

# REMOTE SOIL MONITORING VIA IOT NODE

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This Report is Submitted in Partial Fulfillment of Requirement for the  
Bachelor of Electronic Engineering  
(Industrial Electronic)

Faculty of Electronics and Computer Engineering  
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

JUNE 2015



UNIVERSITI TEKNIKAL MALAYSIA MELAKA  
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN  
PROJEK SARJANA MUDA II

Tajuk Projek : REMOTE SOIL MONITORING VIA IOT NODE

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I hereby declare that I have checked this project and in my opinion, this project is adequate in term of scope and quality for the Degree of Bachelor of Electronic Engineering.

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Date : .....

For my beloved mom, dad and family

## ACKNOWLEDGEMENT

I would like to record many thanks to my supervisor, Engr. En. Khairul Muzzammil Bin Saipullah for all advice and guidance during I carried out this project. All guidance and advice from of you, I will remember for my future. There is a lot of unwritten skills and experiences that could not be found anywhere but in Universiti Teknikal Malaysia Melaka (UTeM).

I would like to express my greatest gratitude to my mother Mrs. Siti Fatimah Binti Abd Kadir, that have always sacrifice for me and always give their love, prayer and support for me and my lecturer at UTEM for supervising me during my completing this final year project, and teaching me almost everything about the learning at Universiti Teknikal Malaysia Melaka (UTeM).

I am also appreciation to have them as tutor and good friend. Moreover, I would send the greatest gratitude to the Academic Supervisor, Mr Imran Bin Hindustan for the guidance towards completing this report.

Thank you.

## ABSTRACT

This project is aimed to develop an IOT node device that transmitted soil moisture information to an IOT server that relays those information to a Web page and an Android application. IOT is Internet of Things technology where anything can be connected to the internet and can be access from anywhere while node is a connection point. The remote soil monitoring via IOT node will help people or farmer monitor agricultural soil moisture and it is also very efficient in terms of collecting and recording soil growth related data since the data is stored online on the cloud and user can export the data into Microsoft excel format for personal record. The presence of these system, to some extent can help researchers or farmer to investigate further the situation of the most appropriate care for the plants. Monitor the soil conditions are difficult, particularly involving the type soil structure. The development of this system consists of the construction of IOT node to sense the moisture data and transmit it to the IOT server via Wifi module, the development of web page and Android application which is medium for the user to monitor the moisture data from anywhere, anytime they want as long as there is internet. The IOT node is build from Wido board which is a microcontroller with build in Wifi module. The completed system is tested with a number of soils with different level of moistures. The result shows the system sense the moisture correctly and available to update the moisture data in interval of 30 seconds to the IOT server which the developed web page and Android application can view and record those data.

## ABSTRAK

Projek ini bertujuan untuk membangunkan satu peranti nod IOT yang menghantar maklumat kelembapan tanah ke pelayan IOT yang tertuju maklumat mereka ke laman web dan aplikasi Android. IOT adalah Internet teknologi Perkara di mana apa-apa yang boleh disambungkan ke internet dan boleh diakses dari mana-mana sementara nod adalah titik sambungan. Pemantauan tanah jauh melalui nod IOT akan dapat membantu orang atau petani memantau kelembapan tanah pertanian dan ia juga amat berkesan dari segi mengumpul dan merekodkan data pertumbuhan tanah yang berkaitan kerana data yang disimpan dalam talian di awan dan pengguna boleh mengeksport data ke Microsoft excel format untuk rekod peribadi. Kehadiran sistem ini, sedikit sebanyak dapat membantu penyelidik atau petani untuk menyiasat lagi keadaan penjagaan yang paling sesuai untuk tumbuh-tumbuhan. Memantau keadaan tanah adalah sukar, terutamanya yang melibatkan struktur jenis tanah. Pembangunan sistem ini terdiri daripada pembinaan nod IOT untuk mengesan data kelembapan dan menghantarnya ke pelayan IOT melalui modul Wifi, pembangunan laman web dan aplikasi Android yang sederhana bagi pengguna untuk memantau data kelembapan dari mana-mana sahaja, bila-bila masa yang mereka mahu asalkan ada internet. Nod IOT adalah membina dari papan Wido yang merupakan pengawal mikro dengan membina di dalam modul Wifi. Sistem siap diuji dengan beberapa tanah dengan tahap yang berbeza melembapkan. Hasilnya menunjukkan rasa sistem kelembapan dengan betul dan boleh didapati untuk mengemaskini data kelembapan dalam tempoh 30 saat untuk pelayan IOT yang laman web yang dibangunkan dan aplikasi Android boleh melihat dan merekodkan data tersebut.



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## NOMENCLATURE

FKEKK	Faculty of Electronics and Computer Engineering
IOT	Internet Of Things
WIDO	Wifi and Arduino
ADC	Analog Digital Converter
TCPIP	Transmission Control Protocol/ Internet Protocol
HTTP	Hypertext Transfer Protocol
API	Application Programming Interface
REST	Representational State Transfer
GUI	Graphical User Interface
GSM	Global System of Mobile
NI	National Instrument's
WSN	Wireless Sensor Network
UWB	Ultra-wideband
VB	Visual Basic
PC	Personal Computer

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## **CHAPTER I**

### **INTRODUCTION**

This chapter presents the general ideas of the research which provides an overview of the Remote Soil Monitoring via IOT node. Basically, it consists of four minor sections, which are background, problem statement, objectives and scopes which describe the overall operation of this Remote Soil Monitoring via IOT node research.

#### **1.0 Background**

Nowadays, the internet is a progressive network communication platform to generate our future daily life. So, the item of an IOT (Internet of Things) refer that a worldwide network of interconnected objects uniquely access, based on standards. The IOT project is an emerging technology to facilitate people for plant management and treatments by using the cloud internet. The IOT system will provide an IOT device, cloud internet and interface application. Therefore, this project was aimed to develop an IOT node device that transmitted soil moisture information to an IOT server that connect this information to a Web page and an Android application. Basically, the soil is the part of the natural environment. It is a dramatically important to plants, animals, rocks, landforms, lake and rivers. The main factor why the soil is too important is because it influences the quality of the plantation product and provides a habitat for a wide range of organisms. Plus, the soil pH balance and

conditions is essential especially when it comes to agriculture. However from the statistics, only 20% of the people who involved in this industry did carry out the soil quality and assurance roughly. We surely believe that the lack of efficiency is due to the insufficient resources and time management. As a result, the soil becomes unproductive. Awareness about soil health should be rise up by the people to avoid this. Soil supplies many importance nutrients that required for healthy growth of a crop. The yield is largely depend on the soil in which the crop growth. So, before cultivation, it is very important to check the soil for its nutrients and moisture. Different plants have different soil nutrients and the moisture requirement.

Generally, water content in the soil is called soil moisture. Soil moisture is the most important to plant growth. It serves as a solvent and carrier of food nutrients for plant growth. Water is essential for photosynthesis. Malaysia has different climate such as hot season. When the hot season, the agriculture had to face some problems because they spent much energy and time to maintain the cultivation. Therefore, an agricultural country needs some innovation equipment to monitor the soil for reduced water consumption. It is can be set to lower and upper thresholds to maintain optimum soil moisture saturation and minimize plant wilting.

Remote Soil Monitoring via IOT node is the electronic device to monitor the amount of moisture present in the soil surrounding it. It is a low technology sensor, but ideal for monitoring an urban agriculture or garden. The main purpose of the Remote Soil Monitoring via IOT node is an indicator of the moisture, soil condition, whether the soil is dry, humid and more water. It is normally determined on all agricultural soils. Soil moisture influences many aspects of crop production and soil chemistry, including availabilities of nutrients and toxic substances, activities and nature of soil bacteria, soil structure, and activities of certain insecticide.

Remote Soil Monitoring via IOT node is the measure of the soil moisture or judge if there is water around the sensor. IOT (Internet Of Things) is the network of physical object embedded with electronics, software, sensors and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator or other connected device. So, the farmer or consumer is easy

to monitor of plant cultivation from long distance. Most crops or plants will grow under an advanced range of soil moisture than is indicated by their preference.

In short following are the benefits of Remote Soil Monitoring via IOT node which are encouraging plant growth by providing the best amount of water recommendations, it diagnoses whether there is too little or too much of a nutrient and the moisture of the soil can affect the availability of nutrients in the soil to the plants that grow there. It also will promote environmental quality and saves money that might otherwise be spent energy.

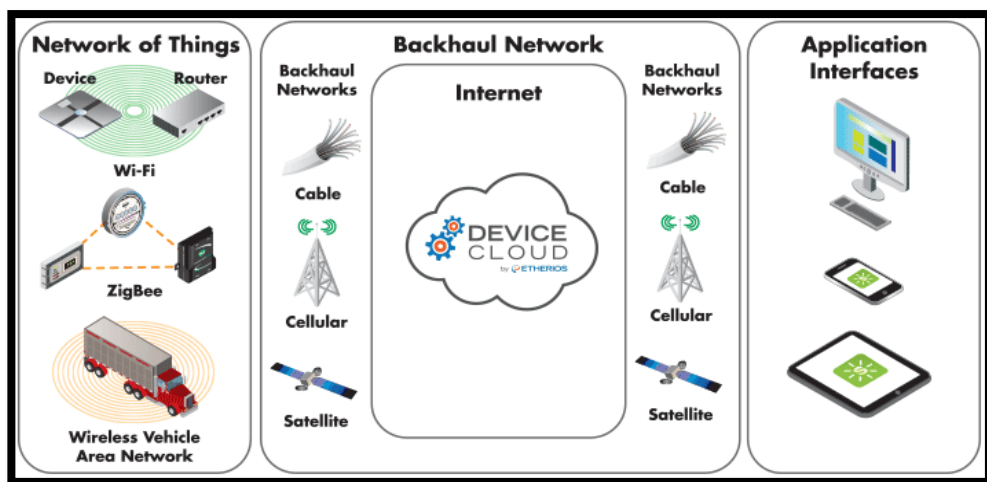


Figure 1: IOT system



Figure 2: Type of soil

Remote Soil Monitoring via IOT node uses a soil moisture sensor to connect IOT client that have an Arduino Leonardo to convert ADC (Analog Digital Converter), then import the CC3000 wifi module from library for generating access

point. The cloud wifi communicates each other to send the data from the restful interface like thingspeak.com as IOT server. The data will save and the JSON (Java Script Objective Notation) is the understandable language between web application, android application and thingspeak. This system monitors data access and update from anywhere and everywhere using mobile phone and personal computer or gadget. The agriculture level of productivity, accurate monitoring and control of the soil moisture must be implemented during the production cycle. This system improved the investigated soil moisture from manual to automatic to make the farmer easier monitor soil condition cultivation. Its lower power consumption, and cost affordable design specifications.

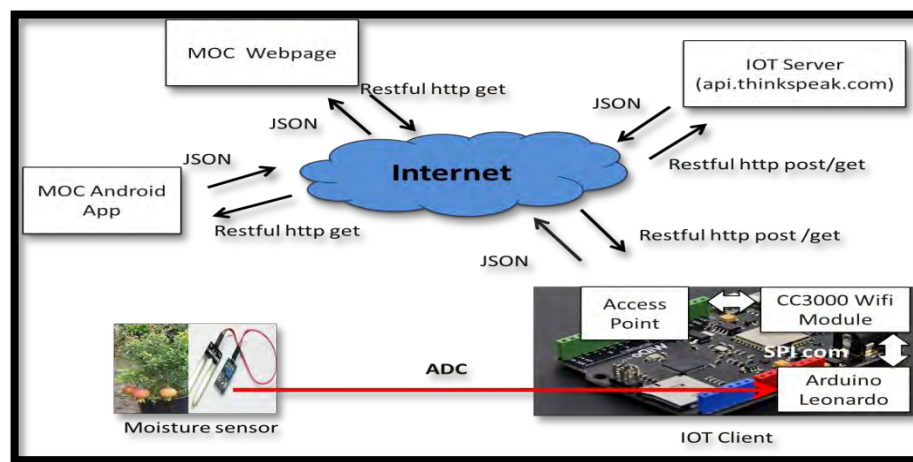


Figure 3 : Block diagram of architecture project

Refer on sector agricultural, this project will save manpower and to increase the economic product.

## 1.1 Objectives

In order to achieve the goal of this project and solve the current problem, objective of this project is determined:

1. To develop an IOT node device which inteprete about soil moisture sensor and Wido board are an IOT device to monitor from anywhere and everywhere using mobile phone and PC.

2. To develop web application and mobile application and digital Soil Moisture Reader.
3. To observe moist of the soil digitally in IOT node device and communicate them with IOT server and relay the data in the server to web application and mobile application.

## **1.2 Problem Statement**

Nowadays, an agricultural industry is one sector that is an important source of economic growth. Agriculture is seen as the country's most successful field that profitable. An agricultural sector uses the manpower to work, such as uses the manual system to monitor the soil condition but they not efficiency and unreliable to collect data.

In addition, by using the manual system, a lot problem can occur, for example, it will reduce the productivity and quality of the product. No sensor to control the moist and creates difficulty to humans to analyze the soil condition. It will take more costs to investigate or monitor the problem and waste time or energy to get the result. At the same time, the user will depend on the lab system to know the previous data.

Furthermore, in agriculture, such as seed palm oil need to observe the soil for growth. Imagine when the plant has corrupted, the consumer or farmer will have less money and how much time that they need to recover.

## **1.3 Scope of Project**

The scope of this project is to develop an IOT node device like moisture sensor and wido. Then, to develop web application and mobile application for human or farmer monitor the agriculture. In addition, to develop digital soil moisture reader

from moisture sensor to convert analog to digital (ADC) and change in percentage of moist soil. Lastly, to observe the moist digitally in IOT node device and communicate them with IOT server and relay the data in the server to web application and mobile application.

#### **1.4 Important of Project Design**

This project is important such as sustainability in term of:

- i) Economy
  - It is easy to obtain and the cost is affordable
  - It will reduce the manpower
- ii) Environment
  - Consume low power
  - Does not harm the environment
- iii) Social
  - User friendly

#### **1.5 Impact of Commercialization**

The target market for commercialized for research purpose, such as student study agriculture or somebody for doing the research, secondly, for agriculture sector such as MARDI, MPOB, FELDA, RESDA, FECRA and others. They didn't depend for lab to test the soil condition.

Next, Remote Soil Monitoring via IoT Node for farmer monitor soil moisture. They didn't loss yield the crop or plant. Lastly, it can be commercialized for anybody to obtain for the community produce the agricultural or plant.

## 1.6 Thesis Outline

This final year project consists of five chapters. There are have Chapter I is discusses about the introduction, problem statement, objectives, and scope of the project and thesis outline of Remote Soil Monitoring via IOT node.

Next, second part which is Chapter II describes literature review and background study of this project.

Then, Chapter III covers about the design and development which is a methodology project of Remote Soil Monitoring via IOT node.

The fourth part which is Chapter IV consists of the results and application of the Remote Soil Monitoring via IOT node. It includes the result analysis and software development.

Lastly, the Chapter V part of conclusion and suggestion the overall the project design and the system as well.

## **CHAPTER II**

### **LITERATURE REVIEW**

This chapter describes the literature review, which related to the development of the Remote Soil Monitoring via IOT node. It consists of four literature review, which are Monitoring and Controlling the crop field using the Zigbee network, the Greenhouse Environment System Based on Remote Control, An Effective Method For Crop Monitoring Using Wireless Sensor Network, A Comparative Study Of Wireless Protocols: Bluetooth, UWB, Zigbee and WIFI and Designing a Wireless Sensors Network for Monitoring and Predicting Droughts. In order to Remote Soil Monitoring via IOT node have the background about the hardware and software of the project design.

#### **2.0 Background Theory**

This section provides a previous study of related work about the application to monitor or control the soil moisture. Some of researches have been studied to gain more information about a network monitoring system that was previously implemented. It should be necessary to know and understand how the software and hardware were used in Remote Soil Monitoring via IOT node development. Th is reason to ensure that the study that currently being conducted contribute at a certain level of application. Then it come more efficient and flexible at coming soon.