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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I hereby, declared this report entitled Development of Horizontal Single Axis Solar Tracker via Arduino Approach is the results of my own research except as cited in references.

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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:

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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.

ACKNOWLEDGEMENT

First, I would like to thank from deepest of my heart and gratitude to Allah SWT who gave me strength to bear all circumstance and obstacles during finishing my final year project. Next, not to forget my supervisor who guided me with his knowledge and experience Ts. Zaihasraf bin Zakaria from the beginning of the report until completion. Moreover, my special thanks first go to my family, who over the duration has been neglected even ignored, during my deepest concentrations.

Secondly, I want to thank everyone such as my parents, colleagues, lecturers who supported me in this effort directly and indirectly. The idea that they gave me a lot of help during the development process of this project. Plus, deeply acknowledge who gave me moral support, positive vibes, and never-ending encouragement and patience during the duration of final year project. Besides, I dedicated this final year project to my family and friends for your support.

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W	-	Watt
V	-	Voltage
P	-	Power
I	-	Current
1	-	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

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.

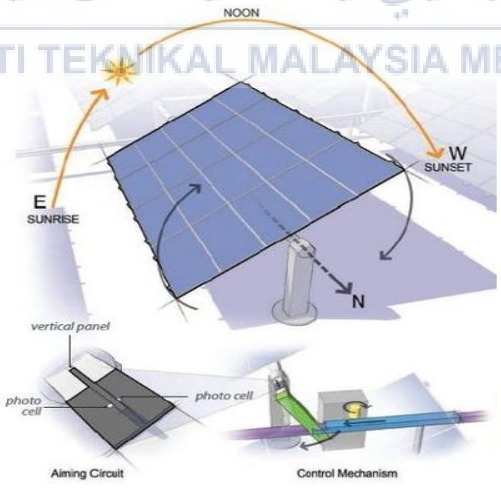

Figure 2.1: Horizontal single axis solar tracker

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