Wireless Charging for Electric Vehicles

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Abstract: One potential alternative to traditional plug-based electric vehicle (EV) charging stations is wireless power transfer (WPT). Electric vehicle charging technologies that are compatible with the WPT idea include induction and magnetic coupling. The WPT system for electric vehicles is analyzed and modelled in this research. In order to charge electric vehicles, a new sophisticated WPT technology is developed and tested. This system can automatically align the transmitting and receiving coils using an IR sensor technique. In addition to saving drivers time and reducing human error in automobile WPT method, the developed system will also conserve energy and intelligently charge the car during off-peak periods. For electric vehicle owners, this means less money spent on power and more energy saved.

Keyword: Electric vehicle, Wireless charging, Arduino UNO, IR Sensor

1. Introduction

Pollution of the environment is a major problem all around the world. The list of effects is long and includes things like acid rain, air pollution, greenhouse gas emissions, and global warming. Vehicle emissions are a major source of air pollution. One possible main source of global warming is the greenhouse gases released into the environment by gasoline-powered vehicles. One way to stabilize the climate and address automobile pollution is to transition to sustainable technology [1]. A significant step toward preserving a healthy environment would be to switch from gas-powered vehicles to electric ones [2]. A wonderful stride toward environmentally friendly technology, EV adoption is a transportation sector concept that is generally well-received across the world. Electric vehicles (EVs) get their power from a battery, which in turn powers the motors and wheels. You may charge the battery by connecting it to the power grid. Because they don't require gasoline, electric vehicles are a great green alternative to the ever-increasing cost of fossil fuels. Electric vehicles not only don't harm the environment, but they also cut down on noise pollution and maintenance needs compared to gas-powered vehicles [3]. The majority of electric vehicles on the market today can be charged simply connecting them to a designated outlet. Some problems with this kind of charging include the need to physically plug in the cable, worries about safety, and the amount of time it takes to charge. There is a potential danger of an electric spark or other harm while charging manually. Hence, a more practical, secure, and efficient method of charging the vehicle is required. The capacity to transmit a substantial quantity of electricity across short to medium distances has been demonstrated by advancements in Wireless electricity Transfer (WPT). With WPT, the idea is to transmit energy over an air gap instead of using wires. When it comes to charging electric vehicles, WPT is the way to go. By placing a hotspot on the parking lot floor, commercially available WPT charging systems are showcased. The driver must park the car in a certain way and ensure that it is properly aligned with the hotspot point in order for the wireless charging technology to charge the vehicles properly. Consequently, the human element is crucial. Because the charging system's efficiency is dependent on precise alignment to the hotspot, the driver's effort is vital. Vehicle charging becomes more difficult for drivers due to this. Only 5% of drivers can park with a frequently tolerated misalignment for optimal wireless transmission, according to Birrell et al. [4]. Innovative methods are needed to enhance the flexibility of electric vehicle wireless charging, as the charging process is hindered by misalignment. This research aims to shed light on these problems by examining efficient wireless power transfer and charging. Drivers won't have to worry about the alignment of the charging coils anymore thanks to the Semi-smart Wireless Charging Station (SSWCS) for electric vehicles, which automates the charging process with minimal human intervention.

1.1 Problem Statement

Right now, electric car chargers require unsightly and cumbersome wires and connectors, which becomes a real pain when you need to charge more than one vehicle at a time. In order to make charging electric vehicles more easy and efficient, this project aims to build a wireless charging system that does away with the need for wires and plugs.

2. Literature Survey

Supriyadi and Edi Rakhman. [1] prove that the power transmission capacity is proportional to the square of the wire diameter (AWG) and the number of turns employed. More power will be transmitted as the number of windings grows. We get the desired results when we utilize a 470 kHz input frequency, a 0.5 mm enameled copper wire with 26 twists. A power efficiency of around 1.51% is achieved at a distance of 1 cm. With this output, a 1 Watt LED light may be turned on.

N.UthayaBanu and U.Arunkumar. [2] To run the automobiles with high efficiency and enhance quality criteria, this research represents the many technologies linked to Wireless Power Transfer System, which is utilized to reduce flux leakage during power transfer. The development of renewable energy sources as a power source is also demonstrated by this project.

Govind Yatnalkar and Husnu Narman. [3] provide a brief study of electric vehicle charging durations. So, to get around the issue of charging time, electric vehicles rely on wireless charging. Additionally, the paper includes a state-of-the-art overview of electric car wireless charging as well as the necessary charging parameters. The transmission and reception coil distance, coil placement on the electric car, battery capacity, charging duration, and overall characteristics are the most critical for wirelessly charging electric vehicles. Electric vehicles, like gas-powered vehicles, need a charging station; since this process takes time, it's more convenient to charge the vehicle while it's parked; thus, it is efficient to integrate the charging and parking systems, which are both built on Internet of Things technology, making them user-friendly. Cloud storage and mobile devices can now process data uploads in real time. One problem that many have is making sure their cars are safe when parked. Wider connectivity, improved sensing, information processing, and increased extensibility are all benefits of the internet of things (IoT), making it the ideal platform for WPT system status monitoring.

[4]. Therefore, synchronized parking is made easier with the aid of the Internet of Things (IoT), which allows for easy monitoring of parking and charging of automobiles simultaneously. The ability to keep data on the cloud, which can be accessed from any location at any time, is another significant aspect of IoT that simplifies and expedites life.

[5] What if we could combine the idea of a parking lot with an electric station, where cars could be parked while still receiving a charge? That would solve the problem of where to charge our electric vehicles. Consequently, this approach has various benefits.

[6] It was also noted that the present transportation system and parking lots can't handle the influx of cars on the road, which causes significant environmental and financial harm from things like wasted time looking for parking places. Consequently, strategies are required to accommodate EVs and their charging needs in a way that makes optimal use of existing parking and charging facilities.

3. Methodology

When many charging stations are equipped with a cable charging system. There are a number of drawbacks to using a wired charging station, including the following: the need for additional space, a smaller substation, converter circuits built at each station, a restricted range of the wire, and longer charging times. A wireless solution for charging electric vehicles eliminates all of these issues. Both users and the environment suffer from the conventional, plug-in charging methods. Using a large number of batteries or quickly switching out dead

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ones for fully charged ones can cut down on charging time. Line loss causes energy to be wasted when the coil is conducted over an extended period of time. Due to constant operation, its service life would be reduced.

4. Block diagram

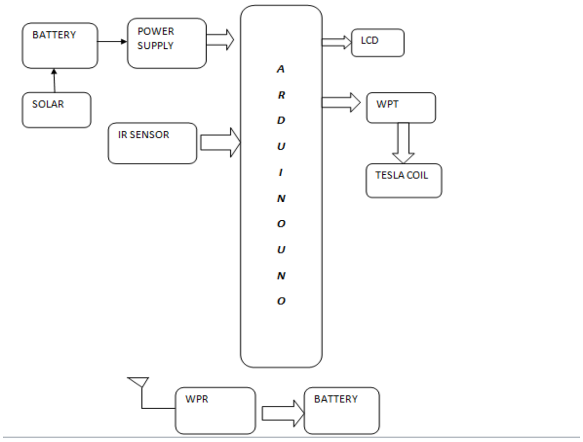

Fig.1.block diagram

4.1 16X2 LCD Display with I2C module:

If you're looking for an LCD module that can show 16 characters per row and 2 rows of characters, you're looking at a 16x2 display. A controller chip, an array of pixels, and a backlight make it up. In order to show the intended text or graphics, the controller chip takes signals from a microcontroller or another input source and instructs the pixels to do so. A number of applications exist for the display, including electronic devices, embedded systems, and industrial control systems, where it can show data, messages, and other information.

Fig.2.LCD

4.2 Arduino Uno

The ATmega328 is the basis of the microcontroller board known as the Arduino Uno (datasheet). A 16 MHz crystal oscillator, 6 analog inputs, 14 digital I/O pins (including 6 PWM outputs), 1 USB port, 1 power connector, 1 ICSP header, and 1 reset button are all part of it. It comes with all the necessary components to support the microcontroller; all you need is a USB cable, an AC-to-DC adapter, or a battery to begin.

Fig.3.Arduino uno

4.3 Wireless coil

Charging Coil Module for Wireless Power Supply Transmitter and Receiver:-With its compact size, user-friendliness, high efficiency, and affordable pricing, the 12V 2A Large Current Wireless Charger Module Transmitter Receiver Charging Coil Module is ideal for a range of tiny electronic devices, wireless charging, power supply research, and design.A variety of small electronic devices, wireless charging systems, and power supplies can benefit from the 5V 2A Large Current Wireless Charger Module Transmitter Receiver Charging Coil Module's small size, ease of operation, high efficiency, and affordable pricing. This technology has several uses, including wireless charging for mobile phones, video game consoles, tanks, electric razors, adult entertainment goods, machine learning, healthcare, digital audio players, digital still and video recorders, electric razor blades, and many more. Thanks to a contactless charging power supply, the items are entirely sealed, making them waterproof and dustproof.

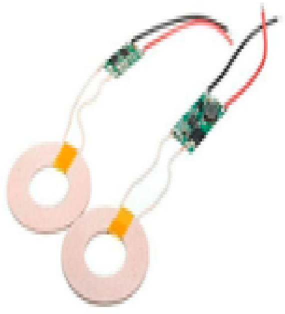

Figure 4: Transmitter Receiver Charging Coil

Specifications:

- Model: XKT-412.
- Input Voltage: 12V.
- Output Voltage: 12V.
- Operating Current: 1.2-2 A.
- Receive Coil: 3mm, the receiver output 5V / 1A current
- Transmitter Length × Width × Height(mm) : 17 * 12 * 4
- Receiver Length × Width × Height(mm) : 24 * 10 * 3
- Coil Height: 2mm
- Coil Diameter: 38mm

4.4 Relay

An electromechanical switch, a relay may automatically turn things on and off. Figure 3 shows a schematic of a double contact relay. If you need to control several circuits with a single, low-power signal or if you need to provide total electrical isolation between the control and controlled circuits, a relay is the way to go.

Fig.5. relay

4.5 IR Sensor

One sort of electrical equipment that can detect infrared radiation is an IR (Infrared) sensor. Although infrared sensors are unable to see it with the naked eye, they are able to pick up on other forms of electromagnetic radiation. An infrared (IR) light source (LED, for example) and an IR detector (photodiode, phototransistor, etc.) make up most infrared sensors. A beam of infrared light is emitted by the IR source and reflected off of nearby objects. Following this, the infrared detector picks up on the reflected light and produces an electrical signal whose magnitude is directly proportionate to that of the reflected light.

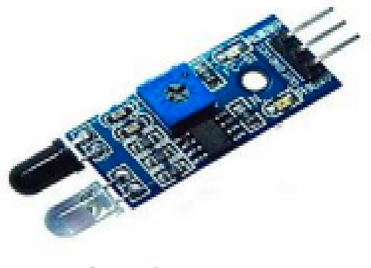

Fig.6. IR sensor

4.6 Solar panel

Power Source: Solar Panel The photovoltaic effect allows solar panels to convert sunlight into usable electricity. They take advantage of the idea that solar panels release electrons when light hits them, known as the photoelectric effect. One component of solar panels is a silicon cell. Two of silicon's outermost electrons are present when light strikes a silicon cell due to the element's atomic number of fourteen. The electrical current that I initiated begins to flow now. There are two distinct sales models for silicon. both multi- and single-crystalline From the finished silicon block, monocrystalline solar panels are made in the form of silicon wafers. Similar to how polycrystalline silicon cells are created by melting many silicon crystals together, monocrystalline silicon cells are more efficient but also more costly.

4.7 Battery

Power Source: Batteries In places without access to a constant power source or where portability is paramount, batteries shine as a power source. Any electronic equipment that plans to utilize a battery as its power source has to be compatible with that battery's design. Additionally, the device's design should accommodate the battery's voltage range and current output capabilities. Keep an eye on the battery life indicator and recharge or replace the battery as needed when utilizing batteries as a power source. Batteries eventually die and may require replacement because of this loss of charge capacity. In general, batteries provide a practical and flexible solution for many different kinds of power needs that call for a portable or backup source of energy.

5. Project Output Results

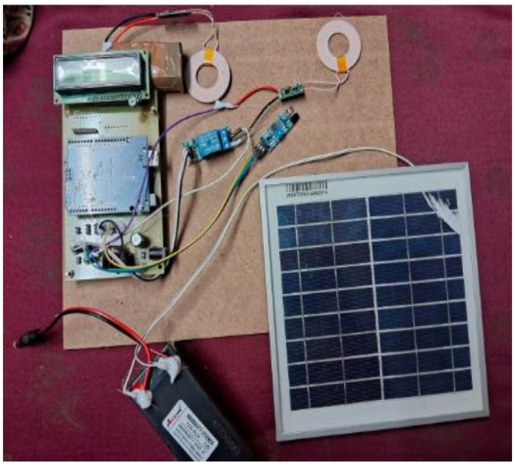

Fig 7.project final over view

6. Conclusion

One emerging area for electric vehicle charging is wireless power transmission. This research outlined methods to enhance the performance of wireless charging for high-frequency and high-power applications and demonstrated the effectiveness of resonant inductive coupling for electric vehicle (EV) charging. After going over a number of different coil alignment approaches, the fingerprint method was proposed as an affordable, practical way to provide WPT intelligence. We introduced and detailed in detail the algorithm for coil detection. Because of space constraints, the practical aspects were not included in this study. It should be noted, nevertheless, that the system's accuracy and effectiveness in aligning WPT coils in the prototype were noteworthy. But when the parking lot is really big, it starts to move slowly.

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