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Polycrystalline Photovoltaic Test Set Design

Asist. Prof. Riyad ŞİHAB[1], Prof. Yusuf ÖNER[2], Asist. Prof. Sertaç GÖRGÜLÜ[3], Lec. Bahtiyar USLU[4]

[1]*Afyon Kocatepe University, Dazkırı Vocation Schooll,rishihab@gmail.com*

[2]*Pamukkale University, Faculty Of Engineering, yoner@pau.edu.tr*
[3]*Mehmet Akif Ersoy University, Faculty Of Engineering And Architecture, sgorgulu@mehmetakif.edu.tr*

[4]*Mehmet Akif Ersoy University, Gölhisar Vocation Schooll, bahtiyaruslu@mehmetakif.edu.tr*

Abstract: *Today, energy demand is increasing day by day. The reserves of fossil fuels are limited and cannot meet this energy which it is needed. To make use of renewable energy resources to provide the energy needs. In this study, the important kind of resource the renewable energy application is polycrystalline solar panels, has been determined. Polycrystalline panel is the most popular and preferable among the kinds of solar panels which are most favored in the solar panel market. The realized work is spent on all the energy consumed by the polycrystalline solar panel. To measure the current and voltage sensors are used for generated energy. The analogue data from the current and voltage sensors are converted to digital data and a control card with USB output which is fixed to send this data to the computer. Finally, the interface with the C # program was used to display the data from the control card on the computer.*

Keywords -Polycrystalline solar panel, PIC18F4550, control system, C # interface

I. INTRODUCTION

The method which is used for producing poly-crystalline silicon is similar to the monocrystalline silicon method. Poly-crystalline silicon is obtained by cooling the molten semiconductor silicon in molds. Cooling semiconductors are sliced in the form of circular, rectangular or polygonal, as well as monocrystalline solar cells, with thicknesses of 0,2-0,3 mm. Then the semiconducting materials are brought together and connected with special adhesives so that they are not separated from each other. As a final step, the antireflective glass layer is glued to form the solar cell. Polycrystalline silicon is not homogeneous because the Czochralsi method or other purification method is not used in the production of poly-crystal silicon. Therefore, the efficiency of polycrystalline solar cells is lower than that of monocrystalline solar cells. Due to the ease of production poly-crystalline silicon, the price is lower than mono-crystalline solar batteries. Polycrystalline solar panels look blue if there is glass to prevent the reflection, silver is the glass, or the glass to prevent reflection. Figure 1.1 shows the poly-crystalline silicon solar cell.

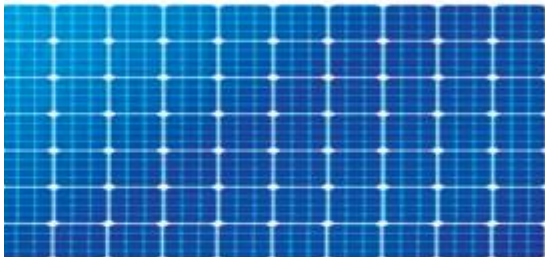

Figure 1.1. Polycrystalline silicon solar cell

Many researches have been done on solar panels [1-14]. These studies are sometimes based on a single solar panel, sometimes using two or more solar panel types. The most commonly used polycrystalline solar panel was selected in the solar energy experiment set.

II. MATERIALS AND METHOD

The purpose of this research is to provide students in the Electricity Department of Afyon Kocatepe University Dazkırı Vocational School with the practical knowledge and application about solar panels. The system shown in Figure 1.1 is shown.

Figure 2.1. Solar energy experiment set

Solar Panel

Two types of solar panels, monocrystalline and polycrystalline, are used in the solar energy experiment set system. Since the production methods of solar panels are different, reactions to solar rays are different. Thus, it has been determined which solar panel is more efficient in Afyonkarahisar Province. Figure 1.2 shows the solar panels used in the system.

Figure 2.2. Solar panels used in the system

The technical information of the solar panels used in the system is shown in table 1.

Power	20 Watt
Maximum Voltage	18,68 Volt
Maximum Current	1,12 Amper
Open Circuit Current	22,51 Volt
Short Circuit Current	1,12 Amper
Weight	2,1 kg

A. Consumer

20 Watt receiver was used to use all of the electricity generated in the solar panel.

B. Control Card

Control card; 220 Volt supply input, solar panel input, receiver output, USB output current and voltages. Figure 1.3 shows the control card used in the system.

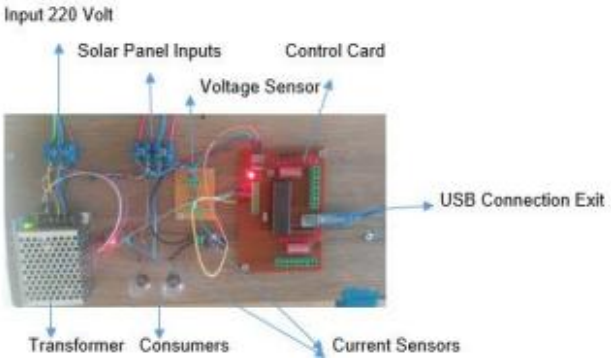

Figure 2.3. Control card used in the system

The control board has a voltage and current sensor. The analog data from the current and voltage converters are processed on the control card and converted into digital data. Digital data is sent to the computer via by USB connection. The control card needs to be connected to an external power source so it can measure up to 24 hours. There's a 220 volt input for this. By adding power plant to the 220 volt input, the electricity needed for the sensors and control card which used for the system is provided. In order to increase the sensitivity of the voltage sensors, the solar panels have been designed with respect to the maximum voltage values which has being taken into consideration. The maximum voltage at which the voltage sensor is measured is 30 volts. The sensitivity of the current sensors is also increased by selecting max. 5 Amps, in the same way.

C. Interface

An interface has been designed through the C # program so that all the data produced by the solar energy experiment set can be displayed on a computer. With this designed interface, the voltage, current and power values of polycrystalline solar panels are shown. In addition, all generated data in the system are recorded in the access database at intervals of 10 seconds in order to get a comparison. Figure 1.4 shows the interface used in the system.

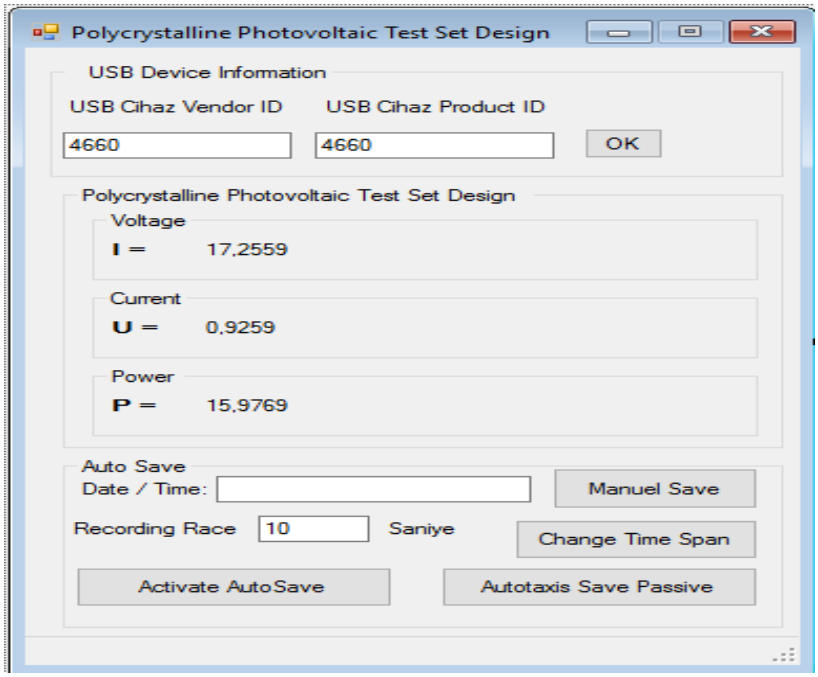

Figure 2.4. Interface used in the system.

III. RESULT

As a result of examining the current, voltage and power values have produced by the solar energy experiment set, the following data were obtained. Figure 3.1 shows a daily voltage graph of 20/06/2017.

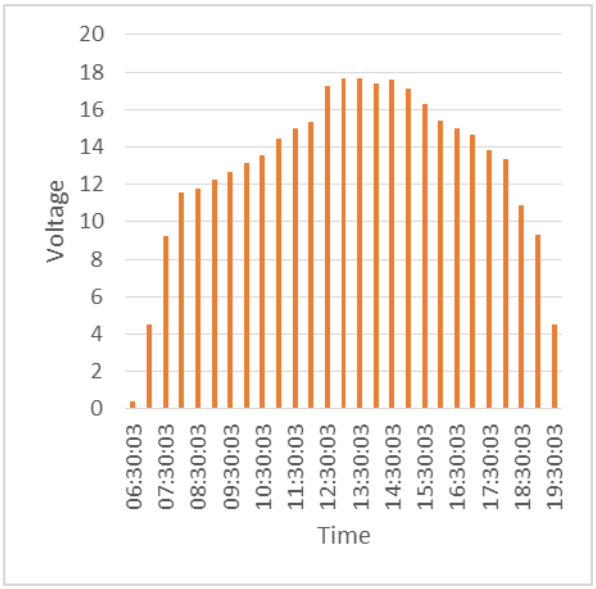

Figure 3.1. Voltage-Time

According to the voltage graph that the polycrystalline solar panel produced between 06: 00-20: 00 hours on 20/06/2017, electricity energy production becomes lowest in the early morning and late in the afternoon. In the noon hours, when the sun's rays are at the vertical, electric energy production has reached the highest level. Since there is no production of electricity in the hours when there is no sun, those hours are not added to the graph. The chart covers the sunrise from 06:00 to sunrise at 20:00. A daily current-time curve is shown in Figure 3.2.

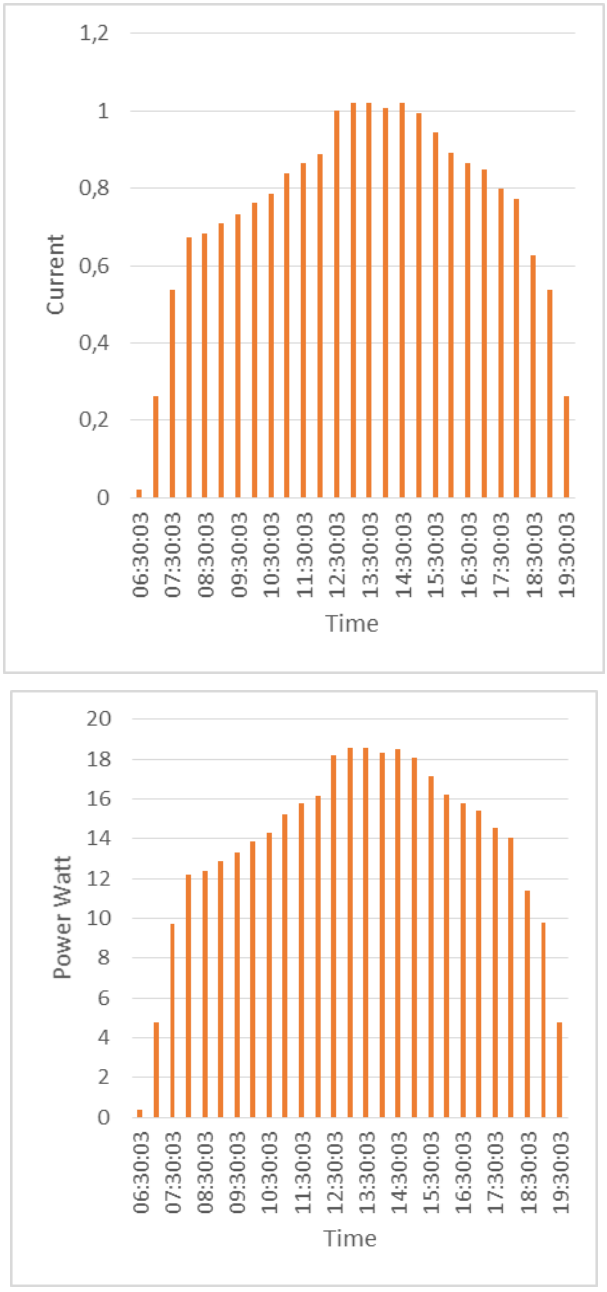

Figure 3.3.Power-Time

The polycrystalline solar panel is affected by the height of the environment where the yields are, the arrival angle of sunlight, ambient temperature and many other factors. Sometimes the places and times of the polycrystalline solar panel may be more efficient while the polycrystalline solar panel on some circumstances can be higher.

When a day's power chart is blurred, the power generated in the early hours of the morning stays at the limit of 5-10 watts, but reaches the limit of 20 watts at noon when the sun's rays are vertical. The energy that is produced after lunch is gradually falling down.

IV. CONCLUSION

Afyon Kocatepe University Dazkırı Vocational School Electrical Department students have been informed about solar panels in practice. Polycrystalline solar panel on 20/06/2017 194,9522 Wh energy production has been determined .

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