



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**Development of Horizontal Single Axis Solar Tracker via
Arduino Approach**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

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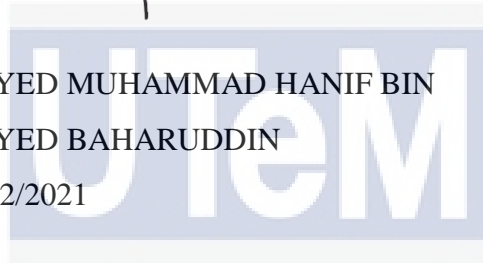
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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:



ABSTRAK

Pada zaman moden ini, permintaan tenaga elektrik semakin meningkat dan menyebabkan kekurangan sumber tenaga yang banyak. Tenaga boleh diperbaharui yang sering disebut sebagai tenaga bersih, berasal dari sumber atau proses semula jadi yang sentiasa diisi semula. Cahaya matahari atau angin, tetap bersinar dan bertiup walaupun kewujudannya bergantung pada persekitaran dan waktu. Tenaga suria adalah salah satu contoh tenaga yang boleh diperbaharui. Tenaga suria merupakan tenaga yang menarik tenaga dari cahaya matahari dan menukarkannya ke tenaga elektrik. Terdapat beberapa jenis panel suria yang telah dicipta seperti sel suria polikristalin, sel suria monokristalin, sel suria amorf dan sel suria hybrid. Kadar kecekapan untuk sel suria ini berbeza kerana pembuatannya yang berbeza. Objektif projek ini adalah untuk meningkatkan kecekapan panel suria dengan memasang pengesan pada panel suria. Untuk pengesan paksi tunggal, terdapat konfigurasi dalam bilangan atau cara kedudukan paksi iaitu pengesan paksi tunggal mendatar, pengesan paksi tunggal menegak dan pengesan paksi tunggal condong. Walaubagaimanapun, konfigurasi yang berbeza mempunyai keupayaan yang berbeza tetapi mereka masih mempunyai konsep yang sama iaitu untuk meningkatkan kecekapan panel suria dengan mengesan cahaya matahari. Pembentukan pengesan suria paksi tunggal mendatar ini menggunakan tiga komponen penting iaitu sensor, motor dan mikro pengawal. Sensor bertindak sebagai masukan untuk mengesan sinar cahaya matahari, mikro pengawal memproses signal data dari sensor dan motor pula berfungsi untuk ke posisi yang tepat. Hasilnya, kecekapan yang dihasilkan oleh panel suria ini dapat ditingkatkan kerana ia sentiasa menghadap cahaya matahari. Projek ini mudah dipasang dan merupakan projek yang dapat meningkatkan kadar kuasa panel solar.

ABSTRACT

Nowadays, electricity demand is increasing and it is leading to a shortage of energy sources. Renewable energy, also called renewable energy, comes from natural sources or processes that are continuously replenishing. Sunlight or wind, keep shining and blowing even their availability depends on the environment and time. Solar energy is one an example of renewable energy. Solar energy is an energy that captures energy from the sun and converts it into electricity. There are different types of solar panels, such as polycrystalline, hybrid, amorphous and monocrystalline solar cells. The efficiency rated for these solar cells are different due to their different manufacturing. The objective of this project is to improve the effectiveness of a solar panel by installing a tracker on the solar panel. For the single axis tracker, the axis orientation of the horizontal single-axis tracker, vertical single-axis tracker and tilted single-axis tracker are positioned in a number or theirs way. Therefore, different configurations have different capabilities but they still have the same concept to upgrade the effectiveness of solar panels by follow the sunlight. Development of horizontal single axis solar tracker uses three important components namely sensors, motors and microcontroller. The sensor acts as an input to track the sun, the microcontroller processes the data signal from the sensor and the motor works to rotated to the right position. As a result, the efficiency of a solar panel can be enhanced as the solar panel is constantly facing the sun. This project is easy to install components and is a project that can greatly improve solar panel power rates. Thus, it can also reduce the cost of buying solar panels that require a lot of energy and can help to provide energy from renewable energy.

DEDICATION

Dedicated to my beloved mother, siblings and all friends.



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TABLES OF CONTENTS

	PAGES
TABLES OF CONTENTS	x
LISTS OF TABLES	xiv
LISTS OF FIGURES	xv
LISTS OF APPENDICES	xviii
LISTS OF SYMBOLS	xix
LISTS OF ABBREVIATIONS	xx
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Statement of the Purpose	2
1.3 Problem Statement	2
1.4 Objectives	3
1.5 Scope of Research	3
CHAPTER 2 LITERATURE REVIEW	4
2.1 Introduction	4
2.2 Overview of Single Axis Solar Tracking	5
2.3 Basis of Driving System	6
2.3.1 Active Solar Tracking System	6

2.3.2	Passive Solar Tracking System	7
2.4	Tracking Strategies	8
2.4.1	Date and Time	8
2.4.2	Microprocessor and Electro Optical Sensor	9
2.4.3	Sensor, Date and Time	9
2.5	Collector	9
2.5.1	Fixed Collector	10
2.5.2	Tracking Collector	10
2.6	An Overview type of Single Axis Solar Tracker Microcontroller	11
2.6.1	Arduino Uno Microcontroller	12
2.6.2	PIC Microcontroller	13
2.7	Sensor Input	14
2.8	An Overview type of motor in Single Axis Solar Tracker	15
2.8.1	Servo Motor	16
2.8.2	DC Motor	17
2.8.3	Stepper Motor	18
CHAPTER 3 METHODOLOGY		19
3.1	Introduction	19
3.2	Specification of Component	19
3.3	Project Development	20

3.3.1	Flowchart	20
3.3.2	Block Diagram	21
3.3.3	Project Software Simulation	21
3.3.4	Expected Result	23
3.4	Solar Panel	25
3.4.1	Type of Solar Panel	26
3.4.2	Polycrystalline Solar Cells	26
3.5	Microcontroller of Horizontal Single Axis Solar Tracker	28
3.5.1	Arduino ATmega328P	28
3.6	Light Dependent Resistor	29
3.6.1	Construction and Operation of LDR	30
3.7	Servo Motor	31
3.7.1	Servo Motor Control with Arduino Uno	32
3.8	Concept of using 2 LDR	33
3.9	Gantt Chart	34
CHAPTER 4 RESULT AND DISCUSSION		35
4.1	Introduction	35
4.2	Testing with No Load	36
4.2.1	Voltage against Time	37
4.2.2	Current against Time	39

4.2.3	Power against Time	40
4.2.4	Power Gain and Efficiency	42
4.3	Testing with Load	44
4.3.1	Voltage against Time	46
4.3.2	Current against Time	48
4.3.3	Power against Time	49
4.3.4	Power Gain and Efficiency	50
4.4	Solar Panel I-V Characteristic Curve	52
CHAPTER 5	CONCLUSION AND RECOMMENDATION	54
5.1	Conclusion	54
4.4	Recommendations	55
REFERENCES	56	
APPENDIX A	58	

LIST OF TABLES

TABLE	TITLE	PAGE
Table 1.1:	Advantages and Disadvantages of Tracking Collector	10
Table 3.1:	Expected Result by using 60W Solar Panel System	24
Table 3.2:	Specification of Polycrystalline Solar Cells	27
Table 3.3:	Specification of Arduino Uno	29
Table 3.4:	Project Planning	34
Table 4.1:	The Specification of Polycrystalline Solar Cells	35
Table 4.2:	No Load Measured Value of Fixed and Solar Tracking Panel	36
Table 4.3:	With Load Measured Value of Fixed and Solar Tracking Panel	45

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1:	Horizontal Single Axis Solar Tracker	4
Figure 2.2:	Type of Rotation Single Axis Tracking	5
Figure 2.3:	Active Trackers	6
Figure 2.4:	Passive Trackers	7
Figure 2.5:	Solar Tracker Capturing the Sun	8
Figure 2.6:	Example of Open-Loop System Flowchart Process	11
Figure 2.7:	Example of Closed-Loop System Flowchart Process	12
Figure 2.8:	Arduino Uno Microcontroller	13
Figure 2.9:	PIC Microcontroller	14
Figure 2.10:	(a) Lateral trim (b) Central side (c) With different slope	15
Figure 2.11:	Servo Motor	16
Figure 2.12:	DC Motor	17
Figure 2.13:	Stepper Motor	18
Figure 3.1:	Flowchart Process	20
Figure 3.2:	Block Diagram Process	21
Figure 3.3:	Arduino Program Code	22

Figure 3.4:	Single Axis Solar Tracker via Arduino Approach Control Circuit	23
Figure 3.5:	Polycrystalline Solar Cells	26
Figure 3.6:	Light Dependent Resistor	30
Figure 3.7:	LDR Symbol and Construction	31
Figure 3.8:	Construction Servo Motor with An Arduino Uno	32
Figure 4.1:	Voltage against Time Line Graph	37
Figure 4.2:	(a) Fixed Panel (b) Tracking System with No Load Connection	38
Figure 4.3:	Current against Time Line Graph	39
Figure 4.4:	Power against Time Line Graph	40
Figure 4.5:	The Bar Graph of Power Gain	42
Figure 4.6:	Efficiency against Time Bar Graph	43
Figure 4.7:	Voltage against Time with Load Connection Line Graph	46
Figure 4.8:	(a) Fixed Panel (b) Tracking System with Load Connection	47
Figure 4.9:	Current against Time with Load Connection Line Graph	48
Figure 4.10:	Power against Time with Load Connection Line Graph	49
Figure 4.11:	Power Gain Bar Graph	50
Figure 4.12:	Efficiency against Time Bar Graph	51
Figure 4.13:	I-V Characteristic	52



LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	Proteus 8 Demonstration Software	37



LIST OF SYMBOLS

W	-	Watt
V	-	Voltage
P	-	Power
I	-	Current
l	-	Length
η	-	Efficiency
A	-	Ampere
kg	-	kilogram
mm	-	millimeter
mA	-	milliAmpere
MHz	-	MegaHertz
kb	-	kilobytes



LIST OF ABBREVIATIONS

PIC	Programmable Interface Controllers
VDD	Voltage Drain Drain
Vref	Voltage reference
LDR	Light dependent resistor
VDC	Volt Direct Current
USB	Universal Serial Bus
CdS	Cadmium Sulphide
PWM	Pulse Width Modulation
Voc	Open Circuit Voltage
Isc	Short Circuit Current
Vmp	Maximum Power Voltage
Imp	Maximum Power Current

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CHAPTER 1

INTRODUCTION

1.1 Background

Renewable and non-renewable energy sources can produce electricity for consumers around the world. There are two variations in this source where renewable energy derived from sources that do not deplete whereas non-renewable energy originates from sources that run out or are not replenished. This lack of energy sources leads to the existence of various sources of energy such as solar energy, wind energy, hydro energy and many other explored resources. Solar energy is one of the most important renewable energy in the world as it uses energy from the sun and converts it into electricity. The existence of this solar energy has contributed to reduce pollution and costs from expensive energy source such as hydro and wind energy. The title for this Final Year Project is Development of Horizontal Axis Solar Tracker via Arduino Approach. The purpose of this project is to improve the efficiency of solar panel by installing a tracker on the solar panel so that it is constantly facing the sun. The main components in this project are sensors, motors and microcontroller. Each component has different roles and the project selects the type of components that have a good efficiency rated and construction. Thus, the installation of project is simple and the control circuit is easy to understand with simple program code.

1.2 Statement of the Purpose

The purpose of the project is to improved and increased the efficiency of solar panel by installing and develop horizontal axis solar tracker via Arduino approach. The project installed the sensors to keep track of the sun all day, using microcontroller to process data signals from input and motor to rotate the PV panels in specified location.

1.3 Problem Statement

Generally, solar tracking system had many problems that occur in previous project. Most people installed the solar panel in fixed condition cause of lack in experience towards solar. Because of this problem, the solar panel is in a static state and does not receive the light properly. If the panel surface is continuously perpendicular parallel to the sun, the solar panel will receive full light.

The other problem is fixed solar panel are lack of efficiency. This is because the solar panel does not receive enough light. As a result, the efficiency of the solar panel can create a low as a required. Based on the papers, the system does not monitor the light, the highest theoretical potential efficiency is only 55%, while the perpendicular direct to the light panels are 85% efficient.

Moreover, the problem associated with the movement of the sun from morning to night. Fixed solar panel only absorb enough light in certain time because of its static condition. To rectify these above problem, the solar panel should be such that it always receives maximum intensity of light.

1.4 Objectives

The goals of the project are:

- a) To develop a tracking solar panel system with 180 degrees that constantly tracking the sun during daytime.
- b) To develop a tracking system that maximize the solar panel power efficiency.
- c) To develop a tracking system based on light dependent resistor (LDR)

1.5 Scope of research

The scope of this project is made to inform the features and components used in this project. This project will construct a small prototype of horizontal single axis solar tracking system using Arduino. This project will conduct in research and testing the efficiency on the solar panel. On the other hand, this project will test its effectiveness by performed and build a tracking solar panel system and compare the result with fixed solar panel system. In addition, this experiment performed a simulation by using Proteus 8 Demonstration and Arduino IDE software in order to obtain the result from the simulation software. In this project, Arduino act as microcontroller to control all the equipment and component for the process. Light based resistor (LDR) also known as photo resistor senses the light intensity and able to adjust the rotation of the motor by dropping a light on its surface. For a rotation, servo motor is the best and suitable in this project cause its characteristic can rotates by degree from 0° to 180° degree. Light dependent resistor sensor sense the intensity of the light and give the signal to microcontroller to process hence give the motor rotates to a required position. By using solar panel, this project can be test and work during the daylight.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Electricity usage around the world is increasing caused humans are turning to renewable energy such as solar and other things. Solar panels have a variety of methods in their manufacture and installation. Therefore, efficiency in solar panels plays an important role in generating sufficient electricity in an industry or firm. The high efficiency of this solar panel can have a great impact on an industry such as it can reduce the cost on solar panel. In other word, this chapter will discuss the explanation about the solar panel tracking system. There are various solar panel tracking systems in the world and different installation method. Sensor, motor and controller is a main component of solar panel tracking system installation.

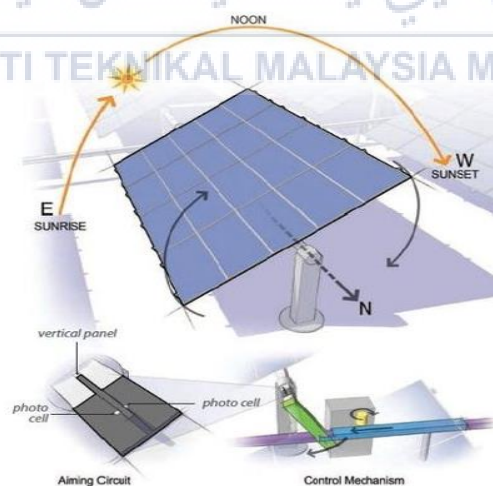


Figure 2.1: Horizontal single axis solar tracker

(Source: <https://vishalnagarcool.blogspot.com/2019/01/single-axis-solar-tracking-system-using.html>)