UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN OF A SMART INDOOR GARDENING SYSTEM VIA PID CONTROL SCHEME

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electrical Engineering Technology (Industrial Power) (Hons.)

by

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DECLARATION

I hereby, declared this report entitled "Design Of A Smart Indoor Gardening System via PID Control Scheme" is the result of my own research except as cited in references.

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Date : 12th January 2016

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 in Electric (Power Industry). The member of the supervisor is as follow :

……..

(Ahmad Muzaffar bin Abdul Kadir)

Project Supervisor

ABSTRAK

Sistem Perkebunan Dalaman melalui Skim Kawalan PID adalah projek yang menyediakan alat-alat taman pintar untuk sistem berkebun tertutup. Penggunaan sistem berkonsepkan kebun adalah untuk semua pusingan tahun dengan mengawal elemen tumbuh-tumbuhan untuk berkembang maju. Sistem ini menggunakan PID sebagai pengawal untuk mengawal keseluruhan sistem dan untuk elemen kawalan, sistem ini menggunakan kipas, pam air DC dan mentol AC. Kipas akan diguna untuk mengawal peredaran udara di sekeliling tanaman. Sensor kelembapan, sensor LDR dan sensor suhu LM35 digunakan sebagai unsur pengukur untuk sistem ini. Sensor kelembapan akan mengesan jika tanah tidak lembap dan maklumat itu akan dihantar untuk dianalisis oleh pengawal untuk mengawal persekitaran pembesaran yang sihat untuk tumbuh-tumbuhan. Sensor suhu akan mengesan suhu persekitaran yang diperlukan untuk tumbuhan untuk tumbuh dan berkembang maju. Sensor LDR digunakan untuk mengawal jumlah pemberian pencahayaan yang mencukupi untuk tumbuhan. Keadaan tanah, suhu dan cahaya akan dipaparkan pada skrin komputer. Kelebihan sistem ini ialah ia boleh mewujudkan konsep rumah hijau dengan berkebun tertutup. Kesimpulannya, Sistem Perkebunan Tertutup melalui Skim Kawalan PID telah dihasilkan dengan menggunakan perisian LabView versi 2015 untuk mengawal tumbuhan untuk hidup dan berkembang maju. Perisian Arduino versi 1.6.4 digunakan sebagai penyambung antara papan Arduino dan perisian LabView.

ABSTRACT

The Smart Indoor Gardening System via PID Control Scheme is a project that provides smart garden devices for indoor gardening system. The systems are use gardening concept which is for all year round gardening by controlling the element of the plants to thrive. This systems are used PID as the controller to control the whole system and for the control element, this system use the fan, the DC water pump and the AC bulb. The fan is used to control the circulated air surrounding the plants. The moisture sensor, the LDR sensor and LM35 temperature sensor is used as the measuring element for the system. The moisture sensor will detect if the soil is not moist and the information is send to controller to analyze it by the controller to control healthy grow environment for the plants. The LM35 temperature sensor will detect the temperature surrounding and control it based on the needed for the plant to growth and thrive. . The LDR sensor is used to control the sufficient lighting for the plant. The condition of soil, temperature and light is displayed on computer. The advantage of this system is that it can create the greenhouse concept with indoor gardening. In conclusion, the Smart Indoor Gardening System via PID Control Scheme was developed using LabView software version 2015 to control the plant to grow and thrive. The Arduino software version 1.6.4 is used to link the Arduino board with LabView software.

DEDICATION

To my lovely and beloved parents,

Mohammad Sa'at bin Salamat and Fadzilah binti Muhamad

My siblings,

Mohammad Anuar bin Mohammad Sa'at, Noor Rashidah binti Mohammad Sa'at, Mohammad Hafidz bin Mohammad Sa'at and Mohammad A'riff bin Mohammad Sa'at

My beloved friends,

Kamarulhuda bin Mohd Nazri, Mohamad Syufaat bin Md. Amil, Mohamad Azri, Soleha binti Ahmad, Nor Syazana binti Hasan, Farha binti Jumali, Siti Aisyah binti Jumat and Siti Safwanah binti Misri,

My Supervisor,

En. Ahmad Muzaffar bin Abdul Kadir

Dedicated in thankful for the supporting, best wishes and encouragements.

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CHAPTER 1

INTRODUCTION

The purpose of this project is to build the model of Smart Indoor Gardening System via PID Control Scheme. This chapter will briefly discuss the project overview on how the project is developed. The systems providing optimum condition for the plant to grow and thrive. It also can be automatically watering plant without looking after plant to be under or over watering. The sufficient lighting for the plant to growth can be maintained for the whole day. The control element for this system would be temperature. The temperature surrounding would be controlled in analog output by using the PID control scheme to control the system. The background of the project, problem statement, objective, scope, and the outline report will be presented in this chapter.

1.1 Background Of The Project

The Smart Indoor Gardening System via PID Control Scheme is a system that controlling the element of the plants to thrive by using the gardening concept for all year round gardening. Nowadays, the planter cannot control the plant growth to be in good state. The soil fertility and plant fertility also cannot be maintained. Therefore, the system of the Smart Indoor Gardening System via PID Control Scheme are be made to overcome the problem. The systems are providing optimum condition for the plant to

grow and thrive especially in country of four seasons. It also helps the planter produce plant with good quality, matured and unaffected. The plant used for the system is more to valuable plant like herbaceous plant, which is can be used for medicinal use. Other than that, the humidity of the soil can be maintained to be always in good state at the range needed by the plant. The sufficient lighting for the plant to growth can be maintained for the whole day. The system also can be automatically watering plant without looking after plant to be under or over watering. The systems are using Arduino Uno as the controller to control the LDR sensor, the moisture sensor, the LM35 temperature sensor, the DC water pump, the fan and the AC bulb.

1.2 Problem Statement

The most common problem encountered in looking after plant is the plant produced are not in good quality, not matured and affected because the plant grown are not controlled and maintained properly. The required amount of water for each plant depends on what type of the plant it is. To make the plant healthy, it must be avoided from drowned of water. So, the automatic systems would watering the plant when needed are developed to overcome the problem.

Other than that, the humidity of the soil during day and night cannot be maintained. The humidity needed for the plant during day and night should be controlled in the range needed by the plants. The sufficient lighting for the plant to growth and the temperature of surrounding also cannot be controlled. This project needs to control for the lighting and detect temperature surrounding with good technology to make the system success in providing optimum condition for the plant to go and thrive.

1.3 Objective

There are several objectives need to achieve in this project:

1. To maintain the sufficient lighting for the plant to growth.
2. To detect and maintain the temperature surrounding the plant.
3. To maintain the moisture level of the soil in good state at the range needed by the plant during day and night.

1.4 Scope

The scope of the project is to build hardware and design a system for the indoor gardening which can produce plant with good quality, matured and unaffected by controlling and maintaining the plant growth. The plant used for the system is more to valuable plant like herbaceous plant, which is can be used for medicinal use like Orthosiphon Stamineus, Phaleria Macrocarpa and Andrographis paniculata.

The systems are using Arduino Uno as the controller to control the system of the Smart Indoor Gardening System via PID Control Scheme.

The systems are using the fan and the AC bulb as the control element. The fan are circulated the air and maintain the temperature surrounding the plants. The AC bulb is used to ensure the plant get enough intensity of light.

There are three types of sensor used in this system which is soil moisture sensor, LM35 temperature sensor and LDR sensor. The moisture sensor will detect the moisture level of the soil. The LM35 temperature sensor will detect the temperature surrounding and optimizing it to the value suitable for plant. The LDR sensor will detect the presence of light and control the intensity of light needed by the plant.

1.5 Report Outline

This report is organized into six chapters and the outline of each chapter is explained briefly as follows.

In chapter 1, the objectives, project advantages, problem statement and scope of the project is discusses in the introduction.

For chapter 2, the idea for the project and all theoretical are explained in the literature review.

In chapter 3, the methodology of the project described. In this chapter shows the planning of project implementation. This chapter also explains in detail the methods that have being selected.

At Chapter 4, the development process for the project was explained. This chapter also will show the equipment involve to accomplish this project.

Chapter 5 is the project result. This chapter consists of discussion and analysis of the project results.

The last chapter is chapter 6, conclusion for the project. The whole project was summarized in this chapter. Some additional idea is discussed to implement in the actual field and for improvement in the future.

CHAPTER 2

LITERATURE REVIEW

At this chapter, all components and all information that involve in the Smart Indoor Gardening System via PID Control Scheme are described. This project is controlled by the Arduino Uno to provide optimum condition for the plant to grow and thrive. This chapter reviews existing project created to get an idea about the specification, project design, conception and any information that related to this project. The flow of the system is based on the reviews made from existing project and the previous project.

2.1 The Type Of Plant

The Smart Indoor Gardening System developed to help the planter produce plant with good quality, matured and unaffected. The plant used for the system is more to valuable plant like a herbaceous plant, which is can be used for medicinal use. There are several types of plant used for the system test on which is Orthosiphon Stamineus, Phaleria Macrocarpa and Andrographis paniculata.

2.1.1 Orthosiphon Stamineus

The Orthosiphon Stamineus are also known as “Misai Kucing”. This plant is a traditional herb and can be distinguished by its white or purple color flower that resembles cat whiskers. It is widely grown in tropical areas [1].

The characteristic of the plant is it can grow up to height of 1.5m. The leaf arranged in opposite pairs and the petiole is relatively short, about 0.3cm in length. The flowers are borne on verticals about 16cm in length and white bluish in colour. The flowers are about 6.2m in length with very irregular flower symmetry and it is a hermaphrodite in nature. There are two calyx lobes, which are measuring about 6mm in length, greenish red in color and the other one entire, both covered with minute white hairs [2]. Figure 2.1 show the Orthosiphon Stamineus.

Figure 2.1: Orthosiphon Stamineus [1]

2.1.2 Phaleria Macrocarpa

The Phaleria Macrocarpa is a dense evergreen tree. It is also known as “Mahkota Dewa”. It thrives in loose and fertile soil. The characteristic of this plant is this chronic shrub grows up to 2.5m tall, round its trunk, it is brown in colour, the surface is rough, single leaf, short-stemmed and located opposite. The flower lying scattered on the stems

or leaves armpits, tube shape, small, white and come out throughout the year. The fruit are 3 to 5 cm in diameter, smooth, grooved, and round in shape. The seeds is round, brown and hard.

Parts of plant used as medicine are the leaves and fruit leather. The skin of the fruit and the leaves can be used dried or fresh, while the flesh of the fruit is used after drying it [3]. Figure 2.2 show the Phaleria Macrocarpa.

Figure 2.2 : Phaleria Macrocarpa [3]

2.1.3 Andrographis Paniculata

The Andrographis paniculata is an annual herbaceous plant and also known as "Hempedu Bumi". It is extremely bitter in taste in all part of the plant body. It can grow up to 60 to 70 cm. The stems are quadrangular and the leaf is green in color, glabrous, simple and decussately arranged with entire margins. As the plant matures, the leaf size is reduced [4].

This plant will start issuing new branch in 2 to 3 weeks after planning. The flower will start out at age 6 to 8 weeks after planting, followed by the formation of pods 10 weeks after planting. Figure 2.3 show the Andrographis paniculata.

Figure 2.3 : Andrographis paniculata [4]

2.2 The Applications Of Indoor Gardening

Indoor gardening is the practice of cultivating the plants and growing up the plant as part of the horticulture. For this project, it is created by combining the DC water pump, the fan, the AC bulb, the soil moisture sensor, the LDR sensor and the LM35 temperature sensor. There are two types of indoor gardening which is forced air circulation for indoor gardening and without forced air circulation for indoor gardening

2.2.1 Forced Air Circulation For Indoor Gardening

This type of indoor gardening use exhaust fan to gives a uniform temperature surrounding the plants. The temperature can be constant and meet the requirement of the plants. The fan circulated the air inside the cage when it detect the temperature surrounding is higher than the level required for the plants to grow and thrive. Figure 2.4 show the forced air circulation for indoor gardening.

Figure 2.4: Forced air circulation for indoor gardening

2.2.2 Without Forced Air Circulation For Indoor Gardening

This type of indoor gardening is different than the type of indoor gardening with forced air circulation because it don't use fan inside it. The air inside is circulated by convection. There are holes at the surround of the cage for indoor gardening as the air source from the outside of the case. The cages protect the plant from rain and straight directly exposed to the sunlight. The temperature surrounding the plant cannot be control and the air flow naturally inside the cage without help of forced air. Figure 2.5 shows the without forced air circulation for indoor gardening.