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Design of Hybrid Energy Control System for Powering Small Scale Green House

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Abstract. The world energy crisis from non-renewable fossil energy sources greatly impacts the electricity sector. Meanwhile energy is needed to ensure food security is estimated at 38 percent of the energy consumed in the food system. Agrifood systems require renewable energy, access to modern energy services in rural areas, technology related to climate-smart agriculture. Hybrid technology makes it possible, we combine several new and renewable energy sources to save electricity more effectively and efficiently. Able to manage the shifting period of any renewable energy source in hybrid energy by the control system. In this case, each of these new renewable energies can be arranged based on their respective existence. With the existence of a power plant with renewable energy in the form of hybrid energy, it can also facilitate farmers in terms of electricity sources because in the most recent agriculture there is no electricity installed. With this method farmers can process the natural products they have easily, and are cost-effective.

1. Introduction

Rapid technological developments today can help the needs of the wider community. One of the developments that is now being developed is in the electrical sector, which is a part of saving electricity so that we can reduce the use of fossil fuels for power plants. With the availability of new and renewable energy sources that utilize natural resources or alternative sources of energy that are much cheaper even free. Besides that hybrid systems can also be used in agricultural fields to treat, process crops, so as to increase the productivity and quality of agricultural products even the economic level of farmers, as a simple case example if there are still many agricultural fields in Indonesia that do not have electricity so this is difficult for farmers to improve the quality and quantity of agricultural products, and even often crops are damaged.

So the existence of this hybrid system can be beneficial for the efforts of farmers on agricultural land, plantations, so they can directly process agricultural products. Thus the income of farmers can increase and the economy can increase as well. Hybrid technology makes it possible, we combine several new and renewable energy sources to save electricity more efficiently, effectively and efficiently. Thus to regulate the time of use for each new and renewable energy source in the hybrid system requires a control system. So that each of these new renewable energies can be arranged coordinated when they

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are used according to their respective existence. With the existence of a power plant with renewable energy in the form of hybrid energy, it can also make it easier for farmers in terms of electricity sources. For agriculture/farmers whose fields have been electrified. This way farmers can process the natural products they have easily, and are cost-effective.

In general, hybrid power generation technology from new renewable energy in the form of potential energy, wind and solar. In the use of solar energy, generally solar panels are used in a fixed or stationary state at a pre-arranged angle position without considering the intensity of sunlight that changes from time to time, as well as the direction of the wind. This makes the utilization of these energies not optimal. Thus the need for design to control the direction or position of solar panels to follow the intensity of the sun.

2. The Design

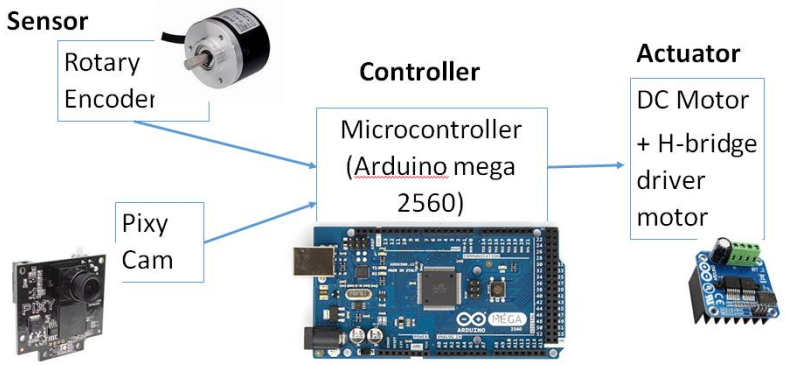

Figure 1: The component of the control system

The components of the control system consist of a rotary encoder sensor and a pixy cam camera sensor that enters the arduino mega 2560 microcontroller and then enters the actuator in this case a DC motor + H-Bridge motor driver.

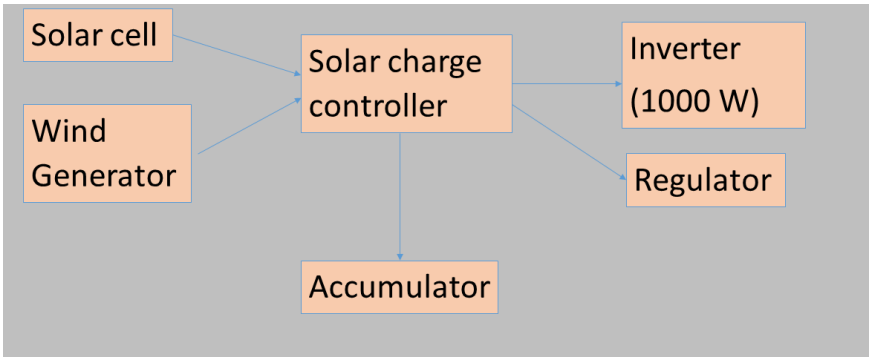

Figure 2 : The block Diagram

This system block diagram can be explained in Figure 2. Where the solar cell and wind generator enter the charge controller sollar and will go to the inverter (1000 W), regulator and accumulator.

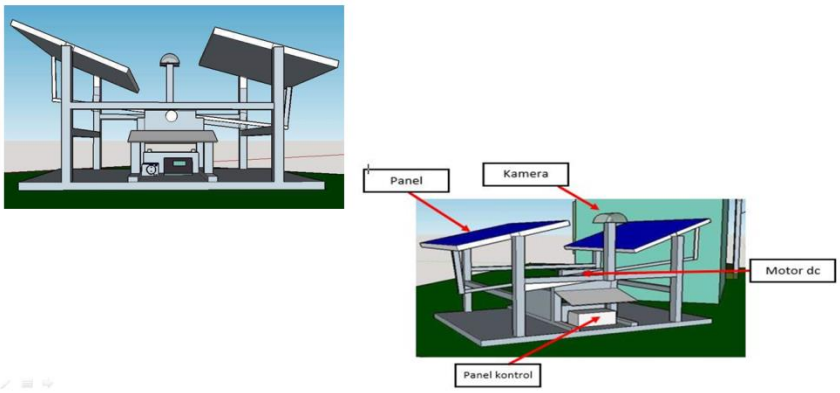

Figure 3: System Design

This system is designed as shown in Figure 3 where it is designed to use a camera, 2 pieces of solar panels, a DC motor and a control panel to place the supporting components of this system.

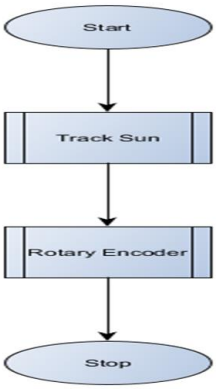

Figure 4: Flow chart

3. Results

Table 1: The results of camera sensor readings and the movement of the motor

No.	Sun Angle	Sensor Output	Moving Angle
1	45º	< 90º	CCW
2	90º	90	stop
3	135º	>90º	CW

From the results table above can be seen there are 3 conditions that are obtained in the field with the results of digital image processing. Where if the position of the sun at a 45º angle, the camera will read the position of the sun at <90º so the panel will move to the left or counter clockwise so that the panel will move to the position where the sun is. And if the position of the sun is at a 90º angle, the camera reading the sun is in line with the camera. And if the sun is at 135º, the camera will read the position of the sun in a position> 90º. And if the conditions in the field during the test take place experiencing natural conditions such as cloudy or cloudy and do not allow the camera to read the sun, the camera will

not process the image, so the position of the panel will stay at the last time the camera reads the image from the sun.

Table 2: Wind speed measurement results

Hour	Wind Speed	Weather
15.00	1,37 Km/h	Sunny
15.30	1,4 Km/h	Sunny
16.00	6,23 Km/h	Sunny
16.30	5,47 Km/h	Sunny
17.00	4,11 Km/h	Cloudy
17.30	5,43 Km/h	Cloudy
18.00	1,21 Km/h	Light Rain

This hybrid power plant uses 2 different elements of the power plant, this time using solar panels and wind turbines. Then the measurement of the wind is considered very important. This wind speed measurement is carried out 2 days at 3:00 p.m. and takes wind speed samples every half hour, with as many as 7 sample data. The following are the results of wind speed measurements carried out at the UNSRAT basketball court, Manado. By using an annemometer for Km / h.

Table 3: Logic on a hybrid power control system

Solar Panel	Wind Turbine	Output
High	High	Both
High	Low	Solar Panel
Low	High	Wind Turbine
Low	Low	Not Charging

In the results of this test, the simulated data is taken first. This simulation is carried out based on actual conditions or according to the voltage generated from each generator. Wind generators can generate 3V of electricity and solar panel generators can generate up to 12V, with a setpoint on the sensor, which is 2V on wind generator and 12V on solar panels. This setpoint will later be a comparison between the readable values on the sensor. By taking data on several simulated conditions to resemble the conditions that occur in the field.

Figure 5: The Implemetations on the Field nearby Laboratory

4. Conclusions

- Factors of high-intensity rainy weather greatly affect hybrid power plants. Due to the high intensity of the rain the solar panels cannot work optimally due to the decrease in the intensity of sunlight, and also the wind direction that changes very rapidly so that the wind turbine cannot rotate and produce a good voltage.
- Wind speed in the field of elements is not enough to turn the turbine based on the testing process and data collection in the field, it takes at least 15Km / h-17Km / h to get 3-5V voltage, while the wind in the basketball court is less than 10Km / h
- After data collection on the wind, the increase in voltage generated from the wind turbine increases linearly with the wind speed.

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