

DESIGN AND DEVELOPMENT OF HORTICULTURE GREENROOM

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**This report is submitted in partial fulfilment for the requirements for the award
of Bachelor of Electronic Engineering (Industrial Electronic) with Honour**

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

April 2009



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Design and Development of Horticulture Greenroom
Sesi Pengajian : 2008/2009

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Special dedicated to my beloved parents, family and fellow friends, who had strongly encouraged and supported me in my entire journey of learning...

ACKNOWLEDGEMENT

I have completed my thesis which is a partial fulfilment of requirements for the Degree of Bachelor in Electronic Engineering (Industrial Electronic).

On this opportunity, I would like to express my gratitude to the Faculty of Electronic Engineering, Universiti Teknikal Malaysia Melaka generally and especially to supervisor Miss Wong Yan Chiew for her help, advices and guidance in whole process of searching, collecting information, analyzing and completing this report.

To my parents, I would like to express a million of thanks to them for their support and their love to me. Last but not least, I would like to thank to all of my friends in BENE. And also to everyone who involve in this project either direct or indirectly.

ABSTRACT

Plantation of horticulture crop in Malaysia is growing restrict locally at the highland. This is due to the climate necessary of horticulture crop. Thus, plantation of those crops in the lowland tropic is a difficult task. However, the horticulture plant can be cultivated in lowland unless there is a huge investment in term of environment facility, space and modal. Besides, greenroom equipment on current market is unaffordable for people who do have interest in cultivate small scale horticulture plant in home or office. One solution to this is by designing a horticulture greenroom suitable for small spaces, low cost and intelligence climate control. By using the humidity, temperature and light sensor, this system can automatically control and monitor heating, cooling, humidity, ventilating, and intensity of light according to the necessary condition of the crops. An integrated Liquid crystal display (LCD) is also used for real time display of data acquired from various sensors and the status of the various devices. Aside, the use of easily available components reduces the manufacturing and maintenance costs. The design is flexible as the software can be changed any time. It can thus be customizing to the specific requirements of the user. The accuracy and efficiency is proving by conducting experiments on a 10-inch diameter rounding greenroom design. By using the recycle material, the greenroom is low cost and safe to the environment. Hence, the design of horticulture greenroom system is economical, low maintenance, and able to utilize a limited space in a residential unit to fulfil on horticulture plant requirement and is no longer limited to any place and time.

ABSTRAK

Penanaman tumbuhan hortikultur di Malaysia adalah terhad di kawasan tinggi. Ini adalah disebabkan tumbuhan hortikultur amat peka terhadap perubahan suhu di sekeliling kawasan. Tumbuhan tersebut amat memerlukan keadaan suhu yang rendah, sinaran cahaya yang serdehana dan kelembapan sekitar yang tinggi. Oleh demikian, penanaman tumbuhan hortikultur dianggapkan sesuatu yang amat mencabar. Walaubagaimanapun, tumbuhan tersebut dapat ditanamkan di kawasan rendah sekiranya mempunyai alat-alat kelengkapan yang cukup, ruang yang besar, dan modal yang tinggi. Selain itu, alat pengawal rumah hijau yang sedia ada di pasaran adalah sangat mahal. Memandangkan isu ini, projek ini adalah bertujuan untuk mencipta alat pengawal yang padat, murah dan lagi mempunyai ciri-ciri pengawalan cerdas. Dengan menggunakan alat pengesan suhu, kelembapan, dan cahaya, sistem ini dapat mengawal and memerhati kepanasan, kesejukan, kelembapan, keterangan cahaya, dan pengedaran udara dalam rumah hijau. Alat kristal cecair akan digunakan untuk memaparkan keadaan rumah hijau. Selain itu, dengan menggunakan bahan yang sedia ada, projek tersebut adalah murah. Alat pengawal tersebut adalah fleksible sebab kawalan boleh ditentukan oleh pengguna dengan mengubahkan nilai- nilai yang ditetapkan. Kecekapan dan ketepatan alat ini telahpun dibuktikan dengan beberapa kajian dalam acuan rumah hijau yang berdiameter 27cm . Hasilnya, alat ini adalah murah, ekonomi, kurang proses penyelenggaraan dan dapat menanam tumbuhan hortikultur di merata-rata tempat dengan ruang yang kecil.

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CHAPTER I

INTRODUCTION

1.1 Background

Nowadays, growing horticulture crop in Malaysia at natural lowland seem to be the most interesting and modern way of plant cultivation. Horticulture plantation is differ from agriculture where its concentrate on small scale of plant cultivation, and use a small area of ground for variety of crop rather than large field of single crop[1]. Typical of horticulture crops in Malaysia is oyster mushroom and strawberries. Cultivation of horticultural crop is difficult and complex due to their tendency on specify climate condition. Unless there is a natural of growing condition like Cameron Highland and Genting Highland which provide the suitable necessarily need of climate condition. In 2008, more than 2.6 million tones of mushrooms and 2 million tones of strawberry were imported into Malaysia amounting to RM25.74 million[2]. This mean Malaysia was indeed a huge market for that plantation need. Because oyster mushroom and strawberry is not merely for the ornament purpose, but also be a part of medicine usage and business ideal. Environmental factor include temperature, relative

humidity, intensity of light and carbon dioxide influence to the growth of horticulture plant [3]. Therefore, it is necessary to bring the environmental conditions under control in order to have those condition as close to the ideal as possible. To create the optimal environment, the main climatic and environmental parameters such humidity, temperature, intensity of light and ground water need to be control.

The existing systems employ PC or SMS-based systems for keeping the user continuously informed of the conditions inside the greenhouse are unaffordable, bulky, difficult to maintain and less accepted by the technologically unskilled workers. Thus, this project aimed to design an economic microcontroller-based greenroom to provide suitable environmental condition for optimum plant growth, increase crop yields, and efficient use of water and other resources. By automating supervisory level of control over the greenroom, various climatic parameters that govern plant growth were collected at high frequency with less labour requirements. There are five most significant parameters to be considered in creating a greenroom. These include light intensity, temperature, relative humidity, soil condition and water. In order to fulfil the greenroom requirement on the parameter in view, the system was design based on to operate as following:

1. Acquisition of data thought sensor [4].
2. Processing of data, comparing it with desired state and deciding change the state of the system
3. Actuation component carrying the necessary action

1.2 Objective

The objective of the project is:

1. To design and develop a greenroom controller for horticulture plantation to control room's light intensity, humidity and temperature by using microcontroller 16F877 with the sensor as input.
2. To generate a new model of monitoring and controlling system for the use in modern horticulture plantation.
3. To economize the current greenroom controller product and saving on cost by reduce the need of labour monitoring.
4. To cultivate interest among horticulturalist, small scale grower and urbanite on the horticulture plantation at low land.
5. To learn and study of the function of microcontroller as an intelligent controlling device.

1.3 Scope of Project

The scope of the project is to develop a greenroom monitoring and controlling system by utilized microcontroller application. This project will be constructed according to the composed of sensor module, microcontroller module, LCD display module and output controlling module. The designed microcontroller unit consists of 4 inputs and 6 outputs. The input is light, humidity, and temperature sensor. Meanwhile the output is water pumper, character LCD display, buzzer, ultrasonic humidifier, light

bulb and computer exhaust fan. The input and output unit is symbolize as figure 1.1. Due to the system program of microcontroller unit contains predefine running algorithms; all of the sensor will detect ambient environment change at the same time. The real time data will be transmitting from sensor to microcontroller, and microcontroller will process the environmental condition as indicated in figure 1.2. The microcontroller then performs the needed actions by employing controller circuit until the strayed-out parameter has been brought back to its optimum level. As the system also employs an LCD display for continuously alerting the user about the condition inside the greenhouse, the entire set-up becomes user friendly. Since a microcontroller is used as the heart of the system, it makes the set-up low-cost and effective nevertheless.

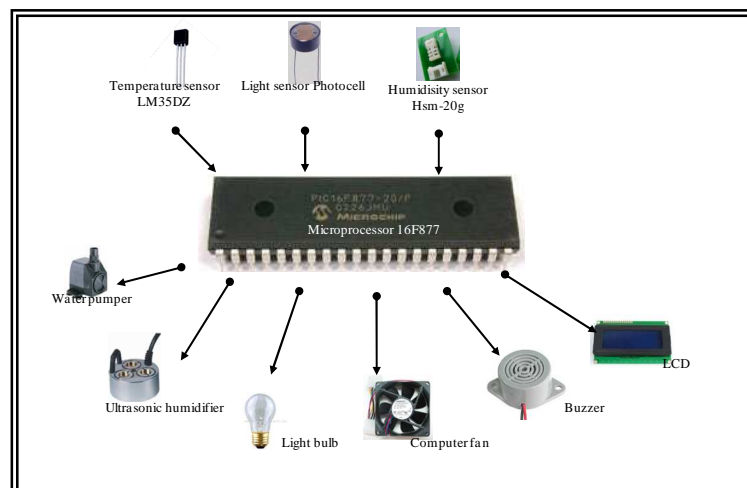


Figure 1.1: Input and output device of microcontroller base system

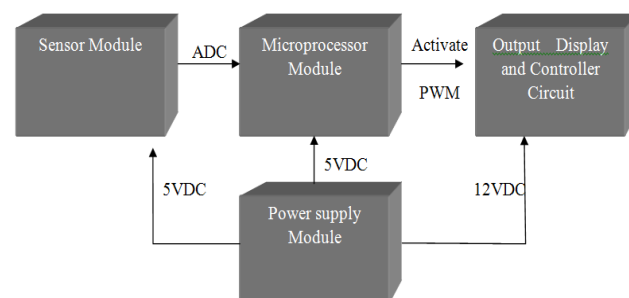


Figure 1.2: Block diagram of the project scope

1.4 Problem Statement

Light, temperature and humidity in the air are the most significant element for plant to growth in rich. There has been a popularity rise of greenroom environmental control by using computer. The main improvement in the computer-based climate control is found in data logging, the determination of climate set-point, monitoring and alarm function [4]. However, the existing systems employ PC or SMS-based systems is unavailable for small scale grower and home appliance. This is due to the several factors in Malaysia which:

1. The grower are unaffordable, device is bulky, difficult to maintain and less accepted by the technologically unskilled workers [5].
2. Investment in the automation process is high. Greenhouse control systems are designed for only one parameter monitoring [5]. Hence to control a few parameters simultaneously there will be a need of more than one device.
3. High maintenance and need for skilled technical labor [5]. The modern proposed systems use the SMS-based technology as the data acquisition systems, providing global access to the information about ones farms. But it suffers from various limitations like design complexity, inconvenient repairing and high price. The reliability of the system is relatively low. When there is malfunctions in local devices, data will be lost and result in the whole system breaking down
4. The use of microcontroller-based systems is increasingly wide-spread, is the trendy solution in the current market for reduction of power consumption. This device is cheaper yet possessing powerful functionality which enable user to control multiple system devices simultaneously.

5. Horticulturalist in Malaysia do not work under such sophisticated environment and find no necessity of such an advanced system, and cannot afford the same [4].

Considering the versatility function and advantage offer from microcontroller, an economic investigation of microcontroller-based system was utilized in implement for cultivation of horticultural crop to help small scale grower and household appliance in Malaysia.

1.5 Significant of Study.

Plantation of horticulture crop in lowland has forming strong interesting among horticulturalist, small-scale grower and urbanite. The potential market of horticulture crop is wide and the demand of that crop has kept increasing. However, controlling the natural necessarily of horticulture crop –humidity, intensity of light and temperature is difficult moreover doing it in the high temperature area. And yet, the existing controller system in the market is definitely unsuitable due to the cost and size. Therefore, a low-cost investigation on current greenroom controller is emerging keep abreast with the necessary. Based to the study on horticulture characteristic and current greenroom system, there are several significant contributing to project development:

1. Cultivating interest of horticultural plantation in lowland profit among horticulturalist, small-scale grower, and urbanite.
2. Provide an alternation in controlling of humidity, temperature and intensity of lighting issue.
3. Convenience the design system reliability by monitoring and controlling the growth of horticulture crop through by user friendly controller.

1.6 Structure of Thesis

This thesis is a documentary delivering the idea generated, concepts applied, activity done, and finally the final year project product itself. It consists of five chapters. The following paragraphs are chapter-by chapter description of information in the thesis.

Chapter 1, is the brief introduction to horticulture characteristic and greenroom system on current plantation technology. The problem statements, objective, scope of work of this project also presented within this chapter.

Chapter 2 introduced the literature review on the history of horticulture, the concept of study in horticulture, the significant point of horticulture and horticulture plantation in greenroom and constraints facing. This chapter also include the concept and fundamental of PIC microcontroller, sensor and controller circuitry..

Chapter 3 is regarding the project methodology that consists of two parts which are hardware development and software development. The hardware developments as stated in project methodology which include the design and construction of modern greenroom controller circuitry, microcontroller circuit, drive system and sensor. In the software development, the result is obtain form the virtual simulation tools in Proteus, then follow by design the PCB track using Proteus Advanced Routing and Editing Software (ARES).

In chapter 4, all the analysis result from the hardware and software experiments is included in this chapter in the form of table, discussion, and improvements done.

Finally, the chapter 5 will be the summary of this final year project. The conclusion, suggestion or recommendation for improvements and application are discussed within this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Horticulture is an important part of agriculture. The first definition of horticulture included those crops normally cultivated in gardens such as flowers, vegetables, fruits and ornamentals. These crops became known as “horticulture crops” and were separated from field crops such as corn, wheat and cotton. These is differs from agriculture where it’s concentrate on small scale of plant cultivation, and use a small area of ground for variety of crop rather than large field of single crop. It covers a wide broad of crop cultivation which often includes the fruit and mushroom plantation.

Horticulture is implementing in many gardens, plant growth centers and nurseries. Activities in nurseries range from preparing seeds and cuttings to growing fully mature plants. These are often sold or transferred to ornamental gardens or market gardens. Horticulture is usually majoring in the plantation of mushroom or such plantation needed high humidity such as strawberries and grape as indicated in figure 2.1. The cultivation process for those plantation is complexes and difficult. As