Developing a Dual-Axis Solar Tracker System with Arduino

Baha Rudin Abd Latif, Muhammad Irfan Abdul Satar

Abstract: ***Solar panels have been used increasingly in recent years to convert solar energy to electrical energy. The solar panel can be used either as a standalone system or as a large solar system that is connected to the electricity grids. The problem that we can see now is most of the solar panel that had been used by a user is only in a static direction. This project is focusing on consuming more energy from the sun using solar tracker. The developed dual-axis solar tracker uses a Light Dependence Resistor (LDR) to sense the intensity of light while servo motor will rotate the solar panel based on the highest intensity of light.***

Key Words: ***Light Dependence Resistor (LDR), solar panel based on the highest intensity of light.***

I. BACKGROUND

It is expected that the efficiency of the conversion system may show a form of progress because of the solar panels' orientation. The system is an integration of mechanical, electrical and computer system components. The project proposed to be developed during this research will track the sun throughout the day and make the sun normal to the solar panels at all time. This system is suitable to be used in home or small factories that want to save their budget for a long term.

Below are the main objectives of "Development of Dual Axis Solar Tracker Using Arduino" projects.

1. To design system that tracks the sun position
2. Comparison the voltage output of solar panel between fixed, single and dual axis

Analyze the efficiency of fixed, single and dual axis solar tracker.

II. METHODS

In the process of making this project which is "Development of Dual Axis Solar Tracker Using Arduino", this project used Arduino Software as the microcontroller that control the operation of the circuit according to the programmed that had been wrote. Proteus is for design the circuit for solar panel to battery. So, we just use one circuit and 2 coding this project.

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III. RESULTS

The results for the project were collected from LDRs for the fixed, single and dual axis solar tracker system. The results were recorded for 4 days, recorded and tabulated. The outputs of the LDRs were dependent on the light intensity.

Arduino environment's built in serial monitor can be used to communicate with the Arduino board. Data was collected from the LDRs after everyone hour. The values from the LDRs are to be read and recorded at the given intervals.

As a result, by measuring the light intensity at a given time, it will be possible to get the difference in efficiency between fixed, single axis and dual axis solar tracker. The values obtained were tabulated and used to draw graphs to show the relations as follows:

[Results for abright, sunny day on 27 April 2018]

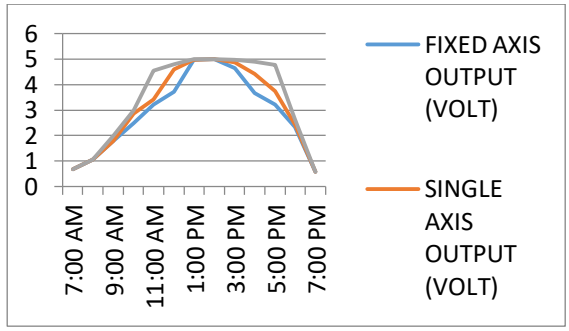


Fig. 1 Results for bright and sunny 27 April 2018

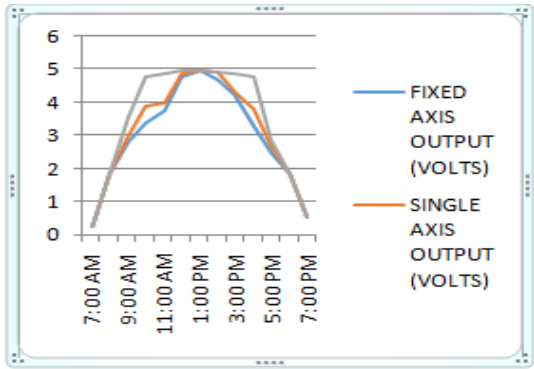


Fig. 2 Results for bright and sunny day 30 April 2018

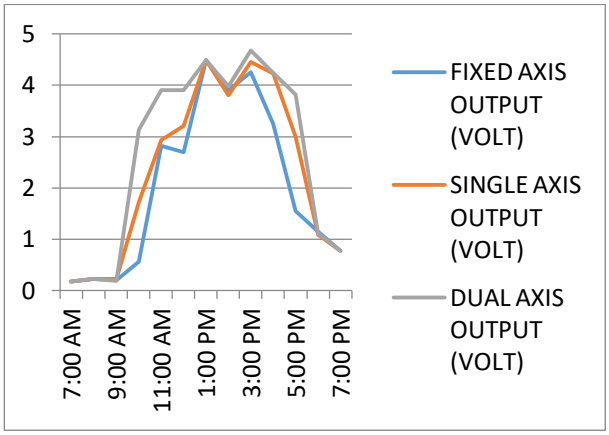


Fig. 3 Results for cloudy day 22 April 2018

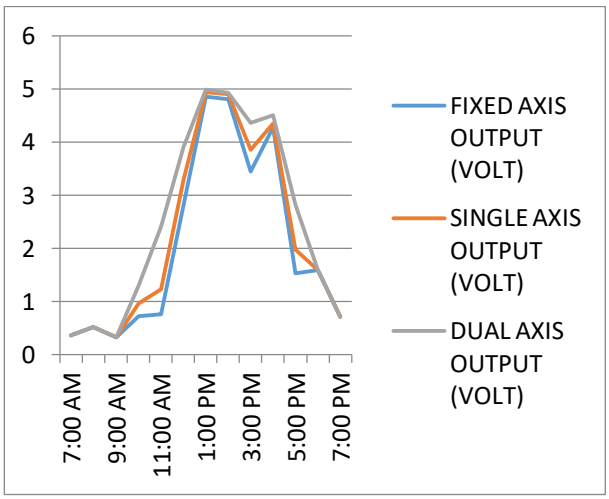


Fig.4 Results for drizzled day24 April 2018

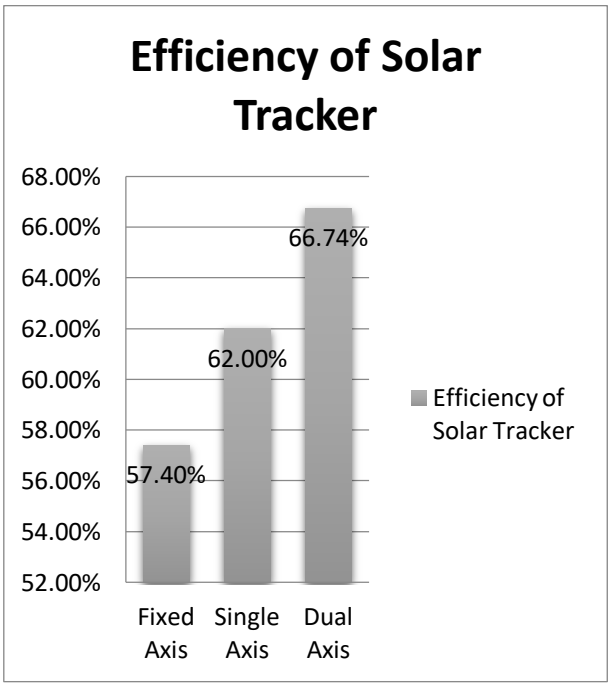


Fig. 5 Column chart results for bright and sunny day 30 April 2018

The difference between fixed and dual axis is 10.34% and single and dual axis is 5.74%. This means the dual axis tracker system has an increased efficiency which is better than fixed and single axis solar tracker

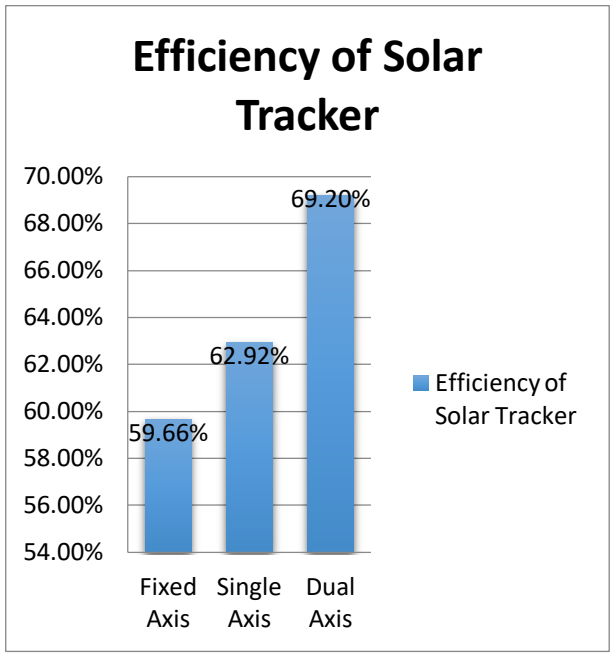
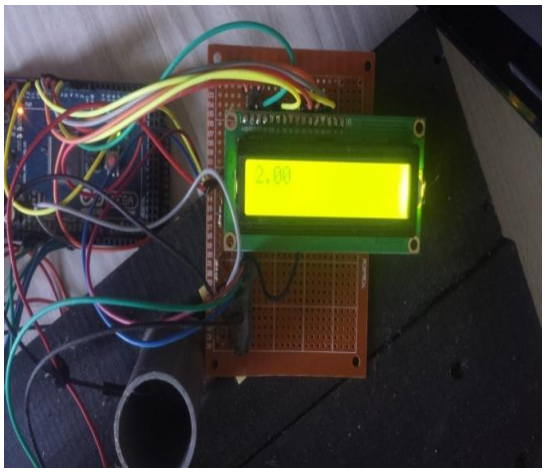


Fig. 6 Column chart for efficiency– for bright and sunny day 30 April 2018

The difference between fixed and dual axis is 9.54 % and single and dual axis is 6.28 %. This means the dual axis tracker system has an increased efficiency which is better than fixed and single axis solar tracker



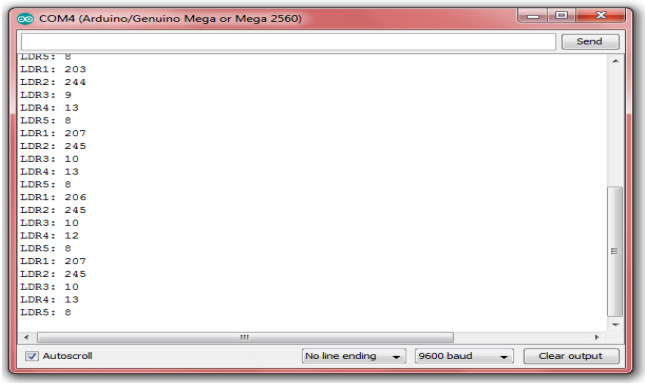


Fig. 7 Project outcomes

From the result, the maximum sunlight occurs at around midday, with maximum values obtained between 1100 hours and 1400 hours. In the morning and late evening, intensity of sunlight diminishes, and the values obtained are less that those obtained during the day. After sunset, the tracking system is switched off to save energy. It is switched back on in the morning.

For fixed axis solar tracker system, it uses one LDRs. The digital value and voltage of the LDRs are calculated by fixed position which angle is 45˚. At 7.00 AM until 2.00 PM the value and voltage of LDRs is calculated as an expected but the value and voltage of LDRs drop at 3.00 PM until 7.00 PM. This is because there is no movement of the solar panel which angle is remains constant at 45˚ all the time.

For the single axis solar tracker system, it uses three LDRs. The digital value and voltage of the LDRs are calculated by rotation of x-axis direction which angle is 45˚, 90˚ and 135˚. The values of the three LDRs are varying because the solar panel moving at one direction only. The motion of the panel is stopped when the one of the three LDRs has higher of the digital value. In term of efficiency of solar tracker system, it shows that there is different efficiency between fixed axis, single axis and dual axis. From the data, it can be said that the dual axis solar tracker is more efficiency method of maximizing the energy received compare to single and fixed axis. It is calculated as a percentage and the three systems compared. It shows that the dual axis solar tracker system has better efficiency compare to fixed and single axis[2].

IV. CONCLUSIONS

This chapter had discussed about the result and the analysis that had been done in the project. Moreover, the project was successfully built. The process and result obtained from the experiment. Testing process is covered sensor and motor of the system and from hardware until software development. Overall, the expected outcome had totally achieved the objective.

Technology and innovations for tracking and harvesting solar energy are recommended to revolutionise aviation domain[3-21] in general to maintain the balance of preserving the environment.

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