



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 7, July 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.569



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Review on Solar Charger Based on Microcontroller

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ABSTRACT: This project is developed for a solar based charger which is used to charge a battery with help of renewable solar energy. This device converts the electrical energy into solar energy. The main idea is to solve the issue as we cannot directly use a solar panel to charge a battery. This device has components like voltage sensing, display charging and controlling unit.

I. INTRODUCTION

Our main project 'solar charger based on Microcontroller' is one of the coolest and the popular project around globe. There are unlimited excess to solar energy, which is renewable energy. We human yet to completely harness this energy in better way as possible. Because of which we have to mostly used non – renewable energy like coal thermal plant, which are more costly than other plant energy. Our project 'solar charger based on microcontroller' are the perfect example to show case the utilization of the solar energy and extract energy as much as possible through this project.

Recently various Electrical equipment that include, solar lamp, home premises lighting system, park lighting, solar heater which are drive by solar energy. Now if you are thinking about how this process is going on, how nature energy is converted to electrical energy, then let me tell you. This transferring of energy comprises of the components of: Photovoltaic (PV), chargeable battery, solar charger controller and load.

Here, in this the Photovoltaic Module hold the solar rays where chargeable battery act as storage house of the solar energy and load comprises as the method to be power by it when needed. The solar charger controls all the action going on the system, where there is enough energy is stored in the battery as per its capacity. Hence make it most crucial part of the system because it helps in linking all the equipment with greater efficiency between solar panel and the battery, based on the load.

II. BLOCK DIAGRAM

The block diagram of "solar charging-based microcontroller" is given below. It basically consists of microcontroller, switching for system, input sensing unit, chargeable battery and LCD display. The solar panel that we are using, it will convert solar energy into electrical energy. Our solar panel help in charging the battery at the output of 12.0v. The voltage of solar panel is 14V. Our battery used stored energy given by solar panel. Voltage sensor are placed to monitor the voltage supply and battery voltage. MOSFET is used as switching device and modem of connecting all the equipment.

Components and Methodology:

Required Components

1. 35W Solar Panel
2. 12V Battery
3. PIC microcontroller
4. MOSFET
5. LCD

III.METHODOLOGY

The charging system is controlled by microcontroller. It measures the voltage of solar panel and battery. It also controls the switching device by sensing voltage of panel and battery, deciding when to stop charging.

This circuit is divided in four parts

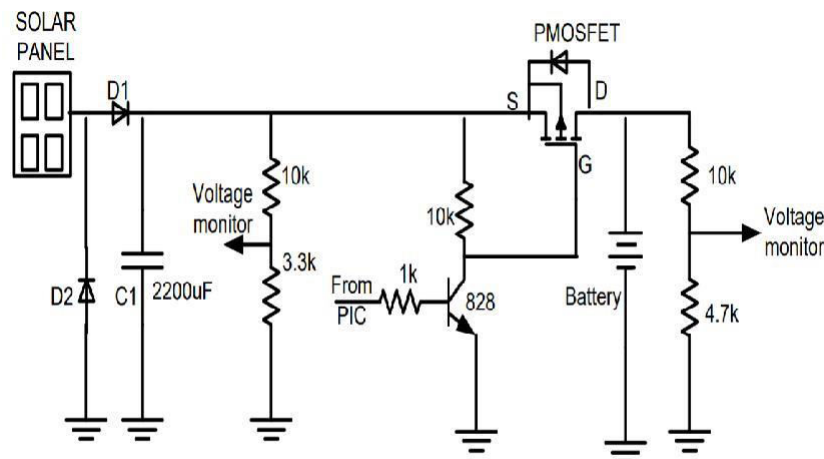


Fig 3. The circuit diagram of battery charger

1. Sensing of voltage
2. MOSFET Switching and driver
3. Protection and filter
4. Display Function

Voltage sensing-For sensing voltage of the system voltage divider is used. As microcontroller only have 5V sensing capacity so with the help of voltage divider, solar voltage and battery voltage are reduced less than 5 V then microcontroller is used to sense it. The 10k and 3.3k resistors are used for solar panel and 10k and 4.7k for battery.

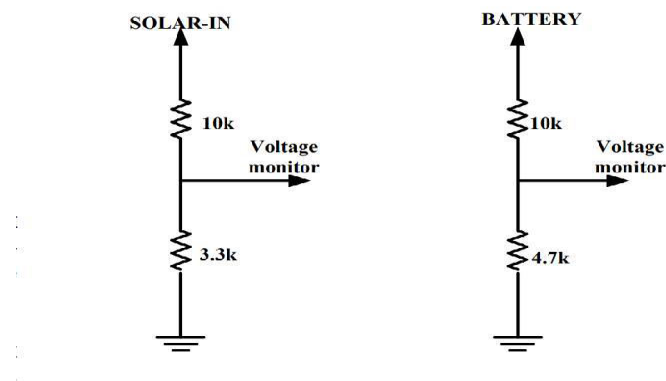


Fig 4. Circuit diagram of voltage divider

Solar-Volt

let $R1=10k$ and $R2=3.3k$

$V_{out}=R2/(R1+R2)*V$

Max solar power Voltage is 20V

Solar volt= $3.3/(10k+3.3k)*20=4.9V$

Bat-Volt

Let $R_3=10k$ and $R_4=4.7k$

The battery voltage is 12V

Bat-volt= $4.7k/(10k+4.7k)*12=3.8V$

Both the voltages are under 5V and suitable for microcontroller.

MOSFET switching and driver-The power flow from solar panel to the battery is controlled by MOSFET. The high switching speed, high input impedance and low voltage drop than BJT make it ideal for battery charging. For switching between solar panel and battery P-channel MOSFET is used which is controlled by microcontroller. The combination of MOSFET and transistor is used between solar panel and battery for switching purpose.

Protection and filter-For removing any unnecessary ripple voltage a capacitor of 2200uF, 35V is used at the input side as the filter. Whereas in load side 0.1uF disc capacitor is used. To protect over voltage Zener diode is used. Diode is also used for protection against reverse current flowing from battery to source. The power is coming through diode D1 from solar panel. Another diode D2 is used to take off the over voltage at the input terminal.

Display Function-For monitoring the voltage of panel and battery an LCD is used. The voltage and battery are displayed on this LCD based on microcontroller. The sensor provides a signal to microcontroller when the solar voltage is present, then it displays voltage on LCD screen. When it reaches to 13.5V, microcontroller interrupts the charging and 'charging off' display comes on LCD.

Circuit Operation: -

The solar energy which is converted into electrical energy by solar panel is stored in battery as the output of solar panel is connected to battery. The microcontroller with the help of ADC reads solar voltage and battery voltage then values are displayed on LCD screen. For switching application between solar panel and battery MOSFET is used. The voltage is given at the gate, the panel ground is at the source and battery ground is applied at drain. For voltage sensing network voltage divider is used. The analogy pin of microcontroller receives the output voltage from the voltage divider. The microcontroller-based circuit for solar battery charger controls the MOSFET switching. When it is on, the power from solar panel comes to battery.

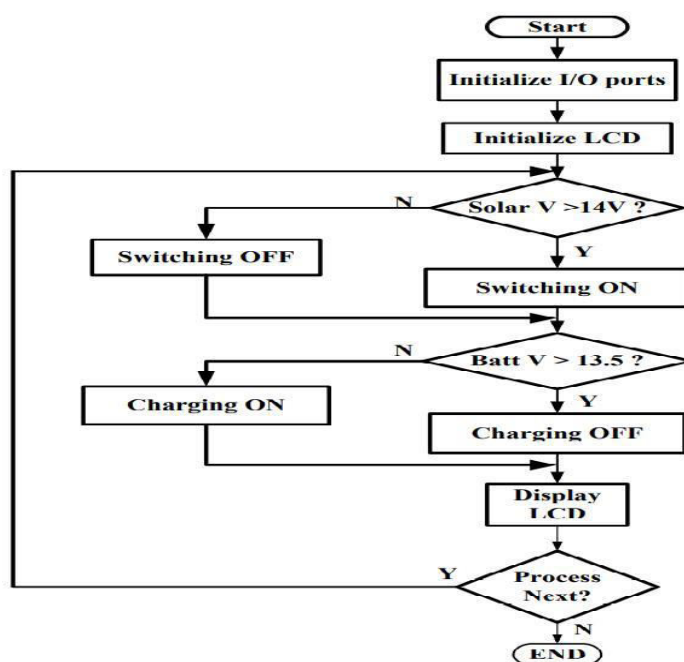
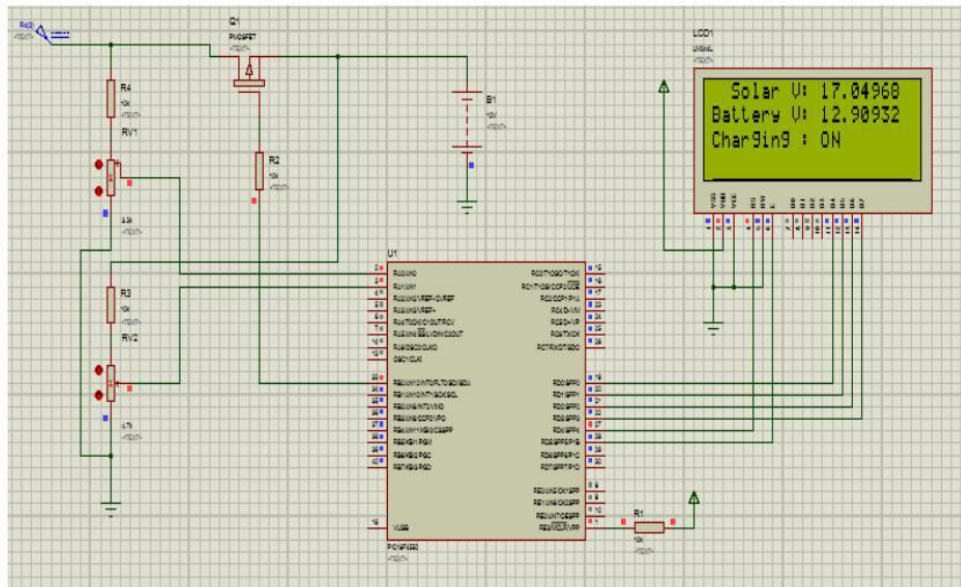


Fig 6. Flow-chart of battery charging system

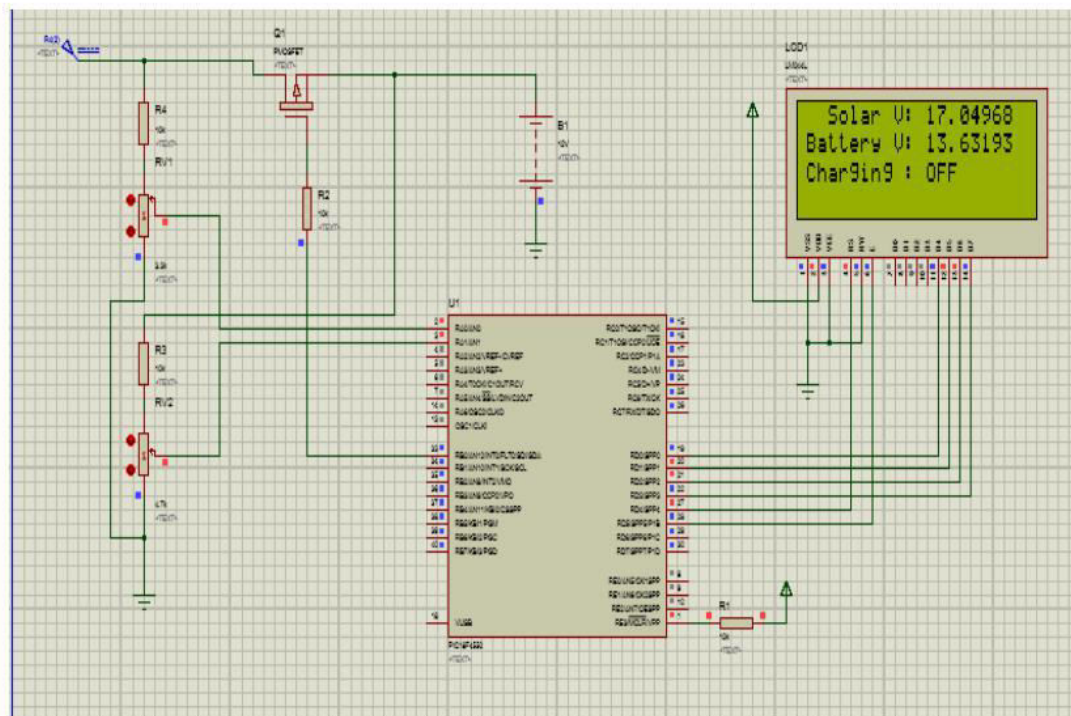
At the starting, solar panel voltage will be checked by controller. If the voltage is more than battery voltage, the MOSFET will be on to charge the battery. Afterwards microcontroller checks the full charge or not. If the voltage of

battery reaches 13.5V, the microcontroller interrupts the charging voltage which flows from solar panel to battery. For displaying the charging state of system LCD is used.

Simulation:



Simulation when battery is not full



Simulation when battery is fully charged



IV.CONCLUSION

In this, the microcontroller based solar battery charger is presented. The main concept is to use solar energy to charge the battery effectively. The solar energy is used as the source of power for battery charging. The battery is used to store the converted energy from panel and this stored energy can be used in various applications. To measure the voltage and switching applications of battery, microcontroller is used. So we consider that microcontroller is the main part of this system.

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