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IMPROVEMENT CONTROLLING CLOSED LOOP SOLAR CELL BASED ON PIC AND IOT

Catra Indra Cahyadi
Akademi Teknik Dan Keselamatan Penerbangan Medan

ABSTRACT.

In this paper describes the design of a solar panel position control system for the incoming sunlight which is controlled using the Android smartphone application and microcontroller. The control system via an Android smartphone to send control controller data to the microcontroller for processing. The data used as input is obtained by measuring the incident angle of sunlight, so that the position of the solar panel is always perpendicular to the incident ray of sunlight. In addition, the application can display temperature and light sensor data in graphical form as a monitoring function of the control system. By using the Internet to control and monitor certain places such as homes, commonly known as smarthomes. The microcontroller used in this study was the Wemos D1 R2 microcontroller which has an esp8266 module that supports wireless network formation. The control system can work at a minimum step of 1 step (2.8 °), with intervals ranging from 8 steps to 50 steps.

Keywords : Sun Position Control, Microcontroller, Wirelless.

1. INTRODUCTION.

One of the most needed energy by humans, especially in Indonesia is electricity. Electricity supply in Indonesia is still relatively low. Data from the Department of Energy and Mineral Resources only about 66% of Indonesian people enjoy electricity. One of the main alternative energy sources of electricity available today is solar energy produced by the use of solar cells that convert sunlight into electrical energy through the photovoltaic effect . The sun can be used directly to produce electricity and then convert solar energy into electrical energy. Solar cells which are semiconductor materials using photovoltaic effects. One way to optimize the performance of solar cells is to look for positions where the earth receives the maximum heat from the sun by looking for positions where the incident ray is perpendicular to the plane of the cross section. The solar cell is basically an active element that converts sunlight into electrical energy. In general, a single solar cell has a thickness of 3 mm, composed of positive and negative poles made of sliced semiconductor material. In summary, when sunlight hits the surface of a solar cell, the energy of the photons will be utilized to form pairs of electrons and holes which are charge carriers in the semiconductor. The controller uses a microcontroller which is basically controlled via an android smartphone.

The device that can be used is a microcontroller which will function to receive messages and process messages to be received or sent by devices that are connected to an Android smartphone. Because in the microcontroller there is an electronic circuit or microprocessor that has been equipped with a processor, memory, and input / output interface. Because nowadays mobile phones are a daily necessity for every human being because of their importance as a medium of communication and information that can be accessed instantly wherever and whenever therefore mobile phones are always carried and are near us.

2. LITERATURES.

Solar thermal energy is one of the potential energy to be managed and developed further as a source of energy reserves. Solar panels are used to convert solar thermal energy into electrical energy, where new designs in this solar panel system will be controlled via a microcontroller. The speed of microcontroller operation generally ranges from 1 to 16 Mhz. Although the data processing speed and memory capacity of the microcontroller is much smaller, the ability of the microcontroller is sufficient to be used in many applications. Wemos D1 R2 is a microcontroller that is compatible / similar to Arduino Uno only Wemos D1 R2 is based on ESP8266-12 module, the programming language used to program Wemos D1R2 is a C programming language but the esp8266 module already has enough libraries to use so that the microcontroller programming esp8266 based module becomes relatively easy though for beginners, to do programming on the Wemos D1 R2 board it can use the Arduino IDE application, wemos D1 R2 has 11 digital input / output pins, 1 analog input pin, microusb for connection, and a 9- power jack 24V input power (Wemos, nd). On

PC microprocessor speeds used today have reached the order of GHz, while the speed of operation of microcontrollers in general ranges from 1 to 16 MHz. So
Also the capacity of Random Access Memory (RAM) and Read Only Memory (ROM) on a PC that can reach the Gbyte order, compared to microcontrollers that only revolve around the order of bytes / Kbyte. Although the data processing speed and memory capacity of the microcontroller is much smaller when compared to a personal computer, the ability of Figure 1: A microcontroller circuit diagram is sufficient to be able to
used in many applications mainly because of their compact size

The microcontroller as the brain of the solar panel position control system as a whole, will then send the pengontolan data to the android smartphone so that it can be controlled via the smartphone. To facilitate this control can use the publish / subscribe method for the communication method. Publish / subscribe itself is a pattern of exchanging messages in network communication where the sender of the data is called a publisher and the recipient of the data is called a subscriber, the publish / subscribe method has several advantages, one of which is loose coupling or decouple which means that between the publisher and the subscriber does not know each other's existence, There are 3 pieces of decoupling namely time decoupling, space decoupling and synchronization decoupling, time decoupling is a condition where the publisher and subscriber does not have to be active at the same time, space decoupling is where the publisher and subscriber are active at the same time will be between the publisher and subscriber do not know each other's existence and identity, and the last is synchronization decoupling the condition where the event settings either receive or send messages on a node so that they do not interfere with each other. To control the solar panel position control system using an android smartphone, an android application is designed using the App Inventor software. This application is useful as a remote controller for sending strings to the microcontroller.

3. METHOD OF RESEARCH.

In designing hardware or hardware it needs some Electronic components, mechanical equipment and supporting devices for the system can work and run well according to function.

Figure Block System diagram as a whole

Figure 1. Block System diagram as a whole

After designing the topology for the smarthome to be made, a design related to the network connection to be made, the design of the network connection consists of node connections with access points, node connections with brokers, and the role of publish / subscribe to each node. The implementation is carried out in accordance with the design that has been made previously where the system can carry out its controlling and monitoring functions through the application of the control system, the implementation is initiated by the hardware implementation. the results of functional testing where each function functions correctly in accordance with the expected output, in addition to the success of the application function also illustrates that the system built can be connected and integrated properly.

4. RESULT ANALYZE.

After testing the tool with the results according to the design, the next is the implementation of the tool. Application requirements and prototypes for the system to be implemented are as follows:

1. Retrieval of the sun's angle of view data perpendicular to the cross-sectional area (solar panel) obtained by measurement.
2. Application requirements, 1 Android-based smartphone, Minimum SDK 2.2 (API8)
3. Android-based control applications can be developed by any software but in this study using the App Inventor software. The results of this study, that Android-based smartphones can control the door via an interface on the smartphone screen
4. Android-based control applications can be developed by any software, but in this study using the App Inventor software.

Results of Functional testing in which each function functions properly in accordance with the expected output, in addition to the success of the application function also illustrates that the system built can be connected and integrated properly. This data is used as input data and tested on the system, then analyzed the work of this control system. Measuring data for measured sunlight, then calculating the average value of the change in angle and the difference in value for changing the angle every hour. The biggest change in the position of the sun occurs at 16:00 to 17:00 which is 21 °, while the smallest change in the position of the sun, occurs at 11: 00 to 12:00 that is 10.5 ° . In the angle difference column it can be seen that the movement of the sun during the day is smaller and becomes greater in the afternoon.

After successfully implementing the test needs to be done to see the reliability and speed of the system that has been made, testing is carried out with 3 scenarios, namely the scenario of sending data messages every 10 milliseconds, 100 milliseconds, and 1000 milliseconds, the testing process is carried out by capturing the interface

The network has been created using the wireshark application, and from the test results obtained data as in the following table.

Table 1. System Reliability Test Results.

Timing of delay	Delta time	Average data	Percentage send data
10 milldetik	0.007675	36.333333	0.106322%
100 milldetik	0.077292	7.933333	0.111609%
1000 milldetik	0.0206807	3.4	0.110334%

Can be seen the comparison of delta time values, the highest value of delta time is in the scenario of 1000 milliseconds, this happens because the lag time for data sent is longer than other scenarios, resulting in high delta time, when the 10 millisecond scenario mosquitto broker receives the packet very fast and forward packets received directly on the destination node.

Tables 2. Value of Inputs

TIMES	Value OF Inputs	Times	Value of Input Step By Step.
07.00	8	13.00	3
08.00	5	14.00	3
09.00	4	15.00	4
10.00	3	16.00	4
11.00	3	17.00	5
12.00	2	18.00	5

The table above gives the step values as program input, which is has a range of 50 steps with 11 hours (07:00 - 18:00). Number of steps the smallest is at 12:00 (2 steps) and the biggest is at 07:00 (8 step), this is because the new program starts at 07:00 from the time of the program is not working, while the step value is greatest at the moment the program starts, which happens at 08:00, 17:00, and 18:00 (5 steps).

5. CONCLUSION.

A new design has been made in the solar panel position control system for sunlight. The controller system based on an android smartphone and microcontroller can adjust the position of the solar panel with a predetermined amount of change. The control system has been created and can work with an android-based control application that can be developed by any software but in this study using the App Inventor software. The results of this study, that Android-based smartphones can control the solar panel position control system.

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