



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 4, April 2023

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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# Smart Wireless Transmission System for Autonomous Electric Vehicle Charging

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**ABSTRACT:** This paper presents a method for charging electric vehicles (EVs) via wireless power transfer (WPT) and solar charging. With the proposed technique, the wireless charging system can itself determine the most efficient power transfer coil in the EV position based on the proximity sensors activated by its wheels. To ensure optimal charging, we proceeded to measure the transfer efficiency of each transfer coil to determine the most efficient one for its use. This device not only improves charging performance, but also minimizes energy losses by autonomously activating only the coils with the highest transfer efficiency. The results displayed in the device detect the coil, what maximum transmission efficiency is used without actual power transmission and compare the measured efficiency. This project also shows that with the proposed charger setup, the position of the receiver coil can be detected almost instantly and charged while moving down the road. This really saves power and extends charging time. Here we also introduce the solar panel on the top of the EV, which really saves energy and extends the charging time during the day. Vehicle battery voltage and current data can be continuously monitored and updated online.

**KEYWORDS:** wireless power transmission, car charging, electrical vehicle, efficiency, charging pad, sensor network, smart charger.

## I. OVERVIEW

The electrification of transport, but also of trains and electric cars, has become one of the most attractive fields in recent years. Electric cars in particular are increasingly attracting industry attention for environmental and economic reasons. More than 30 million cars were registered and on the road in the UK alone in 2016. Vehicle license statistics show that around 3.3 million cars were registered for the first time in 2016 and 42,000 vehicles were ultra-low emission vehicles (ULEVs). Electric vehicles (EVs) are predicted to account for around 60% of all new vehicle sales in the UK by 2030, with electric vehicles (EVs) seen as one of the most promising alternatives to fossil fuel vehicles. Statistics show that there were 162,000 plug-in EVs (PEVs) on the road in July 2018. In addition, the number of electric car models and brands available on the UK market has grown rapidly in recent years. Wireless electric car charging is based on the inductive transfer of energy between two connected coils, one "primary" connected to the solar and main power charging station and the other "secondary" connected to the battery of the E-vehicle. . The advantages of wireless charging are in terms of safety and convenience, as the driver can avoid the danger of using a power cable and the need to park the vehicle to start charging the battery without having to work from an outlet. WPT can also occur in the opposite direction, so that energy can be sent back from the vehicle battery to the grid if needed. Wireless power transmission is therefore also suitable for two-way power flow. This document mainly deals with the concepts of wireless charging of electric cars. Cable charging can be mainly of four types and all of them are explained. Charging can be done via a pv-wind grid connected system. Using solar and wind energy is pollution free and environmentally friendly. Here we focus on a wireless power transfer solution that uses magnetic resonance coupling between the primary ground coil and the secondary coil side of the vehicle. Using these techniques, power transfer can be made



more than 80% fast and efficient. Wireless power transfer simplifies the charging process by eliminating the use of cabling. With the static WPT system, the driver just needs to park the car and the charging system will work. With the dynamic WPT system, the electric car could be powered while driving in normal traffic; this makes it run forever without stopping. In recent years, emphasis has been placed on dynamic wireless power transfer, and the range of electric cars is expected to increase.

## **II. OBJECTIVE**

- This method can be effectively implemented by installing photovoltaic (PV) systems along intercity routes and in rural areas.
- Energy will be transferred from the PV generator to the EV via wireless power transfer systems. Due to energy availability, environmental protection and many other reasons, vehicle electrification has been done for many years.
- Electric cars (EVs) are seen as a solution to the environmental problem. However, the large spread of electric vehicles faces range concerns.
- The desired system storage must have high energy and performance density, affordable price, long cycle life, good security and reliability; all these items complicate the design of the battery.
- Transmission efficiency has also improved significantly over the years. Currently, the efficiency of the WPT system can reach up to 96%.

## **III. LITERATURE SURVEY**

Electric cars (EVs) are seen as a solution to the environmental problem. However, the large spread of electric vehicles faces range concerns. The desired storage system must have high energy and power density, affordable price, long cycle life, good security and reliability, all these items complicate the design of the dough. While research is constantly optimizing battery technologies, growing EV markets require a more efficient and reliable battery charging system.[1]. Such charging techniques can allow car manufacturers to reduce battery capacity (up to 20%); to make electric cars more affordable. In this paper, we focus on a wireless power transfer solution that utilizes magnetic resonance coupling between the primary ground coil and the secondary coil side of the vehicle. Using these techniques, power transfer can be fast and over 80% efficient. Wireless power transfer simplifies the charging process by eliminating the use of cabling. With a static WPT system, the driver just needs to park the car and the charging system will work. With a dynamic WPT system, the EV could be powered while driving in normal traffic; this makes it run forever without stopping. In recent years, it has focused on dynamic wireless power transfer and is expected to extend the travel distance of electric cars. [2]. First, AC power is converted to direct current (DC) using an AC to DC converter. Then the direct current is converted to high frequency alternating current to drive the transmitting coil through the compensation network. Second, the primary and secondary coil, the high-frequency current in the primary side coil generates an alternating magnetic field that induces an alternating voltage on the receiving coil. Resonance with the secondary compensation network greatly improves the transmitted power and efficiency.[3]. For high power applications, the delivered power is not sufficient due to losses between the transmitter and the receiver. Leakage inductances between the coils lead to poor power transfer efficiency on the coils. The leakage inductance between the coils can be minimized by applying reactive current compensation between the coils. A compensation capacitor is used to improve power transfer capability and efficiency and to reduce power capacitance requirements. There are four basic resonant topologies of the WPT system. [4].



**3.1 EXISTING SYSTEM**

- This existing system represents a new method to improve the performance of a dynamic wireless charging system.
- In this system, receiving coils have been added to maximize charging performance by offering a dynamic mathematical model that can describe and measure the transfer of energy from the source to the vehicle, even when it is in motion.
- All physical parameters describing the model were presented and discussed in the mathematical model.

**Disadvantages:**

- In this existing system of charging the electric car while moving.
- The transmitter coils are always in the active position for charging the vehicle, so the power from the source is wasted. There is no information to update the vehicle's battery status.

**3.2 PROPOSED METHOD**

The proposed system is a wireless charging system for EVs on the go with a dual energy source. The vehicle can be charged wirelessly using wireless power transfer coils on the side of the road, as well as charging the EV from a solar input power source during the day. In this system, it can autonomously determine the position of the receiver using a proximity sensor, which allows the charging pad to use only the coil with the highest transmission efficiency for EV charging. This technology allows us to charge EVs while driving on the road. We also implement a charging system with a solar input source. A solar panel is added on the top of the vehicle to charge the battery during the day and which will help us alternately. Vehicle battery voltage and current data can be continuously monitored using a voltage and current sensor. Sensor data can be updated online using a Wi-Fi device connected to the controller. If the vehicle battery is low, activate the buzzer to inform the user. The voltage data will be uploaded to the online website using the Wi-Fi device. In addition, the proposed design improves the efficiency of the charging system because the transmitter does not have to make measurements on each coil to determine the one with the highest efficiency for each location. Finally, the proposed charging method is more reliable because the position of the car is detected immediately and there is no need to recalibrate the charger if the car slips out of position.

**Advantages:**

- Power loss can be overcome in the proposed system by vehicle detection using a sensor that only activates the power transfer coils.

**IV. SYSTEM FUNCTION**

**BLOCK DIAGRAM**

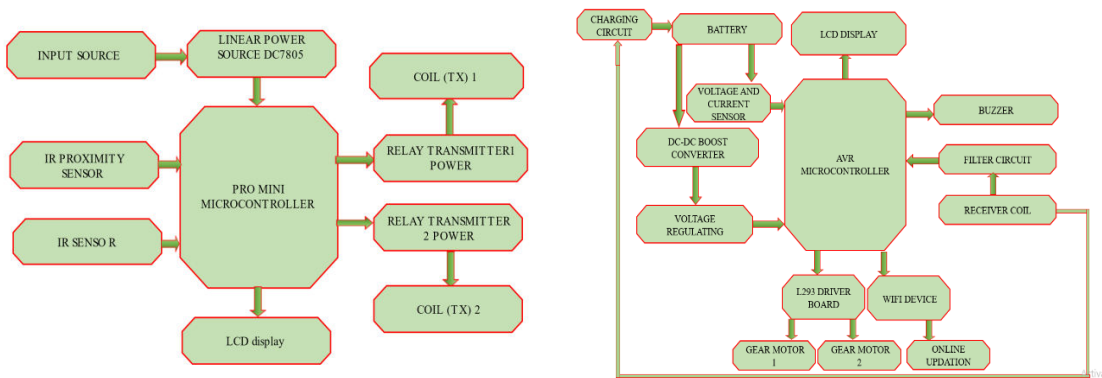


Fig no: block diagram for road side.

Fig no: block diagram vehicle side.

## 4.2 CIRCUIT DIAGRAM

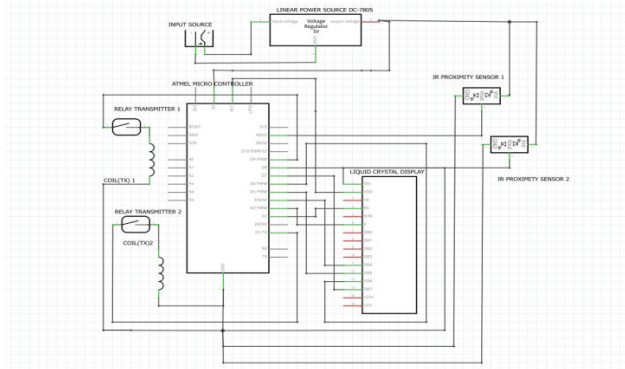


Fig no: circuit diagram in road side.

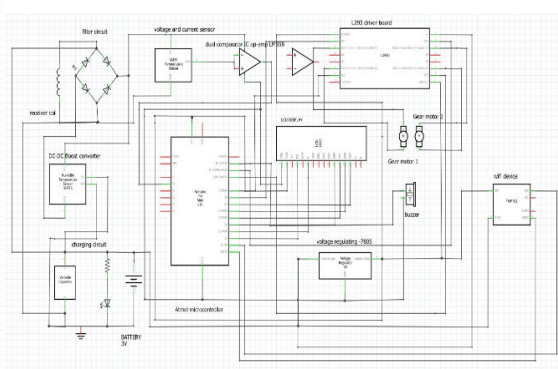


Fig no: circuit diagram vehicle side.

### 4.2.1 CIRCUIT DESCRIPTION

- The transmitter side core components consist of 12V input power supply, linear power supply, DC -7805, liquid crystal display, coil (TX), IR sensors and relay.
- The receiver side core components consist of Inductor (Rx), Boost Converter, Charging Circuit, Battery, DC-7805 Linear Power Supply, Liquid Crystal Display, Driver Board, Gear Motors, Wi-Fi Device, Buzzer, Voltage and Current Sensor. Input source connected to linear DC source – 7805 for voltage regulation 12V to 5V.
- The battery supply is connected to the input pins of the DC amplifier and the output is connected to the voltage regulator. In liquid crystal display VCC pin is connected to 5V power supply, GND pin is connected to ground rest data pins are connected to microcontroller digital pins. The voltage and current sensor have 3 pins. VCC pin is connected to 5V supply, GND pin is connected to ground.
- The output pin is connected to the analog pin of the controller. The instruction pins of the controller board are connected to the digital pins of the controller.
- The enable pins are connected to 5v. The gear motors are connected to the output pins of the controller board. The +v pin is connected to the 12V supply.
- The buzzer has two pins the positive pin is connected to the digital pin of the controller and the negative pin is connected to ground. Wi-Fi device has 4 pins, VCC pin is connected to 5V power supply, GND pin is connected to ground. the output pins are connected to the TX and RX pins of the controller.
- In the circuit on the road side, the IR sensor has 3 pins. VCC pin is connected to 5V supply, GND pin is connected to ground.
- The output pin is connected to the digital pin. The transmitter coils are connected to the regulator.
- The switch has a positive and negative pin the positive pin is connected to the digital pin of the controller and the negative pin is connected to ground.
- In liquid crystal display VCC pin is connected to 5V power supply, GND pin is connected to ground rest data pins are connected to microcontroller digital pins

## V. HARDWARE REQUIERMENTS & SPECIFICATION

### 1.ATMEL 16 BIT MICROCONTROLLER

Atmel's high-performance, low-power 8-bit RISC ATMEL 16A microcontroller combines 16KB ISP flash memory, 1KB SRAM, 512B EEPROM, 8-channel/10-bit A/D converter (TQFP and QFN/MLF), and WIRE debug for on-chip debugging. Atmel 16-bit microcontroller will support from 20 MIPS throughout at 20 MHz and operates

between 2.7-5.5 volts. By executing powerful instructions in a single clock cycle, the Atmel 16-bit microcontroller achieves throughput by approaching 1 MIPS to MHz, this will be balancing power consumption and processing speed

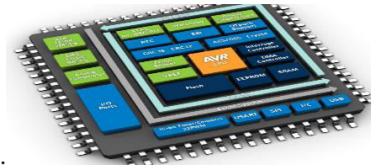


Fig no: 5 ATMEL 16 bit microcontroller

## 2. 7805 Voltage Regulator & Its Working:

A regulated power supply is needed for electronic devices because they are used in semiconductor material with fixed voltage and current. If there is any difference in the fixed rate of voltage and current, the device will be damaged. Batteries are one of the main sources of DC power, but in sensitive electronic circuits we cannot use them over time because they lose their potential and eventually discharge. Batteries provide different voltage ranges such as 1.2V, 3.7V, 9V and 12V. Most ICs work with a 5V power supply, so we require a device to power a reliable 5V power supply called a voltage regulator. The 7805 voltage regulator comes from the 78XX series of linear voltage regulators. This regulator generates a 5V regulated output.

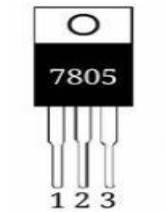


Fig no: 8 Ic 7805 voltage regulator

## 3.VOLTAGE AND CURRENT SENSOR

Sensors are basically devices that can sense or identify and respond to certain types of electrical or some optical signals. The implementation of voltage and current sensors and current sensor techniques have become an excellent alternative to conventional current and voltage measurement methods.



Fig no: 7 Voltage and current sensor

## 4. Coil (TX) &(RX):

Both circuits are built on a breadboard and powered by a 1.5V battery. Both circuits cannot use more 1.5V supply because the transistor can heat up more due to excessive power dissipation. However, additional control circuitry is required for greater evaluation. This wireless electricity transmission is based on inductive coupling technology. Both circuits consist of two parts, one is the transmitter and the other is the receiver. In the transmitting part, the transistor generates a high-frequency alternating current with a coil, and the coil creates a magnetic field

around it. After tapping the coil in the middle, both sides of the coil will start charging. During charging, the base resistor begins to conduct and eventually closes the transistor.

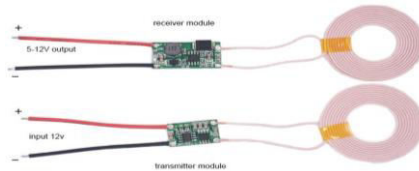


Fig no 8: Wireless Power Supply Transmitter Receiver Charging Coil

## 5.IR SENSOR

The IR sensor can measure the heat of an object and also detect movement. These types of sensors only measure infrared radiation and do not emit it, which is called a passive IR sensor. Typically, in the infrared spectrum, all objects emit some form of thermal radiation. These types of radiation are invisible to our eyes and can be detected by an infrared sensor.



Fig no 9: IR sensor

## VI. RESULTS

A wireless power transfer system, the transmitter part transmits power wirelessly to the receiver part. In the receiving part, the received energy recharges the battery and runs the electric vehicle. initialization of wireless power transmission, the transmitting coil transmits 10.1 V at a frequency of 191.5 kHz. Due to some losses, the receiving coil receives 6.72 V at 194.8 kHz. The calculated and implemented electric vehicle results show a good correlation.

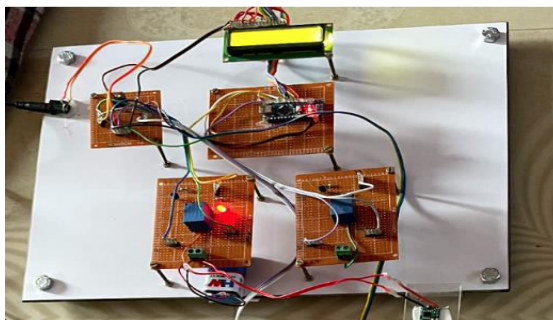


Fig no 10: Receiver for road side

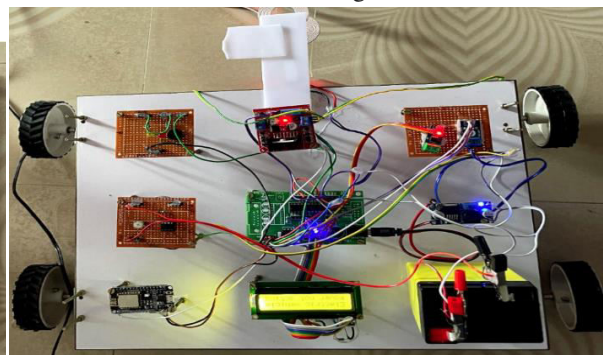


Fig no 11: Transmitter vehicle side

## VII. CONCLUSION

In conclusion, the control method is based on the estimation of the primary voltage, which is only used in the vehicle-side information to simplify the ground devices on the dynamic WPT system. This device verifies whether the primary voltage estimate is achieved or not, and power control using a balance point calculated based on the primary voltage estimate is effective for a dynamic WPT system that can be simplified and may not be required for road-side voltage regulation. We have also implemented a charging system with a solar input source. A solar panel is added to



the top of the vehicle, which recharges the battery during the day and which alternately helps us. Due to their suitability for charging electric cars in terms of performance and range. The latest developments and research are summarized.

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