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Solar Wireless Electric Vehicle Charging System

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ABSTRACT: This paper describes the design of solar powered for charging of electric vehicle describes design of solar powered for charging of electric vehicle that solves the key downside of fuel and pollution. Electric vehicles have now hit the road worldwide and are slowly growing in numbers. Apart from environmental benefits electric vehicles have also proven helpful in reducing cost of travel by replacing fuel by electricity which is way cheaper. Well here we develop an EV charging system that solves with a unique innovative solution. This EV charging of vehicles without any wires, No need of stop for charging, vehicle charges while moving, Solar power for keeping the charging system going, No external power supply needed. The system makes use of a solar panel, battery, transformer, regulator circuitry, copper coils, AC to DC converter, atmega controller and LCD display to develop the system. The system demonstrates how electric vehicles can be charged while moving on the road, eliminating the need to stop for charging. Thus the system demonstrates a solar powered wireless charging system for electric vehicles that can be integrated in the road.

KEYWORDS: solar panel , boost converter, battery bank , high frequency inverter circuit , transmitting coil, receiving coil, rectifier coil, motor- 12v

I. INTRODUCTION:

Electric vehicles have now hit the road worldwide and are slowly growing in numbers. Apart from environmental benefits electric vehicles have also proven helpful in reducing cost of travel by replacing fuel by electricity which is way cheaper.

The system makes use of a solar panel, battery, transformer, regulator circuitry, copper coils, AC to DC converter, atmega controller and LCD display to develop the system. The system demonstrates how electric vehicles can be charged while moving on road, eliminating the need to stop for charging.

The solar panel is used to power the battery through a charge controller. The battery is charged and stores dc power. The DC power now needs to be converted to AC for transmission. For this purpose we here use a transformer.

The power is converted to AC using transformer and the regulated using regulator circuitry. This power is now used to power the copper coils that are used for wireless energy transmission. A copper coil is also mounted underneath the electric vehicle. When the vehicle is driven over the coils energy is transmitted from the transmitter coil to ev coil. Please note the energy is still DC current that is induced into this coil. Now we convert this to DC again so that it can be used t charge the EV battery.

We use AC to DC conversion circuitry to convert it back to DC current. Now we also measure the input voltage using an atmega microcontroller and display this on an LCD display. Thus the system demonstrates a solar powered wireless charging system for electric vehicle that can be integrated in the road.

Electric vehicle (EV)

An electric vehicle (EV) is a vehicle that uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels, fuel cells or an electric generator to convert fuel to electricity[4]. EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft. EVs first came into existence in the mid-19th century, when electricity was among the preferred methods for motor

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vehicle propulsion, providing a level of comfort and ease of operation that could not be achieved by the gasoline cars of the time. Modern internal combustion engines have been the dominant propulsion method for motor vehicles for almost 100 years, but electric power has remained commonplace in other vehicle types, such as trains and smaller vehicles of all types[5].

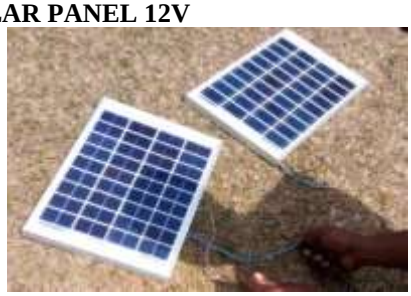
II. LITERATURE REVIEW:

Nikola Tesla was the first who invented Wireless Power Transmission [WPT] technology in 1890.He wanted to create the supply system without use of the wire thus he invented inductive and capacitive coupling system for WPT. he invented coil known as Tesla Coil.

Erhuvwu Ayisire has given the idea related charging system for Electrical vehicle [EV] [2]. N. Uthaya Banu, U. Arunkumar, A. Gokulakannan, M. K. Hari Prasad and A. B. Shathish Sharma has given the knowledge about the battery charging by using solar energy and it also analysed primary and secondary side in detail [1].The most difficult and important part while designing wireless charging system that is designing part of the coil. This paper gives knowledge about the Wireless Charging in Electrical Vehicle by using Solar Energy.

HARDWARE OVERVIEW:

1.SOLAR PANEL 12V



Solar panels are classified according to their rated power output in Watts. This rating is the amount of power the solar panel would be expected to produce in 1 peak sun hour. Different geographical locations receive different quantities of average peak sun hours per day. In Australia, the figures range from as low as 3 in Tasmania to over 6 in areas of QLD, NT and WA.

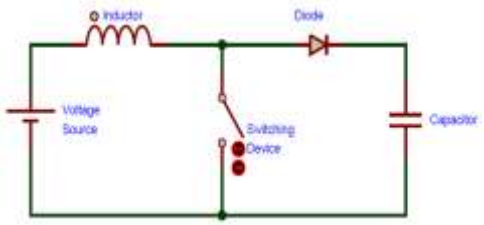
As an example, in areas of the Hunter Valley in NSW, the yearly average is around 5.6. The monthly figures for this area range from below 4.0 in June to above 6.5 in December. This means that an 80W solar panel would ideally produce around 320W per day in June and around 520W per day in December, but based on the average figure of 5.6, it would produce a yearly average of around 450W per day....without taking losses into account.

Solar panels can be wired in series or in parallel to increase voltage or current respectively. The rated terminal voltage of a 12 Volt solar panel is usually around 17.0 Volts, but through the use of a regulator, this voltage is reduced to around 13 to 15 Volts as required for battery charging.

Solar panel output is affected by the cell operating temperature. Panels are rated at a nominal temperature of 25 degrees Celcius. The output of a typical solar panel can be expected to vary by 2.5% for every 5 degrees variation in temperature. As the temperature increases, the output decreases. With this in mind, it is worth noting that, if the panels are very cool due to cloud cover, and the sun bursts through the cloud, it is possible to exceed the rated output of the panel. Keep this in mind when sizing your solar regulator

2 BOOST CONVERTER

A boost converter **is one of the simplest** types of switch mode converter**.** As the name suggests, it takes an input voltage and boosts or increases it. All it consists of is an inductor, a semiconductor switch (these days it's a **MOSFET**, since you can get really nice ones these days), a diode, and a capacitor. Also needed is a source of a periodic square wave. This can be something as simple as a 555 timer or even a dedicated **SMPS IC** like the famous **MC34063A IC.**



3. . BATTERY BANK - 12V

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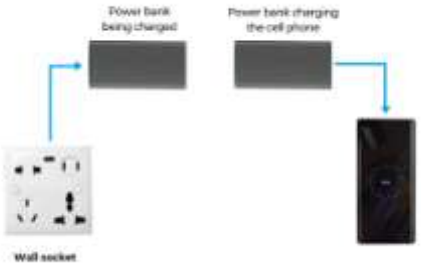
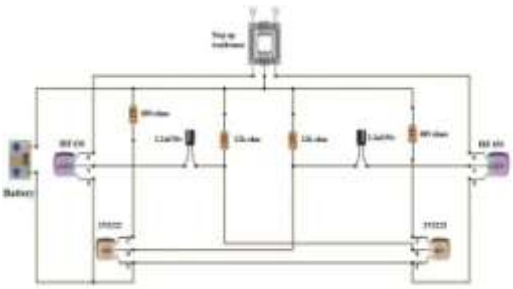


A power bank's built-in battery charges through an external power supply, such as a wall socket, then stores the energy in chemical form. When needed, the battery sends electrical energy to the connected device via the output port. The process consists of three parts: energy absorbing, storing and releasing. It works similarly to a cell phone battery, although a power bank can be more complex and have more functions depending on its design.

4. HIGH FREQUENCY INVERTER CIRCUIT - 12V(DC)/220V(AC)



The circuit can be divided into three parts: oscillator, amplifier and transformer. A 50Hz oscillator is required as the frequency of AC supply is 50Hz.

This can be achieved by constructing an Astable multivibrator which produces a square wave at 50Hz. In the circuit, R1, R2, R3, R4, C1, C2, T2 and T3 form the oscillator.

Each transistor produces inverting square waves. The values of R1, R2 and C1 (R4, R3 and C2 are identical) will decide the frequency. The formula for the frequency of square wave generated by the astable multivibrator is

F = 1/(1.38*R2*C1)

The inverting signals from the oscillator are amplified by the Power MOSFETS T1 and T4. These amplified signals are given to the step-up transformer with its center tap connected to 12V DC.

5. TRANSMITTING COIL-36 TURNS

6.DC Motor:

Geared motors can be defined as an expression of DC motor which already had its insight details are here. A geared DC motor has a gear assembly attached to the motor. The motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps to increasing the torque and reducing the speed. Using the correct combination of gear in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduces the speed of the vehicle but increase its torque is known as gear reduction.

Methodology:

1. Gathering & processing all information related to the system by studying various journals, research papers, books, articles etc
2. Colecting all hardwares
3. Software Designing
4. Assembly of all parts
5. Trial on manufactured machine
6. Interpretation of results

Wireless Charging System Working:

System Description

Across an application space that spans power levels from less than a watt to multiple kilowatts, a wireless energy transfer system based on HR-WPT often has a common set of functional blocks. A general diagram of such a system is shown in figure

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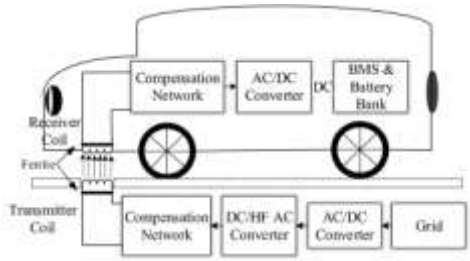

Fig.- Block diagram of a wireless electrical vehicle charging system.

Progressing from left to right on the top line of the diagram, the input power to the system is usually either wall power (AC mains) which is converted to DC in an AC/DC rectifier block, or alternatively, a DC voltage directly from a battery or other DC supply. In high power applications, a power factor correction stage may also be included in this block. A high efficiency switching amplifier converts the DC voltage into an AC voltage used to drive the source resonator. Often an impedance matching network is used to effectively couple the amplifier output to the source resonator while enabling efficient switching-amplifier operation. The IMN serves to transform the source resonator impedance, loaded by the coupling to the device resonator and output load, into such an impedance for the source amplifier. The magnetic field generated by the source resonator couples to the device resonator, exciting the resonator and causing energy build-up. This energy is coupled out of the device resonator to do useful work, for example, directly powering charging a battery.

In fact, wireless charging is almost essential for the deployment of autonomous vehicles where there may not be anyone around to connect a wired charger for otherwise add fuel

ADVANTAGES

- 80% reduced operating cost than equivalent gas powered vehicles.
- Lower maintenance costs than gas powered vehicles.
- Pollution free. Zero recharging time and unlimited range (when operating on an electric road)
- Light weight vehicles.
- A number of devices can be charged at a time
- Electrically safe
- Low maintenance cost
- Charging is convenient

DISADVANTAGES

- Initial installation cost is high.
- Working area is limited.
- Heat generation is more than traditional charging.

III. CONCLUSION:

Through the analysis and comparison of the wireless charging system, it can be found that when the effective radius is equal, the square coil can produce more mutual inductance than circular coil. The output characteristics of the secondary side can be improved when the number of the primary coil is increased in a certain range. The structure of the original coils can also improve the safety of the inductive charging system. When the coil is aging, we should just replace one parallel branch of them. But when the number of primary winding is increasing, the frequency splitting will happen. Through the analysis, it can be found that the reason of frequency splitting includes the change of quality and coupling coefficient. When the structure of the primary winding is changed, the coupling coefficient of the whole system is also changed so that the frequency splitting will happen. The structure of multiple primary winding is used in many fields. When the structure of multiple primary winding is used, the load resistance and the number of the primary winding should be carefully thought about. The results of this paper on electromagnetic inductive coupling are important for promoting the development of wireless charging technology for electric vehicles

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