UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SUN TRACKING SOLAR PANEL WITH SELF-CLEANING SYSTEM USING ARDUINO UNO

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

by

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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 Computer Engineering Technology (Computer Systems) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Cahaya matahari merupakan sumber semula jadi penting yang telah mendatangkan banyak kebaikan kepada dunia di pelbagai sektor atau bidang. Berbandingkan dengan tenaga boleh diperbaharui yang lain di dunia ini, tenaga solar menunjukkan potensi yang tinggi dan baik dalam transformasi kepada tenaga elektrik. Akan tetapi, kecekapan keuntungan tenaga daripada panel suria tidak maksimum. Ini kerana kadang-kala ada objek yang jatuh ke atas panel suria sebagai halangan untuk mendapatkan cahaya matahari. Namun begitu, untuk memaksimumkan kecekapan panel suria dan penuaian tenaga, inovatif tenaga solar dapat dilaksanakan melalui projek ini. Kertas ini akan membincangkan cara membuat prototaip sistem pengesanan panel suria. Prototaip ini akan mengunakan satu berus sebagai alat untuk menghilangkan halangan daripada permukaan panel suria supaya panel ini dapat menyerap cahaya matahari sebanyak yang mungkin. Dalam projek ini, sensor ultrasonic dan LDR adalah komponen utama sistem pengesanan ini menerima cahaya matahari untuk membersihkan kotoran atau halangan dan mengesan cahaya matahari. Selain itu, prototaip ini juga membawa faedah dalam bentuk megurangkan pembaziran tenaga manusia dan masa pada membersihkan permukaan panel suria. Kecekapan dan penuaian tenaga daripada panel suria yang dilengkapi sistem pembersihan sendiri akan dibincangkan dalam laporan ini. Selepas analisis terhadap sistem, kecekapan dan penuaian tenaga telah meningkat 31.83% daripada sistem pengesanan suria yang biasa.

ABSTRACT

Sunlight is the significant natural resource that provided a lot of benefit to the world in various of field and this resource can produce sustainable energy which is solar energy. Among the renewable energy in this world, solar energy provides a good potential for transformation into electric energy. For now, the community have a lot of the solar tracking panel which produce a lot of electricity for their application. However, the efficiency of the energy gain by the solar panel is not maximize. This is because sometimes there have some obstacle object dropped on the panel board to block the sunlight. Solar panel that blocked by obstacle object will not receive maximum light source to produce full power. Notwithstanding the foregoing to maximize the efficiency of the solar panel and energy harvesting, an innovative improvement can implement through this papers. This paper will develop a prototype sun solar tracking system. The prototype will be using a brush to clean the obstacle which to make the solar panel received all the possible sunlight. In this project, ultrasonic sensor and the LDR are the main component to let solar tracker receives input sources to clean the obstacles and face toward the sunlight. This prototype will bring the benefit to the community to reduce manpower and time on cleaning the surface of panel. By doing analysis on the system, the efficiency and energy harvesting for the solar tracker with self-cleaning system has shown increased about 31.84% compared to normal tracker. In short, this solar tracker prototype with the self-cleaning system has a good performance to maximize the energy harvesting.

DEDICATION

To My Parents

Thank for my father and mother always give me a lot of support.

To My Final Year Project Supervisor

Ahmad Nizamuddin bin Muhammad Mustafa

Thank for giving me a lot of useful suggestion and guidance, without his professionalism spirit, my project will not successful finish in time.

To My Seniors

Thank for all the knowledge support and help.

To My Fellow Friends

Thank for the motivation, advice and mental support, whenever I lost myself.

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LIST OF SYMBOLS

Si	-	Silicon
ms	-	Metre per second
cos	-	Cosine
%	-	Percent
MW	-	Megawatt
mA	-	Milliampere
Hz	-	Hertz
m	-	Metre
µs	-	Microsecond
mm	-	Millimetre
cm	-	Centimetre
Kg	-	Kilogram
RM	-	Ringgit Malaysia
mAh	-	Milliampere Hour
Wh	-	Watt-Hour
V	-	Volt

LIST OF ABBREVIATIONS

PV	-	Photovoltaic
LDR	-	Light Dependent Resistor
pm	-	Post Meridiem (Past Midday)
HSAT	-	Horizontal Single Axis Tracker
VSAT	-	Vertical Single Axis Tracker
TSAT	-	Tilted Single Axis Tracker
PIC	-	Programmable Interface Controller
LCPV	-	Low Concentration Photovoltaic
NEMA	-	National Electrical Manufacturers Association
IDE	-	Integrated Development Environment
OS	-	Operating System
USB	-	Universal Serial Bus
DC	-	Direct Current
AC	-	Alternating Current
PWM	-	Pulse Width Modulation
GND	-	Ground
Vcc	-	Voltage Common Collector
ADC	-	Analog To Digital Converter
PCB	-	Printed Circuit Bo

CHAPTER 1

INTRODUCTION

This chapter will discuss briefly the project flow from introduction, objective and problems statement of the project. Furthermore, the scope of the project is also discussing through this section. Each sub-topic in order to make the reader more understand about the project flow and purpose of the project.

1.1 Project Background

Energy is the main factor for the development of a country. A huge amount of the energy is extracted, distributed, and consumed in the all around the world. 85% of the energy is dependent on fossil fuel. (Khan *et al.*, 2010). However, the fossil fuel is not unlimited in this world. A lot of the country have a small amount of fossil fuel. Hence, finding the new energy resource is the essential job for every people. Other than fossil fuel, wind energy, solar energy and rain also can replace the fossil fuel to be renewable energy. Among the non-conventional, solar energy provide a good potential for transformation into electric energy, and it can ensure the electricity requirement of the world is fully fulfilling. Sun is the significant resource of sustainable energy which is solar energy. Because its abundance and sustainability.

Sun is the main source of energy, which is also the fuel of the majority renewable energy system. Among all the renewable energy system, the photovoltaic is the best one to replace the traditional energy resource. Solar panel directly converts sunlight to electric

power. The solar panel is mainly built from semiconductor materials. Si is the major component of solar panel. It has maximum 24.5% efficient.(Deb and Roy, 2012) Unless the high efficient solar panels are produced, the only ways improve the performance of a solar panel is increasing the sunlight intensity that focus on the solar panel. Most of the solar panel is using the photovoltaic solar energy to produce electricity which the semiconductor cell response to solar radiation to produce electrical impulses. Solar panel is easy to purchase in the market and it is not cheap, but the amount of electricity produce is a big amount. Figure 1.1 are shows the solar panel that mount on the house.

Figure 1.1: The Fixed Solar Panel Mount On The House

Before the solar tracking technique apply on the solar panel, there are a lot of the static solar panel which is mount on the building. Those static solar panel is not having the satisfactory performance compare to the solar tracker. Moreover, the efficient of the solar tracker is already proved by the scientist. Furthermore, solar tracker gets popularized in the global in recent years due to its performance. This is far more cost-effective solution than buying an extra solar panel. Because of the solar tracking system, the power output is increasing between 40% and 60% than the system that are stationary. Least but no less, solar tracking solar panel are produce a large number of the electricity to the social and country.