Water Quality Monitoring System Using IOT

Ankit Sharma[1], Harshal Pawbake[2], Hetal Patel[3], Prof. A.R Potdar[4]

[1] Student, Computer Engineering, SIEM, Maharastra, India
[2] Student, Computer Engineering, SIEM, Maharastra, India
[3] Student, Computer Engineering, SIEM, Maharastra, India
[4] Professor, Computer Engineering,SIEM, Maharastra, India

ABSTRACT

Water is a most essential element required for humans to survive and therefore there must be some mechanisms put in place to test the quality of drinking water in real time. This paper proposes a system for water quality monitoring system using IOT. The system consists of various physiochemical sensors which can measures the physical and chemical parameters of the water such as Temperature, Turbidity, pH and Flow. By these sensors, water contaminants are detected. The sensor values processed by Raspberry pi and send to the cloud. The sensed data is visible on the cloud using cloud computing and the flow of the water in the pipeline is controlled through IoT.

Keywords: - *Water quality monitoring and controlling, IoT, Physiochemical sensor, Cloud, Cloud Computing.*

1. INTRODUCTION

The most valuable resource for human is clean drinking water. Compromising with water quality would lead to seriously affect the health condition of humans. These days drinking water utilities are facing various challenges in real time due to limited water resources, global warming, growing population and pollution. Hence, there is need of better methodologies for real time water quality monitoring. Conventional method of water quality monitoring involves the manual collection of the water at different areas and this water is tested in laboratory. This approach takes long time and high cost. Although the current methodologies have so many drawbacks: viz a) Laborious b) absence of water quality information in real time c) poor spatial coverage d) lack of controlling unit to control the flow of the water in pipeline for safe supply of the drinking water. The online water monitoring technologies have made a significant progress for source water surveillance and water plant operation. The use of their technologies having high cost associated with installation and calibration of a large distributed array of monitoring sensors. The algorithm proposed on the new technology must be suitable for particular area and for large system is not suitable. By concentrating on the above issues, this paper designed and developed low cost system for real time water quality monitoring and controlling using IoT. In our design, physical and chemical parameters of the water are measured by physiochemical sensors. The sensed values are processed by core controller. ESP32 is used as core controller for this design. The IoT module access processed data from the core controller to internet. The sensed data can be observed in the internet browser with special IoT account.
Water flow in the pipeline is controlled depending on quality of the water through IoT. In addition to that the controlling and monitoring is observed through mobile by using Wi-Fi provided by IoT module.

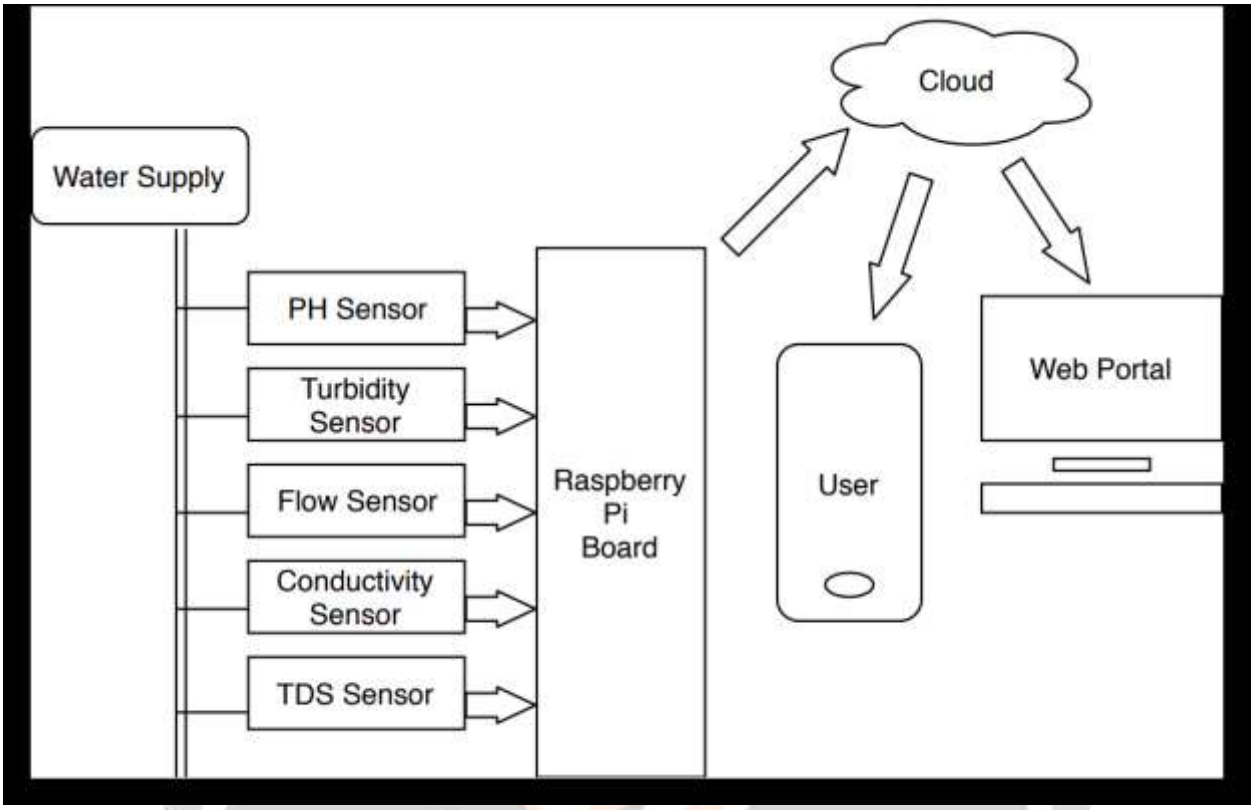
2. LITERATURE SURVEY

The Internet of Things (IoT), is a concept in which objects that we use in our daily life interacts and negotiates with other objects over the internet. This paper demonstrates real time water quality monitoring with the perspective of IoT. This section reviews some relevant research works. Li Zhenan et.al [2], introduced an intelligent water quality and control system based on wireless sensor networks to measure the quality of water. This system used the

mobile wireless sensors to monitor water quality in a remote fashion and can detect pollutant location. Wireless controlled UAVs are integrated for the marking, separation and removal of pollutant. The technical challenges such as sensor selection and wireless control are addressed with customized novel algorithms. But UAV control algorithm is not efficient method for control wireless systems. Mithila Barabde1 et.al [3] proposed new system for water quality assurance. This system is based on wireless sensor network (WSN) which makes use of ZigBee. Another important fact of this system is the easy installation of the system that is the base station can be placed at the local residence close to the target area and the monitoring task can be done by any person with very less training at the beginning of the system installation. One important aspect is the system should work in different environment in more effective way, but using this system it is difficult to get reliable results in every situation. A. Fredrick et.al [4], developed new prototype based on IEEE 802.15.2.4 and solar energy for water quality monitoring is described. The prototype used ECHERP routing protocol for energy conservation purposes and solar panels are used instead of batteries to ensure the system will last in a long period of time. But evidently solar energy technologies remain to be very costly alternative. The fabrication of solar modules and their installation entail large amount of resources. Main drawbacks of this system are costly and difficult to deploy the system. Akila U et.al [5], presented a water quality monitoring system based on wireless sensor network. The system consisting the base station and several sensor nodes. In the node side, water quality data was collected by sensors such as pH and Temperature. Here authors used ARDUINO UNO 3 as hardware component to interface between sensors and GSM module to develop the system. Drawbacks of this system are measures only pH and Temperature of water. It will not measure Turbidity of water and data storage module is not presented in this work. Thamarai Selvi D et.al [6], presented a design of real time monitoring of drinking water quality system at consumer sites. The proposed system consist of several in pipe water quality sensors. These are low power, lightweight and capable to process of data. The System is validated to enable these sensor nodes to make decisions and trigger alarms when anomalies are detected. This automated water utility billing system will overcome the difficulties in existing Water distribution system. The total costing of the meters is supposed to reduce so as the system will be economical along with power consumption reduction will be achieved by programming. Proposed system as per user requirement that is for monthly billing cycle it will be in active mode once in a month and rest of the time it will be sleep mode. But these systems are bulky and remain cost prohibitive for large scale deployments such systems can take frequent samples of the water quality at a very limited number of locations. Amruta Boyne et.al [7], did the detailed study of embedded PLC and its pros and cons. Later, they developed a new system to measure the quality of water. Extra hardwares like camera, LCD, SD card, Ethernet, LAN with many allied techniques were used in that system. The sensors pH and TDS (Total Dissolved Salt) will be kept in the river water surface and the data captured by the sensor will be given to Arm cortex M3 – Microcontroller and then data is captured and transmitted to an authentic source. After calculating the vital inference from the sensed data its analyzed. But microcontroller is specific to particular application and also this system has more complex architecture than the system which is developed using Raspberry Pi 2.

3. SYSTEM ARCHITECTURE

The water quality measurement system uses pH, turbidity and TDS sensors to measure the standard of water. These sensors measure the corresponding values in the water. These three sensors are connected to Raspberry Pi. The Measured information send to Raspberry Pi. the output of the pH sensor is analogue in nature, so, it is converted in to digital using ADC (analog to digital converter). System uses wireless network for communication with the control centre. It's a real time system and it doesn't required any man machine interaction. The systematic arrangements of the components are shown in the Fig 1. The Raspberry Pi is a small sized single-board computer. All Raspberry Pis included the same Video Core IV GPU and either a single core ARMv6-compatible CPU or an ARMv7-compatible quad-core one. Pi is also included the 1 GB of RAM or a Micro SDHC one for boot media. In this work Raspberry Pi 2 model is used. The pH sensor, Temperature sensor and Turbidity sensor are connected to Raspberry Pi as shown in the Figure 1. Python programming language is used to connect various sensors. PHP and html languages are used for Graphical User Interface. For information storage and retrieval MySql is used. The pH Electrode BNC is used to measure the pH value of the water. It is a gel-filled combination pH electrode designed to make measurements in the pH range of 0 to 14.The body that extends below the glass sensing bulb of the electrode makes this probe ideal for making measurements in the environment.



4. MATHEMATICAL MODEL

- **S =(I, O, F, Success, Failure)**
  I = Set of INPUTS
  O = Set of OUTPUTS
  F = Set of FUNCTIONS
  Success = Success case
  Failure = Failure case

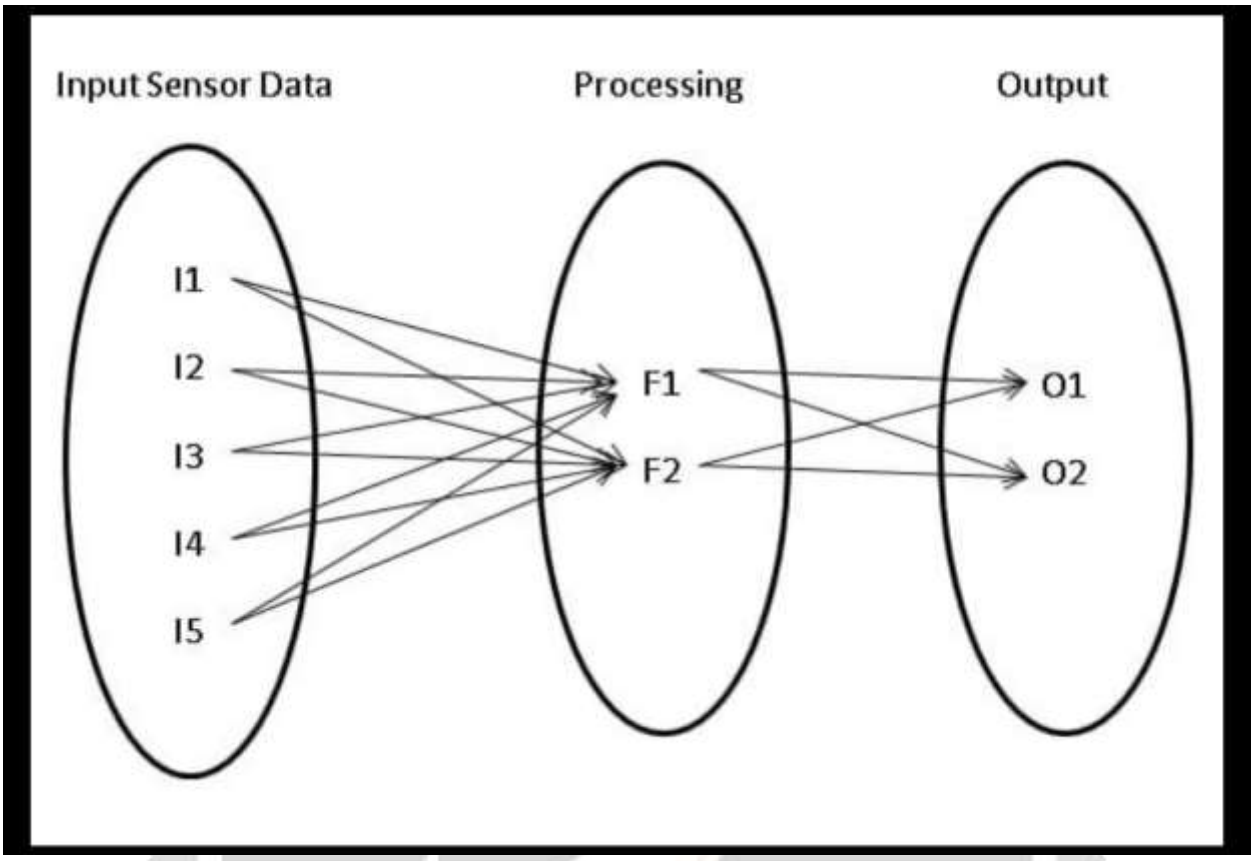
- **I =(i1, i2, i3, i4,i5)**
  i1 = Ph sensor data
  i2 = Turbidity sensor data
  i3 = Flow sensor data
  i4 = Temerature sensor data
  i5 = TDS sensor data

- **O= (i1, o2)**
  o1 = Show data on Display
  o2 = Send data on cloud

- **F = (f1, f2)**
  f1 = Store data on database
  f2 = Predict purity

- Failure = System not showing accurate information.

- Success = System showing accurate information.



4. CONCLUSIONS

Monitoring of Turbidity, PH, Temperature of Water makes use of water detection sensor. The system can monitor water quality automatically, and it is low in cost and automatic. So the water quality testing is likely to be more convenient and fast. The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters. The operation is simple. By keeping the embedded devices in the environment for monitoring enables self protection to the environment.

5. ACKNOWLEDGEMENT

Divya Pathak Department of Electronics & Communication Engg.,R. N. Modi Engineering College, Rajasthan Technical University, Kota, Rajasthan, India**.**

6. REFERENCES

[1]. Aaditya Jain, Bhuwnesh Sharma, Pawan Gupta, "Internet of Things: Architecture, Security Goals and Challenges-A Survey", 3rd International Conference on Recent Trends in Engineering Science and Management (ICRTESM), ISBN:978-81-932074-4-4, 2016.
[2]. Li Zhenan, Wang Kai, Liu Bo, "Sensor-Network based Intelligent Water Quality Monitoring and Control", International Journal of Advanced Research in Computer Engineering &Technology, Volume 2, Issue 4, April 2013, ISSN: 2278 – 1323.
[3]. Mithila Barabde1, Shruti Danve, "Real Time Water Quality Monitoring System", International Journal of Innovative Research in Computer and Communication Engineering, June 2015, ISSN: 2320 – 9801.

[4]. A. Fredrick Romanus Ishengoma, "A Novel Design of IEEE 802.15.4 and Solar Based Autonomous Water Quality Monitoring Prototype using ECHERP", International journal of Computer Science & Network Solutions, January 2014, Volume 2, ISSN: 2345-3397.
[5]. Akila U, Elackiaselvi R, Mahaeshwari R, Shunmugavalli K, Mrs .T. Prathiba, "Industrial sewage water quality monitoring system", International Journal of Advanced Engineering Research & General Science, Volume 3, Issue 2, March-April, 2015, ISSN: 2091-2730.
[6]. Thamarai Selvi D, Anitha S.R, "Potable Water Quality Monitoring and Automatic Billing System", International Journal of Advanced Research in Electrical, Electronics 10and Instrumentation Engineering, Volume 4, Issue 4, April 2015.
[7]. Amruta Boyne, Prof. S. N. Kulkarni, "Build out of Embedded PLC for Water Quality Monitoring", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5, Issue 6, June 2015, ISSN: 2277 128X.
[8]. http://crest.cuny.edu/hires/wpcontent/uploads/2014/08/HIRES_Experiment_Module_Water1.pdf.
[9]. https://en.wikipedia.org/wiki/Raspberry_Pi.
[10]. Diersing, Nancy (2009). "Water Quality: Frequently Asked Questions." Florida Brooks National Marine Sanctuary, Key West, FL.