



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DESIGN AND IMPLEMENTATION OF SMART OBSERVABLE
SYSTEM OF INDOOR HYDROPONIC**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Industrial Automations & Robotics) (Hons.)

by

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DECLARATION

I hereby, declared this report entitled “Design and Implementation of Smart Observable System of Indoor Hydroponic” is the result of my own research except as cited in references.

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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 Power) with Honours. The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRAK

Ia amat menakjubkan apabila kita memanggil hidroponik sebagai sebuah seni. Hydroponik adalah satu kaedah yang jarang didapati atau diketengahkan, serta kaedah yang mudah untuk dijaga tumbuh-tumbuhannya. Bagi menerangkan lagi bahawa kemodenan negara pada masa kini serta peningkatan taraf hidup rakyat, segalanya perlu diletakkan piawaian yang baik untuk sesuatu produk agar ia berpotensi untuk dikemas kini dengan mudah dan berteknologi tinggi. Boleh dikatakan bahawa apa sahaja produk yang berkait rapat dengan teknologi adalah sesuatu yang canggih dan maju. Masih ada lagi sesetengah pihak yang tidak bertanggungjawab menjadikan pembalakan haram sebagai satu aktiviti ekonomikal. Ini adalah dimana tanaman hidroponik dapat dilihat membantu dalam mengekang permasalahan ini. Dimana, telah banyak kawasan yang dikosongkan atau digondolkan bagi aktiviti pembangunan. Oleh itu, keluasan tanah telah berkurang untuk aktiviti pertanian. Hydroponik dengan kepakaran pemerhatian yang canggih, dengan adanya pH meter untuk mengawal nutrisi tumbuhan, sistem pengudaraan dan seterusnya diod pemancar cahaya bagi menggantikan sumber cahaya matahari yang diperlukan oleh tanaman yang dimonitor secara automatik melalui satu aplikasi mudah alih. Keperluan asas hidroponik seperti pam air, lubang perparitan air, serta tangki air diperlukan dan dengan bantuan aplikasi cahaya matahari buatan, nutrisi serta pengudaraan akan terkawal dengan hanya menekan butan yang dipilih. Aplikasi ini sedikit sebanyak membantu tumbuhan mendapat nutrisi yang seimbang. Jika tumbuhan diberikan nutrisi yang seimbang, ia akan tumbuh dengan sihatnya. Ianya adalah sesuatu yang mudah dengan tanaman secara hidroponik berbeza dan jauh lebih sukar dengan penanaman biasa(tanah).

ABSTRACT

Isn't it simply amazing when we call hydroponic as an art. It's a rare, easy and lovable method to grow plants. Well, as to highlights the pursuit of modernity of a country and living standard of the citizens, everything has to be put up to a standard for a product to be potentially up to date. Products that exist is always up to technology control, can be saying as anything that is automated is quite the thing right now. Somehow, there is certain irresponsible organization discover a place for logging or so called as economic activity. This is where, hydroponic cultivation came in since so many land has been discovered, therefore lack of land that can be used for plantation. Hydroponic cultivation is a great way to grow plants to their full potentials. Hydroponic with smart observable system, precisely are the unintended miracle this is because pH as nutrient level, temperature, ventilation system and as well as Light Emitted Diode (LED) with complete needs of spectrum are monitor automatically through a mobile apps. Basic needs of hydroponic such as water pumps, drain hole, water tank is needed and with mobile apps, artificial sunlight will be switch on, fan as ventilation system to keep the temperature at good state, pH value will be monitor so it keeps balance nutrient for crops. In the end, we can see that hydroponic system is the solution for the on-the-go citizens which allows them to growth plants and monitor the health of the plant at all times on a mobile phones supported with three simple step which is put seeds in pods, sync with apps and then start grow. If you give a plant exactly what it needs, when it needs it, the amount that it needs, the plant will be as healthy as is genetically possible. It's an easy task with hydroponic; far more difficult in soil.

DEDICATION

Dedicated to my beloved parents, Encik Makbul Shah bin Mirdad Shah and Puan Hasnah binti Hassan.

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ACRONYMS AND ABBREVIATIONS

pH	-	Potentials Hydrogen
UV	-	Ultra Violet
IDE	-	Integrated Development Environment
DOP	-	Dwarf Ornamental Peppers
LED	-	Light Emitted Diodes
SMS	-	Short Message Service
PC	-	Personal Computer
WI-FI	-	Wirelessly Fidelity
EDR	-	Enhanced Data Rate
UART	-	Universal Asynchronous Receiver/Transmitter
USB	-	Universal Serial Bus
GSM	-	Global System for Mobile Communication
PIC	-	Peripheral Interface Controller
I/O	-	Input / Output
EC	-	Electrical Conductivity
3D	-	Three Dimensional
PWM	-	Pulse Width Module
TXD	-	Transmission Data
RXD	-	Receiver Data
BSC	-	Bluetooth Serial Controller
CO ₂	-	Carbon Dioxide
H ₃ PO ₄	-	Phosphoric Acid
KOH	-	Potassium Hydroxide
FHS	-	Floating Hydroponic System
PVC	-	Polyvinyl Chloride
°C	-	Degree Celsius
°F	-	Fahrenheit

CHAPTER 1

INTRODUCTION

1.1 Introduction

Plants can be classified as a living organism and as well as exemplified by trees, herbs, ferns, grasses and so on. Hydroponics is fairly recent term used for growing plants without soil and method dates back much earlier. It can be exemplified with the hanging gardens of Babylon, the floating garden of the Aztec of Mexico and Chinese culture which always refer or form a “hydroponic” cultivation. The untimely recorded; plant constituent was in 1600 when Belgian Jan Van Helmont showed in his classic experiment that plants obtain substances from water. The conclusion showed from the research that plants obtain substances for growth from water was correct. In the following years, researchers developed many diverse basic formulae for the study of plant nutrition. Hydroponic literally means “water works“. It can be define as the science of growing plants without the use of the soil but has to grow in a water or nutrient-rich solution without presents of oil.

Theory explained that plant could be grown hydroponically but however in gardening practice, it is usually reserved for exotic plants and culinary herbs. Hydroponics allows plants to be grown in a completely controlled environment, soil-barns-pests-free and free from diseases as well. Delicious product can be obtain without using dangerous herbicides and pesticides by carefully monitoring nutrients, temperature, lights level and nutrient water level or solutions level. For that reason,

hydroponics gardening is gaining popularity for both commercial and home gardening application all around the world.

Hydroponics can be exciting and fun. It takes an important place in the classroom. Carrying out hydroponics experiments helps students better in understanding how plants grow. For instance, by withholding certain nutrient from the hydroponics solution, students can observe firsthand how plant growth is affected then overcome the deficiencies. Together with hydroponic provides a hands-on approach to learning and many of the life science educational objectives are reinforced. Whether it's a hobby or a grower or gardener, education is the key for successful growing. This by means, basic plant growth has to be review for better understanding in hydroponics.

A „little tray“ term that is what best explain the water culture system. It used reservoir of nutrient solution in a rectangular tank with a tray of substrate located above the nutrient solution. With the introduction of plastics, small pumps, sensor and drip irrigation supplies, these design will definitely be modifies to operate automatically. Ebb and Flow, known as well as Flood and Drain, when most widely recognized hydroponics system out there. Besides low cost to set up it is absolutely versatile. Easy-alter method so called for your garden, adding or removing plants up to your wish. It has a very basic concept; plants are placed in a tray which periodically filled with nutrient-rich water pumped in and out of a reservoir below. Hydrogen, oxygen and carbon are the first free three essential elements and it comes directly from water and air which are essential for photosynthesis and sugar production. These three elements comprise almost 95% of a plant's dry weight. The other 14 essential elements are minerals and provided in the nutrient solution. The nutrient solution has to be replace for every ten days, or so, preventing the nutrient deficiencies from developing. Those greatest consumptions by the plants including, a critical component of all proteins and enzyme call nitrogen it is important during the vegetative growth state. Phosphorus an energy molecule which essentials for life, Potassium helps in keeping the quality of the fruits high as well as Calcium so plants can easily take up water.

The pH level for plant's nutrient is much important as just adding plant food to the water. pH is basically a measurement of alkalinity and acidity of the nutrient solution which make pH of 7 is neutral, less than 7 is acidic and over 7 is alkaline or basic. While actually, the most suitable pH reading for better nutrient is between 5.8 to 6.4, or slightly acidic. This is to avoid iron and some others metal might be unavailable to the plant and if it is too low, the take-up calcium, magnesium and other macro-element may be hindered.

After explaining the rate plants take up nutrients for environmental regulations conditions, proper lightings is very important to successful hydroponic gardening. There will be two different stage of plant's growing system. Firstly, the vegetative growth stage, which plants in needs of full-spectrum light but with blue end of the spectrum more. Secondly, fruiting and flowering stage, it is preferable to have the red end of spectrum. Plants use mainly the reds and blues where actually so much of the energy of standard lighting is quit wasted. Thus, full-spectrum horticultural lamps have to be chosen when setting up an indoor hydroponic system. A 15W is merely enough for 33.5cm x 27cm area.

Prime factor for hydroponic especially indoor, is the temperature and humidity. Most plants prefer a temperature between 68-78°C. Tropical plants such as tomatoes prefer warmer temperature. The most vital is that, don't ever allow the plant's temperature to go up to 85°C, it says to inhibit the transpiration process and stress the plant is there is too much heat. Somehow, good air movement can eliminate many problems in a grow room. Usually, for outdoor hydroponic air will definitely is the natural wind but for indoor hydroponic gardening, simple oscillating fans, positioned around garden or house fan is okay just to keep the leaves gently moving and removes much of the excess heat.

1.2 Project Development

The design of indoor hydroponic with smart observable system is exactly the title of this project where the main idea of this project is to use Bluetooth features in an android phone to automatically switch on the grow lamp, fan or thermostat, pump in and out water and nutrient into the tank. The cellphone will be the tool to do all of these including figure out the temperature of the plant. Basically, the temperature sensor will send input data of the current temperature in degrees to Arduino and Arduino then will transfer the data to cellphone with the help of Bluetooth module. The programming of the Arduino is burn by using Arduino IDE Programmer editor and transferred using USB cable from the computer board.



Figure 1.1: Inside of Cart for Indoor Hydroponic System



Figure 1.2: Outer Cart of Indoor Hydroponic System

Table 1.1: Project's Plan Characteristics

ATTRIBUTE	DATA
Number of plants	1
Plant	Vegetables
Dimensions	Width= 35cm, Height= 72cm, Length= 35cm
Operating temperature	10-35celcius
Total lifespan	5-7weeks
Reservoir volume	11L
Sensor measurement	Anytime
Operating voltage	24V
Communications	Bluetooth

1.3 Problem Statement

In the past, hydroponic system required research to setting up, steps for installation is many as well, after all it is required daily monitors to ensure proper growing conditions. When growing, pests and bacteria can significantly affects the health of the plants. It'll definitely involve environmental predators that can cause harm. To avoid this harmful pests, UV light as a grow light is used in indoor hydroponic. However, UV has its own drawback which is harmful to human skin. That's when LED as grow light is the best tools to use as an artificial sunlight.

The biggest problem for today's cultivation is that there are problems of enough land and the alternative cost of feed is quite high. It is also worth nothing that there is a significant reduction when weather isn't balance. For soil cultivation, there is a time when draught season when humidity of soil is at substandard or poor. With hydroponics, there will be always a water supply circulating oxygen into the root system of the plants. Hydroponic can also concern or distribute to the issues of food insecurity for poor-food-supply country such as Ecuador and materials for hydroponics are quit cost effective to farme



Figure 1.3: Deforestation

Landslide can be state as one catastrophic event, it can cause human injury including loss of life, economic devastation, construction destroyer and cultural and heritage values. It is usually occurred when the land experience direct hit from the raindrops when raining and surely be one of the land's erosion factors. Without trees, increase in environmental temperature can't be coped. Disappearance of the trees means disappearance of the canopy layer which mainly helps in preventing direct sunlight reaching to the ground. Figure 1.4



Figure 1.4: Landslide

Before that, land discovered has been a widespread problem and this cause the lack of land that can be used for plantation and it puts the limit to the plantation. The drawback of this catastrophic event, price of the raw material will rose-up and due to the limitation of land, it will be not much of plant that can be planted. The most wanted plant or plant that has the most requests from user will be considered important and definitely will be planted widely. While for less-requested plant, price will be high.

1.4 Objective

To realize this project, the project objectives have been finished in the duration time granted according to the main purpose of this project which to provide smart observable system that can monitored and control pH value as well as the temperature value for the close system as to balance the healthiness of crops with nutrient and its temperature. The improvise that will be make is to use Bluetooth module as a communication bridge between application on android smartphone and sensors with the help of float switch act as a mechanical sensor. This project will offer an alternative way to cope with these problem and helping in providing a clean, healthier and disease-less product in a long run.

1. To establish a smart system that can operate indoor hydroponic for home use.
2. To design the whole electrical system that will combine with hydroponic structure and monitor the pH of the crop.
3. To prove how this system helps in development of better system in agriculture.

The mission of this project is to build an indoor hydroponic which basically will not involve sunlight. I will attempt to dispel some of people common fears associated to make the hydroponic gardening endeavor successful and rewarding. Purpose is to build hydroponic system to lead a better and organize-well life and use all the facilities that technologies has offer us in these era.

Main objectives of carrying out this indoor hydroponic is for reliable condition of anywhere and anytime of food supplying such as vegetables like chilies or bean sprouts. Referring to the economical state to a poor country, hydroponic has it best function to provide good food with high nutrients. Somehow when referring to environmental problem such as landslide, bugs bugging plants, hydroponic will be a solution to grow a plant. Hydroponic is a way of growing plant to reduce runoff and soil

erosion cause by regular soil farming. What's make land and water consumption is important nowadays? Seventy- five percent of all fresh water is use for agriculture somehow these fresh water supplies are being over allocated, contaminated and depleted at an alarming rate.

One thing to do, which undeniably an exciting and creative process is that, decorating your home. For many people, decorate a home or office would be so much compelling when choosing the accessories that will decorate the space. From the floor carpet to the candle and the candle holder itself and from vases to houseplants, home accessories is crucial as it personally makes your home to feels like home, enhance and transform positive energy. As to enhance means adding up a little bit of „mood“ no matter at the corner behind the close door, corner under the stairs, or confine spaces used on apartment patios, small backyard, basement and last but not least at the end of the corner of your balcony, this hydroponic indoor for home kits is undeniably suit your home and office. The combination of green plants and cart of 90 centimeter tall will be just perfectly nice to enhance the „mood“for your home to feels like home.

Hydroponic is a great way to teach a life science. Most schools in Malaysia have their own botanical garden as a form of education in agriculture and living things besides humans. This great-platform educational system that will definitely preserved a good life taught for a better future especially for young kids. Hydroponic will let them know that to keep-clean, go-green, and preserved permanent forest reserved. After all, hydroponic is one simple system that can be carried out by anyone regardless of the age. Ultimately, education starts from home and school, therefore it's an ideal platform to broaden the hydroponic education.