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Wireless Turbidity sensor node using PIC16F877A and X-bee

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Abstract:
The present paper gives the low cost potable module for to measure the turbidity of water. The system consists of PIC16F877A, turbidity module and X-Bee S1. The sensor node can detect the turbidity between 130 NTU to 800 NTU. The tool dock-light is used for the coordinator node to PC communication.

Keywords: PIC16F877A, turbidity, X-Bee, docklight, water quality

1. Introduction

Due to increase in human population there is stress on land and water sources to fulfill the requirement, this leads the turbidity levels in water[1]. The turbidity is define as the cloudiness or haziness caused by suspended particles in water it may be organic or inorganic undissolved matter, it is measured in nephelometric turbidity units (NTU) [1-3]. Turbidity is important parameter for water quality monitoring high turbidity cause negative effect on ecosystem so monitoring turbidity is important for drinking water, irrigation water and fish farming. Table 1 showing safest turbidity level in NTU for different water samples[4].

The objectives of systems are given below :

- To design wireless turbidity monitoring system.
- To measure the turbidity level using sensor at remote place.
- To transmit turbidity data from remote place to the receiver section using X-bee S1 module .
- To display the real time data on PC using Dock-light.

Table 1. Turbidity level in NTU for different water

Turbidity Level (NTU)	Water Quality Index
0.1	Safe and Pure Water For Drinking
0.2 to 1.0	Drinkable Water
1.1 to 1500	Impure and Non-Drinkable Water

Raut et al.[4] developed a wireless system for water quality monitoring, system uses PIC 18F4550 , Zigbee and different sensors (pH, turbidity and temperature sensor). Sensor node sense the data pH, turbidity and temperature of water and sends to co-ordinator node using Zigbee and displayed on LCD as well as on PC[4]. Khetre et al[5]. developed a wireless system for water quality monitoring , system uses ARM 7, Zigbee and different sensors (turbidity, water level, salinity and temperature sensor). Sensor node sense the data salinity, turbidity, water level and temperature of water and sends to co-ordinator node using Zigbee and displayed on LCD as well as on PC using VB based GUI. Vijayakumar et al.[6] developed a wireless system for water quality monitoring , system uses Raspberry Pi and different sensors (turbidity, conductivity, pH, DO and temperature sensor). Finally, the sensor data can be viewed on internet using cloud computing. Chung et al[7]. developed a wireless system for water quality monitoring , system uses Atmega 128, IEE 802.15.4 and different sensors (turbidity, depth of water, conductivity, DO, pH and temperature sensor). Sensor node sense the data and sends to co-ordinator node using IEE 802.15.4 and displayed on PC. Yue et al.[8] developed a wireless system for water quality monitoring, system uses SunSPOT nodes, IEE 802.15.4 and different sensors (turbidity, pH and oxygen density sensor). Sensor node sense the data and sends to coordinator node using IEE 802.15.4 and displayed on PC using GUI. Lambrou et al.[9] developed a wireless system for water quality monitoring, system uses PIC32, Zigbee and different sensors (turbidity, pH, ORP, temperature and electrical conductivity sensor). Sensor node sense the data and sends to co-ordinator node using Zigbee and displayed on PC using Pachube open source web platform GUI. D.He et al.[10] developed a wireless system for

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water quality monitoring , system uses CC2430, Zigbee and different sensors (turbidity, pH and temperature). Sensor node sense the data and sends to coordinator node with GPRS DTU. Rasin et al[11]. developed a wireless system for water quality monitoring, system uses 8051 microcontroller, CC2430, Zigbee and different sensors (turbidity, pH and temperature). Sensor node sense the data and sends to PC displayed using C++ based GUI. Nasirudin et al[12]. developed a wireless system for water quality monitoring, system uses PIC16F886, IEEE 802.15.4 and different sensors (turbidity, pH, DO and temperature). Sensor node sense the data and sends via GSM network and displayed on LCD[12].

1. System Architecture:

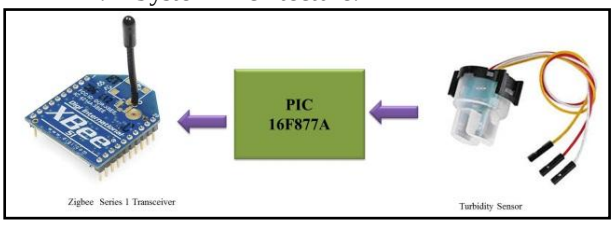

Fig.1

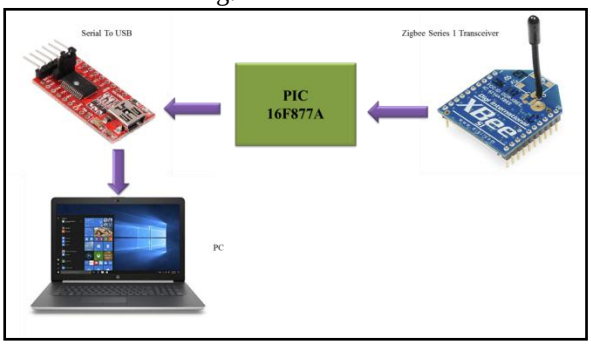

Fig. 2

System Architecture is consists of wireless sensor node based on PIC 18F877A, turbidity module and Xbee-S1 series module is used as the wireless communication protocol as shown in Fig. 1. The turbidity parameter is used for the decide water quality , another PIC16F877A is at receiver side act as coordinator node, which displays the turbidity readings received for sensor node as shown in Fig.2.

2.1 Sensor Node

The wireless sensor node in this work is consisting of PIC16F877A microcontroller. The key role is to convert analog data form turbidity sensor to digital data, calibrate it and send to coordinator node.

2.2 Coordinator Node

Data received from the end device nodes is sent to the computer using the RS 232 protocol and data received is displayed using the built GUI on the base monitoring station. The GUI platform was successfully developed using docklight tool that able to interact with the hardware (coordinator) at the base station.

2.3 Turbidity sensor

Turbidity indicates the concentration of suspended and colloidal material in water and it is measured in nephelometric turbidity units (NTU). Drinking water should have turbidity that is less than 1 NTU table1 shows turbidity level in NTU for different water samples. The SEN0189 module is used as the turbidity sensor. The SEN0189 module measures the turbidity (amount of suspended particles) of the water in river, lakes etc. It has operating voltage of 5V and operating current of 40mA. It has analog output from 0 to 4.5V with the response time less than 500mS. Also it has operating temperature range from 5 to 90 degree Celsius.

Fig.3

3 Simulation results

Fig. 4 shows the muddy water having turbidity 503.85 , which ultimately Impure and Non-Drinkable Water. Fig. 5 shows the turbidity 134.82, which is drinkable water.

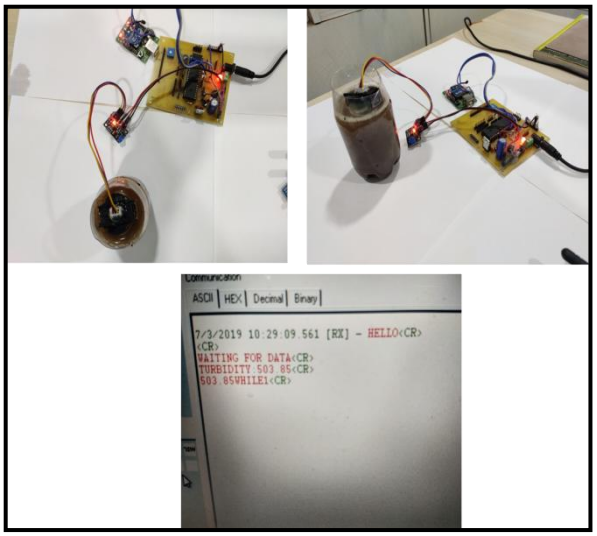

Fig. 4

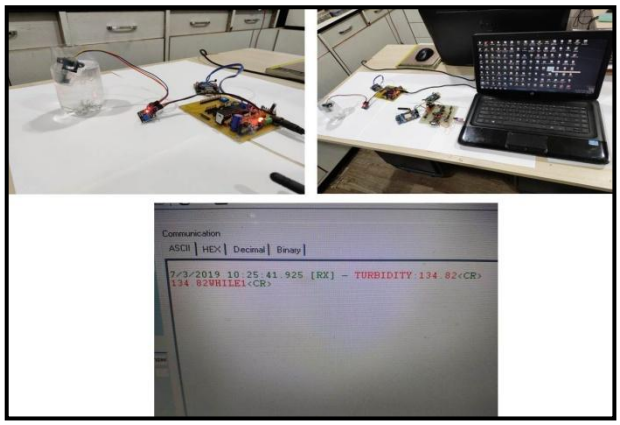

Fig. 5

5. Conclusions

The developed sensor node can differentiate between the polluted and drinkable water , the range of turbidity sensor is 130 to 800 NTU The sensor node successfully send the turbidity data to coordinator node, which successfully communicated to PC using dock-light tool.

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