

# THE DESIGN OF POULTRY EGG INCUBATOR CONTROL AND MONITORING SYSTEM

**MUHAMAD AMRI BIN MOHAMAD BAKHIR**

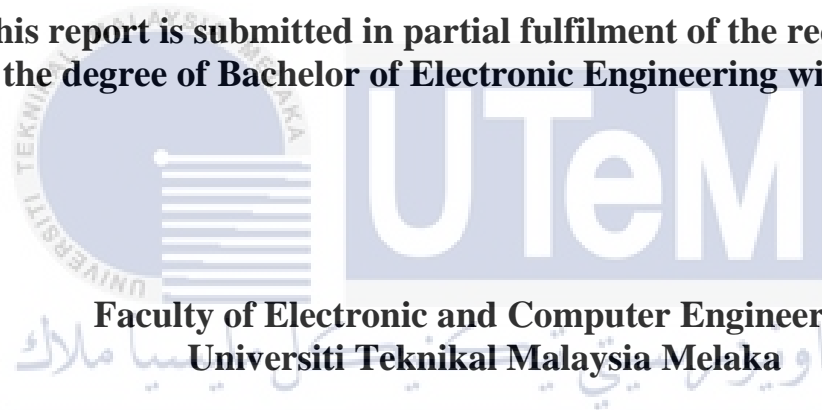


**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

# **THE DESIGN OF POULTRY EGG INCUBATOR CONTROL AND MONITORING SYSTEM**

**MUHAMAD AMRI BIN MOHAMAD BAKHIR**

**This report is submitted in partial fulfilment of the requirements  
for the degree of Bachelor of Electronic Engineering with Honors**



**Faculty of Electronic and Computer Engineering  
Universiti Teknikal Malaysia Melaka**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

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**BORANG PENGESAHAN STATUS LAPORAN  
PROJEK SARJANA MUDA II**

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CONTROL AND MONITORING SYSTEM  
Sesi Pengajian : 2021/2022

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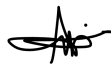
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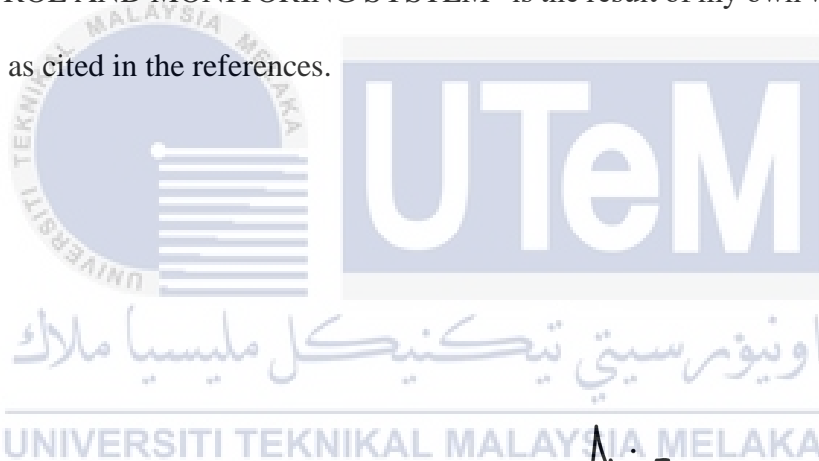
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## DECLARATION

I declare that this report entitled “THE DESIGN OF POULTRY EGG INCUBATOR CONTROL AND MONITORING SYSTEM” is the result of my own work except for quotes as cited in the references.



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## APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.



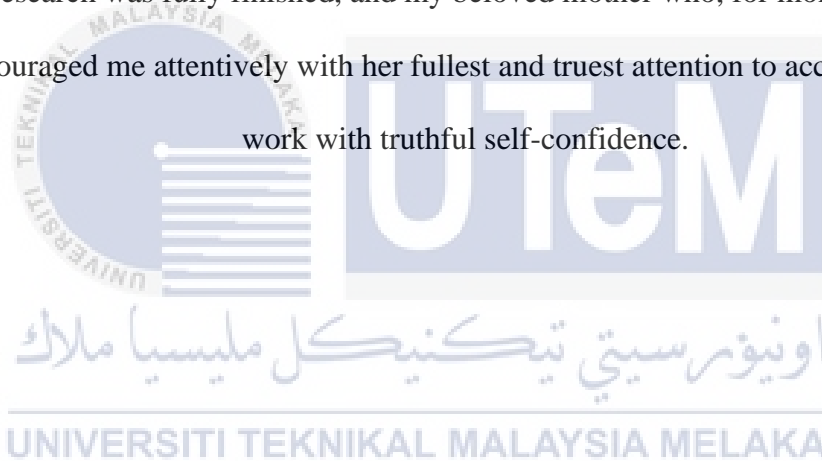
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Date : 21 Jun 2022 .....

## DEDICATION

This research paper is dedicated to my dear father, who has been my supporter until my research was fully finished, and my beloved mother who, for months past, has encouraged me attentively with her fullest and truest attention to accomplish my work with truthful self-confidence.



## ABSTRACT

Poultry egg incubator can be found on easily with many kind of features that are offered with the amount of hatching capacity is diverse, but some of those incubator will still work manually. The stability of the temperature and humidity in poultry egg hatchery will be less effective if the monitoring and controlling will be done manually. The manual monitor and control process are not efficient anymore for the poultry farmers as it spends much of time. Therefore, it needs a modern poultry egg incubator tools that makes it easier for the poultry farmers to handle it anytime and anywhere.

Many types of control and monitoring system has been introduce in electronic projects including the features on using Internet of Things (IoT). Monitor and control is a process of measuring performance and taking corrective data to ensure that the project is on track by its goals and target. Besides that, monitor and control process includes certain activities such as identifying important factors, specifying standard of satisfactory performance, collect and record the data information regarding the project involvement, compare the result in manual and automatic system performance, and developing possible responses if the performance is outside the range

## ABSTRAK

*Inkubator telur ayam boleh didapati dengan mudah dengan banyak jenis ciri yang ditawarkan dengan jumlah kapasiti penetasan yang pelbagai, tetapi beberapa inkubator tersebut masih akan berfungsi secara manual. Kestabilan suhu dan kelembapan di penetasan telur unggas akan kurang berkesan sekiranya pemantauan dan pengawalan dilakukan secara manual. Proses pemantauan dan kawalan manual tidak lagi berkesan untuk penternak ayam kerana menghabiskan banyak masa. Oleh itu, ia memerlukan alat inkubator telur unggas moden yang memudahkan petani unggas menanganinya bila-bila masa dan di mana sahaja. Banyak jenis sistem kawalan dan pemantauan telah diperkenalkan dalam projek elektronik termasuk ciri-ciri penggunaan Internet pelbagai benda (IoT). Pemantauan dan kawalan adalah proses mengukur prestasi dan mengambil data untuk memastikan bahawa projek tersebut berada di landasan yang betul dan tepat pada sasarannya. Selain itu, proses pemantauan dan pengendalian merangkumi aktiviti tertentu seperti mengenal pasti faktor penting, menentukan standard prestasi yang memuaskan, mengumpulkan dan merakam maklumat data mengenai penglibatan projek, membandingkan hasil dalam prestasi sistem manual dan automatik, dan mengembangkan kemungkinan respons jika prestasi berada di luar jangkauan.*



## ACKNOWLEDGEMENTS

I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this report. I would also like to acknowledge with much appreciation the crucial role of the staff of Electronic Laboratory, who gave the permission to use all required equipment and the necessary material to complete this project, The Design of Poultry Egg Incubator Control and Monitoring System. This research was supported by the Universiti Teknikal Malaysia Melaka [PJPC/2020/FKEKK-CETRI/SC0008] grants.

Last but not least, many thanks goes to my supervisor, Dr. Yusmarnita Binti Yusop whose have given her full effort in guiding the team in achieving the goal as well as his encouragement to maintain our progress in track. I would to appreciate the guidance given by other supervisor as well as the panels especially in the project presentation that has improved our presentation skills by their comment and tips.

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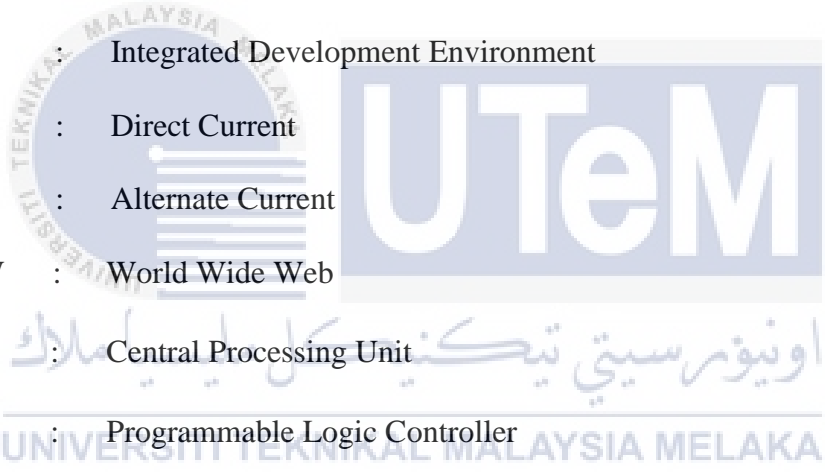
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## LIST OF SYMBOLS AND ABBREVIATIONS

UTeM	:	Universiti Teknikal Malaysia Melaka
IoT	:	Internet of Things
PV	:	Photovoltaic
LDR	:	Light Dependent Resistor
USB	:	Universal Serial Bus
IDE	:	Integrated Development Environment
DC	:	Direct Current
AC	:	Alternate Current
WWW	:	World Wide Web
CPU	:	Central Processing Unit
PLC	:	Programmable Logic Controller



## LIST OF APPENDICES

Appendix A: Control system coding

Appendix B: Monitoring system coding.



# CHAPTER 1

## INTRODUCTION



اونيورسيتي تكنولوجيک ملایسا ملاک  
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This chapter presents an overview of the project. This chapter will explain about the project, objectives of the project, problems statements, and scope of project, methodology and the outline report.

## 1.1 Background of project

Poultry egg incubators are insulated enclosures in which temperature, humidity, and other environmental factors can be controlled to optimal levels for growth, hatching, and reproduction of poultry eggs. The fertilized eggs of chicken are kept warm in a poultry egg incubator until they are ready to hatch [1].

There are three main importance factors that are included in incubating egg artificially. The elements are temperature, humidity, and turning. The most crucial element among the factors are temperature. However, humidity tends to be overlooked and causes many hatching problems. Extensive research has shown that the optimum incubator temperature is 38°C when relative humidity is 65% to 75% percent [1]. The concentration of oxygen should be above 20 percent, carbon dioxide should be below 0.5 percent, and the air movement past the egg should be 12 cubic feet per minute.

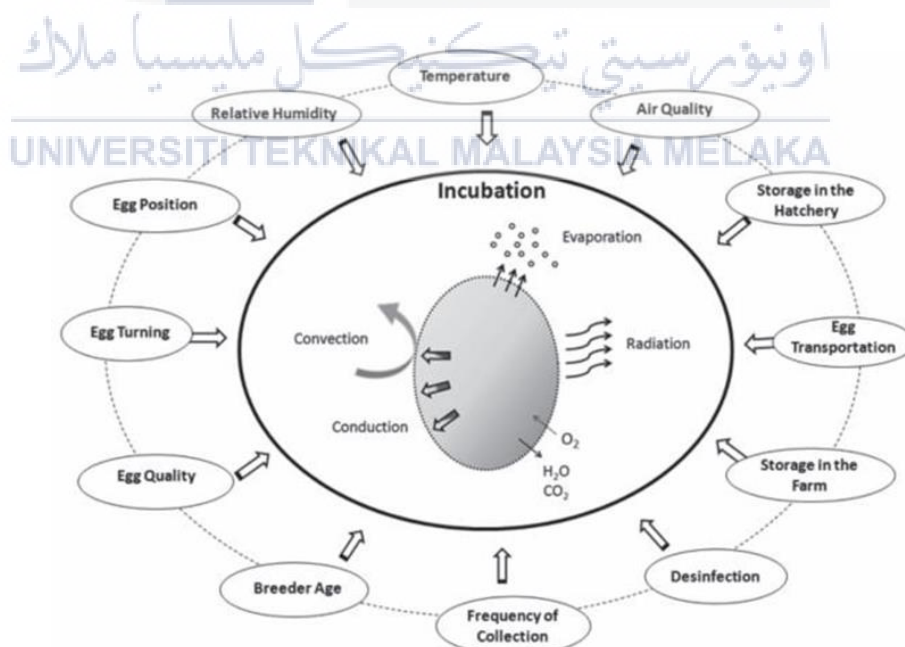


Figure 1.1: The elements involved in incubation period of the poultry egg.

Poultry egg incubators with manual system operations cause a variety of problems, including the fact that it takes a lot of time for poultry farmers to monitor and regulate their egg incubator [2]. As a result, the modern egg incubator tool will be designed to allow poultry farmers to control and monitor their incubator from anywhere at any time. Poultry farmers will be able to save time by using this type of system. As a solution, a novel way of chicken egg incubator design is proposed that might be utilized to hatch eggs utilizing solar Photovoltaic (PV) as a power supply, thereby reducing power consumption, and maximizing the use of solar electricity, which is one of the sustainable energy sources.

Furthermore, using solar Photovoltaic (PV) technology will allow the incubator to be placed in areas that are directly connected to the national grid system. In addition, to make use of the system, this project employs Internet of Things (IoT) technology, which enables poultry breeders to control and monitor the process from afar by maximizing the use of the internet in their work. The use of Raspberry Pi technology in conjunction with temperature and humidity sensors, a stepper motor, a webcam, and a relay to create a control and monitoring system for a chicken egg incubator machine that can be accessible via the online.

As the ultimate objective of this project, a complete system of poultry egg incubator with the integration of PV energy system and IoT technology design will benefit the egg breeder in the technical aspects. This system will be able to help the poultry industries that has experienced positive trends in the artificially hatched eggs which will enable poultry farmers to increase the production volumes to fulfill the market demand.

## 1.2 Problem Statement

### Problem Statement 1:

In order to maintain the time quality of the poultry farmers to monitor and control their incubator, the poultry egg incubator will be design with automatic features of control and monitoring system for temperature, humidity and turning point of the eggshell.

According to research conducted by M. E. Schmitt. D in 2015, the most reasonable poor hatches process occur in manual incubator system is due to the uncontrolled temperature set by the poultry farmers and users until the temperature is unstable, which is the temperature is too high, too low, and too variable during incubation period.

Besides that, according to research supported by O. E. Aru in 2017 stated that the unstable condition of the humidity on the surroundings of the eggshell in the incubator also be the reason for the fail in hatchery process.

Thus, the automatic control system for the user to control the temperature and humidity by their phone and computer will be design in poultry egg incubator system.

## Problem Statement 2:

The user need to monitor frequently the egg incubator to ensure the egg embryo will gain enough amount temperature and surrounding humidity to avoid from the egg embryo to die in its process cycle. (Research by A. M. Mohammad Adid in 2016). In order to monitor the egg condition, the system will be designed for monitoring system with web camera application to ease the poultry farmers monitor frequently.

Apart from that, to make sure the amount of temperature and humidity will be spread evenly among the egg shell, the poultry egg incubator will be design with turning process for the egg shell in certain of time daily

### 1.3 Objective

- To design a poultry egg incubator control and monitoring system with integration of photovoltaic (PV) energy system and IoT Technology.
- To analyze the proposed system performance in term of poultry egg hatching percentage and overall system efficiency

### 1.4 Scope of work

The scope of this project is to design a poultry egg incubator system which the system can be control and monitor by the user. A control and monitoring system has to be designed where it works with the aid of Raspberry Pi Microcontroller. In this project, the IoT devices will be use interface with the Raspberry Pi Microcontroller as the signal of transmitter and receiver.

In this project, the solar power will be used as the main power supply for overall system. The solar supply will be having specifications of 18W of maximum power together with the solar charge controller, Inverter and DC battery of 12V, 7AH.

The input contributes to fulfill the design of poultry egg incubator are temperature and humidity sensor and LDR sensor.

The output use to control and monitor the process in incubator system are relay, bulbs, fans, servo motor, and USB Web Camera.

The expected final prototype in this work expected for this project to able in monitor and control by using the output that will be in the incubator

