POLITEKNIK MALAYSIA

SULTAN SALAHUDDIN ABDUL AZIZ SHAH

JABATAN KEJURUTERAAN MEKANIKAL

TITLE : SOIL MOISTURE SENSOR

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LECTURER NAME : ENCIK MOHD NASIR BIN KAMARUDDIN

CLASS : DMP5B

PREPARED :

NAME	REGISTRATION NUMBER
AMIN FARIS BIN MARWAN	08DMP18F1066
MUHAMMAD RASYDAN BIN ADNAN	08DMP18F1059
ZAHIRAH BINTI SHUIB	08DMP18F1051

POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SOIL MOISTURE SENSOR

NAMA	NO. PENDAFTARAN
AMIN FARIS BIN MARWAN	08DMP18F1066
MUHAMMAD RASYDAN BIN ADNAN	08DMP18F1059
ZAHIRAH BINTI SHUIB	08DMP18F1051

Laporan ini dikemukakan kepada Jabatan Kejuruteraan Mekanikal sebagai memenuhi sebahagian syarat penganugerahan Diploma Kejuruteraan Mekanikal

JABATAN KEJURUTERAAN MEKANIKAL

JUN 2020

AKUAN KEASLIAN DAN HAK MILIK

TAJUK : SOIL MOISTURE SENSOR

SESI : JUNE 2020

1. Kami, **1. AMIN FARIS BIN MARWAN (08DMP18F1066)**
2. MUHAMMAD RASYDAN BIN ADNAN (08DMP18F1059)
3. ZAHIRAH BINTI SHUIB (08DMP18F1051)

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 dirujuk sebagai 'Politeknik tersebut').

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

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

Diperbuat dan dengan sebenar-benarnya diakui,

Oleh yang tersebut ;

a) AMIN FARIS BIN MARWAN	)	…….
(No. Kad Pengenalan: 000111-08-1879)	)	AMIN FARIS BIN MARWAN
b) MUHAMMAD RASYDAN BIN ADNAN	)	…….
(No. Kad Pengenalan: 001015-03-1411)	)	MUHAMMAD RASYDAN BIN ADNAN
c) ZAHIRAH BINTI SHUIB	)	…….
(No. Kad Pengenalan: 000613-07-0416)	)	ZAHIRAH BINTI SHUIB
Di hadapan , ENCIK MOHD NASIR BIN KAMARUDDIN,	)	…….
sebagai penyelia projek pada tarikh:	)	EN. MOHD NASIR BIN KAMARUDDIN

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ABSTRACT

This project is called Soil Moisture Sensor. This product is used to measure soil moisture level. Some of those who are involved in agriculture sector are having difficulties to monitor their soil moisture level. Not all of those who involve in the agricultural sector can afford a soil moisture sensor because it is expensive and if the sensor's component broke, it cannot be replaced. The purpose of this innovation is to help farmers and gardeners monitor their soil moisture level easily. All plants need to be in a specific soil moisture level to grow. It is important to monitor the soil moisture level because it affects the plant growth. This product is affordable and the components are replaceable. This soil moisture sensor uses 9v battery to operate. The 9v battery can be either rechargeable or the normal 9v battery. Arduino Uno R3 is used as the main chip of this product and acrylic is used as the outer shell. This product requires coding process to synchronize all the components and function properly. Surveys are carried out to get reviews about the product and the feedback are positive. A few upgrades can be made to improve this product. The casing design can be improved to make it more comfortable to hold and the sensor can be upgrade to a better sensor if it is possible.

Keywords: soil moisture sensor, arduino

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ABSTRAK

Projek ini dinamakan Soil Moisture Sensor. Produk ini digunakan untuk menyukat tahap kelembapan tanah. Sesetengah individu yang terlibat dengan sektor pertanian mengalami kesukaran untuk memantau tahap kelembapan tanah mereka. Tidak semua yang terlibat dengan sektor pertanian mampu memiliki sensor kelembapan tanah kerana harganya yang mahal dan sekiranya berlaku kerosakkan pada komponen sensor tersebut, ia tidak boleh diganti. Tujuan inovasi ini adalah untuk membantu pekebun dan peladang memantau tahap kelembapan tanah mereka dengan lebih mudah. Semua tumbuhan memerlukan tahap kelembapan tanah yang tertentu untuk membesar. Amat penting untuk memantau tahap kelembapan tanah kerana ia mempengaruhi pembesaran tumbuhan tersebut. Produk ini adalah mampu milik dan komponennya boleh diganti. Sensor kelembapan tanah ini menggunakan bateri 9v untuk beroperasi. Sensor tersebut boleh menggunakan bateri 9v yang boleh dicas semula ataupun tidak boleh dicas. Arduino Uno R3 digunakan sebagai cip utama produk ini dan akrilik digunakan sebagai penutup dan pelindung produk. Produk ini memerlukan proses pengekodan untuk segerakkan semua komponen dan juga untuk berfungsi dengan baik. Tinjauan telah dilakukan untuk mendapatkan pandangan tentang produk ini dan maklum balas yang diberikan adalah positif. Terdapat beberapa penambahbaikan yang boleh dilakukan. Antaranya ialah mengubah reka bentuk penutup dan pelindung produk supaya ia lebih selesa untuk dipegang. Penambahbaikan seterusnya ialah menggunakan sensor yang lebih baik sekiranya ada.

Kata kunci: sensor kelembapan tanah, arduino

CONTENT

CHAPTER 1 : INTRODUCTION

CHAPTER 2 : LITERATURE REVIEW

CHAPTER 3 : METHODOLOGY

CHAPTER 4 : FINDING AND ANALYSIS

CHAPTER 5 : DISCUSSION , CONCLUSION AND UPGRADE PLAN

CHAPTER 1: INTRODUCTION

Prepared by Amin , Rasydan , Zahirah

1.1 INTRODUCTION

The product is made to monitor the soil moisture level which is known as " Soil Moisture Sensor ". Farmers can monitor their soil moisture level for their plants growth because plants growth is affected by soil moisture level. This product can help the farmers to manage their plants at the farm more systematically. The existing product in market is expensive and if there is a component broken in the product, it cannot be replace. This soil moisture sensor components can be replace if the component is broken. Besides, the price of the components used is cheap. There are also some innovation made from the existing product.

1.2 RESEARCH BACKGROUND

A good quality soil is the one with fertility and produce a productive effects. Factors such as the moisture and the soil pH can affect its fertility. Therefore, with a moisture soil sensor, it can determine the moisture and the soil pH.

To ensure a better product with qualities, we are making improvements to this existing product.For example, the sensor without cover and not neat.Therefore, the idea is created for the sensor to be better than before and more qualities is provided such as the cover for the sensor which makes the sensor look more neat and long lasting.

1.3 PROBLEM STATEMENT

i. It is hard to determine the soil moisture level.

ii. The component of the existing product cannot be replaced.

iii. The existing product is expensive.

1.4 OBJECTIVE

The objective of this project is to:

i. Make it easier to determine the soil moisture level.

ii. Make the components used can be easily replaced if there are defects occur.

iii. Make a budget soil moisture sensor.

1.5 RESEARCH QUESTIONS

This study will answer the following research questions:

i. What is the purpose of making soil moisture sensor?

ii. Does it need to be plugged on power socket to operate?

iii. Is the soil moisture sensor portable?

1.6 SCOPE OF THE RESEARCH

The soil moisture sensor is related to the agriculture sector. The scope of the research is limited to farmers.

1.7 THE IMPORTANCE OF RESEARCH

This research has some importance. The importance are:

i. To make it easier for farmers to monitor the soil moisture level.

ii. To encourage farmers to continue farming.

iii. To reduce the cost of farmers to buy soil moisture sensor.

1.8 SUMMARY

In this chapter , the ideas of the project was explaine . The objectives of the research made out of the problem statements. The objectives of this project is to help farmers to measure the soil moisture level of the soil.

CHAPTER 2 :

LITERATURE REVIEW

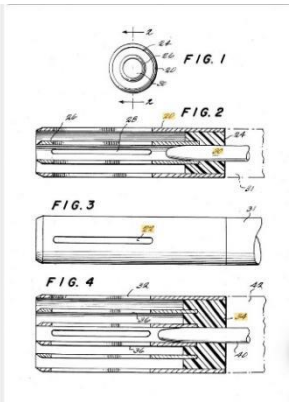
2.1 INTRODUCTION
Prepared by Zahirah Shuib

Literature review can be defined as a process of prior research to assist in the design process of an object to be produced. Literature review are needed to help produce a product. Without doing research, a product to be manufactured does not meet current needs and usage. Therefore, this study is very important to determine which products are being used well. Through this research, deficiencies in existing products can be identified. Therefore, the product being designed is a new invention to satisfy the requirements without causing problems with the product.

2.2 RESEARCH
Prepared by Zahirah Shuib

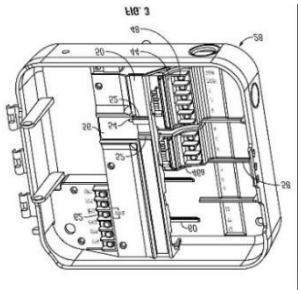
2.2.1 SOIL MOISTURE SENSOR

A moisture sensor including in one embodiment a probe formed with a first cylindrical tube extending outward from a base and having a plurality of axially extending slots around the periphery thereof and a second slotted cylindrical tube extending outward from the base separated and insulated from the first tube, and extending coaxially with the first tube. The tubes form an effective coaxial capacitor and are insertable into material to be sensed appear as a ground plane. In a second and third embodiment a member defining flat surfaces extends from a base forming in cross-section a volume with a square center and legs extending from each side thereof to an open peripheral end (John E.Walsh , July 2005).



2.2.2 IRRIGATION SYSTEM WITH SOIL MOISTURE BASED SEASONAL WATERING ADJUSTMENT

A soil moisture based irrigation system includes a stand alone irrigation controller with a seasonal adjust feature and a stand alone weather station including at least one soil moisture sensor. The soil moisture based irrigation system further includes a stand alone soil moisture control unit operatively connected to the irrigation controller and the soil moisture sensor. The soil moisture control unit includes programming configured to calculate an estimated soil moisture requirement value using a signal from the soil moisture sensor and to automatically modify a watering schedule of the irrigation controller through the seasonal adjust feature based on the estimated soil moisture requirement value to thereby conserve water while maintaining plant health.(Peter J.Woytowitz & San Diego , October 2008).



2.2.3 WIRELESS SOIL MOISTURE METER NETWORK

A wireless Soil moisture meter network includes a central display unit and a plurality of remote Sensor units. Each Sensor unit uses a probe to measure moisture content in Soil, and uses a wireless transmitter to transmit the measurement through a wireless channel to the central display unit. The central display unit receives and displays the measurement in a format Selectable by a user. The user may add to or remove from the network a Sensor unit using a user interface of the central display unit.(Peter Ethan Staples & Hermosa Beach , January 2003).

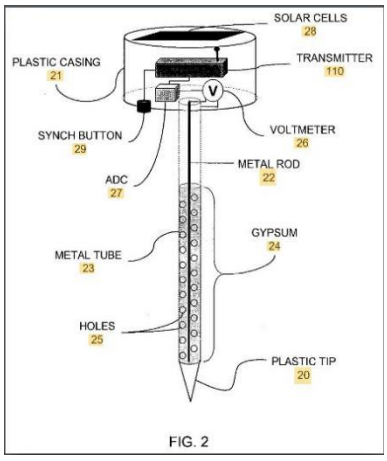


FIG. 2

2.2.4 THE INTELLIGENT FLOWER WATERING SYSTEM THAT A KIND OF BLUETOOTH OF MOBILE PHONE OR PC CONTROL AND CONTROL METHOD THEREOF

The invention discloses intelligent flower watering system and the control method thereof of a kind of Bluetooth of mobile phone or PC control, comprise signal acquisition process module, the input of signal acquisition process module is connected with soil humidity sensor and state modulator module, the output of signal acquisition process module is connected with module of watering, and the communication channel of signal acquisition process module is connected with terminal control module; Wherein, soil humidity sensor is for detecting flowers and plants soil moisture state; State modulator module is used for arranging presets threshold value of watering; The threshold value of watering that signal acquisition process module is used for the flowers and plants soil moisture received and potentiometer are preset compares, and is undertaken controlling the instruction that module of watering is opened or closed alternately by terminal control module and terminal installation.The present invention can obtain humidity in flowerpot in soil by soil humidity sensor, and module of watering can carry out unlatching or the close down of water pump according to soil moisture and the contrast of threshold value of watering, thus can monitor the state of flowers and plants in real time (Zhang Baiyi , March 2003).

2.2.5 Plant intelligent irrigation system based on wechat platform

The invention provides an intelligent plant irrigation system based on a WeChat platform. The intelligent plant irrigation system is connected with a WeChat client, so that hardware is directly controlled by the WeChat, and the WeChat remotely receives data. The intelligent plant irrigation system comprises a sensor module, an Arduino board, a Sina cloud module, a GPRS module, a WeChat platform module and an irrigation facility module, wherein the sensor module and the irrigation facility module are respectively connected with the Arduino board, the Arduino board is connected with the GPRS module, the GPRS module is connected with the Sina cloud module, and the Sina cloud module is connected with the WeChat platform module. The intelligent plant irrigation system has the advantages that plants are monitored in real time whenever and wherever possible by the mobile phone WeChat, the plants are irrigated according to actual needs, energy is saved favorably, water resource utilization is benefited, and water resource waste is avoided (Zhu Tao Lu , March 2017).

2.3 CONCEPT/THEORY
Prepared by Zahirah Shuib

TYPES OF SENSOR

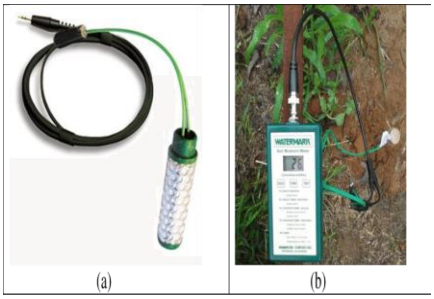
2.3.1 Soil Moisture Sensor

Tensiometric and volumetric are the two primary sensor types that measure soil moisture. As the name implies, tensiometric sensors or probes measure soil moisture tension, or the potential soil moisture. Tensiometers are sensitive to soil properties by measuring how tightly a particular soil type retains water. Volumetric sensors measure the actual volume of water in the soil. Soil moisture sensors can work in tandem with your irrigation system by signaling the need for water and turning on the system, or they can prevent sprinklers from coming on if there's enough moisture in the soil.

2.3.2 Tensiometers

Tensiometer probes are water-filled tubes that you insert into the soil to the depth of plant roots. At the bottom of the probe is a porous ceramic tip, and at the top of the probe is an above-ground gauge. Water from the tube leaves the porous cap and enters the soil around it. As the moisture inside the tube reaches equilibrium with the soil moisture outside the tube, the moisture tension registers on the gauge. When soil is dry, a plant must use greater suction to extract the available water from the soil. The tensiometer gauge reflects this soil water suction -- the higher the reading, the drier the soil.

2.3.3 Gypsum Blocks



Another type of sensor that measures soil water tension is a gypsum block, also called an electrical resistance block. A porous block, typically made of gypsum, is placed on top of the soil and must maintain firm contact with it. The block contains two embedded electrodes into which wires are inserted. The other ends of the wires penetrate the soil surface. As water moves through the block to maintain equilibrium with the soil moisture, the electrodes measure the electrical resistance that the water generates. A portable meter converts the resistance readings to water tension values.

2.3.4 Time Domain Reflectometry

Time domain reflectometry (TDR) technology measures actual soil water content instead of soil water potential. Steel rods that you bury in the soil receive electrical signals from the TDR device. Sensors measure the signal's rate of return, which estimates how much water is in the soil. Dry soil returns the signal faster than wet soil. TDR soil moisture sensors provide accurate readings quickly and require minimal maintenance. On the down side, TDR sensors require data interpretation, and they may need different calibrations depending on varying soil makeup.

2.4 TYPES OF ARDUINO

2.4.1 Arduino Uno R3

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.

2.4.2 LilyPad Arduino

The LilyPad Arduino is a microcontroller board designed for wearables and e-textiles. It can be sewn to fabric and similarly mounted power supplies, sensors and actuators with conductive thread. The board is based on the ATmega168V (the low-power version of the ATmega168) (datasheet) or the ATmega328V (datasheet). The LilyPad Arduino was designed and developed by Leah Buechley and SparkFun Electronics.

2.4.3 Arduino Mega

Arduino is an open-source physical computing platform based on a simple i/o board and a development environment that implements the Processing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer (e.g. Flash, Processing, MaxMSP). The open-source IDE can be downloaded for free (currently for Mac OS X, Windows, and Linux)

2.4.4 Arduino Leornado

The Arduino Leonardo is a microcontroller board based on the ATmega32u4. It has 20 digital input/output pins (of which 7 can be used as PWM outputs and 12 as analog inputs), a 16 MHz crystal oscillator, a micro USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

2.5 TYPES OF BATTERY

2.5.1 Nickel-Cadmium Battery

The nickel–cadmium battery is a type of rechargeable battery using nickel oxide hydroxide and metallic cadmium as electrodes.

2.5.2 Nickel-Metal Hydride Battery

A nickel metal hydride battery, abbreviated NiMH or Ni–MH, is a type of rechargeable battery. The chemical reaction at the positive electrode is similar to that of the nickel–cadmium cell, with both using nickel oxide hydroxide. However, the negative electrodes use a hydrogen-absorbing alloy instead of cadmium.

2.5.3 Lead Acid Battery

The lead–acid battery was invented in 1859 by French physicist Gaston Planté and is the earliest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio.

2.5.4 Lithium ion Battery

A lithium-ion battery or Li-ion battery is a type of rechargeable battery. Lithium-ion batteries are commonly used for portable electronics and electric vehicles and are growing in popularity for military and aerospace applications.

2.5.5 Lithium ion Polymer Battery

A lithium ion polymer is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte. High conductivity semisolid (gel) polymers form this electrolyte. These batteries provide higher specific energy than other lithium battery types and are used in applications where weight is a critical feature, like mobile devices and radio-control aircraft.

2.6 TYPES OF SWITCH

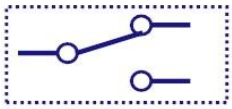
2.6.1 Single Pole Single Throw Switch


Symbol


SPST Switch

This is the basic ON and OFF switch consisting of one input contact and one output contact.It switches a single circuit and it can either make (ON) or break (OFF) the load.The contacts of SPST can be either normally open or normally closed configurations .

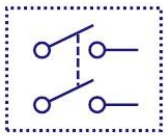
2.6.2 Single Pole Double Throw Switch


Symbol


SPDT Switch

This switch has three terminals,one is input contact and remaining two are output contacts.This means it consist two ON positions and one OFF position.In most of the circuits, these switches are used as changeover to connect the input between two choices of outputs.The contact which is connected to the input by default is referred as normally closed contact and contact which will be connected during ON operation is a normally open contact.

2.6.3 Double Pole Single Throw Switch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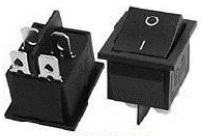
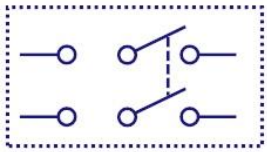

DPST Switch

This switch consists of four terminals,two input contacts and two output contacts.It behaves like a two separate SPST configurations, operating at the same time.It has only one ON position, but it can actuate the two contacts simultaneously, such that each input contact will be connected to its corresponding output contact.In OFF position both switches are at open state.This type of switches is used for controlling two different circuits at a time.Also, the contacts of this switch may be either normally open or normally closed configurations.

2.6.4 Double Pole Double Throw Switch

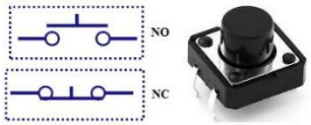


Symbol

DPDT Switch

This is a dual ON/OFF switch consisting of two ON positions.It has six terminals,two are input contacts and remaining four are the output contacts.It behaves like a two separate SPDT configuration, operating at the same time.Two input contacts are connected to the one set of output contacts in one position and in another position, input contacts are connected to the other set of output contacts.

2.6.5 Push Button Switch



It is a momentary contact switch that makes or breaks connection as long as pressure is applied (or when the button is pushed).Generally, this pressure is supplied by a button pressed by someone's finger.This button returns its normal position, once the pressure is removed.The internal spring mechanism operates these two states (pressed and released) of a push button.It consists of stationary and movable contacts, of which stationary contacts are connected in series with the circuit to be switched while movable contacts are attached with a push button.Push buttons are majorly classified into normally open, normally closed and double acting push buttons as shown in the above figure.Double acting push buttons are generally used for controlling two electrical circuits.

2.6.6 Toggle Switch

A toggle switch is manually actuated (or pushed up or down) by a mechanical handle, lever or rocking mechanism. These are commonly used as light control switches.Most of these switches come with two or more lever positions which are in the versions of SPDT, SPST, DPST and DPDT switch. These are used for switching high currents (as high as 10 A) and can also be used for switching small currents.These are available in different ratings, sizes and styles and are used for different type of applications. The ON condition can be any of their level positions, however, by convention the downward is the closed or ON position.

2.6.7 Limit Switch

The control schemes of a limit switch are shown in above figure , in which four varieties of limit switches are presented.Some switches are operated by the presence of an object or by the absence of objects or by the motion of machine instead of human hand operation. These switches are called as limit switches.These switches consist of a bumper type of arm actuated by an object. When this bumper arm is actuated, it causes the switch contacts to change position.

2.7 Material Selection

Prepared by Amin Faris

2.7.1 Arduino Uno R3

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

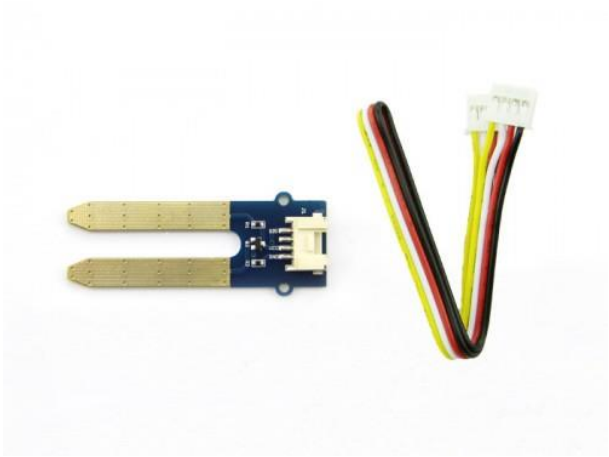
"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

In this project, we use Arduino Uno R3 as the project's core because it can support many sensors other than the soil moisture sensor. Besides, it easier to program and has many functions than the other Arduino boards.

2.7.2 Soil Moisture Sensor

This sensor is very simple to use, you insert in into the soil and read the data. With this sensor in the right project, your plants can let you know when it's time to water them.

In this project, the soil moisture sensor is used in this project because it is the component that will detect the soil moisture level.



2.7.3 9V Battery Connector

The 9V battery connector is used to operates the Arduino board. The battery connector function is to supply the current from the dry cell to the board.

2.7.4 9V Rechargeable Battery

The nine-volt battery, or 9-volt battery, is a common size of battery that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in walkie-talkies, clocks and smoke detectors.

The nine-volt battery format is commonly available in primary carbon-zinc and alkaline chemistry, in primary lithium iron disulfide, and in rechargeable form in nickel-cadmium, nickel-metal hydride and lithium-ion. Mercury-oxide batteries of this format, once common, have not been manufactured in many years due to their mercury content. Designations for this format include *NEDA 1604* and *IEC 6F22* (for zinc-carbon) or *MN1604 6LR61* (for alkaline). The size, regardless of chemistry, is commonly designated PP3—a designation originally reserved solely for carbon-zinc, or in some countries, *E* or *E-block.*

To operates the Soil Moisture Sensor successfully, it requires a current supply other than connecting it to computer. Thus, the 9V battery is used as the dry cell to supply the current. But the advantage of this dry cell is it can be charge when the battery is running out. There is also battery indicator beside it to indicate whether it is full or running low.

2.7.5 Switch

A switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another. A switch may be directly manipulated by a human as a control signal to a system, such as a computer keyboard button, or to control power flow in a circuit, such as a light switch.

Switches may be operated by process variables such as pressure, temperature, flow, current, voltage, and force, acting as sensors in a process and used to automatically control a system. For example, a thermostat is a temperature-operated switch used to control a heating process.

CHAPTER 3: METHODOLOGY

3.1 METHODOLOGY FLOW CHART

Prepared by Amin Faris

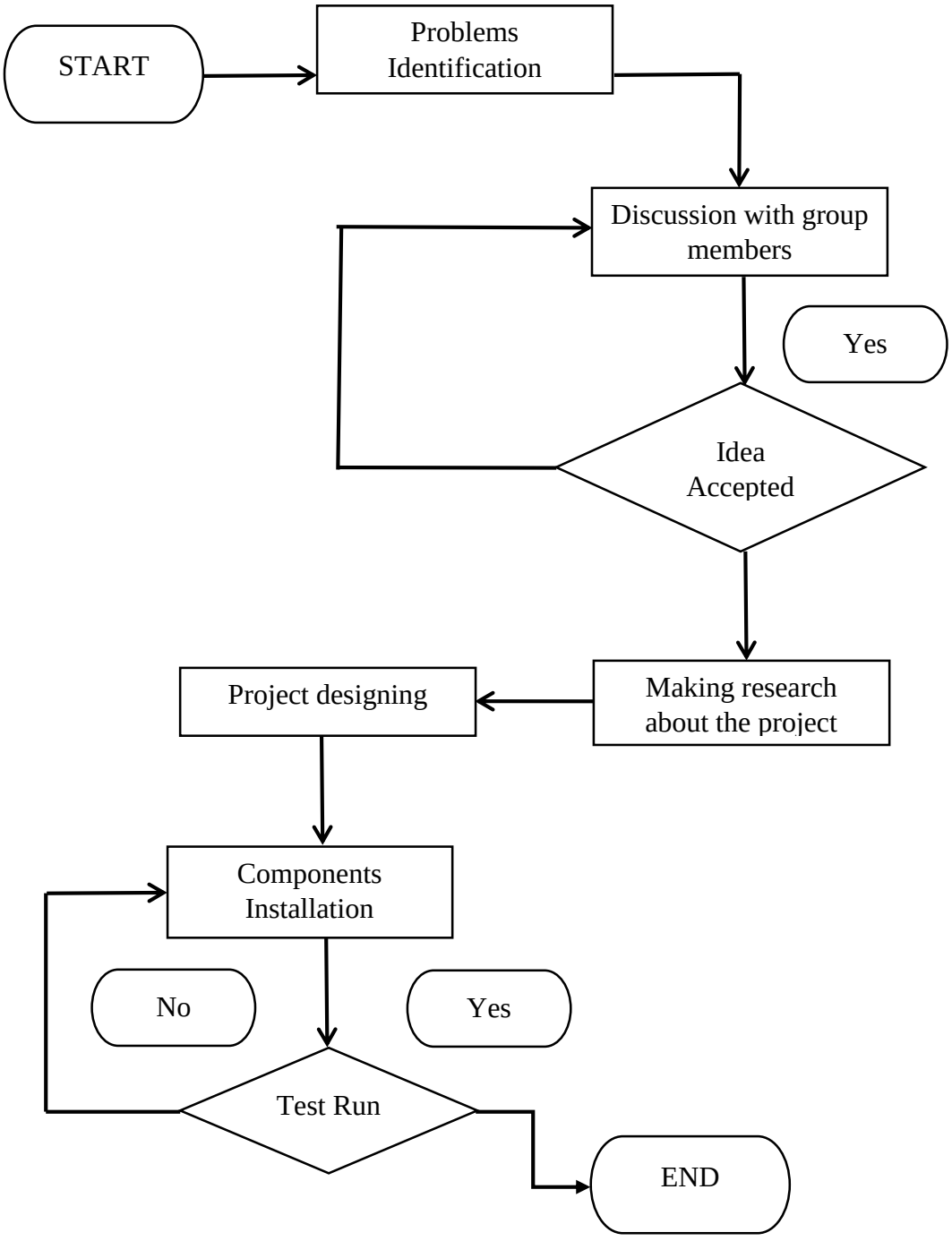


Figure 3.1.1 – Flow Chart

3.2 FLOW CHART EXPLAINATION

Prepared by Amin Faris

DISCUSSION WITH GROUP MEMBERS

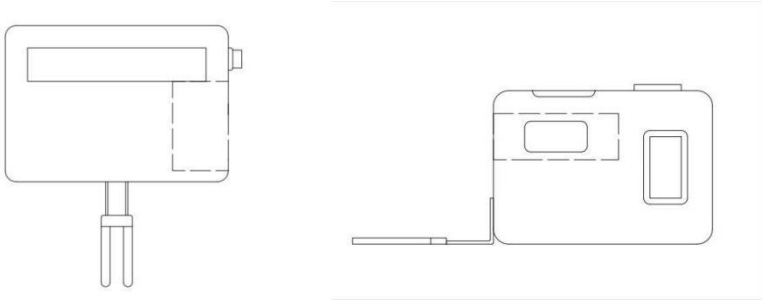
We were given a week to think about the problems that occur around us and to come with a project idea to overcome the problems. Then, a discussion about our findings had been made. During the discussion, the project and the title has been chose according to the majority. The chosen title is Soil Moisture Sensor.

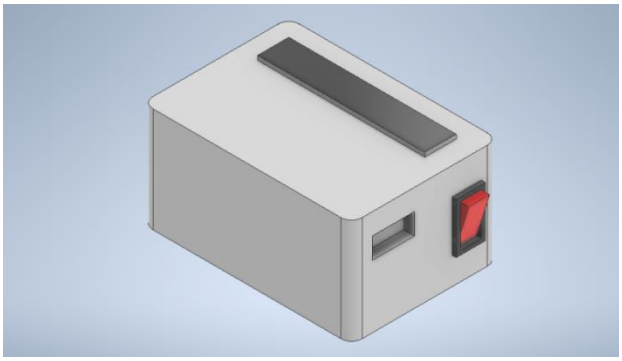
PROJECT'S RESEARCH

After the idea is accepted by group members and supervisor, some researches that have connections with our project are made. The research conclude the history of Soil Moisture Sensor, the sensor used, the material used and others. All the researches had been compiled in the Literature Review section.

PROJECT DESIGNING

The designation of the project began after the researches about the Soil Moisture Sensor gathered. New design was made to make an identical change between the past project and the new one. These are some of the project's design.





3.3 COMPONENTS INTALLATION

Prepared by Amin Faris

The installation began after all the components purchased. The installation start by connecting the wires to the Arduino and the components. After the wires are connected, the components were placed according to the design. Then, the arduino is connected to computer for programming and coding process.

These are the components that is used in this project:

Arduino Uno R3

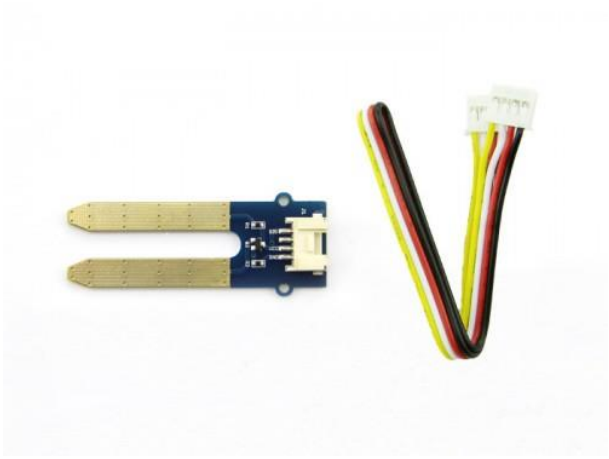
Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

In this project, we use Arduino Uno R3 as the project's core because it can support many sensors other than the soil moisture sensor. Besides, it easier to program and has many functions than the other Arduino boards.

Soil Moisture Sensor

This sensor is very simple to use, you insert in into the soil and read the data. With this sensor in the right project, your plants can let you know when it's time to water them. In this project, the soil moisture sensor is used in this project because it is the component that will detect the soil moisture level.



9V Battery Connector

The 9V battery connector is used to operates the Arduino board. The battery connector function is to supply the current from the dry cell to the board.

9V Rechargeable Battery

The nine-volt battery, or 9-volt battery, is a common size of battery that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in walkie-talkies, clocks and smoke detectors.

To operates the Soil Moisture Sensor successfully, it requires a current supply other than connecting it to computer. Thus, the 9V battery is used as the dry cell to supply the current. But the advantage of this dry cell is it can be charge when the battery is running out. There is also battery indicator beside it to indicate whether it is full or running low.

3.4 TEST RUN

Prepared by Amin Faris

After the programming and coding process was done, the product is tested to see if the product's components functioning well. The product was able to turned on and the components are functioning well which means it is coded successfully. Then, the product was taken outside for the test run. The product appears to be working properly and it is proved as shown below.

CHAPTER 4

FINDING AND ANALYSIS

4.1 INTRODUCTION

This chapter combined data and analysis on soil moisture sensors and their material calculations. Data and analysis are important for this project to achieve the objectives and scope of the project. In this chapter, we want to show the successful results of component testing. We do some tests on soil moisture sensor in different areas are to make sure the soil moisture sensor can work well.

4.2 ANALYSIS

NO	TYPES OF PLANT	OPTIMUM MOISTURE PERCENTAGE	ACTUAL (%)	TARGET AREA	EFFICIENCY (%)
1.	Papaya	60 – 85 %	80	TTDI JAYA	94
2.	Mango	60 – 70 %	66	TTDI JAYA	94
3.	Pandan	20 - 45 %	30	SUNGAI BULOH	67
4.	Banana	50 % and above	82	TTDI JAYA	96
5.	Aloe Vera	50 -70 %	66	SUNGAI BULOH	94

4.3 ADVANTAGES AND DISADVANTAGES

Every project has its own advantages and disadvantages. With the benefits available, it can help every user to use it more comfortably and in control. The benefits of each project will have a positive impact on consumers as well as their plants. However, the disadvantages also be hidden in a project. Existing disadvantages should be improved to further improve the quality of the project so that it becomes better and more efficient compared to branded projects.

Soil moisture sensor has the advantages that will help farmers determine the moisture level of their plants as well as save money because these sensors are easily available at an affordable price. In addition to the advantages, this project also has disadvantages that will be overcome in the future so that users can use it better.

4.4 SUMMARY

In conclusions for this chapter, analysis and study have been done on this project. However, there are some advantages and disadvantages of this soil moisture sensor and challenges have been taken as a space to make improvements to all existing shortcomings. In addition, development and modification will also be enhanced from time to time so that future generations can learn more about the main objectives of this project

CHAPTER 5

DISCUSSION , CONCLUSION AND UPGRADE PLAN

5.1 INTRODUCTION

This chapter describes about the discussions, conclusions and upgrade plans for the project. From the project test result data, analysis was performed. Therefore, a discussion of all the test and analysis results will be explained in this chapter. Then, conclusions will be drawn based on the discussion plan and agreement made between group members.

5.2 DISCUSSION AND UPGRADE PLAN

After this product is invented, test run has been done. This product can read moisture percentage from soil and other materials such as tissue. The Soil Moisture Sensor was tested to read the soil moisture of plants and the result is shown in the analysis. This product has achieved the objectives stated.

For the upgrade plan, the design of the product's casing can be improved by making it more unique and easy to hold. The next upgrade that can be made to this product is improving the coding of this product to make the reading more accurate.

5.3 CONCLUSION

This project is an innovation of existing product with some added features such as replaceable components. Courses provided by Polytechnic for Mechanical Engineering program like electrical technology and packaging related helps in making this product. These courses provided us the knowledge in wire connection, packaging material and the packaging design for this product. This product is made to help farmers and gardeners to monitor their farm's soil moisture level. Nowadays, technologies are widely used in industries. With technologies, the soil moisture level can be determined quicker than the manual method. Therefore, it will save the farmers and gardeners time to get the result.

ANALYSIS OF DATA

In the process of analysing for this soil moisture sensor, the data collected will be analysed and the results will be presented in graph form

POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

MECHANICAL ENGINEERING DEPARTMENT

QUESTIONNARE FORM

SECTION A: DEMOGRAPHIC OF RESPONDENT

1. Gender: ( ) Male ( ) Female

2. Age: ( ) 21 – 25 years old

( ) 26 – 30 years old

( ) 31 – 35 years old

( ) 36 and above

SECTION B: GENERAL VIEW OF THE PROJECT

1. Have you ever gardening ? ( ) Yes ( ) No

2. Do you know about soil moisture ? ( ) Yes ( ) No

3. Is it suitable if the soil moisture sensor is priced at RM 70 ? ( ) Yes ( ) No

SECTION C: RESPONDENT'S PERSPECTIVE ON SOIL MOISTURE SENSOR

Please indicate (/) the extent to which you agree with the following question.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

No	Question	1	2	3	4	5
1.	You can use soil moisture sensor to determine the soil moisture level.					
2.	The components used can be replace if there is defects occur.					
3.	The components used for the soil moisture sensor is affordable.					
4.	The soil moisture sensor use rechargeable battery.					
5.	Are you interested to buying this product ?					

JABATAN KEJURUTERAAN MEKANIKAL

BORANG SOAL SELIDIK

BAHAGIAN A: DEMOGRAFI RESPONDEN/CIRI-CIRI MAKLUM BALAS

1. Jantina: ( ) Lelaki ( ) Perempuan

2. Umur: ( ) 21 – 25 tahun

( ) 26 – 30 tahun

( ) 31 – 35 tahun

( ) 36 tahun dan ke atas

BAHAGIAN B : PANDANGAN TERHADAP PRODUK

1. Pernahkah anda berkebun ? ( ) Ya ( ) Tidak

2. Adakah anda tahu tentang kelembapan tanah ? ( ) Ya ( ) Tidak

3. Adakah sesuai jika sensor kelembapan tanah berharga RM70 ? ( ) Ya ( ) Tidak

BAHAGIAN C: PANDANGAN RESPONDEN TERHADAP SENSOR KELEMBAPAN TANAH

Sila nyatakan (/) sejauh mana anda bersetuju dengan soalan berikut.

1	2	3	4	5
Sangat tidak setuju	Tidak setuju	Kurang setuju	Setuju	Sangat setuju

No	Question	1	2	3	4	5
1.	Anda boleh menggunaka sensor kelembapan tanah untuk menentukan tahap kelembapan tanah.					
2.	Komponen yang digunakan boleh diganti jika terdapat kecacatan berlaku.					
3.	Komponen yang digunakan untuk sensor kelembapan tanah adalah berpatutan.					
4.	Sensor kelembapan tanah menggunakan bateri yang boleh dicas semula.					
5.	Adakah anda berminat untuk membeli produk ini ?					

SURVEY QUESTION INFORMATION:

1. You can use soil moisture sensor to determine the soil moisture level.

ANSWER: To find out how many farmers will use the sensor

2. The components used can be replace if there are defects occur.

ANSWER: How many farmers will agree if the product has a replaceable component

3. The components used for the soil moisture sensor is affordable.

ANSWER: How many farmers agree that the components used are affordable

4. The soil moisture sensor use rechargeable battery.

ANSWER: How many farrmers agree if this product uses a rechargeable battery

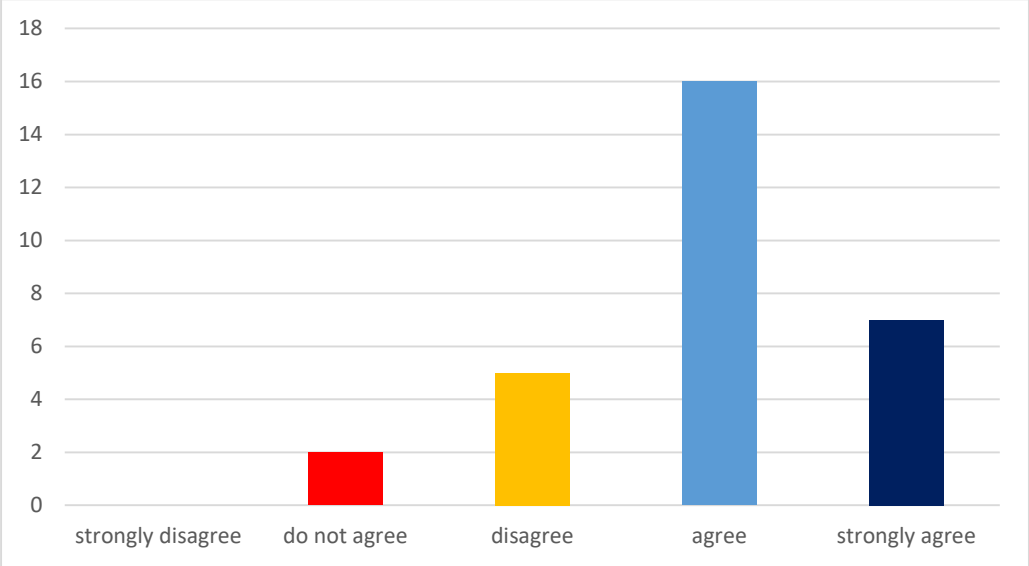
5. Are you interested to buying this product?

ANSWER: How many farmers will be interested if this product is produced

DEMOGRAPHIC OF RESPONDENT

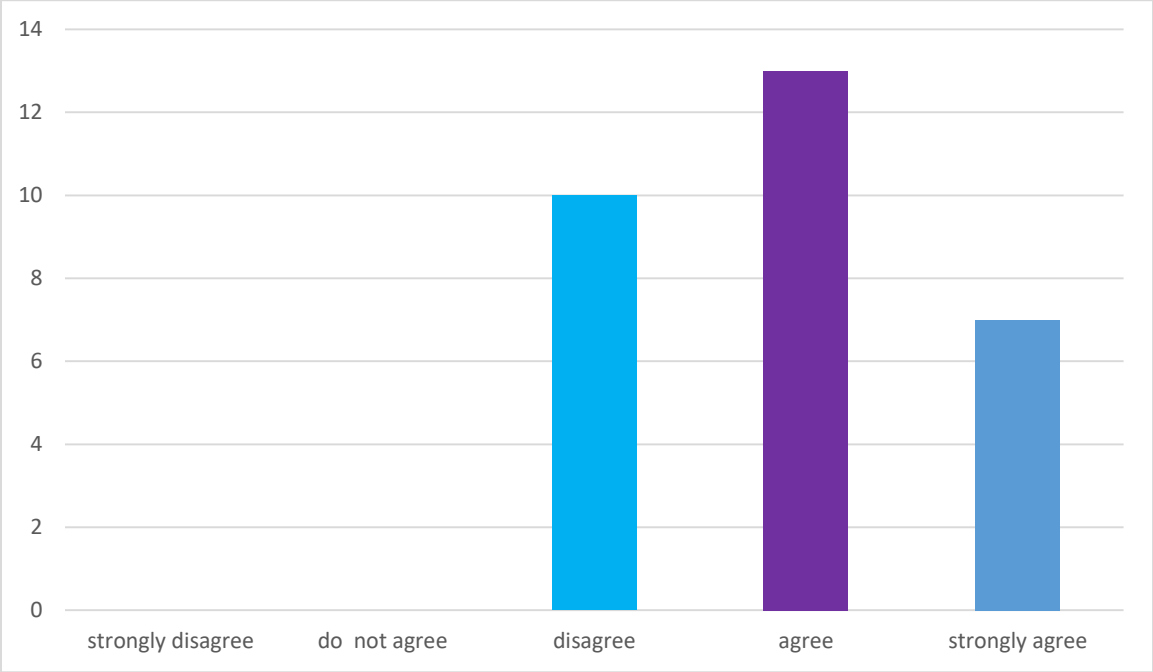
Prepared by Muhammad Rasydan

Who's agreed with this tool could determine the level of soil moisture



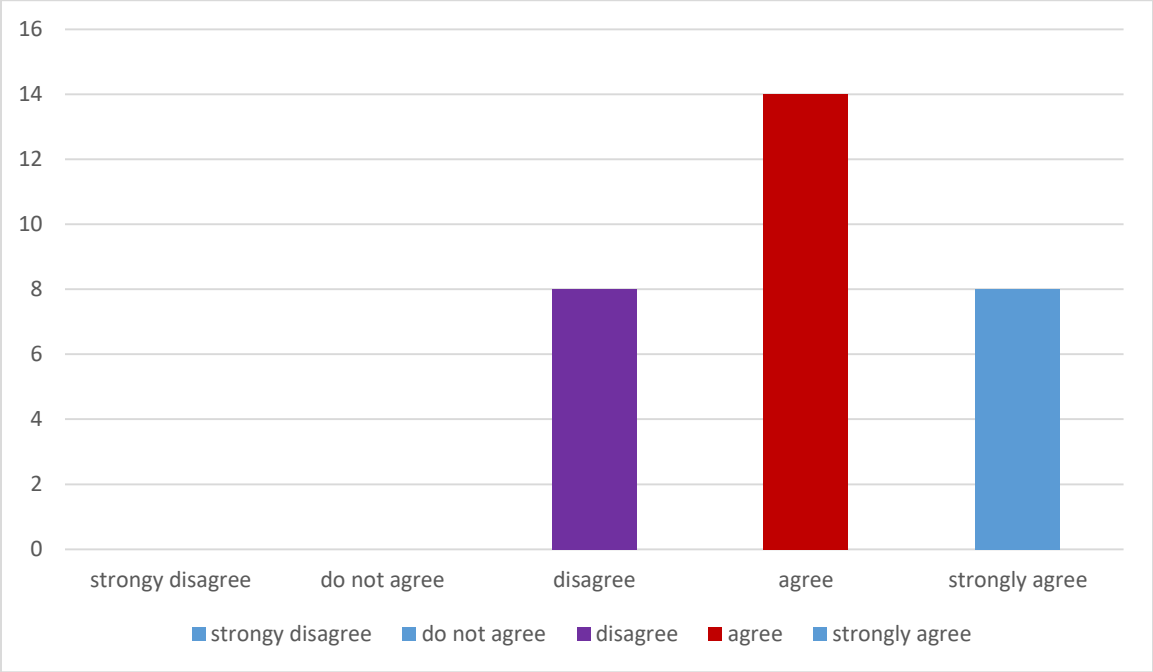
Many gardeners use this soil moisture tool because soil moisture plays an important role before planting a plant. From the 30 questionnaires we distributed, we found that 22 people agreed with the method we used before planting. While 8 people disagree with this method because some of them have never cultivated and still do not understand the right way before planting.

Replaceable components



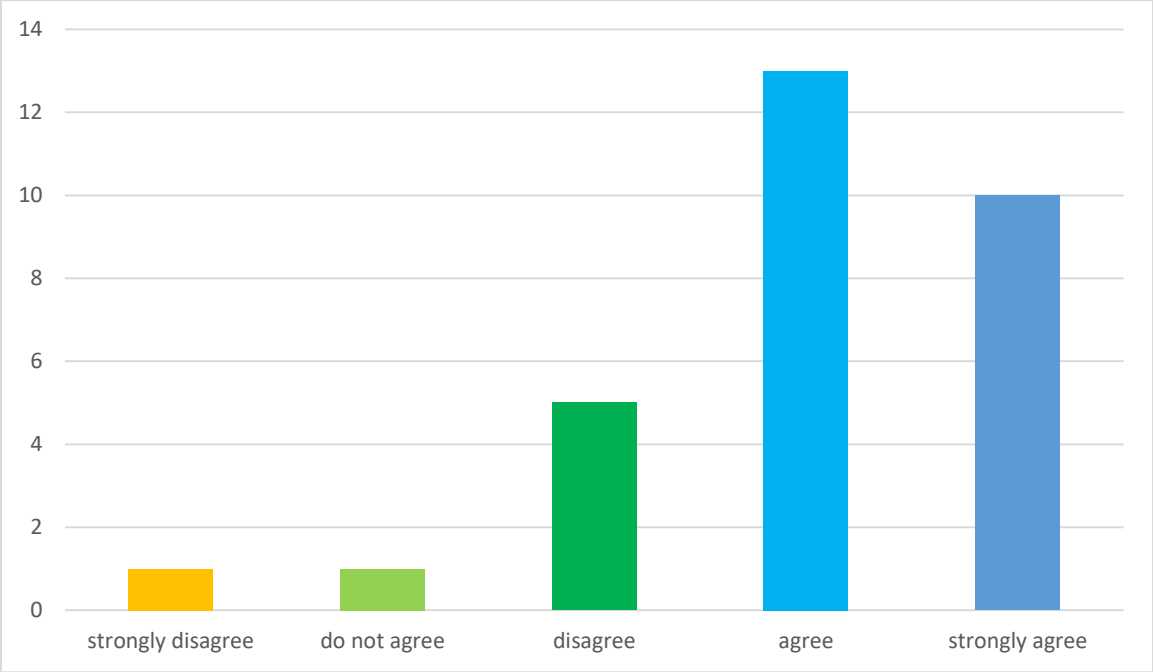
The components in a tool play an important role for the device to function properly. In addition, components are also the main reason for accurate reading or counting. The easy-to-find or replaceable components can attract many gardeners to buy this product. This is because the components for these soil moisture tools can be purchased on the internet to make it easier for buyers to buy them. The study found that 20 respondents agreed to replace this component as it is very easy to install and buy. In turn, 10 republicans disagreed with the replacement tool because they did not want to waste time searching and waiting for it to come online.

Affordable component prices



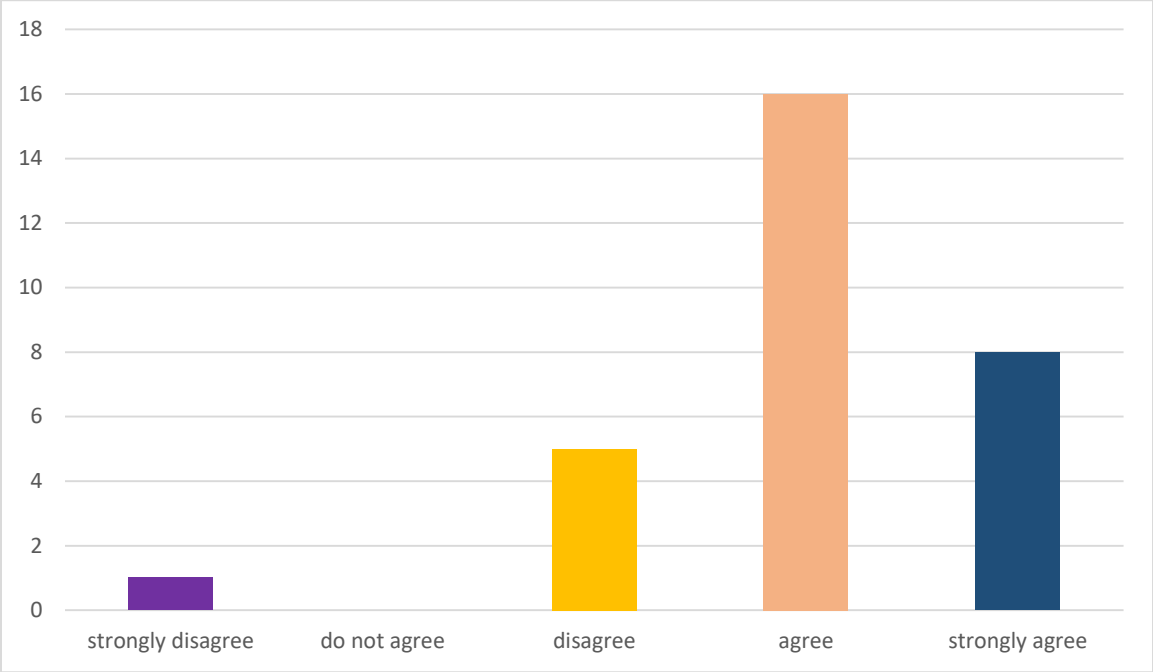
Prices for this component are not very expensive as they are already fixed at affordable prices. It is also able to please some gardeners who cannot afford to buy new soil moisture tools. As such, they do not need to buy new soil moisture tools as they can be repaired by replacing components within the product alone. From our survey, we found that 22 respondents agreed on the price of fixed components because they felt they could afford it and that it was easy to improve the soil moisture tools. In addition, 8 people disagree with the price of the given component because they feel it does not fit the price placed on the component

Use of rechargeable batteries



Nowadays battery usage is too much in a device to turn it on. Batteries are also very expensive to buy as they can be used only once. As a result, we have found that 23 people have agreed to the use of rechargeable batteries. This is because they can save them money from buying batteries and are able to use these soil moisture tools repeatedly. There were 7 respondents who disagreed with the rechargeable batteries as they rarely used this soil moisture tool.

Respondents interested in soil moisture sensors



Many crops today are unable to thrive well due to soil factors used during the planting process. Thus, this soil moisture tool has many benefits to the people in the process of cultivation. The study found that 24 people are interested in buying this soil moisture tool because they want to have good and fertile crop. In addition, there are 6 people who are not interested in this soil moisture tool because they have no plants to grow. Therefore they do not know the benefits and uses of this soil moisture tool.

GANTT CHART

Prepared by Muhammad Rasydan

PROJECT ACTIVITIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Make a group														
Get the title about the project														
Briefing about the project														
Discuss the objectives and problem statement														
Discuss the theory and sketching														
Preparation of project proposal														
Making reports and submit proposal														
Presentation and submit report														

	PLANNING
	ACTUAL

3.9 REFERENCES

https://en.m.wikipedia.org/wiki/Soil_moisture_sensor

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