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Design of Automatic Garden Watering Based on Solar Cell

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ABSTRACT

In this study, an automatic garden watering device was designed using a solar cell composed of semiconductors that function to convert sunlight into electric power directly. The additional equipment used is a timer, BCU, rain sensor, relay, and inverter. The purpose of the design and design of this tool is to determine the performance of the automatic garden watering design by utilizing solar cells as a voltage source, as well as to find out how the control system works by incorporating rain sensors when watering plants optimally so that it can be utilized by the community. . As for the test results when the solla cel without using a load, the resulting voltage is 15 volts, the resulting current is 1.5 amperes. When a load is used, the resulting voltage decreases to 11.5 volts, the current increases to 5.73 amperes. The output voltage and current with the inverter are 214 volts and 1.05 amperes, respectively. When measurements were made, the voltage and current produced by the battery were 11.8 volts and current 7.8 amperes, respectively, while the voltage increased and current decreased in the inverter were 221 volts and 0.81 amperes, respectively.

INTRODUCTION

Solar energy is energy that has the property of being inexhaustible when used. Solar energy has the advantage that it does not cause pollution so that solar energy can be used as an alternative energy source. Solar energy cannot be utilized directly, so it must be converted into electrical energy. To convert solar energy into electrical energy, equipment in the form of solar cells is needed to convert solar energy into electrical energy.

At this time population growth is increasing in proportion to the increase in the fulfillment of electrical energy needs. However, the availability of fossil energy which has been the main fuel is running low. Humans today are very dependent on electricity generated by fossil energy. Likewise in the field of automatic garden watering, electric power is needed to run the machine automatically.

Watering plants that are usually used conventionally or manually by spraying water on plants according to a schedule using electricity from PLN. Conventional watering is considered less efficient and maximal in use because it requires time, effort, and the plant owner cannot leave the plant within a certain time. So to make plant sprinklers automatically with a source of electrical energy by utilizing solar cell equipment as the main source of electrical energy.

LITERATURE REVIEW

Solar cells or solar panels are tools to convert solar energy into electrical energy. Photovoltaic is a technology that functions to convert or convert solar radiation into electrical energy directly.In simple terms, solar cells on solar panels will capture sunlight and convert it to DC electricity. Then, the inverter contained in the solar panel will convert the DC current into AC current to form an electric current. After that the electricity generated will be stored in the battery.

Inverter is an electrical device used to convert direct electric current (DC) into alternating electric current (AC). The inverter converts DC from devices such as batteries, solar panels / solar cells into AC. Basically the inverter is a device that makes alternating voltage from direct voltage by forming a voltage wave. However, the voltage wave formed from the inverter is not sinusoidal in shape but is in the form of a square wave.

BCU is an electronic equipment used to regulate the direct current that is charged to the battery and taken from the battery to the load. The solar charge controller regulates overcharging (overcharging because the battery is 'full') and excess voltage from the solar panels. Overvoltage and charging will reduce battery life.

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METHOD

The research design flow chart starting from the beginning to the end of the research can be seen in Figure 1.

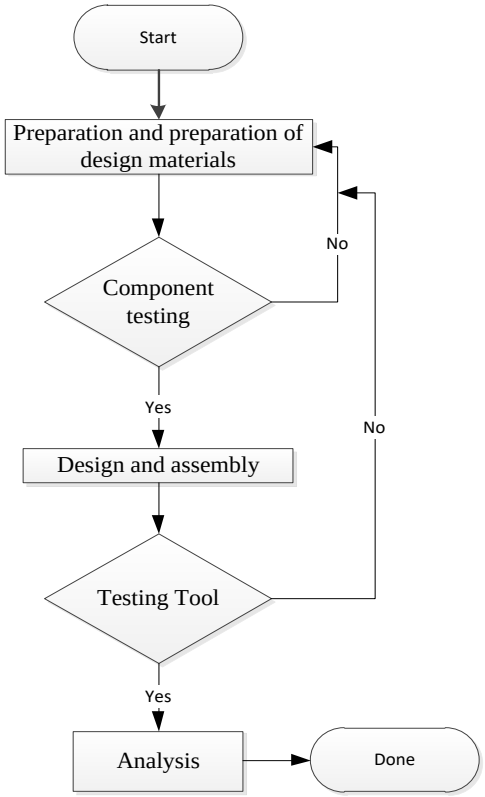

Figure 1. Research Flowchart

The block diagram of the series of tools in this research which has been arranged based on the working process can be seen in Figure 2 below.

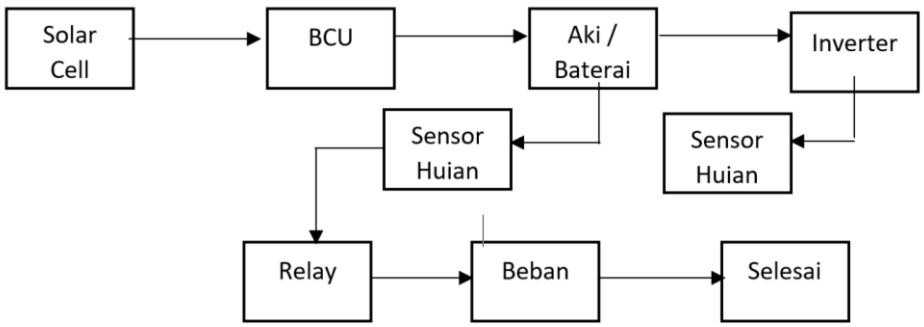

Figure 2. Block Diagram

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RESULT

At the time of the no-load test at the output of the solar cell. Measurements were carried out from 09.00 WIB to 12.00 WIB. This test produces output like Table 1.

Table 1. Solar Cell Voltage and Current Measurement

Testing Time	Voltage (V)	Current (A)	Power (P)	Information
09:00	18	1.5	27	Bright
09:30	12	1.4	16.8	Cloudy
10:00	13	1.3	16.7	Cloudy
10:30	13	1.3	16.8	Cloudy
11:00	12	1	13	Bright
11:30	13	1.4	16.8	Bright
12:00	14	1.3	16.5	Cloudy

For voltage and current measurement for BCU outputas Table 2.

Table 2. BCU Output Voltage and Current Measurement

Testing Time	Voltage (V)	Current (A)	Power (P)	Information
09:00	18	1.5	27	Bright
09:30	12	1.4	16.8	Cloudy
10:00	13	1.3	16.7	Cloudy
10:30	13	1.3	16.8	Cloudy
11:00	12	1	13	Bright
11:30	13	1.4	16.8	Bright
12:00	14	1.3	16.5	Cloudy

DISCUSSION

Testing using a load with a 125 watt battery and water pump as a load. The results of the test carried out in 5 minutes can be seen in Table 3.

Table 3. Test Results Using Load

Minute-	Information
10	Light up
15	Light up
20	Light up
25	Light up
30	Light up
35	Light up
40	Light up
45	Light up
50	Light up
55	Light up
60	Dead

CONCLUSION

Based on the results of the design that has been carried out on a solar cell-based garden watering device, it can be concluded that: Watering plants based on solar cells when loaded produces a voltage of up to 11.5 V and a current of 5.73 with an inverter output voltage of 214 V and a current of 1.05 A. The timer controls the water pump in watering plants, every 6 hours the water pump waters the garden for 15 minutes and the rain sensor functions to cut off the load flow so that watering does not occur when it rains and the design of this tool can ease the work of the community in watering plants.

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