POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SMART PLANT WATERER

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JABATAN KEJURUTERAAN MEKANIKAL

SESI 1 2022/2023

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JABATAN KEJURUTERAAN MEKANIKAL

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AKUAN KEASLIAN DAN HAK MILIK

TAJUK : SMART PLANT WATERER

SESI: 1 2022/2023

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Adalah pelajar tahun akhir **Diploma Kejuruteraan Mekanikal, Jabatan Kejuruteraan Mekanikal, Politeknik Sultan Salahuddin Abdul Aziz Shah**, yang beralamat di **Persiaran Usahawan, 40150, Shah Alam, Selangor**. (selepas ini dirujuksebagai 'Politeknik tersebut').

Kami mengakui bahawa "Projek tersebut di atas' dan harta intelek yang ada di dalamnya adalah hasilkarya/reka cipta asli kami tanpa mengambil atau meniru mana-mana harga intelek daripada pihak-pihak lain.

Kami bersetuju melepaskan pemilikan harta intelek 'projek tersebut' kepada 'Politeknik tersebut'bagi memenuhi keperluan untuk penganugerahan **Diploma Kejuruteraan Mekanikal** kepada kami.

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NOOR HAYATI BINTI MAT TAIB

CONTENT

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Alhamdulillah and thanks to Almighty Allah S.W.T. for giving me the ability to finish this final year assignment successfully and for giving me the knowledge, time, and opportunity to do so. This accomplishment would not have been achieved without his approval.

With this opportunity, I am very pleased to give a million thanks to Puan Noor Hayati Binti Mat Taib, our group supervisor, for putting her full trust in me to complete the assigned task.

ABSTRACT

Watering is essential for plants and trees planted in containers. Many individuals are unsure about how to properly care for plants and trees. Plants might suffer from improper timing or a lack of moisture. An automated device capable of detecting the optimal circumstances for watering plants can greatly simplify the process. An Arduino microcontroller board was utilized in this work. Several sensors are built within it to monitor a plant's wetness and humidity. An Arduino program was assigned to take the sensor's norm, compare the value obtained with our pre-set standard threshold, and switch on or off the water pump based on the demands of the plant. The purpose is to design a product that can function automatically to ensure the plant is always in optimal humidity. Thus, the plant or tree will get enough water every day. In addition, with the availability of watering products that work automatically, we can minimize water loss and maximize the efficiency of water used. Next, it can facilitate consumers in saving their time and energy in planting plants. The product branded as SMART PLANT WATERER successfully works automatically when the soil reaches the specified moisture level and ceases when it reaches the predetermined dryness level. In conclusion, as a result of the analysis and discussions that have been conducted that this product has achieved the objectives that have been discussed.

ABSTRACT

Penyiraman adalah penting untuk tumbuhan dan pokok yang ditanam dalam bekas. Ramai individu tidak pasti tentang cara menjaga tumbuhan dan pokok dengan betul. Tumbuhan mungkin mengalami pemasaan yang tidak betul atau kekurangan lembapan. Peranti automatik yang mampu mengesan keadaan optimum untuk menyiram tumbuhan boleh sangat memudahkan proses. Papan mikropengawal Arduino telah digunakan dalam kerja ini. Beberapa sensor dibina di dalamnya untuk memantau kelembapan dan kelembapan tumbuhan. Program Arduino telah ditugaskan untuk mengambil norma penderia, membandingkan nilai yang diperoleh dengan ambang piawai kami yang telah ditetapkan, dan menghidupkan atau mematikan pam air berdasarkan permintaan tanaman. Tujuannya adalah untuk mereka bentuk produk yang boleh berfungsi secara automatik bagi memastikan tanaman sentiasa berada dalam kelembapan optimum. Oleh itu, tumbuhan atau pokok akan mendapat air yang mencukupi setiap hari. Selain itu, dengan adanya produk penyiraman yang berfungsi secara automatik, kita dapat meminimumkan kehilangan air dan memaksimumkan kecekapan air yang digunakan. Seterusnya, ia dapat memudahkan pengguna dalam menjimatkan masa dan tenaga mereka dalam menanam tumbuhan. Produk yang dijenamakan sebagai SMART PLANT WATERER berjaya berfungsi secara automatik apabila tanah mencapai tahap lembapan yang ditetapkan dan berhenti apabila ia mencapai tahap kekeringan yang telah ditetapkan. Kesimpulannya, hasil daripada analisis dan perbincangan yang telah dijalankan bahawa produk ini telah mencapai objektif yang telah dibincangkan.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Plants, like people, require food; the process of making food for plants is known as photosynthesis. Plants and their creatures utilize Carbon Dioxide from Water and Water from Soil or other water sources in the presence of light to generate Sugar and Oxygen during photosynthesis. Water, oxygen, light, and nutrients are vital components of plants. Light, water, and carbon dioxide are essential components of photosynthesis and must be present at the same time. Plants can acquire carbon dioxide at any time since it is present in the air, and if it is kept in the appropriate area, it can even get sunlight. Plants cannot develop healthily and become morbid as a result of a lack of water. Excessive water supply, on the other hand, can be harmful to plants at any time. Plants, too, require a steady supply of water to thrive. This indicates that the proper amount of water is important for plants to develop properly.

There are various microcontroller-based plant watering systems available today, but the problem with such devices is that they do not water in the amount necessary for the plants. Many pieces of equipment continue to irrigate even when the plant does not require water and is still wet. To eliminate all of these issues, we provide an autonomous watering system that ensures plants receive water as needed. This device also prevents overwatering by measuring the plant's humidity and dryness as well as the water released by the plant's demands.

1.2 RESEARCH BACKGROUND

Plants are a pleasant house decoration for anyone who wants a greener home interior; they can also be a creative home decorating concept. Furthermore, growing plants in the home may naturally assist clean the air of human breath and function as a modest source of oxygen that is good for humans. It was demonstrated in NASA and Associated Landscape Contractors of America (ALCA) research (Johnson, 1989). However, most individuals struggle to maintain their plants alive and healthy. According to certain research, individuals frequently neglect to nurture their crops when engaged in everyday tasks (Sanberg, 2012). Watering plants in suitable quantities is necessary to keep them growing. According to previous research, the key environmental needs for plant growth include enough room for root and canopy development, enough light, water, oxygen, carbon dioxide, and mineral components, and a temperature that is optimal for critical physiological activities. Watering is thus a crucial action in plant maintenance. Each plant requires a varied amount of water since too much water might smother the plant's roots and too little water produces unpredictable and stunted development.

1.3 PROBLEM STATEMENT

Irrigation is a means of watering the soil artificially in order for the plant to develop properly. It is generally utilised in arid and low-rainfall environments. Irrigation also helps with weed management in agricultural regions. In the past, bucket and watering can irrigation, sprinkler irrigation, targeted irrigation, drip irrigation, and other systems were employed.

Plant irrigation is a time-consuming task that normally requires a big number of human resources to be accomplished in a fair amount of time. Traditionally, humans performed all processes. Some systems now employ technology to minimise the number of workers or the time it takes to irrigate the plants. Control is severely limited in such systems, and significant resources are still squandered.

Water is one of these resources that is overused. One way of watering the plant is mass irrigation. This strategy results in significant losses since the amount of water provided is in excess of the plant's requirements. Excess water is expelled through the pores in greenhouse pots or percolates through the soil in the fields.

Water is currently viewed as a free, renewable resource that may be exploited in plenty. However, this is not the case; in many places of North America, water use has been reduced. As a result, it is realistic to expect that it will soon become an extremely expensive resource worldwide.

Aside from the increased cost of water, labour is getting increasingly expensive. As a result, if no effort is made to optimise these resources, the same procedure will cost more money. Technology is most likely a solution to decrease expenses and minimise resource loss.

1.4 RESEARCH OBJECTIVE

The aim of this project is to build an automatic plant irrigation system that senses soil moisture using a microcontroller.

The objectives to this research are:

i. To design a product that can function automatically to ensure the plant is always in optimal humidity.

ii. To minimize water loss and to maximize the efficiency of water used.

iii. To facilitate consumers in saving their time and energy in planting plants.

1.5 RESEARCH QUESTION

This study will answer the following research questions:

i. Is there any automated irrigation system that allows the user to control the irrigation process more efficiently?

ii. What would be the requirements to create an automated irrigation system?

iii. How mobile apps could support the automated irrigation system

1.6 PROJECT SCOPE

i. The project is an improvement of the conventional method of watering plants to an automatic watering system. Therefore, the availability of this product can facilitate the work of people who always do not have time to manage crops in their homes.

ii. This product should not be left on for too long as the amount of water is limited. By using a medium-large container, the amount of water that will be used for watering will run out over a while and the container will need to be refilled.

iii. Suitable for potted plants such as gardens, courtyards, schools, and shopping malls. Potted plants also do not require large quantities of water.

1.7 THE IMPORTANCE OF THE PROJECT

This product is beneficial to the community. The development of this product has the potential to make the public's work easier. Working folks, for example, do not have time to tend their crops. As a result, they can devote more time to crop maintenance. Furthermore, this tool operates automatically, detecting soil moisture while ensuring that the crop is constantly wet. This can keep agricultural soil from drying up.

1.8 CHAPTER SUMMARY

The ideas and inspirations discovered in this chapter can be gleaned from the research conducted. Every issue must have a solution. The goal and significance of this product may be concluded as follows: people are constantly busy, and there is no need to be concerned about the status of the crop since the nature of the product that runs automatically keeps the crop healthy at all times. Implementing the production of this product is a vital first step in resolving the issues that have arisen.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will describe the research conducted based on the theories that are true and have been applied in the field. For example, through journals, articles, and so on. In addition, some theories and a few methodologies will be described in this chapter to answer the problems faced today that can help society in the future.

An irrigation or watering system has been a central feature of agriculture for over 8,000 years and has been developed independently by many cultures across the globe. Irrigation is an agricultural process of applying a controlled amount of water to the soil to aid in crop production, as well as planting landscape plants and grasses, which may be known as watering. Agriculture that does not use irrigation but instead only relies on direct rainfall distribution is referred to as rain catchment.

Archaeological investigations have found evidence of irrigation in areas that lack sufficient natural rainfall to support crops for rainfed agriculture. Some of the earliest known use of technology dates back to the 6th millennium BC in Khuzestan in southwestern present-day Iran. The Choga Mami site, in Iraq on the border with Iran, is believed to be the earliest showing the first canal irrigation operating in about 6000 BC.

Irrigation or watering system has been going on since ancient Egypt. Most automated technologies began to take shape in the 1800s, technologies such as residential sprinklers and nozzles for your water hoses. With the suburban boom happening in the 1950s, property values for these suburban properties came down to a significant factor, one of which was the condition of the yard.

Nowadays, modern irrigation systems have evolved to include reservoirs, tanks, and wells, with reservoirs functioning to collect water from natural sources such as lakes and rainwater runoff. With an automatic irrigation system, watering is done promptly for efficient water use and less runoff. Having a professionally certified irrigation technician set up this automated system and performing annual maintenance for the system will pay off in the long run.

2.1 COMPARISON OF THE IRRIGATION METHODS

(Prepared by Muhammad Naim Akmal Bin Aziz)

TRADITIONAL WATERING PLANTS VS AUTOMATIC WATERING PLANTS.

Traditional Watering Plants	Automatic Watering Plants
➢ **Watering your lawn is easier than doing it by hand:** Traditional way to water your lawn is a preferable choice to walking around with a water hose. They enable you to simply place the sprinkler where needed and leave the system to do its work.	➢ **Programmable watering schedules:** Automatic lawn sprinkler systems help run a watering schedule following presets. Add in the fact that some systems have rain sensors or temperature gauges that help adapt watering schedules to be more efficient and you can see why they're a great option for homeowners.
➢ **Wasted water:** This method may occur many problems as failing to turn off your water sprinklers can mean a costly water bill. This comes as a result of you having to manually shut off the system once you feel that the lawn has been properly watered.	➢ **Time saved:** It goes without saying, but using an automatic lawn sprinkler system saves time that would otherwise be spent on manually watering your lawn or setting down sprinklers.

➢ **The lawn may not have been properly watered:** As previously stated, you are responsible for turning off the sprinklers. This means that if you don't turn off the system first, you might cause problems for your plants.	➢ **Watering that is more precise and reaches the root system:** Installing multiple sprinkler heads throughout your lawn can ensure that you cover the entire lawn. This, in turn, alleviates many of the headaches associated with determining whether you've overwatered or underwatered your lawn.

2.2 COMPARISON OF INDOOR PLANTS.

(Prepared by Muhammad Naim Akmal bin Aziz)

	Bonsai	Cactus
Soil	**Water the trees when the soil gets slightly dry:** This means you should not water y water your tree when the soil is still wet but only when it feels slightly dry, use soil moisture sensor to check the soil at around 1cm (centimeter) deep.	**Water the tree when the soilgets dry:** This means the Cactus needs a soil with excellent drainage. If it's in the ground, that might mean adding some loam to your soil.
Watering	**Never water on a routine:** Keep observing your trees individually, instead of tering them on a daily routine, so thed Automatic Watering Plants to set the watering daily water.	**Never water on a routine:** cactus does not need much water, it is best to have intervals where you add a little water, but always using the same amount.
Temperature	Subtropical Bonsai trees can withstand somewhat lower temperatures, and generally thrive when they enjoy a winter season with temperatures well below that	The favorable temperature for indoor gardenias is about 70 degrees Fahrenheit during the day and about 60 degrees Fahrenheit

	of the standard room temperature.	during the night. Warm days and cool nights are perfect for blooming gardenia plants.

2.3 MARKETING RESEARCH

(Prepared by Muhammad Mirdas Bin Multazam)

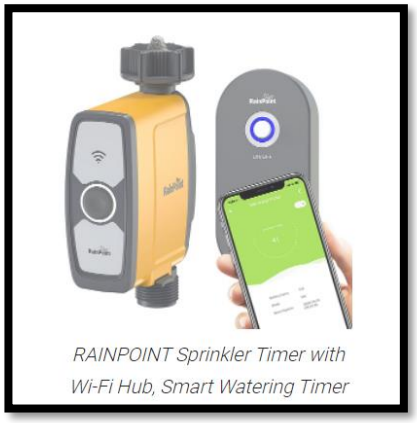
After I did some research on the products available in the market, I found that there are various forms and types of automatic plant waterers. Of the many automatic plant waterers, I have come across, all use timers.

For me, a system that uses a timer is not very effective. The matter is because it depends on the temperature and the environment as well, we are not sure whether the water that has been watered has become dry or not. If a timer system is used, the waterer will water the plants even if the plants are still at a humidity level. When that happens, the plant will get quite a large amount of water and it shouldn't and it is not good for the plant. This should be avoided to protect the plant from things that are not desired by the keeper. Below are some examples of sprinklers that use a timer system.

Picture 2.2.1 Oscillating Sprinkler

Picture 2.2.2 Plant Waterer Timer

Picture 2.2.3 Window Box Planter



Picture 2.2.4 Smart Watering Timer

Picture 2.2.5 Digital Watering Timer

To overcome the problem from happening, we will create a product that can detect the moisture and dryness of a plant. It can also be watered with an adequate and proper quantity of water. This can cause the sprinkler to water when the plant needs the right amount of water.

The product uses an Arduino Prototyping Shield, a soil moisture sensor, and a relay module to detect moisture and water dryness as well as to limit the amount of water that comes out.

2.4 RESEARCH OF MATERIAL AND EQUIPMENT

(Prepared by Muhammad Afiq bin Badiuzaman)

1. Arduino

Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its hardware products are licensed under a CC BY-SA license, while the software is licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially from the official website or through authorized distributors.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the **Arduino language**, inspired by the Processing language and used with a modified version of the Processing IDE. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) and a command-line tool developed in Go.

The Arduino project began in 2005 as a tool for students at the Interaction Design Institute Ivrea, Italy,[2] aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

The name *Arduino* comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

2. Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons , as a proxy for the moisture content.

The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners.

Soil moisture sensors typically refer to sensors that estimate volumetric water content. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks.

3. Relay Module

Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not.

The single-channel relay module is much more than just a plain relay, it contains components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active.

First is the screw terminal block. This is the part of the module that is in contact with mains so a reliable connection is needed. Adding screw terminals makes it easier to connect thick mains cables, which might be difficult to solder directly. The three connections on the terminal block are connected to the normally open, normally closed, and common terminals of the relay.

The second is the relay itself, which, in this case, is a blue plastic case. Lots of information can be gleaned from the markings on the relay itself. The part number of the relay on the bottom says “05VDC”, which means that the relay coil is activated at 5V minimum – any voltage lower than this will not be able to reliably close the contacts of the relay. There are also voltage and current markings, which represent the maximum voltage and current, the relay can switch. For example, the top left marking says “10A 250VAC”, which means the relay can switch a maximum load of 10A when connected to a 250V mains circuit. The bottom left rating says “10A 30VDC”, meaning the relay can switch a maximum current of 10A DC before the contacts get damaged.

The 'relay status LED' turns on whenever the relay is active and provides an indication of current flowing through the relay coil. The input jumper is used to supply power to the relay coil and LEDs. The jumper also has the input pin, which when pulled high activates the relay. The switching transistor takes an input that cannot supply enough current to directly drive the relay coil and

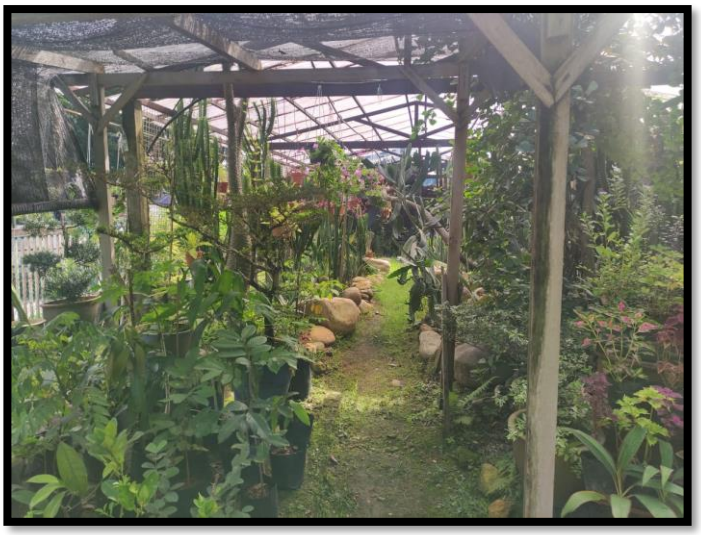
amplifies it using the supply voltage to drive the relay coil. This way, the input can be driven from a microcontroller or sensor output. The freewheeling diode prevents voltage spikes when the relay is switched off. The power LED is connected to VCC and turns on whenever the module is powered.

Field Research

Go to nursery to do some research and find information.

Picture 2.2.6 Mirdas went to Zetty Grrden

Picture 2.2.7 Zetty Garden



Picture 2.2.8 Zetty Garden

After doing research and questionnaires at Zetty Garden, I have gained some information about plants and crops.I asked about the needs, effects and also some differences of ornamental plants as well as gardening crops like fruit trees and even vegetables. Ornamental plants should be watered two to three times a day, it also depends on the type of plant. There are some examples of plants that always need water when the water has dried for example hibiscus and paper flowers. Watering techniques for plants usually flush until the entire soil in the pot is wet. In addition, the effect of excess water is that the plant will become soft and the leaves will fall while if there is a lack of water the plant will wither.

Next for gardening crops, tree trunks should be watered daily, only once a day. It also depends on the weather. When it is too hot, farmers will usually water twice a day.

Crops also need other needs such as fertilizer. Fertilizer is mixed into the soil, the plants should be fertilized every two weeks. The soil for each crop should not be changed every day, it should only be sprayed unless there are insects.

2.5 CHAPTER SUMMARY

As a conclusion to this chapter, the literature review is critical in highlighting all of the research on materials and techniques to expand understanding about this project. After much discussion and investigation, the most significant item for our project was the Arduino. This is due to the fact that Arduino serves as the primary master, controlling the project's movement and activities. Finally, because of its low and fair price, this product is highly suited and economical.

CHAPTER 3
METHODOLOGY

3.1 INTRODUCTION
(Prepared by Muhammad Afiq Hakimi Bin Badiuzaman**)**

Methodology is the study of research methods or, more formally, "'a contextual framework for research, a coherent and logical scheme based on views, beliefs, and values, that guides the choices researchers [or other users] make

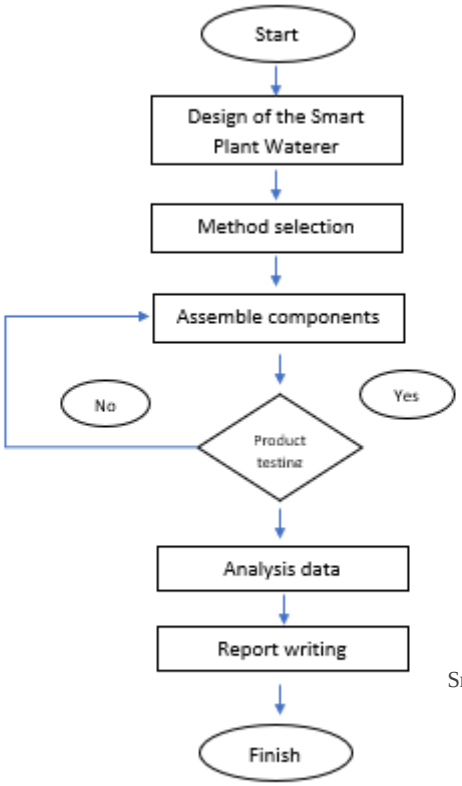
It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge such that the methodologies employed from differing disciplines vary depending on their historical development. This creates a continuum of methodologies that stretch across competing understandings of how knowledge and reality are best understood. This situates methodologies within overarching philosophies and approaches.

Methodology may be visualized as a spectrum from a predominantly quantitative approach towards a predominantly qualitative approach. Although a methodology may conventionally sit specifically within one of these approaches, researchers may blend approaches in answering their research objectives and so have methodologies that are multimethod and/or interdisciplinary.

In general, a methodology proposes to provide solutions - therefore, the same as a method. Instead, a methodology offers a theoretical perspective for understanding which method, set of methods, or best practices can be applied to the research question at hand.

3.2 FLOW CHART

In this chapter, there will be a lot of information about the process and journey throughout the making of our final project. There will be a flow chart showing the process of us making the whole project. Figure 3 which is our flow chart will explain the processes we took.



Smart Plant Waterer.

Figure 3.2.1 Project Flow Chart

3.3 FLOW CHART EXPLANATION

3.3.1 START

The key thing is to get started, which is the first step in anything. A successful start makes the rest of the project more manageable, and it establishes the groundwork for the project's completion. When anything ends, the conclusion is partially determined by how it began. Define and determine the project's core relevant aim, which will eventually lead to project success. The objectives will save time in the long term by speeding the entire project plan. Identify specific achievements, activities, and difficulties related with each objective, as well as a step-by-step action plan for achieving goals and overcoming barriers.

3.3.2 PRODUCT DESIGN

DESIGN BY FUSION
(Prepared by Muhammad Naim Akmal Bin Aziz)

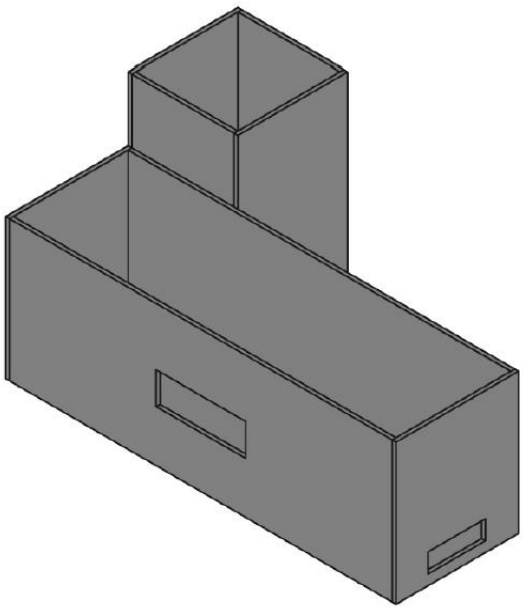


Figure 3.3.2.1 Design of Smart Plant Waterer

Isometric view

(Prepared by Muhammad Mirdas Bin Multazam & Muhammad Afiq Hakimi Bin Badiuzaman)

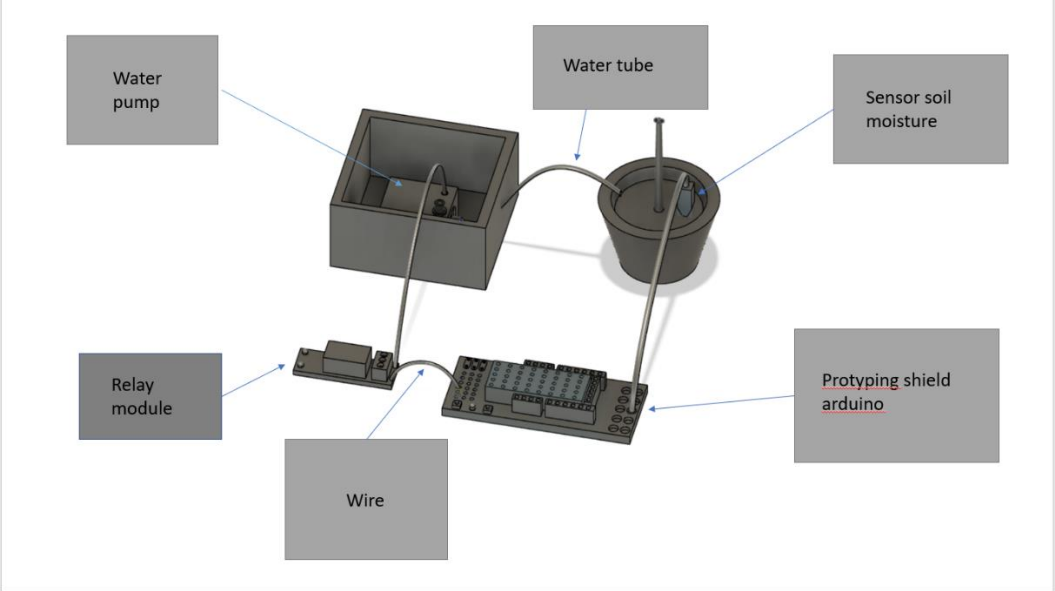


Figure 3.3.2.2 Design and component of Smart Plant Waterer

Top View

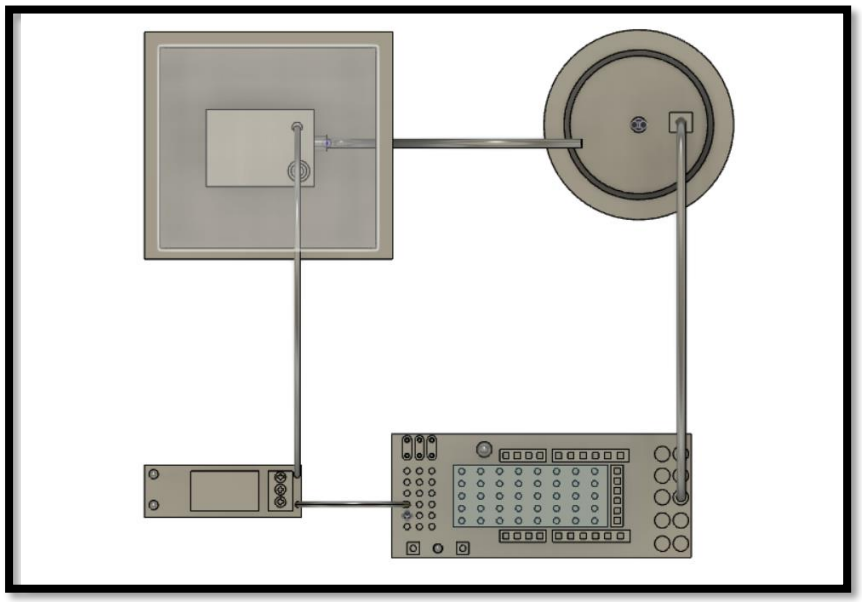


Figure 3.3.2.1 Top View of Smart Plant Waterer

3.4 CODING DAN PROGRAMMING

Creating codes from one language to another is essentially what is meant by the term "coding." Since it really carries out the first steps of programming, it can also be referred to as a subset of programming. It entails following instructions and writing codes in many languages.

The machine only comprehends machine code, which is the binary language, and cannot communicate with human conversation. Therefore, a coder's primary responsibility is to interpret the requirements into language that computers can understand. Coders must possess a solid command of the project's working language. But they typically code in accordance with the project's requirements and given instructions. The process of creating a software product starts here.

Making an error-free, machine-level programme readable and executable is the process of programming. In order to keep human inputs and related machine outputs in sync, formal code writing is the procedure.

The process starts with writing code, which is then analysed, put into practise, and produces the right machine-level output using programming. Additionally, it encompasses every essential aspect, from testing and implementation through debugging and compilation. To create the right machine outputs, programmers must understand and analyse the various facets of communication.

3.5 PROGRAMMING APPLICATION

Arduino programs are written in the Arduino Integrated Development Environment (IDE). Arduino IDE is a special software running on your system that allows you to write sketches (synonym for program in Arduino language) for different Arduino boards.

The Arduino programming language is based on a very simple hardware programming language called processing, which is similar to the C language. After the sketch is written in the Arduino IDE, it should be uploaded on the Arduino board for execution.

3.5.1 CODING

```
//Welcome

int relayPin = 8;
int sensor_pin = A0; // Soil Sensor input at Analog PIN A0
int output_value ;
void setup()        // put your setup code here, to run once:
{
  Serial.begin(9600);
  pinMode(relayPin, OUTPUT);
  pinMode(sensor_pin, INPUT);
  Serial.println("Reading From the Sensor ...");
  delay(2000);
}

void loop()
{
 output_value= analogRead(sensor_pin);
 output_value = map(output_value,550,10,0,100);
 Serial.print("Mositure : ");
 Serial.print(output_value);
 Serial.println("%");
 if(output_value>21){
  digitalWrite(relayPin, HIGH);
 }
 else
 {
  digitalWrite(relayPin, LOW);
 }
 delay(1000);
```

3.6 MATERIAL AND EQUIPMENT

(Prepared by Muhammad Mirdas Bin Multazam)

The identification and prioritising of essential design requirements is the first step in material selection. Material selection is the act of selecting the best material to meet the specifications of a certain product. Mechanical qualities, physical features, and cost are only a few of the aspects that influence the selection requirements. The primary purpose of acquiring resources is to achieve the desired quantity at a fair price. As a result, it is critical to purchase raw materials at affordable costs.

1. Arduino Uno

Figure 3.6.1 Arduino Uno

2. Relay module

Figure 3.6.2 Relay module

3. Sensor soil moisture

Figure 3.6.3 Sensor soil moisture

4. Water pump

Figure 3.6.4 Water pump

5. Water tube

Figure 3.6.5 Water tube

6. Electrical cable

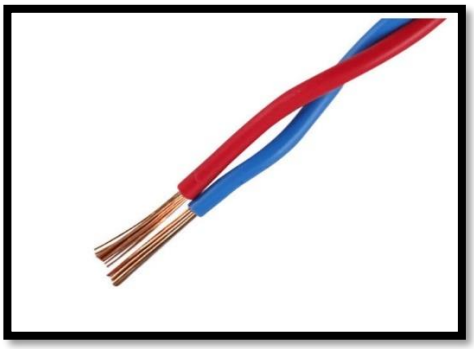


Figure 3.6.6 Electrical cable

7. Small container

Figure 3.6.7 Small container

8. Battery holder

Figure 3.6.8 Battery holder

9. Battery AA

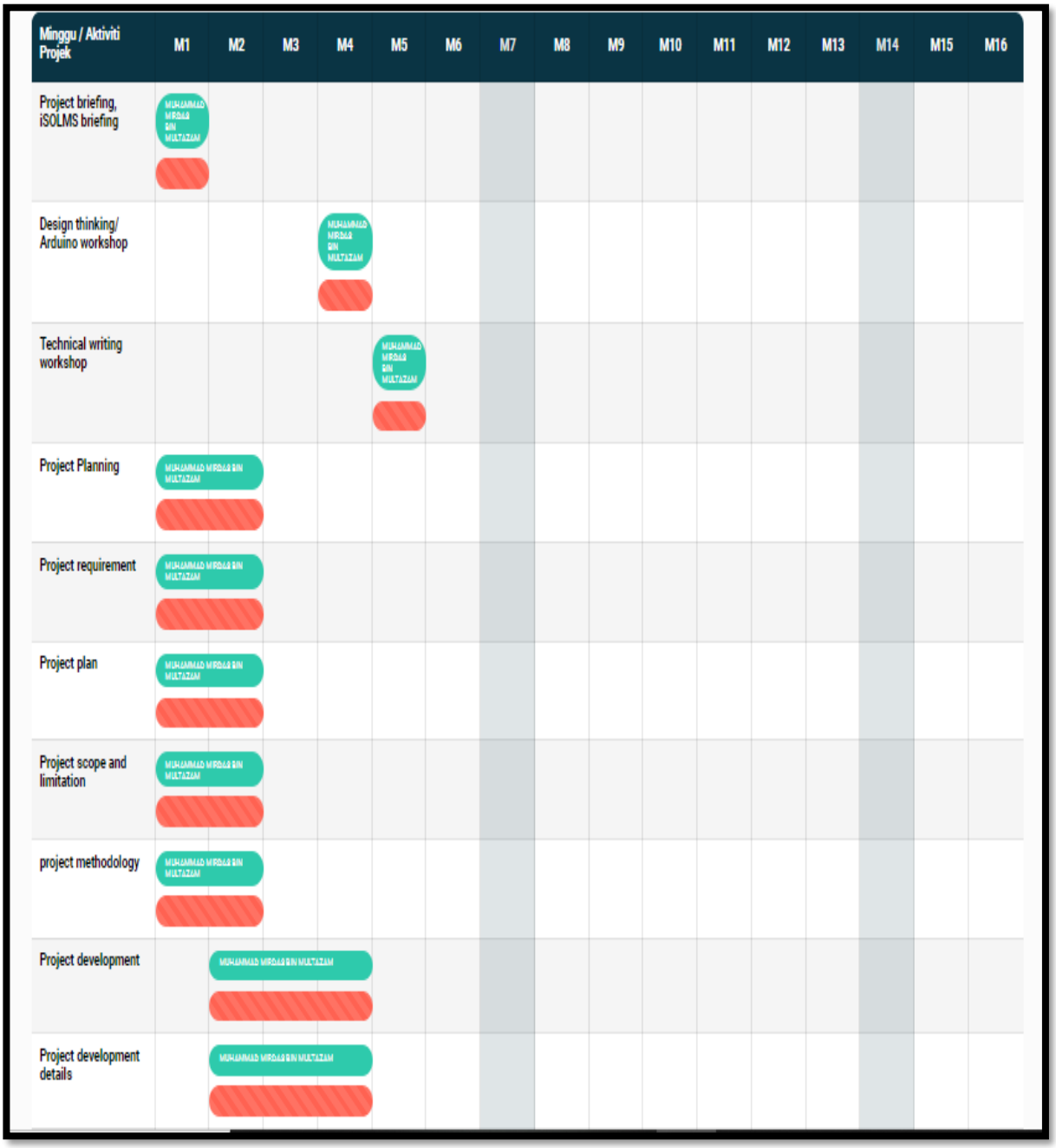
Figure 3.6.9 Battery

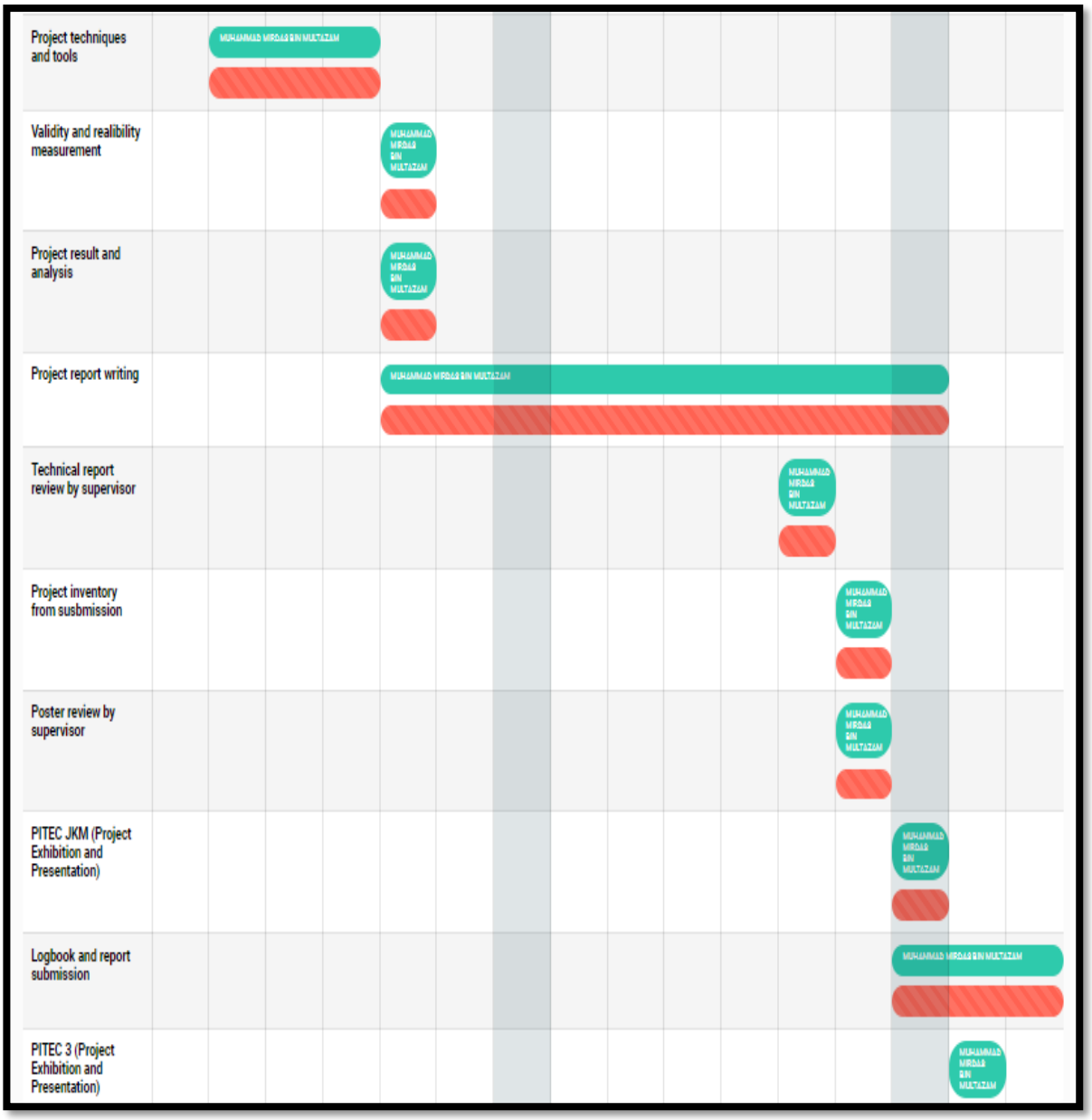
3.7 BUDGET CALCULATION

Table above shows the cost of material used for this product.

Numbers	Components	Price (RM)
1	Arduino Micro-controller.	50.00
2	Soil Moisture Sensor.	20.00
3	Relay.	15.00
4	Water Pump.	15.00
5	Connecting wire and Pipe.	10.00
6	Battery Holder.	5.00
7	Batteries.	7.00
8	Board	7.00
9	TOTAL	129.00

3.8 PROJECT ACTIVITY





	Planning
	Actual

3.9 SUMMARY

In conclusion, design is important in producing a product. In this project i.e., smart plant waterers can be produced well without any problems. The materials used in this project are easily available in the market as well as online. hence this product is also easy to use as it moves automatically. However, this product cannot run smoothly in the event of damage to the material or the omission of a method.

CHAPTER 4
PRELIMINARY FINDINGS OF THE STUDY

4.1 INTRODUCTION
(Prepared Muhammad Mirdas Bin Multazam)

For this chapter, all the ideas, data and analysis about smart plant waterers were previously combined. data and analysis are very important in product production to achieve project goals. with this analysis, can bring ideas and innovations for the improvement of this product. after getting the data that has been collected, analyze each one to produce a perfect product.

4.2 ADVANTAGES AND DISADVANTAGES
(Prepared by Muhammad Afiq Hakimi)

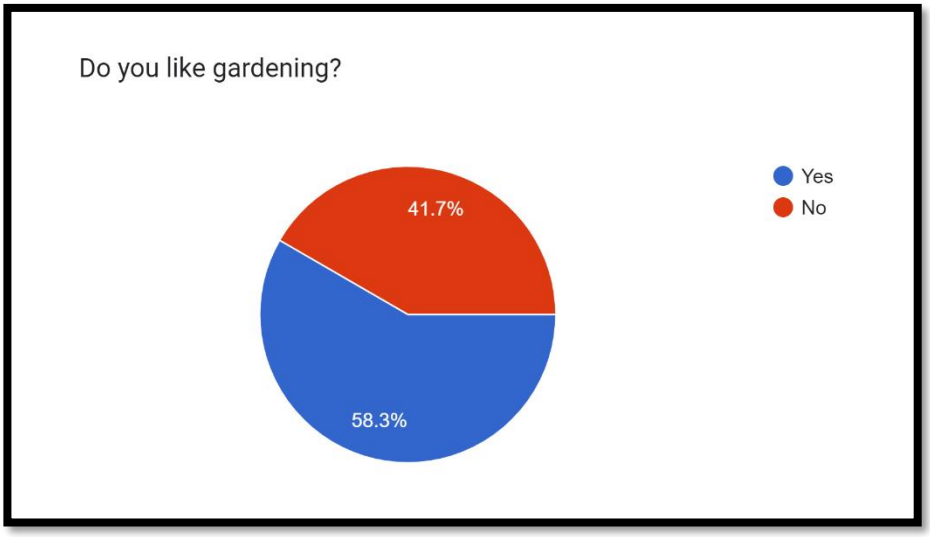
Every project has advantages and disadvantages. The benefit of this initiative is that it can assist people, particularly working couples who do not have time to care for their plants.

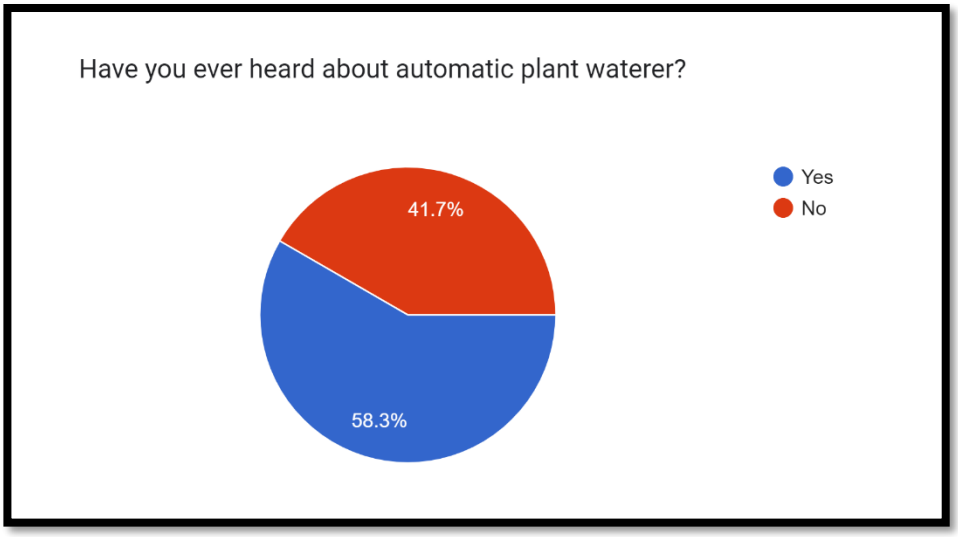
However, the disadvatages or cons must be corrected or modified in the future so that we may create a good and highly efficient product that virtually does not detect the project's shortcomings. Every new product must have specific features that need to be improved in order to raise the product's value. As with all goods, we must guarantee that the code placed into the Arduino is appropriate and accurate. We will discover the most effective solution to this problem.

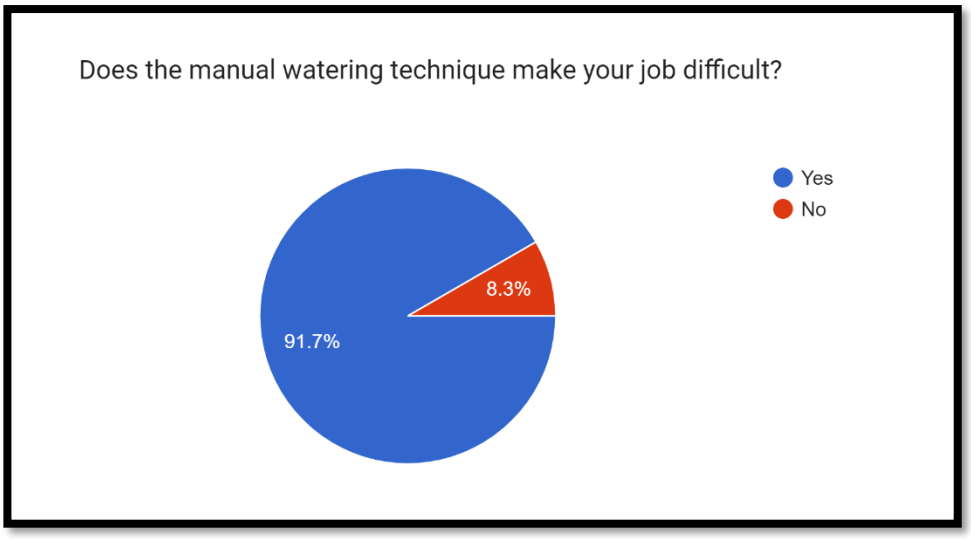
4.3 ANALYSIS

(prepared by Muhammad Afiq Hakimi)

This is one of result from the questionnaire:







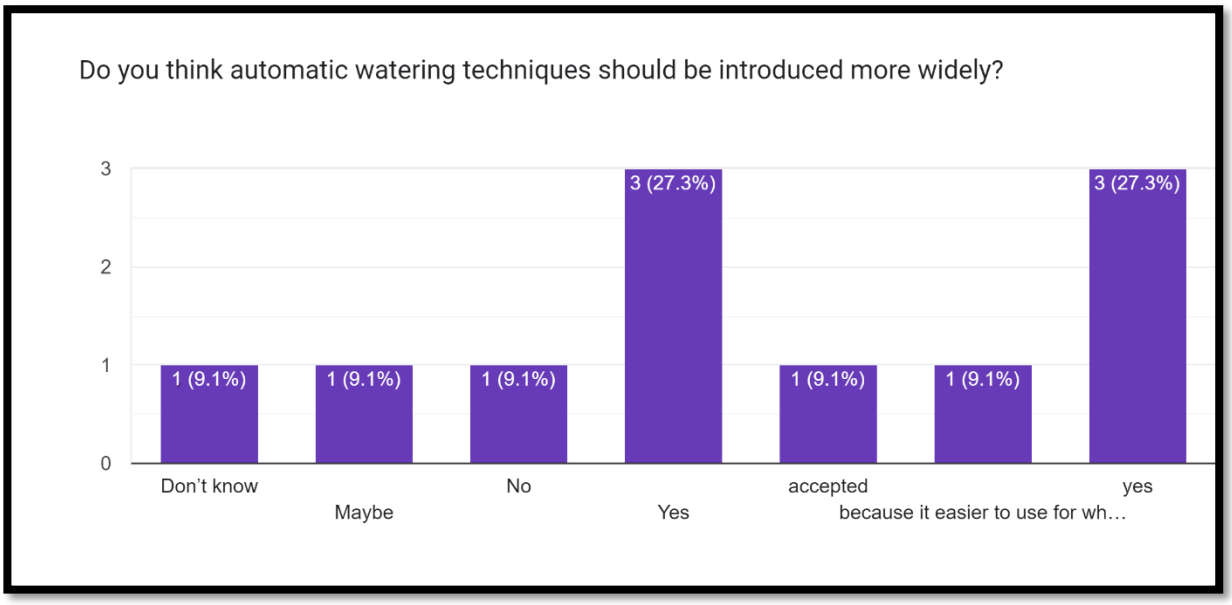


Figure 4.3.1 Result

We incorporate the information from the survey about our project for the outcome. This information will help us determine whether or not our project is appropriate for society. After getting all of this information, we carefully consider every element that can improve it. Every endeavour has benefits and drawbacks. The advantages of this project are that it can save individuals time while watering plants and is also simpler to use for those who enjoy gardening. To enhance the good and extremely efficient items that barely find a disadvantage of the project, the drawbacks must be modified or changed in the future.

We concluded from data that 91.7% of respondents believed that manual watering was more difficult than automatic watering, while 8.3% disagreed.

4.4 CHAPTER SUMMARY

In this chapter, we encounter the problem for our project,Smart Watering System. Suddenly, we also find the solution to solve the problem that we encounter. Besides, our project also further enhances the level of automatic watering system in malaysia. This project can keep pace with the times and we will improve our project become more easy to use and reduce the cost to let morepeople to have it.

CHAPTER 5
DISCUSSION

5.1 INTRODUCTION

The conclusion allows presenting the last word on the issues and innovation have raised in the report paper which is to demonstrate the importance of the project and opportunity to make a good final impression on a positive note. The conclusion also is intended to help the reader understand the project should matter after finished reading the paper.

This chapter covers the conclusion for the overall of this project. The conclusion will be concluded the future recommendation and improvement for future innovation with a better result for the watering system. In promoting a good explanation, the following sections also present the discussion of the project and recommendations to improve quality**.**

5.2 DISCUSSION

(Prepared by Muhammad Naim Akmal bin Aziz)

The main function of Smart Plant Waterer is to be one of the modern watering initiatives in line with the Industrial Revolution 4.0 by automatically watering plants by detecting soil moisture levels. Current watering methods take too long to do and require a large amount of manpower. This can take forever and may not be as effective as it seems. However, we got a new idea. The idea of the Smart Plant Waterer project arose to make it easier for the working community and housewives to water their plants without having to take care of them. Once the product is completely finished, we conducted some tests to make sure that the product functioned as well as it should. Based on the test, we manage to collect data and manage to discuss what can be improvised based on the project and also what can help the product to be more effective in the future. We also notice some points that need to be take note especially about the work function & design to make sure that this product is completely useable & can be

commercialized.

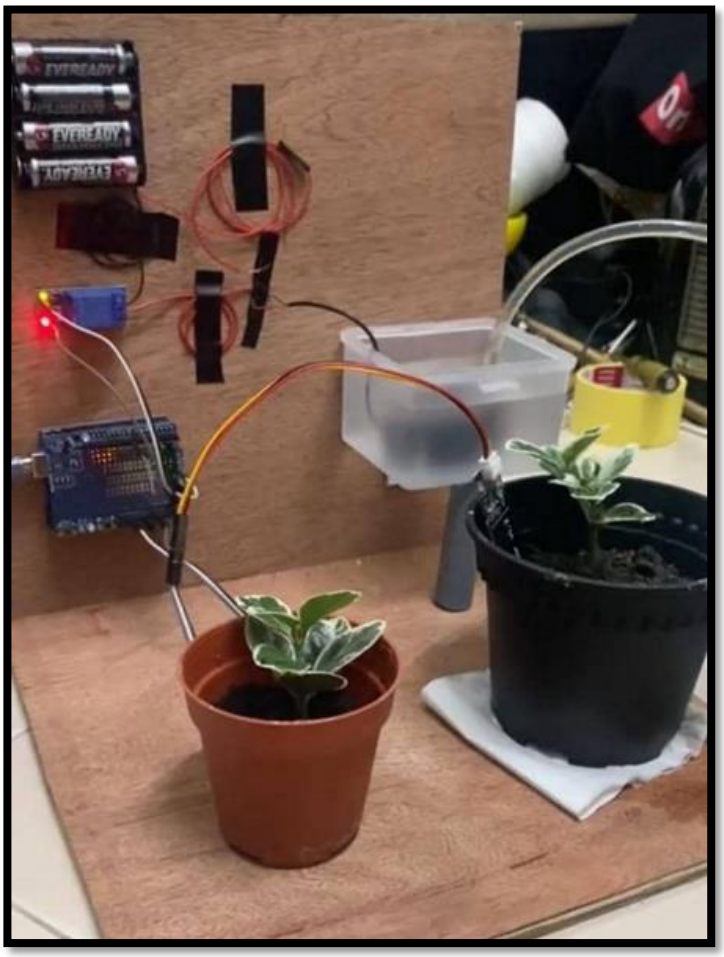


Figure 5.2.1 Smart Plant Waterer

5.3 PROBLEM

(Prepared by Muhammad Mirdas Bin Multazam)

Every project is different and distinct, thus there will nearly always be unforeseen issues and inquiries over the course of the project. Most crucial, find a speedy and efficient solution to the issue.

- The problem that happened to the water pump, the problem experienced when trying to connect the wire from the relay module and the battery to water pump. We need to peel the skin on the cable to extend the wire. The process of stripping the cable skin was quite difficult because the cable on the water pump was very thin and several times the cable broke while the cable was being stripped.
- During product testing, we did not expect that due to the high-power source causing the soil moisture sensor to become overheat and possibly causing the soil moisture sensor to be damaged.
- The next problem, during the installation of all components. The error during the installation of the wires on each component caused the soil moisture sensor to function but the water pump did not work as desired.

5.4 RECOMMENDATION

(Prepared by Muhammad Mirdas Bin Multazam)

Some recommendations to meet the demands of the product and further appease the user are made in light of the observations and justifications provided after finishing the Smart Plant Waterer. However, improving the features and quality of items is a difficult process. Speaking with users and potential customers has aided the project and kept the team motivated to take a more strategic approach to product development. Adding new features or enhancing existing ones are the two most common approaches to improve products.

- The crucial parts of any electrical system are the wire, which also poses risks. Make sure purchase the proper materials for electrical wiring and cable that are based on a strong basis of quality, reliability, and safety to improve the product.

- Design a product that is waterproof so that the buyer may feel confident that it will likely continue to function even when it rains.

- Design an automatic plant waterer that can be function to many plants at the same time. Adding sensors and water pumps and changing the water pump to a more powerful water pump.

5.5 CONCLUSION

(Prepared by Muhammad Naim Akmal bin Aziz)

In conclusion, the project meets the objectives. Firstly, the electronics knowledge and skills are learnt and acquired in a very practical manner. Secondly, the knowledge and skills of using both the Arduino IDE programming software and the Arduino boardare possessed through the hands-on experience. Lastly, the desired engineering design process skills are successfully applied and learnt. The project does resolve the problem statement it is meant to address—to innovate from the daunting problem of gardening and that is having to water the plant regularly. The project or the system ofthe product brings forth the solution to the problem statement by providing an automated system that performs the watering of plant based on the soil moisture of the plant. The product constantly runs and measures the soil moisture level and only at acertain threshold value does the system initiate its watering feature system. All in all,the project has given the benefit of the opportunity in designing and devising a product through the engineering design process.

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APPENDIX