International Journal For Technological Research In Engineering
Volume 5, Issue 7, March-2018 *ISSN (Online): 2347 - 4718*

WATER QUALITY MONITORING SYSTEM USING IoT

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ABSTRACT: In the modern world, Internet of Things (IoT) and Remote Sensing (RS) techniques are being used in diverse areas of research for monitoring, collecting and probing data from isolated locations. Drinking water is a very valuable Commodity for all human beings. Drinking water utilities face a lot of new challenges in real-time operation. The existing system consists of several sensors which are used for measuring physical and chemical parameters of water. The parameters such as temperature, pH, turbidity, conductivity, dissolved oxygen of the water can be measured. Our proposed system consists of Turbidity and pH sensor of water evaluation testing, single board computer module/mobile module, internet and other accessories. Our proposed work describes the wireless water quality monitoring system through which the quality of the water can be monitored and sends the alarm signal when the eminence of water is not on the anticipated value. A user can check the status of pH on the mobile through Wi-Fi. The undesired pH value shows that the stored water is contaminated and not useful to consume, hence one should clean their water tank or change the water as early as possible.
Keywords: Water Quality; pHsensor; Turbidity Sensor; Raspberry Pi3 model B

I. INTRODUCTION

Ensuring the safety of water is a challenge due to the unnecessary sources of pollutants, most of which are man-made. The foremost causes for water quality problems are over exploitation of natural resources. The hurried pace of industrialization and greater prominence on agricultural growth combined with latest advancements, agricultural fertilizers and non-enforcement of laws have led to water pollution to a large scope. The crisis is sometimes annoyed due to the non-uniform distribution of rainfall. Individual practices also play a significant role in determining the quality of water (Central Ground Water Board, 2017). Water quality is exaggerated by both point and non-point sources of pollution, which comprise sewage discharge, expulsion from industries, run-off from agricultural fields and urban run-off. Other sources of water pollution include floods and droughts and due to lack of responsiveness and education among users. The need for user contribution in maintaining water quality and looking at other aspects like hygiene, environment cleanliness, storage and disposal are critical elements to preserve the quality of water resources. Poor water quality spreads disease, causes death and hampers socio-economic progress. More than 5 million people die due to waterborne diseases around the world (Water Resource Information System of India, 2017). Fertilizers and pesticides used by farmers can be washed through the soil by rain, to end up in rivers. Industrial waste goods are also joined into rivers and lakes. Such contaminations enter the food chain and accumulate until they reach toxic levels, eventually killing birds, fish and mammals. Chemical factories also dispose wastes in the water. Factories use water from rivers to power equipment or to cool down machinery. For proper water supply, water administration is required for the wise use of water assets. The major problems are: poor water allocation, degraded water health or quality and lack of tolerable water management system. The above problems are the key enthusiasm of this research and the ultimate purpose is to monitor the water health. Due to leakage of pipes where water distribution networks are implemented, the water can be polluted and the quality of water degrades. Hence it is suitable to continuously monitor the water health. The earlier methods required a person to take samples of water and then testing was done manually which consume a lot of time and was lengthy.

II. RELATED WORKS

Numerous systems have already been developed based on the topics of remote monitoring. Various researches have been performed to monitor the quality of water:

Autonomous water quality monitoring system using GSM [4]. This system was developed jointly as an element of the Autonomous Live Animal Response Monitor (ALARM) toxicity biosensor, designed to be deployed in-stream for continuous surveillance. The objective of their work is to create a low cost, wireless water quality monitoring system that aids in continuous menstruation of water conditions. Their involvement during this is that the system-level integration of biosensors, sensing element signal processing and sensing element information management. Their system was designed to measure a suite of biologically relevant physiochemical parameters in fresh water. They measured temperature, intensity level, pH, electrical conduction, total dissolved solids, salinity, dissolved oxygen and red sox potential. These parameters provide insights into the current status of changing water conditions and assist in identifying pollution sources.

Design of Smart Sensors for Real-Time Water Quality Monitoring using ZigBee[5].

The system is able to calculate physiochemical parameters of water quality, such as flow, temperature, pH, conduction and also the redox potential. These physiochemical parameters are used to detect water contaminants. The sensors which are designed from first principles and implemented with signal conditioning circuits are connected to a microcontroller-based measuring node, which processes and analyses the data. In this design, ZigBee receiver and transmitter modules are used for communication between the measuring and

notification node. The notification node presents the reading of the sensors and outputs an audio alert when water quality parameters reach unsafe levels. Numerous qualification tests are run to validate each aspect of the monitoring system. The sensors are shown to work within their intended accuracy ranges. The menstruation node is in a position to transmit information via ZigBee to the notification node for audio and visual display. The results demonstrate that the system is capable of reading physiochemical parameters, and can successfully process, transmit and display the readings.
Data management subsystem includes the applications which access the data storage cloud and displays the same to the end user.
Data transmission subsystem consists of a wireless communication device along with build in security features, which transmits the data from the controller to data storage cloud.
Data collection subsystem consists of multi-parameter sensors and optional wireless communication device to transmit the sensor information to the controller. A controller gathers the data, processes the same.

III. SENSOR DETAILS

PH sensor

Fig. 3.1 ph sensor

pH Sensor works on 5V power supply and it is simple to interface with arduino.The ordinary range of pH is 6 to 8.5. This sensor gives the output indicator corresponding to the hydrogen ion absorption that is measured by pH electrode. Because it can be directly associated to controller, and then you can monitor the pH assessment at any time. This device can be used for pH measurements, such as waste water, sewage and other occasions.

Turbidity sensor

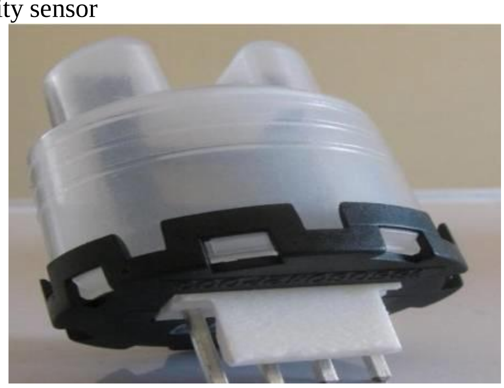

Fig 3.2 turbidity sensor

Turbidity is a measure of the cloudiness of water. Turbidity has indicated the degree at which the water loses its transparency. It is considered as a good measure of the quality of water. Turbidity blocks out the light required by submerged aquatic vegetation. It also can elevate surface water temperatures above standard because suspended particles near the surface assist the absorption of heat from sunlight. The TSD-10 module measures the turbidity (amount of suspended particles) of the water source. An optical sensor is a measuring product for a turbid water density or an extraneous matter concentration using the refraction of wavelength between photo transistor and diode. By using an optical transistor and optical diodes, an optical sensor measures the amount of light coming from the source of the light to the light receiver, in order to calculate water turbidity.

IV. PROPOSED SYSTEM

The proposed system is to keep an eye on the quality of water from natural or man-made disasters, and develop the preventive measures for the protection of the water quality. We can edit, process,analyse, send and view the data on cloud. Here the sensor values are updated in the twitter.

4.1. Functional block diagram:
The proposed block diagram consists of ph sensor and turbidity sensor.

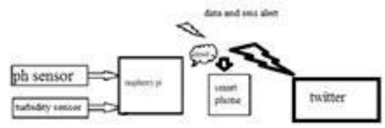

Fig 4.1 System Diagram

Our proposed system (Fig 4.1) consists of number of devices, having relevant sensors, and the composed data from all devices are gathered and sent to the wifi module. The device consists of pH and turbidity sensor for measuring the water quality. The parameters collected from the sensors are sent directly to the Raspberry pi3 model B. Then the proposed system gathered the data from the sensors and processes them, put the parameters in a text file which is transmitted to IOT. For transmitting data to the IOT, opening is created on the Raspberry pi 3 model B using FTP (file transfer protocol) protocol. In the proposed system, for monitoring the processed data through internet, cloud computing technology is used
which provides the individual local server. In cloud computing, separate IP address is provided which makes achievable to scrutinize data from anywhere in the world using the internet. After that, the sensor values are updated in the twitter for the situation to the people about the quality of the water what we have calculated. Also using browser application, the user can access and examine the data from all over the world.

4.2. SYSTEM DESCRIPTION
The Raspberry Pi3 Model B is a amazing platform that can be used to build automation systems. Clearly, the Raspberry

Pi3 model B board is perfect when being used as a “hub” for automation systems, connecting to other open-source hardware parts like sensors.

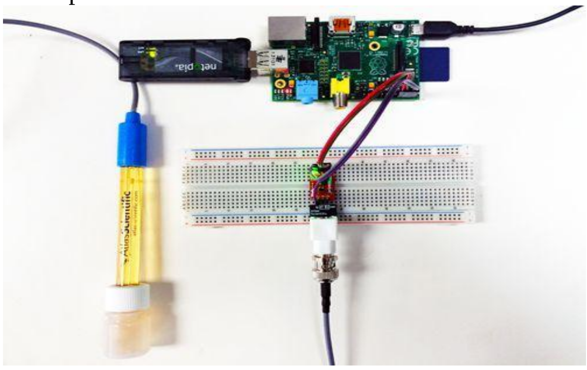

Fig 4.2.1 raspberry pi

Data acquisition

In PH meter the pH range is from 0 to 14, with 7.0 being neutral. The values above 7.0 are alkaline and anything below 7.0 is considered acidic.

Substance	pH
Gastric juice	1.0
Lemon juice	2.5
Vinegar	3.0
Wine	3.5
Tomato juice	4.1
Acid rain	5.6
Urine	6.0
Milk	6.5
Pure water	7
Blood	7.4
Lime water	11.0

Table 4.2.1 ph values

With the help of the ph sensor, it is very easy to estimate and update the ph values that are being recorded. It indicates the present substance whether it is an acidic, basic or neutral. Then the measured ph values are updated in the twitter as follows:

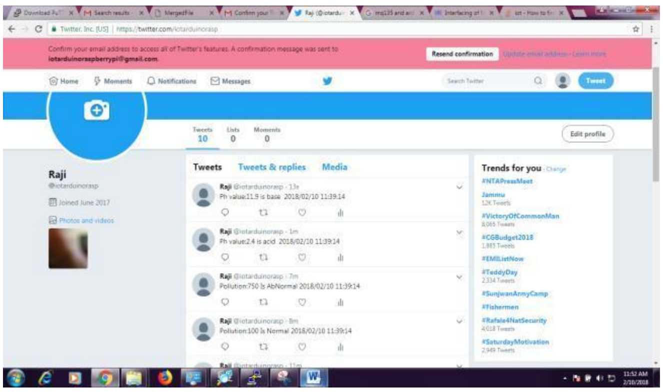

Fig 4.2.2 ph values in the twitter

In this if ph value is indicated as 2.4 then the substance present in it is said to be of acid, if the ph value is of 11 then it is said to be of basic solution or substance. Similarly in the turbidity sensor, the sensor working on the standard that when light is passed through a sample of water, the amount of light transmitted through the sample is dependent on the amount of soil in the water. As the soil level increases, the amount of transmitted light decreases. The turbidity sensor measures the amount of transmitted light to conclude the turbidity of the water. These turbidity parameters are supplied to the Raspberry Pi3 Model B, which makes decisions on how long to scrutinize. These conclusions are made based on a assessment between clean water measurements (taken at the beginning of the process) and the turbidity water measurement taken at the end of process cycle. This results in water quality check.

Typical Turbidity Data

Water Source	Turbidity Level
Water bodies with sparse plant and animal life	0 NTU
Drinking water	<0.5 NTU
Typical groundwater	<1.0 NTU
Water bodies with moderate plant and animal life	1 - 8 NTU
Water bodies with large plumes of planktonic life	10 – 30 NTU
Muddy water or winter storm flows in rivers	20 - 50 NTU

Table4.2.2 turbidity values

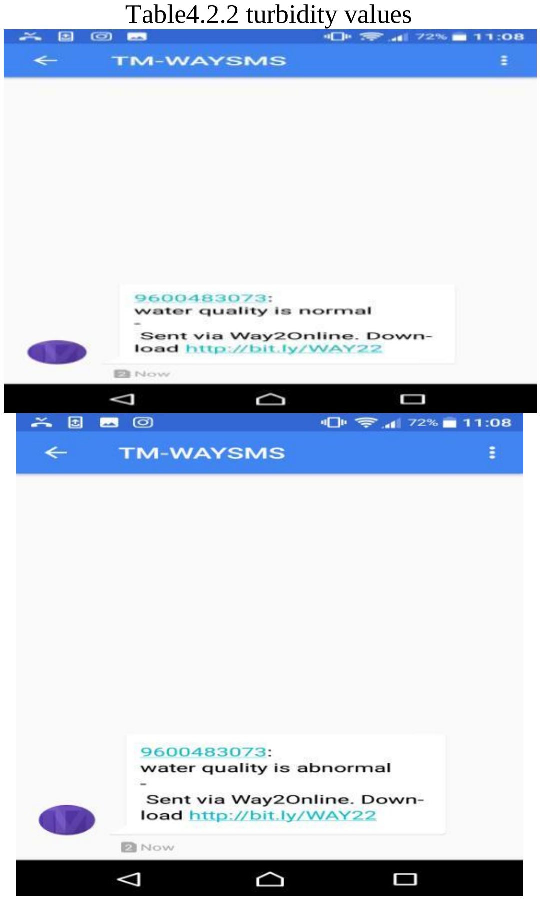

Fig 4.2.3 alert messages through phone

Here in this it measures the amount of the suspended particles if they are in the appropriate manner the result of the water is said to be normal, otherwise if the suspended particles are in unordered manner or if it is present high then the level of the water results in abnormal condition. After that the values are analyzed and compared with first set of values that we have taken at the beginning of the section.

V. CONCLUSION

Monitoring of Turbidity, pH of Water uses corresponding sensors. The system can monitor water quality automatically, and it updates the parameter details automatically to the cloud server. Server can update the water quality to the people via sms and twitter. The proposed water quality testing has to be more cost-effective, suitable and rapid. The system has good flexibility by replacing the corresponding sensors and changing the appropriate python programs. This system can be used to monitor other water quality parameters. The operation is simple. The system can be prolonged to examine hydrologic, air pollution, industrial and agricultural fabrication and so on.

VI. FUTURE WORK

The future scope of the current work is huge. In future, it can be executed to monitor the quality of water not only in household but for the whole city or a town or a dam, from where the water supply takes place. With combination of other sensors, hybrid quality monitoring systems can be designed in the near future for the whole city or town.

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