DESIGN AND FABRICATION OF DUAL AXIS SOLAR SYSTEM TRACKER

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project and in my opinion, this project is adequate in terms of scope and quality for the award of the degree of Bachelor of Engineering Technology in Manufacturing

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRACT

Solar power is the energy from the sun that is converted into thermal or electrical energy. The uses of solar energy are now developing rapidly since it is the cleanest and renewable energy source available. This paper presents the design and fabrication of high-efficiency dual-axis solar tracking system. Moreover, the objectives of this paper is to make sure the designed dual-axis solar tracking system can move the solar panel to the direction of the light accurately. The project can be divided into two stages, which are the designing the structure of the solar tracker and the fabrication of the parts. In the design development, SolidWorks software is used to create the structure of the solar tracking system. To prove the structure is perfect for the solar tracking system, another software is used to test it. For the fabrication part, correct process is carefully chosen based on the machines and tools available in UMP. After the structure is completed, a solar panel, two linear actuators, sensors and batteries are assembled in the solar tracking system. The efficiency of the system has been tested and compared with static solar panel on several time intervals, and it shows the system react the best at the to-minutes intervals with consistent voltage generated. Therefore, the structure has been proven working for directing the solar panel towards the direction of light accurately so that it can capture maximum sunlight source for high efficiency solar harvesting applications.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

According to National Center of Policy Analysis, solar power is the fastest growing means of renewable energy production with grid connected solar capacity increasing on average by 60 % annually from 2004 to 2009 (D.Johnson-Hoyte *et al*, 2013). Unfortunately, solar energy only contributing a small part in energy work field. It is stated that the future of PV solar technologies looks promising considering favorable location and continued federal tax subsidies as well as state renewable standard protocol (S.J.Reichelstein and M.Yorston, 2012). According to paper, with the continued trend in decreasing cost of PV panels and government subsidies, PV Solar energy might become cost competitive in the next 10 years (subsidy-free), for commercial installations while for Utility-scale installations it will take longer. The latest solar energy production is by using the solar panel and solar tracker where the device is used to identify and track the light direction.

The goal of this project is to build a Dual-axis Smart Solar Tracking System which is basically a device onto which sensors had been used to track the accurate direction of the sun across the sky to ensure maximum amount of sunlight strikes on solar panel throughout the day. The tracking system is continuously finding the sunlight by navigating through the path ensuring the best sunlight is detected. Our team members are divided to three major specializations which are manufacturing for design chassis part, electrical for controller and energy for solar panel and determine the experimental location. The design of the solar tracker requires many components. The design, construction and test of it could be divided into five main parts, each with their main function. They are: 1. Design of tracker 2. Solar panel chosen, 3. Sensor and Sensor Controller, 4. Solar working mechanism with the sun, 5. Solar tracker efficiency.

Dual-Axis solar systems allow for precise control of the elevation and azimuth angle of the panel relative to the sun. The tracking system is reported to be more accurately potentially double the energy output of a fixed PV Solar system which is about 48.982% (A.Catarius and M.Christiner, 2010). Meanwhile, if it is compared to the single axis solar tracker, it is also proven that dual axis solar tracker will give more energy output since they can rotate on two axes due to its two degrees of freedom that act as axes of rotation. They are primary axis, the axis that is fixed with respect to the ground and secondary axis, which is the axis referenced to the primary axis. These axes are typically normal to one another. There are several common implementations of dual axis trackers. They are classified by the orientation of their primary axes with respect to the ground. Two common implementations are tip-tilt dual axis trackers (TTDAT) and azimuth-altitude dual axis trackers (AADAT). So, the dual axis solar tracker can produce 40% more power compared to the single axis solar tracker (M.Scanlon, 2010).

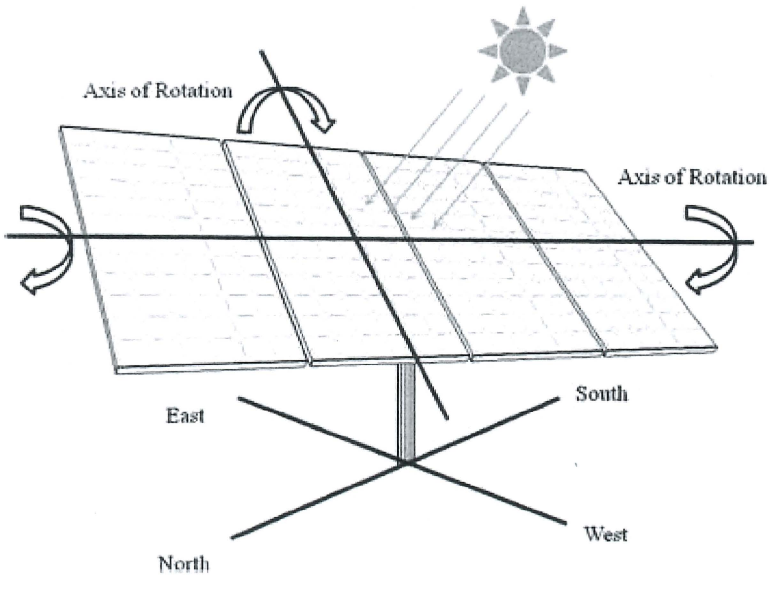

***Figure 1.1**: Movement for dual-axis solar tracker*

The design of the solar tracking system is completed by using SolidWorks software, which is one of the friendliest designing tools. The design is used to help the process of fabrication where the measurement of each part is precisely done in the drawing. After the design process, the construction process of the solar tracker it is done with the aids of many machines and tools. For example, saw machine, grinder and welding machine. At the end, the solar tracking system is tested practically under the sunlight.

Compared to last year's, this project can ensure more precise direction since the solar panel is moved in two axes. Two linear actuators are used in order to move the solar panel in east-west and also north-south directions. With the used of these two linear actuator, it can increase the movement range of the solar panel. So, the solar panel are able to face any direction of the sunlight. Besides, with the aid of five sensors, it enhances the accuracy of the tracking system in order to trace the light intensity. By doing this, the solar tracking system are able to navigate to the best angle of exposure of light from the sun. the sensors constantly monitor the sunlight and tilt the panel towards the direction where the intensity of sunlight is maximum.

Figure 1.2*: Linear actuators of our project*

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