Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF SMART GARDEN BY USING ARDUINO

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Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours

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A project report submitted in partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours

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I declare that this project report entitled “Development of Smart Garden by using Arduino” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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DEDICATION

I dedicate this project to my beloved parents for providing all the support and assistance that have made possible the fruition of our efforts. They have never given up and will always be remembered in this heart.

Next, I dedicate this project to my supervisor lecturer for all support and give full cooperation during Final Year Project. Your patience, knowledge, and words of encouragement gave me immense strength throughout the project.

Then, to all my friend's thanks for their cooperation, advice, motivation, and support while conducting the Final Year Project

To all lecturer, thank you for all their moral guidance and support during all this semester in Universiti Teknikal Malaysia Melaka

ABSTRACT

In today's technologically advanced era, several industries, particularly agriculture and horticulture, have risen in size over time. We can see clearly that entrepreneurs seeking to start a firm will undoubtedly focus on the tree planting sector, since it is capable of producing raw materials such as fruits, herbs, and medicines, as well as timber. As a result, everyone working in agriculture almost certainly has a crop irrigation system. This method is critical for maintaining the freshness and safety of the crops. This is because plants, like living organisms, require water to exist. Plants will grow if we water them on a regular basis, in the proper manner, and at the appropriate time. Additionally, by referencing unpredictable meteorological elements such as high heat, the concept of switching light sources for crops becomes more plausible. With that, the project addresses how to advance the newest smart garden technology in terms of automatically constructing water systems based on soil moisture and switching the light source for trees from sunshine to LED lighting. The system will thereafter be totally powered by solar energy, maximising electricity savings. The project will incorporate both software and hardware components. The programme will use Arduino to communicate with the hardware that will be tested on the crop.

ABSTRAK

Pada era teknologi yang maju sekarang ini, beberapa industri, khususnya pertanian dan hortikultur, telah meningkat dari masa ke masa. Kita dapat melihat dengan jelas bahawa pengusaha yang ingin memulakan sebuah syarikat pasti akan fokus pada sektor penanaman pokok, kerana ia mampu menghasilkan bahan mentah seperti buah, herba, dan ubat-ubatan, serta kayu. Hasilnya, setiap orang yang bekerja di pertanian hampir pasti mempunyai sistem pengairan tanaman. Kaedah ini sangat penting untuk menjaga kesegaran dan keselamatan tanaman. Ini kerana tumbuhan, seperti organisma hidup, memerlukan air untuk wujud. Tumbuhan akan tumbuh jika kita menyiramnya secara berkala, dengan cara yang betul, dan pada waktu yang sesuai. Selain itu, dengan merujuk unsur meteorologi yang tidak dapat diramalkan seperti panas tinggi, konsep menukar sumber cahaya untuk tanaman menjadi lebih masuk akal. Dengan itu, projek ini membahas bagaimana untuk memajukan teknologi taman pintar terbaru dari segi membina sistem air secara automatik berdasarkan kelembapan tanah dan menukar sumber cahaya untuk pokok dari cahaya matahari ke pencahayaan LED. Sistem ini akan dikuasakan sepenuhnya oleh tenaga suria, memaksimumkan penjimatan elektrik. Projek ini akan merangkumi kedua-dua komponen perisian dan perkakasan. Program ini akan menggunakan Arduino untuk berkomunikasi dengan perkakasan yang akan diuji pada tanaman.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter, we will describe information regarding the use of tree plant technology, the basics of Arduino, project background, project problem statement, objectives to be found in this project, project scope, and thesis organization.

1.1 Background of Project

It is not as simple as one might imagine to create a plant. Heat, soil moisture, the demand for irradiation or the intensity of light employed, and other elements all have an effect on the growth of the plant. Numerous scientists are now working on more advanced agricultural technology systems as a result of this. One of the devices in use is electronic technology. A Smart Garden system, which is an automatic watering device that is controlled by soil moisture, is one of the most recent advancements in agricultural technology to emerge from the field of electronics. This technology is based on the soil moisture level, which means that if the soil is dry, this tool will automatically water the plants, and if the humidity is sufficient, this tool will automatically close. The development of instruments to aid and promote human work, such as guessing or measuring soil quality or plant water requirements, is one strategy to resolve this issue. Soil moisture values may be determined more accurately and efficiently with the help of this smart garden system.

The next step is to replace natural sunshine with LED lighting for plant growth. Plant light or growth light is an artificial light source. The purpose of employing electric light bulbs is to encourage the growth of plant life. With this technology, scientists want to create an electromagnetic spectrum that is favourable to photosynthesis. Growth light is utilised when natural light (sunlight) is insufficient or when more light is required. As an example, in a place that experiences winter and receives less sunshine, which is less desirable for plant growth, growth lights can be utilised to offer additional light to a plant. Research and analysis conducted by scientists and arborists has revealed that the light used on plants has specific features.

1.2 Objectives

The objective of the study in this project is to test the level of effectiveness of the way of growing and caring for crops using current technology compared to traditional crops. Therefore, the main objectives of this project are:

I. To study and verify the effectiveness of four type LED color which is red, blue, ultraviolet and white that will be used as a source in the process of tree photosynthesis.

II. To create automatic control system that can measure the parameter related to agriculture without implementation internet of things due to lack of internet affordability.

III. To verify the use of electronic technology on crops can help in terms of tree growth, efficiency in time and manpower, and affordability of the equipment or components used.

1.3 Problem Statement

Tree planting technology can improve the quality of crops which can contribute to the greenery of the environment and can also prevent plant extinction. But as we have seen, at the moment the weather is extremely erratic. Therefore, the processing of light from solar sources in the process of photosynthesis must be transformed into a more systemic and harmless mechanism for plants. Therefore, this solution can be implemented with the current lighting technology that is Light Emitted Diode (LED). The use of LED systems for lighting has actually been implemented by some gardeners or scientists but the selection of the light spectrum and inaccurate brightness makes the plants not grow or stunted. So, for solution and enlightenment, this project will study and analyze crop data using proper spectral light by creating light systems as well as related crop control systems.

1.4 Scope of Project

As various weather elements have also allowed for major changes in crops, the project will develop a control system and data collection to streamline the cropping process. First, the Arduino Nano will be chosen as the main configuration because it is capable of integrating drive components as well as controllers with easy -to -understand language chess. Therefore, there are several systems that will be controlled by this Arduino that can help the crop process, including soil moisture control system, temperature and humidity control system, plant data storage system and solar energy system. Therefore, all these systems will be set up without the use of internet technology now as smart systems crop using the internet of things. This is because to solve the lack of internet resources. Going back to all the systems in this project, in a nutshell, Arduino will programme sensors such as soil moisture sensors to detect soil moisture that will control water pump motors, temperature and humidity sensors for the purpose of controlling ventilation around crop areas, and finally as a platform for transmitter and receiver the data plant. Furthermore, a lighting system using high power LEDs without Arduino will be built as well. This project has also shifted the focus from outdoor cultivation towards indoor cultivation, where one can cultivate regardless of the space available.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter describes in more detail the previous topics and literature review related to the main system that will be used in this project, which is an irrigation system. In addition, it covers the development of smart gardens over time, the use of light types in agriculture as well as solar functions for storing energy.

2.1 Information to Smart Garden

Smart gardens may be grouped into two sections: indoor and outdoor. Plant development is impacted by a range of elements that aren't usually connected to whether the plant is inside or outside. Plants require a few essential conditions to grow. Water, nutrients, light, and carbon dioxide are all required. A human can supply water to a plant whether it is maintained inside or outside, although being outside is preferred because water is not a precious resource. The same is true of nutrition. Plants obtain their nutrients from the soil they are planted in. Thus, if a farmer prepares by planting with appropriate fertilizer, the plant should be healthy whether it is inside or outdoors. When you contemplate how big the plant will grow, you're bound to run into difficulty. Because plants require sunshine to thrive, it looks like they should be maintained outside, but if you are prepared to acquire specialized light bulbs that resemble the sun, you may keep the plant indoors. Plants can also be stored near a window, but keep in mind that the sun may not shine through the glass all day. Finally, plants require carbon dioxide, a gas found in the environment, to grow. While carbon dioxide

may be found everywhere, it is more concentrated inside dwellings than outside. This is because humans create carbon dioxide by breathing, and much of it is confined indoors.

2.1.1 Type of Smart Garden

The most prevalent smart garden-related primary system presently is irrigation. There are several variations or ways to regulate the water via mechanical or electrical systems to feed the plant. The reason why the irrigation system has to be monitored is because it avoids water waste and wants to maintain the soil's sustained wetness, so that the plants may develop extremely healthily. According to (Al-Omary, AlSabbagh and Al-Rizzo, 2018), garden irrigation may be converted from manual and static to smart and dynamic by automating the monitoring process. This results in better comfort, more efficient water consumption, and less human oversight. Soil moisture can modify the watering requirements of a plant. Measuring plant soil moisture tells you if the plant is appropriately watered, overwatered, or underwatered.

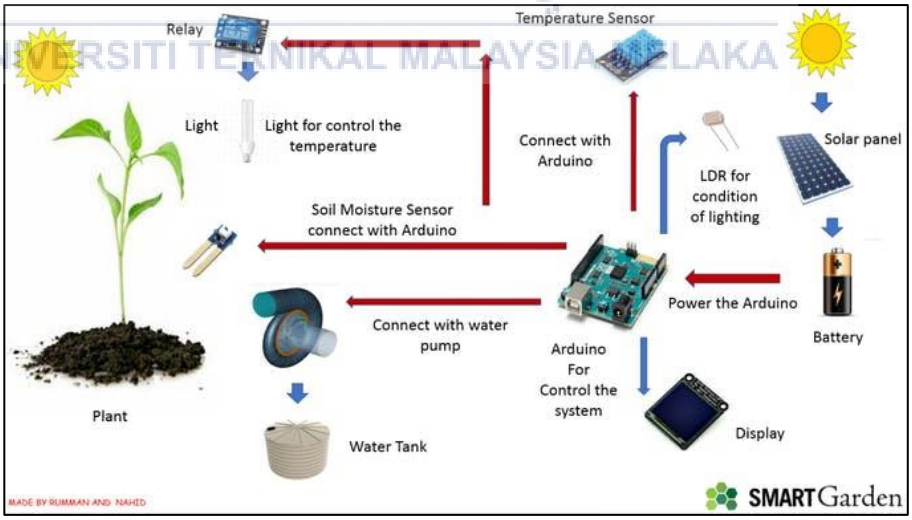

Figure 2.1: Conventional System of Smart Garden

2.2 Light of LED Imitate from Sunlight in Agriculture

Light supplementation can enhance agricultural productivity by increasing photosynthesis and plant development. On the other hand, high energy costs associated with light supplementation are a key barrier restricting the growth and advancement of controlled-environment farming. LEDs are a promising technology with huge promise for improving irradiance efficiency and replacing traditional horticulture lighting. LEDs provide notable benefits over traditional crop light sources (e.g. high-pressure sodium lamps and metal halide lamps), such as compact size, extended life and high photoelectric conversion efficiency,(Bian *et al.*, 2018).

2.2.1 Introduction to Light Emitting Diode (LED)

In 1962, Nick Holonyak Jr. ("the father of a diode of light-emitting") designed the first LED which, while at General Electric, created visible red light. The term "LED" refers to a light source that generates light when current flows through a semiconductor. Electrons recombine with electron holes in the semiconductor to emit energy in the form of photons. The energy required for electrons to pass the semiconductor band gap determines the hue of light (equivalent to photon energy). White light is produced by combining numerous semiconductors or by coating the semiconductor with a phosphorous layer. The early LEDs were discovered to emit very little infrared (IR) light. Convenient electrical components are available. Remote control circuits employ infrared LEDs, similar to those used in a broad variety of consumer gadgets. The original visible-light LEDs were low-intensity and confined to the colour red. Modern LEDs are available in the visible, ultraviolet (UV), and infrared spectrums.

2.2.2 Grow Light

The Russian botanist, Andrei Famintsyn, used artificial light for plant cultivation and study (1868). His dedication to photosynthesis and metabolism. He was the first to employ artificial light to cultivate and investigate plants (1868). Famintsyn proved that plant conversion and starch production may occur under artificial illumination. Definition Growth Light is an artificial light type used to stimulate plant development. Growing lights either strive to duplicate the sun's light spectrum or have a spectrum better suited to the demands of the plants being grown. Changing the growing light's hue, temperature, and spectrum emissions, as well as the lamp intensity, replicates outdoor circumstances. Certain spectrum ranges, luminous efficiency and colour temperature are ideal for usage in specific plants and periods based on the type of plant being cultivated, the stage of culture (e.g., germination/vegetative or flowering/fruiting phase) and the photoperiod required by the plants.

2.2.3 Color Spectrum of Sunlight

(Pavlis, 2017) , Plants are genetically wired to develop in the presence of white or yellowish-white light, which humans characterize as sunshine. This light seems white because it includes all of the colours of the rainbow, and when the colours of the rainbow are mixed, the result is the colour of white. A colour spectrum is a graphical depiction of all of the colours that may be seen while light is shining. In science, hues are referred to by wavelength numbers rather than names because it is a far more precise way of quantifying the colors. For example, the wavelength of a red colour might be 630 or 660 nanometers. Although both of these appear to be red to us, they are not.

When using fluorescent bulbs in a growing light, the hue of the bulb is referred to as cold white (which contains bluer) or warm white (which contains less blue) (which contains redder). However, although this was effective for fluorescent lights, it did not work as well for LED lights. When discussing LEDs, it is more appropriate to utilize wavelengths and represent the full colour spectrum rather than just the visible spectrum.

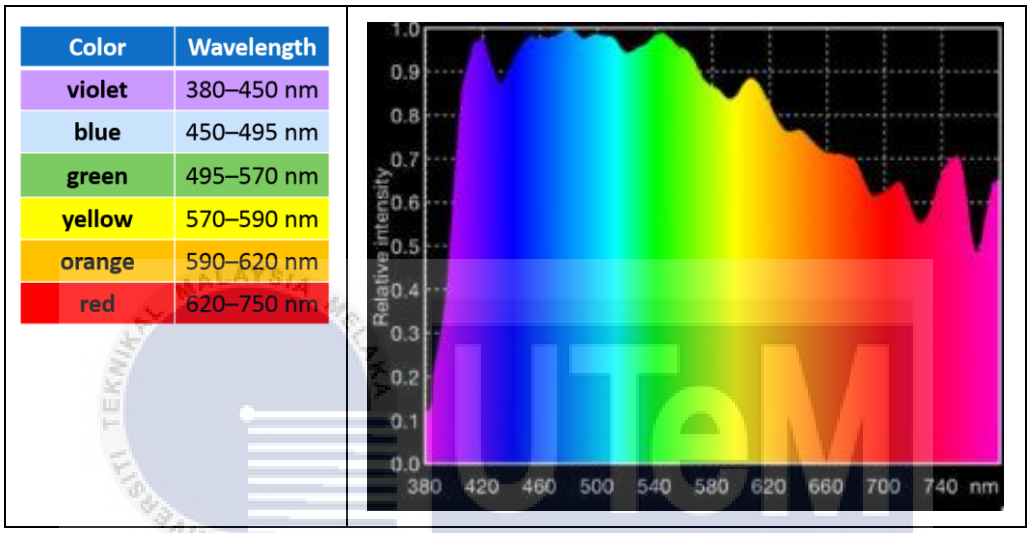

Figure 2.2: The color spectrum contains in sunlight

2.2.4 Theory to Choose Best Color Spectrum for Plants

Based (Pavlis, 2017) also, plants are mostly utilised for photosynthesis, which is accomplished via the use of light, and certain chemicals are produced in the leaves. Chlorophyll A and B are only a few examples of the most significant compounds in the environment. There are distinct spikes in the blue and red portions of the absorption spectrum (which measures how much light is absorbed), indicating that these colours will be used for photosynthesis. Almost no light is absorbed in the green wavelength band. Thus, the incorrect conclusion was reached that only blue and red lights are required by plants.