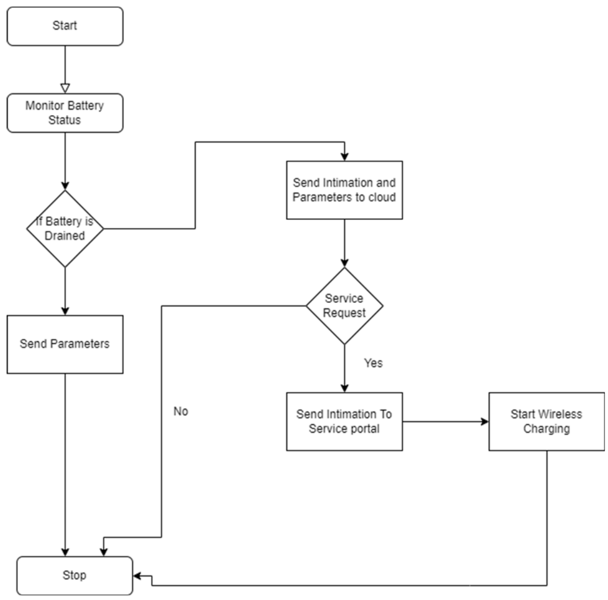


Fig.1.1 The flow chart for the EV Charging Module

The receiver system operates in tandem with the service portal and GPS technology to provide a seamless and convenient charging experience for electric vehicle owners. The step-by-step operation of the receiver system is as follows:
User Requests Charging is when an electric vehicle owner needs to charge their vehicle, they initiate a charging request using a dedicated mobile web application. This application is linked to the receiver system.Transmission of User Details is the mobile application sends the user's details, such as their identification and location, to the receiver system via the Wi-Fi integrated controller.Location Tracking of GPS technology integrated into the receiver system accurately tracks the electric vehicle's current location in real-time. This information is continuously updated and shared with the service portal.In low Battery Triggering,the receiver system monitors the vehicle's battery voltage. If the voltage drops to a predetermined low level, indicating the need for a recharge, the system prepares to receive power from the transmitter system.In service Portal Coordination,The receiver system communicates with the service portal, providing real-time updates on the vehicle's location and the user's request for charging assistance.In charging Initiation,the electric vehicle approaches its designated charging location, the system is programmed to recognize when it is within range of the transmitter system in the service team's vehicle. At this point, the charging process is initiated.After initiation the wireless Charging takes place in the transmitter coil in the service team's vehicle generates an alternating magnetic field, which induces an electric current in the receiver coil of the electric vehicle. This current is then converted into electrical energy to charge the vehicle's battery. Communication between the receiver and transmitter systems ensures safe and efficient power transfer.Charging Progress Monitoring Throughout the charging process, the receiver system continuously monitors the battery's voltage and state of charge. It also maintains communication with the service portal to provide updates on the charging status.Charging Completion takes place Once the vehicle's battery is adequately charged, the receiver system automatically halts the charging process. The system then communicates the completion status to the service portal.

The proposed dynamic wireless charging system, featuring both the receiver and transmitter systems, offers a promising solution to the challenges facing electric vehicle owners, such as limited charging infrastructure and range anxiety. By harnessing the power of inductive power transfer and advanced technologies like GPS, Wi-Fi, and high-frequency inverters, this system aims to make electric vehicle charging more accessible and convenient. It eliminates the need for static charging stations and offers extended driving ranges, reduced battery reliance, and increased charging accessibility. The receiver system, integrated into the electric vehicle, plays a pivotal role in user interaction and location tracking, while the transmitter system in the service team's vehicle is responsible for wireless power transfer. Their close collaboration ensures a seamless and efficient charging experience, making electric vehicles a more practical and sustainable choice for a wide range of users. As electric vehicles continue to gain traction, this dynamic wireless charging system has the potential to revolutionize the way we power our vehicles, contributing to a more sustainable and environmentally friendly transportation sector.

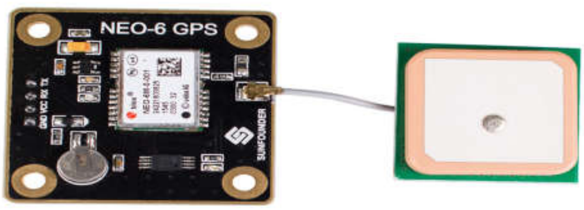
A. SYSTEM COMPONENTS

NODEMCU (ESP8266)

The Atmel AVR® core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in a single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The ATmega328/P provides the following features: 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), three flexible Timer/Counters with compare modes and PWM, 1 serial programmable USARTs , 1 byte-oriented 2-wire Serial Interface (I2C), a 6- channel 10- bit ADC (8 channels in TQFP and QFN/MLF packages) , a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and six software selectable power saving modes.

This allows very fast start-up combined with low power consumption. In Extended Standby mode, both the main oscillator and the asynchronous timer continue to run. Atmel offers the QTouch® library for embedding capacitive touch buttons, sliders and wheels functionality into AVR microcontrollers. The patented charge-transfer signal acquisition offers robust sensing and includes fully debounced reporting of touch keys and includes Adjacent Key Suppression® (AKS™) technology for unambiguous detection of key events. The easy-to-use Q Touch Suite toolchain allows you to explore, develop and debug your own touch applications. The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed In-System through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot program running on the AVR core.

NEO-6M GPS module



The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, you can monitor the status of the module. Thanks to the data backup battery, the module can save the data when the main power is shut down accidentally. Its 3mm mounting holes can ensure easy assembly on your aircraft, which thus can fly steadily at a fixed position, return to Home automatically, and automatic waypoint flying, etc.

Wireless Power Transfer Web Portal: Enhancing Convenience and Efficiency:
In the ever-evolving landscape of technology, the advent of wireless power transfer has heralded a new era of convenience and efficiency. At the forefront of this innovation stands a web portal designed to seamlessly connect users with charging stations, facilitating hassle-free charging experiences. Comprising two integral sides—the user portal and the charging station portal—this platform redefines the paradigm of power accessibility.

Features

1) A complete GPS module with an active antenna integrated, and a built-in EEPROM to save configuration parameter data.
2) Built-in 25 x 25 x 4mm ceramic active antenna provides strong satellite search capability.
3) Equipped with power and signal indicator lights and data backup battery.
4) Power supply: 3-5V; Default baud rate: 9600bps.
5) Interface: RS232 TTL

User Side Portal: Empowering Convenience

The user portal serves as the gateway for individuals seeking wireless charging solutions. Boasting a simple yet comprehensive interface, it offers two primary options: Request Charging and Cancel Request. This intuitive design empowers users with the autonomy to initiate and manage their charging sessions effortlessly.Moreover, the portal provides real-time insights into the State of Charge (SoC) of the battery—a crucial metric for informed decision-making. By furnishing users with up-to-date SoC values, the portal enables strategic planning of charging activities, optimizing resource utilization and enhancing user satisfaction.Furthermore, the integration of location access functionality augments the user experience manifold. Empowered by location-based services, the portal facilitates seamless coordination between users and charging stations, ensuring timely and efficient service delivery.

Charging Station Side Portal:

The charging station side portal serves as the nerve center of wireless power transfer operations. Featuring a suite of versatile options, including Approve Charging, Don't Approve Charging, Turn On Charging, Turn Off Charging, and Locate on Maps, this portal empowers charging stations with unprecedented control and flexibility.Upon receiving charging requests from users, charging stations can swiftly evaluate and respond through the intuitive approval system. This dynamic functionality not only expedites the service delivery process but also fosters a collaborative ecosystem conducive to user satisfaction and operational efficiency.The integration of GPS-based location tracking further enhances the capabilities of charging stations, facilitating real-time monitoring and coordination with users. Leveraging this feature, charging stations can precisely pinpoint user locations, streamline logistical operations, and optimize resource allocation—a testament to the platform's commitment to efficiency and innovation.
At its core, the wireless power transfer web portal epitomizes the convergence of technology and user-centric design. By seamlessly integrating user and charging station interfaces, the platform transcends conventional boundaries, fostering a symbiotic relationship characterized by convenience, efficiency, and unparalleled service quality.In today's dynamic landscape, where connectivity reigns supreme, the wireless power transfer web portal stands as a beacon of innovation—a testament to the transformative potential of technology in enhancing everyday experiences and shaping a brighter, more connected future.

III. SIMULATION RESULTS

Fig. 3.1, 3.2, 3.3 to shows the simulation output of the proposed system.

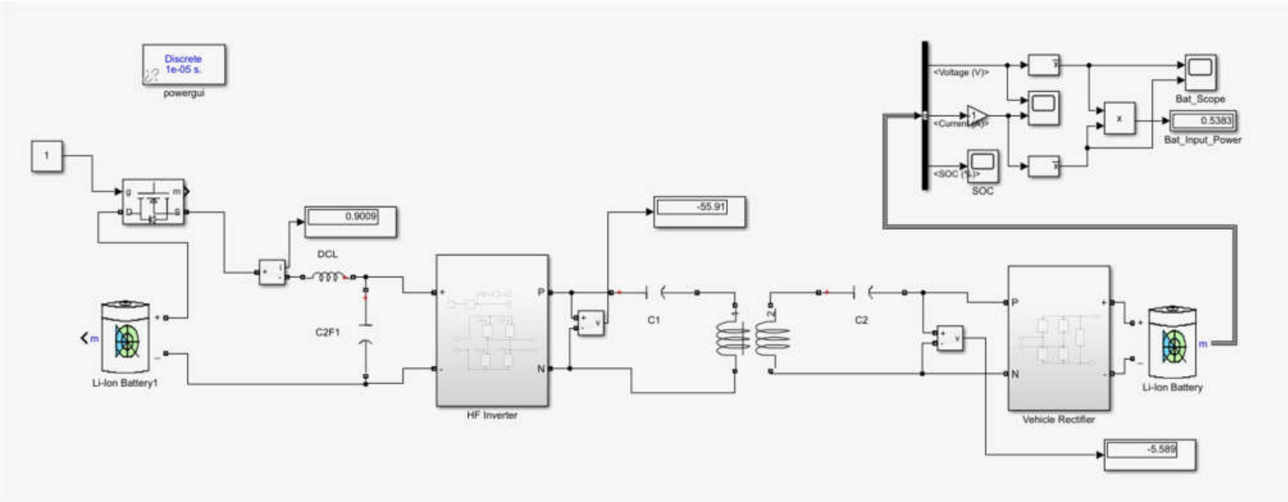


Fig 2- simulation of the proposed work

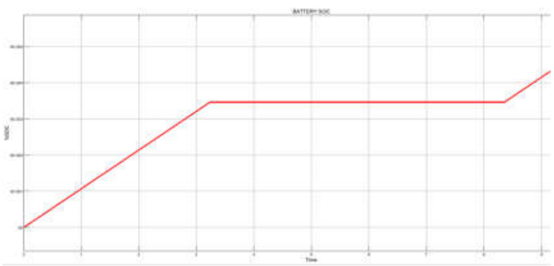


Fig.3.1-SOC of EV while charging

Fig.3.2- SOC of battery pack (A) is more than battery pack (B)

A State of Charge (SOC) graph in electric vehicle battery charging represents the battery's energy level over time during the charging process. It typically shows the percentage of the battery's capacity filled (SOC) against the charging duration.At the beginning of charging, you often see a steep increase in SOC as the battery rapidly absorbs a high current for fast charging. As the battery approaches a higher SOC, the charging rate may slow down to prevent overheating and ensure the battery's longevity.Towards the end, the SOC graph may show a tapering effect, where the charging rate decreases significantly as the battery gets closer to its full capacity. This is a common strategy to protect the battery and maintain its health. The SOC graph is crucial for optimizing charging strategies, ensuring efficient energy use, and extending the overall lifespan of the electric vehicle battery.

maximum point it can attain. Here SOC of (B) is having 79.88 precent, SOC of (A)

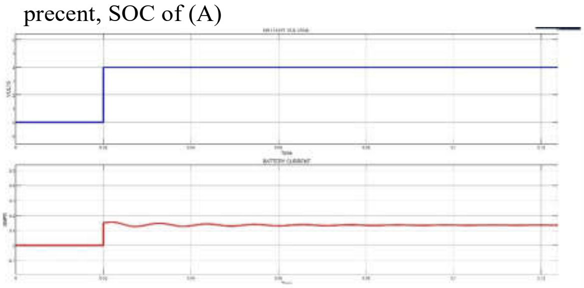


Fig.3.2- current and voltage of EV

A graph showing voltage over time typically illustrates how the voltage changes during the charging process.The simulation results of the voltage and current levels of the user vehicle battery according to the time and ratings of the battery in the voltage and time graph initially the voltage value is at zero and increases at the constant level once it reaches the particular value and it increases eventually. As an electric vehicle charges, the voltage usually starts at a lower level, gradually increases, and then stabilizes as the battery gets closer to being fully charged. This graph helps visualize the charging profile and can be crucial for monitoring the charging process efficiency and ensuring the battery's health.These characteristics are shown in the graphical representation in the figure.The charging current is crucial because it determines how quickly the battery of the electric vehicle can be charged. Higher currents generally result in faster charging times.Charging an electric vehicle involves supplying a certain amount of electrical energy to the battery. The time it takes to charge depends on the charging power (measured in kilowatts, kW) and the capacity of the vehicle's battery.The charging process involves higher current at the beginning (fast charging) and a gradual decrease as the battery approaches its capacity, extending the time required for a full charge.In the graphical representation there are similar levels are shown both in the voltage and current values of the users battery.

IV CONCLUSION AND FUTURE SCOPE

In conclusion, the proposed dynamic wireless charging system, featuring a receiver system integrated into electric vehicles and a transmitter system within service team vehicles, presents a forward-thinking solution to the challenges of limited charging infrastructure, range anxiety, and the need for more accessible electric vehicle charging. By leveraging the principles of inductive power transfer, along with advanced technologies such as GPS, Wi-Fi, and high-frequency inverters, this system aims to provide an innovative and convenient charging experience. It eliminates the dependence on static charging stations, offers extended driving ranges, reduces battery reliance, and enhances overall charging accessibility. The collaboration between these two systems ensures a seamless and efficient charging process, potentially revolutionizing the electric vehicle landscape and contributing to a more sustainable and eco-friendly transportation sector.

The future scope of the dynamic wireless charging system is exceedingly promising. As electric vehicle adoption continues to grow, the system's potential to eliminate range anxiety, reduce infrastructure costs, and promote sustainable charging practices becomes increasingly significant. Further research and development can lead to advancements in power transfer efficiency, standardized protocols, and the integration of dynamic wireless charging infrastructure into urban planning and transportation networks, ultimately accelerating the transition to cleaner and more convenient mobility solutions. Additionally, as the technology matures, the prospect of dynamic wireless charging becoming a mainstream feature in electric vehicles and public transportation holds great potential, offering a substantial step forward in sustainable and efficient transportation systems.

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