

DEVELOPMENT OF SOLAR TRACKER AND CHARGER SYSTEM

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Special dedicated to my beloved family, lecturer, friend and those people who have guided and inspired me throughout my journey of education.

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ABSTRACT

Solar energy is one of the popular renewable energy nowadays. It is consider as total free and clean energy source since the sun is estimated still able to exist for more 5×10^9 years. Malaysia is a place suitable to develop solar technologies because of the climate of the Malaysia which is sun all long year; the sun light intensity does not vary by season. In addition, some natural resources like fossil fuels is consider as short-term resources because it is estimated will finished in next 30 year. Based on this situation, renewable energy like solar energy is essential to human being after the natural resources is finish. The fact is, conventional solar panel power system is stationary, means the solar panel will not always facing to the direction of sun, this make the light intensity falling on the solar panel is not in maximum level so the solar panel will not always work in its maximum performance. Besides, the smart phone and tablet has become a trend to young generation in the last few years, user normally charge up their electronic devices in home or car by using non-renewable energy source. In this project, a prototype of microcontroller-based small scale solar charger will be built to allow user to charge up their electronic device by using totally free and clean energy and maximize the performance of the solar charger by combine it with a solar tracker, which solar tracker will align the solar panel to the direction of the sun so that the solar panel will always perpendicular to the sun with the help with microcontroller, sensor and DC motor. This method enable the solar panel work in maximum performance because the light intensity falling on the panel will be in maximum intensity level in all long day. A solar tracker and charger system is designed and experimentally tested. The information and design detail are shown in the report.

ABSTRAK

Tenaga solar adalah salah satu daripada tenaga yang boleh diperbaharui pada masa kini. Ia adalah sumber tenaga percuma dan bersih kerana daripada anggaran, matahari boleh wujud selama 5×10^9 tahun lagi. Malaysia adalah salah satu negara yang sesuai untuk membangunkan teknologi solar kerana Malaysia boleh mendapat cahaya matahari sepanjang tahun dan mempunyai keamatan cahaya matahari yang tidak berubah-ubah mengikut musim. Beberapa sumber asli seperti bahan api fosil adalah dianggarkan sebagai sumber jangka pendek kerana ia dianggarkan akan habis dalam masa 30 tahun yang akan datang. Berdasarkan keadaan ini, tenaga boleh diperbaharui seperti tenaga solar adalah penting kepada manusia selepas sumber asli tamat. Hakikatnya, konvensional panel solar system adalah pegun, bermakna panel solar tidak akan sentiasa menghadap ke arah matahari akan menjadikan intensity cahaya yang jatuh pada panel solar tidak akan berada di tahap maksimum, jadi panel solar tidak akan sentiasa dalam prestasi maksimum. Di samping itu, “smart phone” dan tablet telah menjadi satu trend kepada generasi muda pada tahun-tahun lepas, pengguna biasanya mengecas peranti electronic mereka di rumah atau kereta dengan menggunakan sumber yang tidak boleh diperbaharui. Dalam projek ini, prototaip pengecas solar akan dibina bagi membolehkan pengguna untuk mengecas peralatan elektronik mereka dengan menggunakan tenaga yang benar-benar percuma dan bersih dan memaksimumkan prestasi pengecas solar dengan menggabungkan dengan tracker solar yang boleh menjajarkan panel solar ke arah matahari dan akan sentiasa serenjang kepada matahari dengan batuan mikropengawal, sensor dan motor DC. Keadaah ini membolehkan panel solar di prestasi maksimum kerana cahaya matahari yang jatuh panel akan berada di tahap intensity maksimum sepanjang hari. Sistem untuk tracker solar and pengecas solar

akan direka and diuji dengan ujikaji. Maklumat dan butiran rekabentuk akan ditunjukkan dalam laporan ini.

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LIST OF SYMBOLS/ABBREVIATION/TERMS

PIC	- Programmable Interface Controllers
LDR	-Light Dependent Resistor
MPPT	-Maximum Power Point Tracking
DC	-Direct Current
ADC	-Analog to Digital Conversion
IC	-Integrated Circuit
PCB	-Printed Circuit Board
LED	-Light-emitting Diode
SMT	-Surface-mount Technology
Si	-Silicon

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CHAPTER 1

INTRODUCTION

This chapter explains the overview of this project which includes the information of the list below:

1. Introduction to the project
2. Objective
3. Problem statement
4. Scope of the project
5. A Brief Description of the Methodology
6. Report structure

1.1 Introduction to Project

Nowadays, there are many renewable energy was invented due to natural resources available was getting less and less, and the problem of global warming has getting serious. There are many renewable technologies available nowadays, such as solar electrification by using sunlight as source, wind turbines by using wind energy as power source and water turbine by using movement of water as power source.

In my opinion, Malaysia is the most suitable and beneficial place to development solar energy technology because of the climate of Malaysia. Because of Malaysia located near the equator, its climate is considered as equatorial, being hot and humid throughout the year and sun all long year. Thus, in Malaysia, the sunlight's intensity do not varies by season.

Solar panel is a piece of square thing that capable to convert the solar radiation to electrical energy. Actually, solar panel was made from a semiconductor material called Silicon(Si). Majority component of solar panel is Si and in practically the maximum allowed by the law of physics is 24.5%. The fact is, unless a higher efficient solar panel was invented, increasing of the intensity of light falling on the solar panel will be a good solution to enhance the performance of solar panel[1].

For the traditional solar system, most the solar panels are stationary, meaning the solar panel will not always directly or perpendicularly face to sunlight due to the position of sun will always change in day. This condition will affect the performance of solar panel because the light intensity falling on the solar panel is not in maximum level. To solve this problem, a small scale of microcontroller based solar tracking system was applied to the solar panel to increase its efficiency. This tracking system will align the position of solar panel according to the light intensity.

Besides, this is a trend that the usage small electronic appliances, such as smart phone, tablet and mp3 players was dramatically increasing recently and most of these electronic appliances are use nickel or lithium-ion type rechargeable battery. Users have to always charge up their electronic device. By using a solar charger and solar tracking system, the efficient of solar panel can be enhanced, they can charge up their electronic device by using clean energy source with high mobility and high performance.

In conclusion, this project is mainly concern to green technology and clean energy. All of these contribute a lot to environment.

1.2 Project Objectives

Project objectives are basically the mission, purpose or standard that can accomplish within the expected schedule. There are three main goals have to be achieved at the end of the project, which are:

- a) To design and construct automatic cut-off battery charger by using solar as its power source to enable user to charge up their electronic devices virtually by using a clean and totally free power source.
- b) To design and construct a microcontroller-based solar tracking system where this system will align and orientate the position of solar panel according to light intensity falling on it to keep the surface of the solar panel always perpendicular to the sun position so that light falling on the solar panel will be in maximum level.
- c) To combine solar charger with the solar tracker system so that the solar charger can worked in maximum performance.

1.3 Problem Statement

The problem of the global warming is getting serious recently. Thus, the demand of the clean energy or renewable is keep increasing. The solar system is using sunlight as source, convert the solar radiation into electrical energy is one the popular renewable energy nowadays.

The main purpose of this project is to charge the small electronic devices by using solar charger system and maximize the efficient of solar panel by creating solar tracking system.

The demand and usage of the rechargeable battery is keep increase in last few years due to electronics devices, such as mp3 player, smart phone and tablet are getting

popular. The user will need one to two hour to charge up their battery in home which power source is non-renewable energy. A solar charger can improve the condition because it is using totally free and clean energy in the charging process, brought many benefits to user and also environment.

Besides, the performance of the solar panel is basically depends on its efficient, its performance will not improve unless a higher efficient solar panel was invented. In addition, most of the solar panel is stationary; it will always face to only one direction while the position of the sun keeps change in day. As a result, the intensity of sunlight falling on the solar panel will not always in highest level, this lead to negative effect of the performance of solar panel. A solar tracking system will improve the performance of solar panel.

By combining the solar charger and the solar tracking system, the solar charger can be worked in maximum performance.

As a conclusion, this project is develops to cater the above necessities by maximizing the use of the solar energy.

1.4 Project Scope

Project scopes are the limitation of the tasks that need to be accomplished in the project. The scopes of this project are:

- The theory, studies and calculation that involved in simulation of solar charger and tracking system
- Design of an effective small scale solar charger system by using LM317T and LM339.
- Design of a microcontroller-based dual axis solar tracking system by using LDR as light intensity sensor and make sure that LDR can send

correct output to PIC 16F877A so that PIC 16F877A will control the direction of solar panel should face by using DC motor that control by L293D in vertical axis and stepper motor in horizontal axis according to light intensity received.

1.5 A Brief Description of the Methodology

Methodology is actually the general guideline to the execution of project. It includes some analysis of the rules or the principles that might include in the project and study of the potential methods that will be used in the project. It gives a plan to the one who is going to do the project where it will show planning activities.

First of all, discussion with the supervision has been made to discussion about the potential final year project title. Then, literature review was made. The proposal of the project is made to identify the project objective, project scope and problem statement of the project. Inside the proposal, the flow chart and Gantt chart must be clearly statement because well planning of time is the key success of the project. After that, project proceeds to simulation, hardware and mechanical construction. Troubleshooting has been made to solve the potential problem of the prototype. Prototype can be finalized after all the problems has been solved.

1.6 Report Structure

This report basically consists of five chapters. In the chapter 1, it will discuss the about the introduction of the whole project which include the project object, problem statement and the project scope

In the chapter 2, it will discuss about the overall literature review that have been done. It includes the study of solar energy, solar panel, way to enhance the power output of the solar panel and component and technique related in construction of the prototype.

In the chapter 3, it will mainly discuss on the methodology on the project, which include the flow chart, mechanical part and electronic part of the project. In the chapter 4, it will show the expected, achieved result and the discussion on each result. Lastly, in the chapter 5, it will conclude the entire project finding and some recommendation of the project.

CHAPTER 2

LITERATURE REVIEW

This chapter focused on the literature review of a component and device in this project. The information, characteristics, operations, advantages and disadvantages of the component and device will be discussed in this chapter. The components include PIC microcontroller, stepper motor, and photovoltaic cells. Besides, this chapter includes the information about the solar charging system and solar tracker system.

2.1 The Sun

The sun has played a dominant role since time immemorial for different natural activities in the universe at large and in the earth in the particular for the formation of the fossil and renewable energy source[2]. The life span of the sun was predicted to have more 5×10^9 years. Deposited fossil fuel, in the form of coal, that are used through combustion are expected to last for approximately the next 300 years at most, and from then onward human beings will be left with the renewable energy resources only.