A Low Cost System for Real Time Water Quality Monitoring and Controlling using IoT

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***Abstract*— Water is a prerequisite element required for humans and therefore there must be mechanisms put in place to vigorously test the quality of drinking water in real time. This paper proposes a low cost system for real time water quality monitoring and controlling using IoT. The system consist of physiochemical sensors which can measures the physical and chemical parameters of the water such as Temperature, Turbidity, Conductivity, pH and Flow. By these sensors, water contaminants are detected. The sensor values processed by Raspberry pi and send to the cloud. Finally 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 sensors;Cloud; Cloud Computing

I. INTRODUCTION

Clean drinking water is the most valuable resource for humans. Any imbalance in the water quality would seriously affect the health condition of the humans. Now a day's 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.

As the recent survey of WHO estimated that in India 77 million people face problems due to unsafe drinking water and 21% of the diseases are related to impure water. WHO also estimated that 1600 people die every day in India due to diarrhea .

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 [1-5]. 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. Raspberry pi 3 model B 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.

II. RELATION WITH IOT

The IoT is a revolutionary technology which changed human lives from past decade [6]. The term IoT was first used in 1994 by British technology. IoT stands for Internet of Things or Internet of Everything; it is a proposed set up in which existing, common-day-to-day objects like machines, sensors, appliances and people connect through a network and will able to transfer data over network without human intervention [7]. There are several embedded technologies related to IoT are ubiquitous computing, RFIP, wireless technology and cloud computing.

Cloud computing is an on-demand computing or Internet based computing, it is low cost technology that process the data during run time. A characteristic of the IoT has been discussed in [8-12].IoT has a lot of applications in various fields and can solve so many day to day problems. The application areas include home automation, smart cities,

978-1-5386-1887-5/17/$31.00 ©2017 IEEE

industrial automation, health monitoring and smart environment like water quality monitoring etc. By this technology, water quality is monitored and controlling is performed through internet.

III. METHODOLOGY

In this section, we present theory on low cost system for real time water quality monitoring and controlling using IoT. In section A, the proposed system overall block diagram is explained .In section B, each and every block of the system is explained.

A. Overall Block Diagram

The overall block diagram of the system is shown in Fig. 1

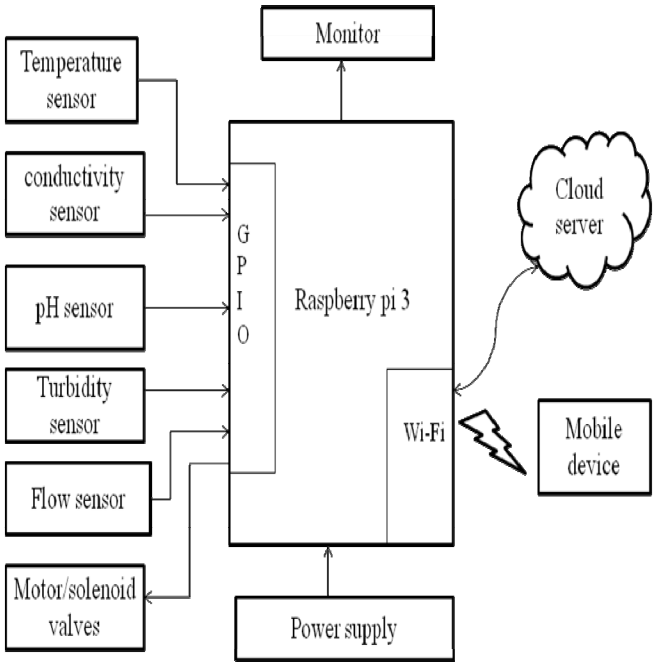

Fig.1. Block diagram

The proposed system consist of physiochemical sensors which measures water quality by pursuing Temperature, Turbidity, Conductivity, pH, Flow. To control the flow of water solenoid valve is used. They are connected to core controller which processes the data and sends to the internet. The sensed values viewed on internet browser can be controlled by sending simple commands through internet solenoid whether to ON (or) OFF the valves.

B. Proposed System

In this system, several sensors are used for measuring water quality parameters such as pH, turbidity, conductivity, temperature and flow .The measured values are sent to the core controller by ADC. Raspberry pi 3 is a core controller with high speed, Wi-Fi and Bluetooth compatibility. Raspbian os is boot on raspberry pi. Raspbian is linux-kernal based computer operating system. Python program is used to access terminals of the sensors which will read and process the sensed values automatically .The Raspberry Pi comes equipped with a range of drivers for interfacing. However, it's not feasible to load every driver when the system boots, as it will increase the boot time significantly and use a considerable amount of system resources for redundant processes. Then the monitoring parameters of the water from the sensors are transmitted through IoT module to the gateway.

A gateway is created on Raspberry pi, which is responsible for data analysis and forwarding the sensed data to server [13]. The UDP packets are generated at the gateway and encapsulate the sample data that is to be sent to remote server. The server collects UDP packets and stores at data base. With separate IoT account sensed values are viewed and solenoid valves controlled from anywhere in the world using the in internet. Wi-Fi is used for accessing mobile devices.

IV. EXPERIMENTAL RESULTS

In this section, we present results of physiochemical sensor values and condition of controlling unit. In different areas like aqua farming, drinking water distribution system etc, the water quality monitoring and controlling is very important. By this system, we can monitor the water quality and control the flow of water through internet by cloud computing. The values measured by sensors are stored in separate web server. We can view the results with separate IP address .The Fig. 2 Shows the output results from internet browser, Fig. 3 Shows the output result on mobile device.

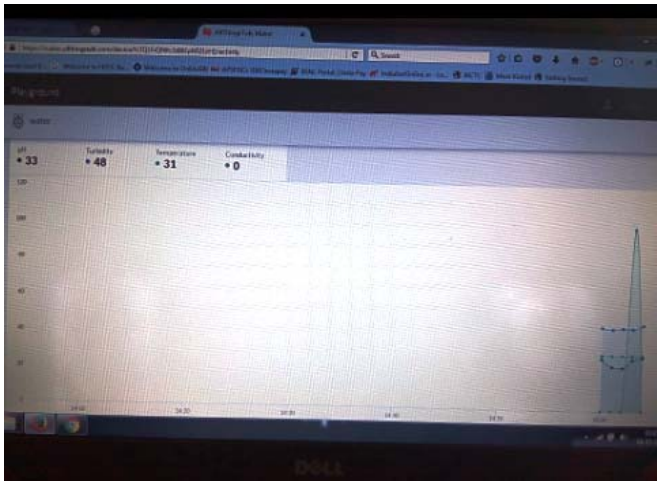

Fig.2.Output Results from Internet Browser

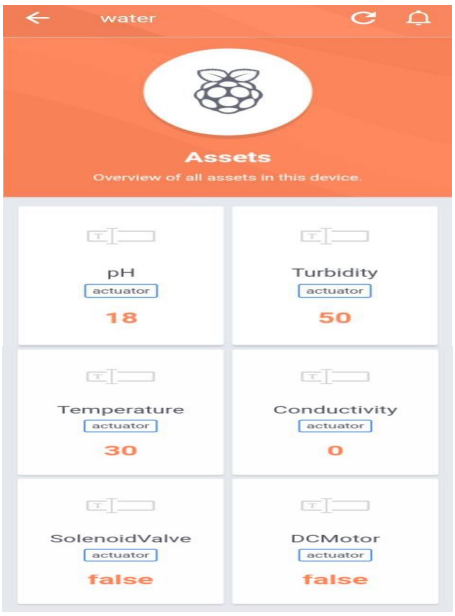

Fig .3.Output Results on Mobile Device

V. CONCLUSION

In this article, the design and development of low cost system for real time monitoring of water quality and controlling the flow of water by using IoT is presented. The proposed system consists of sensors for water quality monitoring and solenoid valve for controlling the water flow in the pipeline. These devices are low in cost, high efficient and flexible. These are connected to Raspberry pi core controller and IoT module. Finally sensed values viewed and controlling is performed by internet and also through Wi-Fi to mobile devices.

This system is used in many fields like water distribution system, industries and aqua farming. This monitoring and controlling process can be performed at anytime and anywhere in the world. In future, we can include biological sensor for better detection of contaminants in water and can install the system in several locations for high spatiotemporal coverage.

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