UNIVERSITI TEKNIKAL MALAYSIA MELAKA

The Design and Development of Temperature Controlled Oyster Mushroom Farmhouse Using PID Control Technique

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

by

STUDENT NAME: LEE DE RONG
MATRIX NUMBER: B071410316
IC NUMBER: 941110-01-5049

FACULTY OF ENGINEERING TECHNOLOGY
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SESI PENGAJIAN: **2017/18 Semester 1**

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This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of **Bachelor's Degree in Electronics Engineering Technology (Industrial Electronics) with Honours**. The member of the supervisory is as follow:

……

(A Shamsul Rahimi Bin A Subki)

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ABSTRAK

Cendawan tiram adalah sejenis tumbuhan yang memerlukan julat suhu tertentu untuk berkembang secara berterusan. Oleh itu, teknik pengawal Proportional, Integral, Derivatif (PID) digunakan yang akan membandingkan suhu diukur dengan suhu rujukan dengan gelung maklum balas kawalan. Sebagai metodologi projek ini, penalaan manual PID untuk mendapatkan respon yang optimum terhadap sistem. Untuk peralatan yang digunakan, sensor suhu DHT11 digunakan untuk mengesan dan mengukur suhu di sekelilingnya di dalam sistem rumah ladang. Kemudian litar pemalar AC PWM yang mengawal intensiti cahaya mentol lampu AC untuk mengawal suhu sekitar sistem rumah ladang sehingga kekal pada suhu rujukan. Selain itu, kami juga menggunakan kipas DC untuk menyejukkan suhu sekitar untuk mengekalkan suhu rujukan jika suhu di sekitarnya terlalu tinggi. Sebagai analisis dalam keputusan, tunas terbaik PID adalah K_P = 1, K_I = 2, K_D = 0 yang memperoleh masa kenaikan, T_r iaitu 12s untuk suhu awal 29℃ meningkat sehingga 30℃, masa puncak, T_p = 136s untuk suhu awal mencapai suhu maksimum 35℃, masa ayunan, T_{ayunan} = 256s untuk suhu yang diukur mula berayun sebelum akhirnya mencapai suhu rujukan 33℃ yang memerlukan masa penyelesaian, T_s = 263s. Bagaimanapun, sistem suhu ini mempunyai beberapa ketidaksempurnaan yang memperlihatkan peratusan suhu yang melebihi,% OS = 6.06%.

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ABSTRACT

Oyster mushroom is a type of plant that need a specific temperature range for it to grow continuously. Therefore, a technique of Proportional, Integral, Derivative (PID) controller is used that will compare the measured temperature with the reference temperature by a control feedback loop. As a methodology of this project, the manual tuning of the PID to get optimal response on the system. For equipment used, the DHT11 temperature sensor is used to sense and measure the surrounding temperature insides the farmhouse system. Then the AC PWM dimmer circuit that controlling the light intensity of the AC light bulb to control the surrounding temperature of the farmhouse system until stay at reference temperature. Besides, we are also used the DC fan to cool down the surrounding temperature to maintain at reference temperature if the surrounding temperature is too high. As an analysis in results, the best PID gains tunings are K_P = 1, K_I = 2, K_D = 0 that obtain the rise time, T_r = 12s for the initial temperature of 29℃ increase up to 30℃, peak time, T_p = 136s for initial temperature achieve to the maximum temperature of 35℃, oscillation time, $T_{ocillation}$ = 256s for measured temperature start to oscillate before eventually reach the reference temperature of 33℃ that needs settling time, T_s = 263s. However, this temperature system had some imperfection that showing the temperature percentage overshoot, %OS of 6.06%.

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DEDICATION

Specially dedicated to,

My parents, Lee Swee Chye and Tsoi Siew Meng.

My supervisor, En. A Shamsul Rahimi bin A Subki.

All my friends and faculty.

Thousands of special thanks and appreciation for their support, guidance and encouragement.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

ADC	-	Analog-to-Digital Converter
CAN	-	Controller Area Network
DC	-	Direct Current
DOF	-	Degree of Freedom
DUT	-	Device Under Test
FOTD	-	First Order Time Delayed
GPIO	-	General-purpose Input/Output
GUI	-	Graphical User Interface
ICSP	-	In-Circuit Serial Programming
IDE	-	Integrated Development Environment
LabVIEW	-	Laboratory Virtual Instrument Engineering Workbench
LCD	-	Liquid Crystal Display
MATLAB	-	Matrix Laboratory
NTC	-	Negative Temperature Coefficient
PCB	-	Printed Circuit Board
PI	-	Proportional, Integral
PID	-	Proportional, Integral, Derivative
PLC	-	Programmable Logic Control
PV	-	Process Variable
PWM	-	Pulse Width Modulation
RPM	-	Revolution per Minute

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SP	-	Setpoint
SPI	-	Serial Peripheral Interface
TCB	-	Temperature Controller Board
TE	-	Thermo-Electric
TEC	-	Thermo-Electric Cooler
TEG	-	Thermo-Electric Generator
USB	-	Universal Serial Bus
<	-	Less than
=	-	Equals to
℃	-	Degree Celsius
%	-	Percentage

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CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter will be provided an introduction about the development of the temperature controlled oyster mushroom farmhouse using PID controller technique. It firstly comes out with the project background and the related problem statement as following. These are followed by the research objectives and scope of the study which involves the design and development of the temperature controlled oyster mushroom farmhouse using PID controller technique.

1.1 Project Background

As a history, oyster mushrooms are one of the family of fungus that grow wild throughout North America and much of the world. It is also named as Pleurotus Ostreatus. They grow in clumps on tree trunks and stumps and are easy to be spotted. Besides, they have a very unique fruity and liquorice-like aroma and the cap of the oyster mushroom is in scallop shaped with the range between 5 to 25cm. It is also appearing as white, yellow, brown, tan, and even pink colour. The agro-climatic conditions in Malaysia are suitable for cultivation of mushrooms throughout the year. Currently, there are up to seven varieties of mushrooms are grown commercially in Malaysia. But the most popular varieties of mushrooms are grown in Malaysia including grey oyster mushroom, black jelly, Ganoderma, and shitake. According to Mohd Anim (2014), Ganoderma and gray mushrooms are widely grown in lowlands

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