Faculty of Electrical and Electronics Engineering Technology

DEVELOPMENT OF SOLAR POWERED SYSTEM FOR HYDROPONIC PLANTING USING MICROCONTROLLER

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Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJURUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : DEVELOPMENT OF SOLAR POWERED SYSTEM FOR HYDROPONIC PLANTING USING MICROCONTROLLER

Sesi Pengajian : 1 - 2022/2023

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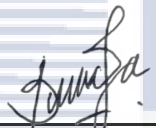
Signature : 

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DEDICATION

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ALHAM BIN KASSIM and ROSNANI BINTI RABANI

Siblings.
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NUR FARHANA AINA BINTI ALHAM

Supervisor,
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Classmate,
BEET COHORT 9

Faculty Lecturer,

FTK Lecturer

Thank you for always support me regardless of morality, motivation and financial.

ABSTRACT

Recently, there have been many techniques available for planting and gardening. The advancement in technology improves planting the plant in more effective ways. Nutrient film Techniques (NFT) is one of the hydroponic methods of growing the plant using a nutrient solution. The system required a pump to circulate the solution. Typically, the system is powered by electricity from a socket outlet located far and may contain electrical consumption. This system can cause safety issues such as the cable being exposed to water and animals and tripping. Thus, this project aims to develop a solar-powered hydroponic system from solar Photovoltaic (PV). The solar PV system is designed for the homeowner to perform a modern technology of NFT. (Using the solar energy system as an electrical source is generated power for the hydroponic system. The solar system is generating power from sun irradiation and then charge the solar charger controller and battery to supply to the water pump. The system will be designed using the water pump rating, solar panel, solar charge controller and battery. A microcontroller will control the system functionality). The outcome is to produce a solar PV generation system prototype for the NFT application. The developed project is targeted for a lower rating to reduce the cost and focus to lower the power consumption of the system.

ABSTRAK

Pada masa kini, terdapat banyak teknik untuk menanam dan berkebun. Kemajuan dalam teknologi meningkatkan kaedah penanaman dengan cara yang lebih berkesan. Teknik filem nutrient (NFT) adalah salah satu kaedah hidroponik dengan menanam tanaman menggunakan larutan nutrient. Sistem ini memerlukan pam untuk mengalirkan air atau nutrien. Biasanya, sistem ini menggunakan kuasa elektrik daripada soket yang agak jauhdaripada pengguna dan akan menghasilkan penggunaan tenaga yang banyak. Sistem ini juga boleh menyebabkan masalah keselamatan seperti kabel terkena air dan haiwan. Oleh itu, projek ini bertujuan membangunkan sistem hidroponik berkuasa suria daripada solar Photovoltaic (PV). Solar PV akan dirancang untuk pemilik rumah untuk menggunakan teknologi dan teknik moden iaitu NFT. (Dengan menggunakan sistem tenaga suria sebagai sumber elektrik, ia akan menghasilkan tenaga untuk system hidroponik. Sistem suria akan menghasilkan tenaga dari sinaran cahaya matahari kemudian akan mengecas pengawal pengecas solar dan bateri untuk dibekalkan ke pam air. Sistem ini akan di reka menggunakan pam air, panel solar, pengawal caj solar dan bateri. Micro pengawal akan mengawal fungsi sytem). Di anggarkan hasil generasi sitem solar PV prototaip untuk aplikasi NFT. Projek yang telah dihasilkan di sasarkan untuk penilain yang rendah untuk mengurangkan kos dan mengurangkan penggunaan kuasa dalam sistem.

ACKNOWLEDGEMENTS

I would like to express my deep gratitude to my family, friend and supervisor because they have help me a lot when I am studying at Universiti Teknikal Malaysia Melaka. They are also always support and provide encouragement. I pray that they will always protects by Allah S.W.Tand live in healthy. I would also like to extend my thanks to my supervisor and lecturer which is help me a lot and teach me more about my project when the experiment is underway. Lastly, a big appreciation to my colleague who are always support and keep give a spirit to develop this project.

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LIST OF SYMBOLS AND ABBREVIATIONS

V	-	Voltage
DC	-	Direct Current
PV	-	Photovoltaic
MPPT	-	Maximum Power Point Tracking
PWM	-	Pulse Width Modulation
SCC	-	Solar Charge Controller
AC	-	Alternative Current
I	-	Current
AGM	-	Absorbed Gas Mat
VRLA	-	Valve Regulated Lead Acid
W	-	Watts
NFT	-	Nutrient film Techniques
V	-	Voltage
DC	-	Direct Current
PV	-	Photovoltaic
MPPT	-	Maximum Power Point Tracking
PWM	-	Pulse Width Modulation

CHAPTER 1

INTRODUCTION

1.1 Research Background

Recently, due to covid-19 and uncertain climate change, shortage of food has become the top topic to be discussed. However, there are many ways to avoid it from happening. There are many techniques available for planting and gardening. Nutrient film Techniques (NFT) is one of the hydroponic methods of growing the plant using a nutrient solution[1]. The system required a pump to circulate the solution. Typically, the system is powered by electricity from a socket outlet located far and may contain electrical consumption[2]. This system can cause safety issues such as cable being exposed to water and animals tripping issues. Thus, this project aims to develop a solar-powered hydroponic system from solar Photovoltaic (PV). The solar Photovoltaic (PV) system will be designed for the homeowner to perform modern technology and technique, which is Nutrient Film Technique (NFT). Using the solar energy system as an electrical source will generate power for the hydroponic system[2]. The solar system will generate power from sun irradiation and then charge the solar charger controller and battery to supply to the water pump.

Many types of energy, both conventional and non-conventional, have been discovered as result of research and study. The primary sources of electricity generation, such as oil, gas, and nuclear power are more expensive than they have ever been. Furthermore, using fossil fuels produces greenhouse gases, which contribute to rapid global warming. Because the globe is utilising energy sources, it is necessary to take preventative measure to protect the environment. To address this issue, a new renewable energy system has been designed. Solar energy is one of the cleanest forms of energy production currently available[2]. Solar panels create the greatest energy in the middle of the day, and Malaysia is well suited for solar energy generation due to its proximity to the equator, which receives an average of 6 hours of sunlight per day and night throughout the year. This can be seen on the Malaysian Department of Meteorology's website. Because of the project's location, the solar panel is the best green energy source for powering the hydroponic control pump. Solar electricity, a solar controller, a battery, and a water pump make up this hydroponic system. This project uses 12V for the system to ensure that the voltage is stable. Aside from that, this project will run on DC power.

1.2 Problem statement

Gardening can help people engage in beneficial hobby. It also has a lot of favourable effect on people. Furthermore, due to it reliance on energy sources, hydroponic farming faces difficulty with energy supply continuity. Electrical parts are usually supplied from a socket outlet that is located far away from the planting area. Hydroponic systems are commonly found in outdoor locations and can offer safety risk due to the cable being exposed to water and animals, as well as tripping hazards. By using a contained area near the hydroponic system instead of a direct supply from a socket outlet, the solar PV system safeguarded cables from safety issues. Coal and fossil fuels are Malaysia's primary sources of electricity which decreases with time and continuous usage. Thus, an alternative source of energy is required. Therefore, this experiment developed a hydroponic system powered by a solar panel. A solar system is renewable energy besides wind power and geothermal[3].

As known, sufficient water is required for conventional farming, whether hydroponic or others. The amount of water required will be determined by the delivery method and the needs of the plants. Many folks do not have access to an irrigation system. This is due to the fact that modern irrigation systems necessitate the employment of human resources. In truth, a lot of water was wasted due to a poorly maintained manual irrigation system. As a result, this technique will reduce garden upkeep, such as ensuring that plants have enough water. Artificial pesticides and fertilisers also do not need to be used. There are very few pest problems; therefore, there is very little pest control, no weeding, tilling the soil, and adding things into the garden. This will save money on buying grow media and hydroponic nutrients. Next, narrow yards allowed people to farm. Less space is needed with the hydroponic present, so more land remains unused. Thus, a hydroponic system powered by solar power is a great idea for reducing the total amount of work required and maximising the productivity of gardening efforts.

1.3 Project Objective

The objective for this project is as follows:

a) To reduce the power usage of hydroponic system through utilising a solar power.

b) To develop a prototype of a solar powered hydroponic system.

c) To evaluate the performance of solar PV system designed.

1.4 Project scope

The scope of the project is to enable people to use solar powered hydroponic system which the solar system has many advantages such as it does not use large space to construct the project. This project focuses more on the design and development of the solar powered hydroponic system prototype which will be the baseline for the construction of a practical and acceptable system. This development project will study the scope as follows:

a) To design a conceptual framework of the developed project, such as:
   - Utilisation of the Nutrient Film Techniques (NFT) for the project.
   - The working principle of the developed project.

b) To identify the components and modules to be utilised in the design, such as:
   - Use solar PV system to generate the water pump.
   - Use Solar Charge Controller and Lead Acid Battery which can protect and backup the solar PV system

c) To develop a solar powered hydroponic system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter explains on hydroponics and solar PV systems. It includes a comparison of the components that would be used and those that have been used in past projects by other researchers. All the above information presented in this chapter comes from a project related study.

2.2 Solar Powered Hydroponic

The solar-powered hydroponic system is a method that has been use widely. The source is from solar panel by the sun radiation [1]. The energy that has been supplied through the solar panel the solar panel is taken to the battery to charge and discharge power. The motor will active through a relay and humidity sensor and timer are connected to Arduino UNO. Figure 2.1 shows the block diagram presented:

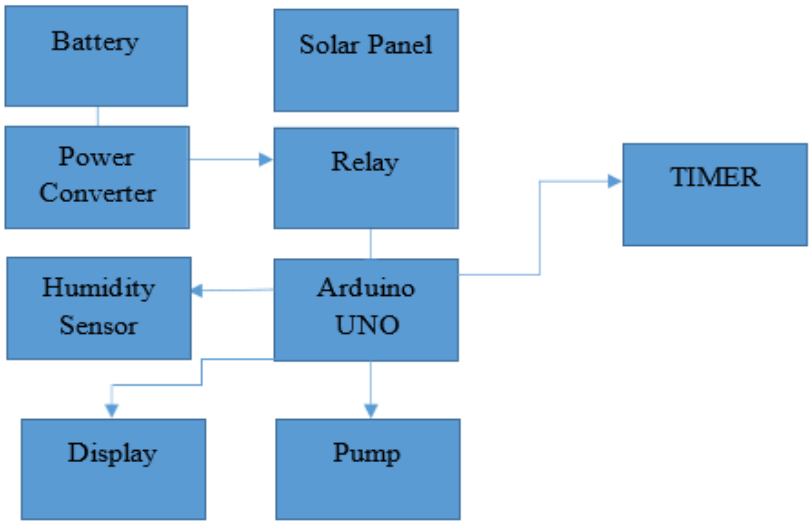

Figure 2.1: Solar Powered Hydroponic System

2.3 Renewable Powered Hydroponic

Renewable energy is a method that is most commonly user used nowadays. Renewable energy sources are not reduced and transferred over a geographical area and are rapidly regenerated via natural processes. Therefore, it will not create any issues with environmental damage. The primary benefit of using renewable resources is it is available over the year[2].

Usually, sustainable energy growth initiatives include three big technical developments, which are energy demand, productivity increases in energy generation and fossil fuel substitution by diverse green energy sources.

Renewable Energy:

a) Solar PV

b) Wind energy

c) Biopower

d) Biofuels

These various green energy sources are briefly describe in following sub-sections.

2.3.1 Solar PV

A photovoltaic system is made up of one or more solar panels, an inverter, and mechanical components that harness the sun's energy to generate electricity. PV systems can in a wide range of sizes, from small rooftop or potable systems to large utility-scale power facilities. The basic PV system is depicted in Figure2.2:

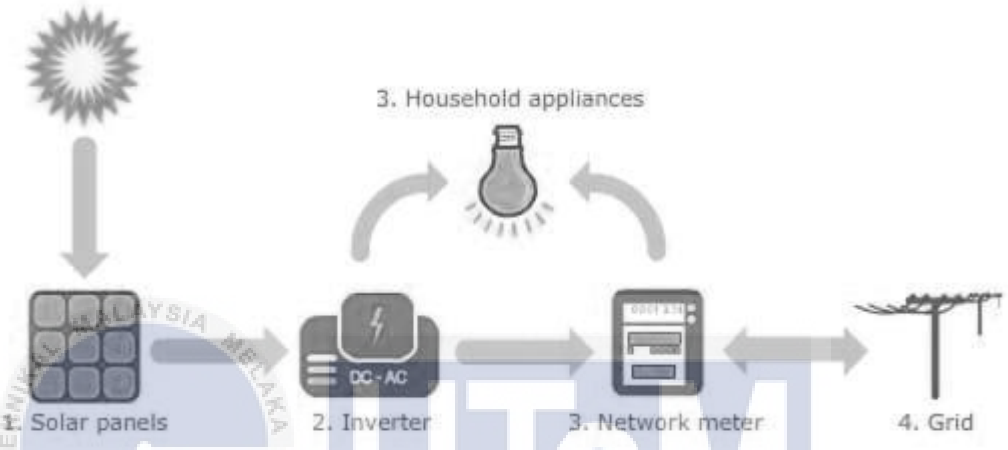

Figure 2.2: Application of solar PV

2.3.2 Wind energy

Instead of using the sun to generate electricity, wind turbines use a simple idea. Wind turbines generate electricity by harnessing the power of the wind. The propeller-like blades are turned by the wind around a rotor, which spins a generator and generates electricity. The basic diagram of wind energy conversion is shown in Figure 2.3:

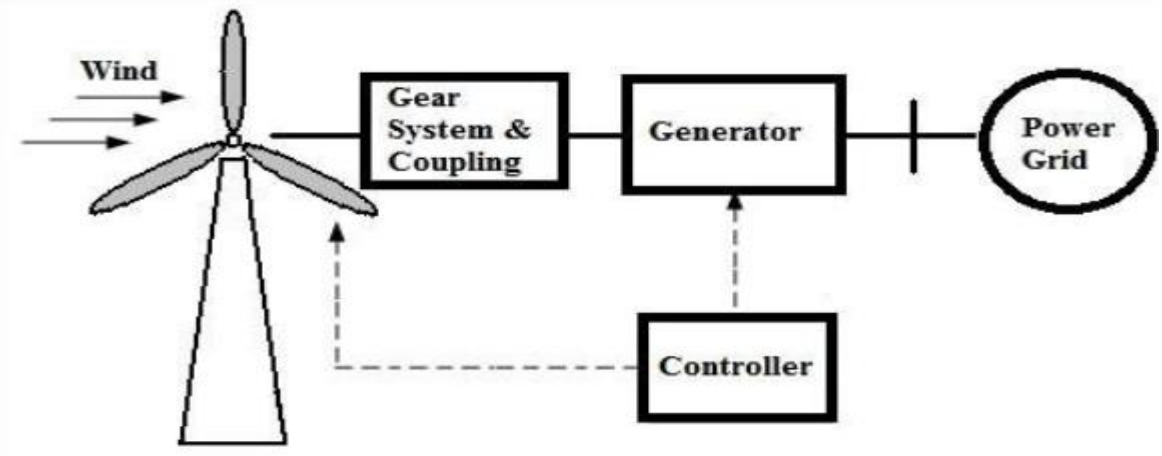

Figure 2.3: Application of wind energy

2.3.3 Biopower

The term "biopower" is used to describe new power mechanisms and strategies that are centred on life, as opposed to those that function within sovereign power's legal and political realms. Biopower systems use procedures similar to those used with fossil fuels to transform renewable biomass fuels into heat and electricity. Burning, bacterial degradation, and conversion to gas/liquid fuel are the three methods for releasing the energy trapped in biomass to produce biopower.

2.3.4 Biofuels

Biofuel is a fuel created from biomass in a short period of time rather than the very slow natural processes that lead to the formation of fossil fuels such as oil. Because biomass may be burned directly, some people mix up the phrase's biomass and biofuel (for example, wood logs). The phrase "biofuel" is, nevertheless, often used to refer to liquid or gaseous transportation fuels.

Biofuel can be made from plants, as well as agricultural, residential, and industrial biowaste. Biofuels offer a wide range of green house gas reduction options, ranging from emissions comparable to fossil fuels in certain scenarios to negative emissions in others.

2.3.5 Comparison on renewable energy sources

Each energy source has its advantages and disadvantages. Table 2.1 summarises the comparison of energy sources.

Table 2.1: Comparison on renewable energy

Type of renewable energy	**Advantages**	**Disadvantages**
Solar Power	• Can be used in different size • Easy to manage • High sunshine in Malaysia • Does not create green house gas	• High investment
Wind Power	• Does not create green house gas	• High investment • To big for hydroponic • Unavailable when win velocity below 3m/s
Biopower	• Carbon neutrality • Reduce waste	• Not completely clean • Possible deforestation