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# Effective Solar Power Control for Houses

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***ABSTRACT— Solar powered systems are increasing day by day. But the storage units and unwanted usage of that power results in wastage of solar power and causes damages to appliances in the long term. The objective of this paper is to provide a solution to save the battery units from getting overflowed and also to provide intelligent power supply with the help of various kinds of sensors. This are controlled by an Arduino Mega 2560 Microcontroller board. This will provide a low cost Solar power control system without any computers. To demonstrate the results of the system, sensors like motion sensor, water level sensor, etc are integrated within the home.***

## I. INTRODUCTION

Solar cells are rapidly increasing as conventional source for many applications. Smart homes one of such applications where the solar cells are used to power the entire home. But During night times or when the solar energy is not readily available we use the stored solar energy to continue the power. This makes use of high capacity batteries which constantly store electrical energy.

The problem arises when voltage of the voltage of the solar cells are not uniform and they will produce oscillations in the output voltage. The high voltages from the solar cells affect the battery life at the long run. It is important to produce a stable charging condition for the battery.

There are solar chargers available in the market which are either costly or they are not used for high power applications. This motivates to develop a control system which monitors the output voltage from the solar grid and also the battery level using a controller which then controls the system either by breaking the circuit or reconnecting it based on the sensor values.

Another important aspect to be considered while tackling the problem of power wastage is when the power is supplied without any purpose. This can be avoided by integrating various simple sensors to monitor basic parameters to ensure the power requirements.

## II. PROPOSED DESIGN

### A. Battery Monitor

This first part of the design focuses on monitoring both the output voltage of the solar grid and also the battery level. This is done using Arduino's Analog Reference voltage and this is compared with the battery output voltage.

The second part monitors the solar grid which is connected to the battery using a relay switch. When the output voltage reaches the threshold value above than the threshold value of the battery then the circuit is disconnected automatically by changing the state of the relay switch.

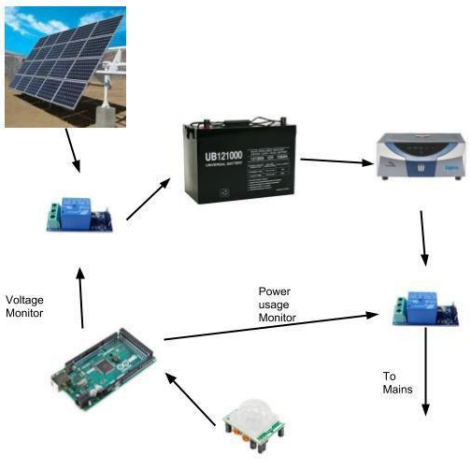


Fig. 1. Basic structure of proposed system

B. Power Usage Monitor

The second part of the system focuses on what is termed as the internal power management. This system consists of different sensors to measure various parameters of the house. The main objective of this monitor is to save power and not intended to automate the entire home which is basically done in IoT systems.

Some of the parameters to be considered are the presence of human in the house, other important activities being done irrespective of presence of human. Thus we make use of the Passive Infra Red sensor otherwise called as the motion sensor to detect motion of the human at multiple locations inside the house. We also use a standard switch to give the choice to turn off automatic power management because there may be instances where the motion is not present but still there will power requirement.

These sensors are centrally connected to the Arduino which constantly monitors these sensors to take appropriate action. Instead of constantly checking these pins for a state change we can use the External Interrupt feature of the Arduino to make this monitoring happen in the background. This makes the Arduino to other jobs without wasting CPU time on those pins.

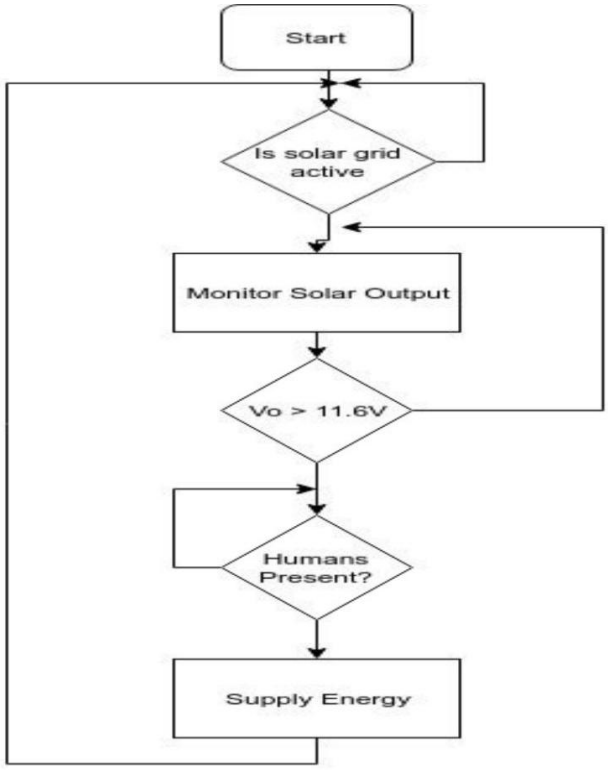


Fig. 2. Flowchart representing the algorithm

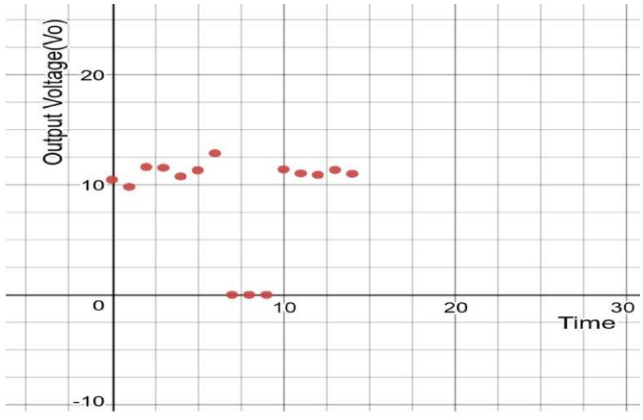


Fig. 3. Graph showing input voltage to battery from solar grid

## III. RESULTS

### A. Experiments

The experiments are done with 300 Watt solar cell grid and a 150Ah battery. The controller used was Arduino Mega with arduino C language. The experiments measured various parameters like

- Is the output voltage of the solar grid stable?
- When the controller breaks the circuit and the battery?
- Will the average battery life increase in the long run when compared to prior methods?
- How much power is wasted without human presence on average?

### B. Measurements

As it can be seen from the graph that the voltage output of the solar is quite oscillatory in nature. This shows that the battery charging cycle will be affected by the varying input to the battery. The controller is set with the threshold voltage of $V_{TH}$ = 11.90V and above this the relay is de magnetised to disconnect the circuit.

It is noted that the average charging cycle of the battery is maintained at a constant voltage and thus producing longer life time and possibility of accidents are avoided. It also helps to reduce the heat dissipation of the battery since the voltage is maintained well within the rated voltage given by the battery manufacturers.

The next part of the experiment uses the motion sensor output to control the supply to the mains. This was tested to save power exponentially. The main advantage of this method is multiple sensors are placed thus each block or room can be controlled seperated by the controller with multiple relay switches.

## IV. DISCUSSION AND LIMITATIONS

This method uses the low cost electronics to provide solution to effective way of controlling solar power and in general power consumption. The overall system only targets the general power flow into account and not the specifications of individuals. Thus it can further be improved to alter based on the requirements of the user by providing a user interface.

This can be done with help of IoT systems giving access to the controller from their mobile phone. This can also be improved to work for multiple battery storage systems with different threshold voltages.

For the final part, We can also use some cloud based machine learning algorithms to collect and analyze data from the sensors to provide even smarter solutions like when to cut off the main supply, which rooms require power even without humans, etc.

## V. CONCLUSION

In this era of renewable energy sources, it important to investigate the storage problems that arise from these sources. Since these sources are not man-made they vary naturally based on its environment. The solution that is provided in this paper to control the solar energy can be useful even for other renewable energy sources which are also oscillatory in nature. Super chargers are improving day by day and the life time of the battery will be a crucial parameter that will affect the commercial solar products. This system provides the basic structure for more advanced systems to make the life time of the battery longer and much more safer.

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