



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SMART GREEN TECHNOLOGY FARM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronics Engineering Technology (Industrial Electronics) with Honours

by

NURSYAZWANI BINTI JAMIL

B071110048

890807025688

FACULTY OF ENGINEERING TECHNOLOGY

2015

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Smart Green Technology Farm**

SESI PENGAJIAN: **2014/15 Semester 1**

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ABSTRAK

Projek yang dinamakan „Smart Green Technology Farm“ adalah konsep ladang berteknologi tinggi yang terdiri daripada tiga sistem pintar utama iaitu sistem penyiraman air automatik untuk tanaman, sistem pagar elektrik bagi mengelakkan kerosakan tanaman oleh haiwan dan sistem pencahayaan pintar yang hanya akan diaktifkan apabila sensor mengesan kehadiran manusia ke dalam ladang. Semua sistem akan digabungkan dan dikawal dengan menggunakan mikropengawal PIC16F877A. Projek ini direka bagi menggantikan cara tradisional yang menggunakan tenaga manusia dalam proses penyiraman tanaman yang dikatakan tidak lagi berkesan di samping dapat melindungi kerosakan tanaman oleh haiwan. Satu lagi konsep khas projek pintar ini adalah ia menggunakan bekalan tenaga solar dan bukannya bekalan kuasa elektrik biasa. Sistem solar menukarkan kuasa cahaya matahari melalui panel solar kepada tenaga elektrik yang akan disimpan di dalam bateri berkapasiti 12 V serta boleh dicas semula. Bateri ini akan membekalkan kuasa elektrik ke seluruh sistem „Smart Green Technology Farm“. Projek ini dicipta selepas menganalisis proses penyiraman tanaman biasa yang tidak berkesan dan juga kes tanaman dirosakkan oleh haiwan yang kerap dialporkan di akhbar hari demi hari. Projek ini dibuat untuk cuba untuk mengatasi semua masalah ini. Juga, penggunaan tenaga solar sebagai tenaga yang boleh diperbaharui merupakan penyelesaian untuk menggantikan tenaga guna habis yang kini semakin berkurangan di samping dapat membantu untuk menyokong kempen teknologi hijau bagi melindungi bumi. Dengan adanya projek ini, diharap masalah dan kesukaran yang diatasi akan dapat diatasi dan menjadikan pemilik ladang lebih produktif dalam menguruskan ladang di samping dapat meningkatkan keuntungan hasil ladang tersebut dengan menghasilkan tanaman yang subur.

ABSTRACT

The project of Smart Green Technology Farm is a new technology concept farm that consists three main smart system which are automatic self-watering system for plants, electric fencing system in avoidance of crop damage by animals and a smart lighting system that will only activate when sensor detect the absence of the human. All the systems are combined and controlled by using PIC16F877A microcontroller. The project is designed to replace the traditional way of using human energy in watering the plants besides can protects crop damage by animals. Another special concept of this smart project is it uses solar energy instead of normal electrical power supply. The solar system is the circuit that converts sunlight power through the solar panel to electrical energy which will be stored in a 12 V rechargeable battery. This battery will supply electrical power to the whole Smart Green Technology System. This project was invented after analyzing the normal process of watering plant that is ineffective, and with the wide spread of crop damaged by animals day by day. This project is proposed in order to overcome all the problems. Also, solar energy harvesting also is a solution of a renewable energy to replace consumable energy which is nowadays decreasing while helping to support green technology campaign to protect earth. With the existence of this project, the indicated problems and difficulties are hope to be overcome and will make owner of the farm become more productive in managing the farm and increasing plantation profit because of healthier plants.

DEDICATION

Specially dedicated to my beloved parents
Jamil bin Wan Choh and Che Rose binti Hamid,
also my brothers and sisters.
Thank u for all the support, love and prayers.

ACKNOWLEDGEMENT

The success and final outcome of this project for this semester required a lot of guidance and assistance from many people and I am extremely fortunate to have got this all along the completion of my project work. Whatever I have done is only due to such guidance and assistance and I would not forget to thank them.

Firstly, I respect and thank Mr. Fauzi bin Abd Rahman as my project supervisor which giving me a lot of support and guidance on completing this PSM project report on time. I am extremely grateful to him for providing such a nice support and guidance though he had busy schedule.

Next, I also would like to acknowledge Mr. Ahmad Nizam bin Ahmad Jahari, as the panels of my project presentation on their advice and suggestion about my project. Not to forget, lab technicians, Mr. Azizi Bin Osman and Mr. Mohd Mohidden Bin Mansor that helps a lot during the phase of construction the project's model.

As well, I would also like to thank my parents, siblings and friends for their unceasing encouragement and support who helped me a lot upon completing this project.

Last but not least, thanks to the authors and philosophers of some journals on the internet where I manage to get help on designing my Smart Green Technology Farm.

I also place on record, my sense of gratitude to one and all who, directly or indirectly, have lent their helping hand in this venture. I am making this not only for marks but also to increase my knowledge.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

AC	-	Alternate Current
ADC	-	Analogue Digital Converter
DC	-	Direct Current
IR	-	Infrared
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
PCB	-	Printed Circuit Board
PIC	-	Programmable Integrated Circuit
PV	-	Photovoltaic
SPDT	-	Single Pole Double Throw
UV	-	Ultra Violet
Ω	-	Ohm
Σ	-	Summation

CHAPTER 1

INTRODUCTION

This chapter will give full view about Smart Green Technology Farm project with the details of the project background, problem statement, project objectives, project significance and scope of work. Besides, this chapter will also briefly explained the whole process that carried out in order to complete this project.

1.1 Background

Energy is important to all aspects of development to support population growth, urbanization, industrialization and as well as tourism industry. The energy consumption is also increasing and several alternative green energy sources are seriously taken into consideration to fulfill Malaysia's energy demand. The Malaysian government has looked into the renewable energy (RE) sources such as solar energy to be one of the alternatives to face problems related with the increase in energy demand. In generating healthy environment of the earth, the project which name as Smart Green Technology Farm is a project that use one of the green technology energy which is solar electricity.

Solar electricity is the technology of converting sunlight directly into electricity to provide voltage supply to the whole system. It based on photovoltaic cells or solar modules which are very reliable and do not require any fuel or servicing. The electricity produce from this solar panel will be stored on a power bank that later will be used to vitalize the system of automatic plant irrigation system which is to give

automatic self-watering system to the plant by using soil sensor, solar fencing system that gives mild electric shock to prevent crop damage by animals and also lighting system by using infrared sensor that will only energize when sensor detect the absence of people at the gate. The project will focus more on solar energy system that will be used to harvest energy. The prototype of the project will be developed after full investigation and data analysis have been completed. Stages of project methodology to achieve the project objectives will also be discussed. Lastly, it is expected that the Green Technology Farm project will be function successfully with good strategy of quality and project management.

1.2 Problem Statement

Electricity is one of the consumable energy which is nowadays decreasing from time to times. Besides, the utilities bill such as electricity bill is also increasing from time to times. Therefore, the idea comes to reduce this burdensome and to have fuel-efficient energy, solar energy could be use as the method to replace electricity supply. It believes that in solar system, depending on the size of the solar system to install, an average of 50% of electricity bill can be saved.

Another problem that we always seen on newspaper or television is about farm where its plant got damaged by wild animals such as elephants or deers. Smart system with electric fencing security will be the good solution for this problem as it can prevent crop damage by animals. Other than that, smart watering system that will help farmer in watering their plants will also be develop.

Therefore, the project Smart Green Technology Farm can be said have a good value placed on energy efficiency, intelligent power sourcing and end-user consumption. The development and implementation of alternative sources of energy is important for our environment, a stimulus for our economy and a step in the right direction to achieving energy independence. All the system in this project is echo-friendly. Overall, it is clearly that the concluded Smart Green Technology Farm could help on saving electricity bill and also help in preventing global warming besides helping

worker on managing the farm easily while preventing plantation from getting damage.

1.3 Project Objective

The main objectives of carrying out the project are :

- (a) Investigation of sunlight source through photovoltaic cell for energy harvesting.
- (b) To design and construct prototype of project based on photovoltaic cell power.
- (c) Testing and evaluation of Smart Green Technology Farm's system.

1.4 Project Scope

Green technology or clean technology is the application of one or more environmental science, green chemistry, environmental monitoring and electronic devices to monitor, model and conserve the natural environment and resources besides to curb the negative impacts of human involvement. Green technology concept covers large scope in describing sustainable energy generation technologies such as photovoltaic, wind turbines, bioreactors and others. But for this Smart Green Technology Farm project, we will be focus on harvesting energy from solar.

Besides, the Smart Green Technology Farm will only focus on developing a prototype rather than implying the system real in a farm or agriculture industry. The process of developing the prototype can be categorized into three parts which are electrical, mechanical and software. The project is targeted to be developed successfully by achieving all the objectives.

1.5 Project Significance

The significance of this project is to help in reducing the burden of farm workers. Furthermore, with this smart system, it is believed to help in decreasing the case of crops damaged by animals. In addition, with the use of green renewable energy supply, the electricity supplied by consumable will be reduced and will help the users and societies to reduce expenditure on paying higher electricity bill. Other than that, this project also can be significance to researchers and practitioners who will be constructing a research based on this smart technology system. It is hopes to facilitate their works on related research which could give more improvement related to this project in future.

1.6 Report Outline

This thesis is organized in five chapters. The first chapter gives an overview of the project which is the introduction of Smart Green Technology Farm. It consists of main points such as project background, problem statement, objective, project scope and report structure.

Chapter two covers literature review that includes the main system used in the project such as is solar energy supply, microcontroller, electric fence system, automatic irrigation system, and automatic lighting system. Basically this chapter is concentrating on any previous project that has the similarity with Smart Green Technology Farm System.

Chapter three covers the flow of methodology and description of each procedure. The details of the implementation of software and hardware are discussed. It also consists of theory in relation to some system implementation.

The fourth chapter is explaining on results and discussion related to the project. Each parts of project's system will be discussed. The working principles is clarified with

more figures included. There will be a hardware and software implementation besides the system operation.

The last chapter is the conclusion and suggestion. This chapter will conclude the achievements and information obtained in completing the whole process of this project. Besides, suggestion will be discussed for a better performance in the future.

1.7 Conclusion

As all the main points of introduction such as background, problem statements, project objectives, project significance and project scope has been identified in this chapter, it hopes that the background on the Smart Green Technology Farm could be understand better. Besides, this chapter also consists of an overall review on the contents of this report as intended to facilitate the reader in understanding the whole project ideas.

CHAPTER 2

LITERATURE REVIEW

This chapter discusses on the overall project theory and concept. The purpose of this chapter is to review perspective and method that is used in previous research or projects and also to classify how much this project relate with those research and theory. In addition, this chapter will briefly explain the theory and concept used to solve the project problem. Theoretical understanding is very important as a guide in doing any kind of project or research.

2.1 Solar Energy Power

Research on renewable energy by Stallo, C. et al. (2010) point out that there are two possible ways to implement application of green and renewable energy which are to produce renewable energy and to support the current renewable energy production process. She in her research also said that in ICT fields, technologies and methodologies related could be reuse to produce energy in different and efficient way. This also may help our country to support green technology energy harvesting process aimed while enhancing the efficiency and safety to the Smart Green Technology farm.

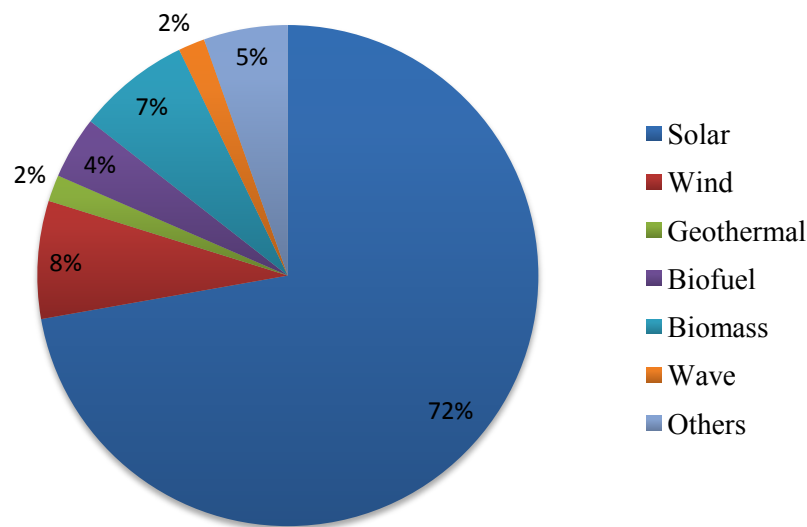


Figure 2.1 : Choices of renewable energy sources for Malaysian

Refer to Figure 2.1, Gomesh, N. et al. (2013) had done a research on Malaysian's preference of using renewable energy shows that solar energy is the most chosen energy. Solar energy is the most effective way in supporting green technology of using renewable energy. This is also backed up by Mekhilef, S. (2010) which agreed that Malaysia has a strategically geographical location to generate solar power. Malaysia which located on the South China Sea is relatively have high level of humidity, so do the temperature. Receiving more light from the sun and produce high temperature lead to more solar energy could be generated.

Therefore, the Smart Green Technology Farm project will be focused on using one of the renewable energy resources which is solar power. Solar power is a technology of obtaining usable energy from the light of the sun. However, although solar energy is free, it is hardly used because nowadays, consumable energy such as oil is cheap and easy to produce. Solar energy which is resource from sunlight can be directly converted to electricity through solar cells. These non-polluting solar cells, known as photovoltaic cells use no fuel, mechanical turbine or a generator. Solar energy has great potential as a resource of clean and unlimited electricity around the world. Nowadays, with the increasing demand for energy coupled with increasing environmental pollution from the burning of fossil fuel, it is good to turn into this solar energy. In Malaysia, there ara many research about installation of solar PV cells

is focused mainly in rural areas where there is difficulty setting up electricity cables or it is used by individuals.

According to Cotana, F. et al. (2014), installation of solar panel to harvest solar energy in rural areas is compaction because the resident there can develop the area with high technology system while generating more profit income. However, the design of an integrated energy in rural tower must be in logic of high efficiency solar power which is in its small scale, as example of the highly integrated power grid, characterized by a high energy density per square meter of footprint land. Based on all the research from the philosophy statement before, Smart Green Technology Farm system is suitable to be implementing in helping farmer especially in rural area to develop their farm with high technology facility and gain more profit. This system is believed to be more productive compare to the traditional way of cultivator plant.

In Malaysia, the solar energy applications can be divided into two main categories which are solar thermal application and photovoltaic (PV) technologies. Solar thermal is a technology where the heat from solar energy is harnessed for heating purposes while photovoltaic is a technology where arrays of cells which contain solar photovoltaic material convert the solar radiation into direct current electricity. The main focus of the Smart Green Technology System is using photovoltaic technologies.

Erge T. et al. (2003) found that history of photovoltaic technology invented in Malaysia was in 1980s with the aim of providing electricity to rural areas (electricity and telecommunication), communication towers and consumer products. In 1998, Tenaga Nasional Berhad (TNB) set up grid-connected PV systems as the initiative for national power utility which was inspired by the success of the German Rooftop and Japanese Sunshine programs. During year 1998 to 2002, six pilot grid-connected PV systems were installed with power capacity ranging from 2.8kWp to 3.8 kWp. The first practical experience of this solar system in July 1998 was relatively simple, basic but it is very expensive. The photovoltaic system was installed by Tenaga National Research (TNR) Sdn. Bhd. on the roof top of College of Engineering, University Tenaga Nasional (UNITEN) with the system capacity of 3.15kWp.