



Faculty of Electrical and Electronic Engineering Technology



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

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MUHAMMAD AIMAN HAZIM BIN RASYIDI

Bachelor of Electronics Engineering Technology with Honours

2022

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

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

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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.

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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° 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 27° Celcius.

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TABLE OF CONTENTS

	PAGE
DECLARATION	
APPROVAL	
DEDICATIONS	
ABSTRACT	i
ABSTRAK	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	i
LIST OF TABLES	iii
LIST OF FIGURES	vi
LIST OF SYMBOLS	ix
LIST OF ABBREVIATIONS	x
LIST OF APPENDICES	xi
CHAPTER 1 INTRODUCTION	12
1.1 Background	12
1.2 Problem Statement	13
1.3 Project Objective	14
1.4 Scope of Project	14
CHAPTER 2 LITERATURE REVIEW	15
2.1 Introduction	15
2.2 Past Studies	15
2.3 Past Studies	19
2.3.1 Why using Thermoelectric Peltier	20
2.4 Hardware	22
2.4.1 Comparison of Component	22
2.4.1.1 Microcontroller	22
2.4.1.2 Temperature Sensor	24
2.5 Solar as a Power Supply	26
2.5.1 Type of Solar Panel	26
2.5.1.1 Monocrystalline	26
2.5.1.2 Polycrystalline	27
2.5.1.3 Thin Film	27
CHAPTER 3 METHODOLOGY	28
3.1 Introduction	28

3.2	Methodology	28
3.3	Flowchart	29
3.4	Software and Component	31
3.4.1	Software	31
3.4.1.1	Proteus	31
3.4.1.2	Arduino IDE	31
3.4.2	Component Use	32
3.4.2.1	Arduino Mega 2560	32
3.4.2.2	Temperature Sensor	34
3.4.2.3	Thermoelectric Peltier	36
3.4.2.4	12C 16X2 Liquid Crystal Display (LCD)	37
3.5	Cooling Box Model	38
3.6	Gantt Chart	39
CHAPTER 4	RESULTS AND DISCUSSIONS	40
4.1	Introduction	40
4.2	General Analysis	40
4.3	Results and Analysis	41
4.3.1	Coding	41
CHAPTER 5	CONCLUSION AND RECOMMENDATIONS	112
5.1	Conclusion	112
5.2	Future Work	112
REFERENCES		113
APPENDICES		115

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LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	The advantages and disadvantages between Peltier and Compressor-Based System	20
Table 2.2	Differences between micro-controllers	22
Table 2.3	Differences between types of temperature sensor	24
Table 3.1	Specification of Arduino Mega 2560	32
Table 3.2	Specification of Temperature Sensor	34
Table 3.3	Specification of Air-to-Air Thermoelectric Cooling Assembly	36
Table 3.4	Gantt Chart	39
Table 4.1	Recorded data for W/m^2 VS Ambient Temperature, °C	43
Table 4.2	Data 10 days for Ambient Temperature, °C	50
Table 4.3	Average for Maximum & Minimum Ambient Temperature, °C	51
Table 4.4	Recorded data for W/m^2 VS Box Temperature, °C	54
Table 4.5	Data 10 days for Box Temperature, °C	61
Table 4.6	Average for Maximum & Minimum of Box Temperature, °C	61
Table 4.7	Day 2 collected data for Peltier current usage.	64
Table 4.8	Day 2 collected data for Peltier current usage.	64
Table 4.9	Day 3 collected data for Peltier current usage.	65
Table 4.1.1	Day 1 collected data for Fan current usage.	65
Table 4.1.2	Day 5 collected data for Peltier current usage.	66
Table 4.1.3	Day 6 collected data for Peltier current usage.	66
Table 4.1.4	Day 7 collected data for Peltier current usage. (Corrupted Data)	67
Table 4.1.5	Day 8 collected data for Peltier current usage.	67

Table 4.1.6	Day 9 collected data for Peltier current usage. (Corrupted Data)	68
Table 4.1.7	Day 10 collected data for Peltier current usage.	68
Table 4.1.8	Data 8 days for Total Current	76
Table 4.1.9	Average of Maximum & Minimum for P1 +P2, A.	77
Table 4.2.0	Day 1 collected data for Fan current usage.	81
Table 4.2.1	Day 2 collected data for Fan current usage.	81
Table 4.2.2	Day 3 collected data for Fan current usage.	82
Table 4.2.3	Day 4 collected data for Fan current usage.	82
Table 4.2.4	Day 5 collected data for Fan current usage.	83
Table 4.2.5	Day 6 collected data for Fan current usage.	83
Table 4.2.6	Day 7 collected data for Fan current usage. (Corrupted Data)	84
Table 4.2.7	Day 8 collected data for Fan current usage.	84
Table 4.2.8	Day 9 collected data for Fan current usage. (Corrupted Data)	85
Table 4.2.9	Day 10 collected data for Fan current usage	85
Table 4.3.0	Total Current F1 + F2,A for 10 days	94
Table 4.3.1	Average of Maximum & Minimum for Total F1 + F2 Current,A	95
Table 4.3.2	Total Current usage for 2 Peltiers & 2 Fans,A	99
Table 4.3.3	Average of Maximum & Minimum Total current for 2 Peltiers & 2 Fans	100
Table 4.3.4	Total Voltage usage for 2 Peltiers & 2 Fans,V	103
Table 4.3.5	Table of Maximum & Minimum for Average Voltage usage for 2 Peltiers & 2 Fans,V	104
Table 4.3.6	Correlation Ambient Temperature,°C & Power Consump,W	107
Table 4.3.7	Correlation Box Temperature, °C & Power Consump,W	109



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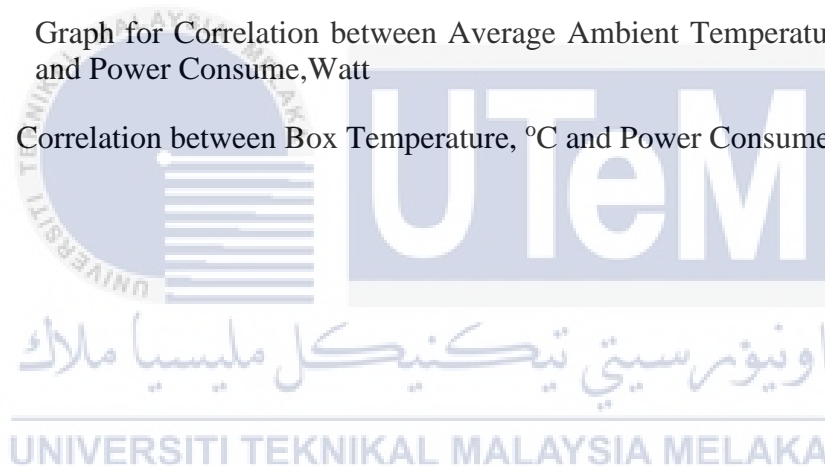
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1	Arduino Mega 2560	23
Figure 2.2	Raspberry Pi B+	23
Figure 2.3	DS18B20+	25
Figure 2.4	KTY81/220,112	25
Figure 2.5	TMP36GT9Z	25
Figure 2.6	Monocrystalline Solar Panel	26
Figure 2.7	Polycrystalline Solar Panel	27
Figure 2.8	Thin Film Solar Panel	27
Figure 3.1	Project Flowchart	29
Figure 3.2	System Flowchart	30
Figure 3.3	Icon of Proteus	31
Figure 3.4	Icon of Arduino IDE	31
Figure 3.5	Arduino Mega 2560	33
Figure 3.6	Arduino Mega 2560 Pin Diagram	33
Figure 3.7	DS18B20+	35
Figure 3.8	DS18B20+ Pin Diagram	35
Figure 3.9	Air-to-Air Thermoelectric Cooling Assembly.	36
Figure 3.1.1	12C 16x2 LCD	37
Figure 3.1.2	12C 16x2 LCD Pin Diagram	37
Figure 3.1.3	Front and left view of Cooling Box Model	38
Figure 3.1.2	Behind and right view of Cooling Box Model	38
Figure 4.1	Graph 10 days for Time, Hours VS W/m^2 and Ambient Temperature, $^{\circ}C$	45

Figure 4.2	Graph for Time, Hours VS W/m^2 and Ambient Temperature, °C. (Without Corrupted Data (Day 7 & Day 9))	46
Figure 4.3	Graph for Time, Hours VS Maximum & Minimum W/m^2	47
Figure 4.4	Graph for Time, Hours VS Maximum & Minimum Ambient Temperature, °C	48
Figure 4.5	Graph for Time, Hours VS Average Ambient Temperature, °C	52
Figure 4.6	Graph 10 days for Time, Hours VS W/m^2 and Box Temperature, °C	56
Figure 4.7	Graph for Time , Hours VS W/m^2 and Box Temperature, °C (Without Corrupted Data (Day 7 & Day 9))	57
Figure 4.8	Graph for Time, Hours VS Maximum & Minimum W/m^2	58
Figure 4.9	Graph for Tiome, Hours VS Maximum & Minimum Box Temperature, °C	59
Figure 4.1.1	Graph for Time, Hours VS Box Temperature, °C	62
Figure 4.1.2	Graph for Time, Hours VS Average Current P1 + P2, A. (Without Corrupted data (Day 7 & Day 9))	69
Figure 4.1.3	Graph for Time, Hours VS Total Current P1 + P2, A (Without Corrupted Data (Day 7 &v Day9))	70
Figure 4.1.4	Graph for Time, Hours (11am-16pm) VS Average Current P1 + P2, A. (Without Corrupted data (Day 7 & Day 9))	71
Figure 4.1.5	Graph for Time, Hours (11am-16pm) VS Total Current P1 + P2, A. (Without Corrupted data (Day 7 & Day 9))	72
Figure 4.1.6	Graph for Time, Hours (11am-16pm) VS Average for Max & Min Current P1 + P2, A (Without Corrupted data (Day 7 & Day 9))	73
Figure 4.1.7	Graph for Time, Hours (11am-16pm) VS Total for Max & Min Current P1 + P2, A. (Without Corrupted data (Day 7 & Day 9))	74
Figure 4.1.8	Graph for Time, Hours VS Average Current P1 + P2, A.	78
Figure 4.1.9	Graph for Time, Hours VS Average Current F1 + F2, A (Without Corrupted Data (Day 7 & Day 9))	86
Figure 4.2.0	Graph for Time,Hours VS Total current F1 + F2,A (Without Corrupted data (Day 7 & Day 9))	87

Figure 4.2.1	Graph for Time, Hours VS Average current F1 + F2,A (Without Corrupted data (Day 7 & Day 9))	88
Figure 4.2.2	Graph for Time, Hours VS Total current F1 + F2,A (Without Corrupted data (Day 7 & Day 9))	89
Figure 4.2.3	Graph for Time, Hours VS Max & Min Average current F1 + F2,A (Without Corrupted data (Day 7 & Day 9))	90
Figure 4.2.4	Time,Hours VS Max & Min Total current F1 + F2,A (Without Corrupted data (Day 7 & Day 9))	91
Figure 4.2.5	Graph for Time, Hours VS Average Fan Current, A.	96
Figure 4.2.6	Graph for Time, Hours VS Average Total Current	101
Figure 4.2.7	Time, Hours VS Voltage Average,V	105
Figure 4.2.8	Graph for Correlation between Average Ambient Temperature, °C and Power Consume, Watt	108
Figure 4.2.9	Correlation between Box Temperature, °C and Power Consume, W	110



LIST OF SYMBOLS

°	-	Degree
m ²	-	Metre Square
	-	
	-	
	-	
	-	
	-	
	-	
	-	



LIST OF ABBREVIATIONS

<i>LDS</i>	-	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



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LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	Example of Appendix A	Error! Bookmark not defined.
Appendix B	Example of Appendix B	116



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 from one battery (120 AH), continuously. The system will stop operate if the ambient temperature is less than 27° 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 cannot 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].