Faculty of Electrical and Electronic Engineering Technology

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

MUHAMMAD SYUKRI BIN SULIAMAN

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Tajuk Projek : **Development of Automated Exhaust Fan for Modern Kitchen with Safety Fire Detection System.**

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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.

Signature	:	
Student Name	:	MUHAMMAD SYUKRI BIN SULIAMAN
Date	:	8/3/2023

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 :

Supervisor Name : EN. ADAM BIN SAMSUDIN

Date : 9/3/2023

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.

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Supervisor Name : EN. ADAM BIN SAMSUDIN

Date : 9/3/2023

Signature : ....

Co-Supervisor 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 developement 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 tnb elektrik boleh dikurangkan.

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LIST OF SYMBOLS

℃	-	Degree Celcius
I	-	Current
W	-	Power
V	-	Voltage
S	-	Speed
°	-	Degree angle

LIST OF ABBREVIATIONS

V	-	Voltage
KWh	-	Kilowatt per hour
S	-	Speed

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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.

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.

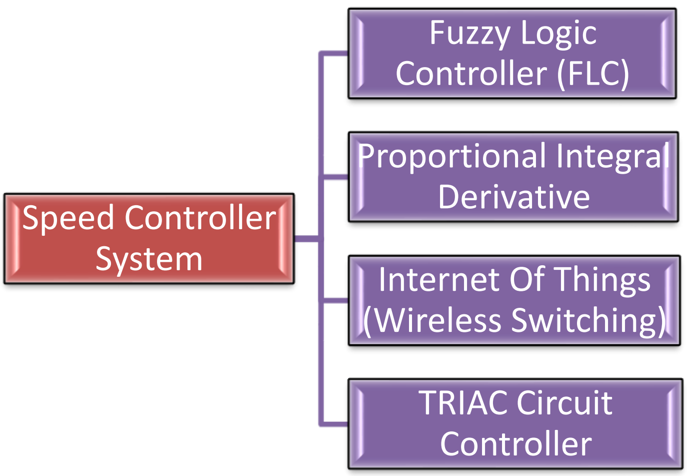

Figure 2.1 Speed Micro Controller System