CHAPTER I

INTRODUCTION

1.1. Background

Water, as a primary of human needs takes an urgent role to support everyday activities. Water has an important parameter to measure its quality, that is turbdity. The turbidity of water is caused by suspended solid particles comes either from organic or anorganic subtances. Turbid water has long been correlated to various dangerous diseases such as dysentry, cholera, and many more. In indonesia many institutions that conducting water processing such as PDAM always take a great care in measuring water turbidity levels. To make water turbidity measurement more convenient and easier, the system which could monitor the water turbidity levels remotely, continously and sotore its measurement results in a database is needed. The Wireless Sensor Network (WSN) system could make that possible. The water turbidity sensors could also be made by a simple electronics circuitry and relatively cheap component price so the tools to measure water turbidity (turbidimeter) could be made cheaper than the available commercial turbidimeters which cost more than Rp5.000.000,00 (U.S. $ 600) in the market.

WSN is already implemented pervasively in many sectors to measure various physical paarmeters such as voltages, temperatures, vibrations, and many more parameters because of its robustness and easiness to implement the network installation. Furthermore, the power needed to run WSN is relatively small so it will bring to an efficient, effective power-use electronics system. WSN with XBee Radio Frequency (RF) modules that implement IEEE 802.15.4 protocol will be used as a transciever that could send and receive a stream of data packet which contain sensors reading output and its RSSI values and display it at a monitoring center using Laptop through Graphical User Interface (GUI) designed Bay the help of Visual Basic Program. Sensors which could measure the water turbidity levels are made of Phototransistors as photodetector and Infrared Light Emitting Diode (LED) as the source of light.

This final project is expected to be able to create WSN system with sensors which coud measure water turbidity levels with good performance and relatively low cost compared to the available commercial turbidimeter . Besides that, it is expected that the optical phenomena which cause the water or any liquid to become turbid is explained in a satisfactory way.

1.2. Problem Statement

The problems which are discussed in this final project include :

1. How to design and implement WSN system by using RF XBee modules and phototransistor-based sensors to perform water turbidity monitoring ?
2. How to decide, design and implement sensor modules so it could measure water turbidity levels ?
3. How to design experiment scenarios to measure the water turbidity level ?
4. How to wirelessly communicate data from sensors with its RSSI value to the monitor station so it could be perceived in a GUI form and stored in a database ?
5. How to qualitatively explain optical phenomena that caused water or any liquid to become turbid ?

1.3. Purpose

The purposes of this final project are :

1. To design WSN system by using XBee RF modules and photoransistor-based sensors to detect water turbidity and represent it in monitoring base in graphical interpretation and save the sensors readings in database so that it could be taken anytime.
2. To analyze the performance of created turbidimeters.
3. To analyze the created WSN system by conducting measurement in various distances and in two different indoor environment conditions.

1.4. Scope of Problems

There are some restrictions to this final project :

1. WSN system is implemented by using RF XBee modules model XB24-AWI-001 with wire antennas.
2. This final project does not discuss about network security systems and only briefly explains the power usage of WSN system.

3. WSN system uses star topology and single hop communication based on IEEE 802.15.4 communication protocol.
4. WSN system uses two RF XBee modules. One acts as a node coordinator and two act as node sensors.
5. There are two experiments that will be performed to measure WSN performance, experiment in the semi confined and confined indoor environment.
6. Solution from liquid soap and water mixture is used to made standard turbidity solution.
7. Monitoring system is created by Visual Basic 2010 and a laptop with specification of : Windows 7 Professional Operating System, intel Core i5 processor and 4 GB of RAMs.

1.5. Research Methodology

1. Literature study

   In this phase, literature based study will be conducted to support research experimentations and to explain the data that resulted from it.

2. System and design analysis

   Design and analysis to the system will be performed to set suitable WSN system specifications.

3. Implementation

   After specifications are already at set, the implementation process is on the way to implement the design which is made before.

4. System testing through experiments

   The realization of design will be tested by experiments in order to determine overall WSN system performance.

5. Analysis

   The analysis is conducted to confirm whether the designed system follows every theory explained in literatures and able to measure water turbdity reliably.

6. Report Making

   In this final phase, every data regarding this research will be summarized in one book so that it could become a reference for people who interested in WSN system.

1.6. Writing Systematics

This final project book comprises of several chapters that assembled in this way :

Chapter I INTRODUCTION

This chapter explains background, problem statement, purpose, scope of problem, research methodology, writing systematics, and plan of scheduling.

Chapter II THEORY

This chapter explains theories that are made as a foundation to support research literature and to explain experiments outcome.

Chapter III SYSTEM DESIGN AND IMPLEMENTATION

This chapter explains WSN system design and implementation.

Chapter IV EXPERIMENT RESULTS AND ANALYSIS

This chapter explains experiment results.

Chapter V SUMMARIES AND FURTHER RECOMMENDATION

This final chapter explains the summary of research and further recommendation to improve WSN system performance in the future.