Faculty of Electrical and Electronic Engineering Technology

SOIL MONITORING AND CONTROL SYSTEM IN AGRICULTURE USING IoT

WAN MUHAMAD AFIQ BIN W. ZAINAL

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

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WAN MUHAMAD AFIQ BIN W. ZAINAL

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics)
with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

APPROVAL

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

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Supervisor Name : PUAN SITI NUR SUHAILA BINTI MIRIN

Date : 20 JUN 2021

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Tajuk: ESTIMATING THE WEIGHT OF MANGOES USING IMAGE PROCESSING AND ANALYSIS TECHNIQUES

Sesi Pengajian: 2021

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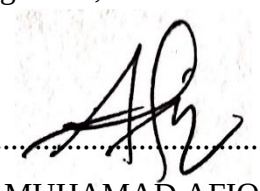

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I declare that this project report entitled "SOIL MONITORING AND CONTROL SYSTEM IN AGRICULTURE USING IoT" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Student Name : WAN MUHAMAD AFIQ BIN W. ZAINAL

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DEDICATION

I would like to express my special dedication to people who support me with this thesis. I am grateful and acknowledge for both of my parents, W. ZAINAL BIN W. HARUN and NOR'AINI BINTI MAT ALI, and also my siblings for giving me encouragement and endless support to me for complete this Bachelor's Degree Project (BDP). Without them, I probably cannot reach until this level. I also want wish to express my sincere appreciation to my supervisor for this project , Pn Siti Nur Suhaila Binti Mirin that guide me through this project by support their keen and endless guidance, encouragement, critics and inspiration till the success and completion of this project. Besides, special thanks for all my fellow lecturers for advices and guidance along my studies. Not forgetting, all my beloved friends for the moral support along this wonderful journey. Lastly, I would like to thank you to all people who help me directly or indirectly for helped, giving support and encourage me to complete this project.

ABSTRACT

In Malaysia, the agricultural sector is one of the branches of the people's income source. This is because the agricultural sector can have a huge impact on a country's economy. In this era of globalization, the agricultural sector has gradually evolved into modern agricultural systems such as aeroponic systems. This aeroponic system is one of the methods of cultivation or the process of enlarging plants in the air without the use of soil. This method of planting the aeroponic system is very effective as it allows the nutritional fluid to absorb into the roots easily. However, the system requires appropriate equipment to monitor and ensure nutritional levels in water, humidity, temperature and pH under appropriate conditions. In this project, it focuses more on the control and observation of moisture, temperature and nutrition levels with the use of microcontrollers and wireless connections to the internet and the use of smartphones. Users can monitor parameters through the Blynk application. There are three (3) types of sensors used to check and monitor moisture levels, temperature and nutrition levels. If this sensor detects a reading beyond the specified level, the user will receive a notification from the Blynk application. The reading data collected will be sent to the ThingSpeak server for storage and updating to facilitate the monitoring of system development.

ABSTRAK

Di Malaysia, sektor pertanian merupakan salah satu cabang sumber pendapatan rakyat. Hal ini demikian kerana, sektor pertanian ini dapat memberikan impak yang besar terhadap ekonomi sesebuah negara. Pada era globalisasi ini, sektor pertanian telah beransur-ansur berevolusi kearah sistem pertanian moden antaranya seperti sistem aeroponik. Sistem aeroponik ini merupakan salah satu kaedah penanaman atau proses membesarkan tumbuh-tumbuhan di udara tanpa pengunaan tanah. Kaedah penanaman sistem aeroponik ini amat efektif kerana ia membolehkan cecair nutrisi menyerap ke akar dengan mudah. Namun begitu, sistem ini memerlukan peralatan yang sesuai untuk memantau dan memastikan tahap nutrisi dalam air, kelembapan, suhu dan pH dalam keadaan yang sesuai. Dalam projek ini, ia lebih menumpukan kepada pengawalan dan pemerhatian terhadap tahap kelembapan, suhu dan nutrisi dengan pengunaan mikrokontroler dan sambungan tanpa wayar ke internet serta pengunaan telefon pintar. Pengguna boleh memantau parameter melalui aplikasi Blynk. Terdapat tiga (3) jenis sensor digunakan untuk memeriksa dan memantau tahap kelembapan, suhu dan paras nutrisi. Sekiranya sensor ini mengesan bacaan melebihi paras yang telah ditetapkan, pengguna akan mendapat notifikasi daripada aplikasi Blynk. Data bacaan yang diambil akan dihantar ke server ThingSpeak untuk disimpan dan dikemaskini bagi memudahkan pengunna memantau perkembangan sistem.

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Alhamdulillah, all praises to Allah for the strength and His blessing in completing this project. In the process of doing this project, it needs a lot of patients and knowledge to do. For myself, this project very important because it is one of the tasks to complete degree level of electrical and electronic engineering technology course.

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LIST OF ABBREVIATIONS

HPA	-	High Pressure Aeroponics
LPA	-	Low Pressure Aeroponics
IoT	-	Internet of Thing
IDE	-	Integrated Development Environment
TDS	-	Total Dissolved Solids
EC	-	Electrical Conductivity
PPM	-	Parts per million
RH	-	Relative Humidity

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

This paper is about the soil monitoring and control system that applied in aeroponics method as an automatic system and continually checked the state of plant roots like the mugginess, temperature, pH and supplement inside the water. The aeroponics could be a kind of estate measure that develops plants in air or fog climate without utilizing any soil or total medium.. In hydroponic systems, plant's roots are lowered into water and nutrient to help its life. Aside from aeroponics, the nutrient is supply through fog shower by sprinkles or spouts to plant's underlying foundations. The aeroponics framework can established for certain fundamental parts kind of a siphon, spouts, and developing chamber. There are a few assortments of aeroponics at present exist like air mass sort, high sort and business framework. Distinctive type of aeroponics required diverse sensibly part to arrange however the functioning idea is about the indistinguishable.

1.2 Problem Statement

Nowadays, the plant cultivation is using new agriculture methods that very popular among the farmers such as aeroponic systems. However, the development of the aeroponic systems has become challenge to the farmers. The aeroponic systems needs to monitor and control several parameters such as the humidity, temperature, acidity (pH) and the concentration of nutrient (EC/PPM). In addition, there are some problems that need to encounter in managing this aeroponic system. Firstly, the difficulty to provide the sufficient

nutrient solution and control the acidity. Secondly, requires proper systems to help the farmer get early fault detection and diagnosis the problems in the system. Lastly, required significant component to monitor and control the system and required attention for flourishing plant growth.

1.3 Project Objective

The objectives of this project are as follow:

i. To develop the soil monitoring and control system that is able to give feedback to aeroponics system by using microcontroller and sensors.

ii. To monitor the humidity, temperature and water level nutrient by connecting it with smart gadgets to ease human's daily life activities.

iii. To analyse the performance of the automated aeroponics system towards the agriculture industry.

1.4 Scope of Project

The scope of this project will be fixed according to the requirements from the objectives. By referring to the first objective, this project focused on the development the soil monitoring and control system that is able to give feedback to aeroponics system by using microcontroller and sensors. Besides that, the automated aeroponics system also connected to smart gadget that close to human daily's life, such as smartphone, tablet, laptop or other electronic devices for monitoring and controlling the system from distance. Lastly, this project focussed on to analyse the performance of the automated aeroponics system towards the agriculture industry.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the existing soil monitoring and control system in agriculture using IoT especially that related to the aeroponics systems technique. It also includes survey on the types of the aeroponics techniques, monitoring parameters and the comparison of the previous study. The literature review discusses the source and backs up the claim with facts from similar research or study.

2.2 Aeroponics Systems

The aeroponics framework is one in every one of the strategies of the soilless culture, where the plant develops inside the air with the help of artificial assistance rather than soil or substrate culture. It is an air-water plant developing method where lower parcels very much like the underlying foundations of the plant are hanged inside the extension chamber under complete obscurity in controlled conditions. Nonetheless, the upper bits of the plant like leaves, natural products, and crown divide are stretching out external the growth chamber.

The plastic or thermo-foam is given to help and separation the plant into two sections (roots and leaves). Inside the framework, plant roots are straightforwardly uncovered inside the air and straightforwardly inundated with a touch bead size of the water nutrients. The nutrients are provided through various atomization spouts with or without high gas pressure.

Additionally, a few investigations considered aeroponics as an advanced rural movement which is drilled in an inner development chamber under whole controlled

conditions, since it could dispose of the outside natural factors as contrasted and customary horticulture action. Subsequently, it's anything but fanatical about enormous scope land use, and it ought to rather be established in anyplace, a structure that has lifted worldwide environment without considering the flow environment like season and winter.

2.3 Types of Aeroponics Systems Technique

There are three (3) types of the aeroponics systems technique that can be used which are High Pressure Aeroponic (HPA), Low Pressure Aeroponic (LPA) and Ultrasonic Fogger Systems.

2.3.1 High Pressure Aeroponic (HPA)

High Pressure Aeroponics (HPA) is viewed as True Aeroponics and was utilized by NASA to develop vegetables. It likewise is the overpriced and the most complex developing framework to construct. Be that as it may, HPAs utilize less assets for plant develop: 98% less water, 60% less manure, and 100% less pesticides (no pesticides), all upheld by NASA lab examines. The HPA (True Aeroponics) framework was reformed by NASA in the 1990's by announcing it as the most proficient approach to develop plants in space. Studies have shown numerous advantages of developing plants with aeroponic procedures on both Earth and in space.

HPA frameworks should work at a high pressing factor, regularly over 80 PSI, yet in a perfect world at 100 PSI. The high pressing factor is utilized to atomize the supplement water through a little hole (opening) to make water drops of 50 microns or less in breadth, at the end of the day a fine fog like hair splash. One micron is one-millionth of a meter. The normal width of human hair is 80 microns. HPA additionally should run on a much exact time cycle. HPAs may run 1 to 5 seconds on, and afterward off for three to five minutes.

Explicit parts are needed in controlling the timing stretch and making the appropriate size fog.

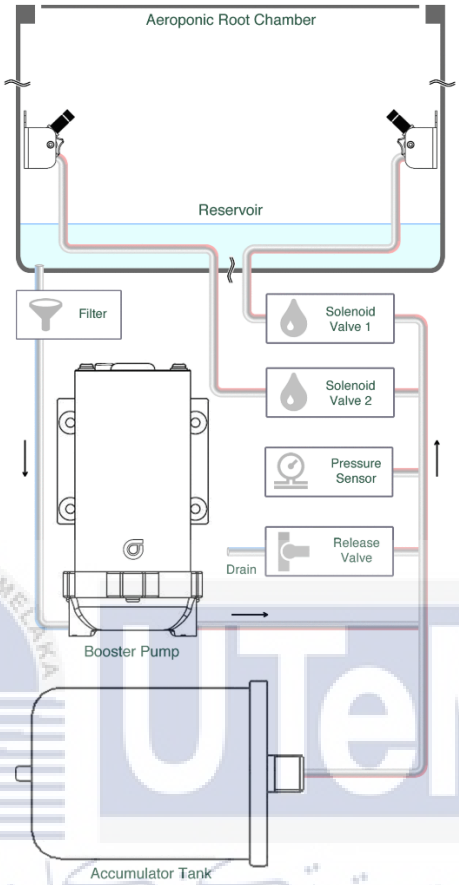

Figure 2.1 High Pressure Aeroponic

2.3.2 Low Pressure Aeroponic (LPA)

Low pressure frameworks are the most mainstream decision for the individuals who need to assemble their own DIY aeroponics framework since they are less complex, less expensive, and less in fact testing to assemble and keep up. These frameworks can be just about as straightforward as a repository for the supplement arrangement, a high-limit water siphon that can run every minute of every day, tubing, and some smaller than usual sprinkler heads – all of which can be set up inside the encased developing chamber. Low-pressure frameworks provide extraordinary root oxygenation. For the best outcomes, position the

sprinkler heads so they can shower the roots from a higher place, permitting the water to stream down through the root masses.

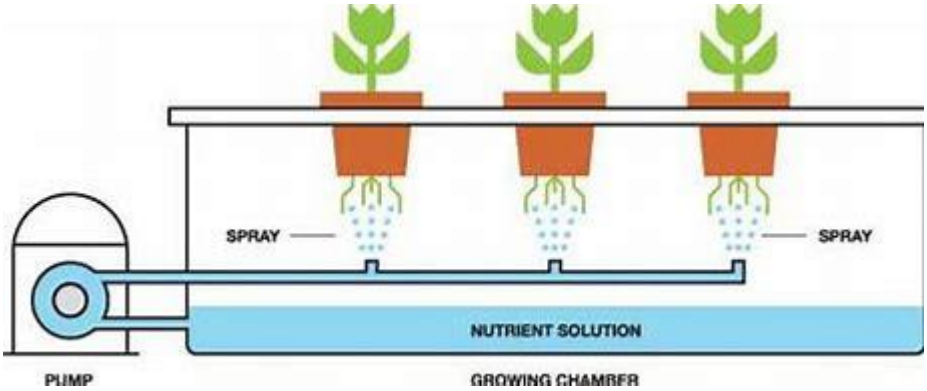

Figure 2.2 Low Pressure Aeroponic

2.3.3 Ultrasonic Fogger Systems (Fogponics)

A third alternative for aeroponics developing frameworks is to utilize an ultrasonic fogger. This alternative goes the other way than that of low-pressure frameworks, creating drops that are excessively little, which makes roots grow an abundance of hairs to the detriment of the parallel root frameworks that support plant development. Different issues with ultrasonic foggers incorporate the mist dropping to the lower part of the holder and the plates having a tendency to obstruct with mineral stores. Aeroponics farmers have been exploring different avenues regarding foggers in blend with different systems.