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Analysis and Metering of Industrial Waste Water in Lake With IoT Measures

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ABSTRACT

The industrials wastes generated from different operation performed by various industries are very much complex. All these different kinds of waste which is released effects the daily functioning of sewerage and sewage treatment plants. These daily functioning or sewerage treating plants can be taken care only when it is pre-treated at the source which is causing damage to this normal daily functioning. The wastes which are generated from the different industries contains the property such as acidity, suspended waste solids, alkalinity, inorganic solids, BOD and dissolved organics all the above wastages and chemicals are present in the domestic sewage normally. All these unwanted water wastes cannot be treated as in same method as treating the normal domestic sewage waste easily. To treat all these waste released by different factories in sewage requires specifically designed sequence of methods. Before releasing this waste water it should be treated and should be taken care of to reduce the pollution all the above should be taken into account and hence for this purpose the project is being proposed. In this project the samples of waste water is being collected randomly using the sensors and the values generated by these are stored in cloud which can be used to monitor and access data from anywhere [1].

INDEX TERMS: ***Polluted Lakes, Sensors, Web Technologies, WSN, WQM, and Prototyping Model.***

1. INTRODUCTION

In recent years, pollution especially water pollution has become one of the major issues that are faced by countries around the world. Water is a limited natural resource and it is very essential for human beings. This is because nowadays, humans use water for daily uses such as hydration, washing, cooking, and others. Aside from that, water is also a vital substance for most of the human activity such as agriculture, industrial manufacturing, animal rearing, etc. The increase in the number of factories and vehicles had caused the emission of plague water and chemical to the river, lakes, sea, and pond. Besides, the plagued air that is released to the atmosphere also causes acid rain to occur when the chemical is mixed with the water in the atmosphere. The acid rain will damage the building and reduce the lifespan of the building. Hence, it is important to monitor the water quality constantly so that immediate action can be taken to counter water pollution. Water quality is described as the general composition of water with reference to its chemical, physical and biological properties. Therefore, it is necessary to maintain the water at high quality so that the water is saved for the consumption of human and human activity. Nowadays, WQM is performed by integrating advanced technologies to achieve a larger amount, more precise and accurate data for better data analysis. The technology such as a microcontroller system and electrical and electronic sensors are implemented for a better result. Further improvement of WQM systems is done by applying the concept of the wireless sensor network (WSN) and the Internet of Things (IoT) to achieve effective results in supporting the capture, analysis, and transmission of water quality data. Realizing the advantages of integration between the microcontroller system and WSN for WQM, this project is motivated to develop a low-cost WQM system with large coverage and user-friendly based on Wi-Fi technology. This project is carried out by developing a prototype of a water quality monitoring system using the WSN technology system and microcontroller system. The scope of the development includes hardware and software. The multi-sensor circuit is designed to collect data. The sensor that is applied in the system is a conductivity sensor, water level, pH sensor, Flow sensor, Turbidity sensor, solenoid valve, and DHT11 sensor. The system is able to measure, collect and display the readings of the water quality. Subsequently, the collected data is transmitted to the IOT platform via the Wi-Fi shield. The Wi-Fi shield is used as the medium to transmit the data due to Wi-Fi is able to transfer a higher amount of data without loss and the data transfer rate of Wi-Fi is also higher compared to another medium. The data collected from the sensors is stored and displayed via the IOT platform can be analyzed by the government with time frequently and take measures as per the results immediately[2,3].

2. LITERATURE SURVEY

The total amount of water that is removed from the source of water such as river or lakes is known as water withdrawals which only return a portion of the water source which is removed. These withdrawals of water are being increased in the most of the developing countries by 8%. Water is the basic need of requirements for all the human beings, for the healthy functioning of eco systems around the world and also for economic development of the country. The more and more extraction of ground water resources, the improper way of water distribution networks and risk of water and getting contaminated are the reasons for the limited availability of water resources. The increasing in pollution of fresh water has lead to the shrinking of availability of fresh water. All this has led to environmental damages also. The main cause for all these is poor monitoring system which is often neglected. The industrialization and urbanization has led in squeeze of more and more fresh water which has been leading to find alternative source of water resources supply [9,10]. The water resources and the quality of the water are getting decreased or it is deteriorating because of the gradual or rapid growth population. These increases in growth of population also increase the need to meet the ever increasing demands for the usage of agriculture, daily requirements of human beings and also for industrial purpose. The insecticides and pesticides effect the ground water quality. The untreated sewage and wastes produced by various different industries pollutes the rivers of India. To get rid of manual water monitoring problems the central pollution control board uses high technologies for real time monitoring of water quality. The water quality parameters are collected by using wireless sensors network [4]. The online monitoring of quality of water is done using GPRS/GSM system. The water quality parameter information was sent using GPRS network by which we can remotely check the conditions and the quality of water [5].Wireless sensor network a web based WSN for monitoring the pollution of water is done using Wimax and Zigbee networks. The data collected, measured and processed from the sensors are directed using Zigbee gateway using ultimate network to the web interface. This helps to monitor the quality of water from far distances. This was capable of monitoring the water quality on real-time [6, 7]. The sensor was also created using solar power for water quality monitoring. These information were collected by the nearest base station from the distant sensors which can be accessed remotely. The nearest base station was equipped with Zigbee module which was powered using the sunlight as energy harvesting [8].

3. EXISTING SYSTEM

The traditional usage for water quality monitoring methods collects the water sample from different locations and then these samples are sent to laboratory for analyzing the character or properties of qualities in water. These types of manual approaches take long time to analyse and it's not efficient enough. The current usage of methods for water quality analyses the physical, chemical and biological agents which contains drawbacks such as-

1. The spatiotemporal coverage is poor.
2. It requires more labors, time and the cost is high.
3. The traditional method doesn't include real time water quality monitoring system which doesn't provide the exact information about current water quality conditions.

4. PROPOSED SYSTEM

The real-time water quality monitoring system is developed using IOT by focusing the issues present in traditional methods for water quality monitoring. In this a micro controller is used as core controller which helps to fetch the data from sensor such as PH, turbidity, DHT11 and water level then sends to cloud for remote access to view the data. These data are sent to nearest base station for monitoring the quality of water. This real time monitoring system provides the exact information of current condition of quality of water which helps to take preventive steps at the beginning stage water quality instead of at last stage.

5. OBJECTIVE

1. To design and implement the real-time monitoring system for water quality.
2. The devices are cost efficient.
3. It has the reading, processing and sending data on real-time monitoring basis.
4. The data will be sent to cloud server for remote access of the data
5. Easy to collect the data on water quality by using sensors such as PH sensor to identity the potential of hydrogen, DHT11 sensor for temperature and humidity of the water and turbidity sensor to find the turbidity of water
6. By collecting these data we can know the conditions of the water quality.
7. These data can also help to predict that the water can be used for daily usage or drinking purpose or not.

6. IMPLEMENTATION

In implementation part it describes the details of system structure, system design, behavior and provides more view on the system and its analysis. In this many parts are taken and formed as a structure of whole system. All these parts formed as a one whole system is done with some limitations and objectives. All these different components work as an element which is part of whole system which helps to provides the required functionality to form as an one whole system under the given limitations and constraints. A prototype model is developed to analyse the behavioral design of the project. It consists of PCB boards for each and every interface as specified in the diagram. All the PCB boards are connected to the jumper wires. Solenoid helps to collect the samples of waste water from random time. The PH and temperature level is also considered for waste water analysis. The waste water volume of a discharge is monitored using water level sensor for metering and billing. These sensor data are uploaded to cloud using GPRS system for monitoring regularly and for future use.

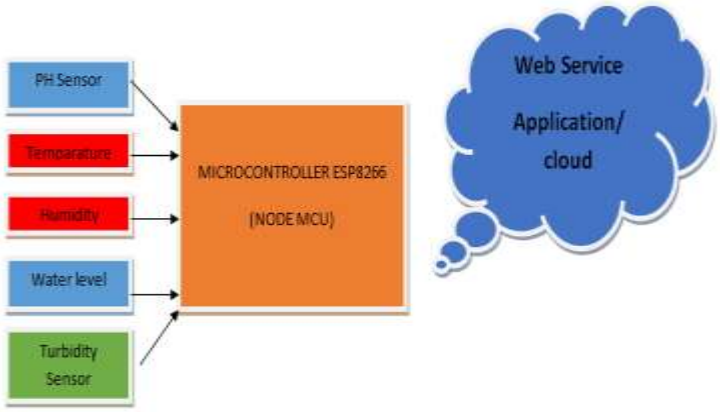

Fig -1: Architecture Design

The project uses multi-sensor circuit such as turbidity, PH, conductivity, water level, DHT11 and flow sensor which helps to collect data to analyze and measure the quality of water. These data are transmitted to IOT using wifi. These wifi helps to transfer the larger amount of data. These data are collected and stored in IOT so that no data is lost while the data is being transmitted to cloud via GPRS [11].

6.1 Sensor

A sensor is a device converts one from of energy to another. Usually the sensors changes or converts the signal in one form of energy to another. These devices are used to detect the changes or events of its environment and then it provides the electrical output accordingly. The important feature is its linearity, resolution, precision and speed. The performance of sensor is improved using sensor collaboration.

6.1.1 PH Sensor

It helps to measure the acidic and alkaline contents present in water. It contains ranges to measure the acidity and alkaline property that is from 0-14. If the value is less than 7 then it is considered as acidic property. If the range value is more than 7 then it is considered as alkaline property and the 7 value is considered as 7. The PH value for water is 7[12].

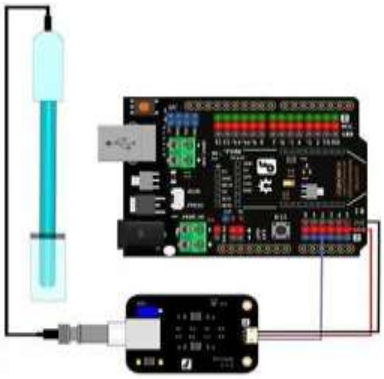

Fig -2: PH Sensor

6.1.2 Water Level Sensor

It is used to detect the specific level in which the substances can flow. It includes substances such as slurries, granular, liquids and powders [13].

Fig -3: Water level Sensor

6.1.3 DHT11 Sensor

It is a temperature and humidity sensor of very low-cost. It is used to detect the temperature and humidity of water which is essential to have proper voltage to provide PH value [14].

Fig -4: DHT11 Sensor

6.1.4 Turbidity Sensor

It is used to measure the level of water turbidity which is used to detect the quality of water. It is used to detect the pendant particles present in water. It measures the level of turbidity by light transmittance and scattering rate measurement. This leads for the changes in the amount of total suspended solids (TSS) in water. This TSS helps to prove that fresh and clean water contains low turbidity [15].

6.1.5 Node MCU

It is known as Node Micro Controller Unit. It is an open source hardware and software development environment that is built on SOC known as ESP8266. It can be programmed using low-level machine instructions which can be interpreted by chip [16].

Fig -5: The Node MCU DEVKIT board.

6.1.6 WiFi

The wifi module used for this project is ESP8266. This module follows the TCP/IP stack protocol and consists of microchip which helps the micro controller to connect with wifi module or wifi network. An ESP8266 consists of IMB flash memory.

Fig -6: WiFi board

6.1.7 THINGSPEAK Server

It provides a platform to build IOT applications. It provides the gathered or collected data in form of diagrams. It provides web administration interface to store, retrieve and monitor the data in real-time using cloud server, it helps to remotely allow the data[17].

6.1.7.1 Working with the THINGSPEAK Server:

The steps to get started with thingspeak server are as follows below:

Step 1: Sign up to create a new account in thingspeak server.
Step 2: To store the data from sensors. Create a new channel in thingspeak server.
Step 3: It contains status update field to add any information when required.
Step 4: Now name the fields such as PH, water level, temperature, conductivity.
Step 5: Now click on server channel.
Step 6: A key will be created as API key to identify the calling program.

6.1.7.2 The data sending to thingspeak server or channel are as follows below:

1. Login on thingspeak server.
2. Enter API key and PH value as 4.5 in the PH content body.
3. Click on post.
4. If the update is successful it will show ok.
5. Any number of values can be added and number will be displayed.
6. Now create a chart to view the data.
7. These importing and exporting the form to sensors are done based on real-time.

7. RESULTS AND FUTURE SCOPE

The people who have access credentials and only people with proper authorization will have permission to access the data on thingspeak website. Once the proper access credentials such as valid username and password the user will be re-directed to the page where the real-time data is being displayed. These systems can be enhanced to obtain for more reliably efficient and accurate water quality monitoring. The more sensors can be added to increase the number of data to be fetched from more logic number of places which helps to measure the dissolved oxygen, amino nitrogen, phosphate, nitrate, bio-chemical oxygen and chemical oxygen demand. The system can be upgraded by paying continued attention to air pollution, industrial pollution, hydrologic and agricultural production. This project is just a prototype. It can be taken to production level in future. This project can be made more user friendly and durable by making it more compact and cost-effective and most of sensors or unit can be further embedded with the micro-controller on single board which helps to reduce the size of system.

8. CONCLUSION

This project is based on real-time and cost-efficient monitoring system of water quality has been implemented and tested. This system helps the officials to keep track of the level of water pollution that has occurred by immediately sending alert messages or warning to the nearest base station officials. It helps to prevent the diseases that are caused due to toxic materials or by polluted water by detecting the damages occurring to the water at earlier stage. By detecting the effects or damages occurred at earlier state the immediate actions can be taken as preventive measures at the beginning stage. This system can be installed at the nearest base station where the system is installed for monitoring the applications real-time by less individuals. The high pollution load of sewerage or liquid waste causes damage and health risks for the rural communities who rely on the nearby water resource available for their daily consumption and usage. So, the effluents released by the industries must be treated before it is released in water bodies. Which pollutes and effects the water and its surrounding environments. The authorized person can access the data on thingspeak server to fetch the details of real-time monitoring system of polluted water. The data displayed on thingspeak server to display the water quantity is done by using PH sensor which is put into a container in which filled with water in which few drop of acid is add. In figure 4 the water PH value is shown as ranging from 4.5 to 3 which mean the water contains acidic properties. The surrounding temperature value ranges from 34 – 32 degrees. Hence this prototype model can be used as major application in future with many upgrades with real-time monitoring to fetch the data with less time consuming comparatively to the present water quality monitoring system.

9. REFFERENCES

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