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Real Time River Water Quality Monitoring Based on IoT

Akash Jadhav[1], Akash Pathak[2], Ajay Suryawanshi[3], Rishikesh Avhad[4]
[1,2,3,4]*Student, Department of Information Technology, Zeal College of Engineering and Research, Pune, India*

***Abstract*—To continuously monitored several water quality parameters through IOT environment that will help to control pollution of water due to sewage through illegal drainage pipelines.**

***Index Terms*— Turbidity sensor, TDS sensor, pH sensor, Water Flow sensor, GSM module, Arduino Microcontroller, Mula-Mutha, ThingSpeak.**

I. Introduction

Water is the most important and essential resources for living things, industry, agriculture. Polluted water leads to the several diseases and may leads to death. Traditional water testing technique includes, take water sample and then send it to the laboratory and wait for reports. This method is time consuming and not economical [1]. In today's polluting Mula-Mutha there is need for reducing pollution in river by continuous monitoring water quality. Therefore water quality parameters such as Turbidity, TDS (Total Dissolved Solids), pH, flow of water should be monitored in real time. There are 320 polluted rivers in India, 49 are in Maharashtra. Mula-Mutha is one of the polluted river in the country. River Mutha which is also called as 'Muthai' or Mother Mutha is dying slow death. The growing illegal activities have left these water bodies in vulnerable state. Due to lack of planning the river face growing levels of pollutants and rapid degradation, creating unhygienic conditions. The primary reason of Mula-Mutha pollution is sewage from illegal drainage pipelines. Due to lack of sewage treatment plants sewage is thrown directly into the river without processing it. Therefore, there is need for continuous monitoring of water quality parameters in real time. Arduino collects sensor's captured information, processed it and send that information through GSM module. So that real time information can be access remotely from all over world.

II. Literature Survey

In [Real-Time water Quality Monitoring System using Internet of Things 2017] the ZigBee module transfer data collected by sensors to the microcontroller wirelessly, and a GSM module transfer the data further from the microcontroller to the smart phone/PC. In this system only pH sensor, EC (Electrical Conductivity) sensor, Temperature sensor are used. In [Implementation of Wireless Sensor Network for Real Time Overhead Tank Quality Monitoring 2017] implementation of Wireless Sensor Network (WSN) is presented. WSN composed of number of sensors nodes with networking capability which are deployed at different overhead tanks. Each sensor node consist of an Arduino microcontroller, Xbee module and water quality sensor. In this system pH, Temperature, Electrical Conductivity (EC) sensors are used.

III. System Architecture

This system is consist different sensors such as Turbidity, TDS (Total Dissolved Solids), pH, Water Flow Sensor to monitor different water quality parameters. That data is send to Arduino, then it collects that data processed it. After that all data is send to cloud database through GSM module. As a result of this all these data can be accessed using Smart Phone/PC using internet.

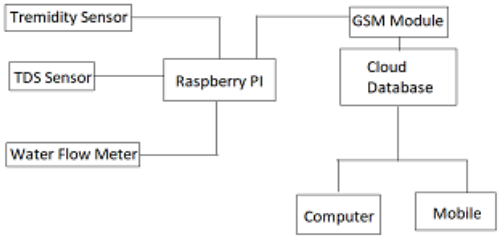

Fig. 1. System Architecture

A. Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.


Fig. 2. Arduino

B. Turbidity Sensor

Turbidity sensors measure the amount of light that is scattered by the suspended solids in water. As the amount of total suspended solids (TSS) in water increases, the water's turbidity level (and cloudiness or haziness) increases. Turbidity sensors are used in river and stream gaging, wastewater and effluent measurements, control instrumentation for settling ponds, sediment transport research, and laboratory measurements.

Fig. 3. Turbidity sensor

C. TDS Sensor

It is used for measuring TDS value of water, to reflect the cleanness of water. TDS (Total Dissolved Solids) indicated that how many milligrams of soluble solids dissolved in water. Therefore, TDS value can be used as one of the references for reflecting the cleanliness of water.

D. P^H Sensor

It is used to determine the value of pH based on pH scale. It shows how water acidic is. pH stands for "power of hydrogen". pH scales from 0 to 14 where, level 0 – 6 is considered as acidic. Level 7 is considered as natural. Level 8-14 is considered as drinkable water.

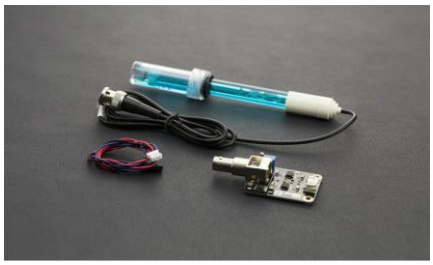

Fig. 3. P^H sensor

Fig. 4. Speed of water flow

E. Water Flow

It is used to determine the speed of water flow. Based on the speed of water flow we can predict the probable amount of waste in water.

IV. Internet of Things (IoT)

The Internet of things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators and connectivity which enables these things to connect, collect and exchange data. Internet of Things (IoT) is defined as the network of physical objects/things - devices, vehicles, buildings embedded with sensor, microcontroller, and network connectivity that enables these objects to collect and exchange data. The IoT can be described as a huge web of embedded objects designed with built-in wireless technologies such that they can be monitored, controlled and linked within the existing Internet infrastructure. Each device has a unique identification and must be able to capture real-time data autonomously [1].

A. Thing Speak

"ThingSpeak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates". ThingSpeak has integrated support from the numerical computing software MATLAB from MathWorks, allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Mathworks.

B. Working with Thing Speak

1) Getting started

1. Sign-up to create a new account in Thing Speak.
2. Create a new channel to store the data from sensors.
3. Thing Speak has a 'status update field' to send any additional information required on the page.
4. Give the field names: pH, Temp, conductivity, TDS.
5. If you check 'public', other people can access your data.
6. Click on 'Save channel'.
7. An API key is created. An application programming interface (API) key is a code passed in by computer programs calling an API to identify the calling program (its developer, or its user to the Web site).

2) Sending data to Thing Speak channel

1. Chrome Poster- a developer tool that allows us to interact with the http server.
2. Copy the URL provided in Poster.
3. Enter 'key=API key & pH=3.5' in the 'Content body'. This will put the data (3.5) into the pH field.
4. Click on 'Post'.
5. If everything is successful, Thing Speak API status will be '200 OK'.

6. We can keep adding any number of values. The status window shows the number of values.
7. Select 'View Charts' to create a chart out of the data sent to Thing Speak channel.
8. Through 'Embed code' given at the bottom of the window, we can give other people access to the channel.
9. Data importing from the sensors, and then exporting the data onto the channel, all takes place in real-time basis.

V. Five Methods to Run a Program

1. rc.local
2. bashrc
3. init.d.tab
4. systemd
5. crontab

VI. Results

Users can access sensors capture data using internet through phone/pc. Authorized users can used that data to analyze, verify that data with actual site and take strict action on illegal drainage pipelines based on analyzed data.

VII. Conclusion

Real Time, Continuous Monitoring System is implemented and tested at actual river site. Through this system Municipal Corporation officials can keep track of level of pollution and control the illegal activities of illegal drainage pipelines. It Result in reduction of river water pollution.

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