UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL MONITORING SYSTEM (CMS) USING ARDUINO MICROCONTROLLER IN POULTRY HOUSE MODEL.

This report is submitted in accordance with the requirement of the UniversitiTeknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Mechanical Engineering Technology (Refrigeration& Air-Conditioning System) with Honours

by

SARNI NUR ATIKAH BINTI ABDUL RAHMAN

B071210544

910827105832

FACULTY OF ENGINEERING TECHNOLOGY

2015

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Development Of Heating, Ventilating And Air Conditioning(HVAC) Control Monitoring System(Cms) Using Arduino Microcontroller In Model Poultry House.**

SESI PENGAJIAN: **2015/16 Semester 2**

Saya**SARNI NUR ATIKAH BINTI ABDUL RAHMAN**

MengakumembenarkanLaporan PSM inidisimpan di PerpustakaanUniversitiTeknikal Malaysia Melaka (UTeM) dengansyarat-syaratkegunaansepertiberikut:

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. **Silatandakan (✓)

☐ SULIT	(Mengandungimaklumat TERHAD yang telahditentukanolehorganisasi/badan di mana
☐ TERHAD	(Mengandungimaklumat yang berdarjahkeselamatanataukepentingan Malaysia sebagaimana yang termaktubdalam AKTA RAHSIA RASMI 1972)
☐ TIDAK TERHAD	

Disahkanoleh:

(TANDATANGAN PENULIS)

(TANDATANGAN PENYELIA)

AlamatTetap:

M2-3-02 Jalan 10/2,

Taman Perkasa Fasa 2,

43100, Selangor Darul Ehsan.

Cop Rasmi:

** 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.

DECLARATION

I hereby, declared this report entitled “Development Of Heating, Ventilating And Air Conditioning (HVAC) Control Monitoring System (CMS) Using Arduino Microcontroller In Model Poultry House” is the results of my own research except as cited in references.

Signature **:……**

Name **: ……**

Date **: ……**

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical EngineeringTechnology (Refrigeration& Air-Conditioning System)(Hons.)
The member of the supervisory is as follow:

…….

(MR. AZWAN BIN AZIZ)

ABSTRACT

The aim of this study is in development of Heating, Ventilating, and Air Conditioning (HVAC) of Control Monitoring system using Arduino Microcontroller in Poultry HouseModel. This paper fuses outline and advancement of temperature, humidity and light control and monitoring system conducted by Arduino Microcontroller. The system takes into consideration a client in information they required conditions in regards to the encompassing climate's parameters prerequisites. This study comprises of two modules. One is the parameters observing and the other one is the parameter controlling. Controlling and monitoring physical parameters like temperature and light is outmost significance. A poultry house controller arranged inside of poultry house manages the relative humidity and temperature inside of the poultry house by means of incitation of fans because of temperature and humidity sensor individually. A temperature/humidity sensor DHT11 will be utilized for the purposed of measuring temperature and humidity while a LDR sensor will be utilized for measuring light intensity. A microcontroller then thinks about the natural conditions against the client requirements, and actuators change the scenes until the fancied conditions have made.Arduino Mega board to process the data information and able to display and save in the serial monitor and REALTERM software.Finally, the effectiveness of Arduino microcontroller as a based system will be determined.

ABSTRAK

Tujuan kajian ini adalah dalam pembangunan Pemanasan, Pengudaraan, dan pendingin hawa (HVAC) sistem Pemantauan Kawalan menggunakan Arduino mikropengawal dalam Model Poultry House. Kertas kerja ini menggabungkan garis dan kemajuan suhu, kelembapan dan cahaya kawalan dan sistem pemantauan yang dijalankan oleh mikropengawal Arduino. Sistem ini mengambil kira pelanggan maklumat dalam mereka memerlukan syarat-syarat dalam hal parameter prasyarat iklim. Kajian ini terdiri daripada dua modul. Satu adalah parameter memerhati dan yang lain adalah mengawal parameter. Mengawal dan memantau parameter fizikal seperti suhu dan cahaya adalah penting. Sebuah pengawal rumah ayam diatur dalam rumah ayam menguruskan kelembapan relatif dan suhu dalam rumah ayam dengan cara incitation peminat kerana suhu dan kelembapan sensor secara individu. Suhu / kelembapan sensor DHT11 akan digunakan untuk mengukur suhu dan kelembapan manakala sensor LDR akan digunakan untuk mengukur keamatan cahaya. Mikropengawal kemudian berfikir tentang keadaan semula jadi terhadap keperluan pelanggan, dan penggerak menukar keadaan sehingga syarat-syarat yang telah dibuat. Arduino Mega papan untuk memproses maklumat data dan dapat memaparkan dan simpan dalam memantau dan REALTERM perisian siri. Akhir sekali, keberkesanan sistem mengunakan Arduino dapat diperolehi.

DEDICATIONS

My dedication go to my family members especially my parents, AbdulRahman bin Ibrahim and ShamsiahbintiYahyafor their fully support throughout the year to accomplish my final year project successfully. Special thanks also go to my beloved friends who really help me direct or indirect in my project and I really appreciate all their help and support. Thank you.

ACKNOWLEDGMENTS

Alhamdulillah, Thanks to Allah S.W.T. for blessing and mercy, for giving me strength to complete the final year project. Firstly, I would like to express my gratitude to all those who have made the completion of this thesis possible. Special thanks goes to my helpful supervisor, Mr Azwan bin Aziz whose help me throughout the researched and thesis writing. The supervision and support that he gave me has truly helped the progression and smoothness of the project and his co-operation much appreciated. My grateful thanks also go to Aminurrashid bin Noordinfor his contribution and hard work to help in me in my final year project.

Not forget my family who support and encourage me with a lot of love and prayers that comfort and relief me. I also grateful because always having a good health during this research study. Finally I would like to thanks with a fully appreciation to my friends that always help me and support me in finished my research study.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS AND ABBREVIATIONS

HVAC	=	Heating Ventilating and Air conditioning
CMS	=	Control Monitoring system
ASHRAE	=	American Society of Heating, Refrigerating and Air Conditioning Engineer
BRI	=	Building Related Illness
HVAC	=	Heating, Ventilating and Air-conditioning
IAQ	=	Indoor Air Contaminants
RH	=	Indoor Air Quality
Lx	=	Light Intensity
UTeM	=	Universiti Teknikal Malaysia Melaka
MPH	=	Model Poultry House
IDE	=	Integrated Development Environment

CHAPTER 1
INTRODUCTION

1.0 Introduction

Today, several techniques are usable to supervise and check the required environmental parameters.It is especially indispensable to assess the methods that can successfully administer the appropriate surroundings.Monitoring and controlling in physical parameters, temperature, relative humidity and light are of outmost importance.All the parameters of poultry house require a comprehensive analysis in order to determine the precise method.

1.1 Background

Environmental control systems typically planned to maintain thermal and air quality, condition within an acceptable scope and as near the deal for optimal animal performance as is practicable, referring to Chapter 21 of the 1999 ASHRAE Application Handbook (SI). Furthermore, lack of the facility of monitor and control the poultry house environment that severely constrained the production of eggs(Wu, Wu, Liang, Li, & Yang, 2011).

Referring to Vergara & Villaruz (2014), there are two ways suggestion the development of compact algorithms benefits power quality that are monitoring simultaneously for large system and help in building powerful embeddable monitoring architectures with in small power devices. According to Alan L, Vergara, Harrez M. Villaruz (2014), the modern electric equipment includes performance on-line monitoring and diagnosis systems based on microcontrollers. Moreover, according to Vergara& Villaruz (2014), everyone wishes to save energy and money.

In the related work, the incorporation of wireless sensor network in green house is the current conception which leads to accuracy husbandry by(Chaudhary &Nayse, 2011). Furthermore, according to (Science, 2005), WSN's will empower our action from the thought of "individualized computing" to an innovation base that permits us to incorporate figuring into nature, an idea begat as "pervasive and installed registering".

Thus, in this research, a main target for study is to develop the HVAC control monitoring system using Arduino microcontroller in poultry house model. This system allows user to input the desired condition regarding the surrounding atmospheres requirement. The parameters of the thermal comfort, which is indoor air temperature, the percentages of relative humidity (%RH), the light intensity, will be measured for a specific time and continuously. The effectiveness of Control Monitoring System (CMS) in model poultry will be determined and assessed.

1.2 Problem Statements

The CMS refers to the monitoring and controlling the specific parameter of the building, such as poultry house.Method and apparatus for controlling environmental conditions in an animal house, and particularly in poultry houses, for producing maximum economic yield. Pour of monitoring; there are some elements, which will involve the production of husbandry.Well maintained monitoring using a proficient system is likewise one of the elements that bear on the production of husbandry.

In a previous, to trace stress of husbandry they conclude, based on observation method by farmers. Unfortunately, it cannot be discovered at an early point. In case of the large poultry house, they need lots of workers. Despite the fact that, ushering in video camera for monitoring was better than human observation, but still come away with the same result where cannot trace at an early level, information gathered not productive and checking not persistently.

According to Duchyant Pande *et. al.*,(2013), monitoring and controlling physical parameters by embedded system utilizing microcontroller are all that much successful in industry and research arranged necessities. Besides that, the scheme must run properly and continuously which the data and info should be recorded and documented to influence the effectiveness of CMS.

1.3 Objectives of the Study

Main Objective:

To develop the control monitoring system using Arduino Microcontroller in Poultry HouseModel.

Specific Objectives:

1. To measure the parameters which are temperature (°C), relative humidity (%RH) and light intensity (lx) in the Poultry House Model.

2. To explore the possibility Control Monitoring System (CMS) to monitor temperature, relative humidity and light intensity in Poultry House Model continuously.

3. To determine the effectiveness of Control Monitoring System (CMS).

1.4 Work Scope of The Study

In this research, a cohort study carried out in the Poultry House Model (PHM). The focus will be primarily on gathering data related to thermal comfort that is indoor air temperature, relative humidity and light intensity, presented in the air of the PHM related with the air conditioning system used. Lastly, the works include the predictive relationship of temperature and relative humidity by using an Arduino microcontroller to determine the effectiveness and continuous operating of CMS in PHM.

1.5 Expected Results

The aim of this work has been to develop command and monitoring system using Arduino Microcontroller in PHM will determine. The appraised value of the parameters presented, followed by exploring the possibility CMS to monitor parameters continuously. Then the effectiveness of CMS will determine.In this inquiry, the focus will be mainly on to furnish a system and method for accurate control and monitor the environment continuously in the PHM.

CHAPTER 2
LITERITURE REVIEW

2.0 Introduction

In the literature review, the author has found a good representative literature discussing the effects of CMS in the building with their relationship of temperature and humidity. However, there was less study in detail about control monitoring in Poultry House. The Author is grateful to some (ASHRAE 1999, Chandra *et al., 2013*,Al-Jibouri, 2003 and Vergara & Villaruz, 2014) who identified some factors of effectiveness of control monitoring system.Although their discussion outlines finding as a major factor in this progress as opposed to good applying system, accurately collecting data, relationship temperature and humidity also the production of husbandry. By studying, the relevant literature it will help the author understand others system used in poultry houses.

2.1 Type of Control Monitoring System

2.1.1 Conversional system

According to David & Stephen(2014) to control temperature within the thermal neutral zone of the bird in the poultry house, traditional ways introduce several type such as use of curtains, usage of fan, spraying of cold water on their bodies, reduction in energy content of the feed intakes during the heat period, and putting of ice into their water.

Other than that, to build up the indications of strain in winged creatures it depended on ranchers perception and their rationale of good conclusion however not

able to notice untimely stage (Hamrita, 2002). Other methods such as use video camera(Bluff & Rutz, 2008; Wolf, Freund & Avidan, 2010), for example, to screen behavioural reactions, utilizing calorimetric routines to screen created warmth and creature weight which more dependable than agriculturist's perception. Anywhere it still does not recognize the strain at the starting stage.Since the traditional system has applied to control temperature in poultry house, some of issues happen, for example, repetitive, wasteful and lengthy and a persistent observing are needed (Longstaff, 1996). To increase poultry birds production and reduce bird death, most of the poultry farmers request for enhanced control system (David & Stephen, 2014).

2.1.2 Automatic system

According toHamrita (2002), the acknowledgment of viability and ideal development condition which use of microcontroller-based control in the poultry house once of a noteworthy step. In writing studies, express a few kinds of control utilization to lead checking control system, for example, PIC microcontroller, ARDUINO microcontroller and PID controller.

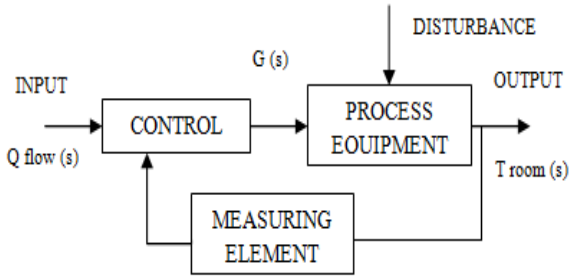

Figure 2.1: Closed Loop Control System, (Seminar *et. al*., 2011)

2.1.2.1 PIC Microcontroller

Around 1980, has outlined by General Instrument as a fast, minimal, sparing embedded microcontroller with physically effective I/O abilities. "Peripheral Interface Controller" stands for PIC. A microcontroller is an incorporated chip that is

of an installed framework. Since, the reason intended to execute scarcely a specific errand to direct a solitary framework, it's minor and rearrange so on a solitary chip, which can incorporate all the capacities needed. The microcontroller comprises a ROM, CPU, RAM, I/O ports with clock same as standard CPU.

There some of reason that made PIC series unprofitable (Chelli & Chavhan, 2012). Indeed, even PIC has contained 10-bit ADCs, yet the working voltages going from 1.8 - 5.5V. Moreover, to transfer a code from the PC a boot loader program alongside its consequent equipment was essential.

2.1.2.2 PID controller

The PID remains for Proportional-Integrating-Derivative. Since, it is utilitarian and auxiliary simplicity, there are a large portion of poultry house are utilized PID controller. Moreover, PID controllers are generally utilized propelled strategy as a part of the procedure business; their adequacy is frequently restricted because of poor tuning (David & Stephen, 2014). A PID controller by the manual tuning, which obliges advancement of three parameters, is a supported task. In creating orderly tuning systems to go to this difficulty, much exertion has contributed (Killingsworth & Krstic, 2006). In the temperature control system are ineffective with non-linear, time-varying and time-delay features (David & Stephen, 2014).

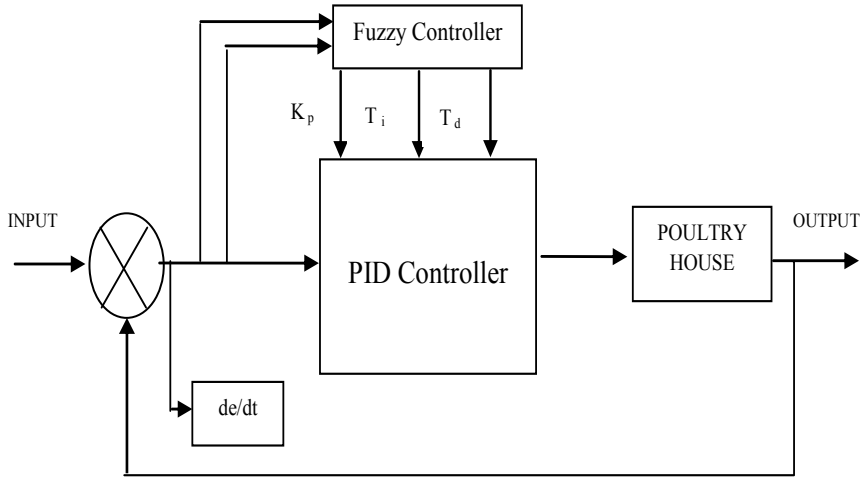

Figure 2.2: Basic structure of poultry house with PID and Fuzzy controller, (David & Stephen, 2014).

2.1.2.3 ARDUINO microcontroller

Figure 2.3: Arduino microcontroller

In study of (Hiremath, 2012), it was convenient to use ARDUINO microcontroller because uses a C programming language. On the web, it is a known board with lots of example and reference, which is other reason the Arduino has chosen. Since the product was open source and unpaid on the Arduino page, to transfer the code onto board from PC was simpler. However, adorable cost may also be effectiveness when use the microcontroller practically than use of personal computer(Vergara & Villaruz, 2014).

This approach combines hardware and software technologies. According toHiremath(2012), of measuring exact parameters like body temperature and development of the chickens utilizing open source technology Arduino have demonstrated.

2.2 Parameters

According to Thermoregulation (1994), fulfilments expresses on situation of mind to thermal environment called “Thermal Comfort”. The comfort satisfaction of poultry birds can improve by dynamically monitoring the parameters such temperature, relative humidity, and solar radiation in the poultry house has revealed

by a comprehensive investigation of studies. Generally, air temperature and humidity in agreement with suggested values with few difficult by (Qian & Jiang, 2009).

Indoor air temperature and %RH were generally in agreement with recommended values with few adverse outcomes health or production(Woloszyn *et. al.*,2009). According to David & Stephen(2014), to reduce birds mortality and increase poultry birds production, most of the poultry farmers depend on better control techniques. In the literature, several studies have reported about computer-based control of poultry-housing environment (Aaslyng, Ehler, & Jakobsen, 2005). Sensor is a device that receives and responds to a signal or stimulus.

2.2.1 Temperature

According to Chaudhary & Nayse (2011), the temperature has to be controlled properly since higher radiation level may give a higher temperature. Temperature sensors are devices that can sense the difference amount of heat between application space and reference. According to ASHRAE 1999, recommendation of room temperature for broiler houses about 15°C to 27 °C. Besides that, temperature's range of 20°C to 24°C, generally accepted that broiler at above 2 weeks of age will grow optimally, (Yani *et. al.,* 2014).

According to Fanatico (2007a), temperature for neutral zone around 65 to 75°F (18-24°C), which condition for adult chicken to maintain their body temperature is 105-107°F (40.6 to 41.7°C). If the temperature less than this zone, heat will lose. During summer, the chickens will reduce feed intake of food that affect increasing body temperature. During state 85°F (29.4°C), chickens started to pant. To avoid dehydration and to help scatter heat, drink more water needed.

According to Ernst RS (1998), using "ON-OFF" control with sling psychometric method, the measurement of stable temperature at 33 to 35°C and 20 to 30°C (Amon Marko, 1997). Furthermore, Computer Fluid Dynamic (CFD) other method is researchers used to state about temperature and humidity in a closed house for two seasons; summer and winter as shown as Table 2.1.