UNIVERSITI TEKNIKAL MALAYSIA MELAKA

STUDY OF PUYUH FARM ENVIRONMENT CONTROL SYSTEM USING PLC APPLICATION

This report is submitted in accordance with the requirement of Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Industry Electronics) with Honours

By

NURUL SAZWANI BINTI SALEH

B071310486

930309125508

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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 Engineering Technology (Industrial Electronic) (Hons). The member of the supervisory is as follow :

……..

(Saifullah Bin Salam)

ABSTRACT

The changeable temperatures in Malaysia today effect the quail's performance. Thus, there are a lot of requests from the broiler industry to preserve great environment conditions by setting up the controlling system, for example, the current evaporative cooling system that can control the temperature and humidity in a poultry house. In any case, there is an issue in an approach to coordinate the total cooling pad region to the installed exhaust fan capacity so that the desired cooling effectiveness is accomplished. In perspective of this, a controlling system based on PLC application that can control fans and lamps will be developed to control temperature and humidity of the poultry house. With this project, the temperature and humidity of quail poultry house were controlled in substantial scale. The controlling system will be functioned when the sensor reach the certain temperature and humidity. When the temperature and humidity sensor sense the temperature and humidity in the poultry house is higher than the maximum range of temperature and humidity, the DC fan will turn ON. Otherwise, when the temperature and humidity is below the minimum temperature and humidity range, the lamp will turn ON. In order to build this project, there are some important component that will be used such as PLC, microcontroller, DHT11 temperature and humidity sensor, fan, lamp and other components that will be described in this report. The purpose of this document is to report the investigation and performance results of the builder-up prototype dealing with temperature and humidity control of poultry house.

ABSTRAK

Suhu yang tidak menentu di Malaysia hari ini memberi kesan terhadap prestasi burung puyuh. Oleh itu, terdapat banyak permintaan daripada industri ayam daging untuk mengekalkan keadaan alam sekitar yang besar dengan menubuhkan sistem kawalan, sebagai contoh, sistem penyejukan penyejatan semasa yang boleh mengawal suhu dan kelembapan dalam rumah burung puyuh. Dalam mana-mana kes, terdapat isu dalam pendekatan untuk menyelaras jumlah kawasan pad penyejukan kapasiti kipas ekzos dipasang supaya keberkesanan penyejukan yang dikehendaki dicapai. Dalam perspektif ini, sistem kawalan berdasarkan permohonan PLC yang boleh mengawal kipas dan lampu akan dibangunkan untuk mengawal suhu dan kelembapan rumah burung puyuh. Dengan projek ini, kita boleh mengawal suhu rumah burung puyuh dan kelembapan di dalam skala yang besar. Sistem kawalan akan berfungsi apabila pengesan mencapai suhu dan kelembapan yang tertentu. Apabila pengesan suhu dan kelembapan mengesan suhu dan kelembapan di dalam rumah burung puyuh adalah lebih tinggi daripada julat maksimum suhu dan kelembapan, kipas DC akan dihidupkan. Jika tidak, apabila suhu dan kelembapan di bawah suhu dan kelembapan julat minimum, lampu akan dihidupkan. Dalam usaha untuk membina projek ini, terdapat beberapa komponen penting yang akan digunakan seperti PLC, mikropengawal, pengesan DHT11 suhu dan kelembapan, kipas, lampu dan komponen lain yang akan diterangkan dalam laporan ini. Tujuan dokumen ini adalah untuk melaporkan siasatan dan prestasi hasil prototaip yang berkaitan dengan suhu dan kelembapan kawalan rumah burung puyuh.

DEDICATION

I would like to dedicate this project to my supervisor, Mr Saifullah bin Salam and Mr Fauzi bin Ab Rahman whom had guided me in this project. I also would like to thank my beloved parents, lecturers and friends whom had helped and supported me in this project.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

PLC – Programmable Logic Controller

DC – Direct Current

AC – Alternate Current

LCD – Liquid Crystal Display

% - Percentage

℃ - Degree Celcius

NRC – National Research Council

PC – Personal Computer

s – Second

RH – Relative Humidity

VAC – Voltage Alternate Current

CHAPTER 1

INTRODUCTION

In this chapter, introduction of the "Puyuh Farm Environment Control System using PLC application" that include the project background, project objectives, problem statement, project scope and the report outline is presented.

1.1 Project Background

The Puyuh Farm Environment Control System project is using PLC application. The unpredictable temperatures in Malaysia today have greatly influence the puyuh's performance. Subsequently, there are a lot of demands from the industry to keep good environmental conditions by installing temperature and humidity controlling system. In view of this, a temperature and humidity controlling system based on PLC that can control fans and lamps will be developed.

The system used temperature and humidity sensor as its inputs to measure the ambient environment in the poultry house. A programmable logic controller, PLC is used to control the environment (temperature and humidity) level of the poultry house. Lamps and fans are installed in the system as the system's output. Based on the combination of the signals received from the sensors, the PLC will turn ON or OFF the lamps or fans according to the programmed codes to get the best possible environment for the poultry house. In this system, OMRON Multi-PLC Control System will be chosen apart from the common temperature sensor, humidity sensor, fans, lamps, and other components which are available in the market. The detail of the components will be highlighted in the next chapter. The purpose of this thesis is to report the investigation and performance results

of the builder-up prototype dealing with temperature and humidity to control the environment of the poultry house.

1.2 Project Objective

The main objectives of this project can be described as follows.

i. To design the environment control system of Puyuh Farm using PLC application.
ii. To analyze and evaluate the performance of "Environment control system of Puyuh Farm using PLC application" prototype.

1.3 Problem Statement

Quails need good environment which are good control system for their breeding and growing rate in order to be optimized. This good environment can be achieves with a very good ventilation that able to control the level of temperature and humidity level in the poultry house. Moreover, quails are very sensitive to cold temperatures and high humidity too. Thus, making controlling of these parameters are significant. By having a reliable and cost efficient poultry house environment controlling system, the breeding of health quails can be alleviated. Hence, Programmable Logic Controller (PLC) is broadly utilized as a primary board controller while it is normally difficult to program. There is another option technique other than PLC to control the factors with a simple to program feature.

1.4 Project Scope

The scope of the project is limited to the electrical part and the construction of the miniature prototype for the controlling system. For the electrical part, this project will focus on how to design the temperature and humidity controlling system based on PLC application. The system needs to be operated by controlling the fans and lamps. The project will be designed in such a way, that PLC application will be able to control the turning ON or OFF of the lamps and fans that used 240VAC, based on the signals received

from the sensors. Then, for the prototype part, a prototype of the poultry house will be designed taking into account similarity with the actual environment.

1.5 Report Outline

This report is outlines as follow:

Chapter 1 explains the introduction that includes concept of temperature and humidity controlling system based on PLC for poultry house application. It also outlines the objectives, problem statement and scopes of this system.

Chapter 2 describes the literature review of recent records, circuits and problem statement with regard to the project.

Chapter 3 provides description about the methodology in order to implement this project from the start until the end. The methodology is illustrated using the flow chart and each of the contents of the flow chart is described in this part.

1.6 Conclusion

This chapter gives general view of the project such as project background that sketches the project objectives, problem statements, project scopes. The study of the temperature and humidity controlling system will give some treasured relating to existing temperature and humidity controlling system that can be used as the references in order to get the idea to implement this project. Then, the problem statement helps to develop the system that will be created, so that it will be more effective than the existing controlling system available in the market. Besides, the project scope will set a limit so that the study will focus only within the desired result whereas in this project is to design a poultry house temperature and humidity controlling system.

CHAPTER 2

LITERATURE REVIEW

This chapter cover in brief, information about the Puyuh Farmbest, one of the quails breeding company located in Melaka, Malaysia, where the actual study and deployment of the controlling system will be studied. In overall, this chapter will explain some of the important findings related to poultry house, research existing controlling system project, some references circuit modifications and project contributions which creates novelty as compared to existing controlling systems.

2.1 Puyuh Farmbest

Puyuh Farmbest Sdn. Bhd. was established in 2003 to conduct research (R & D) on the management of the breed, breeding management and management of indoor farming, processing and grading in addition to management attempts to apply the technology in cattle rearing quail specifically, it then was incorporated in Malaysia in 2008.

Puyuh Farmbest Sdn. Bhd. is currently in the process of further expansion and upgrading farm management technology to improve overall workflow and production operations and control processes for ensuring the quality of the product and safe to eat. Furthermore, these improvements will ensure weekly production can be increased according to plan. This premise also will give visitors a chance to see the flow of farming techniques quail life and income carcass fresh for learning foreign tourists, school children, students, public and private institutions, the youth, the unemployed and for a closer look on the process flow beside the knowledge and reference a variety of

information about the market outlook derived from livestock towards the main food-based businesses that are competitive in the country's economic sector.

Figure 2.1: Quail Poultry House

According on Junho Bang, Injae Lee, Myungjun Noh, Jonggil Lim, and Hun Oh, chickens originate from one of the bird animal varieties [6]. Chicken is a difficult day creature which acknowledges light incitement to proceed with the producing process. The immediate impacts of light to chickens fortify endocrine organs to either defer or help development amid the agonizing period. It likewise empowers bringing forth impelling. The advanced poultry industry is to a great extent separated into two classes by items, oven for chicken meat and layer chickens for eggs. The poultry house structures are separated into an open-sided poultry house and close poultry house.

Figure 2.2: Open Poultry House and Close Poultry House

2.2 Quail Breeding Requirement

Figure 2.3: Quails

The quails were first farmed in the US in around 1870 to take the production of eggs and meat. In Pulau Jawa, quail is known as gemak. There are two types of quail that are normally kept in the U.K. The Chinese painted quail is well known in aviaries and is the smaller of the two, however the Coturnix or Japanese quail is more famous for

producing eggs or meat with smallholders and back patio nursery poultry keepers. Quail can be extremely productive laying around 230 eggs for every year so are an ideal solution for individuals with small back gardens that are unsuitable for quails. They are however more anxious than other poultry and do not like being handled, so care must be taken when catching them since they can fly vertically upwards to escape catch.

Quail can be kept with or without a keep running as long as they are provided with a little grass or other greens in their eating regimen. It is most likely best to begin by converting housing that is already have, guaranteeing it has sufficient ventilation, or to purchase a rabbit hutch. Rabbit hutches are generally big enough for about half a dozen quails and provide satisfactory ventilation and a spot for them to hide to lay eggs. Quails require more protection during the colder winter months which when the temperature is drawing nearer solidifying or underneath. Some individuals will move their accommodation into a garden shed or garage. Likewise with any animals, wet and draughts will cause issues so in spite of the fact that they require good ventilation, it might be important to cover these if there are strong winds.

Young quail can be sustained a high protein starter crumb. From 5-6 weeks of age they ought to be changed over to a grower/finisher ration, a turkey feed comes to the rescue in providing the right protein level for quail. By 10 weeks of age, quail that are being kept for their eggs or rearing require a reproducers encourage which contains 18-20% protein. A few specialist quail feeds contain seeds and in addition pellets. Grown-up quail eat around 15g of sustenance for every day.

Quails have been very productive in the egg division. They are capable for laying around 230 eggs (some have laid up to 300) if kept in the right conditions, given some light amid the shorter days and sufficient protection from the cold over the winter. Quail begin to lay eggs at only 8-12 weeks (assuming there is enough daylight) so they are productive very quickly compared to chickens. Four quail eggs are generally the same as a chicken egg, in spite of the fact that they have a slightly higher amount of yolk to white in an egg. Quail lay well for the first year and regularly the second and although most books recommend they will live for just 2 years.

Research indicates that grouping a single male with two or three females will generally give high fertility. When quail are kept in colony pens, one male to three females is sufficient and reduces fighting among males. Pair mating in individual cages also give good fertility. Fertility decreases markedly in older birds. Avoid mating closely related individuals, because inbreeding increases the incidence of abnormalities and can greatly reduce reproductive performance. For this reason, it is desirable to record quail numbers on the eggs, incubate them in groups, and permanently mark the quails at hatch time. Pedigree records can be kept by using commercially available wing bands or leg bands to identify quail of all ages. Quails can be identified temporarily by a little oil paint on the back feathers (not on the skin) or fingernail polish on the toes.

Alberto Gilberto Bertechini in the paper quail production stated that the phases of rearing birds in the system occur in the floor or in cages, from 1 to 21 days and rearing from 22 to 42 days (Murakami and Garcia, 2010) [2] . The birds start egg creation at 42 weeks of age, and the length of this stage relies on upon the quality of the bird at the beginning of production and management. He also stated that Quail birds are highly sensitive to any anxiety factor. The temperature and relative humidity are deciding elements for increased mortality in the flock. Quail chicks require a warm environment from 1-7 days of age at 38 °C and birds are exceedingly affectability for temperature with a warmth stress reaction for only 0.5 °C variation. In the next two weeks, 34 and 28 C respectively, are the required temperature. The relative humidity ought not to surpass 60% amid these development phases.

2.3 Housing and equipment

Quails are frequently housed in rooms similar to garages. However, such rooms need to be well insulated, well ventilated and free from draughts, and must provide protection from cats, rodents and predatory birds. Housing should be designed to ensure comfort for the birds, to make food and water readily accessible and to permit easy and effective sanitation. The adult facilities should reflect the purpose of the project. For example, if the birds are to be raised for commercial egg or meat production, then small pair-cages are suitable. Hobbyists may prefer aviaries or small deep-litter pens that do not

require regular removal of droppings. For cage or pen construction, 7 mm square welded wire mesh is recommended to provide secure footing, prevent leg injuries and prevent quails escaping through side walls. Adult quail will live and produce successfully if they are allowed 145 cm2 of floor space per bird (125 cm2 per bird on wire floors). Often, in community pens, they will not build a nest but will hide their eggs in the litter. For this reason quail egg producers usually prefer to house their birds in cages. A cage 13 × 20 cm is large enough for two birds. The cage should have a solid metal or plywood roof to minimize head injuries if the birds take fright. Adult quail need 1.25–2.5 cm of feeder space per bird. Ample feed should be present, but if the trough is too full, excessive wastage will occur. Clean, fresh water should be provided at all times with a minimum of 0.6 cm of trough space per quail. Nipple drinkers and cups are suitable for adult quail. One nipple or cup should be provided for every 5 quails.

2.4 Light Requirements

Quails require 14–18 hours of light per day to maintain maximum egg production and fertility. This means that supplementary lighting must be provided in the autumn, winter and spring months to maintain production. Males not required for breeding, or any quail being grown for meat production, can be given only about 8 hours of low-intensity light per day. This is not enough to initiate sexual maturity; therefore, the birds do not expend energy on fighting and mating and will tend to fatten more quickly.

2.5 PLC Operation

A programmable logic controller (PLC) is a current strong state computer that monitors inputs and outputs, and makes logic-based choices for automated process or machines. PLCs were presented in the late 1960s by creator Richard Morley to give an indistinguishable capabilities as relay logic systems. Relay systems at the time had a tendency to fail and make delays. Technicians then needed to inspect an entire wall of relays to settle the issue. Their programming language is easily understood, so they can be programmed without much trouble. PLCs are sectional so they can be connected to

different setups. Relays switching under load can bring about undesired arcing between contacts. Arcing forms high temperatures that weld contacts close and cause degradation of the contacts in the relays, bringing in device failure. Substituting relays with PLCs avoids high temperature of contacts. PLCs do have disadvantages. They do not implement well when taking care of difficult data. At the point when dealing data that requires C++ or Visual Basic, computers are the controllers of decision. PLCs also cannot display data well, so external monitors are frequently required. Figure 2.4 illustrates the PLC System.

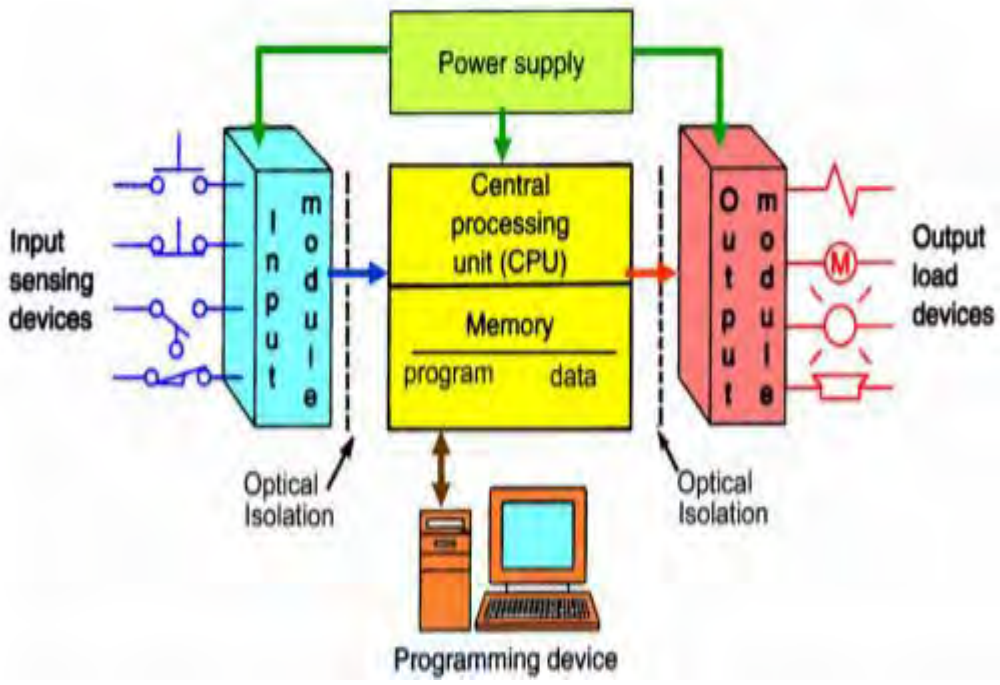

Figure 2.4: PLC System

PLCs read signals from various sensors and input devices. These input devices can be consoles, switches, or sensors. Inputs can be either in digital or analog form. Robots and visual systems are smart devices that can send signals to PLC input modules. Output devices, for example, motors and solenoid valves complete the automated system. Sinking and sourcing are two important terms when discussing about input and output connections of PLCs. Sinking is the common ground line (-) and sourcing is the common VCC line (+). VCC remains for the positive supply voltage connection point. Sinking and sourcing

inputs just conduct power in one direction. Every input has its own return line, and a few inputs connect to one return line rather than a few separate return lines. These common lines are named "COMM." Sensor outputs check the size of the signal given.

A PLC has many “input” terminals, through which it interprets “high” and “low” logical states from sensors and switches. It also has many output terminals, through which it outputs “high” and “low” signals to power lights, solenoids, contactors, small motors, and other devices lending themselves to on/off control. In an effort to make PLCs easy to program, their programming language was designed to resemble ladder logic diagrams. Thus, an industrial electrician or electrical engineer accustomed to reading ladder logic schematics would feel comfortable programming a PLC to perform the same control functions.

PLCs are industrial computers, and as such their input and output signals are typically 120 volts AC, just like the electromechanical control relays they were designed to replace. Although some PLCs have the ability to input and output low-level DC voltage signals of the magnitude used in logic gate circuits, this is the exception and not the rule.

Signal connection and programming standards vary somewhat between different models of PLC, but they are similar enough to allow a “generic” introduction to PLC programming here. The figure 2.5 shows a simple PLC, as it might appear from a front view. Two screw terminals provide connection to 120 volts AC for powering the PLC’s internal circuitry, labeled L1 and L2. Six screw terminals on the left-hand side provide connection to input devices, each terminal representing a different input “channel” with its own “X” label. The lower-left screw terminal is a “Common” connection, which is generally connected to L2 (neutral) of the 120 VAC power source.