IOT Based Electric Vehicle Charging System

Dhanasekaran. A[1], Mahendr Kumar.N[2], Manigandan.T. R[3], Udayakumar.U[4]
Student, Department of Mechanical Engineering, Asian College of Engineering and Technology, Coimbatore - 641110

***Abstract*— This project focuses on the wireless control and monitoring of an electric vehicle (EV) using a NodeMCU microcontroller, integrating various sensors and modules for real-time data acquisition and surveillance. The system employs a voltage sensor to monitor battery levels, a temperature sensor to track heat variations, and a cooling fan for thermal management. An LCD display provides essential operational data, The vehicle's movement and functionality are wirelessly controlled, ensuring efficient automation and safety. This setup enhances EV performance, security, and remote accessibility, making it suitable for smart transportation applications.**

***Index Terms*— electric vehicle (EV), LCD display.**

I. PROBLEM STATEMENT

Electric vehicles (EVs) can be classified as either grid- connected or off-grid. Grid-connected EVs rely on an external source of electricity, while off-grid EVs are self- sufficient and generate their own power through various means, such as solar panels or onboard generators. Additionally, EV technology is constantly evolving, with advancements in battery technology and charging infrastructure paving the way for a more sustainable transportation future. EVs for the road, along with other new vehicles such as driverless, connected and shared vehicles, are creating a vision of the future called Connected, Autonomous, Shared and Electric (CASE) mobility. Electric cars first appeared in the 1800s, providing a level of comfort where electricity was one of the attractions of driving. age. The internal combustion engine has been the main way to power cars and trucks for over 100 years, but electricity is still available in other types of vehicles such as trains and cars. In the 21st century, electric vehicles have been revived due to technological advances, a focus on renewable energy and the impact on lowering transportation costs, climate change, air pollution and other environmental concerns. According to Project Drawdown, the electric car is listed as one of 100 modern solutions to mitigate climate change. In the late 2000s, governments including the US and EU first offered incentives to increase adoption, leading to auto industry growth in the 2010s. Increasing public interest and awareness, coupled with strong incentives such as those created in the eco-friendly recovery from the COVID-19 pandemic, is expected to fuel the growth of the EV market. [1] Lockdowns have reduced greenhouse gas emissions from petrol or diesel vehicles during the COVID-19 pandemic. In 2021, the International Energy Agency emphasized that governments should implement policies that support the use of heavy-duty electric vehicles to meet climate goals. Global EV sales are expected to grow from 2 percent in 2016 to 30 percent by 2030. There are more electric two- and three-wheeled vehicles than any other type of electric vehicle. Electric vehicles are partially electric or fully electric. The growth of electric vehicles can be attributed to their environmental friendliness and low cost. Electric cars are powered by an electric motor powered by a lithium-ion battery. These batteries are known for their stable power and long lasting performance compared to other battery types.

II. NEED OF THE PROJECT

The first thing about an EV is not leaving any carbon footprints. Unlike an internal combustion engine that burns fuel to power the vehicle, the electric vehicle uses a battery to power the electric motor to turn the wheel, and using electricity to move a car does not release any harmful gases from the exhaust. However, it indirectly contributes to environmental pollution as the electricity used to charge the batteries of an electric vehicle is produced from burning coal in a thermal power plant, which releases harmful gases and heat into the environment. Still, these are comparativelysignificantly less than that from an IC engine vehicle.

III. METHODOLOGY

3.1.1 EXISTING SYSTEM

Currently, we are facing issues related to lack of fuel, pollution, so we are moving towards the EV. Still, people are not ready to prefer EVs because of the consumption price and the need for charging stations. Due to concerns about difficulties in EV charging and the imbalance of the utilization rate, i.e., the price of charging facilities. So, by viewing these issues, we can provide intelligent charging availability.

- The efficient vehicle-to-fog communication protocol to address the shortcoming of existing CSMA/CA technique used in DSRC protocol.
- The research challenges based on existing technologies with their possible future impacts.
- The average packet drop rate in channel allocation technique is higher than our channel allocation technique when the number of EVs increases.

3.1.2 PROPOSED METHOD

The functioning concept of wireless charging involves the use of transmitter and receiver coils. The IR sensor has the ability to determine whether vehicles are entering or exiting the lane. Information about vehicles is transmitted to the Arduino controller by the IR sensor. The relay will be activated as soon as the vehicles enter the lane. The Arduino controller is responsible for transmitting vehicle information to the relay. The relay should be turned on only at that time. When the relay is turned on, the charging transmitter coil is activated. Electromagnetic flux will be produced and charging will begin when the receiver coils are activated. The vehicle's rechargeable battery is where the power will be stored. The information is transmitted to the LCD by the Arduino controller. On the LCD, the status of the vehicle, Temperature, current and voltage consumption are displayed. The Arduino controller is informed of the power consumption information of the vehicle, including voltage and current. All information sent to the Wi-Fi module is collected by the Arduino controller. An IoT server like iot app is used to monitor all information sent by the WiFi module. All information will be collected by the owner through an IoT server to monitor the remote location. This project aims to consume electricity to store the battery in a car via wireless charging. One of the latest trends in the world for commercial use is currently being implemented. 1. Designing the Transmitting Coil: The transmitting coil is designed to generate a magnetic field that can transfer power wirelessly to the receiving coil in the electric vehicle. The coil's shape, size, and number of turns are determined based on the power requirements of the electric vehicle.

2. Designing the Receiving Coil: The receiving coil is designed to receive the power wirelessly from the transmitting coil and convert it into usable electricity to charge the electric vehicle's battery.

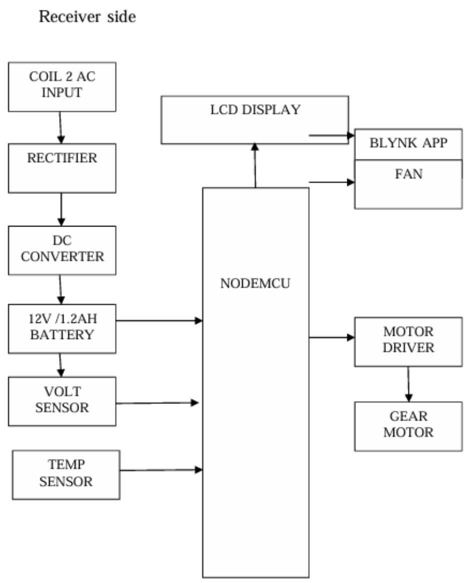
3. Power Electronics: The power electronics are used to control the power transfer between the transmitting and receiving coils. The power electronics must be able to monitor the power transfer and adjust it according to the charging needs of the electric vehicle.

4. Safety Features: The wireless charging system must incorporate safety features to ensure that the charging process is safe for the user and the environment. This includes features such as overvoltage protection, overcurrent protection, and temperature monitoring.

5. Implementation: Once the system is designed and tested, it can be implemented in charging stations and electric vehicles. The charging stations must be equipped with the transmitting coil, and the electric vehicles must be equipped with the receiving coil.

6. Testing: The wireless charging system must be thoroughly tested to ensure that it is reliable, efficient, and safe. The system's performance must be tested under various conditions, such as different power levels and distances between the transmitting and receiving coils. Any issues or errors that are found during testing must be addressed and resolved before the system can be deployed commercially.

3.1.3 BLOCK DIAGRAM



IV. SYSTEM MODELS HARDWARE REQUIREMENTS

- Node mcu
- Lcd display

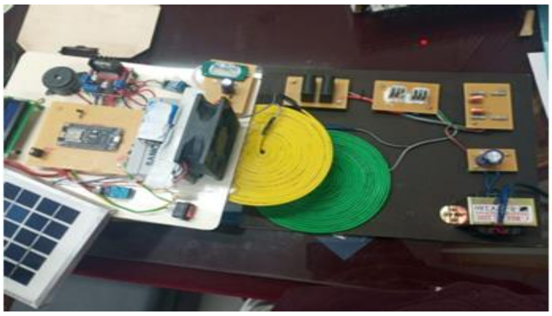
• 12v/1.3ah battery
• Wireless charger
• Volt sensor
• Temp sensor
• Fan
• Motor driver
• Motor

SOFTWARE REQUIREMENTS

- Arduino
- IDE Embedded
- C Proteus.

V. RESULTS & DISCUSSION

Electromagnetic induction is a mechanism that wireless charging stations utilise to transfer power from the charging station to a device without the usage of wires. When an electric current pass through a coil of wire within the charging station, an electromagnetic field is created. When an object with a suitable receiver coil is placed within an electromagnetic field, the energy is picked up by the coil and transformed back into electrical power to recharge the battery. Here, the proposed system provides a method for the ideal alignment for wireless charging an electric vehicle. A Wireless EV model with line follower functionality was prepared. The two coils, often known as the transmitting and receiving coils, are the primary coil and secondary coil. Under the road is the primary coil, and the underside of the car is the secondary coil. This variant uses infrared sensors to find the vehicle and then sends a signal to an Arduino uno. In this scenario, the Arduino acts as the brain and sends the command to the relay control to turn ON and OFF. The IR sensor sends a correction signal to the Arduino if the automobile deviates from the path's range. The relay is then instructed to switch off using Arduino. Relay turns on when a vehicle enters the range of an IR sensor, at which point the car is charged via electromagnetic induction. A possible method to improve the charging experience for EV owners combines the IR infrared obstacle avoidance sensor, LCD display, Arduino Nano, singlechannel relay, and PCBA coil transmitter module. The wireless transmission of electrical power from a transmitter coil to a receiver coil is made possible by a coil transmitter module, also referred to as a wireless power transmitter or wireless charging module. It functions according to the electromagnetic induction principle, where a shifting magnetic field causes an electric current to be induced in a nearby coil. A transmitter coil, a power management circuit, and a control circuit normally make up a coil transmitter module. When an alternating current (AC) is transmitted through the transmitter coil, it creates an alternating magnetic field. The power transfer medium is this magnetic field. While the control circuit oversees the module's general operation and safety features, the power management circuit makes sure that power conversion is efficient and controls the output voltage and current. The power generating stage and the power transfer stage are the two main phases that make up a coil transmitter module's operation. The transmitter coil, which creates an oscillating magnetic field, is coupled to an AC power supply during the power generating stage. The receiver coil, which is frequently built into a different device or module, is placed close to the transmitter coil during the power transfer stage. Through electromagnetic induction, the changing magnetic field causes the receiver coil to produce an alternating current. The device is then charged or its components are powered using this rectified current.



VI.CONCLUSION

In conclusion, the wireless EV control and monitoring system utilizing NodeMCU, LCD display, voltage and temperature sensors, a cooling fan, and enhances automation, safety, and efficiency in electric vehicles. The integration of real-time data monitoring and remote surveillance ensures better performance management and security. By enabling wireless control, the system reduces manual intervention and improves accessibility, making it a viable solution for smart transportation. Future improvements could include advanced AI-based monitoring and IoT integration for enhanced predictive maintenance and autonomous operation

6.1FUTURE SCOPE

The transfer power for 150 mm air gap is 3.74 kW and transfer efficiency are gained up to 92.4%. The charging time is around 1 hour and 39 minutes to fully charge its battery from 0 state for a 150mm air gap for an EV with 5.1 kW power may take. Wireless power transfer technology is a field that has a huge potential of becoming a mainstream technology in the future. The proposed wireless power transfer circuit can be used for EV charging applications. With the necessary research and development in this field, it is possible to create an electric bicycle from a conventional bicycle that is capable of charging wirelessly. In the future, the advanced circuit as used the coil design can be imported from the wireless power transfer circuit that is closer to the real world hardware. With adequate development and innovation in this field, it is certainly possible to create wireless power charging stations capable of charging electric bicycles and electric cars or any heavy EVs from the same power charging station, at a faster charging rate than currently available charging technique.

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