Faculty of Electrical and Electronic Engineering Technology

MODIFICATION OF COOLING BOX SYSTEM FOR LIGHTNING DETECTION SYSTEMBY OPTIMIZING THE TEMPERATURE CONTROLLER

MUHAMMAD AIMAN HAZIM BIN RASYIDI

Bachelor of Electronics Engineering Technology with Honours

2022

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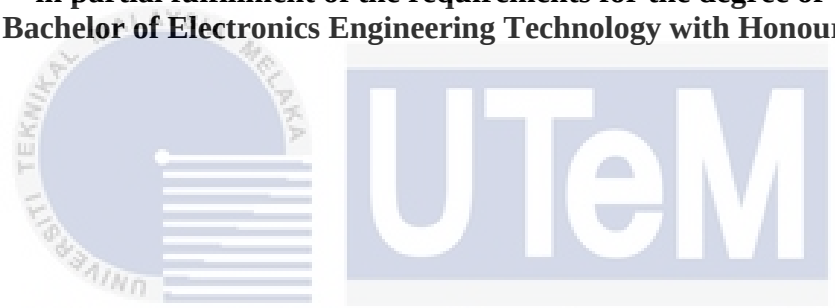
MUHAMMAD AIMAN HAZIM BIN RASYIDI

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours



Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

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Sesi Pengajian: 2021/2022

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I declare that this project report entitled "**MODIFICATION OF COOLING BOX SYSTEM FOR LIGHTNING DETECTION SYSTEM BY USING TEMPERATURE SENSOR**" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : AimanHazim

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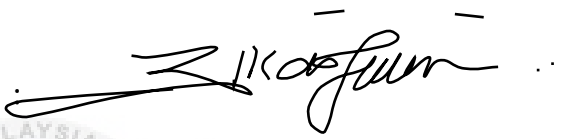
APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

Signature : 

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Date : 31/1/2022

Signature :

Co-Supervisor :

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Date :

DEDICATION

The purpose of Allah, the Creator of the world and the courier of Allah, the prophet Muhammad (May Allah favor and award him). To my cherished mother, Zalinah Binti Jasman and father, Rasyidi Bin Bujang. Additionally, not to be failed to remember my kin, Muhammad Syazani and Putri Nur Aqilah.

ABSTRACT

This proposal is based on the project of the Prototype Research Grant Scheme (PRGS: PRGS / 1 /2016 / TK04 / FTK / 03 / T00014) that primarily a concern in managing the temperature sensor for the cooling of the Lightning Detection System. Moreover, this proposal is based on the Final Year Project of [1]. The problem statement is the temperature sensor used is not very accurate to detect the temperature inside the part of the Cooling Box System. The detected temperature values cause the Peltier and fan to be active at inappropriate times such as nighttime. The Peltiers and the fans should work in the sun because they want to keep the temperature low inside Cooling Box System. The temperature sensor's role is to detect the temperature. Thus, an inappropriate positioning place inside Cooling Box System causing the temperature sensor to detect the temperature in one place only at the same time. The objective of this project is to identify the performance of Thermoelectric Peltiers and fans are functioning at the right and proper time, to improve the temperature sensors circuitry with suitable and more effective components, and to determine the position of the appropriate temperature sensor to be placed in the Cooling Box System to get accurate detection of the temperature in the Cooling Box. The hardware execution will be using Arduino Mega 2560 as the microcontroller, Thermoelectric Peltier as the coolant, and DS18B20+ model as the Temperature Sensor. As a result, the system will operate if the ambient temperature is more and equal to 27^{o} Celcius.

ABSTRAK

Cadangan ini berdasarkan projek Skim Geran Penyelidikan Prototaip (PRGS: PRGS / 1/2016 / TK04 / FTK / 03 / T00014) yang terutama menjadi perhatian dalam menguruskan sensor suhu untuk penyejukan Sistem Pengesanan Kilat. Lebih-lebih lagi, cadangan ini berdasarkan Projek Tahun Akhir [1]. Pernyataan masalahnya ialah sensor suhu yang digunakan tidak begitu tepat untuk mengesan suhu di dalam bahagian Sistem Pendingin. Nilai suhu yang dikesan menyebabkan Peltier dan kipas aktif pada waktu yang tidak sesuai seperti waktu malam. Peltiers dan kipas angin harus bekerja di bawah sinar matahari kerana mereka ingin mengekalkan suhu di dalam Cooling Box System. Peranan sensor suhu adalah untuk mengesan suhu. Oleh itu, tempat penempatan yang tidak sesuai di dalam Cooling Box System menyebabkan sensor suhu dapat mengesan suhu di satu tempat hanya pada masa yang sama. Objektif projek ini adalah untuk mengenal pasti prestasi Thermoelectric Peltiers dan kipas berfungsi pada waktu yang tepat dan tepat, untuk memperbaiki litar sensor suhu dengan komponen yang sesuai dan lebih berkesan, dan untuk menentukan kedudukan sensor suhu yang sesuai untuk ditempatkan di Sistem Pendingin untuk mendapatkan pengesanan suhu yang tepat di Kotak Pendingin. Pelaksanaan perkakasan akan menggunakan Arduino Mega 2560 sebagai mikrokontroler, Thermoelectric Peltier sebagai penyejuk, dan model DS18B20 + sebagai Sensor Suhu. Hasilnya, sistem akan beroperasi jika suhu persekitaran kurang dari 27º Celcius.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, TS. DR ZIKRI ABADI BIN BAHARUDIN for his precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) and my family for the support which enables me to accomplish the project. Not forgetting my fellow colleague for the willingness of sharing his thoughts and ideas regarding the project.

My highest appreciation goes to my parents, partner, and friends for their love and prayer during the period of my study. An honourable mention also goes for all motivation and understanding.

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LIST OF SYMBOLS

^{o}	-	Degree
m^2	-	Metre Square
	-	
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LIST OF ABBREVIATIONS

LDS	-	Lightning Detection System
TEC	-	Thermoelectric Cooler
TEMs	-	Thermoelectric Modules
TEGs	-	Thermoelectric Generators
PV	-	Photovoltaic
TE-HE	-	Thermoelectric Heat Exchanger
I/O	-	Input/Output
LCD	-	Liquid Crystal Display
V	-	Voltage
A	-	Ampere
W	-	Watt
C	-	Celcius
Kg	-	Kilogram

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

Continuation of FYP in year 2019 which was found to have a weakness in the controller, P20L. Ideally, the Lightning Detection System (LDS) system consume 60 A with 12 V fram one battery (120 AH), continuously. The system will stop operate if the ambient temperature is less than 27^{o} Celcius. However, the controller can not allow the system to operate directly from the solar panel even during fair weather. It will only operate with the battery. Then the problematic issue always happens when the weather change to twilight condition which lead the battery to drain quickly.

Finally, the system connot operate when there is a lightning event to be happened at night. Therefore, some modification in the controller section needs to be done. This project requires for analysing, contracting and evaluating the performance of the LDS system.

1.2 Problem Statement

The previous Cooling Box System for Lightning Detection System (LDS) is controlled by Arduino Mega 2560 and other important component such as Thermoelectric Peltier and Temperature Sensor. The problem that can be observe from previous project is the temperature sensor used is not very accurate to detect the temperature inside the part of Cooling Box System. The detected temperature values cause the Peltier and fan to be active at inappropriate times such as night time. The Peltiers and the fans should work in the sun because they want to keep the temperature low inside Cooling Box System.

The position of the temperature sensor also plays an important role because to detect the temperature at a strategic position. If the temperature sensor is placed in an inappropriate place inside Cooling Box System, it causes the temperature sensor to detect the temperature in one place only, at the same time another space inside Cooling Box System the temperature cannot be detected.

1.3 Project Objective

The main objectives of this project are:

a) To identify the performance of Thermoelectric Peltier's and fans are functioning at the right and proper time.

b) To improve the temperature sensors circuitry with suitable and more effective components.

c) To determine the position of the appropriate temperature sensor to be placed in the Cooling Box System in order to get accurate detection of the temperature in the Cooling Box.

1.4 Scope of Project

To accomplish this project, the scope has been outlined to be able to design and develop a prototype of Modification of Cooling Box System for Lightning Detection System by Optimizing the Temperature Controller. The electronic component used to control the temperature change in the Cooling Box System is improved.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter explains the knowledge and research that has been done on the engage issue in earlier publications. In other words, it demonstrates to the reader what is known and what is unknown about a specific issue by doing in-depth research.

2.2 Past Studies

The thermoelectric semiconductor material often used in today's TE coolers is a Bismuth Telluride composite that has been properly doped to produce single blocks or components with unique N and P properties. Squeezed powder metallurgy or directed crystallization from a melt are both common methods for producing thermoelectric materials. Although each assembly method has its own ideal location, materials that are produced in a certain direction are common [1].

Electronic components now in use (LEDs, CPUs, CCD matrices) are distinguished by their denser packing of active elements and, as a result, increased heat loss power per individual element. The resulting heat barrier inhibits component operation and development in their current state. Cooling systems (natural or forced, including water cooling systems) may fall short of the desired performance [2].