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Development of Small Scale Solar Charger

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***Abstract*—Depletion of fossil fuel has been concerned worldwide. Many efforts have been done for encountering the problem. Solar energy, one of many alternative source of energies, has been utilized for electrical energy generation. The energy conversion system for converting solar energy to electrical energy is known by solar cell system. The solar cell can be applied in many applications, such as for solar charger. In this work, small solar charger system is developed for charging a laptop which locates at campus area of Institut Sains & Teknologi AKPRIND Yogyakarta. The system has storage battery of 90 Ah and 12 Volt. Solar cell used for the system is Polycrystalline panel with power output of 50 WP which able to generate DC voltage in the range of 14,8 to 17,5 Volt. The system is tested under a load of 6 laptops in which simillar to 390 Watt. The result shows that The utilization of charging controller is able to manage battery charging and load charging as well as prevent overcharging. The system is able to recharge 6 unit laptop with good charging stability and its performance is affected by temperature.**

Keywords—Solar charger, system, generate, stability

I. INTRODUCTION

Depletion of fossil fuel and global warming has been concerned worldwide. Many efforts have been done to solve the problem. Many researchers have investigated various sources of renewable energy and developed the energy conversion system for those sources. One of feasible energy conversion system in Indonesia is solar energy conversion.

Tropical country like Indonesia has a potential for developing solar energy system. Thermal energy from solar radiation is converted to electrical energy by means of solar cell. Many works have been intensively done in the area of electrical energy based on solar radiation.

Bhatt & Verma [1] designed PV system for small scale application. The system is made using nano solar cell. They stated that nano solar cell is more efficient than conventional PV system. Polymer solar cell have also attracted for researchers. Semi-transparent plastic solar cell have been developed [2]. The solar cell was fabricated using lamination technique.

The performance of solar cell is important issue in design of solar energy system. Temperature dependence of solar cell performance has been analyzed [3]. To improve efficiency, utilization of solar tracking has been applied [4, 5, 6] and also using of one dimensional nanostructure [7].

In this work, small scale solar charger is developed for laptop charging in campus area of Institut Sains & Teknologi AKPRIND Yogyakarta.

II. METHODOLOGY

The solar charger system is designed and fabricated prior to data measurement. The system has components of solar panel, charging controller, battery, and inverter. Solar panel is made from two Polycrystalline cells which power output of 100 Watt, and voltage output in the range of 12 V-17,2 V. Charging controller controls the ampere from solar cell to battery during battery charging to prevent overcharging and overvoltage. This controller also controls the charging process from battery to laptop charging load. Principle of charging controller is based on Pulse Width Modulation (PWM). Meanwhile, inverter is used to convert DC output to AC output. Inverter used in the system has output of 220 Volt AC, 50 Hz ± 2 Hz, and input of 10-15 Volt DC. Battery of the system has capacity of 105 Ah. Figure 1 shows schematic diagram of the system.

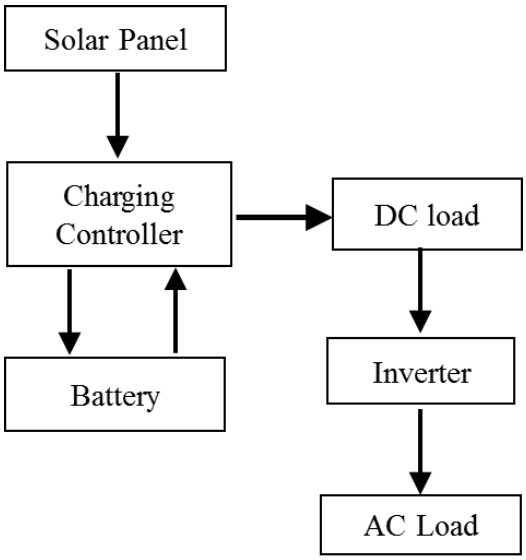

Figure 1. Schematic diagram of solar charger

The system is installed at Institut Sains & Teknologi AKPRIND Yogyakarta and tested to determine the output of solar panel and charging controller and charging stability characteristic. The data are taken every 2 hours during measurement work.

III. RESULTS & DISCUSSION

Figure 2 and Figure 3 show the output voltage and power of solar panel and charging controller. Figure 2 shows that solar panel output voltage fluctuates from 15 Volt to 19 Volt during measurement hours from 7.00 am to 5.00 pm.

Meanwhile, output voltage of charging controller is more stable, approximately from 13.5 Volt to 14.5 Volt. This stability is due to Pulse Width Modulation (PWM) circuit in charging controller. Output power of solar panel and charging controller is shown on Figure 3. Optimum power is generated at 09.00 am.

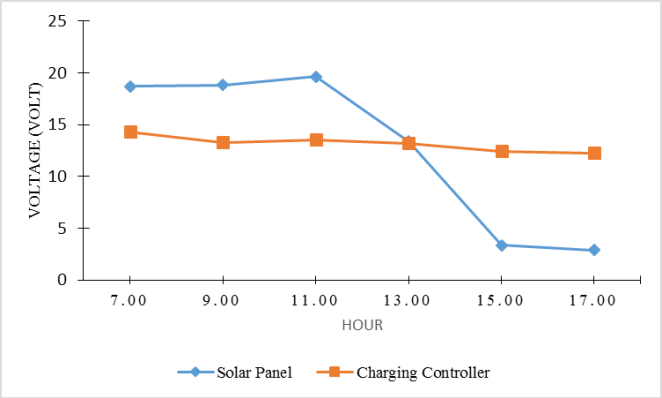

Figure 2. Output voltage of solar panel & charging controller

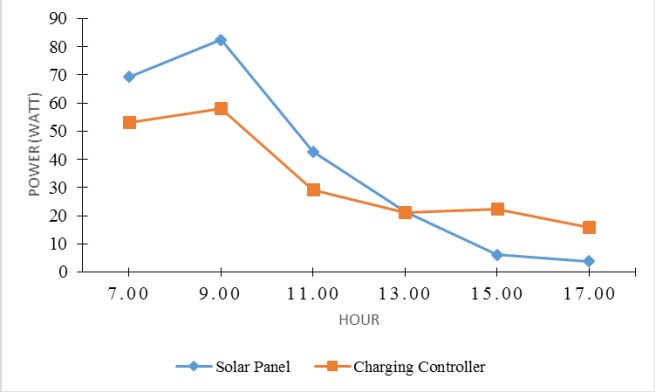

Figure 3. Output voltage of solar panel & charging controller

Whereas, an effect of temperature on output voltage of solar panel and charging controller is shown on Figure 4. Output voltage of both solar panel and charging controller increase as increasing ambient temperature.

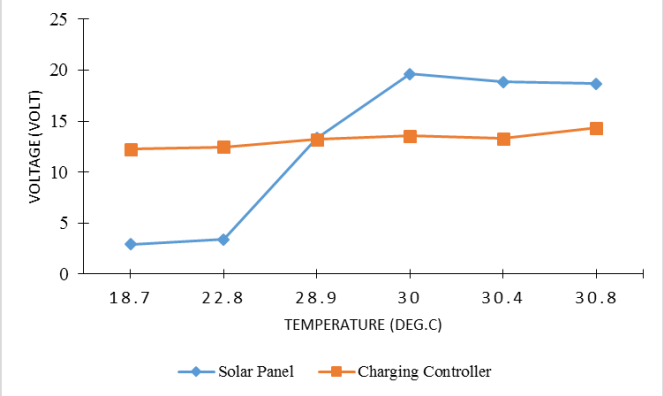

Figure 4. An effect of temperature on output voltage of solar panel & charging controller

After the measurement of output voltage, ampere, and power, the solar charger is tested on 6 unit laptop in which similar with 390 Watt load. It is found that the solar charger is able to recharge the units with good stability.

IV. CONCLUSION

It can be concluded that small scale solar charger is successfully developed and tested. The utilization of charging controller is able to manage battery charging and load charging as well as prevent overcharging. The system is able to recharge 6 unit laptop with good charging stability and its performance is affected by temperature.

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