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Designing Energy Saving Home Lights Using Microcontroller Based Solar Panels

Muhammad Syahputra Novelan[1], Adli Abdillah Nababan[2]

[1]Sistem Komputer, Fakultas Sains dan Teknologi
[2]Rekayasa Perangkat Lunak

[1]Universitas Pembangunan Panca Budi Medan,
[2]STMIK Pelita Nusantara
[1]Jl. Jenderal Gatot Subroto, KM 4,5 Sei Sikambing 20122 Medan, [2]Jl. Iskandar Muda No.1, Medan

[1]putranovelan@dosen.pancabudi.ac.id, [2]adliabdillahnababan@gmail.com

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ABSTRACT

As the population increases, the supply of electricity to homes increases and often there is a lack of electricity in supplying electricity to the community With the design and implementation of energy saving lamps using microcontroller-based solar panels is an alternative source for electricity supply at home Energy-saving lighting devices using a microcontroller-based solar panel is a series of devices consisting of solar panels as converters of sunlight into electrical energy then flowed to the Lead Acid battery as a place to store electrical energy, the battery is used to turn on the LED The circuit works when the LDR has detected sunlight then the panel will charge the battery, and if the weather is gloomy the lights will turn on automatically. The energy saving lamps are PLN's electricity savings and help in reducing the electricity costs of PLN in the house, which works automatically By utilizing solar energy to turn on the lights, so that it can be used for home lighting at night

1. Introduction

Electrical energy is energy that is needed, where electricity is a primary need in this globalization era. Almost all human activities are related to electricity. As the economy grows and the population of this sakarang population increases, electricity demand will also increase, so electricity is not enough to house so electricity blackouts are done to save electricity. In this case the government must continue to find ways to meet the electricity demand.

With the existence of the Solar Panel as an alternative power plant, where the Solar Panel is a silicon cell that is used to receive energy from sunlight in the form of photons processed in the Solar Panel so as to produce electrical energy. By using electricity from the Solar Panel, this is an answer from the Government in assisting the supply of electricity to the community, in the use of Solar Panels to store solar energy which is then processed into DC electrical energy in the Panel then stored in batteries and for miniature home lighting using LED lights.

To save the use of electrical energy by not removing energy from the sun, the Solar Panel is used as electrical energy that will be flowed into homes.

2. Literature

A. Microcontroller Atmega 16

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"The microcontroller is a complete computer system in a single chip (chip). The microcontroller is more than just a microprocessor as already exist or contains ROM (Read-Only Memory), RAM (Read-Write Memory), some standard input and output, and some peripherals such as counter / timer, ADC (Analog to Digital converters), DACs (Digital to Analog converter) and serial communications. One microcontroller which is widely used today is AVR microcontroller. AVR is RISC microcontroller (Reduce Instuction Set Compute) 8 bits based on the Harvard architecture. In general, AVR microcontroller can be classified into 3 groups, namely families AT90Sxx, ATMega and ATtiny. Basically what distinguishes each class is a memory, peripherals, and its "[2].

B. Solar Cell Panel

"Solar Cell is an assembly unit of several solar cells (Photovoltaic). Solar Cellyang is changing sunlight into direct current electricity using thin silicon. Solar cell composed of two semiconductor layers with different charges. The top layer of solar cells is charged negative while the lower layer is positively charged. The cell is mounted in a parallel and series position in a panel made of alumanium or stainless steel and protected by glass or plastic., some photons of light are absorbed by semi-conductor atoms to free electrons from bond atoms to become electrons that move freely. There is an electron transfer electron this is what causes an electric current "[3].

C. LDR (Light Dependent Resistor)

"Light Dependent Resistor (LDR) is a type of resistor that changes obstacles due to the influence of light. The magnitude of the resistance value on the sensor LDR light depends on the size of the light received by the LDR alone. When the dark light the greater the value of the prisoner, while the light the value becomes smaller. LDR is the usual type of resistor used as a light detector or measuring the amount of light conversion. LDR consists of a semiconductor disc that has two electrodes on its surface. LDR resistance changes with changes in light intensity who hit it. In the dark the LDR resistance is around 10 MΩ and in bright conditions of 1KΩ or less. LDR is made of material semiconductors such as the chemical compound cadmium sulfide. With this material energy from falling light causes more charge to be released or currents electricity has increased, meaning that the material resistance has decreased. As as with conventional resistors, the installation of LDR in a circuit is the same just like an ordinary resistor installation. LDR is used to convert light energy into electrical energy. Automatic light switches and burglar alarms are a few examples of devices that use LDR. However, because the response to light is quite slow, LDR is not used in situations where the intensity of the light changes drastic. This sensor will change the value of the obstacle if there is a change in level brightness of the light"[4].

D. LED (Light Emiting Dioda)

"LED is a component that can emit light emission. LED is another product after diode. The structure is the same as the diode, but it was later discovered that electrons that hit the p-n junction also release heat energy and light energy. The difference is if the diode discharges energy into the form of heat, while the LED discharges energy in the form of light. LEDs can emit a small amount of light when current flows at forward bias. LEDs can be designed to emit red, blue, yellow, green and infrared light. Infrared / infrared light is light that is not visible. By using a light spectroscope, infrared radiation will appear in the electromagnetic spectrum with wavelengths above the wavelength of infrared light. With this wavelength, then this infrared light will not be visible to the eye but the heat radiation generated is still felt or detected. Infrared LED is one of the most efficient LEDs as a light generator. In its application, this sensor is ideal as a security detector. This light beam from the infrared LED will be captured by the photodiode."[5].

3. Research methods

A. Research Design

Broadly speaking, the stages of the entire study are as follows:

a) Describe the Problem

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Describing the problem clearly will help in designing and making energy-efficient home lighting devices using solar panels using a microcontroller that will be studied must be described first, because without being able to describe the problem, determine and define the boundaries of the problem to be studied, then there will never be a solution the best of the problem. So this step is the most important first step in this research.

b) Problem Analysis
The problem analysis step is the step to understand the problem that has been determined in its scope or boundary. By analyzing the problems that have been determined, it is expected that the problem can be understood properly.

c) Setting Goals
Based on the understanding of the problems of the problem, the objectives to be achieved in this study are determined. In this goal the targets will be determined, especially those that can overcome the existing problems.

d) System Design
This stage is the stage of the design of the device made, at this stage the design of the device and the design of a series of energy efficient home lamp fixtures.

e) Making The System
This stage is the stage for making energy-efficient home lighting devices, manufacturing tools based on the design and design of tools that have been made in the previous stage..

f) System Testing
Tool testing is done by testing solar panels as a means of converting sunlight into electrical energy, where the light sensor or LDR as an automation in turning on home lights.

g) Testing Results
At this stage the process of drawing conclusions and suggestions on what should be done during the Final work. Basic conclusions and suggestions which are the result of analysis and discussion.

B. Research Design

In this study a block diagram design of the system is made. The block diagram design can be seen in the picture below :

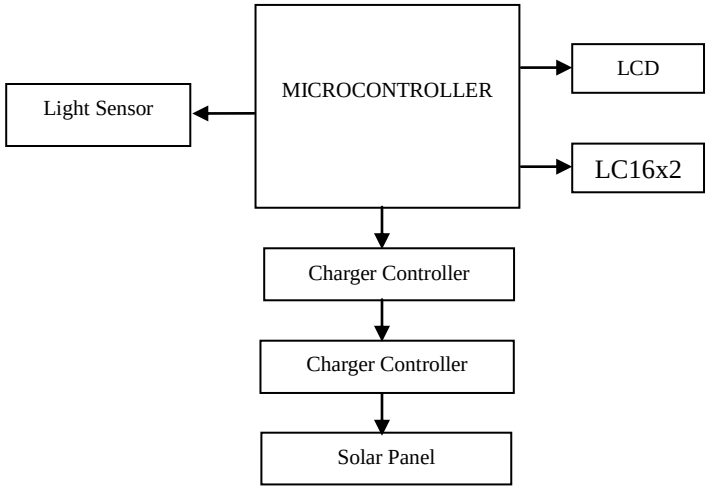

Fig 1. Circuit Block Diagram

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In addition there is also the structure of the running of the program which is described in the form of flowchat.

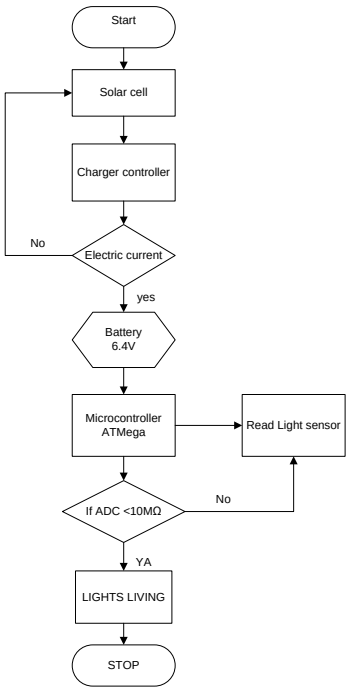

Fig 2. System Flowchart

Flowchart above can be explained how the work of a series of tools to be made. Flowcharts that start from the Start is the light from the sun that is received and processed by the Solar Panel. Then it is fed to the battery using the Charger controller. Charger controller is a tool as a regulator of the charging current to the battery in the direction or DC, to avoid overcharging and overvoltage. Batteries for storing electrical energy generated. Electrical energy will be supplied to the ATMega Microcontroller to adjust the intensity of the Light Sensor (LDR). Where the resistance received by the light will be read on the microcontroller if the data received from the light sensor has a resistance of 10MΩ then the lamp will turn on automatically, if the data received is more than 10MΩ then the lamp will not turn on.

4. Results and Discussion

In this study, it will be explained and displayed how the results of testing the tools made along with the discussion. The results of the test carried out is an energy saving device for home lighting using solar panels whose control center uses a microcontroller. After all the circuits have been designed, the energy saving lamp uses a solar panel using a microcontroller. Then the circuit is designed to make these devices.

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Fig 3. Overall Hardware

In the picture above shows that the solar panel in the house will charge the battery during the daytime. To determine the condition of the lights on at night and charging during the day, then the resistance value of the light sensor is given. Looks like the table below:

Table 1.
Light Sensor Resistance Values

Weather	Score LDR	Lamp	*Battery*
Noon	230-120	Die	Battery Charge
Noon	110-20	Life	*Battery Dead*

From the predetermined table values, it can be conditioned on two weather conditions, namely daytime and nighttime, if the light sensor detects that the weather is dark then the resistance at the LDR will decrease, if the resistance at the LDR is smaller than the fixed value at the potentiometer, then the lamp is on, the potentiator is value limits for turning lights on and off. Test results can be seen in the image below:

Fig 4. Value of LDR

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In the picture above, the LDR value is 57, the weather is night and the LED lights automatically on, the battery stops, because at night the battery is used to turn on the lights. Like picture 9 below:

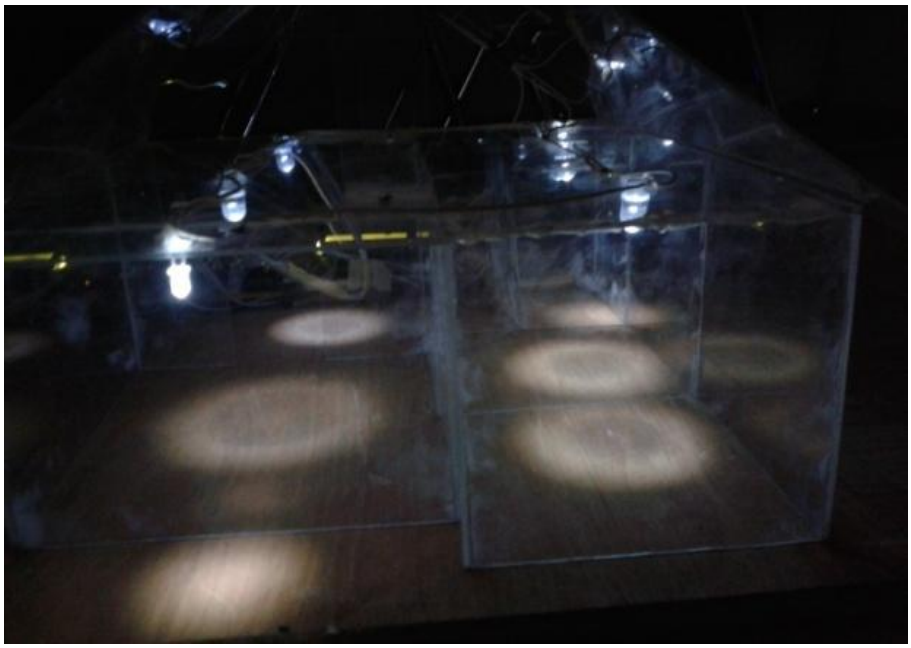

Fig 5. Lights At Night

In energy saving lamps using a microcontroller-based solar panel is a device that uses solar panels as a means of converting sunlight into electrical energy which is then applied to a house, where the light sensor or LDR is used as automation in turning on the lights in the house. To find out the battery usage time at night, it is tested on large load currents with different loads. To find out how long it takes to use Lead-Acid 4.5 Ah batteries in the device, in supplying current to energy-saving lamps. The following are devices that require current from a Lead-Acid battery with different load currents. As shown in the table below :

Table 2.
Load Flow test results

No	Load Used	Load Current
1	ATMega Microcontroller	40
2	LCD	30
3	LED 5mm	2x20
4	LED 10mm	4x30
Amount		230

The above test is taken from the results of the above data with all loads in active condition (ON), then obtained:

$$Suplay\ battery\ = \frac{4500}{230} = 19 \text{ hour}$$

Because the output released from the microcontroller is not too large, the Battery can turn on the lights in the house for 12 hours, ie at 19:00 to 07.00. And when the sunlight received by the light sensor is bigger then the solar panel will charge the battery again. To determine the condition of the battery on the LCD, the calculation on the ADC battery is performed as follows: $\frac{6.8}{256} = 0.0275$.

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5. Conclusion

From the results and discussion of the research that has been done it can be concluded several things:

a. Overall the energy saving lighting system using a microcontroller-based solar panel ATMega8535 can work if the value of the ADC Potentio is greater than the value of the ADC Sensor light then the lamp will turn on automatically. And if the potential ADC value is smaller than the ADC Light sensor, then the solar panel can supply the battery, if the battery ADC is greater than the specified battery ADC value (255), then charging from the solar panel to the battery will be disconnected from the Relay.
b. In the tests carried out, the battery with a voltage of 6.4 volts, can turn on the lights for 9 hours with a remaining voltage of 4.8 volts.
c. The value of the data on the light sensor will change because the weather in the surrounding environment changes from morning to night.
d. The device can run automatically, so the operator is not needed.

6. References

[1] Wang Wei, Huang Ke. The strategy of electric power alteration:opportunities, challenges and policy options[J]. Journal of North China Electric Power University (Social Sciences), 2014
[2] Pankaj Moharikar; Jayakrishna Guddeti, "Automated test generation for post silicon microcontroller validation," 2017 IEEE International High Level Design Validation and Test Workshop (HLDVT).
[3] Y. Mochizuki and T. Yachi, "Relationship between power generated and series/parallel solar panel configurations for 3D Fibonacci PV modules", the Proceedings of ICRERA, San Diego, 2017
[4] RS Components, "Light dependent resistors datasheet," (1997 rev). [Online]. Available: http://fabacademy.org/archives/2014/students/pradnya.shindekar/files/ldr.pdf
[5] Novelan, M. S., Tulus., E M Zamzam. (2018). Control of motion stability of the line tracer robot using fuzzy logic and kalman filter. Journal of Physics: Conference Series, 978(1), 012066. Retrieved from https://iopscience.iop.org/article/10.1088/1742-6596/978/1/012066

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