



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF HUMIDITY CONTROLLER USING
ARDUINO**

This report submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation and Robotic) with Honours.

by

MOHAMAD FAHHIM BIN KAMARUL ZAMAN

B071410538

951021035311

FACULTY OF ENGINEERING TECHNOLOGY

2017

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: Development of Humidity and Temperature Controller by Using Arduino

SESI PENGAJIAN: 2017/18 Semester 1

Saya **MOHAMAD FAHHIM BIN KAMARUL ZAMAN**

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ****Sila tandakan (✓)**

☐

SULIT

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)

☐

TERHAD

(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

☐

TIDAK TERHAD

Disahkan oleh:

Cop Rasmi: _____

Alamat Tetap:

Lot 3704A Kampung Pintu Geng

15100 Kota Bharu

Kelantan

Tarikh: _____

Tarikh: _____

****** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.



FAKULTI TEKNOLOGI KEJURUTERAAN

Tel : +606 234 6623 | Faks : +606 23406526

Rujukan Kami (Our Ref) :

Rujukan Tuan (Your Ref) :

10 JAN 2018

Pustakawan
Perpustakaan UTeM
Universiti Teknikal Malaysia Melaka
Hang Tuah Jaya,
76100 Durian Tunggal,
Melaka.

Tuan/Puan,

PENGKELASAN LAPORAN PSM SEBAGAI SULIT/TERHAD LAPORAN PROJEK SARJANA MUDA TEKNOLOGI KEJURUTERAAN ELEKTRIK (BETR): MOHAMAD FAHHIM BIN KAMARUL ZAMAN

Sukacita dimaklumkan bahawa Laporan PSM yang tersebut di atas bertajuk
“**Development of Humidity Controller Using Arduino**” mohon dikelaskan
sebagai *SULIT / TERHAD untuk tempoh LIMA (5) tahun dari tarikh surat ini.

2. Hal ini adalah kerana IANYA MERUPAKAN PROJEK YANG DITAJA
OLEH SYARIKAT LUAR DAN HASIL KAJIANNYA ADALAH SULIT.

Sekian dimaklumkan. Terima kasih.

Yang benar,

Tandatangan dan Cop Penyelia

DECLARATION

I hereby, declared this report entitled “Development of Humidity Controller by Using Arduino” is the results of my own research except as cited in references.

Signature :
Author's Name :
Date :

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Automation Industry and Robotic) with Honors. The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRAK

Kelembapan berkaitan dengan suhu apabila suhu meningkat, kelembapan juga meningkat. Oleh kerana iklim tropika di Malaysia, kelembapan menjadi masalah utama dalam industri. Selain itu, tidak ada pengawal kelembapan fleksibel yang sesuai di dalam pelbagai bilik. Oleh itu, projek ini berkaitan dengan mengawal kelembapan bilik secara automatik di Makmal Pengedaran Kuasa. Jenis kawalan yang digunakan ialah mikrokontroller Arduino yang digunakan untuk menganalisis data untuk mengawal suhu bilik. Hasil yang dijana menunjukkan bahawa kawalan direka untuk dapat mengikuti input rujukan dan tindak balas output untuk menjadi pengawal yang lebih cekap. Diharapkan projek yang dihasilkan dapat mengawal kelembapan yang berkisar 10% hingga 20% kelembapan relatif untuk mencapai kondisi yang sesuai untuk bilik. Dengan menggunakan pengawal automatik ini jelas dapat membantu yang dapat membantu mengurangkan kelembapan yang dapat mengawal kulat di dalam bilik.

ABSTRACT

Humidity is related to temperature as the temperature is rise, the humidity is also rise. Due to tropical climate in Malaysia, humidity becomes the main problem in industry. Moreover, there is no flexible humidity controller to suit in various room. So, this project is related to control room humidity automatically at Power Distribution Laboratory. This type of control used is the Arduino microcontroller used to analyze the data to control room temperature. Results generated indicating that the control is designed to be able to follow the reference input and the output response to become more efficient controller. It is expected that the resulting project can control the humidity which range of 10% to 20% of relative humidity to reach suitable conditions for the room. By using this automatic controller is obviously helpful which it can help to reduce humidity which can control the fungus in the room.

DEDICATION

To my beloved moms, family, lecturer and fellow friends.

ACKNOWLEDGEMENT

First, praise and gratitude to Allah SWT for giving a strength to through loads of difficulties to successfully finishing up my task. I would like to thank Puan Nurul Ashikin binti Mohd Rais my supervisor for valuable encouragement, guidance, motivate and friendship.

Not to be forgotten, all the lecturers, and all my friends for support and motivate during this project development.

Lasts, thanks to my entire family especially my beloved mother Puan Hasenah binti Abdullah and my sister Norain binti Idris for their supports from preliminary of this project till the end of it.

TABLE OF CONTENT

Abstrak	vi
Abstract	vii
Dedication	viii
Acknowledgement	ix
Table of Content	xi
List of Tables	xii
List of Figures	xii
List Abbreviations, Symbols and Nomenclatures	xiv

CHAPTER 1: INTRODUCTION

1.0	Introduction	1
1.1	Background	2
1.2	Problem statement	3
1.3	Objective	3
1.4	Scope of work	4

CHAPTER 2: LITERATURE REVIEW

2.0	Introduction	5
2.1	Health effect	7
2.1.1	Hot weather	7
2.1.2	Cold weather	8
2.1.3	Direct and indirect health effect	8
2.2	Humidity and temperature effect on domestic	10
2.3	Humidity and temperature effect on industry	11
2.3.1	Effect on paper	11
2.3.2	Effect on electronics	12
2.3.3	Effect on wood	13

2.3.4	Effect on food	13
2.3.4.1	Wireless monitoring of humidity and temperature	15
2.3.4.2	Detection system of humidity and temperature	15
2.3.4.3	Monitor fermentation process in tea processing	16
2.4	Conclusion	16

CHAPTER 3: METHODOLOGY

3.0	Introduction	17
3.1	Project development	18
3.2	Analytic data survey	19
3.3	Calculation of relative humidity	19
3.4	Coding and simulation	21
3.5	Hardware	22
3.5.1	Sequence of project	25
3.5.2	Input	26
3.5.3	Arduino microcontroller	27
3.5.4	LCD display, LED	28
3.5.5	Relay	29
3.5.6	Ventilation Fan	30
3.5.7	Silica gel	31

CHAPTER 4: RESULT AND DISCUSSION

4.0	Introduction	32
4.1	Data from field study	32
4.2	Hardware development	34
4.3	Calculation mass of desiccant	34
4.4	Results	36
4.4.1	Discussion of results	38
4.4.2	Colour reduction for desiccant	39
4.5	Power consumption	40

CHAPTER 5: CONCLUSION

5.0	Introduction	42
5.1	Achievement of research objective	42
5.2	Suggestion for future work	43

REFERENCES	44
-------------------	----

APPENDIX	47
-----------------	----

LIST OF TABLES

2.1	The recommended relative humidity in food production	15
3.0	Vapor saturation pressure at different temperature	21
4.1	Humidity and Temperature at field study	33
4.2	Results after application	36
4.3	Calculation of power consumption	41

LIST OF FIGURES

2.0	Graph of equilibrium moisture content versus relative humidity for solid wood at 70°F	11
2.1	Permeation: The migration of gas or vapor through packaging material	14
3.0	Flow chart of project development	18
3.1	Arduino programming software	22
3.2	Block diagram of humidity and temperature control	23
3.3	Circuit diagram	24
3.4	Sketch of prototype	24
3.5	Sequence of humidity and temperature controller	25
3.6	Humidity and temperature module sensor	27
3.7	DHT11 sizing	27
3.8	Arduino microcontroller	28
3.9a	LCD display	28
3.9b	LCD display pin	29
3.1.1	LED	29
3.1.2	Relay	30
3.1.3	Ventilation fan	30
3.1.4	Silica gel	31
4.1	Prototype	34
4.2	First reading of start time	38
4.3	Reading after 42 minutes	38
4.4	Reading after 2 hours	38
4.5	Normal colour for desiccant	40
4.6	Colour of desiccant during 70% of relative humidity	40
4.7	Colour of desiccant during 80% of relative humidity	40

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

RH	-	Relative Humidity
W	-	Watt
V	-	Volt
A	-	Ampere
°C	-	Degree celcius
exp	-	exponential
T	-	Temperature
AH	-	Absolute Humidity
g	-	gram
ft	-	feet
m	-	metre
UTeM	-	Universiti Teknikal Malaysia Melaka
FTK	-	Fakulti Teknologi Kejuruteraan
NO	-	Normally open
NC	-	Normally closed

CHAPTER 1

INTRODUCTION

1.0 Introduction

Humidity by referring to the Oxford dictionary, means by the state or quality of being humid. In other meaning, humidity is the representative of water vapor in the air. Meanwhile, temperature means by the degree or intensity of heat present in a substance or object, especially as expressed according to comparative scale and shown by a thermometer or perceived by touch.

Humidity usually being used in term of relative humidity. Relative humidity is a ratio of actual amount of water vapour (content) in the air compared to the maximum water vapour the air is to hold (capacity at that temperature). According to Siviah Borra “relative humidity does not tell how much water vapour is in the air, but it tells how close the air is to being saturated. So, air is said to be saturated or full if relative humidity is 100% “.

Temperature does affect the relative humidity in the air. The relative humidity is vice versa of the temperature. If the temperature is increase, the relative humidity is decrease and when the temperature is decrease, the relative humidity is increase.

The purpose of this project is to monitor and control the humidity at the humid room. This controller is using Arduino as the microcontroller. The controller consists of sensors which sense and read the environment humidity and temperature data. In addition, part of this controller will process the data and control the humidity.

At the end of this project, a device which is convenient to the humid room will be produced.

1.1 Background

It is important to understand that the two component that are important to control the room conditions. Relationship of humidity and temperature becomes the most important role to control the room condition.

The proliferation of mild and moisture related problems in buildings today is significantly since we do not have the proper measurement feedback in buildings to properly control moisture. (Mike Schell,2004).

We in Malaysia encountered a problem in control moisture of air especially for the food packaging. This is due to our exchange weather gradually. If the room operated with air conditioner, the moisture will rise during rains.

Furthermore, any changes in surface absolute humidity have implications for upper-tropospheric water vapour content, where it plays a significant role in the global radiation budget as a greenhouse gas. (Soden, 2005).

However, it is not known which condition is suitable for the room condition in this tropic climate. Is it suitable for workers to work in high temperature to control moisture in the room? Or does the air conditioner affect the moisture in the air?

It is generally acknowledged, that evaporative cooling is among the favoured strategy to enhance the indoor warm solace amid summer dry seasons. Then again, air development is the favoured procedure for upgrading the indoor warm discernment in the moist tropics. The evaporative warmth misfortune because of administrative sweating is the real warmth misfortune from human body. In this manner, at higher

stickiness and lower air development, warm solace may not be accomplished (H. Djamila, C.M. Chu, 2014)

1.2 Problem statement

The idea of development this project comes when the humidity becomes the main causes of problem in daily life either in the domestic and household or in the industry. Moreover, Malaysia climate is moist which lead to more humid environment. The excessive of humidity may harm or damage some of products or processes such as food packaging, electronics component and others.

Common problem associates with humidity and temperature, where when the temperature is decrease, the relative humidity is increase which affect the condition of rooms. Too much humid in the air would cause the breeding of bacteria etc. So, it is important to design and provide accurate measurement device.

In fact, in Malaysia, has many humidity and temperature controller used for controlling this humidity in the room. However, the resulting device controller is usually set for the selection room which is usually it is control by using the temperature. No diversification can be set on the controller device.

Therefore, this project aims to full fill the following objectives:

1.3 Objectives

The following are the objective of this project:

- i. To measure and control humidity by using Arduino.
- ii. To measure temperature by using Arduino.
- iii. To develop a prototype of humidity controller

1.4 Scope of work

The scope of this study is to develop a prototype to measure and control humidity for Power Distribution Laboratory. Along this project, the major item that will be used are Arduino microcontroller, the humidity and temperature (DHT11) sensor, relay, and LCD display.

In this project, it will focus more on to get the range of humidity about 60% to 70% RH. The analysis controller performance in term of automatic control based on the precision calculation of the microcontroller.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will discuss mainly on the previous similar research and current development regarding to this project which reveals the knowledge that gained via resources such as reference book, newspaper, journal, articles and documentations regarding application and research work. The study is very essential to get more understanding in relative humidity and temperature control system.

Humidity is measured as a percentage called relative humidity (RH). When the relative humidity is 100%, the air is said to be saturated. High dampness implies that there is a considerable measure of water vapor noticeable all around while low moistness implies there is almost no water vapor noticeable all around. In tropical nations, at specific circumstances of the year, humidity levels can be high. Warm air feels significantly hotter as dampness increments. (Mark G. Lawrence, 2004)

The moisture level of an environment can be measured in two ways which is absolute humidity and relative humidity (RH). Absolute humidity is a measure of the number of grains of water per pound of dry air (7,000 grains equal one pound). Absolute humidity is independent of air temperature.

Relative humidity (RH) is a measure of the amount of water in the air, at a specific air temperature, expressed as a percentage of the maximum amount of water the air can hold at that temperature.

Relative humidity of 100% shows the dew point is equivalent to the momentum temperature and that the air is maximally soaked with water. At the point when the dampness content stays steady and temperature builds, relative humidity diminishes.

The relative humidity (RH) and the dew point temperature (td) are two widely used indicators of the amount of moisture in air. Relative humidity is commonly defined in one of two ways, either as the ratio of the actual water vapor pressure to the equilibrium vapor pressure over a plane of water (often called the “saturation” vapor pressure) or as the ratio of the actual water vapor dry mass mixing ratio w to the equilibrium (or saturation) mixing ratio at the ambient temperature and pressure. (Mark G. Lawrence, 2004)

Temperature is an indication of the thermal energy content of matter. The temperature of an object depends on its nature, its mass and the amount of thermal (heat) energy which has been supplied to it or extracted from it. (Peter R Hicklenton)

The quantity that is designated thermodynamic temperature is defined by the laws of thermodynamics; it is indicated by the symbol T , and has the unit kelvin, symbol K . The unit of thermodynamic temperature is defined to be the fraction $1/273.16$ of the thermodynamic temperature of the triple point of water. It is common practice to express temperatures in terms of their differences from 273.15 K , the value for the ice point. A thermodynamic temperature T expressed in this manner is known as a Celsius temperature t , which is defined by the equation [1]

$$t/^{\circ}\text{C} = T/\text{K} - 273.15$$

The unit of Celsius temperature is the degree Celsius, symbol $^{\circ}\text{C}$. The magnitude of the degree Celsius is defined to be the same as that of the kelvin. Measures of temperature that are defined to be consistent with the laws of thermodynamics are said to be thermodynamic temperatures.

2.1 Health effect through humidity and temperature

Many studies and research has been done to get information on how the temperature, humidity, wind and air pressure effect to human health. Mostly, the temperature and humidity come with the greatest effect on our health which is agreed by the experts. From the literature review (WHO Europe, 2009) states that the problems of indoor air quality are recognized as important risk factors for human health in both low income, middle and high-income countries.

So, here are some of the literature review which consist of the effect of humidity and temperature.

2.1.1 Hot weather effect

Through several studies from the experts such as Tiina M Ikäheimo a professor of Institute of Health Sciences, University of Oulu state that heat depletion is a moderately basic response to extreme warmth and can incorporate indications, for example, dazedness, cerebral pain and blacking out.

The examinations performed so far demonstrates that the high body temperature will expanded heart and respiratory rates and when in extraordinary levels, it will go to the harm of the mind, heart, lungs, kidneys, and liver. Besides, veins expand close to the skin additionally can be issues for those with heart issues, while the kidneys end up plainly worried through an assortment of pathways and may come up short. (Nate Seldenrich, 2015)

The literature review (Nate Seldenrich, 2015) likewise express that warmth stroke additionally progresses toward becoming components in the high death rates seen with warm waves. It adds to a course of perilous physical and mental impacts and has truly been lethal in one of every four individuals in which it is analysed.