UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMPROVEMENT OF SMART FERTIGATION SYSTEM USING MICROCONTROLLER

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

by

TENGKU FARAH NURHIDAYU BINTI TUAN AB RAZAK

B071610318

941004 06 5966

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING

TECHNOLOGY

2019

UNIVERSITI TEKNIKAL MALAYSIA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: Improvement of Smart Fertigation System Using Microcontroller

Sesi Pengajian: 2019

Saya **Tengku Farah Nurhidayu Binti Tuan Ab Razak** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

☐ SULIT* Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.

☐ TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

☒ TIDAK TERHAD

Yang benar,

.....

Tengku Farah Nurhidayu Binti Tuan Ab Razak

Alamat Tetap:

JA 9717 Jln Damai 7

Taman Kesang Damai

77000 Jasin, Melaka

Tarikh:

Disahkan oleh penyelia:

.....

Saifullah Bin Salam

Cop Rasmi Penyelia

Tarikh:

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini

DECLARATION

I hereby, declared this report entitled Improvement of Smart Fertigation System Using Microcontroller is the results of my own research except as cited in references.

Signature: ……

Author : Tengku Farah Nurhidayu Binti Tuan Ab Razak

Date:

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 Electronic Engineering Technology (Industrial Electronics) with Honours. The member of the supervisory is as follow:

Signature: ……

Supervisor : Saifullah Bin Salam

Signature: ……

Co supervisor: Fakhrullah Bin Idris

ABSTRAK

Pada masa kini, sektor pertanian telah memperkenalkan bebereapa teknologi atau penambahbaikan bagi memastikan hasil tanaman yang berkualiti bermula dari tanaman sayuran hijau hingga ke tanaman yang berbuah dan berbunga. Antara penambahbaikan yang telah dilakukan di Malaysia adalah sistem pengairan ataupun irigasi. Sistem irigasi adalah teknik penyiraman baru untuk tanaman. Ia mengawal kuantiti air dengan menyalurkan ke tanaman pada selang waktu yang tertentu. Ia juga mengawal kualiti hasil tanaman dan mengekalkan landskap. Pelbagai teknik pengairan yang digunkan seperti pengairan titisan, pengairan pemercik dan pengairan permukaan. Selain itu, sistem fertigasi juga merupakan usaha yang telah dilakukan. Fertigasi adalah sistem yang mencampurkan baja dengan air irigasi menjadi satu larutan untuk mengimbangi nutrisi tanaman dan penggunaan air. Walau bagaimanapun, fertigasi memerlukan kekerapan yang betul untuk disalurkan ke tanaman bagi mengelakkan kerosakan pada tanaman. Kebanyakan petani hanya mengagak dan mencuba-cuba sukatan larutan fertigasi. Hal ini membawa kepada pembaziran air dan baja. Oleh sebab itu, smart fertigation system dicipta untuk menangani masalah ini. Pengesan kelembapan digunakan dalam sistem ini untuk mengawal kekerapan larutan fertigasi disalurkan ke tanaman. Injap tangki fertigasi (tangki D) akan dibuka dan larutan akan keluar apabila tanah kering. Pengesan takat air pula digunakan untuk mengesan kuantiti larutan di dalam tangki fertigasi. Apabila tangki kehabisan larutan, injap pada tangki air (tangki

A), baja A (tangki B) dan baja B (tangki C) akan dibuka dan mengisi tangki A. Sistem ini adalah sepenuhnya automatik, para petani tidak perlu menghabiskan masa yang banyak untuk memeriksa kondisi tanaman.

ABSTRACT

The agricultural sector has introduced a number of new technologies or improvements to ensure that quality crops come from green vegetables till fruited and flowering plants. Among the improvements that have been made in Malaysia is irrigation systems which is a method for watering plant. It controls the quantity of water by channeling it to the plant at a certain interval. It also controls the quality of crop yields and maintains the landscape. Irrigation system has many methods like dripping irrigation, sprinkler irrigation and surface irrigation. In addition, the fertigation system is also one of the wages that has been done. Fertigation is the system where the fertilizer is injected into an irrigation water to balance the soil nutrients and water usage. However, fertigation requires the right frequency to be channeled to the crops to avoid the crops to damage. Currently, the farmers implemented the fertigation system by using trial-and-error method which lead to water and fertilizers wastage. Because of that, a smart fertigation system for plant is designed to overcome the problems. Moisture sensor is used in this system to control the frequency of water and fertilizers flowing. The fertigation tank valve (tank D) will be opened and the solution will come out when the soil is dry.Then, water level sensor is used to detect when the tank is empty. When the tank runs out of the solution, the valve on the water tank (tank A), fertilizers A (tank B) and fertilizers B (tank C) will be opened and filling the tank A.

The system is fully automated, so farmers do not have to spend much time checking plant conditions.

DEDICATION

I would like to dedicate this project to my supervisor, Mr Saifullah Bin Salam whom guided me in this project. I also would like to thank my beloved parents, lecturers whom had helped and supported me in this project.

ACKNOWLEDGEMENTS

IN THE NAME OF GOD

Most Gracious, Most Merciful

Praise be to Allah, the Lord of the Worlds. Peace and blessings be upon Prophet Muhammad, his entire family, his companions and his descendants.

I would like to express my sincere appreciation to my supervisor Mr Saifullah Bin Salam because of the guidance and discussions given throughout the duration of the project.

Appreciation is also given to anyone who is either directly or indirectly assist in the production of this project. Thank you also to those who have taught me a lot in completing this project.

Thank you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

WSN	Wireless Sensor Network
GPRS	General Packet Radio Services
IGSS	Interactive Graphical SCADA System
SCADA	Supervisory Control and Data Acquisition
PLC	Programmable Logic Controller
PIC	Peripheral Interface Microcontroller
RAM	Random Access Memory
ROM	Read Only Memory
EEPROM	Electrically Erasable Programmable Read-Only Memory
GPR	General Purpose Register
SFR	Special Function Register
PWM	Pulse Width Modulation
USB	Universal Serial Bus
LED	Light Emitting Diode

CHAPTER 1

INTRODUCTION

In this chapter will focus on the project background, objectives, problem statement and project scope.

1.1 Background

The fertigation system is the injection of fertilizer for water soluble products into an irrigation system. It is used to increase the soil quality and the nutrients absorption by plants. It also helps to reduce the water, fertilizers and chemical substances needed. The types of fertilizers can be used in fertigation system are water soluble and liquid fertilizers. In most cases, 10 fertilizers are used in plants that are calcium nitrate, potassium nitrate, sulphate magnesium, phosphate monopotsase, iron, zinc sulphate, sulphite copper, boron, manganese sulphite and molydate ammonium. However, all the components are divided into 2 groups which are fertilizers A and fertilizers B. The amount of fertilizers is delivered through the irrigation water. The normal fertigation system requires user to try-and-error to decide how many times the tree needs to be watered and it is exhausted. The aspects that need to be considered in order to get the right frequency for fertigation solution channelled to the plants are moistness of soil. The Smart Fertigation System is the system that controls the frequency of fertigation solution needed to be watered to the plants automatically. This system consists of four tanks which are water tank (tank A), fertilizer A (tank B), fertilizer B (tank C) and fertigation tank (tank D). Moisture sensor is used in this system

to measure the moisture level of the soil. The plants is watered when the soil is dry. Water level sensor is used to measure the solution level in the tank D. Valve at tank A, B and will opened and filling the empty tank D. Both sensors act as an input of this system. Arduino microcontroller is used in this project to store all the information. The sensors transmit the signal to the microcontroller and microcontroller gives the instruction to the output components which are servo motor, solenoid valve and LCD. Servo motor acts as a mixer that will stir the fertilizers AB and water in tank D. Solenoid valve will control the liquid flow from each tank of the fertigation system and LCD function to display the moisture level of the soil.

1.2 Statement of the Purpose

The main objectives of this project can be described as follows:

i. To design the prototype of Smart Fertigation System using Microcontroller.

ii. To analyse the improvement of "Smart Fertigation System using Microcontroller"

iii. To ensure the plants are always in good condition.

1.3 Problem Statement

The plants need a sufficient nutrient to grow healthier and to grow the flowers or fruits with the best quality. Fertigation system allows the plants to receive the fertilizers and water at once because the fertilizers are mixed together with the water in one tank and channelled into irrigation system. However, the plants need to be watered with the correct time interval to avoid the plants from insufficient or excessive nutrients