Solar based wireless EV charger

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***Abstract*— In today's drastically deteriorated environment, electric vehicles (EVs) are required. India's government intends to have only electric vehicles by 2030. Fast charging of electric vehicles and charging infrastructure are required to make EVs widely accepted, as charging time is the primary obstacle to EV adoption. Having an acceptable charging infrastructure is a crucial aspect of this change. With the widespread use of electric vehicles, the current power supply may experience significant instability. The "solar-based wireless EV charger" project uses renewable energy technology. Solar energy is converted to electrical energy, which is then stored in a lead-acid battery. With the battery management unit, a wireless charging system will be established. This stored energy is utilized to charge Electric Vehicles.**

***Index Terms:* wireless power transfer module, reverse charging protection, ATmega328P.**

INTRODUCTION

To improve charging station efficiency, electric vehicles will be the future mode of transportation. Electric vehicle charging will play a significant role in raising EV demand in the market; the lack of charging infrastructure is the primary reason for not purchasing an EV. We investigated the portable EV charger by reducing charging time with renewable energy. The vehicle battery charging station developed in this work uses a hybrid power system to give a unique service to travelers who seek to travel long distances in an electric vehicle. There are no electric charging stations for such users in between motorways to recharge their vehicles. For charging their electric vehicles, the wireless EV charger is the ideal alternative.

METHODOLOGY

Solar power has increasingly become popular over the past year. With its uncountable improvement and cost-effective ways, more and more people are opting to switch over to solar energy rather than their regular form of energy. Solar charging is based on the use of solar panels for converting light energy into electrical energy (DC). The DC voltage can be stored battery bank. There is Reverse charging protection circuit is provided for the backflow of energy from the battery to a solar panel. The transfer coil is located at charger side and receiver coil is placed on vehicle side. A wireless power transfer module (WPT) is used for transferring electric power which is generated from the solar panel to the Electric vehicle by using the principle of Electromagnetic Induction. To measure battery voltage, a voltage sensor is used. The battery voltage will be measured by microcontroller & showed on a 16x2 LCD. It will also display battery low status, whenever battery voltage falls below a certain level. L239D is the motor driver which is used for movement of wheels of that vehicle.

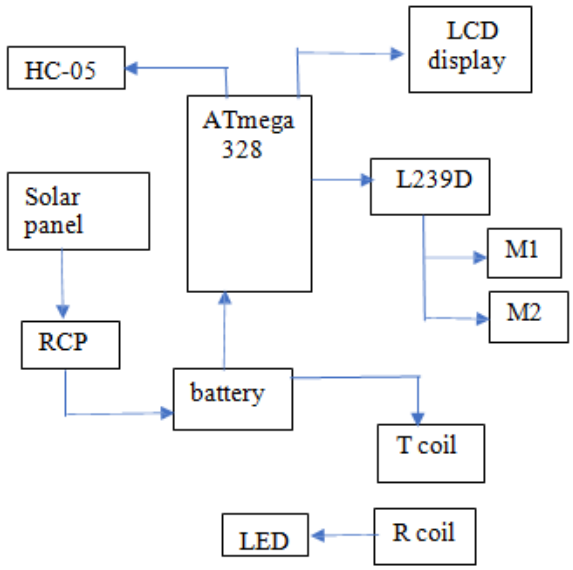

Fig.1 Block diagram of solar-based wireless EV charger

Wireless power transfer module (WPT): In electric vehicles charging of battery through a charger and wire is inconvenient, dangerous, and expensive. The existing gasoline and petrol engine technology vehicles are responsible for air, and noise pollution as

well as for greenhouse gases. The implemented wireless charging system of batteries for Electric vehicles by the inductive coupling method has been studied in this paper. The transmitting circuit is used between the transmitter coil & receiver coil where MOSFET is used for switching operation. The system is achieving a 61% efficiency level while providing safety, reliability, low maintenance, and long product life. This is easy to use Wireless Power Transfer Module. This module consists of Transmitter Section & a receiver Section. Both the sections have a coil that acts as a transmitting/receiving antenna. This product can be used for wireless charging of mobile phones and various small electronic products. It is in a very small form factor and is extremely easy to use efficient & low costing. It can be used for wireless charging of your product thus making the product completely sealed, dustproof & waterproof thus increasing your product's life.

Fig.2 wireless power transfer module

Specification:

- Transmitter Module Input voltage: 9-12 Volts
- Receives the output voltage: 5V
- Receiving the output current: 350-500mA
- Receiving usual distance: 3cm- 4cm

Due to the limited availability of resources, it has become essential to develop different methods to generate approaches to noiseless, cost-efficient, and convenient charging. It is estimated that losses incurred due to wires are about 20-30%. Hence WPT attempts to minimize these losses along with a reduction in pollution levels caused due to resources used presently. But for electric vehicles, traveling range and charging process are the two major issues affecting their adoption over conventional vehicles. The method of dynamic wireless charging allows keeping the vehicle charged while running. To overcome the problem of the charging process, a wireless charging & battery management unit for an electric vehicle is designed. The basic working principle of inductive WPT Charging is that there are two parts to the inductor. The primary winding is at the charger side and the other secondary winding is placed at the vehicle side. If an EV vehicle is stopped on the road because of battery is dead and there is no charging station around it then a movable charger is the most suitable method for charging that vehicle at that place with less effort and without wasting our time.

Reverse charging protection (RCP):

Many batteries powered applications use diodes for reverse battery protection. However, a diode does not always protect a battery charger.

Fig.3 reverse protection circuit

Sometimes when the battery is fully charged from the solar panel then to have proper protection, inserted backward it can cause a large amount of current to flow through the charging circuitry, possibly destroying both the battery and solar panel. A diode and resistor are placed in series with the battery. The diode in series with the main supply is to block current from the battery into the solar panel. Two resisters are in series with the battery to prevent reverse charging.

ATmega328 Arduino: A microcontroller is the heart of every automation system. It is a small, low cost and self-contained on- chip computer. Microcontrollers usually must have low-power requirements since many devices they control are battery- operated.

Fig.4 ATmega328P

The following parameters are mainly conceded for microcontroller selection:

- Number of input-output pins
- Amount of memory required
- Need for inbuilt ADC & DAC
- Processing speed & capacity
- Power requirement for operation
- Programing language
- Software & hardware tools required

As per our requirements, the microcontroller ATMEGA328P matches perfectly. ATmega328P is a high-performance yet low- power consumption 8-bit AVR microcontroller that can achieve the most single clock cycle execution of 131 powerful instructions thanks to its advanced RISC architecture. It can commonly be found as a processor in Arduino boards such as Arduino Fio and Arduino Uno. ATmega328P is one of the high-performance AVR technology microcontrollers with a large number of pins and features. It is designed with 8-bit CMOS technology and RSIC CPU which enhance its performance and its power efficiency get improved by auto sleeps and an internal temperature sensor. This ATmega328P IC comes with internal protections and multiple programming methods which helps the engineers prioritize this controller for different situations. The IC allows multiple modern era communications methods for other modules and microcontrollers themselves, which is why the microcontroller ATmega328P usage has been increasing every day.

CONCLUSION

Transportation is a major concern in the development of any country. Whereas electric vehicle is the future of the transportation industry. While a lot of research has been done on this topic in the previous decade, a large part of it is yet to be explored. From our project, we conclude that a wireless charging system is implemented by our group. Along with this, a battery management unit is designed, which shows the battery voltage. Battery voltage is measured by the microcontroller & displayed on a 16x2 LCD. We have used inductive coupling technology for wireless power transfer, but it is useful only for low power applications and where the distance between receiving and transmitting coils is less. But for real-world applications, the power requirement is high and the distance between receiving and transmitting coil should also be increased. So for this purpose, Magnetic Resonant Coupling technology is appropriate and suitable. Also, we conclude that the wireless charging method requires more time to charge a battery than the other types of charging methods. Our project only represents the prototype of Automation in the wireless charging of electric vehicle systems.

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