

Faculty of Electrical and Electronic Engineering Technology



MUHAMMAD SYUKRI BIN SULIAMAN

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

2022

Development Of Automated Exhaust Fan for Modern Kitchen with Safety Fire Detection System

MUHAMMAD SYUKRI BIN SULIAMAN

A project report submitted in partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this project report entitled "Development of Automated Exhaust Fan for Modern Kitchen with Safety Fire Detection Features" 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.



APPROVAL

I approve that this Bachelor Degree Project 1 (PSM1) report entitled "Development Of Automated Exhaust Fan for Modern Kitchen with Safety Fire Detection System" is sufficient for submission.

Signature	: Aldam
Supervisor Na	me : EN. ADAM BIN SAMSUDIN
Date	ونيونر،سيتي تيڪنيڪل مليسيا ملا
UI	NIVERSITI TEKNIKAL MALAYSIA MELAKA

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 (Industrial Power) with Honours.

Signature :	Adam
Supervisor Name :	EN. ADAM BIN SAMSUDIN
Date :	9/3/2023
Signature	
يا ملاك	اونيوم سيتي تيكنيك مليسه
Co-Supervisor	SITI TEKNIKAL MALAYSIA MELAKA
Name (if any)	Muhamad Falihan bin Bahari
Date :	8/3/2023

.....

DEDICATION

To my beloved mother, PN. SUZANAH BINTI ABD AZIZ, and father, EN. SULIAMAN BIN ZAINAL,

and

To closest team members, Muhammad Akhmal Syafi (Co-Sv Dr. Chong), Muhammad Faiz Zohri, Muhamad Taufik Md Isa and Muhammad Haziq Khairil Azri



ABSTRACT

Since the development of new technologies, especially on modern kitchen appliances which makes cooking more easier and time saving. Futhermore, many users in this modern era will have at least 3 electrical appliances at their home. However, this modern kitchen appliances will emit high heat output which will turn surrounding indoor air temperature hotter than usual. For an example of high heat appliances that are frequently being used in malaysia such as Rice Cooker, Air Fryer and Oven. Thus, the system for air cooling purpose is needed in every houses nowadays although most of the system will be expensive. So, in resolving this problem, the development of air ventilation system with lower electrical consumption as well as low installation cost will be the best solution. With the implementation of exhaust fan as the ventilation system, the cost for installation as well as maintenance will be reduced a lot. The exhaust fan will carry the process of removing how air from the kitchen so that cooler surrounding temperature can be achieved. The application of automated microcontroller system which will allow higher energy efficiency for daily cooking appliances usage. Then, the application of DHT22 temperature sensor as the input for the microcontroller which able to detect precise temperature of the surrounding air. Next the AC voltage coltroller will helps on regulating the speed of the fan according to the input temperature so that more energy can be save during long daily usage. At the end of this project, the outcome product will become a microcontroller that able to used in various type of household which already have a wall mounted exhaust fan. Moreover, more user will be able to install this whole ventilation system for their hot kitchen due to low installation and maintenance cost. Lastly, electrical TNB monthly bill can be reduce.

ABSTRAK

Sejak pembangunan teknologi baru, terutamanya pada peralatan dapur moden yang menjadikan memasak lebih mudah dan menjimatkan masa. Lebih-lebih lagi, ramai pengguna dalam era moden ini akan mempunyai sekurang-kurangnya 3 peralatan elektrik di rumah mereka. Walau bagaimanapun, peralatan dapur moden ini akan mengeluarkan output haba yang tinggi yang akan menjadikan suhu udara dalaman lebih panas daripada biasa. Untuk contoh peralatan haba tinggi yang sering digunakan di malaysia seperti Periuk Nasi, Air Fryer dan Ketuhar. Oleh itu, sistem untuk tujuan penyejukan udara diperlukan di setiap rumah pada masa kini walaupun kebanyakan sistem akan mahal. Oleh itu, dalam menyelesaikan masalah ini, pembangunan sistem pengudaraan udara dengan penggunaan elektrik yang lebih rendah serta kos pemasangan yang rendah akan menjadi penyelesaian terbaik. Dengan pelaksanaan kipas ekzos sebagai sistem pengudaraan, kos pemasangan serta penyelenggaraan akan dikurangkan banyak. Kipas ekzos akan membawa proses mengeluarkan bagaimana udara dari dapur supaya suhu sekeliling yang lebih sejuk dapat dicapai. Penggunaan sistem mikropengawal automatik yang akan membolehkan kecekapan tenaga yang lebih tinggi untuk penggunaan peralatan memasak harian. Kemudian, penggunaan sensor suhu DHT22 sebagai input untuk mikropengawal yang dapat mengesan suhu tepat udara di sekitarnya. Seterusnya coltroller voltan AC akan membantu mengawal kelajuan kipas mengikut suhu input supaya lebih banyak tenaga dapat dijimatkan semasa penggunaan harian yang panjang. Pada akhir projek ini, produk hasil akan menjadi mikropengawal yang dapat digunakan dalam pelbagai jenis isi rumah yang sudah mempunyai kipas ekzos yang dipasang di dinding. Lebih-lebih lagi, lebih banyak pengguna akan dapat memasang keseluruhan sistem pengudaraan ini untuk dapur panas mereka kerana kos pemasangan dan penyelenggaraan yang rendah. Akhir sekali, bil bulanan the elektrik boleh dikurangkan.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, En. Adam Bin Samsudin and co-supervisor, Ts. Muhamad Falihan Bin Bahari for their precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) and my parent for the financial support which enables me to accomplish the project. Not forgetting my fellow colleague, Muhammad Akhmal Syafi, Muhammad Faiz Zohri, Muhamad Taufik Md Isa and Muhammad Haziq Khairil Azri for the willingness of sharing his thoughts and ideas regarding the project.

Finally, I would like to thank all the staffs at the FTKEE, fellow colleagues and classmates, the Faculty members, as well as other individuals who are not listed here for being co-operative and helpful.

MALAYSIA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

TABLE OF CONTENTS

		PAG
DECI	LARATION	
APPR	OVAL	
DEDI	CATIONS	
ABST	`RACT	i
ABST	'RAK	ii
ACK	NOWLEDGEMENTS	iii
TABL	LE OF CONTENTS	1
LIST	OF TABLES	4
LIST	OF FIGURES	5
LIST	OF SYMBOLS	7
LIST	OF ABBREVIATIONS	8
LIST	OF APPENDICES	9
СНА	TED 1	10
СПА 1 1	Introduction	10
1.1	Background under Sie	10
1.2	Problem Statement	12
1.5	Project Objective	12
1.5	Scope of Project	13
CHAI	PTER 2 LITERATURE REVIEW	14
CHAI	PTER 2	14
2.1	Introduction	14
2.2	Automated Speed Controller System Available.	14
	2.2.1 Fuzzy Logic Controller, (FLC)	15
	2.2.2 Proportional Integral Derivative (PID)	10
	2.2.5 TRIAC Circuit Controller 2.2.4 Comparison between microcontroller evailable in market	10
	2.2.4 Comparison between inicrocontroller available in market.	20
23	<i>2.2.5</i> Dest Microcontroller to be implement in the system. (TKIAC) Kitchen Ventilation System Available in Market	20
2.5	2.3.1 Cooker Hood	22
	2.3.1 Contributioner	22
	2.3.2 Exhaust Ean (Various Different Rating)	$\frac{23}{24}$
	2.3.4 Table of comparison between kitchen ventilation system available	25
	2.3.5 Best kitchen ventilation system to be implement in the system	23
	(Exhaust Fan)	26
2.4	Safety Fire Detection System	27

PAGE

	2.4.1	Implementation of Fire Detection System	27
	2.4.2	Safety Fire Detection System Mechanism	28
		2.1.1.1 Circuit Diagram	28
25	The M	2.1.1.2 Flow Chart	29
2.5	The N	ew Generation Automated Exnaust Fan	29
CHAP	TER 3	3 METHODOLOGY	30
CHAP	TER 3	ş	30
3.1	Introd	uction	30
3.2	Hardw	vare Implementation	31
	3.2.1	ESP 8266 Wifi Module	31
	3.2.2	28BYJ-48 5V DC Stepper Motor	33
	3.2.3	ULN2003 Motor Driver	34
	3.2.4	DHT22 Temperature Sensor	35
	3.2.5	Push Button	35
	3.2.6	Liquid Crystal Display (LCD)	36
	3.2.7	Buzzer	37
	3.2.8	Light Emitting Diode (LED)	38
	3.2.9	4000W 230V AC Voltage Regulator Motor Speed Controller LED	•
	a 6	Dimmer	38
3.3	Softwa	are Implementation	39
	3.3.1	Proteus 8 Professional	39
2.4	3.3.2 S - G	Arduino IDE	41
3.4	Softwa	are Development	43
	3.4.1	Flow Chart	43
25	3.4.2	Proteus Design Drawing	44
3.5	Hardw	Vare Development	44
	3.5.1	Stepper Motor System	44
	3.5.2	Alarm Triggering System	43
	3.3.3	Project Design (ThinkerCod)	43
36	5.5.4 Summ	pary JERSIII (TIIIIKerCau)	40
5.0	Juiiin	iury — — — — — — — — — — — — — — — — — — —	Τ,
CHAP	TER 4	RESULTS AND DISCUSSIONS	48
4.1	Introd	uction	48
4.2	Final S	Setup of Project	49
	4.2.1	Hardware Setup	49
	4.2.2	Software Setup	51
4.3	Analy	sis Data	52
	4.3.1	Speed Vs Temperature Data Analysis	52
	4.3.2	Type of System for Exhaust Fan Comparison	54
		4.3.2.1 Normal System for Exhaust Fan	54
		4.3.2.2 IOT Controller Implimented system for Exhaust Fan	56
	4 2 2	4.3.2.3 Data Comparison of Type of system Implimented	5/
	4.3.3	Efficiency of IOT Controller Implimented System for Exhaust Fan.	60
		4.3.3.1 11me taken for Cooling down Kitchen Room Area.	60
1 1	Cumer	4.5.5.2 Graph of Cooling Down Performance of IO1 System.	62
4.4	Summ	iai y	03
СНАР	TER 5	5 CONCLUSION AND RECOMMENDATIONS	64

5.1	Conclusion	64
5.2 Future Works		65
REF	FERENCES	66
APP	PENDICES	67



LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	Table of comparison between microcontroller available in market.	19
Table 2.2	Table of comparison between kitchen ventilation system available	25
Table 4.1	Table Speed Vs Temperature	52
Table 4.2	Normal Condition Exhaust Fan	55
Table 4.3	Controller Implimented Exhaust Fan	56
Table 4.4	Time taken for cooling analysis	61



LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1	Speed Micro Controller System	14
Figure 2.2	The Operation of Fuzzy System	15
Figure 2.3	The Sequence of Fuzzy Arrangement for Temperature Sensor	16
Figure 2.4	The Calculation of PID Equation	17
Figure 2.5	The Instruction Code	17
Figure 2.6	TRIAC Symbol	18
Figure 2.7	TRIAC Implementation in System	19
Figure 2.8	AC Motor Speed Controller Module	21
Figure 2.9	AC Motor Speed Controller Module in Shopee	21
Figure 2.1	0 Kitchen Hood	22
Figure 2.1	1 Samsung Air Conditioner	23
Figure 2.12	2 The Heat Transfer Process	24
Figure 2.1	اويبوم سيتي نيڪنيڪل Khind Exhaust Fan	24
Figure 2.14	4 AC Motor Speed Controller and Exhaust FanSIA MELAKA	27
Figure 2.1:	5 Safety Fire Detection Mechanism	28
Figure 2.1	6 Arduino System Circuit	28
Figure 2.1	7 Flow Chart of Safety Mechanism	29
Figure 3.1	Overall Flowchart of PSM	30
Figure 3.2	Block Diagram of This Project	31
Figure 3.3	Arduino Uno Rev3 V3 Atmel ATMEGA328P	32
Figure 3.4	Features of Arduino Mega microcontroller board	33
Figure 3.5	5V DC Stepper Motor	34
Figure 3.6	DC Stepper Motor Driver	34
Figure 3.7	DHT22 Temperature Sensor	35

Figure 3.8 Push Button	36
Figure 3.9 LCD Display Diagram	37
Figure 3.10 Buzzer Diagram	37
Figure 3.11 LED Diagram	38
Figure 3.12 AC Motor Regulator Module	39
Figure 3.13 Proteus Design Suite 8.6	41
Figure 3.14 Proteus Design Schematic Drawing	41
Figure 3.15 Arduino IDE Interface	42
Figure 3.16 Flow Chart for Microcontroller	43
Figure 3.17 Microcontroller Design for Stepper Motor System	44
Figure 3.18 Stepper Motor Arduino System	44
Figure 3.19 Temperature Sensor Arduino System	45
Figure 3.20 Alarm Triggering Arduino System	45
Figure 3.21 Front View of Project	46
Figure 3.22 Top-Front View of Project	46
اونیوس سینی نیک Figure 4.1 Full Project Hardware Setup	49
Figure 4.2 Microcontroller System Setup	49
Figure 4.3 DHT22 Heat Sensor Setup	50
Figure 4.4 IOT Blynk Placement Setup	50
Figure 4.5 Circuit Diagram of Microcontroller	51
Figure 4.6 IOT Blynk Display	51
Figure 4.7 Blynk Data Display	53
Figure 4.8 Multimeter Reading of Normal Condition	54
Figure 4.9 Multimeter Reading for Controller Implimented Condition	55
Figure 4.10 Prototype Setup for Experimental	60

LIST OF SYMBOLS

- Degree Celcius Current °C -
- Ι _
- Power W _
- V Voltage _
- S _
- Speed Degree angle 0 _



LIST OF ABBREVIATIONS

V-VoltageKWh-Kilowatt per hourS-Speed



LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	: GannChart Full Project	67
Appendix B	: Measurement Tools	68
Appendix C	: Heat Source for Prototype	68
Appendix D	: AC Current Measurement Method	69
Appendix E	: AC Voltage Measurement Method	70
Appendix F	: Full System Coding for Microcontroller	71



CHAPTER 1

INTRODUCTION

1.1 Introduction

In this Final Year Project report will propose a solution the problems of hot indoor temperatures in modern homes by implementing a smart air ventilating system using an exhaust fan without worries about high electricity bills. This is due to the innovative approach of an automated AC motor regulator with a heat temperature sensor. Thus more energy can be saved and more modern users can overcome a hot kitchen environment at a reasonable price.

round

1.2 Background

Nowadays, modern homes mostly equipped with modern cooking appliances for various purposes to serve various kinds of meals. For example, these modern appliances, such as Multi-Cooker, Electrical Steamers, Electrical Pressure-Cooker, Oven, Microwaves and Air Fryer. However, most cooking appliances were the highest contribution of heat to the modern kitchen as well as high electrical energy consumption upon usage. Problems of high indoor temperature will affect the daily routine and bring discomfort to the family living inside.

For an older generation, solving the hot kitchen temperature especially during high cooking activities by just opening nearby doors and windows to allow natural air flow. As bad as it sounds, this technique can only be used only in older design houses that have bigger kitchen windows and perfect air flow. Modern houses are built with smaller windows and do not fully focusing on perfect air flow due to cost reduction for a low selling price point.

Modern homes and air ventilation system is a perfect combination especially after the Corvid-19 pandemic which changes most of Malaysian citizen routine, home cooking activities increases rapidly. Due to the high cooking activities inside most modern homes, the ventilation system is required the most to reduce the hot indoor temperature. Almost all the houses nowadays, have already implemented various kinds of ventilation systems in securing this problem, based on the budget for installation and maintenance.

For example, the invention of the cooking hood ventilation system, which is installed directly above the stove, which acts as continuous heat suction when the fire is open during cooking activities. However, this system only focusses the heat from direct cooking on stove while there are other electrical appliances which contribute more heat to the kitchen surroundings. Moreover, this kitchen hood systems are more efficient for restaurant usage compared to homes because noises while running the system is quite uncomfortable for families with small kids around.

Apart from that, the implementation of an exhaust fan system with a wall mounted design is more efficient for disposing the heat covering more areas of the kitchen. With this system, reliability for removing the heat accumulated in the kitchen as well as the smoke during cooking on the stove. However, as usual, this system is not perfect enough in technological view, because there are still some energy wastages while running continuously with the same rated speed. Also, there are some users who forget to turn off the switch after cooking activities end which leads to more energy wastages. With the new approach of implementing an automated or a smart speed controller into the current exhaust fan, the system will be near to perfect. The smart control system is built with Arduino, some electronic components as well as system coding. This new Controller based exhaust fan system which is now able to control the speed of the fan according to surrounding requirements while continuously running state. Thus, more efficient usage can be applied to the system as well as reduce energy wastage. Finally, with the efficient usage of this system, users can save some money due to the reduction of energy used.

1.3 Problem Statement

Living in a modern era with modern technology, daily usage of high heat output appliances in the kitchen is very common nowadays. However, the solution for this problem such as air conditioning and industrial ventilation will cost higher and doesn't meet most of the user budget for home application. This new automated system with an exhaust fan application will secure the target of removing unwanted heat in the kitchen, so that a cooler room can be achieved after a massive cooking activity. As we know, daily cooking activity produces a lot of stains, which is ideal for exhaust fan application as it is easy to clean. In addition, the approach of TRIAC method of the microcontroller and integrated relay system application will ensure a smart power input and lower cost consumption. With a low cost and user-friendly automated home ventilation system that includes safety fire detection features, more users can have a massive cooking session without worrying about hot kitchen and TNB bills.

1.4 Project Objective

The main aim of this project is to propose a systematic and effective methodology to implement an automated speed controlling AC exhaust fan in the kitchen area of a modern home. Specifically, the objectives are as follows:

- a) To design a smart exhaust fan ventilation system
- b) To develop a low power consumption of air ventilation system by implementing a arduino based controller system for fan speed controlling automation.
- c) To analyze the efficiency and cost reduction through the implementation in real modern home kitchen condition.

1.5 Scope of Project

To avoid any uncertainty of this project due to some limitations and constraints, the scope of the project are defined as follows:

- a) A conseptual design is proposed and tested on a small prototype.
- b) Source code developement using Arduino.
- c) Selection of Heat Detection sensor and AC Regulator controller.
- d) Focus AC current regulation for controlling the speed of fan.
- e) System focus only on modern kitchen household with moderate sized house.
- f) Industrial application require an upgrade and renovation on certain criteria.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A Literature review is a part where the information about the project was investigated. This chapter will find how the flow of the ideas on the design aspect, the comparison between the ideas for the project and the theory of the project. Conducting this part is very important for project development. Besides, this part also we will get the new knowledge about the topic. It is because we need to make some research for our topic based on the journals, articles, books, and sources on the internet. This chapter is written based on the information from the related previous research that has been done.

2.2 Automated Speed Controller System Available.



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 2.1 Speed Micro Controller System

2.2.1 Fuzzy Logic Controller, (FLC)

The Fuzzy Logic Controller approach is based on computing according to "degree of truth", which is better than the usual method of "true or false" (1 or 0) Boolean logic that is frequently used in modern computers. One of the methods for FLC is the Mandani fuzzy method. This method is also represented by another name, which is the max-min method, founded by Abraham Mandani in 1975. The method is popular and widely used due to its easy understanding by the human mind. The Mandani Fuzzy Inference System (Mandani-FIS) is an example of fine computing which provides a reason for approximate reasoning. A Mandani-FIS is able to handle computing with uncertainty of knowledge and imprecision of measurements effectively. It runs a non-linear mapping from an input space to an output space by extracting conclusions through a set of fuzzy if-then rules and known facts. The operation of Fuzzy System Flow by using Matlab is shown in Figure 2.2,



Figure 2.2 The Operation of Fuzzy System

The initialization process is the first step that must be implemented. By implementing this process, the magnitude of the distribution of fuzzy numbers can be determined, as well as the range for each fuzzy class. Inside the FLC, the output controller and system input are produced by using the membership function input and output and the rules table. The membership function is represented by a curve to determine the values condition of fuzzy variables in certain regions are mapped to membership values between 1 and 0. The temperature sensor is divided into 5 parts, which are labelled as very cold, cold, medium, hot, and very hot. The sequence of the fuzzy arrangement for the temperature sensor can be seen in the following Figure 2.3 [1].



Figure 2.3 The Sequence of Fuzzy Arrangement for Temperature Sensor

2.2.2 Proportional Integral Derivative (PID)

A PID controller is used in the calculation of error value as well as the difference between a desired set point and a measured process variable. The controller process will minimise the error by adjusting the process control inputs. The PID design of this system is as shown in Figure 2.4. Calculation of the PID equation is used in finding the control signal for a DC motor.



Figure 2.4 The Calculation of PID Equation

The PWM signal's programming code is calculated by the following steps. The instruction code is implemented by the Arduino microcontroller to determine the control signal. error = output-input; Integral = $xT * error + prv_ui$; Diff = (error - prv_error)/xTPWM = kp * error + ki * Integral + kd * Diff;



The proportional gain (Kp) is utilised to determine the magnitude of error, as shown in Figure 2.5, and both have proportional responses. When a substantial error is identified, the magnitude of the motor position will receive a large response. The integral gain (Ki) tries to lower the steady state error. The derivative gain (Kd) will examine the error signal's rate of change. The derivative control will limit overshoot, resulting in the optimal system response curve for the motor position at a high rate of change. The controller is then calculated. The PWM signal is based on the DC motor's signal variation and uses PID gain parameters to optimise the system's performance [2].

2.2.3 TRIAC Circuit Controller

TRIAC is represented by a three-terminal AC switch, which is special compared to the other types of silicon controlled rectifiers. TRIAC can conduct in both directions if the signal applied at the gate is positive or negative. Thus, this device fits into the AC system, which acts as a switch.

This device is a three-terminal, four-layer, bi-directional semiconductor device that is used to control AC power. The highest rating of TRIAC available on the market is 16 kW.



Figure 2.6 TRIAC Symbol

The symbol of TRIAC is shown in figure 2.6. This component has two main terminals labelled as MT1 and MT2 which is connected in inverse parallel and a gate terminal.



Figure 2.7 TRIAC Implementation in System

The Triac can be turned on by delivering a gate voltage greater than the breakover voltage. It can, however, be turned on without increasing the voltage by applying a gate pulse of 35 microseconds. We use the gate triggering mechanism to turn it on when the applied voltage is less than the breakover voltage [3].

2.2.4 Comparison between microcontroller available in market.

Table 2.1 Table of comparison between microcontroller available in market.

4.6

	Membership function plots tiot software 181 VC C M H VH 0 S 10 15 20 5 10 15 20 5 10 15 20 25 30 35 40 45 50	Set angle I D Control Actual D Motor y(t)	MT ₂ G MT ₁
	input variable "Temperature" FLC Controller	PID Controller	TRIAC Controller
Application for AC Motor	YES	YES	YES
Product Price	MEDIUM	HIGH	LOW
Installation	COMPLICATED	HARD	EASY PLUGGIN
Market Availability	LOW	MEDIUM	HIGH

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.2.5 Best Microcontroller to be implement in the system. (TRIAC)

Based on the comparison shown in the table above, TRIAC is the best component or device that can be implemented in this new system for its compatibility, which suits the system requirements. The first characteristic is that it can be triggered with either positive or negative polarity gate pulses, which provides 2 ways of electrical flow. Thus, in the application of an AC motor for speed control, the system is able to change both ways according to the condition and signals received. Next, it only requires a single heat sink, which is slightly larger in size, as well as just a single fuse for its protection. This will save a lot of installation and maintenance costs for further expenses. Moreover, the product price for this device is cheaper compared to others as well as easy installation in system.

There are some drawbacks for using TRIAC into a system. It has a high switching delay, so it is not suitable for high switching application into system such it will cause problems. Apart from that, it can be trigged in both direction so that higher cautions needed in controlling the input source. Next, This device can only be apply in AC application, it will not benifit any application DC system.

The TRIAC component will not be used directly into the new system, it is represented as a complete module for AC motor controller. This motor controller module is very suitable for controlling the speed of exhaust fan that we want to apply in the system. The complete module of TRIAC motor controller can be seen in the Figure 2.8.



Figure 2.8 AC Motor Speed Controller Module

This module of motor controller is far more cheaper and high market availability compare other type of device for AC motor controller. Thus, maintenance routine and cost are not going to be a problem for this application. Figure 6 shows the price range of the motor controller module in the market [5].



Figure 2.9 AC Motor Speed Controller Module in Shopee

2.3 Kitchen Ventilation System Available in Market

2.3.1 Cooker Hood



There are numerous advantages to installing a kitchen hood. Because it effectively filters out smoke, grease, and carbon monoxide gases, an installed hood is critical to air quality. The hood also regulates temperature, keeping the cook cool and comfortable at the stove. When it comes to kitchen hoods, as with other household appliances, there are a few options to consider. For example, should the hood vent air outdoors or should the air be recirculated? Both options have advantages and disadvantages, much like most home appliances. The advantages and disadvantages of kitchen hoods that vent outside vs recirculating hoods are discussed below.

Let's have a look at how these types of vents function first. Venting hoods, also known as ducted hoods, connect to an outside air source or filter the air. Venting hoods remove cooking gases, smoke, and pollution molecules such as carbon monoxide from smoke outside or through a filtration system when in use. Except for one major difference, recirculating hoods, also known as ductless hoods, work similarly like ducted hoods. Instead of being sent outside or through a filter, the air in the kitchen is recirculated. We've already identified one positive and one disadvantage in this little explanation of how hoods function. Ducted hoods are better at filtering out dirty air, whereas ductless hoods can only filter out a little amount of it. Ducted hoods improve air quality by removing more dirty air from a kitchen, and they can provide significant health advantages to persons with allergies, sensitivities, or asthma [6].



Figure 2.11 Samsung Air Conditioner

The air conditioner system consists of two main component which are indoor unit and outdoor unit. Both are required for completing the air conditioning system in removing warm air from homes. As shown in the figure 2.11, the indoor unit will install at the upper wall inside customer's requested room and the outdoor unit will be install at the nearest outside wall.



Figure 2.12 The Heat Transfer Process

The basic working principle of this system is using chemicals that convert from gas to liquid and back again quickly. These chemicals transfer the heat from the air inside unit to the outer area of home through the outdoor unit. The heat transfer process from indoor unit to outdoor unit as shown in the figure 2.12 above [7].

2.3.3 Exhaust Fan (Various Different Rating)



Figure 2.13 Khind Exhaust Fan

The blades of the fan will begin to revolve as the engine runs. The hot air in the room is drawn towards the fan and absorbed as the blades rotate. This hot air will be sent

outside, allowing cooler, fresher air to enter the space. This current movement will also help to avoid air stagnation, which is especially important in rooms or spaces with poor ventilation.

When installing an exhaust fan, it is recommended that the fan be installed as high as possible. It's best if it's close to the ceiling. This is because hot air rises, therefore if the exhaust fan is placed lower down, it will miss a major portion of the hot air in the room, causing it to perform inefficiently. The more hot air that reaches the exhaust fan, the more it will be absorbed and removed. As a result, a fresher and cooler environment will be achieved more quickly and effectively [8].

2.3.4 Table of comparison between kitchen ventilation system available

AALAYSIA

シ UNI		SAMSUNG AL NOYSIA M	
	Kitchen Hood	Air-Conditioner	Exhaust Fan
Coverage	Small	Large	Medium
Temperature	Room	16°C - Room	Room
Installation Cost	High	High	Low
Daily Usage Cost	Medium	High	Low

 Table 2.2 Table of comparison between kitchen ventilation system available

2.3.5 Best kitchen ventilation system to be implement in the system. (Exhaust Fan)

From the above table comparison, exhaust fans mark the highest score, which is the most suitable for cooling the modern kitchen. First, it covers a reasonable area because it is installed at a higher point where hot air is generated the most. The hot air around the kitchen area can be removed during or after the cooking activity. In addition, smoke and unwanted smells during cooking activities can also be removed. Apart from that, the installation cost and the product price in the market for exhaust fans are the lowest compared to air-conditioners and kitchen hoods. Thus, many users can afford to install the device to remove unwanted heat, smoke, and odours from their kitchen at a reasonable price range. Next, the daily usage cost for electrical energy consumption is the lowest for exhaust fans, and the price for maintenance parts is also cheaper compared to its competitors.

Every device is not perfect. This exhaust fan also has its drawbacks. The exhaust fan will require frequent cleaning routines due to the oils, smoke, and dirt from daily usage. However, the cleaning activity is very easy since the exhaust fan is just a combination of simple components. The exhaust fan also has a limited temperature range, which means the room can only be cooled down until a room temperature, not any below, like the airconditioner, which can cool down a room until 16 °C. Aside from that, this exhaust fan has the shortest life span and must be replaced sooner than air conditioning and kitchen hood.

The implementation of this exhaust fan in the system will be more advanced because of the approach of the micro-controller in controlling the speed of the fan. The combination of both devices is to produce the best efficiency of usage and lower the electrical energy consumption as much as possible. The cost includes the daily energy consumption cost as well as the maintenance cost for longer-term usage. The products for both devices available on the market are as shown in Figure 2.14 below.



Figure 2.14 AC Motor Speed Controller and Exhaust Fan

2.4 Safety Fire Detection System

2.4.1 Implementation of Fire Detection System

ARLAYSIA

A kitchen can be a cause of fire, which is able to destroy consumer belongings in the blink of an eye. For safety purposes, early actions need to be taken to avoid future problems. One of the factors causing these problems is the amount of careless cooking activity due to multitasking. Next, the fire was also caused by a lack of safety features in the kitchen which sent precautionary signals or alarms to warn the user before it was too late. By installing the safety fire detection features inside the system, cooking activity can be a lot safer and increase the chances of avoiding a mass burning accident. The function of the safety device is to produce an alert light signal as well as a sound alarm for critical conditions.
Safety Fire Detection System Mechanism 2.4.2



Figure 2.15 Safety Fire Detection Mechanism

- INPUT = Temperature sensor DHT22 and Smoke Detection sensor •
- OUTPUT = Led lamp and Buzzer alarm •
- PROCESSOR = Arduino UNO R3 •



fritzing

Figure 2.16 Arduino System Circuit

2.1.1.2 Flow Chart



The main reason in implementing the Automated exhaust fan syst em is to provide more energy efficient for daily consumption. The temperature sensor connected to the controller of the system acts as temperature monitoring as well as providing input data to the system. The older version or commonly used exhaust fan in many homes are connected directly to the power source and only have one speed. Beside the high power consumption, user careless mistakes in leaving exhaust fan runs more than needed lowers efficiency of the electrical power usage.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The procedure for "The Development of Automated Exhaust Fans for Modern Kitchens with Safety Fire Detection Features" is discussed in this section. The technique and flow of the project's development will be explained in greater detail using the flow chart displayed in Figure 3.1. This chapter also covers the implementation of the hardware and software used in this project, as well as the setup and procedures.



Figure 3.1 Overall Flowchart of PSM

3.2 Hardware Implementation



For applications requiring a moderate number of I/O lines, a basic microcontroller setup, and the capacity to construct sufficient input and output ports for a medium-sized system. Furthermore, the product's availability for iot application, as well as its lower price range, making ESP 8266 module device more cost-effective. The ESP 8266 is ideal for this project because it uses a limited number of sensor outputs and several device outputs and wireless signal transmission using wifi range to be sent to Blynk application. It is beneficial to provide options for projects to remain simple because there will be sufficient resources

available. The Arduino Software (IDE), an Integrated Development Environment that operates on both online and offline Arduino devices, is used to program the Arduino Uno.





This DC Stepper Motor requires a 5V DC power supply to function properly. This stepper motor is attached to the system as an output for the microcontroller's speed control mechanism. Because the controller movement alternates between clockwise and anticlockwise directions, a stepper motor is the optimum choice for this system. The stepper model used is the 28BYJ-48 5V, which is a four-phase stepper with a low price and high market availability. The ULN 2003 motor driver simple board makes connecting this stepper motor a breeze. A 5 V DC Stepper Motor is shown in Figure 3.4.



Figure 3.5 5V DC Stepper Motor

3.2.3 ULN2003 Motor Driver

The 28BYJ-48 5V DC Stepper motor pairs nicely with the ULC2003 motor driver module. This module has a 5V to 12V DC input voltage supply and a 5-pin stepper motor output slot built in. Furthermore, this module includes four led indicators for monitoring the four processes. The pins for incoming signals from the microcontroller are IN1, IN2, IN3, and IN4. A 5 V DC Stepper Motor is presented in Figure 3.5.



Figure 3.6 DC Stepper Motor Driver

3.2.4 DHT22 Temperature Sensor

The DHT22 is a low-cost electronic temperature and humidity sensor with a simple design. It uses a capacitive humidity sensor and a thermistor to measure the ambient air temperature and calibrate a digital signal on the data pin. The equipment is straightforward to operate and offers a high level of dependability. It offers strong measurement stability and low inaccuracy. This sensor's operational voltage ranges from 3.3 to 5 volts, with an operating current of 0.3 mA and a standby current of 60 uA. The greatest temperature that this device can read is 80 degrees. It has a temperature reading accuracy of 0.5 percent, compared to merely 2 percent for the DHT22. The DHT22 temperature sensor device can be



Figure 3.7 DHT22 Temperature Sensor

3.2.5 Push Button

A temporary SPST push button switch, similar to a button, changes the condition of an electrical device only when it is physically pushed. An automatic mechanism then resets the switch to its default position, restoring the circuit to its original state. This button will be used to turn on the electrical flow into the microcontroller and the exhaust fan.



Figure 3.8 Push Button

3.2.6 Liquid Crystal Display (LCD)

ALAYSI.

The 16x2 LCD is an electrical device that uses a liquid crystal to generate a viewable image. The LCD display function in this project is to show the presence of the infant as well as the temperature inside the car. It includes a monitor, which is a common DIY and electronics component. It converts 16 characters per line into two show lines. The 16 x 2 LCD display and the 16x2 LCD Module Pinout are shown in Figure 3.8. The presence of the youngster and the temperature value within this prototype are displayed on this LCD display.



Figure 3.9 LCD Display Diagram

3.2.7 Buzzer

WALAYS /

A buzzer is an electrical device that emits a beeping signal when electricity is supplied to it. It consists of a piezo core and a 2–4 kHz oscillator. When an electrical source is applied to a crystal form, the effect is called "piezoelectricity." The sound is produced by adjusting the frequency of the transmission. A transistor and a cable are included with the buzzer. This device will operate as an alert signal to the user in the project "The Development of Automated Exhaust Fans for Modern Homes with Safety Fire Detection Features." The buzzer diagram is shown in Figure 3.9.



Figure 3.10 Buzzer Diagram 37

3.2.8 Light Emitting Diode (LED)

The LED's purpose is to tell if the temperature inside the room is safe or dangerous. If the temperature in the room is higher than normal condition, the LED will illuminate, accompanied by a buzzer. The LED diagram is shown in Figure 3.10.



3.2.9 4000W 230V AC Voltage Regulator Motor Speed Controller LED Dimmer

With a 1.6 mm thick FR-4 high temperature durable circuit board, this is a unique design. It can handle huge currents safely and reliably. To protect the SCR more effectively, a double-capacity design was used: a safety capacitor and a metal film capacitor. more effectiveness and security. 1.5-inch-thick aluminum and stainless-steel cases, ideal for home temperature control or speed control, as well as industrial companies. products that are both beautiful and easy to use, as well as safe, convenient, and high-quality. After a lengthy period of use, it will not rust. designed primarily for resistive loads such as air conditioning lights, AC motors, and AC heaters. This module can only handle single-phase loads because its maximum input voltage is 230V and its maximum output voltage is 50V

to 230V and 4000W.





This circuit design program was designed by Lab Center Electronics. It was used to design different circuits on a PCB (printed circuit board) as well as to mimic different circuits. Using proteus in every embedded system project saves money and avoids errors due to the schematics construction on the proteus.

John Jameson, the company's chairman, produced the initial version of Proteus, known as PCB-B, in 1988. In today's post, we'll take a closer look at its functions, structure, and how to utilize Proteus to create various circuits. Proteus is an electronic circuit simulation, design, and drawing software. Labcenter Electronic is the one who has come up with the concept. Two-dimensional circuit designs can also be created with Proteus. You can use this engineering programme to create and simulate electronics and electrical circuits on your personal PCs or laptops. The benefits of simulating circuits on proteus before applying them are numerous.

Circuit design on the proteus takes much less time than circuit assembly. The danger of error is lower in software simulation, such as a bad connection, which takes a lot of time to find in a real circuit. Because some circuit components just aren't practical, circuit simulations have always had the advantage of allowing you to create your circuit on Proteus. There is no danger of any electrical component being burned or damaged in proteus.

Among the most expensive technological tools in proteus, for example, is an oscilloscope. Proteus can detect numerous circuit parents at any moment, including current, component voltage values, and resistance, which is rather challenging in a practical circuit.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

🛃 Home Page 🗙				
PROTEUS	DESIGN SUITE 8.6			
Getting Started	Start			
Schematic Capture PCB Layout	Open Project New Project New Flowchart Open Sample			
 Simulation 	Recent Projects			
 Migration Guide What's New 	C:/Users/syuknDocuments/New Project.pdspg			
Help	News			
Help Home Schemetic Conturn	Proteus Design Suite Professional			
PCB Layout	A Your update subscription (USC) has expired. Renew USC			
Simulation Visual Designer	Software is up to date. Last checked 1 days ago. Manual Update Check.			
	New in Version 8.14			
	Eastpoints Eiled Vias FairConfiguration Eiled Vias inscellaneous v8.14			
About	New in Versions 8.9 to 8.13 more guides			
C Labcenter Electronics 1989-2017	Cone Inspector Olif Pair Pass Through Multi Roard Support PCB Panelization (Indated) Auto Complete Routing			
www.labcenter.com	DXF Importing Non-Functional Pads			
Registered To:	Getting Started Movies			
	Installation and Filing New Project (PCB) Application Overview New Project (VSM) Import Project (VSM)			
Customer Number: 00-00000-001 Network Licence Subscription Expires:				
Free Memory: 10,239 MB				
Windows to (xo4) vto.oo, Build 22000				

Figure 3.13 Proteus Design Suite 8.6



Figure 3.14 Proteus Design Schematic Drawing

3.3.2 Arduino IDE

The NodeMCU microcontroller has an electronic platform that allows it to run a variety of applications. It is designed and implemented in such a way that anyone, whether

a novice or an expert, can program the controller. Because the NodeMCU program are written on paper in the languages of C or C++, the Arduino IDE software is used to program them.

The Arduino website provides free access to this program. It is compatible with a variety of operating systems, including MAC, Windows, and Linux, and runs on the Java Platform, with installed functions and commands that are essential for debugging, developing, and generating code. Arduino IDE supports Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro, and many more boards. Each of them has a microcontroller on the board that is directly programmable and accepts data in code form. The Arduino IDE's interface is seen in Figure 3.14.



Figure 3.15 Arduino IDE Interface

3.4.1 Flow Chart



Figure 3.16 Flow Chart for Microcontroller

3.4.2 Proteus Design Drawing



Figure 3.17 Microcontroller Design for Stepper Motor System



3.5.1 Stepper Motor System



Figure 3.18 Stepper Motor Arduino System 44

3.5.2 Temperature Sensor System



Figure 3.19 Temperature Sensor Arduino System



Figure 3.20 Alarm Triggering Arduino System

3.5.4 Project Design (ThinkerCad)



Figure 3.22 Top-Front View of Project

3.6 Summary

This section describes how the system's apps are created. The flow diagram is necessary to guarantee that the project runs smoothly. The project is handled in part, according to the project flow. This ensures that the project will be completed on schedule. This topic also describes how to build a prototype step-by-step through the planned schedule and applications related. The hardware is the most important for accomplishing this project which involve the controller circuit as well as the prototype stage setup. Next, the prototype is test and analyze for its performance and to decide its effectiveness for modern kitchen cooling temperature mechanism.



CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

The construction of an Automated Exhaust Fan for Modern Kitchen with Safety Fire Detection Features was shown and explained in further detail in this chapter. First, the project development technique and lists of hardware included in the project are best explained in the Block diagram shown in Figure 3.2. This chapter explains the functionality of all of the components utilised as well as their implementation in the project. The software used in the development of this project is then detailed. Finally, this chapter includes information about the project's hardware and software development. The hardware and software that were used in this project are summarised at the end of this chapter.

اونيوم سيتي تيكنيكل مليسيا ملاك UNIVERSITI TEKNIKAL MALAYSIA MELAKA

48

4.2 Final Setup of Project

4.2.1 Hardware Setup



Figure 4.1 Full Project Hardware Setup



Figure 4.2 Microcontroller System Setup



Figure 4.4 IOT Blynk Placement Setup

4.2.2 Software Setup



Figure 4.6 IOT Blynk Display

4.3 Analysis Data

4.3.1 Speed Vs Temperature Data Analysis

Angle of Stepper Motor	Temperature, °C	Speed of Fan, S
0°	0-32.9	0
150°	33.0 - 33.9	1
176°	34.0 - 34.9	2
203°	35.0 - 35.9	3
229°	36.0 – 36.9	4
255°	37.0 - 60.0	5
2		

Table 4.1 Table Speed Vs Temperature



Graph 4.1 Speed Vs Temperature

According to the data from the graph, we can see the trend of the increases of speed of the fan starting from 33°C. Before 33°C, the speed of the fan will remain constant as we can see from the graph and then increase gradually until it reaches 37°C that ignites the highest speed of the fan which is the 5th speed. Thus, the 5th speed is the limit of the system which is the rated normal working specification of the fan and as the increases of temperature more than 37°C will remain the same speed of the fan. Futhermore, for the temperature limit, it is set for 60°C as its the limit of highest temperature can be detected by the DHT22 sensor.





Figure 4.7 Blynk Data Display

From the data that have been collected, we can see that the LED colour indicate the funtionality mode of the sistem which is either green light for sleep mode, yellow light for working mode, or red light for emergency mode. Next the temperature reading is shown at the top left of the Blynk apps and its is directly shows the measured temperature recieved by the DHT22 temperature sensor. Apart from that, The middle part of the apps shows the speed of the fan which are represented by the angle of the stepper motor that include 0°, 150°, 176°, 203°, 229° and 255°. Other than that, live gragh will be shown as the project run and blynk iot is connected while warning indication display at the bottom part of the application will be pop up after 37.1°C is detected.



Figure 4.8 Multimeter Reading of Normal Condition

Speed	Voltage, V	Current, I	Power, W	Daily Consumption (Kwh)
0	0	0	0	0
1	230	0.230	52.9	1.269
2	230	0.230	52.9	1.269
3	230	0.230	52.9	1.269
4	230	0.230	52.9	1.269
5	230	0.230	52.9	1.269

 Table 4.2
 Normal Condition Exhaust Fan



Figure 4.9 Multimeter Reading for Controller Implimented Condition

4.3.2.2 IOT Controller Implimented system for Exhaust Fan

Speed	Voltage, V	Current,	Power, W	Power Consumption Daily
		Ι		(Kwh)
0	0	0	0	0
(Sleep Mode)	65	0.143	9.295	0.223
1	178	0.229	40.762	0.978
2	192	0.234	44.928	1.078
3	211/4	0.233	49.163	1.179
4	220	0.232	51.04	1.225
5	230	0.230	52.9	1.269

Table 4.3 Controller Implimented Exhaust Fan



Graph 4.2 Controller Condition Power Vs Voltage



4.3.2.3 Data Comparison of Type of system Implimented



Graph 4.4 Voltage Operating Comparison



Graph 4.6 Power Operating Comparison



Graph 4.7 Speed Vs Power

From the data that were obtained above, the normal condition exhaust fan have only characteristic data which represented by on and off state. Thus, the off state or initial condition had no value for power while for the on state, it runs at full speed constantly with 60W power output. In addition, for the daily usage of 24 hours, the system will use a total of 1269 W.

On the other hand, for the data measured and collected for the controller implimented exhaust fan system, has various data in which are different for each speed of the exhaust fan. At the practical part, as the room increases in temperature, the data fom the sensor will be send directly and continuously so that the speed of the fan can be adjusted accordingly. The highest tempearature allows the exhaust fan to run at full speed and the power consumption for this stage is the same with normal condition system which is 60 W. However, for the daily consumption for the controller implimented exhaust fan system, the is alot lower which only use a total of 1269 W per 24 hours run time.

In comparison between those 2 graph data, exhaust fan is expected to run 1 hour time range for each speed, which makes a total of 5 hours run time. Thus, the power consumption for the controller implimented exhaust fan is recorded a total of 5729 W, while the total power consumption for the normal system is 6345 W. This shows that the controller implimented system will save a total of 616 W for 5 hours session. Next, the power saving will add up to be much higher for total monthly usage. Besides, human error in switching off when no usage with the normal system has to be considered an extra energy wastage.

4.3.3 Efficiency of IOT Controller Implimented System for Exhaust Fan.

4.3.3.1 Time taken for Cooling down Kitchen Room Area.

Before the trials starts, the initial data and specification are as stated below :

• Initial condition temperature must be around 37°C to 38°C.



Figure 4.10 Prototype Setup for Experimental

The method of analysis is to determine the time spend to cool down a kitchen room area which are set more than 37°C. Five attempts are taken for testing purpose in order to determine the average time taken for cooling down hot room. Next, this test data will be able to determine the efficiency of the system in real kitchen application.

Trials	Speed 5,	Speed 4,	Speed 3,	Speed 2,	Speed 1,
(Initial)	min AY SIA	min	min	min	min
TEKNIF	STAKA				
1st (37.4°C)	0.53	0.93	1.34	2.74	3.49
2nd (37.2°C)	كل مليسب	0.89	ميتي بي د	اوينوس»	3.53
3rd (37.5°C)	0.55 SITI TEK	0.94 NIKAL MA	1.23 LAYSIA I	2.87 VELAKA	3.52
4th (38°C)	0.88	1.02	1.24	2.77	3.47
5th (37.2°C)	0.5	0.88	1.43	2.89	3.55

Table 4.4 Time taken for cooling analysis



4.3.3.2 Graph of Cooling Down Performance of IOT System.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

From the 5 attemps that have been taken, the data of the analysis are as stated in the table as well as shown in the graph above. According to the data, every trials have stated that the system needed approximately 3.5 minutes in order to cool down a heated room of around 37°C until the temperature measured is equal or lesser than 33°C. In addition, the values of time measured are not very distance which implies that the system are efficient and has low percentage of error.

4.4 Summary

To summarize this chapter, the DHT22 temperature sensor is the most important components in which to recieve the heat signal input for the whole system to run. The first part of the project in the stepper motor controller setup which can be seen in Figure 4.2. In this part, the input data via temperature from the DHT22 will be processed by the Arduino so that the output of 5 steps can be determine and move the stepper motor into desired steps position. Then, the end of the stepper motor is connected directly to the Ac voltage regulator for motor speed controller. The next part of the project is the safety fire detection system, which will use the same DHT22 and smoke sensor as the input data for the system. The system will run when there is data input that meets the requirement as the example of fire accident in the kitchen occur. The output for this system is buzzer sound which represent the loud alarm and led lamp which represent the red lamp indicator for warning sign. Lastly, the whole implementation of the project prototype is shown in the Figure 4.10, the microcontroller will acts as a brain which will control the AC input that enter the exhaust fan. Thus the speed of the exhaust fan will change from time to time according to the signal recieved from the microcontroller.
CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This thesis presents a method for implimenting automatic controller system to AC exhaust fan for modern household and to be implimented into kitchen area accordingly. Since the kitchen is proven that it have the highest temperature inside any modern house nowadays, its the best to install this system. As stated in the data analysis in chapter 4, the system implimentation had been proven its power consumption daily and monthly are far lower compared to the system with controller implimented. Thus, the controller system will able to save more energy consumption as well as monthly TNB bills will be reduced accordingly. Moreover, as for the efficiency, the full controller implimented system will need just at most 4 minute in order to cooling a room with more than 37°C. Next, the speed control mechanism with stepper motor is also proven to be function efficiently as well as there are no error in temperature reading and speed controlling function. The system analysis runs at real kitchen house and produce great result and ready to be implement anywhere.

5.2 Future Works

For future improvements, the reliability and efficiency of the speed controller exhaust fan can be improve such as the recommendation as stated below:

- i. Convert for more detail AC voltage controller which have more than 5 speed interval.
- Using relay as the voltage controlling mechanism for longer lifespand instead of stepper motor.
- iii. Emergency notification to be sent using bluetooth module, where internet connection are not necessary.
- iv. Data display for all the characteristic shown would be better if the application are more user friendly such as application to be downloaded using Google Playstore. اونیونی سینی نیکنیک رمایسیا ملاک UNIVERSITI TEKNIKAL MALAYSIA MELAKA

REFERENCES

- M. Khairudin, S. Yatmono, I. M. Nashir, F. Arifin, W. Aulia, and Widyantoro, "Exhaust Fan Speed Controller Using Fuzzy Logic Controller," in *Journal of Physics: Conference Series*, Jan. 2021, vol. 1737, no. 1. doi: 10.1088/1742-6596/1737/1/012046.
- [2] J. Rantung and H. Luntungan, "DC MOTOR PID CONTROLLER WITH PWM FEEDBACK," 2020.
- [3] "TRIAC: What is it? (Definition, Operation & Applications) | Electrical4U." https://www.electrical4u.com/triac/ (accessed Jun. 09, 2022).
- [4] "1000W AC Motor Speed Controller." https://electronics-diy.com/1000w-ac-motorspeed-controller.php (accessed Jun. 09, 2022).
- [5] "2000W 220V AC Voltage Regulator Motor Speed Controller LED Dimmer | Shopee Malaysia." https://shopee.com.my/2000W-220V-AC-Voltage-Regulator-Motor-Speed-Controller-LED-Dimmer-i.33091591.571874410?xptdk=9595b2a7-5ec6-4694-9593-7a9fe3df0d54 (accessed Jun. 09, 2022).
- [6] "Kitchen Hood Venting: Vent to the Outside or Recirculate?" https://callapollo.com/kitchen-hood-venting-vent-to-the-outside-or-recirculate/ (accessed Jun. 09, 2022).
- [7] "How Does an Air Conditioner Work? | Howard Air Conditioning." https://howardair.com/how-does-air-conditioning-work/ (accessed Jun. 09, 2022).
- [8] "How an Exhaust Fan System works | DoItYourself.com." https://www.doityourself.com/stry/how-an-exhaust-fan-system-works (accessed Jun. 09, 2022).

APPENDICES

Appendix A : GannChart Full Project

YEAR (PSM 1)		2022														
WEEK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NO	TASK															
1	Title Submission															
2	Data Collection for Proposal															
3	Proposal Presentation															
4	Finding Research/Journal															
5	Writing Literature Review															
6	System source code testing															
7	Report Writing (Chapter 1,2,3)															
8	Report 1 Submission															
9	Presentation															
10	Revised Report 1 Submission															

	60			_	10000		_	_	-	1 de 1		_				
YEAR (PSM 2)					-					20	22 - 20	23				
	WEEK OWN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NO	TASK		1			1										
1	Hardware Setup	° U						2	19		"V-	اويو				
2	Software Setup															
3	Analysis Data Collection VERSIT	Έŀ	<u>(N</u>	IK.	AL	M	AL	A)	ŝ	A	MEL	AKA				
4	Draft Report Submission															
5	Writing Analysis															
6	Report Writing															
7	Logbook Submission															
8	Turnitin Report															
9	BDP Presentation															
10	Final Report Submission															

Appendix B : Measurement Tools





Appendix D : AC Current Measurement Method



Appendix E : AC Voltage Measurement Method

Appendix F : Full System Coding for Microcontroller

```
#define BLYNK_TEMPLATE_ID "TMPLBygNgbAu"
#define BLYNK_DEVICE_NAME "cuki"
       #define BLYNK FIRMWARE VERSION
       #define BLYNK_PRINT Serial
//#define BLYNK_DEBUG
       // Uncomment your board, or configure a custom board in Settings.h
//#define USE_SPARKFUN_BLYNK_BOARD
      #define USE_NODE_MCU_BOARD
//#define USE_WITTY_CLOUD_BOARD
       #include "BlynkEdgent.h"
       #include "DHT.h"
       #define DHTTYPE DHT22
      #define IN2 4
#define IN3 14
27
28
       #define limit switch 13
       int max_fan_speed = 255, min_fan_speed = 150, off_fan_speed =
       int max_temp = 37, min_temp = 33;
      /*move stepper motor using half-step sequence*/
int pole1[] ={0,0,0,0, 0,1,1,1};//pole1, 8 step values
      int pole2[] ={0,0,0,1, 1,1,0,0};//pole2, 8 step values
int pole3[] ={0,1,1,1, 0,0,0,0};//pole3, 8 step values
38
      int pole4[] ={1,1,0,0, 0,0,0,1};//pole4, 8 step values
                                                                                             ويبوم
                                                                                       V
                                                                   · 0.
      // DHT Sensor
uint8_t DHTPin = D3;
                                                  -
     W Initialize DHT sensor, KNIKAL MALAYSIA MELAKA
      int poleStep = 0;
      double current_angle = 0;
      int input;
      float Temperature;
      float Humidity;
      boolean initiate_on = false, initiate_off = false;
     boolean virtualBypass = false;
      int mapping_fan_speed = 0, fan_speed = 0;
      int count = 0, delay_count = 0;
     WidgetTerminal terminal(V4);
WidgetLED bypass_led(V3);
          virtualBypass = true;
         virtualBypass = false;
      void setup() {
   Serial.begin(115200);
```

```
pinMode(DHTPin, INPUT);
pinMode(bypass, INPUT);
pinMode(IN1,OUTPUT);
            pinMode(IN2,OUTPUT);
            pinMode(IN3,OUTPUT);
            pinMode(IN3,00TPUT);
pinMode(buzzer,0UTPUT);
           dht.begin();
BlynkEdgent.begin();
            homing();
            delay(1000);
            terminal.clear();
            terminal.println("IOT Project By Seng");
         h
        void loop() {
   BlynkEdgent.run();
           input = digitalRead(bypass);
         // Serial.println(input);
Temperature = dht.readTemperature(); // Gets the values of the temperature
Humidity = dht.readHumidity(); // Gets the values of the humidity
               Serial.print(Temperature);
105
         // Serial.print(",");
         // Serial.println(Humidity);
108
109
           Blynk.virtualWrite(V0, Temperature);
           if (input == HIGH || virtualBypass == true){
              move_stepper(max_fan_speed);
digitalWrite(buzzer, LOW);
114
115
116
             Blynk.virtualWrite(V2, max_fan_speed);
          }else{
    if (Temperature >= min_temp && Temperature <= max_temp){</pre>
              mapping_fan_speed = map(Temperature, min_temp, max_temp, min_fan_speed, max_fan_speed);
fan_speed = mapping_fan_speed;
bypass_led.on();
slynk.setProperty(V3,"color", "yellow");
extens(burzen):
117
118
119
120
121
122
                                                                                         ويبونه سيتى
               noTone(buzzer);
terminal.clear();
                                           6
                                                                                    -
123
               count = 0;
      124
               tone(buzzer, 1046);
terminal.println("Warning!! Over Temperature detected!");
terminal.flush();
               if (delay_count >= 10){
                 delay_count = 0;
                 noTone(buzzer);
make_sound();
             ,
delay_count++;
}else if (Temperature < min_temp){</pre>
              fan_speed = off_fan_speed;
               bypass_led.on();
Blynk.setProperty(V3,"color", "green");
               noTone(buzzer);
terminal.clear();
             move_stepper(fan_speed);
Blynk.virtualWrite(V2, fan_speed);
```