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Article Title: **Wireless Solar Charging Stations for Electric Vehicles**

Wireless Solar Charging Stations for Electric Vehicles

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ABSTRACT

The automotive industry is quickly transitioning from IC engine vehicles to electric vehicles as we enter a new era of automobiles. The growing demand for electric vehicles is also driving up the number of charging stations. In this idea, the automobile is charged wirelessly through inductive coupling using a wireless charging system. All we have to do is pull the automobile into the charging station. Wireless Power Transmission is the process of sending electrical energy from a source to a load over a distance without the need of cables or other conducting wires. Nikola Tesla's greatest invention was the idea of wireless power transfer. There is no need for human contact with this technology. One technology that may be a step towards the future is wireless power transmission. With the help of this project, wireless charging may become more practical for everyday usage. Magnetic resonance-based wireless power transfer (WPT) is a technology that has the potential to free people from obtrusive wires. Actually, the WPT uses the same fundamental theory—known as inductive power transfer—that has been studied for at least thirty years. WPT technology has advanced quickly in the last many years. With a load efficiency above 90%, the power transfer distance grows from several millimeters to several hundred millimeters at the mill watts to kilowatts power level. Electric vehicle (EV) charging applications find the WPT highly appealing due to its advancements, as it can be used in both stationary and dynamic charging settings. The WPT technologies that are relevant to EV wireless charging are represented in this presentation. The challenges of charging time, range, and cost can be readily reduced by implementing WPT in EVs. With the widespread adoption of EVs, battery technology is no longer significant. It is believed that the cutting-edge accomplishments would inspire researchers to further both the spread of EV and the continued development of WPT.

Keywords: LED–Light Emitting, Diode, Battery, Electric Vehicle, Microcontroller, Controller.

1 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 a traditional wire system. When charging multiple electric vehicles at

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once, the traditional cable system gets messy. Additionally, it hogs a lot of the charging port's electrical outlets. One may ask a question at this point. What if there was a single piece of equipment that could charge all of these electric cars at once without requiring cables or making a mess in the process? We thought about it and came up with a concept. Inductive coupling provides a straightforward and efficient method of wireless power transfer to address this issue. 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 a traditional wire system. When charging multiple electric vehicles at once, the traditional cable system gets messy. Additionally, it hogs a lot of the charging port's electrical outlets. One may ask a question at this point. What if there was a single piece of equipment that could charge all of these electric cars at once without requiring cables or making a mess in the process? We thought about it and came up with a concept. Inductive coupling provides a straightforward and efficient method of wireless power transfer to address this issue. Supriyadi and Edi Rakhman [1] demonstrate the effect of wirediameter (AWG) and a number of turns used are directly proportional to the amount of power that can be transferred. When the number of windings increases, more the power will be transferred. When we use the enameled copper wire of 0.5mm diameter and number of turns to 26, and apply the input frequency of 470 KHz. The power efficiency obtained at a distance of 1c.m is about 1.51%. This result can turn on 1 Watt LED lamp. N. Uthaya Banu and U. Arunkumar [2], this study representing the various technologies related to Wireless Power Transfer System,which is used to avoid the flux leakage during the transmission of power and to operate the cars with high efficiency and improve the quality parameters. This project also shows the progress of generating the power source through renewable energy. Govind Yatnalkar and Husnu Narman [3] present a survey of Duration of Charging of Electric Vehicles is limited. Therefore, wireless charging is important for Electric Vehicles in order to overcome the charging duration problem. This paper also provides a current scenario of the art in electric vehicle wireless charging and the parameters that require for charging section. The most important parameters for electric vehicle wireless charging are the distance between the transmission and reception coils, the position of the coils placed on Electric Vehicle, battery sizes, and the time for charging.

1.1 Wire Less Power Transmission (WPT)

The efficient 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. For short-range transmission, inductive coupling can be used, and for mid-range and long-range transmission, are to be used along the resonant induction high range power transfer using electromagnetic waves. With the use of WPT technology, power can now be sent to areas that would not otherwise be feasible or feasible. Using an inductive coupling to charge an electric

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vehicle's battery may be the next big thing.

1.2 Solar Energy

As solar electricity will power the entire system, a renewable energy source will be guaranteed. There are no greenhouse gas emissions, no water pollution, and no air pollution from solar electricity. Additionally, the production of electricity from solar panels produces no harmful emissions and is carbon-free. Moreover, it lessens the demand for limited resources. Over the course of their productive lifetime, which can last up to 25 years, solar panel systems are incredibly resilient and require little to no maintenance. Additionally solar systems require very little maintenance. Occasionally dusting these panels to get rid of dirt leaves, and other debris is the only maintenance needed. To have these panels cleaned on occasion; one can simply contact a professional.

1.3 Requirement

The issue of global warming brought on by greenhouse gas emissions and emissions from fossil fuels has grown in prominence along with human society, making energy conservation and emission reduction increasingly crucial. The transportation sector has drawn interest from nations worldwide, as it is one of the businesses that emits the greatest amount of greenhouse gases. Electrical energy is a well-known clean energy source that can be transformed into renewable energy sources. Electric vehicles, which run on electricity rather than fossil fuels, have a special benefit over conventional vehicles in that they produce no emissions. For this reason, EVs are without a doubt the greatest option available to the transportation sector to support energy structure optimization. Nevertheless, the high price, constrained capacity, and cruising range of battery packs for electric vehicles prevent EVs from being promoted much further. Wireless power transmission (WPT) is an important form of charging since it eliminates the need for a physical connection between the source and the load, making it safer and more versatile than the conventional plug-in charging technique. Static wireless power transmission (SWPT) and dynamic wireless power transmission (DWPT) are the two categories of wireless power transfer technologies.

1.4 Statement of Problem

In all nations, the number of electric cars on the road is rising at the moment. Apart from their environmental benefits, electric vehicles have demonstrated their ability to reduce travel expenses by replacing fuel with energy, which is significantly less expensive. Electric vehicles offer an option, but in order to take the lead in transportation, their charging system following are the needs to be upgraded. Consequently, there are two main obstacles for electric vehicles: Extended charging time: the charging process takes one to six hours. In distant and off-city places, charging stations are not able to access power. The goal of this study is to create a functional wireless charging infrastructure that allows EVs to be charged while they are in

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motion and does not require physical charging stations. This can facilitate a seamless charging process and assist in getting Energy is received by the coil from the primary side, which produces a magnetic field surrounding the coil. Due to the high-frequency output being used, there will be a significant magnetic flux production. The current in the inductor and capacitor connected in parallel will be induced when the flux from the primary coil links with the secondary coil or receiver coil. The alternating current acts as the voltage generator throughout the LC circuit.

1.5 Software

This project is made much easier by the ATMega328p microcontroller IC with Arduino boot loader since the Arduino code is written in C++ and has unique methods and functions that we'll discuss later. Human-readable programming is possible using C++. An Arduino code file is processed and compiled to machine language when it is created referred to as a "sketch." The primary text editor used for Arduino programming is the Arduino Integrated Development Environment (IDE). This is the location where you will type your code and then upload it to the board that you wish to program. Sketch code is used to describe Arduino code.

1.6 Code

```
#includes<LiquidCrystal.h>LiquidCrystal lcd (2, 3, 4, 5, 6, 7);
intir [2] = {9, 10}; int re[2] = {11,12};
void setup () {
lcd.begin (16, 2);
lcd.clear ();
lcd.setCursor(0, 0); lcd.print("Wireless Vehicle"); lcd.setCursor(0, 1); lcd.print("Charging System"); pinMode(ir[0],INPUT); pinMode(ir[1],INPUT); pinMode(re[0],OUTPUT); pinMode(re[1],OUTPUT); delay(3000);
lcd.clear (); lcd.setCursor (1, 0); lcd.print ("Spot1"); lcd.setCursor (10, 0); lcd.print ("Spot2");
}
void loop() { if(digitalRead(ir[0])) {
```

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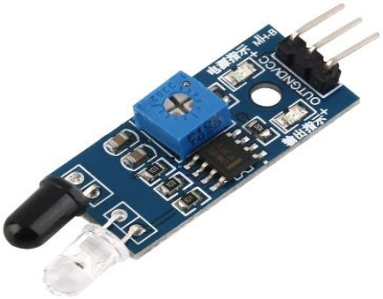
```
DigitalWrite (re [0], HIGH); lcd.setCursor (0, 1); lcd.print ("Charge");
} else {
Digital Write (re[0], LOW); lcd.setCursor(0, 1); lcd.print(" OFF ");
}
if(digitalRead(ir[1])) { digitalWrite(re[1],HIGH); lcd.setCursor(9, 1); lcd.print("Charge");
} else {
DigitalWrite (re[1], LOW); lcd.setCursor(9, 1); lcd.print(" OFF ");
 }
```

1.7 Hardware Components

1.7.1 IR Sensor

One of the most common and fundamental sensor modules in an electronic device is the infrared sensor circuit. This sensor is comparable to the visual senses of humans and is commonly employed in real-time obstacle detection applications.



1.7.2 Copper Coil

The AC is subsequently converted back into DC by the receiving coil's electronics to provide working power. To accomplish this, power source (DC current) is changed into high frequency AC (Alternating Current) by particularly designed electronics erected into the transmitter. The AC boosts a copper wire coil in the transmitter, which produces a magnetic field. When the receiver coil is placed in proximity of the magnetic field, the magnetic field can make an AC (alternating current) in the receiving coil. Electronics in the receiving coil then alters the AC back into DC which becomes operating power.

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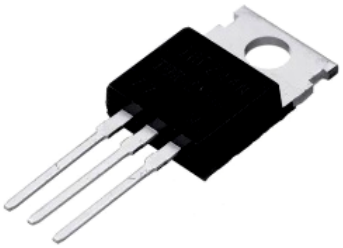
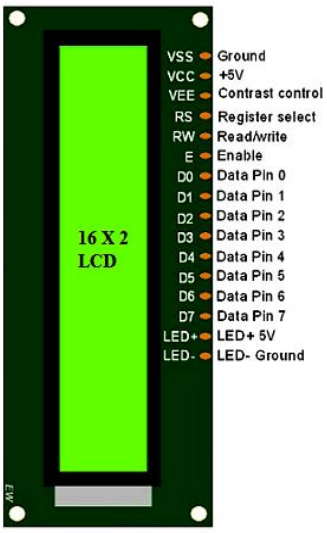
1.7.3 MOSFET

The N-channel MOSFET IRFZ44N has a low Rds value of 17.5 mΩ and a high drain current of 49A. Additionally, the MOSFET's low threshold value of 4V indicates when it will begin to conduct. As a result, driving with 5V is frequently done with microcontrollers. If the MOSFET must be fully switched on, a driver circuit is required.



1.7.4 Led Module

Because LCD modules are readily available, reasonably priced, and programmer-friendly, they are frequently utilized in embedded projects. These displays are probably something that most of us have seen in our daily lives, either at PCOs or calculators. Now that the appearance and pinout have been shown above, let's get a little technical.
The 16x2 LCD gets its name from its 16 columns and 2 rows. Many combinations are possible, such as 8x1, 8x2, 10x2, 16x1, etc., but the 16x2 LCD is the most popular. Thus, there will be a total of 32 characters (16×2=32), with 5×8 Pixel Dots used to create each character.



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1.8 Design and Implementation

Block diagram of primary circuit of WPT is depicted in the figure below- The output produced by timer IC is applied to the inverter circuit to invert the oscillating signal is referred to as signal 2 while signal 1 for a non-inverted oscillating signal. This is both the original and inverted oscillating signal applied to the MOSFET driver IC to generate high and low pulsesto trigger the gate of the MOSFET terminal. This forms a driver circuit. This driver circuit sent the Alternating current to the LC circuit. This current across the inductor and the capacitor produces the magnetic field.

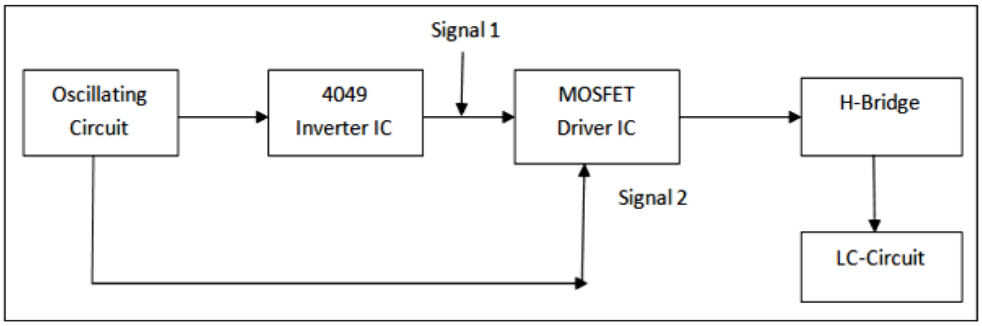

Figure 1: *Block diagram of primary circuit of WPT*

The coil from the primary side gets energy and it creates the magnetic field about the coil. Owing to the use of high-frequency output, the creation of magnetic flux will be very strong. When the flux from the primary coil links with the secondary coil or Receiver coil, this will induce the current in the inductor and capacitor connected in parallel. The voltage generator across the LC circuit is an alternating current and this A.C. signal is applied to the bridge rectifier circuit. This circuit converts the alternating current into Direct current and the capacitor is connected to the output to generate a smooth DC signal. The Voltage regulator is used to limit the voltage to prevent damage to the load. The block diagram of the secondary circuit of WPT is shown in Figure below.

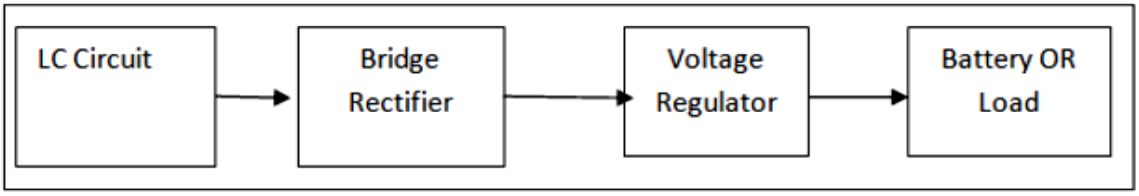

Figure 2: *Block diagram of secondary circuit of WPT*

The block diagram of the work is as depicted below.

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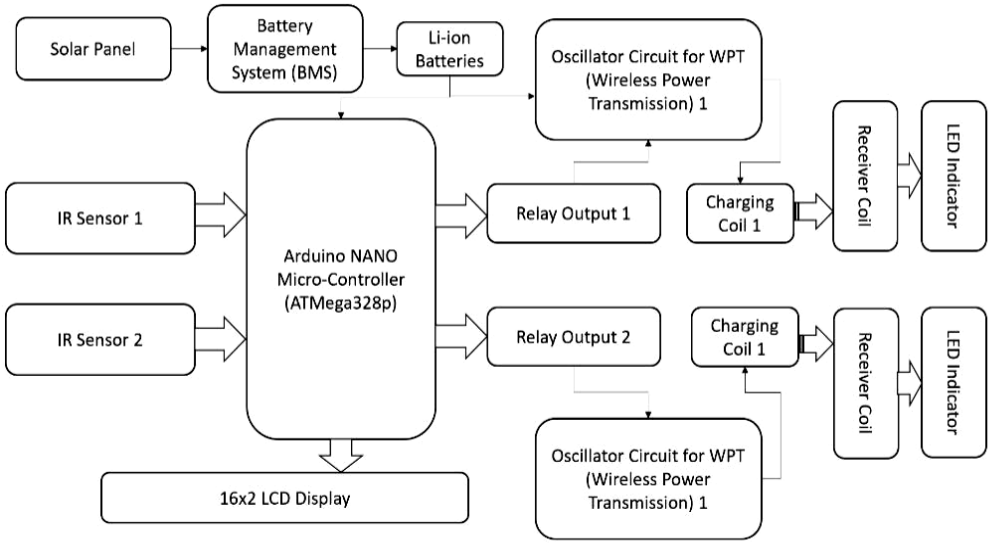

Figure 3: *Block diagram of the proposed work*

The block diagram operation is Solar panels, batteries, regulator circuits, transformers, copper coils, AC to DC converters, LCD screens, and ATMGA controllers are used in the construction of the system. A solar panel is used by the charge controller to power the battery. DC electricity is delivered to the battery, which stores it. It is now necessary to convert the DC electricity into AC in order to transmit it. A transformer helps to convert the power into AC, which is subsequently controlled by regulator circuitry. The copper coils used in wireless energy transmission are now powered by this energy. Furthermore, a copper coil is positioned

1.9 Experimental Set-Up

The experimental set-up and working of the work is as below:

Figure 4: *Diagram of the proposed work*

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Energy is received by the coil from the primary side, which also produces a magnetic field surrounding the coil. Strong magnetic flux production will result from the use of high-frequency output. Inducing current in an inductor and capacitor connected in parallel occurs when the flux from the primary coil joins with the secondary coil or receiver coil. Today's wireless smartphone charging operates on the same concept and can induce 40 watts of power wirelessly. This induction is known as electromagnetic induction, or simply EMI. Alternating current is generated by the voltage generator across the LC circuit, and the bridge rectifier circuit receives this A.C. signal. This circuit connects the capacitor to the output after converting the alternating current to direct current.

2 Parameters/ Components Table

Components	Rating/Model
Solar Panel	2W, 12V
LI-Ion Battery	12V
LCD Model	16X2 Display
Potentiometer	Model-103
Diode	Model-1003
Capacitor	100µF
Voltage Regulator	5V-35V

3 Conclusion

Though the technology for the wireless EV charging is still in its infancy, it has the potential to completely change how we charge electric car in the future. The suggested technique is a workable way to give electric cars continuous charging. The system reduces dependences on the grid and promotes by using solar energy to power the wireless dynamic charging process. The vehicle may be charge while on the way thanks to dynamic charging, which extends the range of electric car. The finding show that the suggested technology can transfer electricity with great efficiency, minimizing the energy loss during charging

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