Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF SOLAR WATER HEATER SYSTEM

AZIZI AIMAN BIN ALI

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

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DEVELOPMENT OF SOLAR WATER HEATER SYSTEM

AZIZI AIMAN BIN ALI

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Ts. Dr. MOHD HATTA BIN JOPRI
Pensyarah
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan Elektrik dan Elektronik
Universiti Teknikal Malaysia Melaka (UTeM)

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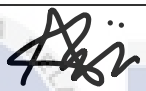
Signature	
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Signature : 

Supervisor Name : DR. MOHD HATTA BIN JOPRI.

Date : 23.12.2022

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Name (if any)

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I approve that this Bachelor Degree Project 2 (PSM2) report entitled “Development of Solar Water Heater System” is sufficient for submission.

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Supervisor Name : DR. MOHD HATTA BIN JOPRI.

Date : 23.12.2022

DEDICATION

I dedicate this essay to my beloved mother, Zaimah binti Hasim, and father, Ali bin Saat, for their unwavering support throughout my degree journey.

ABSTRACT

The existing solar water heating systems and their applications are studied in this review paper. Hot water is now used in the home, the workplace, and the industrial sector. To heat water and produce steam, various resources such as coal, diesel, and gas are used. Solar energy is the primary replacement option for traditional energy sources. The solar water heating technology system that heats water using the sun's to convert free electrical energy. A solar energy system is designed to fulfil the energy needs. A dimensions of system is defined by factors such as the amount of available solar radiation, the temperature requirements of the customer, the geographical area of a solar system, and so on. In this article, one type of photovoltaic was selected which is poly crystalline to measure the perfomance about voltage and current during charging and discharging session. Consequently, the solar hot water system should be designed with the above parameters in mind. In addition to understanding a development, layout, implementations, as well as type of solar panel that will be used in, the relevant literature is reviewed.

ABSTRAK

Sistem pemanasan air suria sedia ada dan aplikasinya dikaji dalam kertas kajian ini. Air panas kini digunakan di rumah, tempat kerja, dan sektor perindustrian. Untuk memanaskan air dan menghasilkan wap, pelbagai sumber seperti arang batu, diesel, dan gas digunakan. Tenaga suria ialah pilihan penggantian utama untuk sumber tenaga tradisional. Sistem teknologi pemanasan air suria yang memanaskan air menggunakan matahari untuk menukar tenaga elektrik percuma. Sistem tenaga suria direka untuk memenuhi keperluan tenaga. Dimensi sistem ditakrifkan oleh faktor seperti jumlah sinaran suria yang tersedia, keperluan suhu pelanggan, kawasan geografi sistem suria, dan sebagainya. Dalam artikel ini, satu jenis fotovoltaik telah dipilih iaitu panel kristal poli untuk mengukur prestasi voltan dan arus elektrik semasa pengecasan bateri daripada solar panel dan semasa pengeluaran kuasa kepada beban. Oleh itu, sistem air panas suria harus direka bentuk dengan mengambil kira parameter di atas. Di samping memahami pembangunan, susun atur, pelaksanaan, serta jenis panel solar yang akan digunakan, literatur yang berkaitan disemak.

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LIST OF SYMBOLS

η	-	Efficiency.
$\bar{x}$	-	Average.

LIST OF ABBREVIATIONS

V	-	Voltage
A	-	Ampere
W	-	Watt
PV	-	Photovoltaic
Wp	-	Watt peak
Si	-	Silicon
DC	-	Direct Current
AC	-	Alternating Current
PWM	-	Pulse Width Modulation
MPPT	-	Maximum Power Point Tracking
COM	-	Common
NC	-	Normally close
NO	-	Normally open

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CHAPTER 1

INTRODUCTION

1.1 Background

The sun has been a powerful presence and force throughout the history of the human race existence on earth. Many cultures worship it in some form, and the vast majority consider it to be the greatest source of life on earth. Over the centuries, it has also been exploited by a variation of cunning means in order to successfully utilise this life-giving energy regarding renewable energy, the sun is the most reliable and effective. It is infinite on all practical timescales, incredibly potent, well-understood, and easy to predict in its overall trends, as well as beyond the influence of humans in the foreseeable future. To summarise, the effective power source; nevertheless, it is not devoid of obstacles. A solar heater is a device that employs solar energy to heat water and generate heat for domestic and industrial applications. Automated systems for capturing the sun's energy and transferring it to water for immediate use or storage have been studied and implemented since 1970s, when they were first used for pool heating in California. Solar water heating (SWH) is the method of heating water with the help of the sun and a solar thermal collector. A variety of configurations with varying costs are available to provide solutions for different climates and latitudes. SWHs are utilised frequently in homes and some industrial sites. The working fluid is heated by a solar collector and then saved in a system for future use. It is a device which converts the sun's light into electrical energy and make heat energy, which is then transferred to the necessary medium. This project will help the users using the hot water without using any electrical supply from power grid. Hence, will reduce their electrical monthly cost.

1.2 Problem Statement

In today's modern world, where new technologies are introduced every day, electrical energy use is increasing quickly Fossil fuel particularly petroleum fuel is the major contributor to electrical production. Quickly depleting reserve of petroleum and decreasing air quality raise question about the future. Solar can be used as a clean alternative energy to reduce electrical production and is promising in the effect to establish environmentally friendly for electrical system.[1] So far, many extensive studies investigated solar water heating system and become the famous application for home and building.

The using of solar water heating system not familiar in Malaysia and the people in Malaysia still not realize about the practical of using solar water heating systems. It's important to study about the power produce to run this experiment system and proving about polycrystalline solar panel are able to develop water heating system.[2]

Due to the unpredictable weather, the availability of sunlight depend on the condition as weather can change from time to time. In addition, sunlight clearly unavailable during night while there is still demand for electricity. As a result, determining the best equipment to construct a stand-alone system.[3]

To make a dependable water heater system, the battery should be installed in this system.[4] Thus, the reserve supply from the solar panel which stored in the battery still can be used when there is still a demand.

To build flexibility system with an automatic feed-back is a challenging part for this project. In order to control the temperature and level of water, a decent sensor need to be

determined for the installation. This is because, the sensor can integrate circuit which detects a specific physical parameter and converts it to an electrical signal.

- Determining the polycrystalline solar panel will be able to supply many loads.
- Identify the equipment to make a self-control system.
- Calculate a sufficient solar energy storage capacity.

1.3 Project Objective

This project's main goal is to propose a systematic and effective methodology for developing a solar water heater system. The following are the specific goals:

- To design a compatibility polycrystalline solar panel in supplying both DC water pump and DC immersion heater sufficiency.
- To construct a systematic and self-control water heater system using sensor and relay controlled by Arduino UNO R3.
- To observe statistical trends by collecting data of solar panel.

1.4 Scope of Project

To prevent any uncertainty regarding this project as a result of certain limitations, the project's scope has been defined as follows:

- Using 20Wp polycrystalline solar panel in developing of solar water heater system.
- PWM solar charge controller will connect from solar panel and regulate power to battery storage.
- Arduino UNO R3 as a brain that control this experiment.
- This experiment will perform in direct current (DC).
- Construct Arduino UNO R3 circuit using Proteus 8 Professional and Arduino IDE.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Photovoltaic (PV) modules are currently seeing widespread adoption as a solution to the ever-increasing need for energy around the world. Solar energy is the renewable energy source that is the most easily accessible, and the process of converting solar energy into electricity using PV modules is straightforward, doesn't produce any unwanted noise, and requires very little upkeep. Modules that are available on the market are almost always based on silicon technology and can be purchased in either the monocrystalline or polycrystalline form of the crystalline structure. In spite of the fact that the monocrystalline module has a higher price per watt than the polycrystalline module, monocrystalline solar cells are able to generate more usable power thanks to their distinct crystal structure and other advantageous cell characteristics. This project applies the 20 Wp for polycrystalline solar panels.[5] The Solar Water Heater (SWH) industry is a traditional manufacturing industry whose product is wholly reliant on the amount of solar thermal energy that is present in the environment. Heating water is a necessary task in the home, and there are a variety of approaches to choose from, including water heaters that run on electricity and water heaters that run on LPG gas. Although they have a lower overall cost of ownership over time, solar water heaters demand an upfront expenditure that is approximately twice as much as that of alternative water