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Water Pollution Monitoring using IOT

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Abstract: ***Activities performed by humans is one of the major reasons for the increase in pollution. This increase in the pollution of earth unfairly influenced the water bodies that is a need for eternity. Asia has the most number of contaminated water bodies which is mainly composed of Bacteria through Human waste. Even if we side with treating water instead of prevention of pollution, identifying the extent to which the water body is contaminated is an essential problem that needs to be addressed. Factoring BOD and dissolved oxygen which are the prime causes of biological contamination of a water body is essential for a system monitoring water pollution. This paper addresses the issue of contamination magnitude through the use of IOT components. Monitoring and presenting data is the main scope of this system.***

Keywords **: Dissolved Oxygen, IOT,** ***Water Pollution.***

I. INTRODUCTION

One of the important elements required for the existence of life on planet earth is water. Without water, no form of life can sustain in this world. Water has a lot of uses. Any form of disease can be cured/prevented from occurring by regular intake of water. Water has so many advantages when it comes to preserving our body health. Like ways, it has also a lot of industrial uses. Another important use of water is, it helps in the process of photosynthesis. Photosynthesis of plants will enable them to produce oxygen which is the next very important element required for living on planet earth. Biochemical oxygen demand is the most broadly utilized parameter to gauge the natural contamination in sewage as well as surface water.

A. Measuring the Oxygen Demand using BOD

BOD essentially includes the estimation of dissolved oxygen (DO) used by the microorganisms for the biochemical oxidation of natural or organic matter. The interest for oxygen and the procedure of oxidation relies upon the sort and amount of organic matter present, temperature and type of life form existing in the area.[1]

BOD indicates the amount of organic matter present in the sewage. Thus, the more the organic content, the higher the BOD. If the available oxygen (dissolved O2) is less than the BOD, the organic matter decomposes an aerobically, deteriorates and produces fetid smell [1]. In other words, if the supply of oxygen (DO) in water is less than the demand for oxygen (BOD) then the equilibrium is broken which results in shortage of surplus organisms in the near future, given that the conditions of the water body stay the same. Thus, BOD is a measure of aggravation potential of sewage.

Table - 1 – BOD Values of different types of sewages.

Source of Sample	BOD Value(mean ± sampling error)
Anaerobic Pond Effluent	57.8 ± 22.2
Raw Sewage Effluent	130.0 ± 43.3
Aerated Pond Effluent	29.8 ± 12.0
Sedimentation Pond Effluent	30.0 ± 6.8

B. Measuring the Dissolved Oxygen using sensor probes

Finding the amount of oxygen that gets dissolved in water is quite a difficult task. This can be performed with the help of dissolved oxygen sensors and dissolved oxygen probes. Some of the components such as the atmospheric pressure between air and water interface, amount of other dissolved substances and the temperature of the water determines the amount of oxygen present in a given volume of water.

Dissolved Oxygen can be expressed in two ways. They are milligrams of oxygen per liter of water (mg/L) or parts per million (ppm). Dissolved oxygen sensors function via a thin organic membrane that covers an electrolyte and two metal electrodes.

Once the water starts entering into the device the process of diffusion of oxygen through the membrane becomes directly proportional to the partial pressure of the oxygen. Directly proportional means, increase in the partial pressure of oxygen would lead to an increase in the amount of oxygen that gets diffused through the membrane.

Once oxygen starts reducing at the cathode and the amount of dissolved oxygen increases, the meters of dissolved oxygen would begin measuring the current. Since the diffusion current is directly proportional to the amount of dissolved oxygen present, the sensors of dissolved oxygen sensor converts the measurement of current into concentration units [2].

The term “dissolved oxygen sensors” refers to the electrolyte Solutions, electrodes, membranes, and thermistor thermometers. Together they form an assembly of electrode sensors.

II. EXISTING SYSTEM

Analyzing the Pollution control papers which use IOT, The most popular choice of microcontroller is Raspberry Pi.

Besides choosing a complex microcontroller, the case study shows that liquid crystal displays are used to transmit the generated results. These choices raise a number of challenges in the system. One such challenge is that the system becomes volatile.

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Real-time transmission brings volatility in the system which can be avoided when a database is used to retain the results. Perusing resembling papers to the former, witness the use GSM module in subsequent proposals. Using a GSM module does not only bring complexity into the system and the maintenance of the system is tiresome and expensive but it causes interference to other electrical appliances nearby like hearing aids and cell phones. Some papers address this issue and install a Zigbee module. This system is cheap and easy to install and operate but it is not secure like a wifi based system. Another challenge that a lot of papers face is the choice of microcontroller. Raspberry Pi is not a microcontroller, it is a fully functioning computer. This means that the system needs an operating system that is compatible with RPi to control the processes. This brings redundant complexity into the system. We wrote a program to flicker an LED with Raspberry Pi, we introduced a working model and some code libraries. The LED light can be made to squint on arduino with the help of ten lines of code. Since Arduino isn't deliberate to run an OS or consists of complicated programming, you can simply connect it and begin. Even though RPi is 10 times faster in processing speed than an Arduino and has more memory storage compared it, it is just put to waste on this system because simple frameworks and a user friendly IDE is more than enough for this system that this paper addresses.

III. PROPOSED SYSTEM

The Crucial part of this paper is to use IOT devices such as Arduino Microcontrollers and use them to inspect sewage water to measure the dissolved oxygen content and other parameters that contribute to water treatability.

The Input from the sensors is accumulated in the microcontroller. The Microcontroller follows the code instructions ,which is uploaded using Arduino IDE, and stores the input data into a Web Server hosted by the Arduino using an Ethernet Shield.

A. Arduino as a Web Server

The main text editing program used for Arduino programming is Arduino Integrated Development Environment (IDE) is. Here, you can type the code first. Once the code is typed, it can be uploaded to the arduino board. The sketches are generally used to refer to Arduino code.

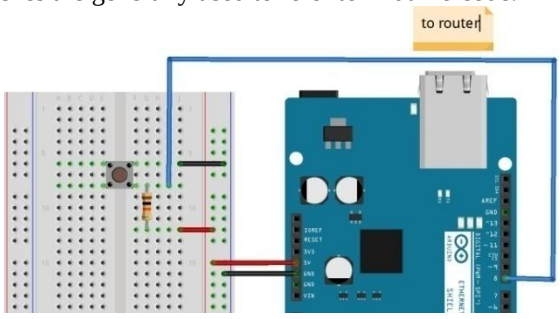

Fig 2 – Ethernet Shield connected to Arduino

An Ethernet shield can be converted into a simple web server by supplying an Arduino. One can run the server on any computer that is connected to the same network with the help of a browser.The Ethernet shield need to be connected to router using an Ethernet cable. Ethernet's library can be utilized to run the Ethernet shield.

The Ethernet begin () function can be used to assign MAC address to the shield. For each and every device, the MAC address is unique. No two devices would have the same MAC address. Current Ethernet shields come with a label indicating the MAC address. The IP addresses can be approved according to the layout of one's network. DHCP is used to dynamically assign an IP address to the shield.[3]

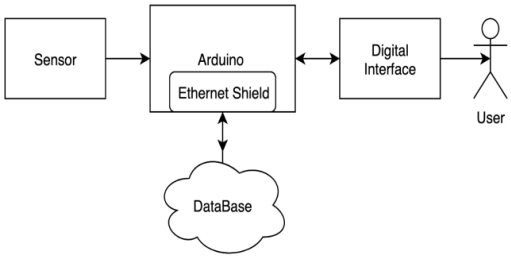

Fig 3 – Block Diagram for proposed system

IV. PROCEDURE

First, the source of the water 0sample and its associated BOD value (which is stored in the Web Server) is required. Then, Probing of the sample is done with the Dissolved oxygen sensor and the pH sensor probe (which has LDR and Temperature sensor in it) to collect data of the sample.

The Sensors measures the DO content in the sample, Temperature of the Sample, pH content present, Turbidity of the Sample(Calculated from the level of distortion in light compared to normal light in the room using LDR) and sends it to the Arduino Microcontroller. Arduino IDE uploads the source code containing the instructions to respond to the input data from the sensors and uploading it to a Web Server using the Ethernet Shield which is also connected to the Arduino. The Ethernet Shield hosts a Web server with a database retaining all the sensor input and analyses the sensor input with some preliminary values(BOD) and standard values of ideal samples, which exist in the database prematurely. The Results of the Sample can be observed through a Browser, which is connected to the same network as the microcontroller, when the IP address assigned to the Arduino is accessed.

V. CHALLENGES AND LIMITATIONS

The System which is proposed in this system is simple and easy to install and operate but has several challenges and limitations. For instance, the Ethernet Shield is not a wireless connection so the system loses portability. Furthermore, the system is not fully secure. Turning the attention on the security and privacy issues opens up a plethora of inconsistencies to the system.[4] There is a need for encryption and proscription of data theft.

Addition of Firewalls and malware prevention can provide padding to the system from dangerous elements in the Internet. Providing remarks for the challenges that come from being exposed to the Internet is redundant.[5]

Considering the fact that this system is near water samples, the system is prone to water damage and short circuits from spatter. It is best to cover the system with a protective shield to prevent water damage.

VI. CONCLUSION

Water is an Important need for the survival of mankind.

There is no practical progress in limiting society with the use of water usage, which leaves the best option that is recycling of water. Reckless pollution and the extensive laboratory process of water testing diminishes the diminutive care towards treating water bodies. Addressing the latter issue by using user friendly IOT components and a neat web interface without the underlying complicated details of BOD values and DO content will surely encourage many people to use this system and improve on this field which is surely a promising lead for humanity. This paper addresses the issues that come with treating a polluted water, thereby helping a bit in the extensive process of treating this resource.

REFERENCES

1. Doug Hamilton - Organic Matter Content of Wastewater and Manure OCES - BAE 1750.
2. Weldan Kusuf - "Embedded Web Server using Arduino Ethernet Shield" SPE STA SMSCP 2013.
3. Navarajan, B. Aswin kumar, S.Venkatesh , T. Jayachandran - "Detection of Water Pollution and Water Management Using Smart Sensors with IOT" IRJET 2017.
4. Himadri Nath Saha, Supratim Auddy, Avimita Chatterjee - Pollution Control using Internet of Things (IoT)
5. A Jeyasekar, Siddharth Nanda, Annie Uthra. "Green SDN: Trends of Energy Conservation in Software Defined Network" , International Journal of Engineering & Technology, 2018

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