



Enhanced Mobility: Dynamic Wireless Charging for Electric Vehicles with Lane Detection Technology

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Abstract-On-Road Wireless EV Charging System, a pioneering solution designed to revolutionize electric vehicle (EV) charging infrastructure. This innovative system enables wireless charging for EVs on the move, offering unparalleled convenience and sustainability. A proposal for a wireless charging technique for electric vehicles that eliminates the need for physical cables, together with a lane detection system. This can assist get around EV range restrictions and offer smooth charging experience. A car can be charged using inductive contactless technology without the driver ever needing to get out of the vehicle. In order to do this, the charging coils must build with the necessary safety precautions and implanted in the lane or in the road surface. The Arduino Uno will receive all the data from the system and it will use that information to send a signal to the DC motor driver based on the conditions. The motor driver then rotates the car model's wheels by controlling each one in accordance with the signal it receives. This research will identify any lane indication lanes on the thoroughfares. After receiving input from the sensors, a microprocessor monitors and controls the vehicle to keep it from leaving its lane.

Keywords: lane detection, induction coil, arduino Uno, DC motor

I. INTRODUCTION:

Our world is one of rapid technological development. Every day, new technologies are developed to improve our quality of life. In spite of all of this, we still charge our common electronic devices using the traditional wire approach. When many electric vehicles are being charged at once, the traditional wiring system gets messy. Additionally, it hogs a lot of the charging port's electric outlets. One may ask a question at this moment. What if there was a single piece of equipment that could charge all of these electric cars at once without making a mess? We thought about it and came up with a concept. Inductive coupling, an easy-to-use and efficient method of wireless power transfer, provides an answer to this issue.

The most common mode of transportation worldwide is the road. The requirement for gasoline and diesel has grown along with the car's dramatic growth in usage. Electric vehicles (EVs) are growing in popularity lately since they utilize fewer fossil fuels and emit fewer environmental gases. The only issue with electric vehicles nowadays is the technology used for power storage, which has a power energy density, a short lifespan, and a high cost. Therefore, our proposal offers a revolutionary way to wirelessly charge an electric car utilizing the inductive power transfer principle and a transmitting and receiving coil, all while reducing the size of the battery, increasing convenience, and doing away with the need for a connection. Both the dynamic wireless power transmission (DWPT) and static wireless power transmission (SWPT) methods can be used to charge an electric car. The project's fundamental image, shown in fig.2.1 below,

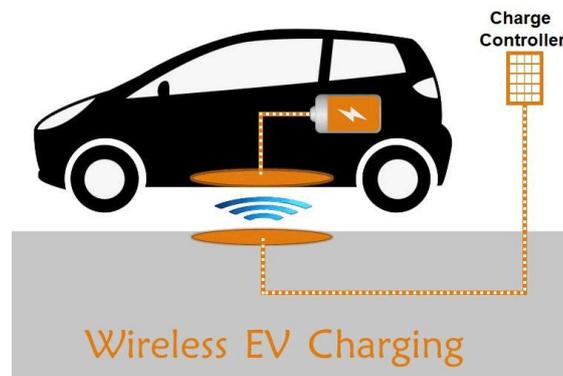


Fig.2.1

The development of driverless automobiles has attracted a lot of interest from the academic and business communities. These vehicles can navigate and function in complex areas with little assistance from humans because they are outfitted with an array of sensors and sophisticated control systems. The capacity of autonomous cars to precisely follow predetermined routes, like lanes on roadways, is one of its most important features since it guarantees efficient and safe travel. In this work, we use well known open-source electronics platform Arduino in conjunction with Infrared (IR) sensors to construct a lane following automobile. One of the main goals of this research is to develop and put into practice a lane following system that is affordable, accessible, and appropriate for small-scale and educational applications.

II. METHODOLOGY

2.1 Wireless Power Transmission:

The efficient way transfer of electric power over an environment or a vacuum without the use of cable or any other material is known as wireless power transmission, or WPT. Applications where electricity distribution is required instantaneously or continuously but conventional lines are prohibitively expensive, inconvenient, dangerous, undesired, or impractical can employ this. Resonant induction can be used for mid-range power transmission. With the use of WPT technology, power can now be sent to areas that would not otherwise be feasible. Using inductive coupling to charge an electric vehicle's battery may be the next big thing.

2.2 Resonant Inductive Power Transfer:

Power can be transferred via the inductive coil in the IPT method. When the receiver coil is centred above the transmitter coil in the static approach, it is the most efficient process for WPT. However, in the case of dynamic charging, the transmitter coil's magnetic flux can hardly be collected by the moving reception coil. In order to resonate the transmitter and reception coils, a capacitor is needed on both the transmitter side and the receiving side, where it is referred to as a compensation network. We refer to this technique as the RIPT approach. The most effective technology for short-range wireless power transfer is the RIPT method.

Coils of various forms are employed in WPT systems. Because it lacks sharp edges, the circular coil is the most efficient shape for high-frequency wireless transfers. Thus there is very little eddy current. Better performance in the WPT system is caused by the large magnetic field generated by the coil. The suggested receiving coil and transmitter coil are displayed in Fig.3.2.1.

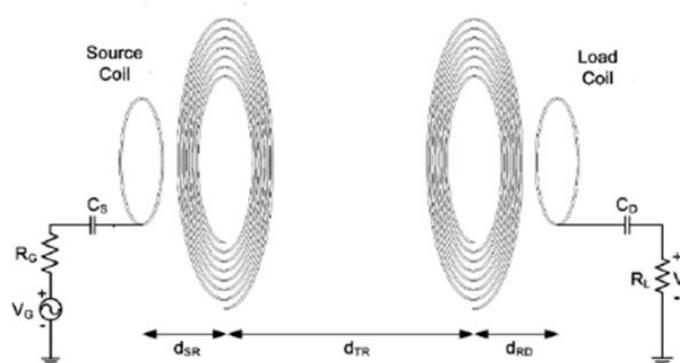


Fig.2.2.1

2.3 DESIGN AND IMPLEMENTATION

The timer circuit's output is fed into an inverter circuit to invert the oscillating signal, which is referred to as signal 2 instead of signal 1 for an oscillating signal that is not inverted. The MOSFET driver IC receives this original and inverted oscillating signal, which it uses to create high and low pluses that open the MOSFET terminal's gate. As a driver circuit, this forms. The LC circuit

received the alternating current from this driving circuit. The magnetic field is created by the current flowing through the capacitor and inductor. The primary circuit block diagram is shown in the Fig.3.3.1.

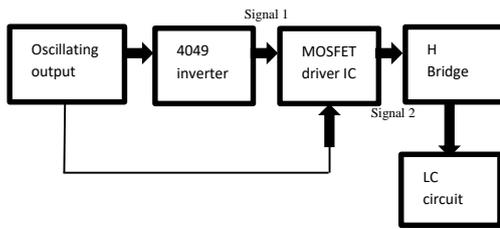


Fig.2.3.1

The magnetic field surrounding the coil is produced by the energy that enters the coil from the primary side. The high-frequency output being used will result in a very powerful magnetic flux production. Current will be induced in the parallel-connected inductor and capacitor when the flux from the primary coil links with the secondary coil or receiver coil. Alternating current (A.C) is applied to the bridge rectifier circuit by use of a voltage generator across the linear circuit. This circuit creates a smooth DC signal by converting the alternating current to direct current and connecting the capacitor to the output. The voltage is limited by the voltage regulator to shield the load from harm.

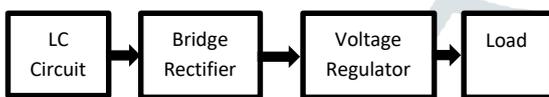


Fig.2.3.2

The secondary circuit block is seen in fig.3.3.2 above. The amount of power the car receives from the coils and the percentage of the battery that is charging may be obtained by connecting an LCD display module to an Arduino Uno

For the lane following technique put together the required hardware, which consists of an Arduino Uno board, DC motors, an L298N motor driver, two IR sensors, and a chassis. A well-known open-source microcontroller board built on the ATmega328P is the Arduino Uno. One of the most popular Arduino boards, it's a wonderful starting place for people who are new to programming and electronics. This is a thorough overview of the Arduino Uno that covers its functions, applications, and the reasons behind its enduring appeal among makers, educators, and hobbyists.

To control the motors, wire the L298N motor driver and connect the IR sensors to the Arduino Uno. Place the sensors with their ground on the robot chassis' front.

Attach the infrared sensors to the Arduino Uno's corresponding digital pins. Connect the motor terminals of the L298N motor driver to it, and then power it with a suitable battery (such as a LiPo). Analyse the IR sensors' analog signals to determine the vehicle's location within the lane. Use an algorithm for control to modify the direction of the vehicle in response to data from the IR sensor so that it stays in the allotted lanes.

III. RESULT

Efficiency of Charging: By comparing the quantity of energy communicated to the energy received and held by the vehicle's battery system, the efficiency of the wireless charging system was determined. After conducting several testing, the charging efficiency was determined to be 83% on average, with a 3% standard deviation. Because of the vehicle's dynamic alignment and fluctuating speed during charging sessions, this efficiency is somewhat lower than that of stationary wireless charging systems.

Display on LCD: Here, we've implemented an LCD display to show both the voltage passed from the transmitting coil to the receiving coil along with the percentage of the battery that is charged. Because of the induction coil mechanism, the coil that gets the signal receives roughly 18 volts from the signal it transmits but the transmitter's sending coil receives 24 volts.

Lane Follow: Here, we've implemented an LCD display to show both the voltage passed from the transmitting coil to the receiving coil along with the percentage of the battery that is charged.

IV. FUTURE RECOMMENDATION

Improving the efficiency of wireless charging systems engages despite significant advancements in wireless charging technology, there is still potential for further efficiency gains. Enhancements can be achieved by using various materials, optimizing the circuitry, or improving coil design.

Expanding the charging system for business applications engages the prototype you are constructing is really the start. You might need to scale up the system to handle more vehicles charging at the same time or cover greater distances before this technology is practicable for broad usage. To guarantee efficiency and safety, further engineering and testing will probably be needed.

While using copper coils for wireless charging of electric automobiles is a promising method, it still requires an external power source. It could be feasible to power the charging system in the future by integrating solar panels or other renewable energy sources into the road.

Integrating with autonomous vehicle technology: As this technology develops, it could be able to incorporate wireless charging right into the cars. This might make charging even more easily for EV owners by doing away with the requirement for external charging stations or coils along the route.

Enhancing the user interface: Although the LCD display you want to use is a fine place to start, there could be ways to make it more user-friendly for EV drivers. You could create a smartphone app, for instance, that lets drivers check their battery life and charge history. This may also make it easier for drivers to locate wireless charging facilities on their journey.

V. CONCLUSION

With the use of inductive wireless power transfer technology, electricity may be transferred between two coils a secondary coil located in the electric vehicle and a primary coil buried in the road that are spaced apart by a tiny air gap. EVs are able to charge while driving thanks to this method.

We have studied and spoken about using wireless power transfer to charge electric automobiles. Because it is more environmentally friendly and user-friendly than traditional cable charging solutions, wireless charging is seen to be preferable. Moreover, it does away with the necessity for wires and mechanical connectors, saving you from the difficulties and risks that come with them. It is simple to calculate the load power and the amount of time needed for an EV battery to fully charge. Thus, a model is created to observe how power is transferred at various speeds and, ultimately, to determine how far an EV can go while using this amount of electricity. However, the EV's speed also affects how well the reception pad can absorb electricity from the transmitter pad. To send more power to the receiving end, shielding materials like as aluminium plates and ferrite planner can be utilized. This study may be expanded for further research in this area and aids in understanding the wireless charging of EVs in the track for high resonant frequency using RIPT.

The use of infrared sensors for lane following improves the system's usability and security by guaranteeing that the electric vehicle stays correctly aligned within its assigned lane. This feature reduces the possibility of mishaps or veering off course in addition to facilitating smooth navigation.

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