MINI WATER BUOY

MUHAMMAD ARIFFUDDIN BIN MOHD NOH

This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Wireless Communication) With Honours

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

JUNE 2013

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : **MINI WATER BUOY**

Sesi Pengajian : **2012/2013**

Saya MUHAMMAD ARIFFUDDIN BIN MOHD NOH
mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (√) :

☐	**SULIT***	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
☐	**TERHAD***	(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☐	**TIDAK TERHAD**	

Disahkan oleh:

_____ (TANDATANGAN PENULIS)

_____ (COP DAN TANDATANGAN PENYELIA)

Tarikh:

Tarikh:

"I hereby declare that this report is the result of my own work except for quotes as cited in the reference"

Signature : ……..

Author : MUHAMMAD ARIFFUDDIN BIN MOHD NOH

Date : ……..

"I hereby declare that I have read this report and in my opinion this report is sufficient in terms scope and quality for the award of Bachelor of Electronic Engineering (Industrial Electronics) With Honours"

Signature : ……

Name : HAMZAH ASYRANI BIN SULAIMAN

Date : …….

Special dedication to my beloved parents, Mr Mohd Noh Bin Hassan, Mrs Ramlah Binti Osman, my beloved aunts Mrs Zaharah Binti Hassan, Mrs Arbaiyah Binti Hassan, and Mrs Puziah Binti Hassan. Not forgetting my dearest brothers and sisters, my colleagues and my friendly supervisor En Hamzah Asyrani Bin Sulaiman.

ACKNOWLEDGEMENT

Alhamdulillah, all praises to God for the strengths and His blessing in completing this thesis.First and foremost, I would like to express my sincere gratitude to my supervisor En Hamzah Asyarani Bin Sulaiman, for his patience, motivation, enthusiasm, and immense knowledge whilst allowing me the room to work in my own way. I attribute the level of my degree to his encouragement and effort and without him this thesis, too, would not have been completed or written. I simply could not wish for a better or friendlier supervisor.

I want to thank my colleagues for helping with the discussions, for the sleepless nights we were working together before deadlines, and for all the fun we have had in the last four years. Not forgetting those indirectly contributed in this research, your kindness means a lot to me.

Last but not the least, I would like to thank Mr Mohd Noh Bin Hassan and Mrs Ramlah Bin Osman not forgetting my aunts Mrs Zaharan Binti Hassan Mrs Arbaiyah Binti Hassan, and Mrs Puziah Binti Hassan for their endless love, prayer, encouragement and financial support thank you very much.

ABSTRACT

As far as the conventional monitoring system are concerned, researchers having difficulties in acquiring data from a remote area with a limited accessibility. Wireless Technology development has helps in many ways in our daily routine and has been implemented in many ways such as in monitoring system. An example of wireless technology application is wireless monitoring using Zigbee network. In Zigbee network mesh network topology. In this topology routing environment every node have an alternative link to get to the destination point, this ensuring a smooth and uncongested network traffic. On top of that with its simple and low overhead routing implementation it improve the network efficiency and quality. Wireless monitoring system can helps in remote monitoring and enable researchers in acquiring data in inaccessible area. This project highlight in the wireless data transferring and displaying the data in user computer with aid of a user friendly Graphical User Interface (GUI), the Graphical User Interface (GUI) was designed using Visual Studio Basic 2010. The project can be upgraded to cover a wider area with the usage of nodes included in the mesh topology network this enable user to monitor wider area.

ABSTRACT.

Dari aspek pemantauan, penyelidik mengalami permasalahan dalam memperolehi data dari sesuatu kawasan dimana ada ketikanya data perlu dikumpulkan dalam tempoh masa yang lama dan memerlukan seseorang penyelidik itu untuk berada disuatu kawasan untuk tempoh masa yang lama. Melalui penggunaan technologi canggih masa kini iaitu teknologi perhubungan secara wayarles, masalah yang timbul dapat diatasi. Dengan mengaplikasikan teknologi secara wayarles, pengawasan dari jauh atau automatik dapat diimplementasikan. Projek ini member focus kepada penghantaran data secara tanpa wayar dimana data dapat dihantar kepada pengguna melalui rangkaian wayarles iaitu rangkaian Zigbee. Rangkaian ini menggunakan konsep jaringan yang mempunyai kelebihan dari segi laluan yang lebih mudah. Dengan penggunaan laluan yang lebih mudah, kesesakkan dalam rangkaian dapat dikurangkan disamping menambah kualiti dan meningkatkan kecekapan penghantaran data. Kelebihan system ini dapat digunakan untuk membantu penyelidik dalam memantau sesuatu kawasan secara langsung tanpa perlu berada dikawasan tersebut dimana data akan dihantar kepada pengguna dan dipaparkan melalui paparan grafik. Penggunaan paparan grafik interaktif(‘GUI’) juga membantu pengguna mengawal peranti computer dengan lebih mudah.Bagi kerja kerja masa hadapan, projek ini boleh dinaiktaraf dimana ia dapat meliputi kawasan yang lebih luas dalam mengaplikasikan penggunaan node yang terdapat di dalam rangkaian Zigbee.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX

CHAPTER I

INTRODUCTION

1.1 Introduction

Vigorous research has been done by researchers to create efficient yet reliable monitoring devices that can automatically record data and can transfer it to user in remote area. The MINI WATER BUOY is a device that collects data that can determine the quality level of water. This project highlights the development of data transferring wirelessly using Xbee that will be used to transfer data to the user that is collected by the buoy. The data will be collected by the sensory data that is located in the device and later will be sent to user wirelessly via Xbee.

Nowadays pioneers have come up with many large-scale weather data collectors many of them are huge in size and require large vessels to deploy it. It is good to be deployed in the vast sea area but it is not suitable for small-scale area application such as rivers or lakes. The MINI WATER BUOY project is chosen to overcome this problem. The MINI WATER BUOY uses similar sensors such as temperature sensors and pH sensor and in addition, it will use Xbee as its medium on sending the collected data to the users. Users can deploy the buoy easily and can be deploy anywhere due to its small size. This is a major advantage for data acquisition in small areas or for agricultures, purposes cage fish farm for example.

In this project, the user can deploy the buoy in the desirable area with a range of 100 meters and still can take measurements. The buoy will collect data when the users initiate the data measurement. This command will be done wirelessly via Xbee. The signal will be received by another circuit which where another Xbee will be implemented. The sensors will start measuring and will send the measured data to user laptop wirelessly.

1.2 Problem statement

Keeping our water resources so that it in good condition is very vital, our water resources are prone to pollution especially from the industrial activities. It is indeed a challenge in the enforcement aspect as it is impossible for the authorities to continuously monitor the location of water resources due to limitation especially in man power, facilities and cost of equipment. For that, it is important to have such a monitoring system with characteristics of small in size, autonomous, lower cost, reliable and flexible. The use of automation in monitoring task will reduce the reliance on man power at the monitoring site thus reducing the cost. This project focuses on the use of wireless data transferring method to transfer data and the usage of multiple sensors as a device to check the level of water quality as an alternative method of monitoring the condition of the water resources.

Several sensors that are able to continuously read some parameters that indicate the water quality level such as pH level and temperature will be used to monitor the overall quality level. The monitoring is intended to be carried out in a remote area with limited access. The recorded data from the sensor unit will then be transmitted wirelessly to users via XBee. A currently becoming popular and widely used technology based on wireless connection was extensively used in this project as it is able to provide flexibility, low cost implementation and reliability.

A high power transmission with a relatively low power consumption Zigbee based wireless sensor network technology is applied in this work. Zigbee is a communication standard for use in the wireless sensor network defined by the Zigbee Alliance [1] that adopting the IEEE 802.15.4 standard for its reliable communication.

It is chosen due to its features that which is low cost, easy to use, minimal power consumption and reliable data communication between two XBee. The development of graphical user interface (GUI) for the monitoring purpose via visual basic at the monitoring station or user laptop is another main component in the project. The GUI should be able to display the parameters that are being monitored continuously in real time.

1.3 Objectives

The objectives of this project are as follows:

i. To apply the concept of wireless data transferring via XBbee.
ii. To design a friendly user Graphical User Interface (GUI) to display the received data from the transmitting XBee.
iii. To construct a circuit that can wirelessly transmit data to users.

1.4 Scope of Work

The scope of this project will focus on the following areas:

i. The collected data are transferred wirelessly via ZigBee system. Zigbee network are using mesh network topology with simpler routing solution. This is very suitable, as the data can be collected at several points in the target area and can be transferred efficiently to the user.

ii. Sensors selection, there are various factors that affect the quality of the water, the selection of sensors are determined by the most suitable, small in size, affordable and easy to maintained. A simple selection sensors that can determine the water quality is the pH sensors and the temperature sensor[1][2].

iii. The output or the collected data area available to be observed in Graphical User Interface made using the visual basic software in the users laptop as they are user friendly and simple to implement.

1.5 Thesis structure

This thesis is a combination of 5 chapters consists of the introduction, literature review, methodology, results, and discussion and the last chapter is conclusion and recommendation for the project.

Chapter 1 is an introduction to the project. It explains the background, objectives and the concept. In addition, the overall view of the project will also be discussed in this chapter.

Chapter 2 focuses on the literature review and the project flow for the development of the Mini Water Buoy which the data will be transferred wirelessly.

Chapter 3 will explain the project methodologies. It discusses project activities such as workflow, procedure, block diagrams and methods used in order to develop this project.

Chapter 4 will define the final result of the project starting from designing until the implementation of the system. It discusses all the results obtained, problems, faced, inspection, and troubleshooting and the solutions.

Chapter 5 discusses the conclusion and recommendations for the project. The project was successfully designed and proven with the expected result. This system can be retested to be improvised with certain recommendation to ensure the system runs more efficient and reliable.

CHAPTER II

LITERATURE REVIEW

In this chapter, it will discuss about the literature review which contains information gathered to gain knowledge and ideas in completing the project. There are several sources that have been taken as a resource such as books, thesis, journal and website. It is included the operation of the circuit, the hardware and software which is useful in the project.

2.1 Project overview

Many projects have been proposed to facilitate human life. Although the literature covers a wide variety of such theories, this literature review explores the five dominant themes of the research: suitable water quality sensors, XBEE module connection, and Graphical User Interface development, the scope of this literature review is expanded to include research that examines the connection between XBEE module and the microcontroller, propose of the project and the interface to users.

2.2 Water quality maintenance

Water plays an enormous role in every living creature in earth. It provides foods water, and human and animal alike. For human water is basically is our needs in fact, 90% of human body are made of water [1], we need water to drink and carries our daily routines, water provides us with food; valuable source of protein which is fish. In agricultural point of view, water plays major roles in sustaining the crops to grow healthy and fresh. Water occupies 70% of the surface of the world, which mean nearly 70% of all the surface in the world are covered in water [2]. Therefore many living creatures such as fishes are living in water, water is their habitat. Being the most valuable and most precious source to man and animal alike it must be protected and natured to ensure the balance of the ecosystem.

By the latest observation many of our water source including fresh water are polluted by humans activities, this including toxic, hazardous wastes, and domestic waste as stated in[3]. Clearly the price of rapid development is high especially on the fresh water aspect, as describe in [4] therefore action must be taken in order to minimize these effects and keep the balance of the ecosystem. With the development of today technology, we can monitor the quality of our precious water sources, a wireless network monitoring system can be used to monitor it as describe in [5]. By this, a wireless network monitoring system was chosen to be implemented in the Mini Water Buoy project.

2.3 Zigbee technology

Since Zigbee is a mesh networking technology it is important to firstly understand what thats mean. Slight contras in Zigbee mesh network such as might be found in Zigbee deployment with the star deployment network topology which can be found in Wifi network or in the Bluetooth network[00], is that in the star network all the traffic funnels into a central point like an access point, while this provide a simple and low overhead routing implementation, it also makes the central nodes a bottle necks and prone to traffic and node failure. Devices are limited in their ability to communicate with other devices in the network even though the devices are maybe located right next to each other physically[7].

On the other hand, on the mesh network topology diagram each points in the network acts as the relay points as the connection outwards to the rest of the network. In this routing environment, no one should be in risk of failure or congested because each the nodes have the alternative link to get to the destination point. Unlike the wireless repeater that consist in the WIFI network, these intermediate nodes in the Zigbee mesh network can select the destination and sources themselves when it comes to application layer communication, maximizing their effectiveness and reducing the use of unnecessary devices[9].

By leveraging the mesh network topology, Zigbee network maximize effective communication range and reduce the cost of the total solution by eliminating unwanted repeater and access points and improve the reliability and robustness of the communication. Taking these advantages the Zigbee networking topology are the perfect candidates to be implemented in the development of the Mini Water Buoy project.

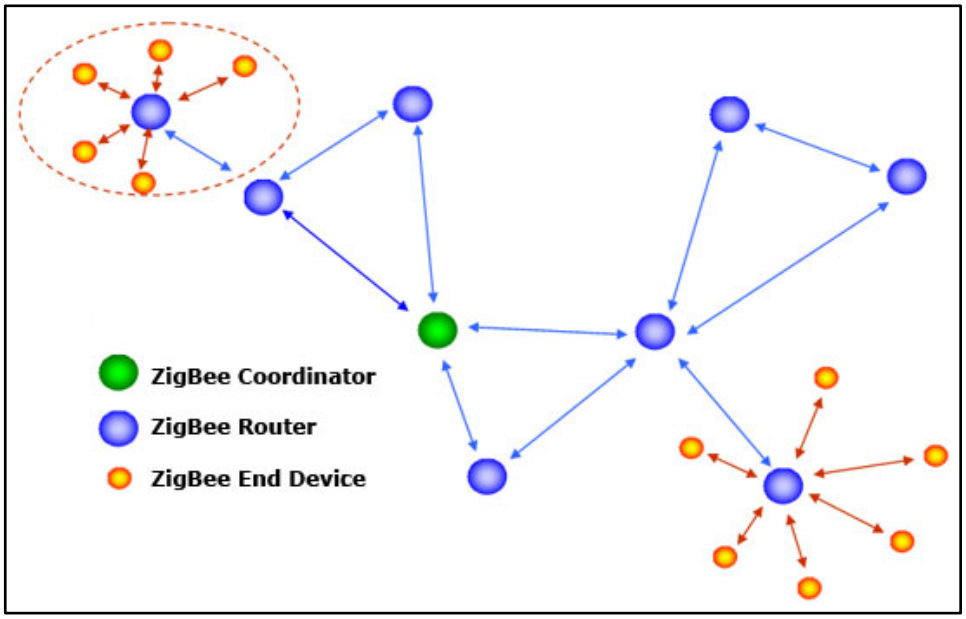

Figure 2.1:ZigBee Mesh Network Topology.

2.4 Zigbee remote monitoring system

Based on the paper [8] it describe an intelligent remote monitor system based on ZigBee sensor networks indoor uses. The system consists of two three types of ZigBee modules and server module. The types of ZigBee modules are First-Cluster node, Second-Cluster node and sensor end-node. The system can control a remote room based on the connection of the ZigBee protocols and conventional Internet networks. The data was collected by the end-nodes in the room and were transmitted through ZigBee networks to the server that can communicate with the remote monitor PC with an Internet connection.

By monitoring the room remotely, the system reduces the total energy consumption and the number of management staff, at the same time, provides reliable, and robust monitoring with the capability to control the equipments in real-time. Therefore, it ensures the safety and operation for the specified room. Based on this paper[12] it is clear that using Zigbee network protocol a set of data can be wirelessly transferred, thus by implementing the idea of it, the system was chosen to be used in the Mini Water Buoy project.

2.5 Zigbee protocols

Zigbee is a protocol that implements the physical radio frequency, which also uses and complies with the IEE 802.15.4 made by the Institute for Electrical and Electronics Engineers (IEEE) as its networking foundation. A 802.15.4 devices operates is an unlicensed bands such as and widely used 2.4GHz, 900MHz, and 868MHz. Zigbee basically defines three different device function, such as coordinator, router, and end devices.

An end device has its own properties for example, an end device must join a Zigbee personal area network (PAN) before can transmit or received data. It also can't allow devices to join its personal network and must continuously transmit and received radio frequency data and cannot route data. Due to its continuously transmitting and receiving data an end device can enter a low power modes in order to reduce the power used and conserved it, in addition they also can be powered by battery.

Next up is the router, same as the end device a router must firstly joined a ZigBee personal area network (PAN) before it can operates. After successfully join the PAN , it will allows its sibling device such as end device to join its network. Unlike an end device, a router can helps in routing data throughout the ZigBee network. It also must continuously transmit data.

Lastly the coordinator, basically it has the same characteristic as the router but with a slight difference. A coordinator is the one who selects a channel and personal area network ID to start the network and enable others to connect to the network. The channel are in both 64-bit and 16bit and if ZigBee network needs to be connected with multiple ZigBee within their range, each nodes must have a unique personal area network ID (PAN)[00].