



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**HI-TECH UNDERGROUND SPRINKLER CONTROLLER  
USING WIFI**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Telecommunications) with Honours

by

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## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Hi-Tech Underground Sprinkler Controller using WiFi**

SESI PENGAJIAN: **2015/2016 Semester 1**

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## DECLARATION

I hereby, declared this report entitled “Hi-Tech Underground Sprinkler Controller using WiFi” is the results of my own research except as cited in references.

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## **APPROVAL**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

.....  
(Encik Hasrul ‘Nisham bin Rosly)

## **ABSTRACT**

“The Hi-tech Underground Sprinkler Controller using WiFi” is designed for the working people that will be equipped with the latest technology and given leisure for them. In addition, the advantage by using this project is to increase property value of lawns to become greener and make the property more attractive. The goal of this project is to develop a smart controlling system for lawns remotely control using WiFi. This project involves hardware and software. In this project, Arduino WiFi Shield CC3000 will acts as the master control unit for the entire system. The Arduino WiFi Shield CC3000 is always connected to WiFi. Besides, web page is used by the user to control turn on and turn off the water pump of the sprinkler. WiFi technology is used as a platform to communicate between the web page and control box.

## **ABSTRAK**

“Hi-tech Underground Sprinkler Controller using WiFi” direka untuk orang yang bekerja yang akan dipasang menggunakan teknologi terbaru dan akan memberi kemudahan untuk mereka. Tambahan lagi, antara kelebihan menggunakan projek ini adalah ia akan meningkatkan nilai harta halaman menjadi lebih hijauan dan membuat halaman menjadi lebih menarik. Matlamat projek ini adalah untuk menghasilkan sistem kawalan untuk halaman melalui “WiFi” dengan bantuan komputer. Projek ini melibatkan alatan-alatan dan program komputer. Di dalam projek ini, “Arduino WiFi Shield CC3000” akan bertindak sebagai unit induk kawalan untuk seluruh sistem. “Arduino WiFi Shield CC3000” akan sentiasa bersambung dengan “WiFi”. Selain itu, laman web akan digunakan oleh pengguna untuk mengawal menutup dan membuka pam air. Teknologi “WiFi” digunakan sebagai platform untuk berhubung diantara kotak kawalan dengan laman web.

## **DEDICATIONS**

Alhamdulillah, praise to the Almighty Allah S.W.T

This thesis is dedicated to:

My beloved parents, family members,  
Supervisor and all my friends  
Thanks for their encouragement and support.

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## LIST OF SYMBOLS AND ABBREVIATIONS

TCP	Transmission Control Protocol
IP	Internet Protocol
PC	Personal Computer
WiFi	Wireless Fidelity
WLAN	Wireless Local Area Network
LAN	Local Area Network
WSN	Wireless Sensor Network
IEEE	Institute of Electrical and Electronics Engineers
RF	Radio Frequency
PWM	Pulse Width Modulation
USB	Universal Serial Bus
ICSP	In-Circuit Serial Programming
SRAM	Static Random Access Memory
EEPROM	Electrically Erasable Programmable Read-Only Memory
DC	Direct Current
AC	Alternating Current
V <sub>in</sub>	Voltage Input
RX	Receiver
TX	Transmitter
TTL	Transistor-Transistor Logic
LED	Light Emitting Diode
SPI	Security Parameter Index

TWI	Two Wire Interface
WEP	Wireless Encryption Protocol
WPA2	WiFi Protected Access II
NO	Normally Open
NC	Normally Close
C	Common
IDE	Integrated Development Environment
SSID	Service Set Identifier
RSSI	Received Signal Strength Indication
HTML	Hypertext Markup Language
AP	Access Point
OS	Operating System



# CHAPTER 1

## INTRODUCTION

### 1.0 Introduction

The first chapter introduces brief idea of the project. It focused on the overview of the project, detailing the objectives, the problem statement, scope and outcome of the project.

### 1.1 Background

Wireless Fidelity(WiFi) is a type of wireless network technology used for connecting to the internet. The purpose of WiFi is facility allowing computers, smartphones, or other devices to connect to the internet or communicate with one another wirelessly within a particular area. WiFi technology is used as a platform to communicate between the web page and control box. After that, the Arduino WiFi Shield known as CC3000 allows an Arduino Uno board to connect to the internet using the 802.11 wireless specifications. The CC3000 can connect to wireless network which operate according to the 802.11b and 802.11g specifications. In this project, CC3000 acts as receiver to turn on and off the water pump.

Hi-tech Underground Sprinkler Controller using WiFi. A design is proposed for a working people who live in residential environment. By using WiFi, it helps working people who do not have time to watering plants. When they want to watering plants, they can controlled remotely with the help of web page to turn on and turn off of the water pump. What they need to do is always turn on home WiFi network. A web page acts as a transmitter will send a signal through WiFi to the CC3000 to turn on or off the water pump which acts as a receiver. By using the

CC3000, it can connect to the home WiFi. From that, home owner can control to turn on and turn off of the water pump.

Since working people had a limited time to care their lawns, they can watering their plants using web page as soon as they reached at the workplace. Everything can be controlled at a fingertip. With that, they can spend more time on doing another important thing. In addition, it can prevents plants from damaged and lose freshness because of lack of water. Indirectly, the property value of lawns will increase and reduce costs from hire a gardener to care the lawns. Technology is probably a solution to reduce costs and prevent loss of resources.

## **1.2 Problem Statement**

There are many people who love to have the beautiful lawns with the plants that full of freshness. But for working people, they had a limited time to give a full attention to their lawns because of working. Because of failed to take a proper care of plants, it going to lose freshness and damaged because of lack of water to help it grow up well. Some of working people will hire a gardener to care their lawns, but it will cost a lot of money. This project is designed to help the lawns maintain beautiful and green without wasting money. Technology is probably a solution to reduce costs and prevent loss of resources.

## **1.3 Objectives**

The objectives of this project are:

1. To study the advantages and disadvantages of using underground sprinkler using WiFi.
2. To design an underground sprinkler using WiFi to increase property values of the plant.
3. To analyze and test the functional of the system between hardware and software.

## **1.4 Scope of Project**

The scope listed is to ensure the project is conducted within its intended boundary. Scope is useful to ensure the project is heading in the right direction to achieve the goal. This project is focused on WiFi technology in managing water sprinkler. WiFi technology is being chosen for this project because WiFi is facility allowing computers, smartphones, or other devices to connect to the internet or communicate with one another wirelessly within a particular area. CC3000 will acts as a receiver to turn on and turn off the water pump. When the CC3000 received the signal, water sprinkler will do a watering on the yard.

### **1.4.1 The basic concept of Arduino WiFi Shield CC3000**

CC3000 allows an Arduino board to connect to the internet using the 802.11 wireless specifications. The WiFi shield can connect to wireless network which operate according to the 802.11b and 802.11g specifications. For this project, CC3000 acts as receiver to turn on and off the water pump.

### **1.4.2 Water Sprinkler**

Water sprinkler are used to watering plants or yard. The water pump of water sprinkler will connect to the CC3000 which is acts as a receiver. When the CC3000 received a signal to turn on the water pump, water sprinkler will activate to watering plants or yard.

### **1.4.3 Focusing to all home owner who have yard**

A design is proposed for a residential environment. For those homeowner who have a yard or plants at their home, they can used this project to increase the property value and make the property more attractive.

#### **1.4.4 Web page**

Nowadays, monitoring and controlling systems or electronic devices through PC's are very common. By using Transmission Control Protocol (TCP) or Internet Protocol (IP) the data stores in the data base of web server. Monitoring and controlling of device can be done by remote PC's through web server by entering into the web browser which contains a unique IP address. The data from device which we have to control is stored in the data base of web server through TCP/IP protocols can be retrieve through the web browser by using internet facility.

### **1.5 Project Methodology**

Several methods are used to develop the “Hi-tech Underground Sprinkler Controller using WiFi” start with project research. Project research is to obtain the literature review. The second method is gathering information for the project from book, journal, and internet. Third method is identified the suitable component for the whole project. Follow by the fourth method is created web page. After that, create a coding for Arduino the integrated it with web page to control on and off of the water pump. Then, hardware circuit is designed. Finally, hardware circuit, Arduino, and web page is combined. If the result is failed, troubleshoot is needed until it reaches the project requirements. Flow chart for this project is shown on the Chapter 3.

## 1.6 Thesis structure

### Chapter 1:

The first chapter introduces brief idea of the project. It focused on the overview of the project, the project objective, the problem statement, work of scope and outcome of the project.

### Chapter 2:

In this chapter, projects background is discussed. The characteristic and specifications of the component that needed is stated in this chapter. Also, the software that related with this project will be discussed. In addition, the related research also will be discussed in this chapter.

### Chapter 3:

This chapter will explained about the procedure and process flow of the project.

### Chapter 4:

This chapter will discuss about the data collection and analysis data obtained from the project. It is also will discuss about the problems that had to face during design the project and how to overcome it.

### Chapter 5:

This chapter will discuss about the summarization of the project.

## **CHAPTER 2**

### **THEORETICAL BACKGROUND**

#### **2.0 Introduction**

The idea of this project is come from the problems that faced by working people to watering their yard. This problem can be solved by using WiFi to turn on and off the water pump to watering yard by the homeowner anytime and anywhere even though the homeowner is not in the area. This chapter will explain about the description of the project modules that will be used in this project.

#### **2.1 Related Research**

There is several related research that had been done. The Wireless Local Area Network (WLAN) helps the student from having trouble to access through Local Area Network (LAN) cable. WiFi is the default access technology. The system is compatible and reliable. Other than that, at distant location, the transmission system can access the data. Furthermore, the WLAN is widely used in educational institution, factory, office spaces, restaurant, and college [1].

The system consists of three stations which are Sensor Node, Router, and Server. Via 802.11g wireless modules, the communication between sensor node and the server is achieved. In addition, the installing of wireless sensor network is low in cost [2]. By using WiFi Institute of Electrical and Electronics Engineers (IEEE) 802.11.1, the Wireless Sensor Network (WSN) can be created. Other than that, the user able to reduce man power, save in time, and low in cost by using wireless monitoring [3].

Relays can be operated on and off to change status or devices as per our requirements. For controlling the devices using web browser, owner of the system has to access the web page and change the settings. Ethernet module plays an important role in transferring web pages to the client [4].

## 2.2 Hi-Tech Underground Sprinkler Controller using WiFi

This project is to design the water sprinkler to the working people who have yard by using WiFi technology. The purpose of using WiFi is to ease the user to watering their plant. Web page is created to send a signal to the water pump. In this project, PC will acts as a sender and the WiFi will transmit the signal through transmission medium. After that, CC3000 that acts as a receiver detects the signal and passed it to the recipient which is the water pump. The function of water pump is to turn on or off the water sprinkler.

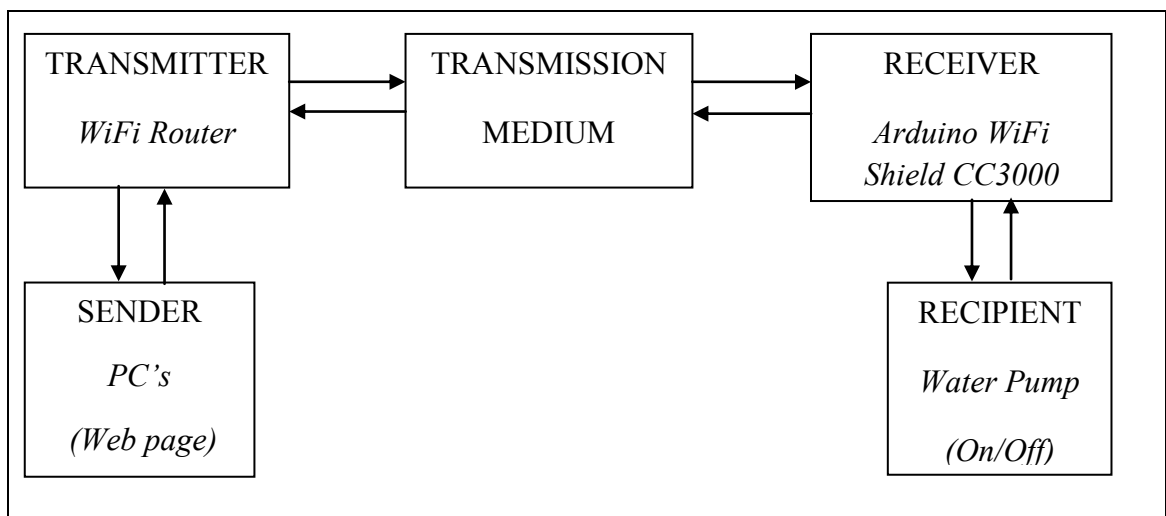


Figure 2.1: Block Diagram of Hi-Tech Underground Sprinkler Controller using WiFi

### **2.2.1 Advantages and disadvantages**

The advantages of water sprinkler using WiFi is it will give an ease to the user. Since it can be controlled at a fingertip, the user can spend more time doing another important thing. After that, the property value of the yard will increase where the yard and plants become greener, and make the property more attractive. The water sprinkler using WiFi not only save time, it is also can save costs. There is no need to hire a gardener to care a yard. This project is designed to help the yard maintain beautiful and green without wasting money. While, there are some disadvantages of this project. WiFi networks have a limited range, so that the sender cannot exceed the range of WiFi. After that, since WiFi is widely used among people, the quality of connection will be poor because at high density, WiFi operating in the same channels which it can interfere with each other.

### **2.3 Wireless Fidelity**

WiFi is a type of wireless network technology used for connecting to the internet that allows computer and other devices to communicate over a wireless signal. The frequencies Wi-Fi works at are 2.4 Ghz or 5Ghz, with no interference with broadcast radio, television antenna, cellphones and two-way radios are encountered during transmission. WiFi works with no physical wire connection between sender and receiver by using Radio Frequency (RF), a frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space [5].

WiFi is a device that detecting and deciphering the waves, and then sending back data to the router. It is two-way communication channel. The range of WiFi is usually not more than 10-20 meters but compared to Bluetooth or infrared, WiFi works over longer. Every laptop, tablet computer and mobile device comes with WiFi, as well as many home theater devices. Printers and scanners may have WiFi built in, and home appliances increasingly use WiFi for user control and notifications [5].