REAL TIME WATER QUALITY MONITORING SYSTEM BASED ON IOT AND GSM

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Abstract : Water being a universal solvent varies from place to place, depending on the condition of source water from the treatment it receives, but it must reach Environmental Protection Agency (E.P.A) conditions. The normal method of challenging conductivity, Turbidity and pH is to collect samples manually and sent them to laboratory for water quality check. However, it has been unable to reach the water quality examining today. The proposed system consists of conductivity, Turbidity and pH sensor of water grade testing, single board computer module/mobile module, internet and other accessories. Conductivity, Turbidity and pH of water are automatically detected under the single board computer Raspberry Pi3 model B. The single board computer gets the data from the three sensors and that data will be sent to the web server using internet. It is able to detect situation of water quality globally. It is distinguished by the advantages of shortcut, perfection and using staffing requirements and material accumulation sparingly. The existing system will be suitable for a particular area but it does not cover for large systems. By clearly observing the above issues low cost system for Online Monitoring of Water Quality using Raspberry Pi3 model B has been developed.

Index Terms **- Water Quality; conductivity Sensor; pH-sensor; Turbidity Sensor; Raspberry Pi3 model B.**

I. INTRODUCTION

With the rapid growth of the thrift/providence, more and more serious troubles of environment arise. Water defilement is one of these problems. Regular monitoring of water quality parameters are Conductivity, pH, turbidity, dissolved oxygen, chemical oxygen demand, biochemical oxygen demand, ammonia nitrogen, nitrate, nitrite, phosphate, various metal ions and soon. The most common method to detect these parameters is to collect samples manually and then send them to laboratory for detecting and analyzing. This method wastes too much man power and material resource, and has the limitations of the samples collecting, long-time analyzing, the aging of demonstration equipment and other issues. Sensor is an ideal solution to solve these problems. It can convert no power information into electrical signals.

II. RELATED WORK

The application of high spectral and spatial resolution airborne remote sensing has developed to an almost operational level. This paper investigates the role of remote sensing especially coupled to the two other available water quality assessment tools: in situ measurements and ecological Water quality modeling data. Discussed about the transfer function between water quality and source of pollution. Implemented an automated water monitoring system for west and Rhode River. Author had developed a multi-sensor heterogeneous real time water monitoring system using the parameters like pH,conductivity, and turbidity and dissolved oxygen Environmental water quality, also called ambient water quality, relates to water bodies such as lakes, rivers, and oceans. Water quality standards for surface waters vary significantly due to different environmental conditions, ecosystems, and intended human uses. Toxic substances and high populations of certain microorganisms can present a health hazard for non-drinking purposes such as irrigation, swimming, fishing, and rafting, boating, and industrial uses. These conditions may also affect wildlife, which use the water for drinking or as a habitat. Modern water quality laws generally specify protection of fisheries and recreational use and require, as a minimum, retention of current quality standards. GSM was designed with a moderate level of service security. The system was designed to authenticate the subscriber using a per-shared key and challenge-response. Communications between the subscriber and the base station can be encrypted with the help of GSM board. Water pollution is the contamination of water bodies. Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds. Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and populations, but also to the natural communities. Water covers over 70% of the earth's surface and is a very important resource for people and the environment. Water pollution affects drinking water, rivers, lakes and oceans all over the world. This consequently harms human health and the natural environment. Here you can find out more about water pollution and what you can do to prevent it. An estimated 700 million Indians have no access to a proper toilet, and 1,000 Indian children die of diarrheal sickness every day.

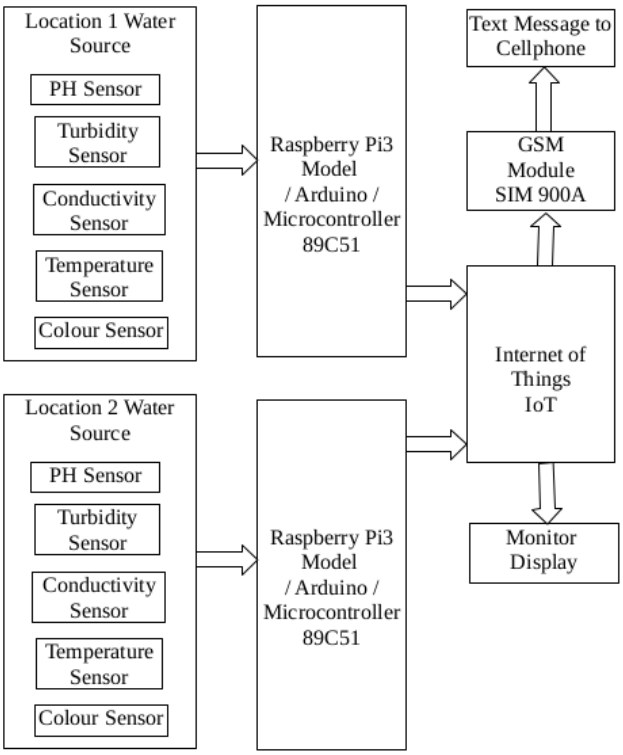

Fig 1: Overall block diagram of proposed system

DISADVANTAGES OF THE EXISTING SYSTEM

- Time consuming and less effective
- High costs.
- More man power

PROBLEM DEFINITION

Environmental regulations require the monitoring of the environmental state of the West and Rhode River in order to preserve or improve its water quality. The current system in place for the West and Rhode River water basin requires travel to 32 locations on the West and Rhode Rivers. At each location a manual sensor sample for dissolved oxygen, conductivity, and bacteria are recorded by hand. Also, a rough estimate of turbidity is recorded using a Secchi disk. Testing occurs once a week during the months from May to October, where a set of volunteers would survey sampling sites on the West River and another set of volunteers would sample on the Rhode River. The process of travelling and collecting data takes two hours to complete. Upon completion; the manually recorded data is then given to a webmaster for input into a web server. The water collected for bacteria sampling is sent to a lab at a nearby community college. There is an apparent time delay between each of these weekly cycles, and there is an apparent chance that data may be incorrectly recorded or lost. Because of these possibilities, the River-Keeper has very little time to investigate and act on poor sources of water quality, nor he have the ability to accurately gauge the West and Rhode Rivers overall current state. There are a limited number of parameters tested in the current system such as pH, Turbidity and conductivity. parameters such as, salinity, phosphorous, and nitrogen, which contribute to water quality, are not tested.

PROPOSED METHODOLOGY

This section explains the complete block diagram of the proposed system. Also, it presents the detail explanation of each and every block. The overall block diagram of the proposed system is as shown in figure 1. This proposed block diagram consists of number of devices having respective sensors, and the collected data from all devices are gathered and sent to the Raspberry pi 3 model B.

The device consists of several sensors for measuring water quality parameters such as pH, turbidity, conductivity. The data from the sensors are sent directly to the Raspberry pi3 model B. So the proposed system gets the data from the sensors and processes on them,put the data in a text file which is transmitted to IOT. For transmitting data to the IOT, gateway is created on the Raspberry pi 3 model B using FTP (file transfer protocol) protocol. In the proposed system, for monitoring the processed data on the Internet, cloud computing technology is used which provides the personal local server. In cloud computing, separate IP address is provided which make possible to monitor data from anywhere in the world using the internet. To access that monitor data and make system user-friendly browser application is introduced which work on HTTP. So, by using browser application user can access and monitor the data from all over the word.

Advantages of the proposed system:

- Improves water quality
- Intelligent management of the services in the city.
- Due to automation it will reduce the time to check the parameters.
- Low maintenance.
- Prevention of water diseases.
- Real time information on the website.

III. HARDWARE DESCRIPTION

The major components used in the proposed have been discussed briefly:

5.1 Raspberry Pi3 Model B

The Raspberry Pi3 Model B is a wonderful 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.

Raspberry Pi3 Model B is a small sized single board computer which is capable of doing the entire job that an average desktop computer does Like spread sheets, word processing, Internet, Programming, Games etc. Raspberry Pi3ModelB Built on the latest Broadcom 2837 ARMv8 64bit processor, the new generation Raspberry Pi3 Model B is faster and more powerful than its predecessors. With built-in wireless and Bluetooth connectivity, it becomes the ideal IoT ready solution. It consists of 1.2GHz QUAD Core Broadcom BCM2837 64bit ARMv8 processor, BCM43438 Wi-Fi on board, Bluetooth Low Energy (BLE) on board,1GB RAM,4x USB 2 ports,40pin extended GPIO,HDMI and RCA video output. The Raspberry Pi3B model is shown in fig.2.

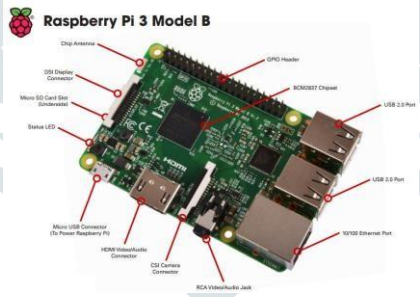

Figure 2 Raspberry Pi3Model B module

Raspberry Pi3Model B runs on Linux kernel based operating systems. It boots and runs from the SD card. It does not have any internal memory other than the ROM. It has an SD card slot which is capable of reading up to 32 GB. The GPIO pins of the raspberry Pi3 Model B are programmed using Python programming language. The I/O devices like sensors are given to GPIO pins whenever needed.

5.2 GPIO:

One powerful feature of the Raspberry Pi3 Model B is the row of GPIO (general purpose input/output) pins along the edge of the board.

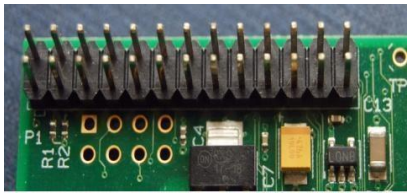

Figure 3 GPIO pins

The program can be written on the pins to interact in amazing ways with the real world. Inputs don't have to come from a physical switch; it could be from a sensor or a signal from another computer or device. For example,the output can do anything, from turning on an LED to sending a signal or data to another device. If the Raspberry Pi3B is on a network, you can control devices that are attached to it from anywhere and those devices can send data back. Connectivity and control of physical devices over the internet is a powerful and exciting thing, and the Raspberry Pi3 model B is ideal for this.

5.3 Water Turbidity Sensor:

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.

Turbidity Sensor Theory of Operation:

The sensor operates on the principle 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 determine the turbidity of the water. These turbidity measurements are supplied to the Raspberry Pi3 Model B, which makes decisions on how long to examine. These decisions are made based on a comparison 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.

Specifications

- Rated Voltage: DC 5V (between No #1 & Ground)
- Operating Temperature Range:-10°C ~ 90°C
- Rated Current: 30 mA
- Insulation Resistance: in 100 MΩ by 500V DC

Fig 4: Water Turbidity sensor

5.4 Water pH Sensor:

Do we need to measure aqueous solution pH? Yes, here the Grove - pH sensor can help you do it. This sensor gives the output signal corresponding to the hydrogen ion concentration that is measured by pH electrode. Because it can be directly connected to controller, and then you can observe the pH value at any time. This device can be used for pH measurements, such as waste water, sewage and other occasions.

Features:

- Grove Interface
- Wide measuring range
- Life span is two years
- Isopotential Point: pH 7.00 (0 mV)

Specifications:

Item	Typical	Units
Working Voltage	5	V
Measure Range	0~14	pH
pH Sensor Output Range	-414.12 ~ 414.12	mV
Measure Accuracy	<15	mV
Temperature Range	0~60	℃

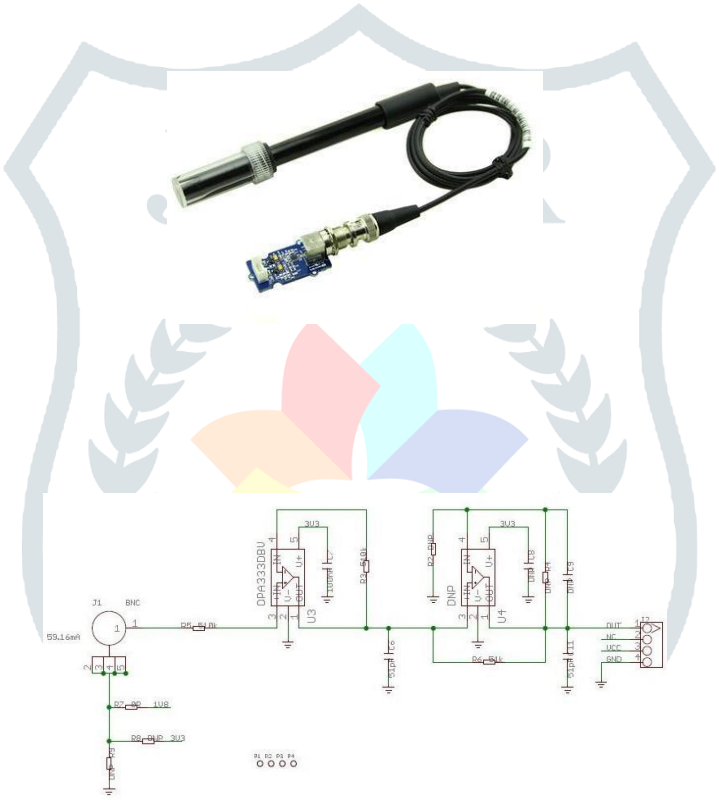

Fig.5: pH Sensor

5.5 Water conductivity sensor:

This sensor allows you to measure water conductivity. It is included in Open Garden Hydroponics.

SOFTWARE DESIGN:

1. GUI PLATFORM:

The GUI platform was successfully developed using Borland html and java programming.

Here the actual values of conductivity, pH and water turbidity are displayed in real time. The user can get display of measurement status of every sensor on the web page.

2. PyCharm:

During the implementation of our project we have utilized certain software. The source code for the Raspberry Pi3 Model B was written in programming language Python. The IDE used was PyCharm Vision make facilities, source code editing, program debugging, and complete simulation in one powerful environment. The **PyCharm** development platform is easy-to-use and helps you quickly create embedded programs that work. The PyCharm editor and debugger are integrated in a single application that provides a seamless embedded project development environment.

3. INTERNET OF THING

In the past decade, all the humans' life changed because of the internet. The internet of things has been heralded as one of the major development to be realized throughout the internet portfolio of technologies. The Internet of Things (IOT) is concerned with interconnecting communicating objects that are installed at different locations that are possibly distant from each other. Internet of Things represents a concept in which, network devices have ability to collect and sense data from the world, and then share that data across the internet where that data can be utilized and processed for various purposes. The internet of things describes a vision where objects become part of internet: where every object is uniquely identified and access to the network. IOT communication is quite different from the traditional human to human communication, bringing a large challenge to existing telecommunication and infrastructure. Furthermore, IOT provides immediate information regarding access to physical objects with high efficiency. The concept of Internet of Things is very much helpful to achieve real time monitoring of sensor data. Internet of Things (IoT) is a kind of network technology, which is based on information sensing equipments such as RFID, infrared sensors, GPS,laser scanners, gas sensors and so on, can make anything join the Internet to exchange information, according to the protocol, which gives intelligent identification, location and tracking, monitoring and management. In proposing system we introduce cloud computing technique for monitoring sensor values on the internet. Cloud computing provides the access of applications as utilities,over the internet. The cloud computing characteristic and development approaches are explained. Cloud computing is a large scale processing unit which processes in run time and it is also a very low cost technology based on the IP. The application area of IoT includes building and home automation, smart city project, smart manufacturing of various products, wearables, health care systems and devices, automotive etc.

IV. RESULTS AND DISCUSSION

The following are the results which obtained from this work,

- Waste Level detection inside the water resources.
- Transmit the information to web.
- The data can be accessed anytime and anywhere in the world.
- It is one of the real-time data transmission and access

This online Monitoring of Water Quality using Raspberry Pi3 Model B is very useful for smart cities in different aspects. We have seen that, in cities there are different water source located in the different areas and water get pollute many times and the people do not get information about this. Our system is designed to solve this issue and will provide pollution details of the water source located in the different areas throughout the city. The concerned authority can access the information from anywhere and anytime to get the details. Accordingly they can take the decision on this immediately.

Fig 7 shows that location-1water source sensors information displayed on the GUI web browser .This information can be accessed from anytime and anywhere and the concern person take the decision accordingly.

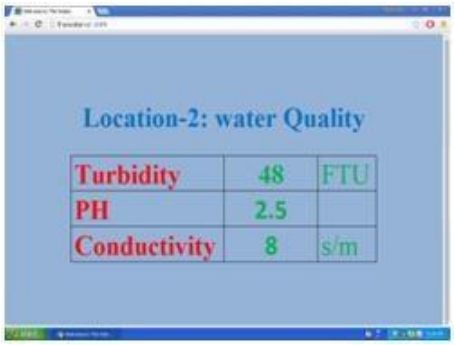

Fig 8: shows that location-2 water source sensors information displayed on the GUI web browser this information can be accessed from anytime and anywhere and the concern person take the decision accordingly.

V. FUTURE SCOPE

This proposed system gives information to whole users those who depend on that plant**.** we can use more sensors to detect more parameters for security purpose **.**By interfacing relay we can controls the supply of water for easy detection.

Applications:

- This system can be used for both commercial and domestic purposes.
- Water supply agencies.
- In health department for identifying the cause of water diseases.

VI. CONCLUSION

Monitoring of Turbidity, pH &conductivity of Water uses corresponding sensors. The system can monitor water quality automatically, and it up date to servers website with low cost and does not require people on duty. So the water quality testing has to be more economical, convenient and fast. The system has good flexibility by replacing the corresponding sensors and changing the relevant python programs. This system can be used to monitor other water quality parameters. The operation is simple. The system can be expanded to monitor hydro logic, air pollution, industrial and agricultural production and so on. It has widespread application and extension value.

REFERENCES

[1]. Mo Deqing, Zhao Ying, Chen Shangsong, "Automatic Measurement and Reporting System of Water Quality Based on GSM," 2012 International Conference on Intelligent System Design and Engineering Application.

[2]. Svetomir Mijović1, Bojan Palmar2 1Serbian Environmental Protection Agency, Belgrade, Republic of Serbia 2State Hydro meteorological Service of Serbia, Belgrade, Republic of Serbia

[3]. Automated Water Quality Monitoring, Field Manual (1999), Ministry of Environment Lands, and Parks, Water Management Branchfor the Aquatic Inventory Task ForceResources Inventory Committee, The Province of British Columbia, and Canada.

[4]. Mijović S. and Palmar B. (2009). "Continuous water quality monitoring on river Kolubara" ,30th scientific professional meeting with international participation.

[5]. Muhammedali Mazdi& Janice Gillispie "8051 Microcontroller & embedded system" 3rdedition pearson. 6

[6]. Prof. Sachin S. patil, Prof. S. J.Patil, Prof. M. M. Raste "Air Pollutant Monitoring Using Sensor Networks" International Journal Of Advanced Research in Electronics and Communication Engineering,Volume.3.Issue.8.,.Aug-2014, pp. 829-833

[7]. Mr. S. S.Patil, A. N. Shinde, A. C. Joshi "Wireless ttemperature Monitoring System Using Wireless Sensor Networks" in international journal of advanced electronics and communication engineering, volume-1, issue-4, oct-2012, ISSN-2278-909X, pp-46-51, ww, ijarece.com