Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF AN IOT BASED CHILLI PLANT ENVIRONMENTAL MONITORING SYSTEM BY USING A MICROCONTROLLER

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Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours

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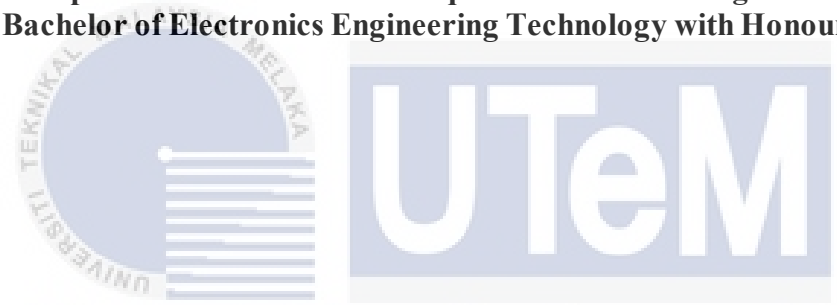
A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours



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DEDICATION

To my beloved parents;

Encik Mohamad Alias bin Omar and Puan Siti Khalijah binti Sulaiman

To my supervisor :

Ir. Ts. Dr. Mohd Fauzi bin Ab Rahman

ABSTRACT

As the world is moving into new advances and executions, many improvements in an agriculture field in line with the development of much renewed in technology especially in chili plant industry. A lot of research has been done to improve and increase the production in agriculture. One of the concepts of Internet of Things (IoT) is the automation field. The automation field can be applied to grow plants that required to monitor environment conditions. This strategy will assist the farmers with utilizing new strategies and can build their pay with less handwork. Now traditional day farming is changing into modern agriculture. The aim for development of an IoT based chili plant environmental monitoring system is to develop a system that can display temperature, humidity, and soil moisture. In this project, user can monitor the plants by using a smartphone. The system consists of a microcontroller (Arduino UNO), sensors (DHT11, soil moisture), Esp8266 Wi-Fi shield, fan and water pump. The project has two objectives, which are to develop a plant environmental monitoring system that can display temperature, humidity, and soil moisture and to analyze the system's functionality by detecting the DHT11 sensor (temperature sensor, humidity sensor) and soil moisture sensor. The results of the test case showed that the system able to display all the sensor values in Blynk App. Other than that, the accuracy of DHT11 sensor have been tested. DHT11 sensor will measured temperature and humidity in environment. Average percent error for temperature has been obtained which is 2.16%. The accuracy of temperature is affected by the temperature changes in environment. The result for humidity shows average percent error of humidity is 5.12%. The accuracy of soil moisture is tested by run the system for 18 hours to collect data from sensor. For average percent error of soil moisture is 3.33%. Thus, the accuracy of the soil moisture is affected by condition of the soil. To conclude, the project of the development an IoT based chilli plant environmental monitoring system by using a microcontroller is developed to provide display information and watering the plants day-to-day without user effort. The purpose of this project is to develop an IoT based chilli plant environmental monitoring system with an artificial intelligent to enable user to perform task without the need of touch input and test the accuracy of DHT11 sensor and soil moisture sensor in real time. This project has potential to be installed in garden, green house and Indoor farm.

ABSTRAK

Ketika dunia bergerak ke arah kemajuan dan pelaksanaan baharu, banyak penambahbaikan dalam bidang pertanian selaras dengan perkembangan teknologi yang diperbaharui terutamanya dalam industri tanaman cili. Banyak kajian telah dilakukan untuk menambah baik dan meningkatkan pengeluaran dalam pertanian. Salah satu konsep Internet of Things (IoT) ialah bidang automasi. Medan automasi boleh digunakan untuk menanam tumbuhan yang diperlukan untuk memantau keadaan persekitaran. Strategi ini akan membantu petani menggunakan strategi baharu dan boleh membina gaji mereka dengan kurang kerja tangan. Kini pertanian hari tradisional berubah menjadi pertanian moden. Matlamat pembangunan sistem pemantauan alam sekitar tumbuhan cili berasaskan IoT adalah untuk membangunkan sistem yang boleh memaparkan suhu, kelembapan dan kelembapan tanah. Dalam projek ini, pengguna boleh memantau tumbuhan dengan menggunakan telefon pintar. Sistem ini terdiri daripada mikropengawal (Arduino UNO), penderia (DHT11, kelembapan tanah), pelindung Wi-Fi Esp8266, kipas dan pam air. Projek ini mempunyai dua objektif, iaitu untuk membangunkan sistem pemantauan alam sekitar tumbuhan yang boleh memaparkan suhu, kelembapan, dan kelembapan tanah serta menganalisis kefungsian sistem dengan mengesan sensor DHT11 (sensor suhu, sensor kelembapan) dan sensor kelembapan tanah. Keputusan kes ujian menunjukkan bahawa sistem dapat memaparkan semua nilai sensor dalam Aplikasi Blynk. Selain daripada itu, ketepatan penderia DHT11 telah diuji. Sensor DHT11 akan mengukur suhu dan kelembapan dalam persekitaran. Purata peratus ralat bagi suhu telah diperolehi iaitu 2.16%. Ketepatan suhu dipengaruhi oleh perubahan suhu dalam persekitaran. Keputusan untuk kelembapan menunjukkan purata peratus kesilapan kelembapan ialah 5.12%. Ketepatan kelembapan tanah diuji dengan menjalankan sistem selama 18 jam untuk mengumpul data daripada sensor. Bagi purata peratus kesilapan kelembapan tanah ialah 3.33%. Oleh itu, ketepatan kelembapan tanah dipengaruhi oleh keadaan tanah. Sebagai kesimpulan, projek pembangunan sistem pemantauan alam sekitar tumbuhan cili berasaskan IoT dengan menggunakan mikropengawal dibangunkan untuk menyediakan maklumat paparan dan menyiram tanaman setiap hari tanpa usaha pengguna. Tujuan projek ini adalah untuk membangunkan sistem pemantauan alam sekitar tumbuhan cili berasaskan IoT dengan kecerdasan buatan bagi membolehkan pengguna melaksanakan tugas tanpa memerlukan input sentuhan dan menguji ketepatan sensor DHT11 dan sensor kelembapan tanah dalam masa nyata. Projek ini berpotensi untuk dipasang di taman, rumah hijau dan ladang tertutup.

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%	-	Percent
℃	-	The degree celcius

LIST OF ABBREVIATIONS

IoT	-	Internet of Things
V	-	Volt
mA	-	Miliampere
Wi-Fi	-	Wireless Fidelity
SMS	-	Short message service
RX	-	Receive
TX	-	Transmit
CO2	-	Carbon dioxide

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CHAPTER 1

INTRODUCTION

1.1 Background

Numerous enhancements in a farming field following the advancement of much-reestablished innovation. A lot of research has done to improve and increase the production in agriculture. The automation field is one of the concepts of the Internet of Things (IoT). The automation field can be applied to growing plants that are required to monitor environmental conditions.

Countless ventures mean utilizing remote sensor networks to gather information from various sensors utilized at different hubs and send it through wireless protocols. The information gathered gives data on different climate factors. The observing climate factors is certifiably not a total answer for increment crop yields. Some different elements can low the creation. Hence, automation is vital to apply in the agriculture field to beat this issue. Subsequently, to give an exit from every one of these issues, it is essential to develop an integrated system that will deal with every element that influences usefulness at each level. In any case, total automation in farming couldn't be accomplished because of different issues.

The proposed of this system is to monitor and automatic watering system for agribusiness dependent on the Internet of Things (IoT) that will assist the farmers with utilizing new techniques and can expand their pay with less handwork. Presently conventional day cultivating is changing into current agribusiness. There are now many agricultural applications that are becoming businesses. Enhancements in farming add to the financial development of the country.

1.2 Problem Statement

Nowadays, there are many domestic gardening uses all sorts of technology such as plant environment monitoring system to keep plants growing well and it will increase agricultural production. Sadly, there are many farmers still using a manual technique to plant because not all of them can purchase the system. If the farmers still using manual method to grow the plant, the plant cannot grow effectively.

In hot weather the high temperature will have a negative effect and likely to damage the plant. The longer the high temperature persists, the greater the injury to the plant. In this case, the process of plant growth will be decreased and will affect the plant produce. In other situations, if the farmer still uses the manual technique, they cannot measure the humidity in the air. Hot air will cause low humidity in the air, and humidity from the plant's leave will lose. Plant growth is normal if some evaporation from leaves, but if evaporation faster and out of normal ability for the plant, it will make the leaves become dry and withered.

Therefore, to overcome this problem a plant environment monitoring system is a good solution. This plant environment monitoring system provides a good hydration system for the plant and also provide the user to monitor the environment in the garden.

1.3 Project Objective

The main objective for development of an IoT based chilli plant environmental monitoring system by using a microcontroller:

1. To develop a plant environmental monitoring system that can display temperature, humidity, and soil moisture.
2. To analyze the system's functionality by detecting the DHT11 sensor (temperature sensor, humidity sensor) and soil moisture sensor.

1.4 Scope of Project

The scope of this project are as follows:

a) This project will focus on designing a low-cost green (indoor) IoT-based chilli plant environmental monitoring system by using a microcontroller.

b) Research of current plant watering system.

c) Research of current plant monitoring system.

d) An IoT-based chilli plant environmental monitoring system has an automatic watering system and able to control the temperature inside by using a fan.

e) Designed to monitor the humidity of air, temperature and soil moisture environment in the garden .

1.5 Thesis Outline

Based on the objectives and studies that have been obtained, this thesis consists of five chapters and can be summarized as follows:

- Chapter 1. Introduction. This chapter starts with the background, problem statement, research objectives, scope of project and significance of the research.
- Chapter 2. Literature review. This chapter will show the overview of the development of an IoT-based chilli plant environmental monitoring system using a microcontroller. This part also discusses the features and technologies used in this project.
- Chapter 3. Methodology. This chapter presents the methodology that is used in this project. The flow of this project is demonstrated to accomplish the goal

efficiently. Furthermore, the hardware used to develop the IoT-based chili plant environmental monitoring system is described in the Hardware Development section, whereas the software and technique to be applied in the Blynk app are discussed in part of the software development.

- Chapter 4. Result. In this chapter, developed models are tested based on the performance and accuracy of the system in real-time.
- Chapter 5. Conclusion and future works. The main conclusions and accomplishments of the work conducted in this report are outlined in this chapter and areas are suggested for future work.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Every existing project has its pros and cons, and each one of them uses different approaches but still aiming for the same purpose. This project aims to develop an IoT-based chili plant environmental monitoring system more user-friendly and make the plant grow effectively. This chapter reviews articles and works about IoT based chilli plant environmental monitoring system from previous researches.

2.2 Overview of an IoT based chilli plant environmental monitoring system

The plant environment monitoring system can clean the ambient air and make people satisfied with nature's approach. Nonetheless, crops quickly stop growing because of poor environmental conditions, such as lack of water. The purpose of this system is to monitor temperature in environment, soil moisture, and humidity of air. Crop growth conditions and environmental conditions will display on the user's smartphone by using Blynk App. The system will automatically be watering the plant if any sensor is detected in some abnormal condition.

2.3 An Automatic watering system

The plant environment monitoring system created by [1] has a programmed water framework and observing framework. The creator specifies this framework is prepared dampness sensor, temperature sensor, pH sensor, and EC sensor. The framework utilizes a mugginess sensor to gauge the current soil dampness, and the information that obtained will

be put away on a microcontroller, the Arduino. This information (moistness) will either turn on or turn off the valve. The framework likewise utilizes a pH sensor used to recognize the sharpness or alkalinity of the stew crop and an EC sensor to decide soil supplement arrangement. The framework is additionally furnished with programmed pH and EC balance. The pH sensor and the EC sensor will be consequently gathered graphically, and the information examined. The outcome is an open valve to kill pH and EC liquids. The prepared information will be shipped off an Internet Application by means of Ethernet Shield, and farmers can monitor the plants progressively utilizing a cell phone.

In [2], the author mentions the necessities of watering is done through controlled water system. The proposed programmed water system and checking framework comprises of raspberry pi, water pump, humidity sensor and temperature sensors. Cell phone modules are utilized for correspondence. In the proposed work, a yield or harvests are considered alongside their water prerequisites at various levels. Harvests or yields are inundated concerning water prerequisites at various development stages. This is a Portable and astute Coordinated water system framework utilizing IoT dependent on an application-controlled checking framework. The primary goal of this task is to control the water supply and screen crops through Cell phones.

At the same time, the author [3] notice this paper use the Internet of Things (IoT) and cloud computing to develop a plant growth environment monitoring system, comprising of a low-power microcontroller as the principal control framework module, LCD screen, humidity sensor, temperature sensor, light. The information is bundled to a phone through Bluetooth correspondence and send to the cloud. Little and modest yield development climate checking framework for clients, reasonable for home and office territory

applications. Through a straightforward human-PC interface on a cell phone, clients set different ecological boundaries for each chose crop, light, temperature, and soil dampness required. At the point when the deliberate worth surpasses or underneath the edge, our framework will consequently transfer an admonition message to the client's cell phone.

In [4], the author intended to plan a programmable microcontroller chip to control watering consequently dependent on soil dampness identified utilizing homegrown soil dampness sensors. He mentions, this gadget identifies if the dirt is dry. At the point when the dirt is dry, this instrument will automatically water the plants. On the other hand, if the dirt is wet, the instrument won't water it. This outcome, the plants will receive water needs are met constantly.

The creator [5], made a programmed plant watering automatic system. By adding a programmed plant watering automatic system to plants, it will help all plants get their maximum capacity just as ration water. By utilizing a sprinkler dribble transmitter, or a mix of both, the creator has planned an appropriate system for each plant in the yard. For the execution of a programmed crop watering system, the creators [5] have utilized a mix of sprinkler, piping, and nozzle system. In this paper, the author has utilized an ATmega328 microcontroller. This is customized to feel the dampness level of the plant at a given time, if the dampness content is not exactly a pre-decided limit following the water needs of a specific plant then the ideal measure of water is provided to arrive at the edge. By and large, the plants ought to be watered double a day, morning and evening. Along these lines, the microcontroller is customized to water the plants double a day. The framework is planned so that it can report its momentum condition and remind the client to add water to the tank. These notices are made through the portable application.