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WIRELESS CHARGING SYSTEM OF ELECTRIC VEHICLES ON ROAD

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ABSTRACT

A wireless charging system for electric vehicles (EVs) on road, powered by solar energy, offers a promising solution for sustainable and efficient EV charging infrastructure. This concept integrates solar panels, energy storage, and wireless power transfer (WPT) technology to provide on-the-go charging for EVs, reducing the need for frequent charging stops and extending driving range. Solar panels installed along or above the roadway generate renewable energy, which is stored and directed to inductive charging coils embedded in the road. As EVs pass over these coils, energy is wirelessly transferred to the receivers through electromagnetic induction, enabling continuous charging even while the vehicle is in motion. This system virtually eliminates charging time, allowing EVs to charge as they drive over the road and ensure safe operation. By utilizing solar energy, this wireless charging solution not only reduces the dependency on fossil fuels but also offers a scalable, eco-friendly alternative to traditional charging stations, paving the way for a sustainable future in electric transportation.

Index item-Arduino Uno, Tesla Coil, L298 Motor Driver, Bluetooth Module, DC Motor, LED, Battery.

INTRODUCTION

A wireless charging system for electric vehicles (EVs) on road, powered by solar energy, offers a promising solution for sustainable and efficient EV charging infrastructure. This concept integrates solar panels, energy storage, and wireless power transfer (WPT) technology to provide on-the-go charging for EVs, reducing the need for frequent charging stops and extending driving range. Solar panels installed along or above the roadway generate renewable energy, which is stored and directed to inductive charging coils embedded in the road. As EVs pass over these coils, energy is wirelessly transferred to the receivers through electromagnetic induction, enabling continuous charging even while the vehicle is in motion. This system virtually eliminates charging time, allowing EVs to charge as they drive over the road and ensure safe operation. By utilizing solar energy, this wireless charging solution not only reduces the dependency on fossil fuels but also offers a scalable, eco-friendly alternative to traditional charging stations, paving the way for a sustainable future in electric transportation.

Problem Statement

The adoption of electric vehicles (EVs) is hindered by challenges such as limited battery capacity, long charging times, and insufficient charging infrastructure, leading to range anxiety among drivers. While wireless charging systems embedded in roads offer a potential solution by allowing EVs to charge while in motion, their implementation faces significant challenges. These include achieving high energy transfer efficiency between the charging infrastructure and moving vehicles.

LITREATURE SURVEY

[1].Linlin Tan ,Wenxuan Zhao, Han Liu & Jiacheng Li "Design and Optimization of Ground-Side Power Transmitting Coil Parameters for EV Dynamic Wireless Charging System". IEEE access, Volume 8 pp. This paper proposes a method for selecting the length of the transmission coil in a long-track EV DWPT system that combines the vehicle speed limit and the energy loss of the power transmitting coil. This paper focuses on the maximum speed limit of the vehicle during dynamic wireless charging, which mainly affects the selection of the length of power transmitting coil and the determination of the lower limit of vehicle's charging power.

[2]. Naoui Mohamed Flah Aymen, Turki E. A. Alharbi, Claude Ziad El-Bayeh, Sbita Lassaad, Sherif S. M. Ghoneim, Ursula Eicker "A Comprehensive Analysis of Wireless Charging Systems for Electric Vehicles". IEEE access, Volume 10 pp. This paper summarizes different wireless charging system topologies that can be used for EV applications. Also, it presents different coil shapes, mathematical models, different architectures, and topologies of the WPT for both dynamic (EV is moving) and static (EV is parked) modes. In addition, this paper shows all the essential parameters and variables that help in building a solid mathematical model for the wireless charging system.

[3].Claudio Scarpelli, Massimo Ceraolo, Emanuele Crisostomi, Valerio Apicella & Giulia Pellegrini "Charging Electric Vehicles on Highways: Challenges and Opportunities". IEEE access, Volume 12 pp. 55816-55818 (2024). This paper proposes a method considering motorway, having a uniform distribution of charging stations, the largest queues are generated just around two urban areas. Therefore, future empowerment of the charging station capability should address these areas, rather than keep following a uniform approach.

WORKING METHODOLOGY BLOCK AIGRAM

Methodology refers to the systematic, The principle of wireless charging for electric vehicles (EVs) on the road is electromagnetic induction, which involves the transfer of energy between two coils that are tuned to resonate at the same frequency Here the concept of inductive charging is also involved which means charging an uncharged body by bringing close to charged body but not in contact with it. Electric vehicles are eco-friendly, battery-powered alternatives to traditional gasoline cars, offering lower emissions and reduced dependance on fossil fuels. A transmitter coil are is a device that sends signals, such as radio waves or data, from one place to another, enabling wireless communication. Arduino Uno is a popular microcontroller board used for building electronic projects, featuring easy programming and versatile hardware for prototyping. Power transmitting circuit are transfers electrical energy wirelessly or through wired connections to power a device or system remotely.

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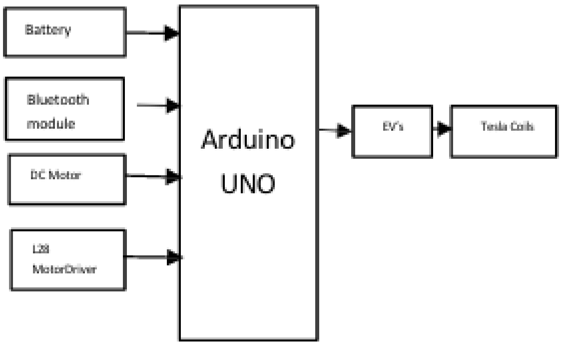

Fig 1 Block Diagram

HARDWARE DETAILS

2.1 Arduino UNO

The Arduino Uno (Fig 2.1) is a highly popular microcontroller board built around the ATmega328P microcontroller, known for its versatility and ease of use. It operates at a voltage of 5V, making it compatible with a wide range of sensors and modules. In board features 14 digital input/output pins, six of which can be used as PWM outputs, allowing for fine control of devices like motors and LEDs. Additionally, it includes six analog input pins for reading sensor data. The Arduino Uno offersa straightforward programming interface via the Arduino IDE, which supports a vast library of prewritten code for various applications. It has 6 analog input pins, labeled A0 to A5, which can read signals from analog sensors. The board also includes a power supply section with pins for 5V, 3.3V, ground (GND), and VIN. The power pins enable the board to be powered either through a USB connection or an external power source. There are also pins for SPI communication (10, 11, 12, 13), I2C communication (A4, A5 for SDA and SCL), and UART serial communication (pins 0 and 1 for RX and TX). Furthermore, the Arduino Uno has a reset pin for restarting the program.

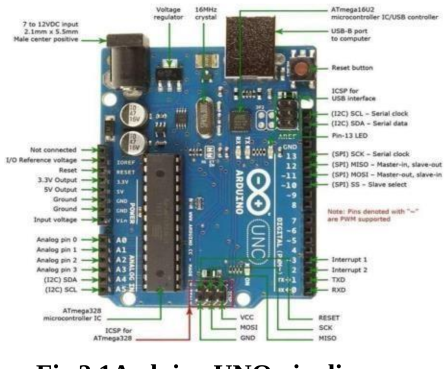

Fig 2.1Arduino UNO pin diagram

2.2 L298 Motor Driver

The Fig 2.2 shows that L298 Motor Driver is an integrated circuit used for controlling the direction and speed of DC and stepper motors. It features a dual H-bridge configuration, allowing independent control of two motors with an operating voltage range of 5V. A current capacity of up to 2A per channel.

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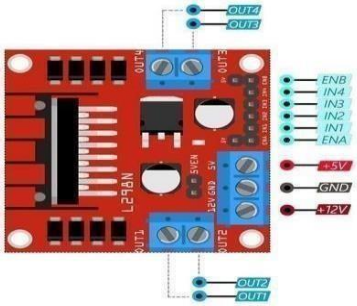

Fig 2.2 L298 Motor Driver

2.3 DC Motor

The DC motor converts direct current (DC) electrical energy into mechanical energy, widely used for its simplicity and precise control. Fig 2.3 consists of a stator, which provides a constant magnetic field, and a rotor (armature) that rotates within this field. The interaction between the magnetic field and the current in the rotor generates torque, causing rotation. Speed and direction can be controlled by varying the input voltage or current. This makes DC motors ideal for applications in robotics, vehicles, and industrial machinery.

Fig 2.3 DC Motor

2.4 Bluetooth Module

The HC-05 is a widely used Bluetooth module (Fig 2.4) designed for seamless wireless serial communication, commonly utilized in various electronics projects. It is operating on Bluetooth V2.0+EDR (Enhanced Data Rate) with a modulation capacity of 3Mbps and a frequency of 2.4GHz, it ensures efficient data transmission. The module supports both Master and Slave modes, providing flexibility in its applications.

Fig 2.4HC-05 (Bluetooth Module)

2.5 Tesla Coil

Tesla coils (Fig 2.5) have influenced the development of wireless power transfer technology, which can be applied in EV charging. The resonant inductive coupling, energy is transferred between coils resonating at the same frequency. This principle is employed in wireless EV charging systems, where a primary coil in the charging station generates a magnetic field that induces a current in a secondary coil located in the vehicle. The primary coil, or charging pad, is installed on the ground or embedded in the floor, and generates a high-frequency alternating magnetic field.

Fig 2.5 Tesla Coil

2.6Battery (9V)

Battery (Fig 2.6) is a compact and versatile power source commonly used in various electronic devices, such as smoke detectors, remote controls, and portable electronics. It typically consists of six 1.5-volt cells connected in series to provide a total voltage of 9 volts.The 9-volt design features a rectangular shape with a pair of snap connectors on top for secure and easy connection. Known for its reliable performance, the 9-volt battery is ideal for low to moderate power applications, making it a popular choice for both household and industrial purposes.

Fig 2.6 Battery (9V)

HARDWARE RESULT

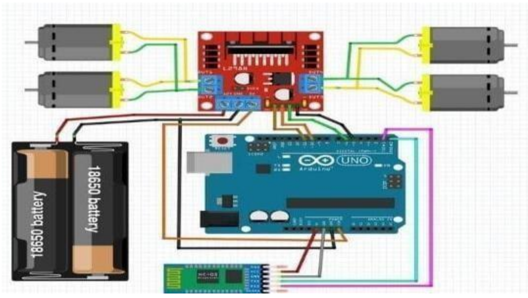

Fig3: Hardware Implementation

The results of implementing a wireless charging system for electric vehicles on roads demonstrate significant potential in enabling dynamic and efficient charging. Testing typically reveals that energy transfer efficiency depends on factors such as coil alignment, air gap distance, and vehicle speed. When alignment is optimal, the system achieves high power transfer efficiency, ensuring sufficient charging even during motion. Minor misalignments or increased air gaps can lead to power losses, highlighting the need for precise coil positioning and improved resonant coupling techniques. Discussions emphasize the importance of advanced control systems to optimize power transfer and mitigate losses. Additionally, while the concept proves feasible, challenges such as infrastructure costs, material durability, and electromagnetic interference must be addressed. Overall, the wireless charging system offers a promising solution for improving EV convenience and reducing range anxiety, paving the way for `smarter and more sustainable transportation networks.

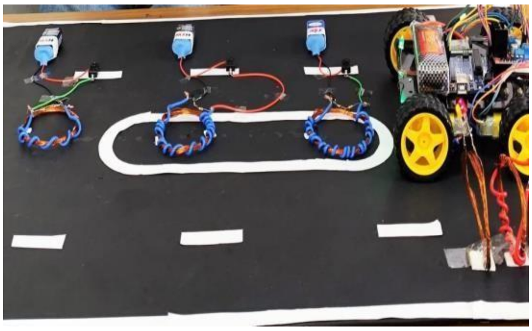

Fig4: Wireless Charging System

CONCLUSION

Wireless charging systems for electric vehicles (EVs) using Arduino have the potential to be a major improvement in the EV charging industry. They can make charging more convenient, efficient, and sustainable. However, there are still challenges to address, such as cost, energy loss, and safety. Wireless charging can eliminate the need for cables and connectors, which can improve safety and reduce the risk of electrical hazards. It can also be integrated with renewable energy sources. The implementation of a wireless charging system for electric vehicles on roads represents a transformative advancement in sustainable transportation. This technology eliminates the need for manual charging, enabling dynamic charging while vehicles are in motion . By integrating primary coils into road infrastructure and secondary coils into vehicles, efficient power transfer through inductive or resonant coupling can be achieved. Although challenges such as high infrastructure costs, efficiency losses, and alignment issues remain, ongoing research and technological innovations are making this system increasingly feasible. Ultimately, wireless charging systems have the potential to revolutionize EV adoption, reduce dependence on fossil fuels, and pave the way for smarter, cleaner, and more efficient mobility solutions.

REFERENCES

[1]. Linlin Tan ,Wenxuan Zhao, Han Liu & Jiacheng Li "Design and Optimization of Ground-Side Power Transmitting Coil Parameters for EV Dynamic Wireless Charging System". IEEE access, Volume 8 pp. 74596-74597 (2020).

[2]. Naoui Mohamed Flah Aymen, Turki E. A. Alharbi, Claude Ziad El-Bayeh, Sbita Lassaad, Sherif S. M. Ghoneim, Ursula Eicker "A Comprehensive Analysis of Wireless Charging Systems for Electric Vehicles". IEEE access, Volume 10 pp. 43867-43868 (2022).

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