UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF A SOLAR-POWERED CONTROLLER FOR DRAINAGE SYSTEM WITH WATER TREATMENT

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Robotic and Automation) with Honours.

by

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BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Development of Solar-Powered Controller for Drainage System With Water Treatment**

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic and Automation) with Honours. The member of the supervisory committee is as follow:

……

Supervisor

ABSTRAK

‘Development of a Solar Powered Controller’ adalah satu system yang digunakan untuk mengawal pengaliran air yang melalui ‘Drainage System with Water Treatment’. System ini menggunakan tenaga solar sebagai sumber kuasa untuk memacu motor arus terus. Tenaga suria yang di serap oleh panel solar akan distabilkan dengan menggunakan litar pengatur voltan agar ianya sentiasa berada dalam kadar 12 volt. Arus elektrik seterusnya di simpan didalam sel kering dan akan digunakan untuk mengoperasikan litar. Pengguna hanya perlu menekan butang mula bagi mengoperasikan litar seterusnya pengawalan akan berjalan secara automatik. Pengoperasian litar adalah berdasarkan kepada paras air yang berada di dalam bendang.

ABSTRACT

Development of a Solar Powered Controller is a system that use to control the Drainage System with Water Treatment. This system uses solar energy as a power source to drive DC motors. Solar energy is absorbed by the solar panels and will be stabilized by using the voltage regulator circuit so that it will always in range of 12 volts. Electric current then stored in batteries and will be used to operate the circuit. Users only need to press the start button for operating the control circuit and will then run automatically. Operation of the circuit is based on the level of water in the paddy-field

DEDICATION

I would like to dedicate this report for my lovely mother and family, all lecture in manufacturing engineering department, all staff, and also for all my friends. They keep me in track and encourage me to do my best.

Thank a lot to all.

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LIST OF ABBREVIATIONS, SYMBOL, SPECIALIZED NOMENCLATURE

DC	-	Direct Current
AC	-	Alternating Current
PV	-	Photovoltaic
N	-	Negative
P	-	Positive
V	-	Voltage
T	-	Torque
F	-	Force
D	-	Distance
Nm	-	Newton Meter
HP	-	Horse Power
Rpm	-	Revolution Per Minute
A	-	Ampere
S	-	Switch
IEEE	-	Electrical and Electronics Engineers
PCB	-	Printed Circuit Board
VSM	-	Virtual System Modeling
Ah	-	Ampere-hour
LM	-	Limit Switch
LED	-	Light Emitting Diode
CAD	-	Computer-aided Design
MIG	-	Metal Inert Gas

CHAPTER 1
INTRODUCTION

1.1 Overview

An introduction is a beginning section which states the purpose and goals of the following writing. This section is usually interesting and it intrigues the reader and causes reader to read on. This chapter is about introducing the research of this project. The project is research and development about drainage system for paddy-field. The drainage system typically refers to the method for control the water level on that paddy-field. Also, it is will state the problems occur during the development, the objectives of this project and expected result at the end of the semester.

1.2 Introduction

In Malaysia, some drainage system for paddy-field was prepared by government to full their paddy-partition with water. This make paddy farmer not worried to get water from natural river and pump the water by water pump to their paddy-field. This system only have small pipe from the drainage to the paddy-field. This small pipe doesn't have any device to control the water flow. Manual methods are use for control that water to past that's pipe and flow to the personel paddy-field from main drainage.

This method needs farmer to used additional pipe or modify the government main drainage to make the water flow fast. Usually farmer use pipe with 'L' shape as interface between government drainage and their paddy-field. Farmer will full the

pipe with water and use the vacuum concept for maintain the water flow. This method also causes farmer need to open and closed the pipe by bung it using un-used cloth, wood or plastic to control the water flow. Farmer also needs to wait in long time to ensure the water was enough and take out the 'L' pipe. This situation cause farmer difficult to do other activities because need to wait.

It is important to develop a system that makes farmer no need to wait at in long time to full their paddy-partition by water. This system is using solar panel to collect the power for drive a direct current motor. Direct current motor will assemble to the inlet outlet valve to operate it. Battery will use to save the solar power for system operate in cloudy weather and night. This system also will stabilize the level of water in the paddy-field.

1.3 Problem Statement

Because of the using of motor as the drive for valve (stop cork), it is important for prepare the electric source. Here the solar power is use for supply the electric source. Direct Current (DC) motor where use in this project should be modify for combine with pipe of Drainage System with Water Treatment. It is needed to design new shaft between DC motor and that pipe. After motor rotate, some cut off circuit should be design to prevent DC motor from burn. Solar board angle and position should be consider for collecting the full sun energy. Conditions in the paddy-field sometimes do not allow the position of the control station to be placed under the path of sunlight. Therefore, the flexible station design is important to ensure maximum absorption of solar energy can be collected.

1.4 Objective

The objective of this project are:

1. To develop a controller for Drainage System with Water Treatment.
2. To design a limit switch that use for maintain the level of water.
3. To design circuit for re-charge the battery voltage by using solar panel.

1.5 Project Scope

1. This project only focus on developing a controller for control the rotation of DC motor where assemble for Drainage System With Water Treatment.
2. Solar panel will be use for supply a power to operate this project.

1.6 Expected Result

In the end of this project, one station for control the Drainage System should design and implemented. This system will able to change the rotary of motor from clockwise to counter-clock wise and otherwise. Battery can be rechargeable by solar energy and automatic cut-off.

CHAPTER 2
LITERATURE REVIEW

2.1 Overview

A literature review is a body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. Most often associated with academic-oriented literature, such as theses, a literature review usually precedes a research proposal and results section. This section will review a logical flow of ideas current and relevant references with consistent, appropriate referencing style proper use of terminology and an unbiased and comprehensive view of the previous research on the topic. For this reports, literature review will explain about the related equipment, theory, formula, electronic circuit and mechanical part that's use for this project.

2.2 Solar Power

Solar or photovoltaic (PV), cell are electronic device that essentially convert the solar energy of sunlight into electric or electricity. The physic of solar cell is based on the same semiconductor principle as diodes and transistor, which form the building blocks of the entire of electronics. Solar cell convert energy as long as there is sunlight. Figure 2.1 show example of solar panel. In the evenings and during cloudy conditions, the conversations process diminished. It stop completely at dusk and resumes at dawn.

Solar cell do not store electricity, but the batteries can be used to store the energy. One of the most fascinating aspects of solar cell is their ability to convert the most abundant and free form of energy into electricity, without moving parts or components and without producing any adverse form of pollution that affect the ecology, as is associated with most known forms of nonrenewable energy production methods, such as fossil fuel, hydroelectric, or nuclear energy plants.

Figure 2.1: Solar Panel (Personel Capture August 2010).

2.2.1 History of the Photoelectric Phenomenon

In late of the century, physicist discover a phenomenon, when light is incident on liquids or metal cell surfaces, electrons are released. However, no one had an explanation for this bizarre occurrence. At the turn of the century, Albert Einstein provided a theory for this which won him the Nobel Prize in physics and laid the groundwork for the theory of the photoelectric effect. Figure 1.0 shows the photoelectric effect experiment. When light is shone on metal, electrons are released. These electrons are attracted toward a positively charged plate, thereby giving rise to a photoelectric current.

Einstein explained the observed phenomenon by a contemporary theory of quantized energy levels, which was previously developed by Max Planck. The theory describe light as being made up of miniscule bundles of energy called photons. Photons impinging on metals or semiconductors knock electrons off atoms. In the 1930s, these theorems led to a new discipline in physics called quantum mechanics, which

consequently led to the discovery of transistor in the 1950s and to the development of semiconductor electronics.

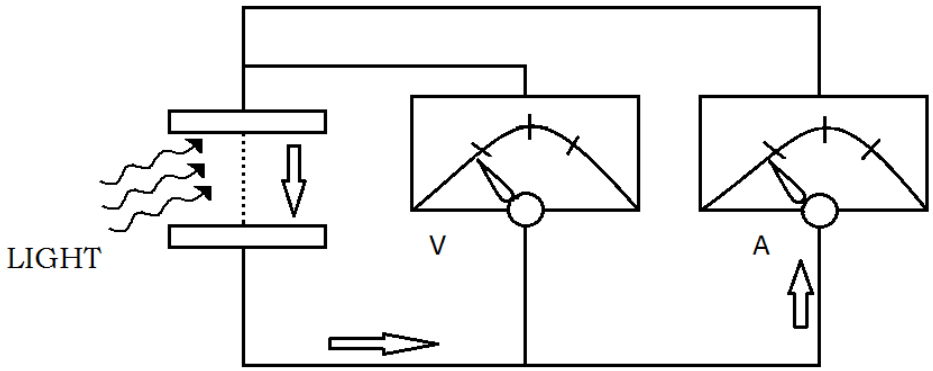

Figure 2.2: The photoelectric effect experiment (Solar Power in Building Design 2008).

2.2.2 Solar Cell Physics

Most solar cell are constructed from semiconductor material, such as silicon(the fourteen element in the Mendeleyev table of elements). Silicon is a semiconductor that has the combined properties of a conductor and an insulator. Metals such as gold, copper, and iron are conductor. They have loosely bound electrons in the outer shell or orbit of their configuration. These electrons can be detached when subjected to an electric voltage or current. On the contrary, atoms of insulators, such as glass, have very strongly bonded electrons in the atomic configuration and do not allow the flow of electrons even under the severest application of voltage or current. Semiconductor materials, on the other hand, bind electrons midway between that of metals and insulators.

Semiconductor elements used in electronics are constructed by fusing two adjacently doped silicon wafer elements. Doping implies impregnation of silicon by positive and negative agents, such as phosphor and boron. Phosphor creates a free electron that produces so-called N-type (negative type) material. Boron creates a ‘hole’ or a shortage of an electron, which produces so-called P-type material. Impregnation is accomplished by depositing the previously referenced dopants on the surface of silicon using a certain heating or chemical process.

The N-type material has a propensity to lose electrons and gain holes, so it acquires a positive charge. The P-type (positive type) material has a propensity to lose and gain electrons, so it acquires a negative charge.

When N-type and P-type doped silicon wafers are fused together, they form a PN junction. The negative charge on P-type material prevents electrons from crossing the junction, and the positive charge on the N-type material prevents hole from crossing the junction. A space created by the P and N, or PN, wafers create a potential barrier across the junction.

2.2.3 Solar Cell Electronics

An electrostatic field is produced at a PN junction of solar cell by impinging photons that create 0.5V of potential energy, which is characteristic of most PN junction and all solar cell. This miniscule potential resembles in function a small battery with positive and negative leads. These are then connect front to back in series to achieve higher voltages.

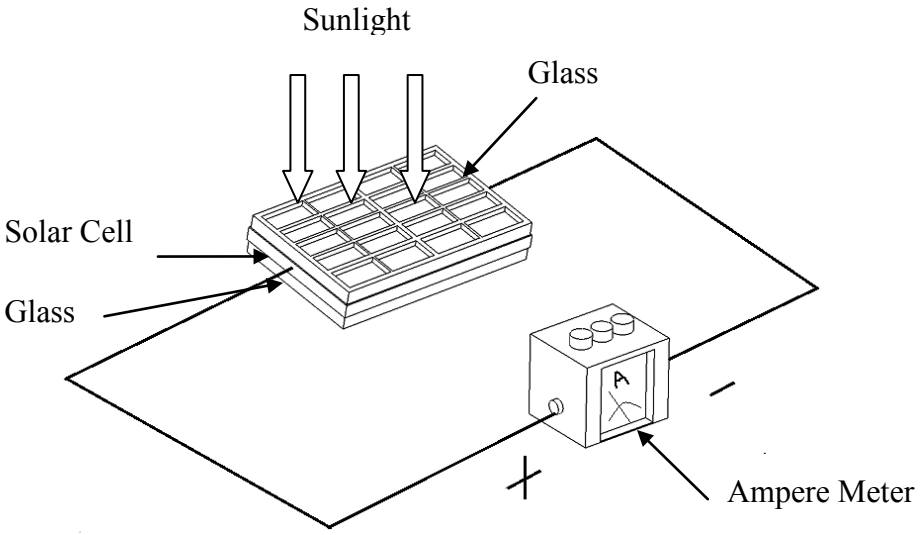

Figure 2.3: Photovoltaic module operational diagrams (Solar Power in Building Design 2008).