ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 4, April 2017

Efficient Method for Monitoring Water Quality Parameters and Alarm System using IoT

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***Abstract*— Due to increase in pollution, monitoring of water quality and biodiversity is very important for day to day life. Many revolutionary changes are possible in these research areas with new technologies. This monitoring process can be carried out with the help of Internet of Things. The water quality may differ from place to place depending upon the conditions prevailing in a particular area. The basic method for testing the water is to take samples of the water and test it manually to find water's pH, temperature, turbidity, dissolved oxygen etc. Here we propose a new methodology for measuring and monitoring water quality parameters using Raspberry pi. Here remote real time monitoring is made possible by making Raspberry pi as a web server. This system can also be used as warning system in case of over pollution**

***Index Terms*— Dissolved oxygen, Internet of Things, pH, Turbidity, Raspberry Pi, Water Quality**

I. INTRODUCTION

Water Quality is a measure of condition of water relative to the requirements of one or more biotic species and /or human needs. It also refers to the physical, chemical, biological characteristics of water. Water Quality parameters includes Physical- Color, Odor, Temperature, Turbidity, moisture. Chemical – pH (hydrogen ion concentration), DO (Dissolved Oxygen), Hardness, Chloride, nitrate and Biological – BOD, COD. In India, the standards for water quality are basically laid down by Environmental Hygiene committee, Bureau of Indian Standards (BIS), Indian Standard Drinking water specifications (IS 10500:1991).

Water quality monitoring will provide us the basic analysis of the quality of the water we use regularly. It is necessary, that an individual should know the quality of water that they are using. The monitoring of water quality refers to the analysis of the parameters such as pH, temperature, turbidity, chemical, physical characteristics of the water, etc. The method which was used formerly for monitoring water quality is analyzing the quality of water by testing the samples of water in the laboratory. But now in this century it is difficult to monitor the quality since the water is contaminated with 'n' number of chemical substances. Hence modern technologies are applied to test the quality of water. Usage of IoT in this field will help us to analyze the water more efficiently

A.INTERNET OF THINGS (IoT)

In modern days, all human life is attached with internet of things (IoT). This IoT is based on interconnecting of communicating objects in the different locations installed in possibly distant from each other. IoT represents the concept that, the device network has ability to sense & collect the information from the worldwide. This IoT makes the vision that the object is part of the internet. That each and every object is uniquely identified and accessed via network. IOT technology is based on sensing equipments such as infra-red sensors, GPS, laser scanners, RFID, gas sensors and so on. The application that IOT includes building and home automation, smart city project, health care systems and devices, automotive etc. Further that IoT provides sudden information regarding access to objects with high efficiency. Thus the IoT concept is very much useful to achieve the monitoring system in day today life.

B. RASPBERRY PI

Raspberry Pi can be used as a web server to store the changes in the quality of water. This system can also act as an alert system when there prevails over pollution of water.

Fig.1 Raspberry Pi Board

ISSN (Online) 2395-2717

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C. PH SENSORS

PH is used to determine the chemical balance of water. pH is defined as the hydrogen ion concentration of a fluid. It is the logarithm of the reciprocal value of H+ ion pH=log 1\[H+] The pH value is

- less than 7 are acidic
- above 7 are basic
- equal to 7 are neutral

A pH meter will be made up of a probe, which itself is made up of two electrodes. This probe passes electrical signals to a meter which displays the reading in pH units. The glass probe has two electrodes because one is a glass sensor electrode and the other is a reference electrode. Both electrodes are hollow bulbs containing a potassium chloride solution with a silver chloride wire suspended into it. The glass sensing electrode has a bulb made up of a very special glass coated with silica and metal salts. This glass sensing electrode measures the pH as the concentration of hydrogen ions surrounding the tip of the thin walled glass bulb. The reference electrode has a bulb made up of a non-conductive glass or plastic.

D. TURBIDITY

The relative purity is measured by the turbidity sensor. The particles which are mixed in water is not visible to the naked eye. It is identified by turbidity. Turbidity is just testing the water quality. Turbidity is the cloudiness of a fluid. Turbidity is caused by growth of phytoplankton and Human activities that disturb land, such as construction, mining and agriculture, can lead to high sediment levels. It is measured by turbidity measure or turbidity sensors. Certain industries such as quarrying, mining and coal recovery can generate very high levels of turbidity from colloidal rock particles. The major issues are, they inhibit the growth of submerged aquatic plants and consequently affect species which are dependent on them, such as fish and shellfish, the higher the turbidity level, higher the risk that people may develop gastrointestinal diseases. It is also measured in NTU (Nephelometric Turbidity Units).

E. DISOLVED OXYGEN

It is the amount of gaseous oxygen dissolved in the water. The essential factor for aquatic life is respiration. Microbes and fungi also utilize DO, to decompose the organic matter at the bottom of the water bodies. The Std value is 5-10 PPM measured using DO analyzer. The major causes are Temperature variation leads to the alteration in DO levels. Higher the temperature lowers the DO level. Cold water holds more DO than hot water. Fresh water holds more DO than saline water.

II. EXSISTING SYSTEM

The National Rural Water Quality Monitoring & Surveillance Programme was launched in February 2005 and has now been merged with NRDWP.

Water quality monitoring is done identifying pollutant levels and locations in a source water. The quality of the water is monitored by taking the samples of the water to the laboratory and testing them. Water quality monitoring is commonly done multiple times a year because water quality may change with Season and with climatic changes. The quality can be monitored by measuring physical, chemical, or biological characteristics of the water. The advanced version of water quality monitoring was designed by using smart water quality monitoring system using sensors. The sensors send data wirelessly to the device which collects data from all the nodes. This data is given to the remote server through GPRS network and user can see data remotely.

III. DRAWBACKS OF EXSISTING METHOD

The drawbacks of these existing systems are, when these waters are taken as samples to the laboratory to test, they tend to get more contaminated, this cause some errors in the result obtained. Even under certain conditions the equipments used in the laboratory may have some defects in it, this also causes error to the result. The quality of the water will not be known immediately, it will cause delay, hence there are chances for damage of crops, living being etc., who makes uses of these water.

The advanced technique also has drawbacks, that is, it is costly because of smart sensors. Further the sensors are not reliable.

IV. PROPOSED SYSTEM

Since monitoring of water quality is very important for day to day life. Many revolutionary changes are possible in these research areas with new technologies. This monitoring process can be carried out with the help of Internet of Things. Here we propose a new methodology for measuring and monitoring water quality parameters using Raspberry pi. Raspberry pi is literally a web server for collecting the information from various sources and displaying it in a single page with the help of database.

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Vol 3, Issue 3, April 2017

Here remote real time monitoring is made possible by making Raspberry pi as a web server. This system can also be used as warning system in case of over pollution.
A program can be framed to send an alert to the system, when the water is over polluted or more contaminated.

V. SYSTEM DESIGN

The sensors are placed inside the water bodies to test the water quality. The sensor detects the values and send those values to the interfacing circuit. There are many sensors available. The output from the sensors are analog in nature. But raspberry is digital. So separate circuitry is needed for analog to digital conversion which done by the interfacing circuit.
The raspberry can be used as webserver. The raspberry webserver is apache webserver type. This type of apache webserver can be used for hosting open source applications.
The below figure shows the use case diagram of the proposed system.

Fig.2 Use Case Diagram

Fig. 3 shows the block diagram of the of the proposed system. A web application inside the webserver stores the sensed data in a database. Using the database values graph is plotted for all water quality parameters on hourly basis or day wise based on the requirement. Using the database values these sensors are geographically plotted on google map.

Every water quality parameter has its threshold value. When these parameters reach the maximum value or when the environment is on dangerous condition an alarm is sent to concern persons through SMS and real time alarm is also available on the webserver.

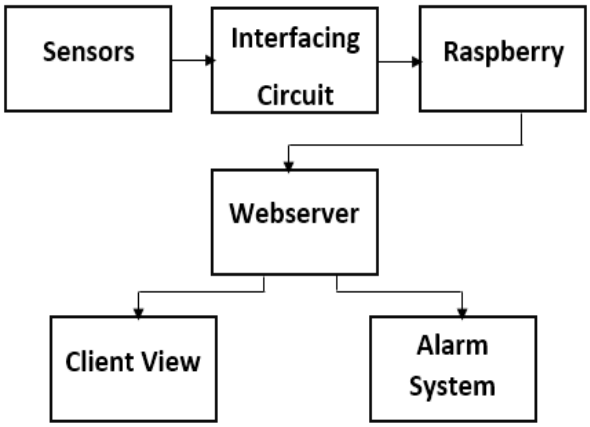

Fig.3 Block Diagram

VI. IMPLEMENTATION

The system is implemented using PHP as front end and MySQL database as back end. The admin and user has to authenticate through a login screen. Proper actions have taken to ensure the security of the system.

Fig.4 Login page

After proper authentication, the homepage with different graph and geographical map menu is displayed. From this page the user can view different types of geographical maps and graphs for different water quality parameters.

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When clicking on the pH graph the following graph will be displayed with the details of the ph value taken in that particular region at a particular period of time. Likewise graphs and geographical maps for different water quality parameters can been seen.

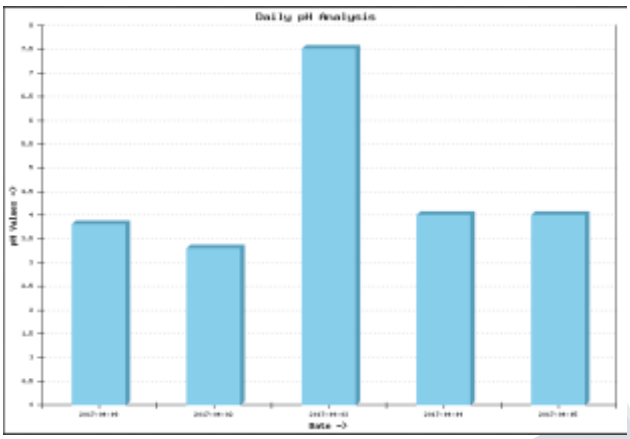

Fig.5 pH Graph

Fig.6 pH Geographical Map

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