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Solar Power Wireless Charger

Mr.R.Manickam[1] ,R.Ajithkumar[2],A.Vengadesh[3],B.Vinoth raja[4],K.Arun[5],

[1]*Assistant professor, Department of Mechanical , Indra Ganesan college of Engineering, Anna University, Chennai,*

[2]*Department of Mechanical, Indra Ganesan college of Engineering, Anna University, Chennai,*

[3]*Department of Mechanical, Indra Ganesan college of engineering, Anna University, Chennai,*

[4]*Department of Mechanical, Indra Ganesan college of Engineering, Anna University, Chennai,*

[5]*Department of Mechanical, Indra Ganesan college of engineering, Anna University Chennai.*

Address

[1]rmanic1996@gmail.com
[2]ajithkumarpka3@gmail.com
[3]vengades2209@gmail.com
[4]flourinevinoth@gmail.com
[5]arunajin82@gmail.com

***Abstract*— In today's environment conscious world, a lot of interest is being taken in alternate forms of energy. Solar power is a renewable source of energy, which has become increasingly popular in modern days. Wireless charging is a type of charging method which uses an electromagnetic field to transfer energy through electromagnetic induction. Energy is transferred between devices (transmitter and receiver) through the process of mutual induction. With the help of wireless battery charger technology, power can be supplied to the electric cars, drones, hospital's equipment, and smartphones. This device also helps to reduce the necessity of using wires.**

***Keywords*— solar panel; wireless charging; Inductive coupling.**

I. INTRODUCTION

Solar energy is a very environment-friendly power source and one type of renewable energy. Wireless charging is an emerging technology now a days. Solar panel uses photovoltaic cells that convert light energy from the source of light into electricity. This renewable energy can be used for various purposes, i.e. to run the home appliances, to operate machines and motors. The same magnetic field produces current within the receiver coil. This current is converted into usable DC current.

The solar or photovoltaic system is a very effective energy resource that has established a great impact on the society and industries. In remote areas, it is quite difficult for people to charge their devices because of unavailability of electricity. In this study, an inductive coupling has been used which creates a magnetic field between two objects and transfers energy from source to receiver. With this energy, the battery can be charged without any physical connection. Solar devices can attain high energy densities when used in direct sun compared to other sources, but it does not function without light (e.g., highly shaded areas, ducts). We have used photovoltaic cell as the source of electricity in our proposed device. Further due to the safety issues raised by RF exposure, radio frequency based wireless charging operates in a low power region. Inductive charging is based on mutual induction concept where magnetic field couples between two coils. Also the magnetic field of an electromagnetic wave attenuates much faster than the electric field hence the power transfer distance is largely limited. Due to safety and implementation the inductive charging is used in our day today life.

II.

III. LITERATURE REVIEW

[1] ***ABU SHUFIANN*** A battery of an electronic device will be charged wirelessly. The solar panel converts the sun light into electrical energy. Power from a solar panel is sent through a transmitter circuit and received by a receiver circuit wirelessly based on Faraday's law of induction. It will be a future charging solution in the modern world. With the help of wireless battery charger technology, power can be supplied to electric cars, drones, hospital's equipment, and smartphones.

[2] ***HARI MOHAN RAJ*** This is special kind of charging system in which there is no need of any kind of communication wire to connect the power supply to charge it. The

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device can charge smartphones or smart devices wirelessly in a short range of distance. This device depletes the use of cables, no need to sit around the phone and cable in a very specific position just to make it charge.

[3] *GILBURT L CHIANG* Develop a miniature solar panel to be installed onto the cell phone itself. This way, the phone can charge independently; independent of power outlets and independent of wires. There won't be any need for electrical outlets or portable solar panels. The mobile phone will be able to charge anywhere outside or where it is exposed to sunlight.

[4] *KUMARSWAMY GM* Wireless charging is a type of charging method which uses an electromagnetic field to transfer energy through electromagnetic induction. Energy is transferred between devices through the process of mutual induction.

[5] *MOHAMAD ASIF* In all most all the countries mobile phones are the most popular form of communication. The number of mobile users will surpass 5 billion in 2017 and the number is growing technology is getting better and cost of production also lowers. Solar phone chargers use small solar panel to absorb light. This process still forces customers to carry another device along with their cell phone.

[6] *AMRA FATHIMA* Solar power is a renewable source of energy, which has become increasingly popular in modern days. Today 80% of the energy we use comes from fossil fuels and 1% comes from solar energy. Solar energy has two big advantages over fossil fuels. In solar power energy can be produced only inn the presence of sunlight.

[7] *ELIZABETH DE REGT* Designed a small charger panel and the associated circuitry to eliminate the need to cut the solar cells, getting the appropriate voltage and power output through a DC-DC step-up converter. We designed a final prototype that should be able to charge any of the commonly used local phones in 10-12 hours of direct sunlight.

IV. METHODOLOGY AND MODELING

Wireless power transmission means transferring power without physical wire. Transmission is possible for inductive coupling. The system implementation is done in two parts, one is transmitting side and another one is receiving side. At the receiver end, a typical battery is connected. Finally, the battery will be charged. Part by part implementation has been described below

- Make sure your phone is compatible.
- Remove all objects, especially metal or magnetic objects, from charging pad or pocket.
- Place mobile device face up on the symbol molded into the charging pad or pocket.
- Move the mobile device slowly until a charging icon displays on the infotainment system's display screen.

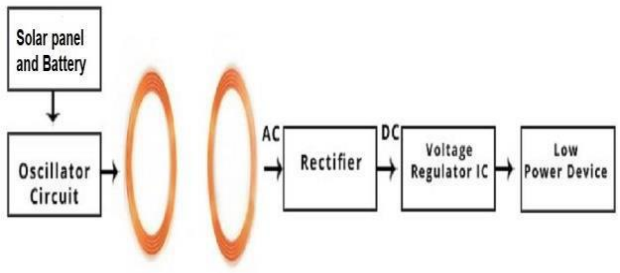

fig.1 Block diagram of solar based wireless charging

3.1 SOLAR PANELS

Simply put, a solar panel works by allowing photons, or particles of light, to knock electrons free from atoms, generating a flow of electricity. solar panels actually comprise many, smaller units called photovoltaic cells. (Photovoltaic simply means they convert sunlight into electricity.)

During the hardware implementation portion, a storage device is required to store the produced energy by photovoltaic cells. A battery is a common storage device which is used to store electrical energy produced by photovoltaic cells. To charge a battery by using a solar PV, a charge controller is an important device. Therefore, it will be necessary to connect a charge controller in series between the solar panels and the battery.

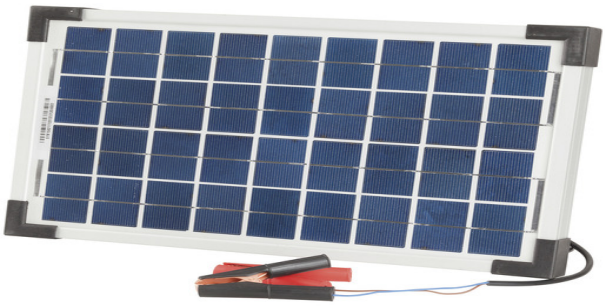

fig.1 Solar panel

3.2 CHARGE CONTROLLER

A charge controller or charge regulator is basically a voltage and/or current regulator to keep batteries from overcharging. It regulates the voltage and current coming from the solar panels going to the battery. Most batteries need around 14 to 14.5 volts to get fully charged.

A charge controller, charge regulator or battery regulator limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and may protect against overvoltage, which can reduce battery performance or lifespan and may pose a safety risk.

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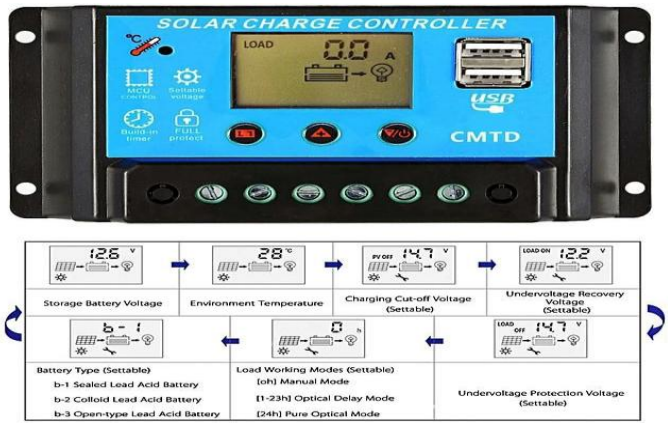

Fig.2 Charge controller

3.3 BATTERY

Working Principle of Battery. A battery works on the oxidation and reduction reaction of an electrolyte with metals. ... As a result of the oxidation reaction, one electrode gets negatively charged called cathode and due to the reduction reaction, another electrode gets positively charged called anode.

In most car batteries you have six cells, and therefore a 12-volt battery. The plates are submerged in lead acid that triggers a reaction between the two plates. ... The result is a chemical reaction that produces electrons. The electrons race around the plates and generate electricity.

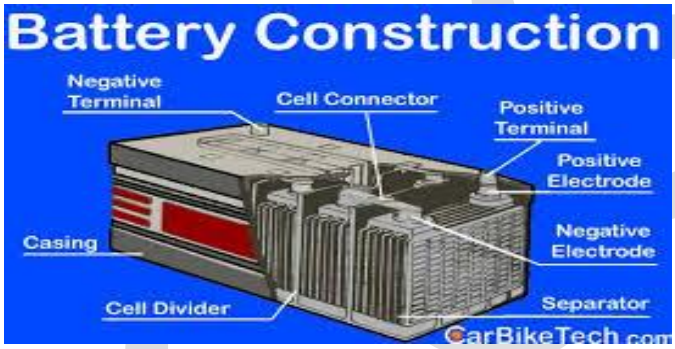

fig.3 Battery

3.4 TRANSMITTER

In electronics and telecommunications a transmitter or radi o transmitter is an electronic device which produces radio waves with an antenna. The transmitter itself generates a radio frequency alternating current, which is applied to the antenna. When excited by this alternating current, the antenna radiates radio waves.

Transmitters are necessary component parts of all electronic devices that communicate by radio, such as radio and television broadcasting stations, cell phones, walkie-talkies, wireless computer networks, Bluetooth enabled devices, garage door openers, two-way radios in aircraft, ships, spacecraft, radar sets and navigational beacons. The term transmitter is usually limited to equipment that generates radio waves for communication purposes; or radiolocation, such as radar and navigational transmitters. Generators of radio waves for heating or industrial purposes, such as microwave ovens or diathermy equipment, are not usually called transmitters, even though they often have similar circuits.

fig.4 Transmitter

3.5 RECEIVER

Receiver section basically consists of receiving inductor coil, bridge rectifier, voltage regulator and rechargeable battery. The AC signal received by the coil should be converted into DC signal it is done by bridge rectifier and voltage form the bridge rectifier is unregulated and this should be converted into regulated constant voltage, voltage regulator IC 7805 is used to convert the unregulated DC voltage to regulated constant DC voltage.

Fig.1.5.1 Receiver

3.6 REGULATOR IC 7805

A voltage regulator IC maintains the output voltage at a constant value. 7805 Voltage Regulator, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides.

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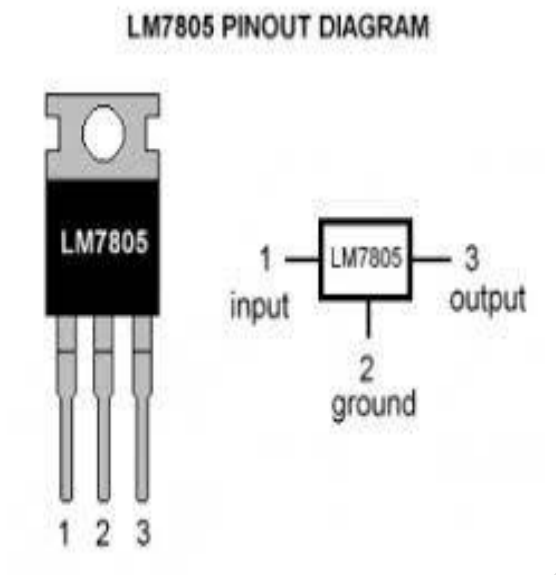

fig.6 pinout diagram

3.7 PRINTED CIRCUIT BOARD

A printed circuit board, or PCB, is used to mechanically support and electrically connect electronic components using conductive pathways, tracks or signal traces etched from copper sheets laminated onto a non-conductive substrate.

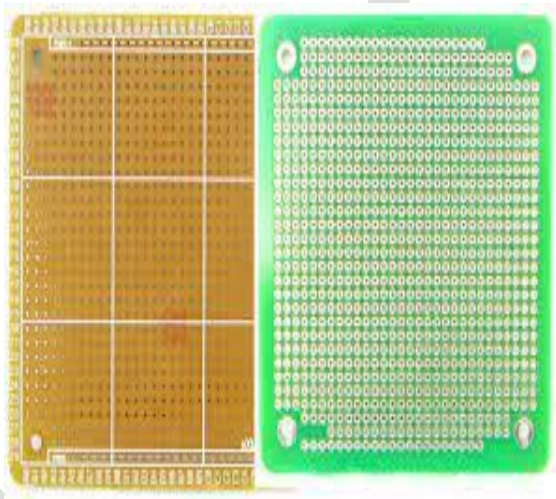

fig.7 printed circuit board

3.8 MICRO- FARAD 10

A capacitor of capacitance `10 mu F` is charged to a potential `50 V` with a battery. The battery is. A capacitor of capacitance `10 mu F` is charged to a potential `50 V` with a battery. The battery is now disconnected and an additional charge `200 mu C` is given to the positive plate of the capacitor.

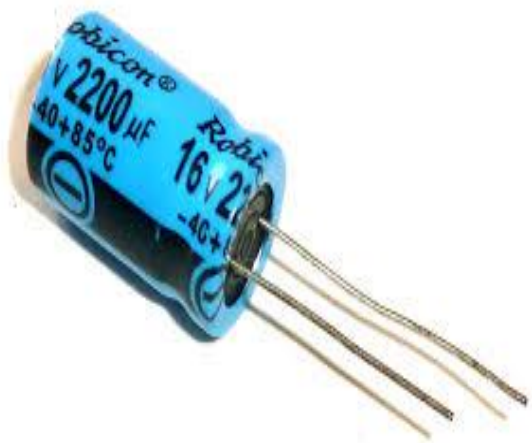

fig.8 micro farad 10

3.9 MICRO- FARAD 0.1

µF means microfarad. Farad is the condenser unit, since its very large unit therefore smaller units such as microfarad, nano farad and pic farad are used. 400 V, 2.2 µF means that it is safe to use this condenser up to 400 times and its capacity is 2.2 µF.

fig.9 micro farad 0.1

1.10 USB PORT

Stands for "Universal Serial Bus." USB is the most common type of computer port used in today's computers. It can be used to connect keyboards, mice, game controllers, printers, scanners, digital cameras, and removable media drives, just to name a few.

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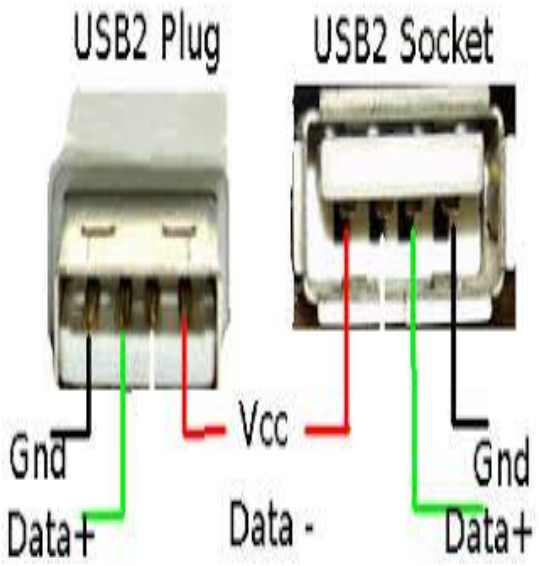

fig.10usb port

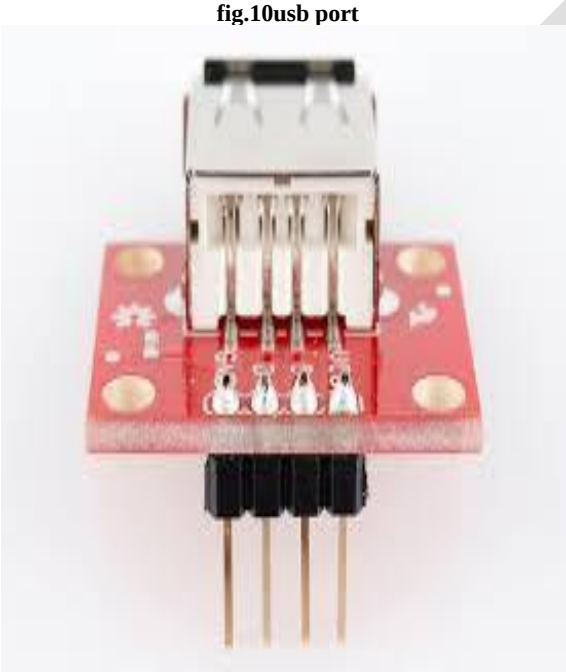

fig.11 (12volt to 5volt converter)

V. WORKING PRINCIPLE

The proposed device is mainly works on the principle of mutual inductance. Power is transferred from transmitter to receiver wirelessly based on the principle of "inductive coupling". Inductive coupling is nothing but phenomena of mutual inductance. Mutual inductance is the occurrences in which, when a current carrying conductor is positioned near another conductor, voltage is induced in that conductor. This is because, as the current is flowing in the conductor, a magnetic flux is induced in it. This induced magnetic flux links with another conductor and this flux induces voltage in the second conductor.

VI. MATERIAL SELECTION

Equipment	Capacity	Quantity
Solar panels	12v, 15w	2
Charge controller	12v, 20 w	1
Battery	7amp, 20hrs	1
Transmitter pad	5v	1
Receiver pad	5v	1

VII. RESULT AND DISCUSSION

The table 1 indicates the time taken to fully charge the battery using the solar panel at different times on a day in summer 5.

Table 6.1Time required charging a battery

Around 7am (morning)	2 hours
Around 10am (morning)	1 hours 15 minutes
Around 1pm (noon)	35 minutes
Around 5pm (evening)	1 hour 35 minutes

The table 2 shows the voltage across the solar panel at various times on a day. The following readings were taken on 26th March 2021(day was cloudy).

Table 6.2 Voltage across solar panel

Time	Max. Voltage (in V)	Time	Max. Voltage (in V)
6am	2	1am	14
7am	3.5	2am	14
8am	6	3am	10
9am	9	4am	8.5

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10am	10	5am	6
11am	12	6am	3
12am	13	7am	1.5

6.1 TESTING

Once the solar cell phone charger prototype was completed, it was necessary to test its real life performance. Our main goal at the beginning of this project was to have a cell phone charger that could charge a fully discharged cell phone in less than 6 hours. To test if our model could fulfill this task, we measured the power coming out of our circuit and into the cell phone and compared it to the energy capacity of the battery we were charging.

6.2 CHARGING TIME

The energy capacity of the cell phone batteries is 800 mAh. If we test the amperage output of our charger, we could figure out around how long it would take for the cell phone battery to charge completely.

6.3 FUTURE SCOPE

- Solar energy can only be harnessed when it is daytime and sunny. To overcome this, solar panels can be coupled with back-up battery which can store the excess power generated during the day and use it to provide energy to system in the absence of sunlight.
- The Lead-acid battery used in the design is large in size and heavy in weight which makes the device non-portable. Hence a battery of pocket size and optimal weight may be designed to make the device portable.
- The large size of the solar panel makes the device bulky and non-portable. The solar panel should be fabricated to cover the entire device, which can effectively reduce the size of the entire device.

Fig 17 wireless charger setup

VII. CONCLUSION

Solar power wireless charger can charge the battery very efficiently without any wire. This wireless charging system is ideal to use for many portable devices such as mobile phones and other wireless applications. This study is based on solar power and wireless technology. So during load shedding and traveling, electronic devices can be easily charged without any wire and charger. This system is actually very efficient and environment friendly.

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