DESIGN AND FABRICATION OF DUAL AXIS SOLAR SYSTEM TRACKER

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Thesis submitted in fulfillment of the requirements
for the award of the degree of
Bachelor of Engineering Technology in Manufacturing with Hons

Faculty of Engineering Technology
UNIVERSITI MALAYSIA PAHANG

DECEMBER 2016
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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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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ACKNOWLEDGEMENTS

I would like to express the deepest appreciation to my supervisor, Dr. Yasir H. Naif, who has the attitude and the substance or a genius: he continually and convincingly conveyed a spirit of adventure in regard to research and an excitement in regard to teaching. Without his guidance and persistent help this senior design project would not have been possible.

I wish to express my sincere thanks to Professor Dato' Dr. Zularisam Ab Wahid, Dean of the Faculty of Engineering Technology, for providing me with all the necessary facilities to complete the fabrication and testing of this senior design project.

I am highly indebted and thoroughly grateful to my group project members, Harvindran A/L Kuppusammy and Nur Izaati binti Arshad for their help and support. We have created the best co-operation among ourselves deliberating over our problems and findings, but also happily by talking about things other than just our papers during this study.

I would also like to thank both of my parents for their wise counsel and sympathetic ear all the time during my study here. My father, Mr. Muhammad Tarminzi bin Mustapha and my mother, Mrs. Norhayati binti Ali @ Mohd Ali. I cannot find the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to attain my goals.
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.
TABLE OF CONTENT

SUPERVISOR’S DECLARATION iv
STUDENT’S DECLARATION v
ACKNOWLEDGEMENTS vi
ABSTRACT vii
TABLE OF CONTENT viii
LIST OF TABLES xi
LIST OF FIGURES xii

CHAPTER 1 INTRODUCTION

1.1 Introduction 1
1.2 Problem Statement 5
1.4 Significance of Research 5

CHAPTER 2 LITERATURE REVIEW

2.1 Solar Power 6
   2.1.1 History Of Solar Power 7
   2.1.2 Technologies In Solar Tracking 8
2.2 Sun’s Position 10
   2.2.1 Elevation Angle 11
2.2.2 Zenith Angle 11
2.2.3 Azimuth Angle 12

2.3 Solar Tracking System 12
2.3.1 Fixed Solar Panel 13
2.3.2 Passive Solar Tracker 14
2.3.3 Single Axis Solar Tracker 15
2.3.4 Dual-Axis Solar Tracker 17

2.4 Solar Panel 19
2.4.1 Monocrystalline Cell 20
2.4.2 Polycrystalline Cell 21
2.4.3 Amorphous Cell 22

2.5 Motor 23
2.5.1 DC Motor Brushed 23
2.5.2 DC Motor Brushless 23
2.5.3 Stepper Motors 24
2.5.4 Servo Motors 25
2.5.5 Linear Actuator 25
2.5.6 Comparison Between Motors 28

2.6 Light Dependent Resistor (LDR) 29

2.7 Batteries (Load) 30
2.7.1 Lead Acid Battery 32
2.7.2 Rechargeable Alkaline Battery 33
2.7.3 Lithium-Ion Battery 34
2.7.4 Nickel-Metal Hydride Battery 36
CHAPTER 3 METHODOLOGY

3.1 Introduction

3.2 Planning for Senior Design Project

3.3 Designing Structure Of Dual Axis Solar Tracker

3.4 Material Selection
  3.4.1 Properties Of Mild Steel
  3.4.2 Comparing Mild Steels To Other Materials

3.5 Fabrication
  3.5.1 Cutting Process
  3.5.2 Welding Process
  3.5.3 Joining Process
  3.5.4 Finishing Process

3.6 Final Product

3.7 Cost Analysis

3.8 Gantt Chart

3.9 Ethical Consideration

CHAPTER 4 RESULTS AND DISCUSSION

4.1 4.1 Project Outcomes

4.2 Design Analysis
  4.2.1 Load Calculation
4.2.2 Stress And Deformation Test 63
4.3 Solar Output 64

CHAPTER 5 CONCLUSION

5.1 Conclusion 67
5.2 Recommendations 68

REFERENCES 69

APPENDIX A SAMPLE APPENDIX 1 72
APPENDIX B SAMPLE APPENDIX 2 75
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table No.</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1</td>
<td>Types and the characteristics of actuators</td>
<td>27</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>Motor actuation comparison table</td>
<td>28</td>
</tr>
<tr>
<td>Table 2.3</td>
<td>Light intensity measurement</td>
<td>29</td>
</tr>
<tr>
<td>Table 2.4</td>
<td>A table of all of the most commonly accepted rechargeable batteries on the market today.</td>
<td>32</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Design of dual axis solar tracker using SolidWorks software</td>
<td>43</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>Properties of Mild Steel</td>
<td>46</td>
</tr>
<tr>
<td>Table 3.3</td>
<td>Comparison between mild steel, stainless steel and Aluminium</td>
<td>47</td>
</tr>
<tr>
<td>Table 3.4</td>
<td>The advantages and disadvantages of using mild steel</td>
<td>48</td>
</tr>
<tr>
<td>Table 3.5</td>
<td>Cost analysis</td>
<td>58</td>
</tr>
<tr>
<td>Table 4.1</td>
<td>Solar voltage output of PV panel in Fixed Mode for Sunny day</td>
<td>64</td>
</tr>
<tr>
<td>Table 4.2</td>
<td>Solar voltage output of PV panel in Tracking Mode for Sunny day</td>
<td>65</td>
</tr>
<tr>
<td>Table 4.3</td>
<td>Comparison of solar voltage output of PV panel in Fixed Mode and Tracking Mode for Sunny day</td>
<td>66</td>
</tr>
<tr>
<td>Figure No.</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Figure 1.1</td>
<td>Movement for dual-axis solar tracker</td>
<td>2</td>
</tr>
<tr>
<td>Figure 1.2</td>
<td>Linear actuators of our project</td>
<td>3</td>
</tr>
<tr>
<td>Figure 2.1</td>
<td>Fix-mounted solar panel fixed on roof</td>
<td>9</td>
</tr>
<tr>
<td>Figure 2.2</td>
<td>Sun’s position</td>
<td>10</td>
</tr>
<tr>
<td>Figure 2.3</td>
<td>The position for elevation, zenith and azimuth angles</td>
<td>11</td>
</tr>
<tr>
<td>Figure 2.4</td>
<td>Solar panel being fix-mounted on ground by solar mounting structure</td>
<td>14</td>
</tr>
<tr>
<td>Figure 2.5</td>
<td>Mechanism for passive solar tracking system</td>
<td>15</td>
</tr>
<tr>
<td>Figure 2.6</td>
<td>Principle of Single Axis Solar Tracking</td>
<td>16</td>
</tr>
<tr>
<td>Figure 2.7</td>
<td>Block Diagram of Single Axis Tracker System</td>
<td>16</td>
</tr>
<tr>
<td>Figure 2.8</td>
<td>Mechanism for dual-axis solar tracking system</td>
<td>17</td>
</tr>
<tr>
<td>Figure 2.9</td>
<td>Dual-axis solar tracking system</td>
<td>18</td>
</tr>
<tr>
<td>Figure 2.10</td>
<td>Monocrystalline solar panel</td>
<td>21</td>
</tr>
<tr>
<td>Figure 2.11</td>
<td>Poly crystalline solar panel</td>
<td>22</td>
</tr>
<tr>
<td>Figure 2.12</td>
<td>Amorphous solar panel</td>
<td>22</td>
</tr>
<tr>
<td>Figure 2.13</td>
<td>Working principle of PM stepper motor</td>
<td>24</td>
</tr>
<tr>
<td>Figure 2.14</td>
<td>The linear actuator system</td>
<td>26</td>
</tr>
<tr>
<td>Figure 2.15</td>
<td>LDR construction</td>
<td>30</td>
</tr>
<tr>
<td>Figure 2.16</td>
<td>Relationship between the lifetimes of each particular type of battery</td>
<td>34</td>
</tr>
<tr>
<td>Figure 2.17</td>
<td>Relationship between the cell capacity and number of discharge cycles for a lithium ion battery</td>
<td>35</td>
</tr>
<tr>
<td>Figure 2.18</td>
<td>The discharge temperature of the nickel metal hydride can be related to the amount of capacity available within the battery itself</td>
<td>37</td>
</tr>
<tr>
<td>Figure 3.1</td>
<td>Planning for senior design project</td>
<td>39</td>
</tr>
<tr>
<td>Figure 3.2</td>
<td>Finished design</td>
<td>44</td>
</tr>
<tr>
<td>Figure 3.3</td>
<td>2-inch x 2-inch mild steel</td>
<td>45</td>
</tr>
<tr>
<td>Figure 3.4</td>
<td>Stress strain curve for mild steel</td>
<td>48</td>
</tr>
<tr>
<td>Figure 3.5</td>
<td>Measuring tape</td>
<td>50</td>
</tr>
<tr>
<td>Figure 3.6</td>
<td>Faithful double end scriber and engineer square</td>
<td>50</td>
</tr>
<tr>
<td>Figure 3.7</td>
<td>Illustration how to use scriber and engineer square</td>
<td>51</td>
</tr>
<tr>
<td>Figure 3.8</td>
<td>Bosh cutting machine</td>
<td>51</td>
</tr>
<tr>
<td>Figure 3.9</td>
<td>MIG welding machine</td>
<td>52</td>
</tr>
</tbody>
</table>
Figure 3.10  The figure shows how the linear actuator is assembled  53
Figure 3.11  The figure shows how the base part is joined to the upper part by using brackets  54
Figure 3.12  The base of linear actuator is fixed to a plate using bolt and nut  55
Figure 3.13  Bowl-type wire wheel wire brush used to remove rust  56
Figure 3.14  Tools to remove welding wear  56
Figure 3.15  Spraying  57
Figure 3.16  Final product  57
Figure 4.1  Simulation results on the main support  63
Figure 4.2  Solar voltage output by time of the day in Fixed Mode for sunny day  64
Figure 4.3  Solar voltage output by time of the day in Tracking Mode for sunny day  65
Figure 4.4  Graph of comparison solar voltages output in Fixed Mode and Tracking Mode for Sunny day  66
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

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](image)
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 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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