Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF DURIAN TREE IRRIGATION SYSTEM USING ARDUINO PLATFORM

MUHAMMAD HELMI BIN AZMAN

Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

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MUHAMMAD HELMI BIN AZMAN

A project report submitted
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ELIYANA BINTI RUSLAN
Pensyarah
Jabatan Teknologi Kejuruteraan Elektronik & Komputer
Fakulti Teknologi Kejuruteraan Elektrik & Elektronik
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Supervisor Name : Ts. Eliyana binti Ruslan

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DEDICATION

I am grateful to everyone who has ever helped me and supported me in finishing this project.

ABSTRACT

Nowadays, technology is an essential part in our daily life. Everything has been integrated with the technology to ease the progress such as communication, medicine, agriculture and many more. Based on the statistic from the government, the population of human have been increased where can contribute the highly demand of the food. Talk about the food, it is related to agriculture. Durian is well known fruit among Malaysian which is fruiting once a year. The demand of the durian has been increased drastically since 2019 when the new varieties such as Musang King, Duri Hitam and IOI have been introduced. Even though the price is high, it does not deter the customer from buy it. The price of the durian has encouraged other people who have the orchard to plant the durian trees. Unfortunately, there is so many challenges on growing the durian tree such as soil humidity, environment temperature and water. The most problem is water management. Therefore, the objective of this project is to develop the irrigation system for durian tree using Arduino platform. In this project, it has a system to irrigate the crops when the water level in the soil decreased. Soil moisture sensor will detect the humidity before allowing the water pump to function where controlled by the relay. This system uses the Arduino Uno as a microcontroller to control all the component and all parameters get the electric from the solar panel. Based on the observation, this system will help the durian farmer to irrigate the crops and control the water given. The possibility for tree to get disease also decrease due to the good water management. This project suitable for part time durian farmer who not always come to the orchard.

ABSTRAK

Pada masa kini, teknologi adalah perkara penting dalam kehidupan seharian kita. Segala-galanya telah disepadukan dengan teknologi hari ini untuk memudahkan kemajuan seperti komunikasi, perubatan, pertanian dan banyak lagi. Berdasarkan perangkaan daripada kerajaan, populasi manusia telah meningkat yang mana boleh menyumbang kepada permintaan yang tinggi terhadap makanan. Bercakap tentang makanan, ia berkaitan dengan pertanian. Durian merupakan buah yang terkenal di kalangan rakyat Malaysia yang berbuah sekali dalam setahun. Permintaan buah durian telah meningkat secara drastik sejak 2019 apabila varieti baharu seperti Musang King, Duri Hitam dan IOI telah diperkenalkan. Walaupun harganya tinggi, ia tidak menghalang pelanggan untuk membelinya. Harga durian telah menggalakkan orang lain yang mempunyai dusun untuk menanam pokok durian. Malangnya, terdapat begitu banyak cabaran dalam penanaman pokok Durian seperti kelembapan tanah, suhu persekitaran dan air. Masalah paling banyak ialah pengurusan air. Oleh itu, objektif projek ini adalah untuk membangunkan sistem pengairan pokok Durian dengan menggunakan platform Arduino. Di dalam projek ini, ia mempunyai sistem untuk mengairi tanaman apabila jumlah air di dalam tanah kurang. Penderia kelembapan tanah akan mengesan kelembapan sebelum membenarkan pam air berfungsi di mana dikawal oleh geganti. Sistem ini menggunakan Arduino Uno sebagai mikropengawal untuk mengawal semua komponen dan semua parameter mendapat elektrik daripada panel solar. Berdasarkan pemerhatian, sistem ini akan membantu petani durian untuk mengairi tanaman dan mengawal air yang diberikan. Kemungkinan pokok mendapat penyakit juga berkurangan kerana pengurusan air yang baik. Projek ini sesuai untuk pekebun durian separuh masa yang tidak selalu datang ke kebun.

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LIST OF SYMBOLS

℃	-	Degree Celcius

LIST OF ABBREVIATIONS

V	-	Voltage
TNB	-	Tenaga Nasional Berhad
DC	-	Direct Current
GND	-	Ground

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CHAPTER 1

INTRODUCTION

1.1 Background

Irrigation systems are getting popular today among durian farmer's since agriculture is integrated with technology in many parts of work. This technology has eased the durian farmer to help do their work and solve the problem that occur when using manual method. Since 2019 the price of durian fruit has been increased due to high demand from customer either local or international especially variety Musang King, Black Thorn, IOI and many more. In addition, Malaysia durian farmer's also export the durian to other country such as Hong Kong, Japan, Australia, Singapore, and Europe where the export demand reaches 1,000 metric tons per month. Nowadays, the price of 1kg of durian is around RM60 where it attracted many people who come from various backgrounds interested in planting durian trees even in a small-scale. The reason the durian plantation project is enough to build in small scale because the project for durian plantation required high capital for instance the price of small size of Musang King tree is around RM25 and the sack of fertilizer weighing 50 kg already RM250. Not only that, to prevent the durian tree from diseases require pesticides and moil poison where the price for 1 litre of bottle already RM100. Nevertheless, not all part time durian farmers know the challenge of growing this tree.

1.2 Problem Statement

Many part time durian farmers today still irrigate their crops in manual method by taking the water from the well and going to each plant to irrigate. This method takes more time and consumes physical work. Other than that, there are also durian farmers who will set up an irrigation system by used timer where it will irrigate the crops every evening on time. If excessive water is on durian trees, it can cause disease. Mostly, the part time durian farmer does not have much time to irrigate the durian tree because the orchard location is in rural area.

1.3 Project Objective

The main aim of this project is to propose a systematic and effective methodology to irrigate the durian tree based on their soil humidity. Specifically, the objectives are as follows:

a) To design and simulate a durian plantation irrigation system.

b) To fabricate and propose the prototype to test in real durian plantation.

c) To design and study the performance of the system.

1.4 Scope of Project

To avoid any uncertainty of this project due to some limitations and constraints, the scope of the project is defined as follows:

a) The usage of suitable power supply in this irrigation system.

b) The location to implement this system.

c) The user of this system which is focus on part time durian farmer.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In today's modern agriculture, water management is identified as an essential item to ensure the best growth for all types of crops. There are many inventions out there which are focusing on agriculture that have been created to support or solve many types of physical work that require large amounts of workers such as machines for harvesting, irrigation, and many more. In this case, the irrigation system should be developed for efficient water management and reduce the disease that can attack the durian tree. It is important, especially for durian trees which are sensitive to the presence of water in the soil.

2.2 Citation Paper

2.2.1 Robotic Irrigation Water Management: Estimating Soil Moisture Content by Fell and Appearance

The purpose of this project is to monitoring soil moisture by "feel and appearance method". It is equipped with soil moisture sensor, RGB-D camera and robotic manipulator to implement the project. According to[1], the fell and appearance method is actually a well defined and proscribed procedure farmers use to schedule irrigation of their crops. By this method, it can irrigate the plant based on the desired quantity which can reduce the usage of water and control the loss of nutrients when apply it too much. With the usage of robot, the (fell) be a sensor which is explore the root zone to measure the amount of water and the (appearance) be a camera to do visual inspection. In manual method, most of the farmers are estimate the water by looking the appearance without do check the moisture of the soil which

is not accurate to determine the amount of water. Figure 2.1 shows the collaborative robot Franka Panda from automation company performing soil moisture measurement. Figure 2.2 shows the RGB-D camera records a pepper plant that grown in a container and the collaborative robot approach vector y with the ground truth point.

Figure 2.1: The robot performing soil moisture measurement[1]

Figure 2.2: Blender setup for validation of the soil surface detection method[1]

2.2.2 Iot-based intelligent irrigation system for paddy crop using an internet-controlled water pump

This project is about the method to irrigate the paddy crops by implement the concept of IoT and use several of sensor to check the pH and soil moisture. In the agriculture field, innovative tools emerge, bringing automated, unremitting, and spontaneous features for communication through internet applications[2] . Nowadays, the implementing of automated and intelligence system is emphasized to improve the yield or method of work. The intelligent irrigation system which is use the concept of IoT has shown the system is more proficient compared to the existing conventional. Water is the essential part to growth this rice plants. The system starts from soil moisture sensor that check the condition of soil, water flow amount and send the data to the web server database by using wireless transmission. So, from the data collected the system can decide to turn on or turn off the water pump to irrigate the crops. It operates via http protocol to control water pump of farmland. By implement this system, the water usage can be utilized effectively for agriculture where reduce wastage of water at the same time. Figure 2.3 shows the block diagram start from soil moisture sensor where check the condition of soil and end at water pump. Then, the collected data sent to the server.

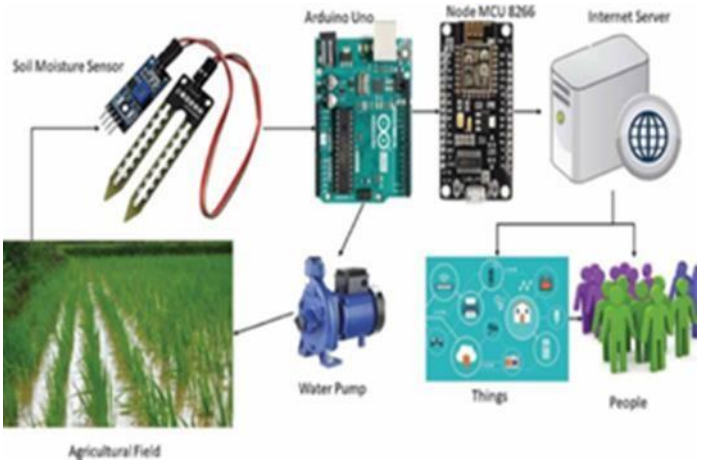

Figure 2.3: The block diagram[2]

2.2.3 Arduino Based Smart Irrigation System Using IOT

Agriculture with the implement of intelligent technology should be a compulsory element for any type of agriculture. For instance, the number of manpower and time can be reduce and the farmer can access their fields condition anytime according to [3] .This project has been applied automated irrigation system for efficient water management and intruder detection system. It consists of the parameters such as soil moisture sensor, pH sensor and humidity sensor. The LCD will display the measured values. With the help of an intruder detection system birds are deterred from using a PIR sensor stepping into the arena. The GSM module includes a communication link has been established between the field and the farmer. In this situation, the farmer will be informed of the field's condition by through SMS, as well as on the website. The farmer has access to information on the server about field condition at any time and location where can reduce manpower and time. Figure 2.4 shows the block diagram consists of input, controller, and output.

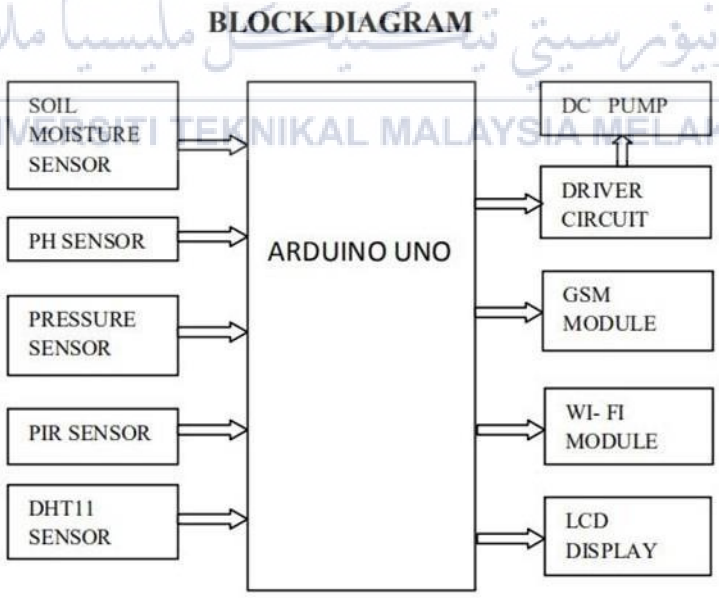

Figure 2.4: Block diagram[3]

2.2.4 Smart Irrigation System using Arduino with Solar Power

Advanced technology and environmental sustainability should move toward together to achieve good and balance life. Based on this sentence, it related to the agriculture with the combination or implementation of the technology. Since the agriculture plays the significant role in improving the country's economy, an improvement should be applied in order to increase the productivity and expand the quality of crops according to [4] . Therefore, the idea to create this project is occur which is smart irrigation system using Arduino with solar power. This project consists of the component such as soil moisture sensor, Arduino Uno, solar panel, LCD, GSM SIM 900, DC water pump and relay. The soil moisture sensor will check the condition of soil and send the data to the Arduino to decide for irrigation. The water pump only allows to turn on based on the condition of soil either wet or dry. When the system is running, the LCD will display the current process and this system gets the electric power from the solar panel. Figure 2.5 shows the project setup of smart irrigation consists of solar panel, soil moisture sensor, GSM module, charge controller, battery, water pump, Arduino, relay, and LCD.

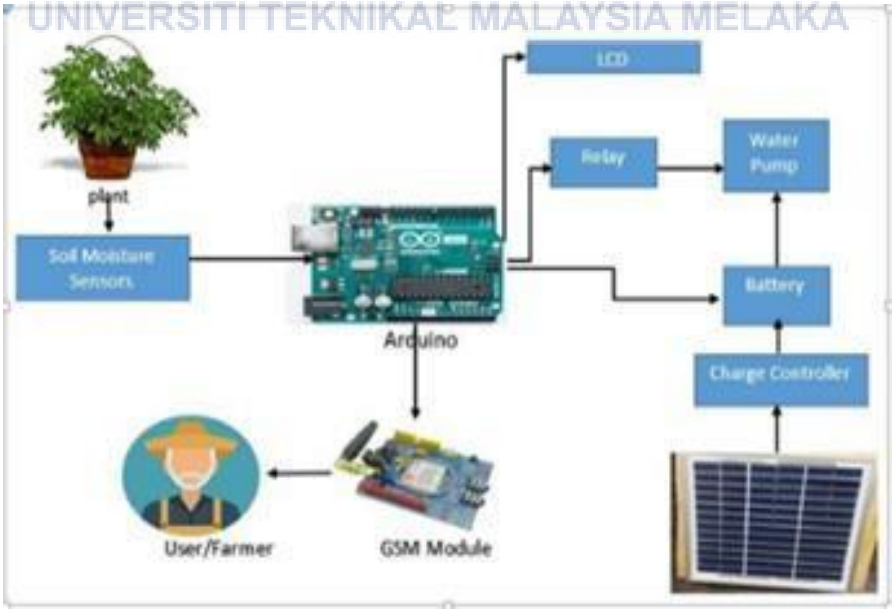

Figure 2.5: Smart irrigation system setup[4]