Comparison of Capacitor with Battery to Optimize Performance of PV System

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ABSTRACT

In this paper is to make an internal real time electrical phenomenon monitoring system. This can be achieved by coming up with an electrical phenomenon system, building the electronic equipment for correct voltage, current, solar radiation and temperature readings, and making an analysis information work that displays the monitored information during an easy charting interface. The model could potentially be adapted to service different types of photovoltaic systems to insure proper functioning and data monitoring.

Keyword: - Super-Capacitor, Solar Panel, PIC Microcontroller, Relay.

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1. INTRODUCTION

The self-sustainability is important for successful data processing within the field. Complete wire-free field systems possess robust economic competitiveness to their simple installation and maintenance. Self-sustainable systems also are environmentally friendly by not mistreatment the fossil-fuel based mostly green-house gas manufacturing power and by requiring a little physical presence within the field. Specifically, a field node must live on ambient energy sources (e.g., solar cells) and energy storage. Use of the super-capacitor-based solar energy buffering, a system that we call supercapacitor. Using solar panels paired with super- capacitors as the energy resource presents unique opportunities and challenges: while rechargeable batteries can reach their peak voltage rather quickly, it is challenging to find an analytical relationship to their stored energy by observing their output voltage. The stored energy in a super-capacitor, on the other hand, is precisely calculated as $E=\frac{1}{2}CV^2$, where C and V are the capacitance and the voltage of the supercapacitor, respectively. This ease of assessing the stored energy, however, is countered with a disadvantage: the super-capacitor voltage (V) increases monotonically as they build up energy, eventually reaching a maximum value (2.7 V for the Maxwell series we used 5 NOS). Therefore, the voltage output of a super-capacitor block may be much lower or much higher than the operation voltage of the circuit they are powering, which dictates a sophisticated circuit design to harness all of the stored energy. The performance of solar panels is dependent upon sunlight it receives. In general, the sun will rise from the east toward the west in seconds, minutes and hours.

As well as the sun will slight change in position from south toward the north in monthly. Generally, solar panels installed permanently (fixed) on the stand. For subtropical countries generally exposes the panels towards the south or to the north. Meanwhile, a tropical country installation is done tends to be flat. Installation techniques like this will cause the light of the morning sun and afternoon are not in the right position against the direction of the sun. As a result, the amount of electrical energy that can be raised to a little more than it should. Therefore, it is necessary to design a device that can set the direction of the solar panel always follows the sun position or perpendicular to the sun using tracker position of the sun to produce maximum energy conversion. Tracking the sun during the day in order to maximize the amount of collected energy. It is possible to gain a significant amount of energy when mounting PV systems on trackers. This gain depends on location. As the radiation level is not constant throughout the day which may direct effect on generation on solar panel result lowering then generation, hence the variance in generation will be optimized by using Super Capacitor in parallel with solar panels, also monitoring each panels voltage and current which use to take decision whether to connect solar panel or not.

2. RESEARCH METHODOLOGY

The analysed during this analysis work system consists of three main components: PV panels, controllers, ultra/super-capacitor (USC) operating as a short-time storage unit, and load. All the system components add cogeneration, that ensures the electrical demand of the unit is glad the least bit times. a bonus of such a mix is that just in case of depleted power from PV panels because of short-time massive power needs or low radiation, the system is (in a position is ready) to deliver high electric power in a short time with the help of supercapacitors (secondary energy source). As a result of the PV panel uses DC, also the best configuration for the supercapacitors also uses DC power. there's a requirement for a controller (with inverter) between those components. Additionally, to regulate the energy flows by the following components of the system, furthermore as management the energy hold on in an exceedingly supercapacitor, the system is provided with a controller which might distribute power between the component. If the shadow falls on panel then the output of the panel is decreases, panel output give 11V is less than tolerance that’s why the inverter will be off because it works only in allows tolerance voltage and MPPT only increases overall generated voltage its does not increase power efficiency. So, we are used supercapacitor in parallel with solar panel. Supercapacitor charged with the help of solar panel. Solar panel gives sufficient output or not and super capacitor is charged or not with help of Pic-microcontroller.

In normal condition solar panel supply to DC bus with the help of relay 1. When supercapacitor is discharge solar panel give power to the load using relay 1 is ON at the same time supercapacitor start charging using relay 2. When solar panel gives output is less than reference voltage then relays 1 and relay 3 is OFF and supercapacitor gives power to load using relay 3. All output voltage is less than reference then all relays are OFF and then system will not work. The solar panel 12V,20W generated the power and supply to the DC bus(12V) with help of relay 1, Here we used current transducer (CT) to measure the current of output of solar panel and supercapacitor. There are three relays (RL), relay 1, relay 2, and relay 3 operated at 12V respectively. That relays are operated by driver because we used 5V Pic-Microcontroller is not sufficient to operate 12V relays so we used driver. In that driver there are 7 outputs. Driver is made up of darling type pairs. We cannot measure solar panel voltage directly from Pic-Microcontroller i.e. we used divider, it divides the voltage and gives 5V output to the Pic-microcontroller. By using voltage regulator to gives the constant 5V supply to the microcontroller from 12V DC bus. LCD display show all information of rating collected from the Pic-microcontroller.

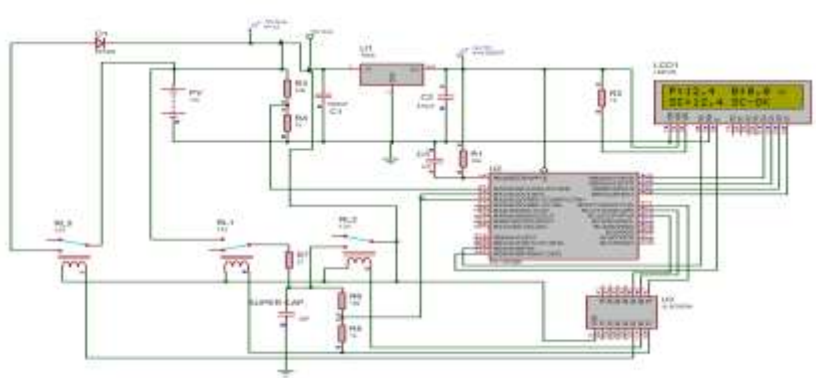

Fig. 1: Circuit diagram of capacitor with battery to optimize the performance of PV System

2.1 COMPONENT RATING

a. ***Super Capacitor****:* A supercapacitor (SC) also called an ultracapacitor, is a high capacity capacitor with a capacitance value much higher than other capacitors, but lower voltage limits, that bridge the gap between electrolytic capacitor and rechargeable batteries.

- **i.** It required 12 V to store in super capacitor.
- **ii.** It using 2.7V/100F super capacitor.
  Therefore 2.7*5 No.=**13.5V**
- **iii.** Super capacitor can charge 20% less or greater than of its capacity.
  Therefore 13.5+20%=**16.2V**

b. ***Relay*****:** A relay is an electrically operated or electromechanical switch composed of an electromagnet, an armature, a spring and a set of electrical contacts.

- **i.** The relay available in the market is 2Amp & 7Amp. We used 7Amp relay
- **ii.** P=I*V; hence,
  I=P/V=20/12=**1.8Amp**

2.2 HARDWARE MODEL

Fig. 2: Actual hardware model of capacitor with battery to optimize the performance of PV System

The module consists of 20W solar panel and 2.7V/100F supercapacitor connected in parallel with solar panel. When the solar radiation is constant or not is detected by Pic-microcontroller with the help of relays then all the information coming from the Pic- microcontroller displayed on LCD displa

3. RESULT

Five numbers of 100F supercapacitors with voltage rating of 2.7 are connected in series to increase the voltage to the maximum voltage on which super capacitor to charged is 13.5V because, super capacitor can charge 20% greater than of its capacity. As super capacitor charged at 13.5V, load will be connected to supercapacitor if solar panel voltage falls below 12v. Load will be connected to supercapacitor until capacitor voltage falls up-to 11.0V to charge supercapacitor from 11v to 13.5v, at 500mA current, it took 3 minutes to charge completely.

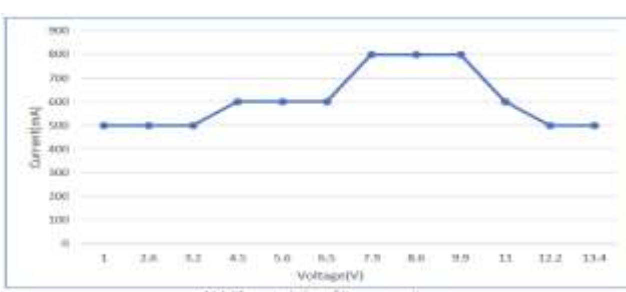

Fig. 3: **V-I Characteristics of Supercapacitor as an output**

4. CONCLUSION

The photovoltaic system equipped with supercapacitor was investigated in order to increase renewable energy utilization (self- consumption) and decrease fluctuation. The impact of the electrical load temporal resolution on the PV system energy flows was evaluated to find the optimum load temporal resolution which ensures low error of calculation. The presented paper clearly show that the temporal load resolution significantly affects the energy flows and energy self-consumption even for a single household system.

5. REFERENCES

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