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Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

DEVELOPMENT OF SMART GARDENING BY USING MICROCONTROLLER

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A project report submitted in partial fulfillment of the requirements for the degree of Bachelor of Electronics Engineering Technology with Honours



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I declare that this project report entitled "DEVELOPMENT OF SMRAT GARDENING SYSTEM BY USING MICROCONTROLLER" 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.



APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

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DEDICATION

This report is dedicated to my beloved parents and family member, thank you for showering me with your continuous love and devotion. It will always be remembered and kept in my heart. They always support me through thick and thin throughout the process of completing this report. Next, to my Supervisor, thank you for all the knowledge and support. Your patience, support and words of encouragement gave me enormous strength throughout the whole project. Then, to my seniors, my bestfriends and fellow friends, thank you for offering guidance and directions when I am at also lost the advice, support and motivations for the start of this project until the end of the project.



ABSTRACT

This project is proposed to build an automatic crop management system using ESP32. The idea to develop this prototype was because of the problems faced by many individuals who love farming, and there is no time to take care of the crop regularly. This matter is raised because the plant needs careful care to ensure that the plant is always healthy. Apart from this, this can also implement the project on a large scale, such as farm care which can help farmers reduce labor costs. That is why the idea arose to develop this automated system. The first objective is to build a prototype of the project. Within this system, there are several systems used to build a complete system. The first system is to control the irrigation system, where the plants will be watered periodically according to the rate of soil moisture or according to a set time to water the plants. The second system is the humidity control system, where the plant will be placed indoors and can cause fungus to form on the plant to tone a vent hole that can be opened and closed automatically. This system uses the Internet of Things (IoT) to link the data to the smartphone application. We can monitor all the data taken by the sensor to ensure that the system is running well, as we need to ensure the plant is in good condition. Overall, From this project it can be concluded that the use of greenhouses can reduce the observation of soil moisture and ambient temperature manually by 40%. For the conclusion, this Smart Garden can be run smoothly and give a excellent result for the plant growth but still need some improvement.

ABSTRAK

Projek ini dicadangkan untuk membina sistem pengurusan tanaman automatik menggunakan ESP32. Idea untuk mengembangkan prototaip ini adalah kerana masalah yang dihadapi oleh banyak individu yang gemar bertani, dan tidak ada masa untuk mengurus tanaman secara teratur. Perkara ini dibangkitkan kerana tanaman memerlukan penjagaan yang rapi untuk memastikan tanaman itu sentiasa sihat. Projek juga dapat dilaksanakan dalam skala besar, seperti penjagaan ladang yang dapat membantu petani mengurangkan kos buruh. Itulah sebabnya timbul idea untuk mengembangkan sistem automatik ini. Di dalam sistem ini, terdapat beberapa sistem yang digunakan untuk membina sistem yang lengkap. Sistem pertama adalah mengendalikan sistem pengairan, di mana tanaman akan disiram secara berkala mengikut kadar kelembapan tanah atau sesuai dengan waktu yang ditentukan untuk menyiram tanaman. Sistem kedua adalah sistem kawalan kelembapan, di mana tanaman akan ditempatkan di halaman rumah dan boleh menyebabkan kulat terbentuk di tanaman untuk menanganimasalah tersebut ia memerlukan satu lubang udara yang dapat dibuka dan ditutup secara automatik. Sistem ini menggunakan Internet of Things (IoT) untuk menghubungkan data ke aplikasi telefon pintar. Kami dapat memantau semua data yang diambil oleh sensor untuk memastikan sistem berjalan dengan baik, kerana kami perlu memastikan loji dalam keadaan baik. Idea ini muncul ketika saya melihat projek rumah pintar automasi di mana telefon pintar dapat mengawal setiap perkakas rumah dengan menggunakan telefon pintar. Secara keseluruhan, fungsi keseluruhan sistem telah diuji secara meluas dan dikatakan berjaya.

ACKNOWLEDGEMENTS

In the name Allah SWT, the Most Merciful and the Most Gracious. Alhamdulillah and thanks to Allah SWT for giving me this opportunity to complete this project report. I want to thank all my family members for their continuous support and encouragement. On top of that, I would love to express my appreciation to my dedicated project Supervisor and Co-supervisor, Madam Rozilawati Binti Mohd Nor for the patience, guidance, support, advice, ideas, suggestions, and comments the project may not be the same as it is supposed to be throughout my Bachelor Degree Project (BDP) journey. May Allah SWT bless sir and madam and repay your both kindnesses. Lastly, I would like to thank all my friends for their endless support and teach in many ways. Their compassionate action is most valued when I was in this awful time. The gift of Allah SWT, unforgettable, to bless me with infinite knowledge, experience, and confidence to meet these amazing people in my life by going through this journey. I firmly believe this may be the breakthrough of my next life journey.

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LIST OF SYMBOLS

- l Litre
- °C Degree Celcius
- A Ampere
- % Percentage
- Cm Centimetre
- m Meter



LIST OF ABBREVIATIONS

| V | - Voltage |
|--------|---|
| IoT | - Internet of Things |
| DHT22 | - Digital-output relative humidity & temperature sensor |
| TCP/IP | - Transmission Control Protocol/Internet Protocol |
| SMS | - Short Message Service |
| GSM | - Short Messaging Service |
| LED | - Light Emitting Diode |
| NFT | Nutrient Film Technique |
| DC | - Direct Current |
| PA | - Precision Agriculture |
| MCU | - Microcontroller unit |
| GPRS | اونیوم سینی نیدGeneral Packet Radio Service مارك |
| WSN | - Wireless Sensor Networks |
| PVC | - Polyvinyl Chloride |
| EBB | - Flood and Drain |
| HTTP | - Hypertext Transfer Protocol |

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CHAPTER 1

INTRODUCTION

1.1 Background

In modern environment, automation is king. It is a method of monitoring and controlling basic parameters of daily life using computers or mobile phones. The practise of using automation for simple tasks will improve the standard of our lives. We develop sensors that communicate with each other using the Internet of Things (IoT) concept, which is extremely useful in automation. This prototype is significant in that it saves money while also ensuring safety.

Maintaining a garden is a time-consuming and laborious effort in and of itself on top of that, watering plants with little waste has become a must to reduce energy usage and conserve water. Garden automation is required in order to gain a stronger feeling of aesthetics and a breath of fresh air without having to be a propagator.(Bhadra and Chakraborty, 2020)

People were cautious in their early stages of trying to make plantings and set up their own garden. Plants are gradually being destroyed as a result of a lack of maintenance. This prototype will assist people in monitoring parameters and ensuring garden maintenance. It is an important component of the ecosystem and a good plant companion. The Internet of Things (IoT) offers solutions to a variety of problems by allowing things to be sensed and controlled remotely in network infrastructure.

IoT refers to a network of items or entities that can communicate with one another through the Internet. Things are predicted to become active participants in the fields of business, social processes, information, and communication by utilising IOT. They must be able to interact with the environment as well as communicate with one another while exchanging and altering environmental data and information. The mechanisms that develop services and initiate activities, with or without human participation, have an automatic influence on it.(Thamaraimanalan *et al.*, 2018).

1.2 Problem Statement

ALAYS

There are a few challenges that may occur for those who enjoy and are interested in gardening. They want to take care of their plants in order for them to grow up. However, they are unable to do so in specific situations. For example, some employees must travel to an outstation for a few days or weeks, preventing them from caring for the plants and flushing them.

They also have a hard time keeping track of their plants' health. When they can monitor, the plant can grow and produce greater, especially plants that require monitoring 24 hours a day, seven days a week, such as strawberry farms, grass farms, and vegetable farms. If they are unable to monitor, the plant may become withered or die.

If they are unable to monitor, the plant may become withered or die. The plant can monitor at any time and from any location with this technology. The plant's data will be sent to the internet's IoT cloud. This device also has the ability to rinse the plant when the soil becomes dry and open the window when the humidity level is low.

1.3 Project Objective

- 1. To develop an automated garden prototype by using Microcontroller
- 2. To design the monitoring garden system by use IOT.
- 3. To analyses the performance of the proposed method of smart garden system.

1.4 Scope of Project

This project is special for the implementation of an automated system for plants or gardens in the home area. It uses an ESP32 microconroller to run this automatic system. the creation of this project it will use several sensors that complement the automated system in this project. The sensors that will be used are soil moisture sensor, humidity sensor, ultrasonic sensor.

The soil moisture sensor function is to measure soil moisture grace to the changes in the electrical conductivity of the earth and the electrical resistance is measured between the two electrodes of the sensor. After that, humidity sensor that have being use in this project is DHT-22 (also known as the AM2302) is a temperature, relative humidity, and digital output sensor. It measures the ambient air with a capacitive humidity sensor and a thermistor and outputs a digital signal to the data pin. Next is ultrasonic sensor(HC-SR04) is a module that employs ultrasound is known as an ultrasonic sensor. Ultrasounds can be used to detect presence or estimate distance. It uses the trig terminals to transmit an ultrasonic pulse and his echo terminals to receive it. This automatic system focuses on ensuring that the plant are always watered as needed, fertilizer can be applied at the right time and can control the presence of pests.

In addition, this automated project will provide a monitoring system for humans to check the condition of the plant as well as be able to control all systems just by using IOT method. In the ESP32 it self already install the build in the Wifi module. So it does not need to add on another external Wifi module.

To operate this system the ESP32 will be connected to the wifi module where our arduino is required to set a fixed wifi into the ESP32. while for smart phones it works to control the system so as long as it has internet data it will be able to be controlled no matter where we are in the world as long as the wifi connection is still connected.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Chapter 2 discussed the overview of smart garden by using ESP32 and IoT. The past research related to the garden technology. This study aims to design the implementation of smart garden that able to solve the plantation problem. The benefits and disadvantages of the previous research were also compared in this project. The literature review examines the source and justifies the statement with evidence of research or study in related fields, respectively.

2.2 History Agriculture

Agriculture, commonly known as farming, is the process of producing and harvesting plants and animals in order to produce food, fibre, animal feed, and other items. Agriculture is practised all around the globe. From the clothing we put on in the morning to the blankets we sleep beneath at night, agricultural goods are used on a daily basis. Think of the five F's when you think about agriculture: food, fabric, forestry, farming, and flowers. (Asouti, 2013)



Figure 2.1: Map showing the locations of select early PPN sites in South-west Asia (Asouti, 2013)

Agriculture's origins can be traced back to the Fertile Crescent. The Syrian Desert to the south and the Anatolian Plateau to the north divide this region of Western Asia, which includes Mesopotamia and the Levant. In the early twentieth century, The nickname "Fertile Crescent" was coined by University of Chicago archaeologist James Henry Breasted to emphasise this location's importance as the origin of agriculture. It's also been dubbed the "Cradle of Civilization" because it was where the wheel and writing first arose. The Fertile Crescent is found in modern Turkey, Iran, Iraq, Syria, Lebanon, Israel, Jordan, and the Palestinian territories.(Fuller and Stevens, 2019)

During the Neolithic era, or the New Stone Age, humans invented agriculture between 7,000 and 10,000 years ago. Emmer wheat, einkorn wheat, peas, lentils, bitter vetch, hulled barley, chickpeas, and flax were the eight Neolithic crops. With the invention of metal implements, the Neolithic age came to an end(Salavert, 2017).

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Irrigation appears to have initially appeared in Egypt and Mesopotamia around the fourth millennium B.C., according to evidence. Floods triggered by the Nile's regular inundation would have wreaked havoc on ancient farmers, destroying dikes and flooding farms. When the water level was low, the land dried up, killing the crops. Man-made underground streams, known as qanats, were the first type of irrigation, and it is still utilised in parts of the Middle East today. To help manage the flow of rivers like the Nile River in Egypt, several groups of people began digging and restoring previous, more primitive canal networks. The canal networks evolved into complex irrigation systems over time.

Agriculture's history has played a significant part in human civilization. Agriculture used to employ the bulk of the human population, and few, if any, humans could exist without it now(Orlovskii, 2003).

2.3 Type of Gardening System

Gardening, which is the process of nurturing and maintaining for plants, is included in landscaping. Root vegetables, leaf vegetables, fruits, and herbs are grown for their flowers, foliage, or general appearance in gardens; utilitarian plants, such as root vegetables, leaf vegetables, fruits, and herbs, are grown for eating, colouring, or medicinal or cosmetic uses.

There have some of the method of the gardening that be use. One of the most latest technology is hyroponic system technology. Hydroponics is a rising trend in plant cultivation that uses a nutrient-rich solution with a water base rather than soil. Peat moss, clay pellets, perlite, and rockwool are used to support plant roots instead. There are hundreds of different types of hydroponic systems to select from when it comes to growing plants. However, there are only six categories of hydroponic systems that all varieties are categorized under.



Figure 2.2: Installation Of Growick Irrigation System (Inonu Et Al., 2021)

The wick system comes first. This is the simplest type of hydroponic system for growing plants, and almost anyone can use it. The wick system does not have any aerators, pumps, or electricity. It is the only hydroponic system that does not require the use of electricity. In the vast majority of wick systems, the plants are placed directly in an absorbent medium such as perlite or vermiculite. Nylon wicks are placed around the plants before they're submerged in the fertiliser solution.(Eddy *et al.*, 2019)(Inonu *et al.*, 2021)

The second type of hydroponic system is the water culture system, which is a very simple type of hydroponic system in which the plant's roots are immersed in the nutrition solution right away. The water culture method, unlike the wick approach, does not require materials to establish a barrier between the plants and the water. The oxygen required by the plants is released into the water by a diffuser or air stone. When utilising this method, keep in mind that the plants should be secured in their proper positions using net pots..(Tendencia *et al.*, 2004)

Then there's the ebb and flow system, which is another typical hydroponic method that's usually used by home gardeners. This approach involves placing the plants in a huge grow bed filled with a growth medium like rockwool or perlite. After the plants have been carefully planted,, the grow bed will be flooded with a nutrient-rich solution until the water

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Figure 2.3: Ebb And Flow Hydroponics System (Daud, Handika And Bintoro, 2018)

reaches a couple inches below the top layer of the grow media, ensuring that the solution does not overflow(Daud, Handika and Bintoro, 2018).

After that, this is the system that will be using in this project which is drip systemA drip system is a basic hydroponic system that could be quickly changed for various plant types. Making it ideal for any grower who wants to change things up frequently. A drip system's fertiliser solution is pumped into a tube that leads to the plant's roots system. The amount of fluid injected into the plant is controlled by a drip emitter situated at the base of each tube. You may adjust the flow to meet the requirements of each plant individually.(Sharu and Ab Razak, 2020).



Figure 2.4: Drip Irrigation System(Sharu And Ab Razak, 2020)

Next is N.F.T. system that has a basic architecture, yet it is frequently utilised due to its ability to scale to a wide range of applications. The nutrition solution is deposited into a big reservoir when you utilise one of these systems. Last method is Aeroponic systems that are simple to understand but challenging to constructUsing this technology, the plants you would like to grow will be suspended in the air. Below the plants, there are a few of mist nozzles



Many individuals regard gardening to be a relaxing hobby. There have also been several research on the beneficial impacts of gardening on mental and physical health.Gardening, in particular, is supposed to boost self-esteem and relieve stress. One's garden might become a "little haven to unwind and replenish [one's] batteries," as writer and former teacher Sarah Biddle puts

2.4 Development of Smart garden

From the first project that was reviewed, this study seek to discover the system of smart garden that can be use at home whether at the backyard and font yard. Based on (Alam and Benaida, 2018) In the agricultural sector, IoT technology is critical in a variety of applications. To store data in the cloud and process data outside of the device, IoT employs the Cloud-Internet communication platform.



The real challenge of the Internet of Things is to allow users to access objects more freely and flexibly from a faraway(Miramontes Meza, Escamilla del Río and Aquino Santos, 2013). For the farming industry, it necessitated coordination and various assistance, such as local or remote data collection, intelligent information processing, and cloud-based decision making. Automation and user interfaces may also aid in the smoothing of the operations process. The agricultural sector is one of the most inefficient in the industrial chain, but IoT has the potential to revolutionise it(Ayaz *et al.*, 2019). Farm product health and quantity are linked to social health, and they can also have an influence on human stability, economic development, and national security, which are all national concerns(Ping *et al.*, 2018). A smart garden system for houses will highly help a household in this agriculture topic.

Designing an irrigation system for monitoring soil moisture using cloud computing and IoT would assist in more efficient irrigation. Cloud computing and the Internet of Things (IoT) are also in use in agriculture. Virtualization, expansion, practicality, and costeffectiveness are all benefits of Cloud Computing. With techniques such as photoacoustic electromagnetic sensors, technology "3S," and ultrasonic sensors, the Internet of Things (IoT) serves as an important supporter in ensuring intensive agriculture, high efficiency, high quality, high yield, ecological, and secure.



Figure 2.7: dominic system(Miramontes Meza, Escamilla del Río and Aquino Santos, 2013)

By developing convenient measurement technologies and soil temperature, air humidity, and moisture sensors, cloud computing and the Internet of Things have been used to develop agriculture automation. By using a smartphone to monitor the irrigation system for plants(Ojha, Misra and Raghuwanshi, 2015)(Kaewmard and Saiyod, 2014). It included a map of the land under management created using a Geographic Information System(Fourati, Chebbi and Kamoun, 2015). The information gathered through wireless communication, radio frequency recognition, IoT information sensing techniques, and automatic control was transmitted through an agricultural information cloud(-, 2013). Monitoring the quality of drinking water is one of most important IoT applications.

Sensors monitor water parameters to ensure good supply stability and reduce accidental contamination of drinking water from waste disposal. The same network was extended to monitor plant irrigation systems(Gubbi *et al.*, 2013). Using wireless sensors and specific applications, a precise irrigation control system was developed and scheduled to operate according to remote sensor data(Chaudhary, Nayse and Waghmare, 2011).



Figure 2.8: WSN Diagram(Chaudhary, Nayse And Waghmare, 2011)

crafted a waterproof and lightroom irrigation device using a camera embedded in a smartphone.Grayscale transformed data light and dark pixels based upon whether soil is wet or dry. Router nodes are used to transmit useful content that instructs the sprinkler to automatically water plants. Apps for irrigation built on smartphones

2.5 Smart Garden Development Method

The previous project method can be used efficiently in resolving the problems by improvement through the project. According to (Astutiningtyas, Nugraheni and Suyoto, 2021) IoT is one of the of the most important thing in the agriculture sector today. And based on (Alam and Benaida, 2018) IoT store data in the cloud and process data outside of the device, IoT employs the Cloud-Internet communication framework.



Figure 2.9: Block Diagram Of The Project On ('Iot Based Smart Irrigation Monitoring & Controlling System In Agriculture', 2020)

The current issue arises as a result of the community's inability to devote sufficient time to monitoring their crops in order to ensure that they continue to grow in a healthy manner.Base on ('IoT Based Smart Irrigation Monitoring & Controlling System in Agriculture', 2020) the project is run by several number of sensor that uses. Firstly, moisture sensor will have to sense the the condition of the soil whether it wet or dry. When the soil's dry level is high in such a condition, the pump will automatically turn on, and this information will be saved and stored in the free server Altair Smartcore. In the meantime, the user will receive information about the pump's status as well as information about the land's temperature and humidity, which will be obtained by the temperature and humidity sensor.

Second, the flow of water may be monitored using a water level sensor. This pump must be turned off when a particular amount of time has passed. When the pump is shut off, the moisture sensor's state and water level will be medium. The user's notification bar also displayed the notification of the pump being switched off. The user will receive additional temperature and humidity information as a result of using it. Also, from the other previous



Figure 2.10: Block Diagram (Siva Kumar, Jilani And Venkata Raman, 2015)

project that can support this by (Siva Kumar, Jilani and Venkata Raman, 2015) The aim of this project is to sense soil moisture levels and relay that information to an Arduino. If the plant's moisture level is low, the arduino will activate the motor, which will light up a certain LED, and the plant will be watered. The arduino will switch off the motor if the moisture level is high enough to provide adequate water to the plants The Arduino processor is protected by the relay, which is utilised to switch on and off the motor.

After that, mean while from (Bandekas and Kanakaris, 2018) it tell that the soil humidity sensor is one of the most significant sensors for the monitored seedbed. The water stored in the gaps between soil particles is known as soil humidity. It is also the primary determinant of the amount of water that will be provided to the seed. Precision irrigation necessitates the precise and definite delivery of water to suit the unique needs of each seed. Irrigation is influenced by soil and air temperature. Because of the watering procedure, the temperature around the seed is often lower. There are two types of soil humidity.



Figure 2.11: Flow Chart Of The Automation Software(Bandekas And Kanakaris, 2018)

measurements now available: contact-based and contact-free approaches. Direct touch with the soil is required for contact-based approaches. Capacitance sensors, heat pulse sensors, and fibre optic sensors are examples of this type of method141617. Contactless measuring techniques, such as passive microwave, synthetic aperture radars, and thermal methods181920, fall within the second group. We're utilising contact-based sensors (Picture 4) to monitor air temperature and humidity (DHT 22), as well as soil temperature and humidity (SHT10). All of these values are compared to an additional space temperature sensor (TMP 100) to ensure that our readings are accurate

2.6 Summary

Based on past studies on this smart garden system by using Arduino, it is very beneficial to humans to facilitate their affairs to take care of their crops; however, some things should be considered to upgrade this system to be better. For example, most crops were previously made using electricity from nearby houses or buildings, and then it will be a waste for a long time. So it can be upgraded with the use of solar power. Other than that, not all systems perform a complex way of care by just doing water irrigation. So it can be upgraded with the care of temperature and humidity in it. The previous project also made the crop open, so any could be exchanged using a greenhouse to be placed outdoors and prevented from pests.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will discuss project methodology and design flow for implementation of smart garden by using ESP32 microcontroller. Methods for this project provide in detail the design, overview of this project's development and procedures. It is also will attach the prototype progress to give some information about the overview of this project.

3.2 Overview of The Project

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Based on Figure 3.0, the project flow chart shown, which is separated into a few parts. The first part is to develop an automated garden prototype by using Arduino. The second part is to design the monitoring garden system by IOT do some research on what needs to be used to develop this project. The third part to analyses the performance of the method of smart garden system. In this section, all equipment will be assembled and connected to the microcontroller (ESP32).

3.2.1 Flowchart Overall Project The Implementation Smart Garden By Using ESP32 Microcontroller



Figure 3.1: Flowchart Of Overall Project The Implementation Of Smart Garden By Using ESP32 Method.
First of all, make a brief sketch of the shape we want to make and what it takes to make the project work as we outline, such as selecting electronic and electrical components such as sensors and other hardware, for example, temperature sensors and water pumps.

Then after the selection of the component items. A full sketch included with the components that have been selected is made to ensure whether it fits what we want and can operate as desired. If the sketch can be adopted, it can create a program for which it uses the C ++ programming language. The arrangement in the program must fit as we wish. If the program is operating well, we can start with the assembly of electrical and electronic hardware items following the full sketch we have made. If the process runs smoothly, it can be turned into a final product and analyzed a full report.

3.3 Project Development

3.3.1 Hardware Development:

The design of this project is built based on the use of a minimal area that can place the necessary control systems and plants in one location. This design is created on two floors that separate between the control box at the bottom and the crop at the top. Things are executed because of the suitability of something. The control box is placed at the bottom is because this protects the devices inside the box from being exposed to hot weather, which can cause the failure of the devices. while green plants are placed at the top because the plant needs sunlight to perform the process of photosynthesis, where when placed at the bottom of the sun, will be less exposed to the plant.



Figure 3.2: Front View Greenhouse



This project will use several types of components that will involve in the process making of this project. The moisture sensor, humidity and temperature sensor(DHT-11), ultrasonic sensor, water pump, DC motor, exhaust fan were included in this portion.

As we know, soil moisture sensor is function as a device that levelling the humidity of the soil. The soil moisture sensor operates in a reasonably straightforward way. The forkshaped probe, which has two exposed conductors, functions as a variable resistor (similar to a potentiometer) whose resistance varies with the amount of water in the soil. This resistance is inversely related to soil moisture, with more water in the soil resulting in better conductivity and lower resistance. Less water in the soil results in poor conductivity and more excellent resistance. The sensor generates an output voltage based on the resistance, which may estimate the moisture level by monitoring it.



Ultrasonic sensors are most commonly used in this project to level the water level in the water tank, product sensors, etc. An *ultrasonic sensor* is a device that uses sound waves to calculate the distance between a target and a barrier and has many frequencies per second. Because it is cost-effective and easy to change, ultrasonic sensing is one of the most significant ways to detect proximity and very accurate speeds. In its range, its measuring precision is efficient and constant.



Figure 3.6: Ultrasonic Sensor

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The next sensor is a temperature and humidity sensor, represented by a DHT22 model in this project. The DHT22 is a primary digital temperature and humidity sensor at a low price. It measures the surrounding air with a capacitive humidity sensor and a thermistor and outputs a digital signal on the data pin (no analog input pins needed). It is simple to use, but data collection necessitates careful timing. Acquire new data from it once every 2 seconds. Therefore sensor readings can be up to 2 seconds old when using the Adafruit

Figure 3.7: Temperature And Humidity Sensor(DHT22)

library. A 4.7K or 10K resistor is included, which you should use as a pullup from the data pin to VCC.



ESP32 is a hardware-based electronics platform that is open-source. ESP32 boards can take inputs such as a sensor light or a finger button and convert them to outputs by turning on the motor and lighting the LED. With a set of instructions on the microcontroller board, you will assert what to do to the board. This Microcontroller is a controller that already build in WiFi module so we does not need to use external wifi module to connect the wifi.You utilise the Arduino programming language (which is based on wiring) and the Arduino Software (which is based on processing) (IDE). 40 Thousands of projects, ranging from everyday objects to sophisticated scientific apparatus, have been created with Arduino throughout the years. This open-sourcing network has attracted a worldwide group of teachers, hobbyists, musicians, programmers and practitioners, who have added enormous usable information that can be of tremendous benefit both for beginners and experts.



Figure 3.8: ESP32

The exhaust fan removes odors, smoke, and moisture from the greenhouse in this project, throwing it outside for removal. The fan uses a motor to rotate the blades, drawing air out of the space. Stale, damp, or polluted air is moved through the drain out of the house. The exhaust fan operates using electricity. They can be controlled by an Arduino microcontroller connected to a temperature sensor to measure the temperature inside the greenhouse.

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Figure 3.9: Mini Exhaust Fan

Aquarium pumps exist in a variety of sizes and flow rates, as we all know. A water pump has a constant RPM, non-adjustable electric motor in its most basic version. The majority of pumps in this category spin at 1750 or 3500 RPM. Flow, not pressure, is created by the pump impeller. The restriction added by the pump head provides the real pressure inside the pump. The pressure water is pumped out of the pump and into the aquarium or filtered. The pressure required to push water from one location to another is created by the design of the head casing, motor RPM, and impeller. The amount of water a pump can move is limited by physics. A little pump will never be able to move the same amount of water as a massive pump.



Figure 3.10: 12V Water Pump

Solar panels collect and convert the sun's energy into practical electricity. Photons are emitted by the sun and travel to Earth, where they can be utilized in solar power. When photons strike a solar cell, they dislodge electrons from the atoms to which they are bound. An electrical circuit is formed when the positive and negative sides of a cell are connected to conductors, and electrons flow through, generating electricity. A solar panel comprises individual photovoltaic cells that can be connected to form a solar array. Solar cells, like semiconductors, are constructed of silicon.



Figure 3.11: Solar Panel

A charge controller, also known as a charge regulator, is a voltage and current regulator that prevents batteries from becoming overcharged. It regulates the voltage and current going to the battery from the solar panels. Because most "12 volt" panels produce around 16 to 20 volts, the batteries will be harmed by overcharging if there is no regulation. To reach full charge, most batteries require between 14 and 14.5 volts.



Figure 3.12: Charge Controller

The variable direct current (DC) output of a photovoltaic (PV) solar panel is converted into a utility frequency alternating current (AC) that can be supplied into a commercial electrical grid or used by a local, off-grid electrical network using a solar inverter. In a photovoltaic system, it is a vital balance of system (BOS) component that allows the use of standard AC-powered equipment. Maximum power point tracking and antiislanding prevention are two features that solar power converters have developed for use with photovoltaic arrays.



The LM2596 Power Supply is a DC-DC Buck Converter Step Down Module that is capable of driving a 3-A load with excellent line and load control. Fixed output voltages of 3.3 V, 5 V, and 12 V, as well as an adjustable output version, are offered. Because the LM2596 series operates at a switching frequency of 150kHz, smaller filter components can be used than with lower frequency switching regulators.



Figure 3.14: Plant Grow light(RGB Led)

LEDs can produce both white and coloured light. Multiple hues are combined together to generate white light (which is used for general lighting). A mixture of blue (B), green (G), red (R), ultraviolet (UV), and yellow (Y) can be used (Y). A phosphor substance placed on LEDs is used to convert the colours. The phosphor substance absorbs energy of short wavelengths () and emits it at longer wavelengths during the conversion process. The light emitted by LEDs is narrow, which reduces light pollution. Another amazing advantage of LED colour emission is the ability to generate or change the composition (colour tuning) for specific plant responses. LEDs may emit wavelengths ranging from 250 nanometers (UV) to 1,000 nanometers (infrared) or more, which is referred to as light quality and is associated with photosynthetically active radiation (PAR). Wavelengths between 400 and 700 nm are thought to be the best for plants. Most plants, however, optimise the wavelengths of 440 (B), 660 (R), and 730 (FR). The production of chlorophyll is increased by blue light, resulting in healthier vegetation. Long-day plants benefit from red and far-red light because it promotes growth and flowering during short-day conditions.

3.4 Monitoring System Development

3.4.1 Flowchart Design The Soil Moisture Sensor



Figure 3.15: Flowchart Design The Soil Moisture Sensor

Based on the flow chart in figure 3.5, the system is started with the code already defined in the program. This flow chart focuses on the processes in a type of sensor called a soil moisture sensor. This sensor is intended to determine the soil moisture, whether it is dry or moist. This sensor is connected to the water pump, where if the soil humidity is less, the pump will run to pump the water in the storage tank and continue to flow through the pipe and go to the nozzle. The function of the nozzle is to distribute water evenly over the plants contained in it.

First of all, when the system is turned on automatically, the program will run asset, so from the flow chart, the first step that has been set for the soil moisture sensor is to determine whether, at that point, the soil moisture rate is less. If the sensor finds that the soil humidity level is high, then the water pump will be in its original state where the water pump makes no changes.

But if the sensor finds the soil moisture rate at that point in less time, the system will send a signal to the microcontroller to activate the water pump, and the water pump will pump water from the storage tank to the plant through the nozzle. The water pump will continue to run until the moisture sensor gets a high reading for the soil moisture rate, and the water pump will stop operating. Then the smartphone will display all the data read by the sensor via Wi-Fi (IoT technology). The data to be displayed is the soil moisture rate at the time the water pump is operating.

3.4.2 Flowchart Design The Temperature Sensor



Figure 3.16: Flowchart Design The Temperature Sensor

Based on the flow chart in figure 3.6, the system is started with the code already defined in the program. This flow chart focuses on processes in a type of sensor called a temperature sensor. This sensor works to measure the rate of temperature found in an area, as in this project measures the temperature in the greenhouse. This temperature sensor is connected to the exhaust fan. The function of the exhaust fan is to suck out the hot heat present in the greenhouse up to the ideal temperature level.

First of all, when the system is turned on, automatically the program will run as predefined, as shown in the flow chart of figure 3.6. if the system is operating, the temperature sensor will measure the rate of temperature found in the greenhouse. If the temperature in the greenhouse is low and still within the desired level, then the exhaust fan will remain in its original state.

While if the temperature sensor finds that the temperature exceeds the predetermined limit, the sensor will send a signal to the microcontroller to activate the exhaust and inhale the hot air present in the greenhouse. The fan will continue to operate until the sensor gets a low reading. If the temperature sensor gets a standard lesson, the exhaust fan will stop running. The smartphone will display the data read by the temperature sensor on the smartphone via Wi-Fi.

3.4.3 Flowchart Design for LDR Sensor



Figure 3.17: Flowchart Design For LDR Sensor

Based on the flow chart in figure 3.7, the system is started with the code already defined in the program. This flow chart focuses on processes in a type of sensor called a LDR sensor. This sensor works to measure the rate of light intensity found in an area, as in this project measures the light intensity in the greenhouse. This LDR sensor is connected to the RGB Led. The function of the RGB Led is to Light up at the night to represent as a sun at the night

First of all, when the system is turned on, automatically the program will run as predefined, as shown in the flow chart of figure 3.7. if the system is operating, the LDR sensor will measure the rate of light intensity found in the greenhouse. If the light intensity in the greenhouse is low and still within the desired level, then the RGB Led will remain in its original state.

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While if the LDR sensor finds that the light intensity exceeds the predetermined limit, the sensor will send a signal to the microcontroller to activate the RBG Led to light up. The RGB will continue to operate until the sensor gets a low reading. If the LDR sensor gets a standard lesson, the RBG Led will turn off.

3.5 Software requirement

This software application plays a significant role in achieving the intended outcome. This initiative comprises software for controlling and monitoring, which may include Arduino IDE. Multiple tools were available to model and execute this project. The features of the Arduino are further described in this section of the software development for this project. The software is Arduino IDE, Arduino is an open-source framework for developing a project that includes electronic components that must be programmed and run to complete the project



Figure 3.18: Interface Of Software Arduino IDE

After that the application that will be use is Blynk application. Blynk was created with the Internet of Things in mind. It has the ability to manage hardware remotely, show sensor data, store data, visualise it, and perform a variety of other fascinating things. Blynk app alow us to create our own interfaces of the project using viriaty of widget that provided. Then the blynk server is responsible as a communication between the smartphone and our hardware. Its was open source, easily to handle thousand of devices and can even run in raspberry Pi. Blynk libraries is for all popular hardware platform just like DHT22, Soil Moisture sensor that use in this project it anable to communicate with the server and process all the incoming and outcoming commands.



Figure 3.19: Interface Of Blynk Application

3.6 Summary

This project will focus on two-semester project planning, with the first and second semesters focused on project growth, at the conclusion of this methodology chapter. Project presentation, literature analysis, and methodology must all be included in the plan preparation. The establishment of the project will entail the development of software and hardware equipment, as well as an evaluation of the results collected in order to execute and achieve the project's goal. The project's outcome will be discussed in further detail in the following chapter. This chapter, according to previous studies, also presents an idea for using the following techniques, such as software, hardware, and controller types. This chapter also provides an overview of the similarities and differences across the various project entries. The following section will cover all methods for analyzing, mythologizing, and designing and implementing projects.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

The predicted findings of watching the experiments and assessments of the relevant procedures will be presented in this chapter. The software implementation for this project will be more comprehensive in relation to the hardware implementation. The projected findings and outcomes should still be compatible with the project's objectives in the preceding sections after a brief study and experimentation on the suggested system and programme.

4.2 **Project Development**

Based on figure 4.1, this simulation was made using Fritzing software. This software will create a simulation of a circuit that is used to replace the original circuit. The diagram shows an ESP32, a soil moisture, LDR sensor, DHT22 sensor, Ultrasonic sensor, water Pump, Fan and RGB light. In this circuit it was just a simulation to run the automation system. This project is start with a mini prototype using a small box to represent the entire greenhouse in the development phase focused on hardware. The primary device part, such the ESP32 controller, soil moisture sensor, DHT22 sensor, Ultrasonic sensor LDR sensor and the relay, tested functionality. This project is a imed to make the greenhouse run smoother based on the command at already setup.



Figure 4.1: Fritzing Simulation

Figure 4.2 and 4.3 show that the actual circuit that already installed in the control box. Where in that box the cable management is already done and some upgrade already done just like add on step down module to convert 12v battery supply to 5v to ESP32 controller. After that in that box we already at on a solar charger because in this project solar



panel is as a main supply to the system to run for the all day and I use 12v rechargeable battery a backup at the night to run the system. At a day the system will be run fully with solar panel supply then the solar panel will recharge the battery till it full to run at the night.



Figure 4.3: control system

The system is divided into several parts. the first system is an automatic watering system that uses soil moisture sensors and a water pump. The system works when the sensor detects declining soil moisture and when it reaches a certain level we have determined a water pump that serves to channel water from the water storage tank to the water nozzle to moisten the dry soil and the moisture value will increase up to a specified level and water pump the water will stop operating. the second system is a temperature control system that uses a DHT22 sensor and a fan. The sensor will always display the current temperature in the blynk application and when the overheating temperature exceeds the set limit the fan will operate to suck hot air out of the greenhouse. The third system is the lighting detection system which uses LDR sensor. This system works to detect the change from daylight with

the sun for plants to do the process of photosynthesis to night by turning on full spectrum LED grow light to help the process of plant growth faster. The fourth system is the system of measuring the water level in the storage tank that will be displayed in the blynk



the fifth system is a system for supplying electrical energy to a predetermined load. This system involves 3 devices such as solar panel, solar charger controller and 12V rechargeable batteries.



Figure 4.6: Greenhouse(without cover)

Figures 4.5 and 4.6 are an overview of a well -functioning system. This system is suitable to be placed in an outdoor area because the entire electricity supply system depends on solar panels and batteries that have been placed in this system.



Figure 4.7: Blynk Application Interfaces

Figure 4.7 shows the interfaces for the blynk application. In these interfaces have been placed several widgets that are used such as gauge widget push button widget and level monitoring widget. for the gauge is used 3 which is for monitoring soil moisture, temperature and humidity. while for push button it is used for manual system to turn on water pump, turn on fan and turn on Led lights. The use of level monitoring is to see the water level in the water storage tank which uses ultrasonic sensors to measure into the water remaining in the tank.



4.3.1 Soil Moisture Control Using Soil Moisture Sensor And Waterpump

Table 4.1: The Analysis between time and soil moisture value (automatic)

| Time (12hour am/pm) | Soil Moisture Value |
|---------------------|---------------------|
| 8am | 79 |
| 9am | 68 |
| 10am | 63 |
| 11am | 58 |
| 12pm | 55 |

| 1pm | 50 |
|-----|----|
| 2pm | 48 |
| 3pm | 42 |
| 4pm | 32 |
| 5pm | 98 |
| брт | 97 |
| 7pm | 94 |
| 8pm | 92 |



Table 4.1 shows that the data between time and soil moisture value. This analysis is measured using the data that taken from the blynk app based on soil moisture gauge as show. Based on the study, the value of soil moisture is decreasing hour after hour because the moisture is absorbed by the plant.

| Time (12hour am/pm) | Soil Moisture Value |
|---------------------|---------------------|
| 8am | 98 |
| 9am | 98 |

| | | 1 |
|----------|-------------------|-----------------|
| | 11am | 87 |
| | 12pm | 77 |
| | 1pm | 72 |
| | 2pm | 60 |
| | 3pm | 55 |
| | 4pm | 49 |
| | 5pm | 98 |
| | брт | 98 |
| | 7pm | 97 |
| No. | 8pm | 95 |
| ABIT TEA | | JIEM |
| 4 | نيكل مليسيا ملا | اونيۈمرسىتى تيك |
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Table 4.2: The Analysis between time and soil moisture value (manually)

Table 4.2 is a table where a crop of the same type is planted but placed outside the greenhouse but covered and watered 2 times in 12 hours at 8am and 6pm manually. It will be able to see from the graph that the soil moisture rate is more or less as set by the system but easier because it does not require physical movement to do watering.



Figure 4.8: line graft time vs soil moisture

Figure 4.7 is show us that the value of the soil moisture is decreasing hour by hour because the plant absorbs the moisture form the soil. After 8 hour the value increasing to the highest value in this data analysis. This is because the soil moisture already reaches the limit VERSITI TEKNIKAL MALAYSIA MELAKA lini

of the moisture that when it reaches 30 the sensor will trigger the relay to turn on the water



Figure 4.9: Placement of soil moisture sensor

pump to watering the plant. Figure 4.9 and 4.10 is a figure of the water pump and water nozzle that included in this process.





Figure 4.11: Water Nozzle

4.3.2 Temperature Control By Using DHT22 And Fan

| | Time 12 hour (am/pm) | Temperature Value |
|--|-------------------------|--------------------|
| | 12am | 26.8 |
| | 1am | 26.7 |
| | 2am | 26.8 |
| | 3am | 26.9 |
| | 4am | 26.8 |
| | 5am | 26.8 |
| | бат | 26.9 |
| | 7am | 26.8 |
| ~ | 8am | 27.6 |
| and the second s | 9am | 28.9 |
| TEK | 10am | 32.5 |
| E | 11am | 35.6 |
| . e g | 12pm | 35.7 |
| | 1pm | 36.4 |
| الأك | نىك_2pm | ويبوني سـ 36.6 تېگ |
| | 3pm | 36.5 |
| UNI | ERSITI 4pmKNIKAL | MALAY 35.7 MELAKA |
| | 5pm | 32.5 |
| | 6pm | 32.5 |
| | 7pm | 30.8 |
| | 8pm | 27.5 |
| | 9pm | 27.8 |
| | 10pm | 26.9 |
| | 11pm | 26.9 |

Table 4.3: The Analysis Of Time with Temperature(With system)

Table 4.3 is showing the data collected when the system is turn on (with fan). At the range between 11pm to 4 pm the temperature is to high but it consistent at the range 35'c to 36'c and continue to drop when at 5pm and so on. But in the table 4.3 it shows the data

collected when the system is turn off (without Fan). At the range between 11pm to 4pm the temperature is to high and reach 40'c but environment temperature is at 36'c to 37'c under the sun.

| | Time 12 hour (am/pm) | Temperature Value |
|--------|-------------------------|-------------------|
| | 12am | 27.8 |
| | 1am | 27.6 |
| | 2am | 26.6 |
| | 3am | 26.9 |
| | 4am | 26.7 |
| MA | LAYSIA 5am | 26.9 |
| S. | 6am | 26.8 |
| K | 7am | 27.6 |
| H | 8am | 27.8 |
| Ela | 9am | 29.9 |
| S JAIN | 10am | 33.4 |
| del | 11am | 36.4 |
| ملاك | 12pm | ر بيوم سر 39.5 س |
| | 1pm | 39.9 |
| UNIVE | RSITI T2pm IKAL I | TALAYS40.0MELAK |
| | 3pm | 38.6 |
| | 4pm | 37.7 |
| | 5pm | 33.2 |
| | брт | 32.7 |
| | 7pm | 30.7 |
| | 8pm | 28.9 |
| | 9pm | 27.7 |
| | 10pm | 27.8 |
| | 11pm | 26.7 |

Table 4.4: The Analysis Of Time with Temperature(Without system)



Figure 4.12: Time vs Temperature

Based figure 4.11 is a comparison between 2 situation, the first situation is that we turn on an automation system that involves all sensors, while the second situation is that we turn off the automation system for all sensors, so for the temperature part most play a role is the fan, based on the comparison graph between the two situations we can see that when the system is turned off the temperature will jump higher than the situation when the system is turned on, this is because when the system is operating the DHT22 sensor will measure the temperature inside the greenhouse if the temperature exceeds the set level the fan will be turned on to suck the hot air out of the greenhouse. In contrast to the situation when the system is turned off the temperature in the greenhouse cannot be controlled because there is no ventilation system that allows the hot air to escape. Apart from that, the use of fans in greenhouses with this type of sealing is very necessary because when the greenhouse is dried in the sun the temperature without use the system is higher 30% compared with when the system automatic is on... However, in this system, only one 12v fan is used so the

temperature that can be obtained is around 36'c to 37'c and it is still not suitable for vegetable crops. the appropriate temperature is between 32'c to 34'c



Figure 4.14: Fan Position

4.3.3 Water Level Monitoring Using Ultrasonic Sensor



figure 4.14 shows a water storage tank used in a greenhouse. to make an analysis on the average water consumption show the purpose of watering the plants we have to calculate the maximum volume of water available in the tank. The formula used is:-

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Maximum water level volume in the water tank :- V = lwh $V = 32cm \times 23cm \times 10cm$ $V = 7360cm^3$ $lcm^3 = 1 ml$ $lcm^3 = 0.001$ liters $7360 cm^3 = 7360 ml = 7.36$ liters


g

Table 4.5: The Analysis Of Water Level By Using Ultrasonic Sensor

Based on table 4.15 the data collected for a period of one week the water level decrease is decreasing day by day. However at the time this data was collected the weather for that one week was in cloudy and rainy conditions. due to that, the use of water for crops is reduced due to weather factors. Where when the weather is hot the watered water will evaporate and cause the soil to dry faster and the plants to need more water. we can see on the third day in the graph provided. The weather that day was a bit sunny. then the decline that occurred exceeded that of the previous days. According to the analysis made, this water tank with a capacity of 7.35 liters can supply water for 10 to 12 days before having to fill with new water depending on weather conditions.

Figure 4.16: Days vs Water Level(l)

4.3.4 LDR Sensor Data Analysis

Table 4.6: The Analysis Of Light Intensity Using LDR Sensor

| UNIVERSIT Time 12 hour(am/pm) | LDR value |
|----------------------------------|-----------|
| 10am | 0 |
| 11am | 0 |
| 12pm | 0 |
| 1pm | 0 |
| 2pm | 0 |
| 3pm | 0 |
| 4pm | 0 |
| 5pm | 0 |
| брт | 0 |

| 7pm | 0 |
|-----|-----|
| 8pm | 538 |
| 9pm | 538 |



Figure 4.16 shows a graph between time against light brightness. we can see between

10am to 7pm the value recorded is 0 this is because the sensor can detect the presence of light regardless of the weather. at 8pm the light intensity value jumped sharply due to the



Figure 4.18: When The RGB Light Up

change of conditions from bright to dark. however the scale at night there is still ambient light such as street lights and so on. so the value must be changed according to the place that have set. This LDR sensor is very sensitive even if there is a slight change from the value that has been determined it will be unstable and the lights used will flash.

| Time 12hour(am/pm) | Voltage Value Battery(V) | Voltage Value Solar |
|---------------------------|-------------------------------|----------------------|
| Table 4.7: The Analysis C | Of Voltage Measured from Batt | tery And Solar Panel |
| 9am | 11.80 | 12.42 |
| 10am | 12.20 | 12.45 |
| 11am WALAYSIA | 12.89 | 13.11 |
| 12pm | 13.06 | 13.40 |
| 1pm | 13.10 | 13.45 |
| 2pm | 13.11 | 13.60 |
| 3pm all | ىتى تىكىيەكەر م | 14.05 |
| 4pm | 13.17 | 13.44 |
| 5pm | 13.20 | 12,08 |
| брт | 13.20 | 1.32 |
| 7pm | 13.20 | 0 |
| 8pm | 12.82 | 0 |
| 9pm | 12.32 | 0 |
| 10pm | 12.11 | 0 |
| 11pm | 11.05 | 0 |



Based on Figure 4.18 is a graph representing the voltage reading in the battery and the voltage reading in the solar panel. The maximum reading for solar panels is 13.20 volts however even if the reading can increase to the highest 16volts ever recorded during the course of this project. however, on the day of taking the weather data, it was not that hot and the readings were low. At 5 pm the reading on the solar panel is decreasing as the sunlight is getting less and at 7 pm the weather is already dark and the data taken is 0volt so on. As for the data, the battery reading starts at 11.06 volts because at this time the battery is ready to be charged by the solar panel. By 5 pm the battery has reached its maximum limit to be charged by the solar panel. If compared to a battery charged using a regular charger it can reach 14.70 Volts which is the maximum value of voltage that can be stored. we can see at 8 pm the voltage value on the battery has started to decrease because at this point the system is completely dependent on the battery and at 11 pm the voltage value has reached the minimum limit of 11.05volts and at this voltage, the battery is no longer able to supply voltage to the system.

4.3.6 Comparison Between 2 Plant Growth



Figure 4.20: Comparison between 2 plant growth

Based on figure 4.17 we can see 2 types of vegetable crops of the same type and grown at the same time but placed in different areas. A plant has been specially placed in a greenhouse that has an automation system for the care of the plant in terms of plant watering, temperature control and lighting at night using plant growth LED. While plant B was placed in an exposed area and cared for manually by humans. We can see a very significant difference between the two plants in terms of the size of the plant where plant A looks bigger

and fresher than plant B. The following is a comparison data that has been taken for 3 weeks involving soil moisture rate and ambient temperature.

| | Soil Moist | ture Value |
|---------------------|-------------------|----------------|
| Days (random times) | Automatically | Manually |
| 1 | 97 | 60 |
| 2 | 98 | 70 |
| 3 | 80 | 20 |
| 4 | 89 | 89 |
| 5 | 79 | 65 |
| 6 | 83 | 40 |
| 7 | 94 | 59 |
| 8 MALAYSIA | 88 | 58 |
| 9 | 79 | 32 |
| 10 | 73 | 57 |
| <u>1</u> 1 | 82 | 45 |
| 12 | 90 | 65 |
| 13 | 67 | 78 |
| 14 4000 = | 76 | 89 |
| 15 | 58 | 90 |
| 16 Juni | e Sigo vier | 79 او يېو مړيد |
| 17 | 78 78 | 69 |
| U18IVERSITI 1 | EKNIKAL67IALAYSIA | MELAKA 70 |
| 19 | 59 | 80 |

Table 4.8: Comparison Between 2 Plant For Soil Moisture



Figure 4.21: Days Vs Soil Moisture

Based on figure 4.18 we can see 2 different types of data between automatic and manual crop care. for crop A which is cared for by an automatic system the graph produced is more stable than the graph shown by crop B which uses a manual system for the care of the crop. It happens because when using an automatic system everything is controlled by a microcontroller to do the watering on time has been programmed. While for the manual system it depends on the individual to go water the crop because the graph for crop B is unstable. and you can see on the 14th, 15th and 16th day the humidity rate is high because at the time the data is taken the soil is wetted by rainwater.

| Dorrs (12) | Temperature(°C) | | | | | | | |
|-------------|-----------------|----------|--|--|--|--|--|--|
| Days (12pm) | Automatically | Manually | | | | | | |
| 1 | 36.7 | 36.2 | | | | | | |
| 2 | 37.6 | 37.4 | | | | | | |
| 3 | 37.3 | 37.2 | | | | | | |
| 4 | 37.3 | 36.5 | | | | | | |
| 5 | 29.5 | 29.5 | | | | | | |
| 6 | 37.7 | 36.5 | | | | | | |

| 7 | 36.3 | 35.6 |
|----|------|------|
| 8 | 36.5 | 36.2 |
| 9 | 37.4 | 36.5 |
| 10 | 37.6 | 36.5 |
| 11 | 36.8 | 36.3 |
| 12 | 36.7 | 36.2 |
| 13 | 37.4 | 36.5 |
| 14 | 29.5 | 29.0 |
| 15 | 29.3 | 29.3 |
| 16 | 29.7 | 29.7 |
| 17 | 37.7 | 36.8 |
| 18 | 36.5 | 36.2 |
| 19 | 36.4 | 36.0 |

Table 4.9: Comparison Between 2 Plant For Temperature



Figure 4.22: Days Vs Temperature

Based on figure 4.20 the data taken between the two locations shows that location A has a higher temperature compared to the ambient temperature taken at location B. this

happens because at location A the plant is placed in a greenhouse and it is sealed so hot air will accumulate in the greenhouse. even if there is a fan to inhale the hot air it is still not enough to bring it down to the ideal temperature as it requires a more powerful fan to inhale more hot air at one time.

4.4 Summary UTEN

Based on the observations made show that the implementation of this smart garden works as planned after the observations and analysis are made, the specifications I got from the observation of the system indicate that the system may be able to be used well by adding some improvements, some of the findings for this project will take the time necessary to gauge the capabilities of this project, the repeatability of this project shows that it can have a huge impact in the agricultural industry. I have done the analysis chapter, as shown in the tables and diagrams provided.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This last chapter ties up the project from the first chapter, which explains the expected development before beginning the project, through the fourth chapter, which explains the project's findings and discusses them in depth. This project has been in progress according to the goal condition in Chapter 1. As a result, this chapter will also include future work rules.

5.2 Conclusion

This project named "Development of Smart Gardening System by Using Arduino" has been designed successfully. This smart garden has been developed by implemented all the hardware and software, the components used in this project are shown in the appendices and chapter 3 in this report. The presence of every module and components parts have been reasoned out and place wisely, thus contributing to the unit best working. The primary function of using the automatic mode is to ensure that all the feature required in this system can be monitored in the smartphone application. The data collected is the humidity of the greenhouse, the current temperature of the greenhouse and the humidity of the soil. All of that system is connected to the motor controlling the data following the program that already set up. The system is using IoT as a connector to link the greenhouse with the smartphone. IoT refers to a network of items or entities that can communicate with one another through the Internet. Things are predicted to become active participants in business, social processes, information, and communication by utilising IoT.

5.3 Recommendation

Recommendations for this project include adding any helpful components and innovations that improve the following system's future. there are some improvements that need to be highlighted to ensure this project runs more smoothly. the first thing that needs to be improved is the use of larger battery capacity. At the time the project was implemented the battery capacity used was 7Ah and at night the system could only last for 5 hours only. The result examination the most suitable battery capacity is 15AH to 20AH, at this point the change cannot be made because of the very high total cost of purchasing a battery of such a capacity. In addition, the second improvement is to use solar panels with a higher wattage value because when the system is running during the day the solar needs to run 2 functions that is to supply voltage to the load and charge the battery at the same time. If larger watts are used faster for the battery to recharge and energy can be used for system operation at night.

The third improvement is the improvement in terms of the ventilation system. at the time of this project it used only one ventilation fan to control the overall temperature in the greenhouse. due to this the hot air sucked out cannot be completely removed and causes the temperature in the greenhouse and the ambient temperature to be more or less the same or higher because the green house is a tight area and there is no efficient ventilation system to release the hot air out on its own.

Next is to add a sensor value to channel water directly from the main water pipe into the water tank when the water capacity in the water tank is decreasing. the next improvement is to increase the greenhouse so that the process of watering the plants using a mist nozzle can be spread throughout the plant area.

5.4 **Project Potential**

After the implementation of this project it can be seen as a very useful project for agriculture in our country. this system can be commercialized to giant companies in the field of agriculture because by implementing this system into the agricultural industry it can reduce human labor for the process of crop care. Apart from that, this project also uses solar as the main source of electricity supply, so the large consumption of electricity from TNB poles is not required.

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APPENDICES

Appendix A Gantt Chart PSM 2

| | | | Gai | ntt C | hart | PSN | A 2 | | | | | | | |
|-------------------------------------|------|-----|------|-------|------|-----|------|--------|-----|-----|-----|----|----|----|
| Week Task | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Briefing PSM 2 | | | | | | | | | | | | | | |
| Workshop 1 PSM 2 | | | | | | | | | | | | | | |
| with SV | | | | | | | | | | | | | | |
| Workshop 2 | YSIA | 40 | | | | | | | | | | | | |
| PSM 2 Hardware Setup | | | . WA | | | | | | | | | | | |
| Hardware Setup | | | | | | | | | | V | | | | |
| Update report Project | | | | | | | | Mid S | | | | | | |
| Chapter1: مالاك Introduction | | لەر |)< | 7 | 2 | - | ب ند | emeste | رىس | يۇن | اود | | | |
| Chapter 2: Literature Review | SITI | TE | KN | IKA | LN | IAL | AY | r Brea | ME | LA | KA | | | |
| Hardware Design | | | | | | | | ık | | | | | | |
| Find source code | | | | | | | | | | | | | | |
| Repaired Chp 1- Chp 3 | | | | | | | | | | | | | | |
| Performance Analysis | | | | | | | | | | | | | | |
| Progress Report Draft | | | | | | | | | | | | | | |
| Prepare Slide Presentation PSM 2 | | | | | | | | | | | | | | |

| | | | G | antt | Cha | rt P | SM 1 | 1 | | | | | | | |
|--|-------|------|-------|------|-----|------|------|----------|----|------|------|----|----|----|----|
| Week Task | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Briefing Workshop1 PSM1 | | | | | | | | | | | | | | | |
| Discuss project with SV Workshop? | | | | | | | | | | | | | | | |
| PSM1 Hardware Setup | | | | | | | | Mid | | | | | | | |
| Project Chapter1: | YSIA | 40 | | | | | | Semes | | | | | | | |
| Introduction Chapter 2: Literature Review | | | - KA | | | | 7 | ter Brea | | V | | | | | |
| Chapter 3: Methodology Chapter 4: Expected | | | | | 2 | | 1 | ak | | V | | | | | |
| Result Prepare Slide and | | به ر | - | 2 | | - | ei, | : | | يونه | او د | | | | |
| Recheck Report Presentation PSM 1 | \$ITI | TE | KN | IKA | LN | IAL | .AY | SIA | ME | LA | KA | | | | |

Appendix B Gantt Chart PSM 1

Appendix C Full Coding

#include <BlynkSimpleEsp32.h>

#include "DHT.h"

#define Moisture_Pin 34

#define DHT_Pin 25

#define DHTTYPE DHT22

#define Trigger_Ultrasonic_Pin 32

#define Echo_Ultrasonic_Pin 33

#define LDR_Pin 39

#define IN1_Light 21

#define IN2_Water_Pump 19

#define IN3_Cooling_Fan 18

#define auth " DNm0vwl1Z0ECOd27R19izJWk8ZVF0x4-" // You should get Auth Token in the Blynk AppSITI TEKNIKAL MALAYSIA MELAKA

#define ssid "TuaDegilCorp@unifi"

//Enter Wifi Name

#define pass "PNL51419"

//Enter wifi Password

DHT dht(DHT_Pin, DHTTYPE);

BlynkTimer timer;

const int Air_Value = 3536;

const int Water_Value = 1987;

```
const int Moisture_Min_Threshold = 20;
const int Moisture_Max_Threshold = 60;
const int Light_Threshold = 500;
const float High_Level = 2.0;
const float Low_Level = 15.0;
const float Temperature_Max_Threshold = 32.0;
const float Temperature_Min_Threshold = 31.0;
```

int intervals = (Air_Value - Water_Value) / 3; int Moisture_Value = 0; int State_Pump = 1; int State_Fan = 1; int State_Light = 1; int Level_Percentage; mt Level_Percentage; float Temperature_Value; float Temperature_Value; float Humidity_Value; float Duration_us; float Distance_cm;

void MoistureSensor()

{

Moisture_Value = analogRead(Moisture_Pin); //put Sensor insert into soil

Moisture_Value = map(Moisture_Value, Air_Value, Water_Value, 0, 100);

Blynk.virtualWrite(V6, Moisture_Value);

// Serial.print("Moisture Value");

// Serial.println(Moisture_Value);

// Serial.println;

// delay(200);

}

void DHTSensor() {
Humidity_Value = dht.readHumidity();
Temperature_Value = dht.readTemperature(); // or dht.readTemperature(true) for
Fahrenheit
Blynk.virtualWrite(V4, Temperature_Value); // Virtual Pin for Temprature
Blynk.virtualWrite(V5, Humidity_Value); // Virtual Pin for Humidity
// if (isnan(Humidity_Value) || isnan(Temperature_Value))
// {

// Serial.println("Failed to read Data from sensors!");

// return;

// }

// else

// {

Serial.print("Temperature Value :"); // Serial.print(Temperature_Value); // // Serial.println("°C"); Serial.print("Humidity Value :"); // Serial.print(Humidity_Value); // Serial.println("%\n\n"); // // } } void UltrasonicSensor() { delay(500); digitalWrite(Trigger_Ultrasonic_Pin, HIGH); delayMicroseconds(10); // generate 10-microsecond pulse to TRIG pin digitalWrite(Trigger_Ultrasonic_Pin, LOW);

Duration_us = pulseIn(Echo_Ultrasonic_Pin, HIGH); // measure duration of pulse from ECHO pin

Distance_cm = 0.017 * Duration_us; // calculate the distance

if (Distance_cm >= High_Level && Distance_cm <= Low_Level)

{

```
Level_Percentage = map(Distance_cm, High_Level, Low_Level, 100, 0);
```

Blynk.virtualWrite(V7, Level_Percentage);

}

- // Serial.print("Distance : ");
- // Serial.print(Distance_cm);
- // Serial.println(" cm");

}

```
void LDRSensor() {
```

delay(100);



void LightLED() {

```
if (State_Light == LOW)
```

{

```
digitalWrite(IN1_Light, LOW);
```

}

else {

```
if (Light_Value < Light_Threshold)
{
    digitalWrite(IN1_Light, LOW);
}
else if (Light_Value > Light_Threshold)
```

{



if (State_Pump == LOW)

{

digitalWrite(IN2_Water_Pump, LOW);

}

else {

if (Moisture_Value < Moisture_Min_Threshold)

```
{
  digitalWrite(IN2_Water_Pump, LOW);
  }
  else if (Moisture_Value > Moisture_Max_Threshold)
  {
  digitalWrite(IN2_Water_Pump, HIGH);
  }
 }
}
void CoolingFan() {
if (State_Fan == LOW)
 {
          UNIVERSITI TEKNIKAL MALAYSIA MELAKA
 digitalWrite(IN3_Cooling_Fan, LOW);
 }
```

else {

if (Temperature_Value > Temperature_Max_Threshold)

{

digitalWrite(IN3_Cooling_Fan, LOW);

}

```
else if ( Temperature_Value < Temperature_Min_Threshold )
```

```
{
    digitalWrite(IN3_Cooling_Fan, HIGH);
    }
}
BLYNK_WRITE(V1)
{
    State_Light = param.asInt();
    UNIVERSITI TEKNIKAL MALAYSIA MELAKA
```

```
BLYNK_WRITE(V2)
```

{

```
State_Pump = param.asInt();
```

}

BLYNK_WRITE(V3)

{

State_Fan = param.asInt();

}

BLYNK_CONNECTED() {

Blynk.syncVirtual(V1, V2, V3);

}

void setup() {

// put your setup code here, to run once:

pinMode(Echo_Ultrasonic_Pin, INPUT); pinMode(IN1_Light, OUTPUT); pinMode(IN2_Water_Pump, OUTPUT); pinMode(IN3_Cooling_Fan, OUTPUT); pinMode(DHT_Pin, OUTPUT); pinMode(Trigger_Ultrasonic_Pin, OUTPUT);

digitalWrite(IN1_Light, HIGH);

digitalWrite(IN2_Water_Pump, HIGH);

digitalWrite(IN3_Cooling_Fan, HIGH);

Serial.begin(9600);

dht.begin();

Blynk.begin(auth, ssid, pass);

timer.setInterval(1000L, MoistureSensor);

timer.setInterval(1000L, DHTSensor);

timer.setInterval(1000L, UltrasonicSensor);

}

| void loop() { |
|--|
| // put your main code here, to run repeatedly: |
| |
| LDRSensor(); |
| اونيومرسيتي تيكنيكل مليسيا ملا <u>(OttleD</u> // |
| Water_Pump(); IVERSITI TEKNIKAL MALAYSIA MELAKA |
| CoolingFan(); |
| Blynk.run(); |
| timer.run(); |
| |

}

Appendix D Water Pump Datasheet



Description:

R385 12V 3M DC Diaphragm Pump Micro Small Tank Aquarium Fish Bar

Mainly used in the aquarium, experimental model, inflatable pool, car washing, watering, timing of mineral water filling etc.

Specifications:

Working voltage: 6-12V DC Load operating current: 0.5-0.7A Maximum flow: 1-3L/Min Maximum head: 3 m Maximum suction range: 2 m Temperature: ≤80°C Service life: 2500H Inlet pipe diameter: 6mm Size: 86 x 43mm

Package include: 1xMini-aquarium pumping small pumps Details pictures:



Appendix E DC Fan Motor





Appendix F LED Plant Grow light

Specification:

- * Product name: full spectrum LED grow light strip
- * Voltage: DC 5V (USB power supply)
- * Waterproof: NO waterproof/IP65 waterproof
- * LED type: SMD 2835
- * Strip length: 0.5m / 1m / 2m / 3m
- * LED quantity: 30leds / 60leds / 120leds / 180leds
- * Beam angle: 120 degrees
- * Usage: With 3M strong adhesive paper on the back, it can be easily pasted
- * USB cable length: 1.5m
- * Lifespan: > 50000 hours

Features:

WALAYS/4

- * The specification of the product is 60 beads per meter.
- * Appearance: high-end atmosphere.

ملالت

* With touch-type stepless dimming function, adjust the brightness according to your needs. If the touch time is less than 2

seconds, the light will turn on or off, if the touch time is more than 2 seconds, can adjust the brightness, brightness will be raised to highest or fallen to lowest.

2.5

1.0

S:

ودية

*High-performance material flexible glass fiber board has a large heat dissipation area.

ameril

100

1.0

* Driven by any devices with output 5V USB port, such as computer, desktop, laptop, tablet, tab, car cigar lighter, etc.

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1.0