
# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## THE DEVELOPMENT OF SMALL SCALE OF HYDROPONIC SYSTEM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

by

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# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **THE DEVELOPMENT OF SMALL SCALE OF HYDROPONIC SYSTEM**

SESI PENGAJIAN: **2014/15 Semester 2**

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# APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours. The member of the supervisory is as follow:

…….

(Khalil Azha Bin Mohd Annuar)

# ABSTRACT

In pursuit of modernity country and improve the living standards of the people, economic activities and tree felling activities of a country cannot be avoided. People often overlook the environmental problems developed from the implementation of economic activity and activity logging. These activities led to a few problem that will contributes to a huge differences in our environment. Nowadays, so many land has been discovered for development especially in town. This cause the lack of land that can be used for plantation and when most of the trees been cutted. This project will improve the current traditional hydroponic method by providing a system that can be used to monitor and control the important element in order to help the plant grow up smoothly. This proposed system is quite efficient and user friendly which can be used by anyone. This project is a combination of traditional hydroponic system and smart phone. This project is actually been suggested after observing the needs of our environment and the behavior of people nowadays whom cannot live without their smart phone. In future, this project will help in encourage people to use hydroponic method in any plantation activities. Also, maybe that someday that this project can help other developer‟s project to function smoothly and comfortably in order to give a great service not just for users, but also to people that have the interest in trying something new. There are a few steps need to be completed before this project can be used widely. This report will explain every details about this project from software and hardware development until its final form.

# ABSTRAK

Pada hari ini kita sedang menghadapi banyak masalah yang melibatkan alam sekitar kita. Kita boleh melihat dengan jelas pada masa kini bahawa terdapat banyak pokok telah ditebang, peningkatan pemanasan global dan masalah kesihatan. Dalam usaha untuk mengurangkan masalah ini dan menyelamatkan bumi kita, kita perlu mencari jalan penyelesaian atau cara alternatif lain untuk membantu memulihkan alam sekitar kita. Seperti yang kita lihat, terdapat banyak cara alternatif untuk membesarkan tumbuhan dan kaedah hidroponik adalah salah satu teknik yang terus mendapat tempat dalam bidang pertanian ini. Projek ini akan menaiktaraf kaedah hidroponik tradisional semasa dengan menyediakan satu sistem yang boleh digunakan untuk memantau dan mengawal elemen penting bagi membantu tumbuhan membesar dengan lancar. Sistem yang dicadangkan agak cekap dan mesra pengguna serta boleh digunakan oleh pelbagai lapisan masyarakat. Projek ini adalah gabungan sistem hidroponik tradisional dan telefon pintar. Projek ini sebenarnya telah diilhamkan selepas memerhatikan keperluan persekitaran dan tingkah laku pengguna pada masa kini yang sentiasa bersama telefon pintar mereka. Pada masa akan datang, projek ini diharap dapat membantu dalam menggalakkan orang ramai menggunakan kaedah hidroponik dalam mana-mana aktiviti pertanian dan perladangan. Selain itu, diharap suatu hari nanti bahawa projek ini dapat membantu para pereka cipta lain untuk untuk mencipta sesuatu yang berfungsi dengan lancar dan selesa bagi memberikan perkhidmatan yang besar bukan sahaja kepada pengguna, tetapi juga kepada mereka yang mempunyai keinginan dalam mencuba sesuatu yang baru. Terdapat beberapa langkah yang perlu diambil sebelum projek ini boleh digunakan secara meluas. Laporan ini akan menerangkan setiap butiran mengenai projek ini dari perisian untuk pembangunan perkakasan sehinggalah bentuk akhirnya.

# DEDICATIONS

Dedicated to my beloved parents Tuan Haji Mujtahidin bin Husin and Puan Hajah Aishah bt Abdul Wahab.

Also to my late grandfather Tuan Haji Abdul Wahab bin Haji Hashim

# ACKNOWLEDGEMENT

First of all, I want to thank to Allah S.W.T for giving me the chance of completing my Final Year Project successfully just in time. I had to face some challenges and problems throughout this final two semesters in completing this subject due to lack of knowledge and information related to this project.

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| | |
|---|---|
| GSM | Global System Monitoring |
| USB | Universal Serial Bus |
| pH | Potential Hydrogen |
| DC | Direct Current |
| KOH | Potassium Hydroxide |
| H3PO4 | Phosphoric Acid |
| SMS | Short Messaging Services |
| PWM | Pulse Width Modulation |
| W | Watt |
| V | Voltage |
| L/h | Litre/hour |
| EPA | Environmental Protection Agency |
| CO2 | Carbon Dioxide |
| Hz | Hertz |
| IDE | Integrated Development Environment |

# CHAPTER 1
# INTRODUCTION

## 1.0 Introduction

Hydroponics is the activities of planting without soil. Most people thought of hydroponics, when they think of plants that grown with their roots drown directly into water with no growing medium. This is actually referred as Nutrient Film Technique (N.F.T )

Hydroponics provides healthier, desease free plants and faster than growing in soil. In soil less culture, plants are cultivated using a liquid solution of water and nutrients. Plants need light, water, nutrients, and carbon dioxide order to grow. Appopriate temperature and suitable level of nutrients are important for the plants to grow. There are so many types of plant that can be grow up using hydroponic method such as lettuces, tomatoes, celery and etc. In hydroponics, all its nutrients are delivered directly to it's roots by bypassing the soil, which is much faster and efficeient at providing all the nutrients need to the plant. to the plant. Also In hydroponics, all that we are are doing is providing nutrients directly to a plant's roots because roots can only take in pure elements.

Together with hydroponics, the particular facilities are usually expanded within an inert developing medium (see below) as well as a correctly well-balanced pH adjusted vitamin solution will be transported to the particular root base in the remarkably soluble type. This gives the plant the advantages to absorb its nutrients with very little effort as compared to soil where the roots must search out the nutrients and extract them and this explains why some root are big and long. This is a fact even when using rich, organic soil and top of the line nutrients. The energy spent

by the roots in this process is should be better spent on vegetative development and flower production.

## 1.1 Project Developement

The developement of small scale of hydroponic system are the title chosen this project where the main idea of this project is to use the Global System for Mobile (GSM) as a monitoring method for hydroponic cultivation. The cellphone will be the tools for user to get the current status of their plant and control the pH value. Basically, the ph sensor will send input data which is the current water ph to arduino and arduino will transfer the data to cellphone using GSM. The programming of the Arduino is burn by using Arduino Programmer Editor and transfered using USB cable from computer port. The motivation for this project came after observing the needs nowadays.

For example, hydroponics method provides more quality product and use less space. The conventional method nowadays use so many chemical products and took a lot of space for cultivation. We can reduce this problem by improve a several element and start producing a healthy product for a better living in future.

Futhermore, cultivation need a lot of intensive care to avoid the product from infected by desease or parasite. Since people are too busy for intensive care due to daily work or routine, the idea to use mobile phone for intensive care splited outsince mobile phone and man nowadays cannot be saparated. By using mobile phone, user can monitor the plant by using the technology that they are familiar with,

## 1.2 Problem Statement

In pursuit of modernity country and improve the living standards of the people, economic activities and tree felling activities of a country cannot be avoided. People often overlook the environmental problems developed from the implementation of economic activity and activity logging. These activities led to a few problem that will contributes to a huge differences in our environment.

Nowadays, so many land has been discovered for development especially in town. This cause the lack of land that can be used for plantation and when most of the trees been cutted. We know that since there are limitation for plantation, many problem will occur such as raise in price for raw materials and due to limitation of land, only a few products or plant can be planted and of course, only plant that have high request from user will be considered as important and been planted widely. Not only that, price for plant that didn"t get a high request from user will raise since it is so hard to get due to limitation of land that can be used for this products" plantation.

As we known, there are so many erosion of lands that cause death and losses each year. The land loss all its strength when the trees that hold"em gone. When its raining, the land will experience direct hit from the raindrops and this is one of the factors that cause erosion of land. The disssaperence of trees in most of the land is actually cause the increase in temperature. The trees is actually indeed help us to reduce the environmental temperature increases. Deforestation causes temperature increases locally because there is no canopy layer that prevents sunlight from reaching the ground.

Forest burning for agricultural causing air pollution. For example, poor haze caused by open burning that occur on a large scale in Sumatra and Kalimantan, Indonesia in 1997. In addition, deforestation in the end of the river also causes water and air pollution. When forests are been being eliminated, the rain will erode the exposed soil slowly. The eroded materials will be taken to the river and deposited on the riverbed. At the end, the water becomes turbid and cloudy which is not good for living things.

In an old school soil-based garden, plants wastes a huge amount of its strength designing a complex root circuit because it has to seek all over the soil for its meals. Futhermore, in soil-based plant, the chances of having plant with worms and pest are high. As we can see, some pests and worms lived in soil environment, the risk of having them in our plant is high since the activity is placed in the environment that conquered by them. Not only that, in order to eliminate them or avoiding them from damaging their plant, some farmer put pesticides on their plant and in some cases, they poisoned the soil just to make sure that these creatures didn‟t eat or damaging their plant. This might be effective in eliminating these creatures but we should not forget that this action will also effect the plant as they absorbs nutrients from the poisoned soil as well. User will be enjoying poisonous food and many health problems will brings effect on them later on.

Thus, Hydroponic is an alternative method to overcome these problem and this method will offer more healthier and desease-less products and help us to save environment from all these problem.

## 1.3 Objective of the Project

To realize this project, the project objectives have been finished in duration time granted. The main target of this project is to invent a smart system that can monitored and control pH value which is one of the main factor that effect the growth of an hydroponic plant. Basically, the idea of this project is also to encourage people to apply the hydroponic method as the sollution for all the problem stated before. This poject will improvise the current hydroponic system by adding the controller to control the pH and adding the usage of mobile phone for monitoring. This project will offer an alternative way to overcome these problem and help to provide clean, desease-less and healthier products for a better future development.

## 1.4 Scope

This project is one of the small fundamental that has been prepared in the earlier of the semester. Scope of this project will include:-

i. The usage of arduino as a controller. The input for arduino is gained from ph sensor. Then this input data will be send to cellphone using Global System for Mobile (GSM) when user send message for status of their plant.

ii. User also can control the value of pH by using mobile phone. User can choose either to increase or decrease the value of pH according to the plant‟s need. There will be two water pump that will pump out the water nutrient mix into the main tank.

iii. The choosing of sensor and other component is choosen after doing some research from the journal, books, internet, tutorials, megazines, and other resources and discussion between the experience in hydroponic fields and project supervisor.

iv. Planting a few plant manually will be the beginning of this project. This is important step to measure the data needed for this project such as the pH value and the time taken for the plant to grow up.

v. After collecting all the data from day 1 (planting seed) until day 30 (estimated day for seed to produce product) , project will be proceed based on the data gained.

## 1.5 Report Outline

For this study‟s report, there are five chapters included in order to explain everything. For Chapter 1 is introduction, shows the general information included in every other reports, such as introduction of the studies, problem statements, objectives and scopes.

While for Chapter 2 is the literature review, this chapter will share some previous studies that some are related about the component that were used in this project. Each component that were used in this project are also used in other project and literature review about other usage are focussed more on this chapter.

Meanwhile in Methodology for Chapter 3 of this studies will explain the procedures from design process using software from software developement until mechanical and hardware developement

In chapter 4 covered the analysis and discussion of this study, and also shows the results obtained from all the experiment and test conducted for this project

Last but not least Chapter 5 that discussed about the conclusion for this study. Here, the conclusion was made based on the results obtained and some suggestion for references in the future studies.

# CHAPTER 2
# LITERATURE REVIEW

## 2.0 Introduction

This chapter explains about previous project in which are related to this project and research theories will be discussed. The information from this topic will be advantages and additional source for implement this project more successfully. The literature review has been done for a clear explaination and better vision about the project. This chapter can be summarized as the fundamental and basic information that contained the theories of the components, equipment and programming that is used in the project.

## 2.1 Literature Review

### 2.1.1 Arduino UNO

Arduino UNO R3 is a microcontroller board which contains 14 digital input and output pins which 6 of it can act as PWM outputs, and another 6 act as analog inputs. It also includes with a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller by simply connect it to a computer using a USB cable or power it with a DC adapter or battery to get started. There are a few types of arduino board that used nowadays but the most commonly used nowadays are arduino UNO and MEGA. The difference between these two is only the number of input and output pins which arduino MEGA have better number of input and output pins compared to

arduino UNO. In these modern day, Arduino are commonly used in microcontroller programing among other things due to its user friendly and easy to use setting, like any microcontroller, an Arduino is a small circuit board with chip that can be programmed to do numerous number of tasks, it sends information from the computer program to the Arduino microcontroller and finally to the specific circuit or machine with multiple circuits in order to execute the specific command.

According to Yusuf Abdullahi Badamas, Arduino can help to read information from input devices such as sensors, antenna, Trimmer (potentiometer) and can also send information to output devices such as LED, Speakers, LCD Screen, and DC motor. According to Shamsul Aizal Zulkifli and Mohd Najib Russin, Arduino also can be used as microcontroller for 3 phase inverter while Tiffany Tang state that there were also a project that linking Arduino with Kinect to control motion This shows that there are so many application an Arduino can be used for and in this project, Arduino will be used to process data gained from ph sensor before being transmitted to mobile phone. Arduino also will be used to turn on the water pump and motor.


Figure 2 1: Arduino UNO board

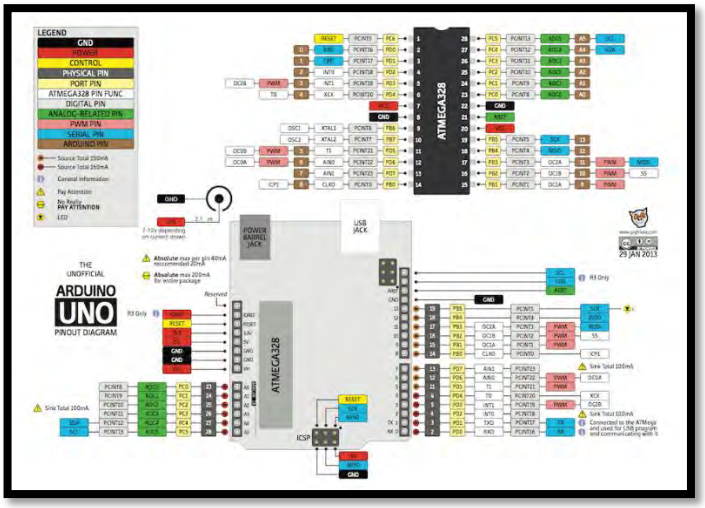


Figure 2.2: Arduino UNO board pin directory.

### 2.1.2 Float Switch

Craig Schneider state that the purpose of a float switch is to open or close a circuit as the level of a liquid rises or falls. Most float switches are in normally closed position, meaning that the two wires coming from the top of the switch complete a circuit when the float is at its low point, resting on its bottom clip. To complete a circuit, float switches utilize a magnetic reed switch, which consists of two contacts sealed in a glass tube. When a magnet comes close to the two contacts, they become attracted to each other and touch, allowing current to pass through. In a float switch, the magnetic reed switch is hermetically sealed in a stem, most often made from plastic or stainless steel. The float encases a sealed magnet, which moves up and down the length of the stem as a fluid level rises and falls. As the magnet passes by the contacts in the encased reed switch, they touch and complete a circuit between the two lead wires, as shown in the cutaway below.

These are the basic principle of floating switch however, there are a few different purpose of float switch in the previous study. For example a study conducted by Mei-Chao Yeh shows that some of the project use float switch to improve power performance. Another advance application in some previous work done by Muhammad Talha Gul used float switch for phase shifting. For this project, float switch is used to turn of the water pump by stopping it when the water pumped