ABSTRACT

Turbidity as an important parameter to determine the quality of water holds important role for every living creature and therefore worth to be measured. The unit to measure turbidity is called Nephelometer Turbidity Unit (NTU). The higher NTU, the more turbid the body water becomes and therefore affects the water quality. Turbidimeters are commonly used to measure various liquid turbidity with high accuracy but come in a high price (US$600). By the advance of technology, any sensors could be measured wirelessly from the distance by using Wireless Sensor Network (WSN).

This final project aims to build a relatively low-cost turbidimeters with a reasonable accuracy that come with additional WSN feature. The constructed WSN system for measuring water turbidity consisted of two turbidimeters at its end nodes created from IR LED and phototransistors and one coordinator node at the base station. The RF XBee modules are used as devices to transmit and receive data wirelessly. A custom XBee library is used to define data packets frame format and data packetization-assembling mechanism. A monitoring program in GUI form is located at coordinator node to measure the levels of water turbidity remotely.

The constructed turbidimeter in end node has a measuring range of 0-1289.3 NTU for end node A and 0-1415.7 NTU for end node B.The smallest error variation occurs in range of 119 – 350 NTU for both turbidimeters while the errors could as high as 700% in low NTU range measurement (0-100 NTU). This indicates that the configuration of turbidimeter is not suitable for low NTU measurement (below 100 NTU). The average error percentage for turbidimeter within range of 119 – 350 NTU for end node A is 3.56% while in node B is 5.9%. The difference of NTU measuring range in each end node is caused by different path distance travelled by IR lights therefore affects the intensity value preceived by both sensors. The intensity relationship between node A and node B can be stated as $I_B = e^{(l'-l)} I_A$ where *l*' is the distance travelled by IR light in node B and *l* is the distance travelled by IR light in node A. The positioning of IR LED and phototransistor is significantly affect the readings and NTU measurement range. Larger intensity acquired in node B yields to more NTU range but also decreases its measurement accuracy significantly. The WSN performance in a semi confined space environment of 60x5x20 meter^3 yields a maximum range of 40 meters for both end nodes at RSSI value of -87 dBm for end node A and -86 dBm for end node B. In a confined space environment of 100x5x5 meter^3, a maximum range of 75 meters for both end nodes at -80 dBm of RSSI value is achieved. More confined space slightly increases the RF XBee range however the RSSI value will be more fluctuative due to radio wave interferences phenomena such as variation of distance travelled by radio signals and various multipath fading effects.

Keywords : WSN, RF XBee, phototransistor, turbidimeter, NTU