Charging Devices Using Wireless Transfer of Solar Power

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Abstract- *Mobile portability has proved to be a major problem as it is power hungry. The mobile devices need to be charged on a regular basis. The present available system to generate the electricity for charging mobile devices in a vehicle is by using the alternator connected to the axel of that vehicle, which increases fuel consumption of the vehicle. This paper proposes a system where the solar panel with a sun tracking algorithm is fitted on the roof of the vehicle and the received power is transmitted through a module. At the receiving end the system makes use of a battery that stores the charge to which the mobile device can be connected and charged while travelling.*

The module uses an electromagnetic field to transfer electric energy between a transmitter circuit and a receiver circuit. This system is mainly focused on reducing the fuel consumption in vehicles and to increase and encourage the use of renewable energy. Thus, making mobile devices truly portable.

Keywords- Wireless power transfer, solar power, Electromagnetic field, Mobile charger, MPPT.

I. INTRODUCTION

Food, shelter and clothing had always been the basic need of man. But in today's era mobile devices like cell phones, tablets, laptops etc…have also been introduced as a basic need. Unlike food, shelter and clothing; the fourth need is power hungry and need to be charged on a regular basis.

A power source is hard to find when travelling in a vehicle. The charging ports available in vehicles do not provide a constant voltage to the mobile device and it also increases fuel consumption.

The present system makes use of a cigarette lighter port to charge devices. The device requires 1-3Amps while the cigarette lighter ports provide up to 10Amps.This can result in overheating, slower intake of charge and damage to the internal components. Another drawback to this method is the draining of the car battery. The USB port used for charging might provide less electricity than what is required by the mobile which might damage the mobile battery.

Renewable energy, even though freely available, is not widely popular This proposed model makes use of solar energy to charge mobile devices. The solar panel mounted over the roof of a vehicle, say a car, makes use of MPPT which is an algorithm for sun tracking. MPPT stands for maximum power point tracking and this algorithm extracts maximum power from the solar panel.

The power received from the solar panel is transmitted via a module using electromagnetic field. At the receiving end, a battery stores the charge which is then used to charge the devices inside the vehicle.

Light Dependent Resistors or LDR's are programmed with the help of an Arduino board to execute the MPPT algorithm. The wireless power transfer module uses the current safest and most efficient method of electromagnetism.

II. EXISTING SYSTEM

What started in the 1880's as a simple tool to light cigars evolved into the present cigarette lighter receptacle used to supply power to charge accessories in an automobile. Some of the devices that make use of this port are music players and mobiles.

The main components for this system include an alternator, a voltage regulator and an interconnecting wire. The alternator produces an alternating current which is then converted to Direct current within the alternator itself. The voltage regulator periodically regulates the voltage that is produced by the alternator. The movement of the alternator is dependent on the car battery or the fuel itself.

Plugging any device into the USB port in a vehicle can drop the mileage by 0.013kmpl. This number might seem small, but on adding the contribution of other accessories in the car like headlights and AC, we arrive at the conclusion that charging anything in the vehicle has a major cost in fuel.

As it is common knowledge that fuel consumption is directly related to carbon dioxide emission, the 0.013kmpl amounts to about 970,00 tons of Carbon dioxide in a year when taking into consideration all the vehicles in India.

III. PROTOTYPE CONSTITUENTS

The components used in this module are simple, easily available and practical. Below we have a detailed description of each component used.

1. Monocrystalline solar panel

Photovoltaic solar panels make use of renewable energy to generate electricity. A PV module is an array of PV solar cells that generate and supply solar electricity for commercial and domestic use. Since a single module produces only a small amount of power, multiple modules are used.

There are two types of solar panels-monocrystalline and polycrystalline. This system makes use of the former. These monocrystalline panels are space efficient, have long life-span, tend to be much more efficient than polycrystalline solar panels.

Figure 1. Monocrystalline solar panel

2. Arduino Uno R3

The microcontroller board has 14 digital input or output pins, 6 pins for analog input, 16MHz quartz crystal, a power jack, a reset button, USB connection and an ICSP header. The Arduino Uno is programmed to control the servo motors based on the input of the LDRs. This is the entire sun tracking system.

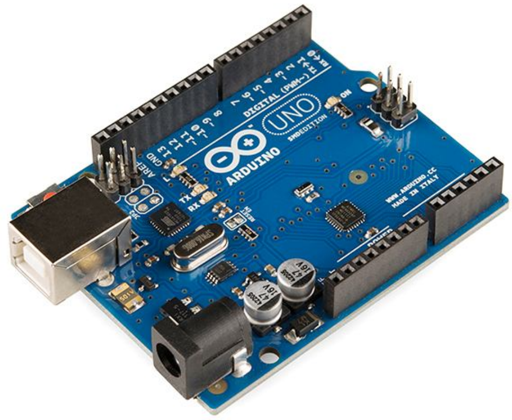

figure 2. Arduino Uno R3

3. LDRs

LDRs or Light Dependent Resistor is a variable resistance component. The resistance of the LDR changes with the intensity of the light that falls on it. This makes them useful in light sensing applications.

The LDR resistance falls with an increase in the intensity of the light that falls on it.

Typical values of LDR resistance are
Daytime: 5k Ω
Dark: 20M Ω

The LDR helps in implementing the sun tracking algorithm to achieve maximum power.

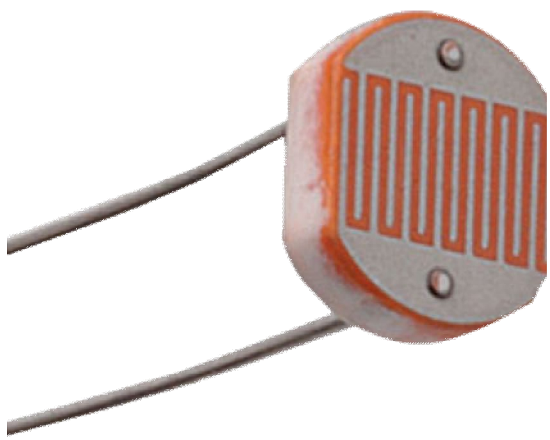

Figure 3. LDR

4. 9g Micro Servo Motor

Servo motors are small in size and light weight and provide high output power. They can approximately rotate 90 degrees in each direction. The servo motors can be coded easily. Two servo motors are used, one placed horizontally and one vertically. Each motor contributes 180 degrees making the entire module capable of rotating 360 degrees.

Figure 4. 9g Servo Motor

5. Wireless Power Transfer Module

The wireless power transfer module consists of a transmitter circuit and a receiver circuit and can be used for close wireless charging or power supply.The transmitter input voltage is 12V DC and the receiver output is 5V DC.

This system makes use of electromagnetic field for wireless transfer of solar power.

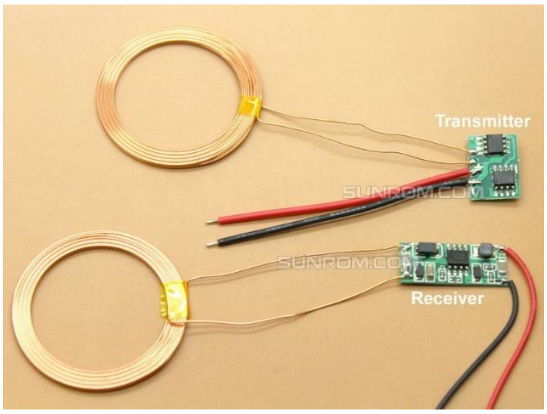

Figure 5. Wireless Power Transfer Module

6. Rechargeable Batteries

The lithium-ion battery is a rechargeable battery used to store charge in the form of a load which can be discharged and recharged multiple times. It accumulates and stores energy through a reversible electro-chemical reaction. For this paper we use the 3.7V lithium ion battery.

7. 18650 Lithium battery protection modules

The lithium battery used tends to overheat and discharge rapidly leading to loss of efficiency. To avoid the battery from overcharging and any other damage, a battery protection module is used.

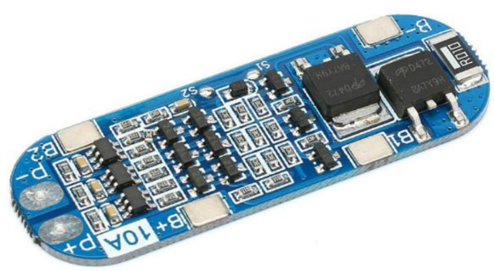

Figure 6. 18650 Lithium battery protection module

IV. WORKING

- The solar module is mounted on the roof of a vehicle. The transmitter is connected to this solar module. The receiver circuit is placed inside the vehicle.
- The solar panel convers the light incident on the PV cells into electrical energy.
- The sun tracking algorithm ensures maximum power.
- The power is then transmitted using electromagnetic field over a small distance.
- The receiver placed inside the car receives the power transmitted and stores it in a battery.
- The battery used is a rechargeable one which discharges the load into 3 ports to which the mobile cables can be connected.

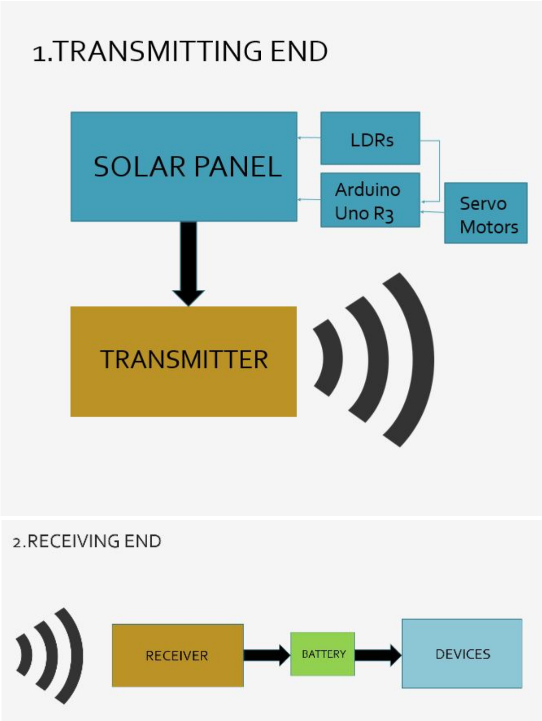

Figure 7. basic block

V. PROTOTYPE BUILDING/RESULTS

The main objective of this system is to find an easy yet effective way to charge mobile devices using an easy combination of hardware and software. The entire module is divided into 3 parts. The said parts are explained below.

1. The Solar Module

The solar module consists of a solar panel, LDRs, servo motors and an Arduino board. The LDRs are fitted at the corners of the panel and are connected to the Arduino in a voltage divider fashion. There are two servo motors used, one for the horizontal movement and one for the vertical movement. This entire module expresses the sun tracking algorithm.

2. Wireless Power Transfer Module

The transfer board has two IC's which help with the transfer of the power. The receiving end consists of an IC that helps receive the maximum power after facing loses.

3. The Receiving End

This bit of the entire module consists of a battery and the female USB port to which the mobile devices are connected. The battery charges from the receiver. Lithium ion batteries are used to increase the efficiency.

VI. FUTURE WORK

The two main focuses of the presented system are solar power and wireless power transfer, both of which have untapped potential. Dire need to use renewable energy has given a new era and meaning to the use of solar powered technology. With the advancements in technology and ease of life, wireless power transmission is being adapted in all walks of life.

With the advancement of the suggested module, in the future it can be used to drive ACs in cars, power headlights hence increasing fuel efficiency and reducing the strain on the environment.

The suggested systems can also be modified and used for domestic use such as in smart homes. Thus, encouraging safe energy use and a decline in pollution rates.

VII. CONCLUSION

We proposed a system for wireless power transfer to charge the mobile devices. The system consists of solar panel, Arduino based microcontroller board, transmitter and receiver module. The power transmitted by the Tx coil is coupled with the Rx coil. At receiving end, we have a battery whose power is used to charge the mobile devices.

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