Water Quality Monitoring System

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Background

Wireless communication developments are creating new sensor capabilities. The current developments in the field of sensor networks are critical for environmental applications. Internet of Things (IoT) [1-3] allows connections among various devices with the ability to exchange and gather data. IoT also extends its capability to environmental issues in addition to automation industry. As water is one of the basic needs of human survival, it is required to incorporate some mechanism to monitor water quality from time to time. Around 40% of deaths are caused due to contaminated water in the world. Hence, there is a necessity to ensure supply of purified drinking water for the people both in cities and villages. Water Quality Monitoring System (WQMS) is a cost-effective and efficient system designed to monitor drinking water quality which makes use of Internet of Things (IoT) technology.

Implementation

Our proposed system, below in Figure 1, uses four sensors for data collection which are turbidity, pH, temperature, dissolved oxygen. The system also uses a microcontroller unit as the main processing module which allows for communication to the The Things Network (TTN) server we are using. The microcontroller unit is a significant part of the system development for water quality measurement because the TTN uno consumes low power, and it is small in size, where the size is a good use for a crucial point of sale technology standard. The four sensors collect data in analog signals, but can also convert to digital since all four have an ADC chip.

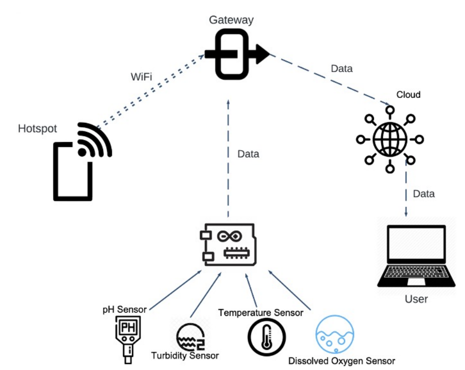

Figure 1: System Overview

Experiment Results

The water quality sensors have been tested and integrated to the microcontroller unit of our WQMS and are able to collect readings. The temperature sensor has an accuracy of ±0.7degrees Celsius, the pH sensor has an accuracy of ±0.19 pH, and the turbidity sensor has an accuracy of ±28.8 NTU below 25 NTU.

The temperature and pH sensors were both shown to be accurate and displayed the data as expected, shown below in Figure 2 & 3. While the turbidity sensor displayed data that was quite inaccurate as shown below in Figure 4. Therefore, the temperature and pH sensors performed well as opposed to the turbidity sensor.

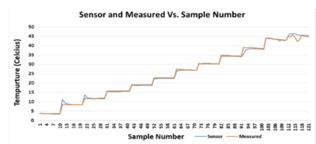

Figure 2: Temperature Sensor

Figure 3: pH Sensor

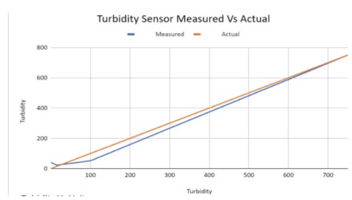

Figure 4: Turbidity Sensor

The data gathered from each sensor gets uploaded to a webpage, shown below in Figure 5, that makes it publicly accessible to view our real-time water quality data. Our webpage contains a map, in order to identify where the readings have been collected from, and data graphs for the collected readings of temperature, dissolved oxygen and turbidity. The data can be observed at different time ranges which is convenient for the user to notice any trends in the water quality data.

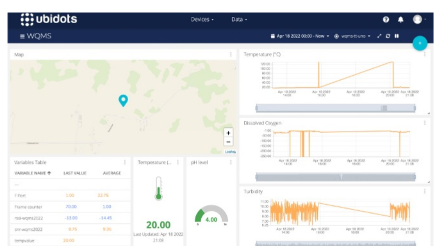

Figure 5: Webpage displaying acquired data from WQMS

Previous Works

There have been water quality monitoring systems created in order to gather real-time data and display it on a website in order for companies and other users to access this real time data. One previous work is one based out in Kansas called the RTWQ conducted by the US Geological survey office [4]. Real-time water quality gathers water quality data from local streams that is able to be made available on the web in real time. This continuous water stream data is made available on the web near real-time, meaning the information uploaded to the website is updated every 4 hours or less. It is possible to collect real time water quality data because of the types of sensors this project used. It is able to directly measure concentrations of various water quality factors. This project is able to gather information on the water conductance, pH, temperature, turbidity, dissolved oxygen, and possible nitrate. This project uses stream chemical analyzers and portable field laboratories for nitrate and phosphorus.

Another form of previous work is a handheld portable water quality data logger developed by Global Water.This Water Quality Monitoring system includes a multichannel data logger and has four water quality sensors. These sensors are used to collect information on temperature, pH, dissolved oxygen, and turbidity. There is software provided in order to have real time data readout, sensor calibration and allows for simple data collection that could be downloaded and opened in any PC spreadsheet program for further analysis [5.] This system also has the ability to add remote communications to this device.

Conclusion

We were able to successfully collect water quality data from our WQMS and upload that same data to a webpage allowing public access for users to observe that data in real-time.

Future Work

Improvements to our WQMS can be made by adding more water quality parameters to monitor such as: dissolved oxygen, nitrate chemicals, and bioindicators. As well as using sensors with higher accuracy to provide better water quality readings.

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