UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF CUCUMBER PLANT CONTROL AND MONITORING SYSTEM USING IOT

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer System) with Honours.

by

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer System) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Dalam era teknologi baru ini, teknologi merupakan alternatif terbaik untuk meningkatkan kualiti sumber pertanian. Selain itu, kebanyakan teknologi kini diintegrasikan dengan Internet Things (IOT) di mana sensor atau objek berinteraksi dengan internet. Sistem kawalan dan pemantauan pertanian menggunakan IoT dibangunkan terutamanya di taman pada skala yang kecil. Perkara yang amat penting dalam pertanian adalah siraman. Kajian ini memfokuskan kepada kawalan dan monitoring air dengan menggunakan beberapa sensor. Dengan kawalan secara tradisional atau manual menyebabkan petani tidak dapat mengawal kuantiti air untuk siraman pada satu-satu masa kerana keperluan air siraman untuk timun perlu tepat pada kuantitinya. Selain itu, ini menyebabkan pembaziran. Oleh sebab itu, sebuah sistem telah dibangunkan untuk menangani masalah ini dengan menggunakan WiFi sebagai protokol tanpa wayar. Justeru, petani dapat mengawal dan monitor pada jarak jauh. Petani juga dapat membuat analisis dengan data yang diperolehi daripada parameter seperti suhu, kelembapan, keamatan cahaya dan kelembapan tanah. Kajian ini juga ingin menunjukkan keberkesan kaedah kawalan menggunakan pengesan elektronik pada pertanian berskala kecil. Sebuah ujian telah dijalankan untuk melihat perbezaan antara dua cara ini. Penyiraman secara berjadual adalah dengan membekalkan air kepada tanaman pada masa yang telah ditetapkan. Manakala, penyiraman berdasarkan maklumbalas pengesan elektronik adalah berdasarkan maklumbalas daripada kelembapan tanah. Semua fungsi ini memerlukan sambungan internet pada kawasan yang mempunyai sambungan WiFi. Di samping itu, sebuah pangkalan data telah dicipta untuk menyimpan sejarah dan status terkini

pengesan elektronik dan pum air. Data ini juga boleh diakses pada web yang telah disediakan. Hasilnya penyiraman secara berjadual menyebabkan pembaziran penggunaan air berbanding penyiraman seacara automatik.

ABSTRACT

In this era of new technology, technology is the best alternative for improving the quality of agricultural resources. In addition, most technologies are integrated with Internet Things (IoT) where sensors or objects interact with the internet. Agricultural control and monitoring systems using IoT were developed primarily in small-scale gardens. The most important thing in agriculture is irrigation. This study focuses on water control and monitoring using several sensors. Traditional or manual control causes farmers to be unable to control the quantity of water for a shower at a time because the need for tap water for a cucumber needs to be precise. Moreover, this causes waste. Therefore, a system has been developed to address this problem by using WiFi as a wireless protocol. Thus, farmers can control and monitor remotely. Farmers can also analyze with data obtained from parameters such as temperature, humidity, light intensity and soil moisture. This study also wanted to demonstrate the effectiveness of the feedback control method on small-scale agriculture. A test was conducted to see the difference between these two methods. Regular watering is by supplying water to the plant at a set time. Whereas for feedback-based irrigation is based on feedback from soil moisture. All of these functions requiring internet connection to areas or places with hotspots. In addition, a database has been created to store the history and current status of sensors and water pumps. This data is also accessible on the web provided. As the result, the schedule irrigation produced waste in water resources than automatic irrigation.

DEDICATION

To my beloved parents

Thank you for providing all the support you have never given up. It will always be remembered in this heart.

To my Supervisor and Lecturer

Thanks for all your unwavering knowledge and support. Your patience, support and words encouragement gave me immense strength throughout the project.

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LIST OF ABBREVIATIONS

GDP	Gross Domestic Product
IoT	Internet of Things
WiFi	Wireless Fidelity
MCU	Microcontroller Unit
LDR	Light Dependent Resistor
CPU	Central Processing Unit
AC	Alternate Current
DC	Direct Current
GUI	Graphical User Interface
IDE	Integrated Development Environment
MySQL	Structured Query Language
PHP	PHP: Hypertext Preprocessor
HTML	Hypertext Markup Language
CSS	Cascading Style Sheet
SGML	Standard Generalized Markup Language
PCB	Printed Circuit Board
OLED	Organic Light-Emitting Diode
LED	Light Emitting Diode
GPIO	General Purpose Input/Output
PVC	Polyvinyl Chloride

CHAPTER 1

INTRODUCTION

1.1 Background

Malaysia has shown sustained economic growth in the 1980s until the 1990s. Initially, the country is promoting agriculture and fisheries, but today is spearheaded by the services sector which accounts for about 55 percent of Malaysia's Gross Domestic Product (GDP) value. Agriculture is the most significant division in our national economy. It is not just the biggest supporter of work to the general population yet, in addition, the biggest supporter of this present nation's income. Now, Malaysia needs structural changes on a massive scale driven by the Smart Farm Revolution to re-cultivate this area. The Smart Farm Revolution refers to the use and integration of the latest wider technology in agriculture aimed at enhancing the quality and yield of crops (Mat et al. 2019).

For instance, the utilization of the Internet of Things (IoT) sensors may likewise be connected to transmit information or data identified with a plant progressively (Roslan and Mohd. Ali, 2018). Subsequently, this data can be utilized for further activity by the farmer. For the most part of Malaysia, the farming segment still subject to old innovation, for example, manual observing innovation. Since this innovation is obsolete and should proceed onward to new, cutting edge innovation. In 2017, the Australia government has allocated AU$60 million worth of grants to further promote the smart agricultural sector. China has also focused on applying IoT in agriculture through its government in the 13th Five-Year Plan (Mat et al. 2019).

Irrigation is an important part of agriculture that influences crop production. Farmers mostly rely on rain for water supply for irrigation purposes. But when rain is deficient, they use the available water to irrigate their fields. The problem here occurred when water was compelled to open during the night and was left to supply the water to the plant. This makes uncontrolled water supply (Kumar et al. 2018). It can cause some dead plants if water supply excessively. Hence, the rate of water dissemination can be enhanced by utilizing using soil moisture sensor readings. Therefore, measuring and monitoring the use of water and irrigation systems are ineffective when using manual monitoring. Furthermore, manual controls now and again burden the farmers as the rate of watering is hard to quantify for a plant. For example, the manual judgment of soil moisture content provides defective outcomes. Thus, it produces unproductive results for crop maturation (R et al. 2018). The system is additionally for the most part not for farming on a substantial scale but rather it is increasingly reasonable for agriculture on a small scale on account of the utilization of its limited equipment. The purpose behind this is to monitor and control the watering and distribute the fertilizers to crops. This monitor and control will be led consequently and ceaselessly. Hence, less manpower is used for this monitoring.

This system uses the output control method to be controlled by input. All inputs will be measured using sensors and the size of the size will be controlled by NodeMCU ESP32. NodeMCU ESP32 will hold the value of the sensor and send it to the WiFi module, ESP32. To allow the data to be transmitted to the cloud database, the WiFi module must be connected to the internet. The output will be displayed on the website and outputs some control sensors such as soil moisture sensor. For example, if the soil moisture detects lower moisture content, it will cause the DC water pump to operate and drain water and vice versa. Similarly, temperature sensor and LDR sensor, it used only for environmental temperature and light intensity monitoring. Despite the low temperatures, plants still need water and enough light

for photosynthesis. Therefore, a soil moisture sensor is used to measure soil moisture. The water supply method will be scheduled in the cloud database and monitored from the website application. The invention of this system enables the rate of growth of crops to be maintained in a controlled condition.

1.2 Problem Statement

Uncontrolled water supply causes waste and crops to absorb excess water from its needed. For example, the farmer needs to open the water and let the water irrigates the crop for some time until the farmer feel water has been sufficiently supplied on the crop. However, this causes wastage and water irrigation to need to be more systematically managed.

Furthermore, measuring and monitoring the use of water and irrigation systems are ineffective when using manual monitoring. For example, farmer is difficult to measure air drainage rates as they only make an estimation for water drainage. Consequently, it leads to poor performance on crop yields.

1.3 Objectives

The main objectives of this project are as listed below:

1. To develop an agricultural control and monitoring system for soil moisture, environment temperature, light intensity and water pump based on IoT.
2. To analyze the effectiveness of the system towards small-scale agriculture.