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Wi-Fi Enabled Wireless Charging System for Multiple EV's

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Abstract: *The increasing use of EV's requires efficient and convenient charging solutions. This paper presents a Wi-Fi enabled wireless charging system for multiple electric vehicles based on WPT technology. Power is transferred from a ground transmitting coil to a vehicle receiving coil without using physical cables. In this work, electrical power is transferred wirelessly through inductive coupling between a transmitting coil and a receiving coil. The system also integrates an IoT- based BMS using an Arduino Nano and a Wi-Fi module to continuously monitor battery voltage and temperature. The charging status and battery health data are transmitted to a mobile device for real-time monitoring. A safety feature is included in which an alarm is activated when the battery temperature exceeds, ensuring safe operation. The rapid growth of EV's has increased the need for efficient and convenient charging systems. To overcome these limitations, wireless charging technology has emerged as a promising solution for EV's charging.*

Keywords: Embedded System, Wireless Power Transfer (WPT), Internet of Things (IoT) based Battery Management System

I. INTRODUCTION

Wireless charging for electric vehicles (EVs) is an emerging technology attracting global research interest. It aims to enhance charging efficiency and increase the distance between transmitting and receiving coils. Currently, efficiency and range are major challenges, but advancements could make this method widely adopted. In this system, the receiving coil is placed beneath the vehicle chassis, and onboard converters generate required DC voltages based on battery ratings. The charger uses resonant inductive coupling, transferring energy wirelessly through magnetic fields tuned to the same frequency. An Arduino-based digital monitoring system measures and displays battery voltage and temperature on an LCD, with safety alerts triggered if overheating occurs. The ESP8266 module transmits real-time data to a smartphone, demonstrating 5–8 cm wireless power transfer for EV charging with IoT-based temperature protection for safer, efficient performance.

II. LITERATURE SURVEY

Wireless Charging and BMS for Optimizing Electric Vehicle Charging and Battery: Mohammed Irfan Ahamed M 2023 Dynamic wireless charging with wireless BMS is a promising technology for charging electric vehicles while on the road. This technology offers several advantages over traditional charging methods, such as reducing the need for frequent stops and allowing EVs to travel longer distances. The use of Bluetooth Low Energy wireless BMS enhances the efficiency and safety of the charging process by dynamically adjusting the charging power level based on the battery state of charge and charging requirements. The high-frequency inverter and active front-end rectifier used in the system improve the efficiency of the charging process. The simulation results demonstrate that the proposed system can achieve efficient and stable wireless charging of EVs and can provide a flexible and convenient charging experience for

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EV owners. This technology has the potential to revolutionize the way electric vehicles are charged and pave the way for a greener and more sustainable future.

III. WORKING METHODOLOGY

The working methodology of the Wi-Fi enabled wireless charging system for multiple electric vehicles is based on wireless power transfer using inductive coupling. In this system, electrical power from the supply is converted into high- frequency AC using an oscillator circuit and is fed to a transmitting coil placed beneath the ground at the parking area. When an electric vehicle is parked above this coil, a receiving coil mounted under the vehicle chassis captures the electromagnetic energy and converts it back into electrical power. The received AC power is rectified and filtered to obtain DC, which is then supplied to an on-board DC-DC boost converter to produce the required voltage levels for different EV batteries such as 12V, 24V, and 36V. An embedded system based on an Arduino Nano continuously monitors battery voltage and temperature using sensors. The charging status and battery parameters are displayed on an LCD and also transmitted to a mobile phone through a Wi-Fi module using IoT technology. Additionally, a safety mechanism is included where an alarm is activated if the battery temperature exceeds the threshold value of 45°C, ensuring safe and efficient wireless charging of multiple electric vehicles.

IV. SYSTEM ARCHITECTURE

The system architecture of the Wi-Fi enabled wireless charging system consists of two main sections: the wireless power transmission unit and the vehicle side receiving and monitoring unit. The transmitter section includes a power supply, oscillator circuit, and transmitting coil installed beneath the parking area. The AC mains supply is converted to DC using a step-down transformer and rectifier. This DC power is fed to a high-frequency oscillator circuit built using MOSFETs, which generates alternating current for the transmitting coil. The transmitting coil produces an electromagnetic field that transfers power wirelessly to the receiving coil placed beneath the vehicle chassis through inductive coupling.

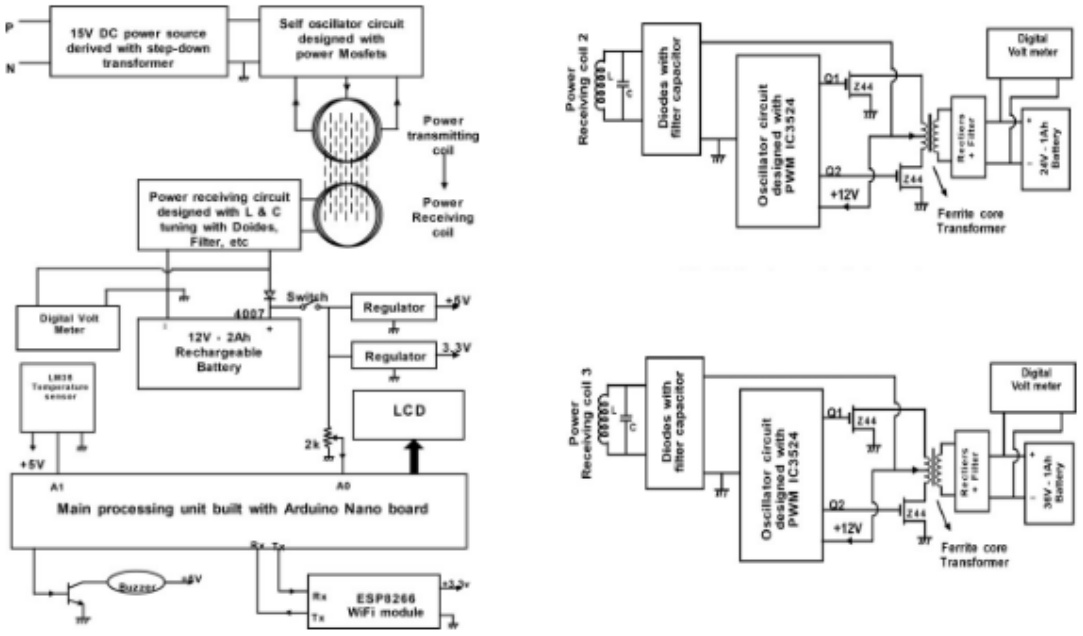

Fig. 01: Block Diagram of 12V, 24V, 36V battery EV's

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The receiving coil captures the transmitted electromagnetic energy and converts it into AC power. This AC signal is then rectified and filtered to obtain DC power. The obtained DC voltage is supplied to DC-DC boost converters that adjust the voltage according to the battery requirements of different EVs such as 12V, 24V, and 36V. The charging system is integrated with an embedded monitoring unit consisting of an Arduino Nano, temperature sensor, LCD display, and ESP8266 Wi-Fi module. The Arduino continuously monitors battery voltage and temperature, displays the data on the LCD, and sends the information to a mobile device through Wi-Fi using IoT technology. A safety mechanism activates a buzzer alarm if the battery temperature exceeds the threshold value, ensuring safe charging operation. This architecture enables efficient wireless charging of multiple electric vehicles with real-time monitoring and protection features.

V. RESULTS AND DISCUSSIONS

Electrical Outputs

Regulated DC charging voltages:

• 12V DC (low-voltage EV battery)
• 24V DC (medium-voltage EV battery)
• 36V DC (high-voltage EV battery)

Wireless Charging Output

• Contactless energy transfer
• No physical connectors or exposed terminals

Monitoring & Display Outputs

• Battery voltage displayed on digital voltmeter
• Battery temperature measured in real-time.

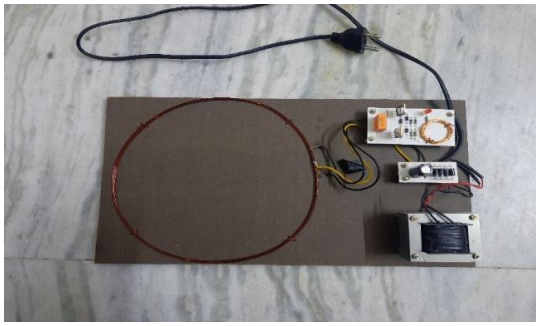

Fig. 02: Transmitting Coil generates 12kHz

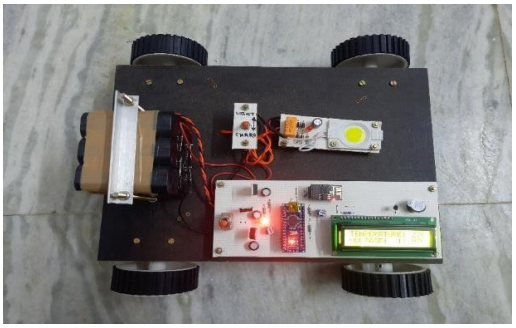

Fig. 03: 12V battery EV

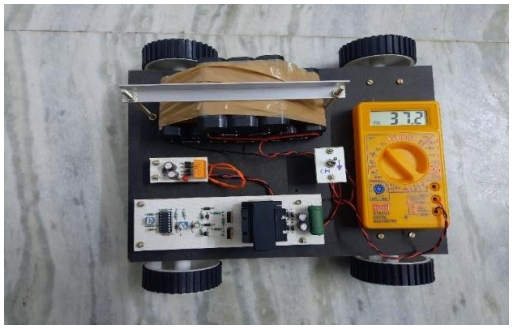

Fig. 04: 24V Battery EV

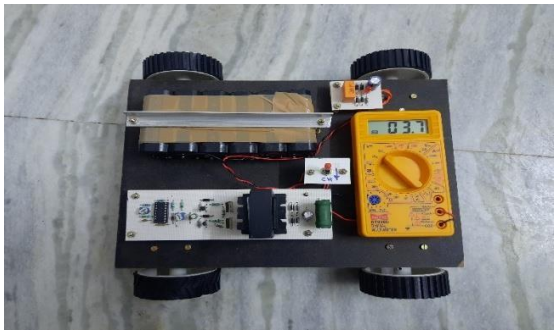

Fig. 05: 36V Battery EV

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Fig. 06: Charging status and battery health data

VI. CONCLUSION

The Wi-Fi based wireless charger for multiple EVs demonstrates an efficient method of charging electric vehicles without using physical cables. The system uses electromagnetic induction to transfer power wirelessly from a transmitting coil to receiving coils placed in vehicles. The received power is converted into DC and then boosted to the required voltage levels using isolated converters to charge different batteries such as 12V, 24V, and 36V.

The project also integrates Arduino Nano, temperature sensor, LCD display, buzzer, and ESP8266 Wi-Fi module to monitor battery voltage and temperature. If the battery temperature exceeds the safe limit, an alarm alerts the user, improving safety. In addition, the battery status can be transmitted to a mobile device through Wi-Fi for remote monitoring.

Overall, this system provides a simple, safe, and convenient wireless charging solution for multiple electric vehicles, reducing the need for different chargers and improving ease of use in parking or charging stations.

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