DESIGNING A LAPTOP CHARGING SYSTEM BY USING SOLAR PANEL

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ABSTRACT: Power is one of the most important factors for a developing country like Bangladesh. Like the rest of the countries of the world, the demand for power is increasing day by day in our country. Power failure has become an acute problem for rural areas. The sluggish industrialization which has hindered development activities is apprehended to create a negative impact on employment and consequently on the people's livelihood. Now-a-days to ensure a greener world and healthy environment for human being the use of renewable energy is given much importance than conventional energy sources. In this project we have developed a system which will be mainly used in rural areas. It is mainly a renewable energy based project. The project contains a 20W solar panel, a 150W inverter, a digital charge controller and a rechargeable battery. As we know a laptop or note book is a very important thing in e-education. So our main goal is to charge a laptop or note book without using any external battery.

KEYWORDS: solar panel, charge controller, inverter.

I. INTRODUCTION

Solar panels a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. In off grid region, it is very difficult for the students to get accounted with modern technologies for learning due to lack of electricity. A laptop powered by access to modern learning methods. By using a laptop we can introduce the modern education. But in of grid region where electricity can hardly pass, it is impossible to using a laptop or notebook without charging. So by using the solar energy we can easily charge a laptop or notebook. But the main problem of our typical solar photovoltaic system is that it consists an externally battery which cost a lot. As a result the total system becomes expensive. And it becomes almost impossible for the consumers to purchase the expensive system. By eliminating the external battery we can make the whole system less costly, simpler and more efficient. There is also an internal battery inside the laptop so by charging this internal small battery through solar electricity we can easily operate the electronic based education because in day time when the sunlight is available then the laptop can operate through this current and when the sunlight is not available then the laptop can consume power from the internal batter. And in this way we can provide the modern technology in the remote corner of this country.

II. METHODOLOGY AND SIMULATION

Design:

The main purpose of this work is to reduce the externally battery and charge a laptop. This design can be form into two ways. These two designs are given below:

Design 1:

In this system we can see that there is a battery in the system. Actually this battery is a portable battery that can give us a fixed voltage, without any fluctuation. From the above design we can see that the panel connection goes into the digital solar charge controller, and then the output connection of solar charge controller goes into the 12V8.2AH/20HR battery, that will control the voltage fluctuation.

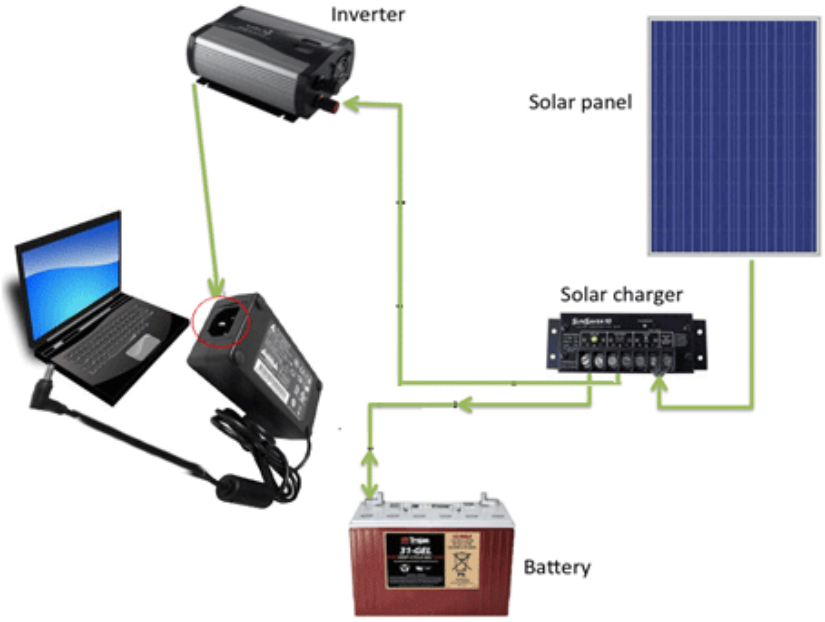


Figure: Design of system 1.

Then the supply port of the battery is connected to another port in the charge controller which called load port. And then a connection is connected with the inverter that converts the DC current into AC current. And a connection goes from the inverter which is connected to the notebook or laptop.

Design 2:

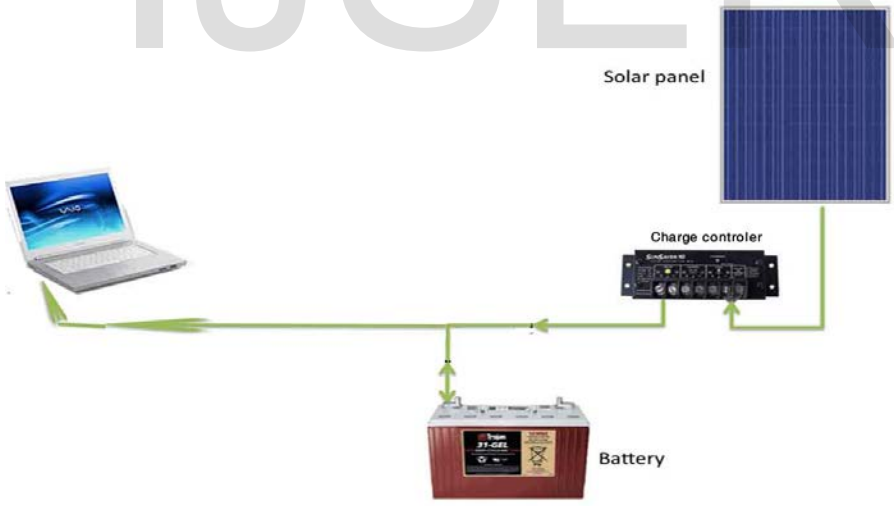


Figure: Design of system 2

In this system we can only use the solar charge controller and portable battery. Laptop or notebook operates with DC current, so if we can reduce the voltage fluctuation then we can charge a laptop/notebook very simply through the above design.

Circuit diagram of full-bridge inverter:

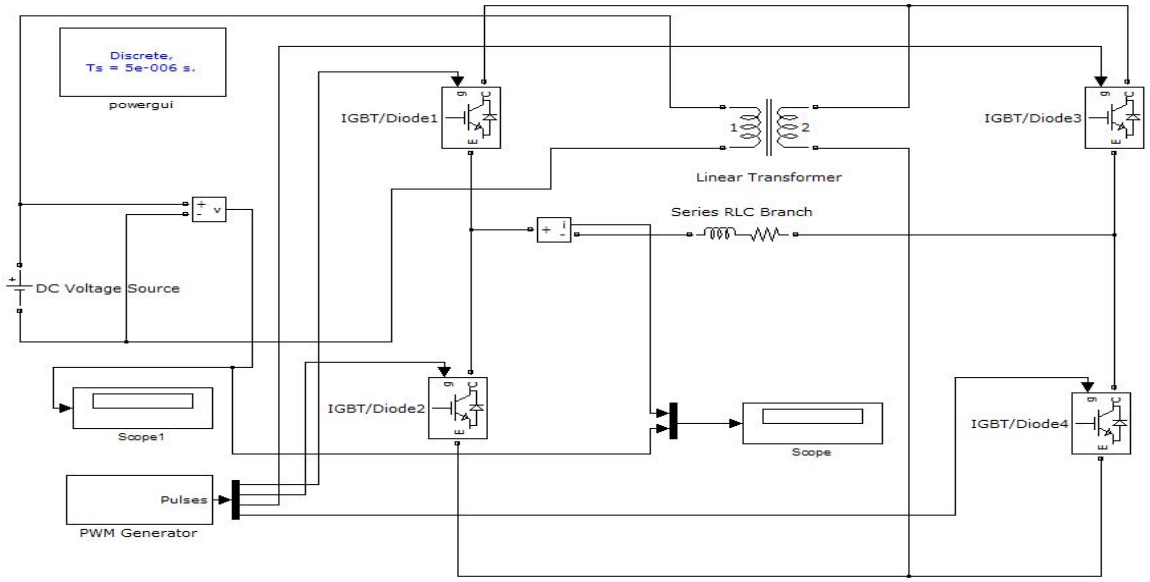


Figure: Circuit diagram of a full bridge inverter

Output of full-bridge inverter:

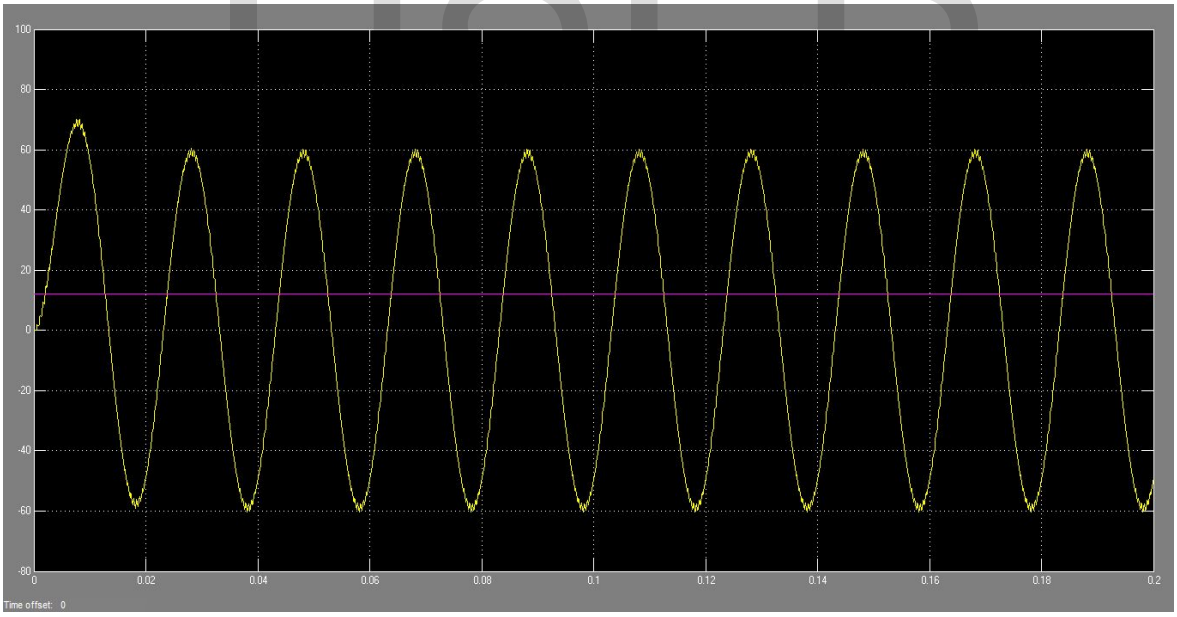


Figure: Output of a full-bridge inverter

Simulation of charge controller using protease:

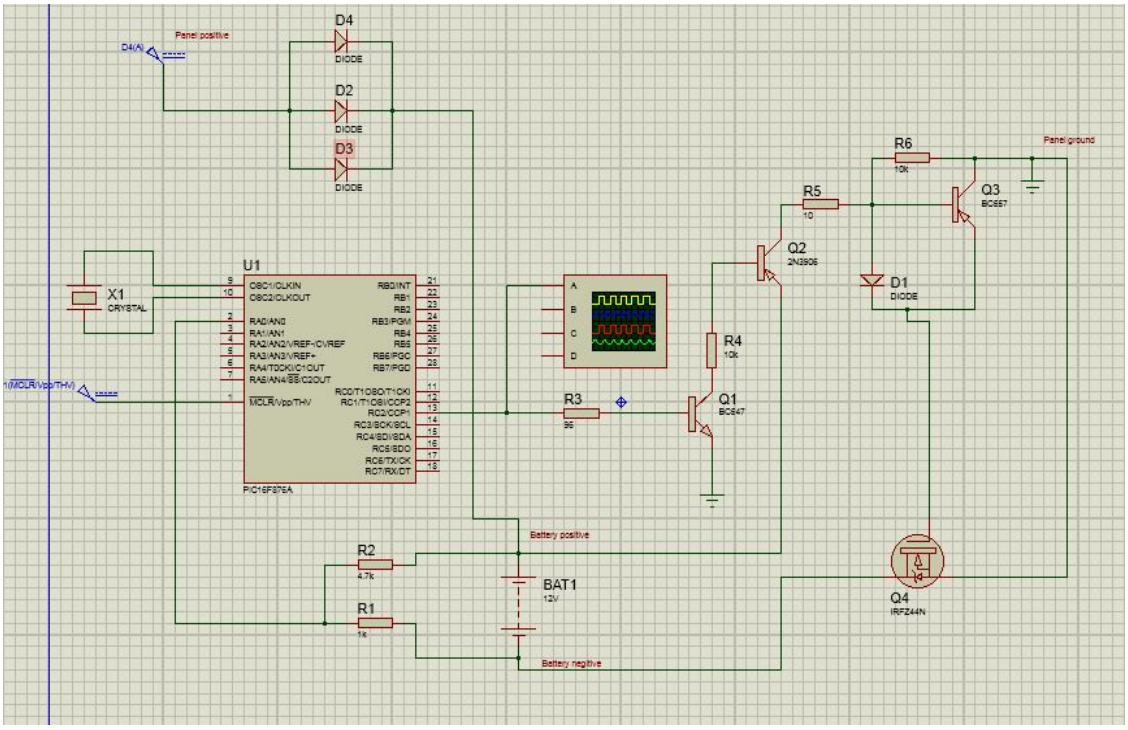


Figure: Simulation of charge controller

***Output of charge controller*:**

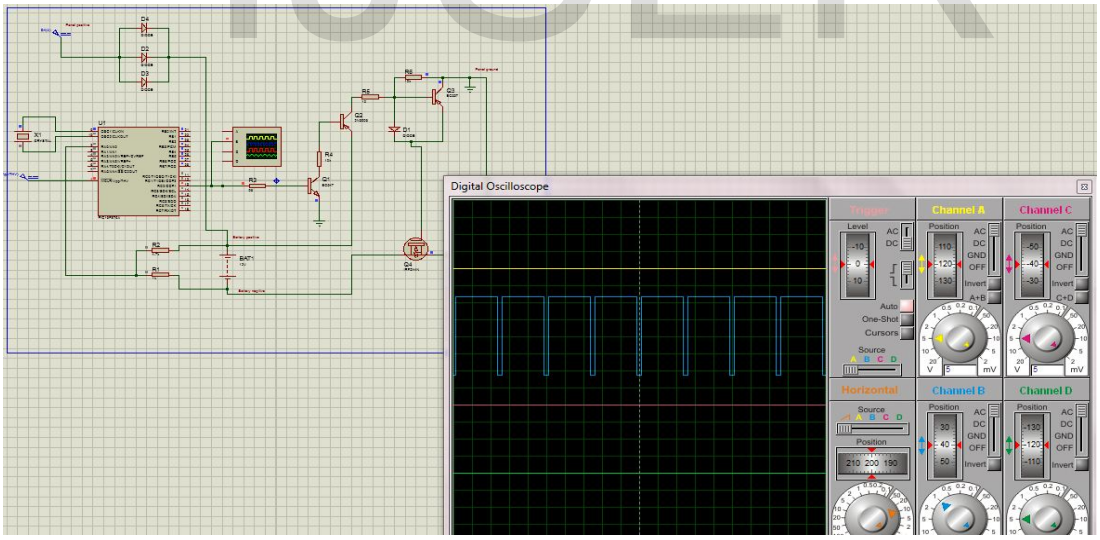


Figure: Output of charge controller

III. EXPERIMENT AND RESULTS

Experiment:

The whole experimental view is given below.

Figure: Implemented design.

In this experiment here use a 20W mono crystalline solar panel, a 150W inverter, a portable battery, and a charge controller. The description of this purchased equipment is given below:

Solar panel:

It is a 20W mono crystalline solar panel. The panel collected from GTL. Its cells are made in Germany. And its model no is GTL20-18-P. The ratings of this panel are given below

Maximum power (Pmp)…… 20W

Open circuit voltage (Voc)……21.6V

Short circuit current (Isc)……1.27A

Voltage at maximum power (Vmp)……17.35V

Current at maximum power (Imp)……1.15A

Module weight……2Kg

Figure: 20W solar panel

Solar charge controller:

In this experiment a microcontroller based solar charge controller is used. Its model no is CHCC-2014. Its properties are given below

Figure: Solar charge controller

- *RISC Micro-controller based design.*

- *LED indications-over load, Charging, Load Off.*
- *12V/24V Auto detection.*
- *Pulse charging technique.*
- *Fully solid state switching.*
- *Capacity:12V/24V-10A/20A*

Inverter:

In this experiment here use a power inverter. And its features are given below

- ✓ *DC to AC, modified sine wave.*
- ✓ *All-auto protects, safe reliable.*
- ✓ *Volume is small, High Efficiency.*

Figure: 150W inverter

Adapter:

In this experiment here use a dell laptop charging adapter. The configuration of this is given below

- ✓ *CN-0928G4-72438-09G-7C25-100*
- ✓ *Made in China.*

Figure: Adapter

Rechargeable battery:

In this experiment here use a 12V 8.2 AH/20 HR battery. Its initial current is 2.4 MAX. And its voltage regulation is 13.5-13.8V (stand-by-cycle).

Figure: Rechargeable battery.

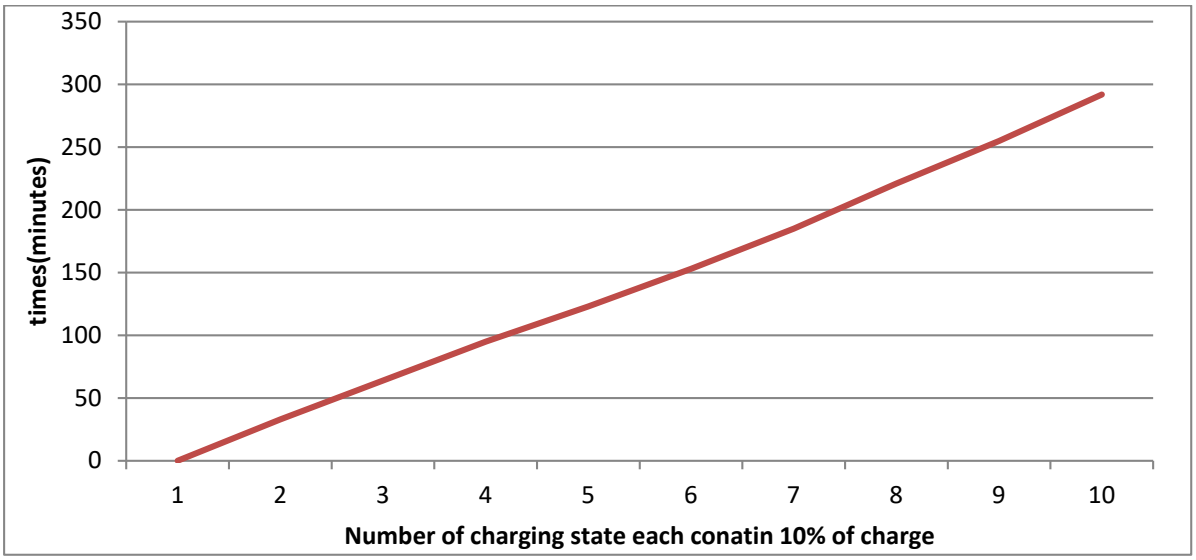
Table of charging state of battery:

Table: Charging state of battery

Percentage of charge	Times (minutes)
0-10	0
10-20	33
20-30	31
30-40	31
40-50	28
50-60	30
60-70	32
70-80	36
80-90	43
90-100	37

Graph of charging state of battery:

Table: Charging states



Bar diagram charging state:

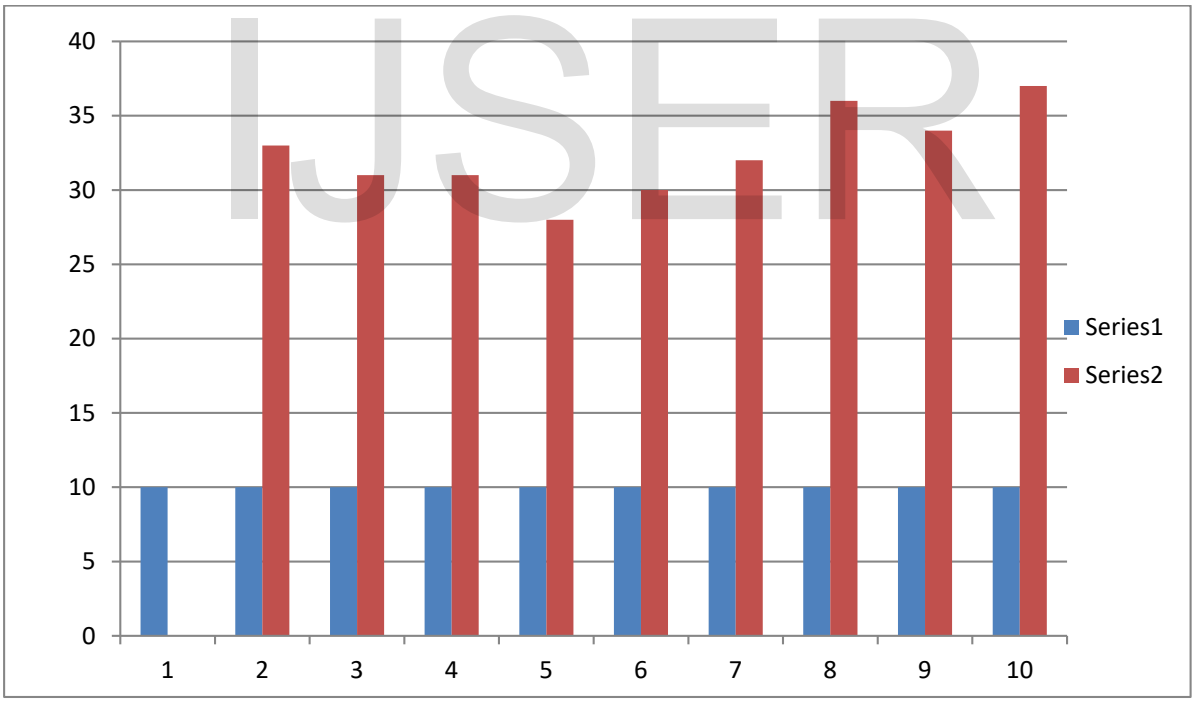


Figure: Bar diagram charging state

Series 1: each state of 10%charge and Series 2: times (minutes) required to each state of charge

Using all this equipment's and finally get the desired result. And calculate all the currents in different time. And we take the time duration very carefully.

IV. CONCLUSION

As we all know fuels are limited resource and it is not free that is why the modern world is emphasizing on renewable energy. Our country is a developing country, and the population of this country is about 158.5 million marks according to the latest estimates from the United Nations. About 80% people are living in villages. There are 59,990 villages. Most of the people here are living in these villages. In these villages there is shortage of electricity. Most often these villages suffer from heavy load shedding problem. Moreover some villages are in off grid region. As a result the people of these villages suffer a lot. But the students suffer the most for this lack of electricity, they initially don't understand that what kind of lose they have. This lose is the ignorance about modern education system. They cannot get accounted with the modern technology because of the lack of electricity. In some schools and colleges there are modern equipment's like laptop, projector, notebook etc. but this equipment cannot use due to the lack of electricity. If we can charge the laptop/notebook or other similar electronic devices through the solar system then it might help the students to get in with these facilities. Moreover, e-education can be introduced to the children in the rural areas. But the typical solar system is highly costly due to an external battery. If we eliminate this external battery and design a system then the system will be less costly and simpler. We can eliminate the external battery because there is an internal battery in the laptop/notebook that can provide backup up to 5-6 hours. Moreover our school, colleges are usually remain open during the day time, so we can easily charge the system during the day time, if any faulty weather occur then the internal battery will be used as a backup system. In this project we use a laptop and do the experiment. In our experiment the laptop takes about 5-6 hours to charge fully. If we take a close eye on the charging system then we can see that it takes about 5 hour and 1 minute to be fully charged. So by this charging system we can easily introduce e-education in the remote corner of our country. And make the rural students more efficient in their future work. Moreover this system also can be used to run the DC and AC lights, fans, mobile etc. and this system can easily be implemented by the normal people of the villages because the whole system cost about 3000tk which is not a big amount for the people. Moreover the longevity of this system will be about 1-2 years. So we can easily say that this is absolutely an effective system.

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