ISSN No: - 2456 – 2165

# Water Quality Monitoring Using IOT

Syed.Rabiya Basri
M.Tech, Embedded System
Indira institute of technology and sciences.
Markapur,Prakasam,Andhra Pradesh.
syedrabiyabasri@gmail.com

N.santhi priya
Assistant professor, Embedded System
Indira institute of technology and sciences.
Markapur,Prakasam,Andhra Pradesh
nerurisanthi@gmail.com

**Abstract: In order to ensure the safe supply of the drinking water the quality needs to be monitored in real time. In this paper we implement a design and development of a low cost system for real time monitoring of the water quality using IoT(Internet of Things). The system consists of several sensors which are used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, conductivity of the water can be measured. The measured values from the sensors can be processed by the core controller. The raspberry PI model can be used as a core controller. Finally, the sensor data can be viewed on internet using IoT.**

**Keywords**: water quality monitoring, Internet of Things, Raspberry PI.

## I. INTRODUCTION

utilities faces new challenges in real-time operation. This challenge occurred because of limited water resources growing population, ageing infrastructure etc. Hence therefore there is a need of better methodologies for monitoring the water quality.

## II. PREVIOUS/EXISTING METHODS

Traditional methods of water quality involve the manual collection of water sample at different locations, followed by laboratory analytical techniques in order to character the water quality. Such approaches take longer time and no longer to be considered efficient. Although the current methodologies analysis the physical, chemical and biological agents, it has several drawbacks:

a) poor spatiotemporal coverage
b) it is labor intensive and high cost (labor, operation; and equipment)
c) the lack of real time water quality information to enable critical decisions for public health protection. Therefore, there is a need for continuous online water quality monitoring.
d) 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 focusing on the above issues our paper design and develop a low cost system for real time monitoring of the water quality in IOT environment. In our design raspberry PI is used as a core controller. The IOT module also provides a Wi-Fi for viewing the data on mobile.

## III. IN RELATION WITH IOT

The internet has changed all the human lives in past decade. The IOT becomes a foundation for connecting things, sensors and other smart technologies. IOT is an extension of the internet. IOT gives an immediate access to information about physical objects and leads to innovative service with high efficiency and productivity. There are several important technologies related to the IOT are ubiquitous computing, RFID, wireless sensor network, cloud computing. The IoT application areas include home automation, water environment monitoring, and water quality monitoring etc. The water quality monitoring application involves large distributed array of monitoring sensor and a large distribution network. It also requires separate monitoring algorithms.

## IV. METHODOLOGY

This system consist of several sensors (temperature, Ph, turbidity, conductivity) is connected to core controller. The core controller are accessing the sensor values and processing them to transfer the data through internet. Raspberry PI is used as a core controller. The sensor data can be viewed on the internet using cloud computing with a separate IP address.

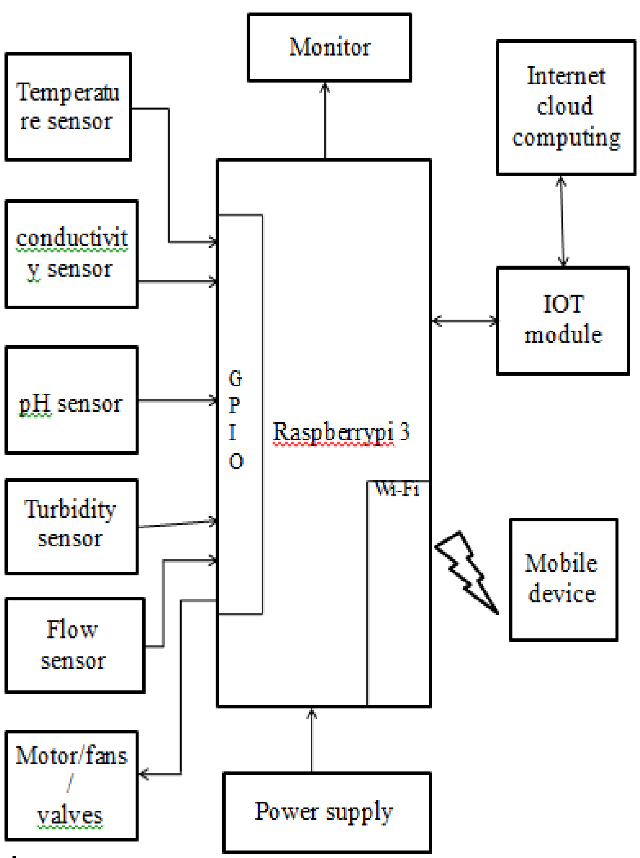
## V. PROPOSED SYSTEM

In our proposed method, Raspberry PI is used as a core controller. The temperature sensor, conductivity sensor, turbidity sensor, Ph sensor can be read directly from the command line. However, this requires us to input a command every time we want to know the sensors reading. In ordered to access all the terminals of the sensors, python program is used, which will read the sensors value automatically at set time intervals.

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. The gateway is responsible for data analysis and forward sensing data to the remote server.

### *A. Block Diagram*




### *B. Hardware Raspberry PI*

## VI. SPECIFICATIONS

| | |
|---|---|
| **Audio Type** | 3.5 mm Jack, HDMI USB 4 x USB 2.0 Connector |
| **Brand/Series** | Raspberry Pi 3 Series |
| **Camera Input** | 15-Pin MIPI Camera Serial Interface (CSI-2) |
| **Card Slot** | Push/Pull Micro SDIO |
| **Dimensions** | 85 x 56 x 17 mm |
| **Interface** | HDMI, USB, Bluetooth 4.0 |
| **Memory** | LPDDR2 |
| **Operating System** | Boots from Micro SD Card, running a version of Linux or Windows 10 IoT |
| **Power** | Micro USB Socket 5V1, 2.5A |
| **Processor Speed** | 1.2 GHz |
| **Processor Type** | Quad-Core ARM Cortex-A53 |
| **RAM Size** | 1 GB |
| **Special Features** | 802.11 b/g/n Wireless LAN and Bluetooth 4.1(Bluetooth Classic and LE) |
| **Type** | Single Board Computer (Open Frame) |
| **Video Output** | HDMI, Composite RCA (PAL and NTSC) |

## VII. OVERVIEW

### A. *Raspberry Pi 3 Model B*

The Raspberry Pi 3 Model B is the third generation Raspberry Pi. More than 10x faster than the original Raspberry Pi B. Wireless LAN & Bluetooth have been added to this powerful credit-card sized single board computer which makes this ideal for connected & IoT applications . Same footprint & connections allow easy migration. The new 5V1 2.5A power supply is required as well as the NOOBS software rev. 1.5 for the Raspberry Pi 3 Model B.

### B. *Features*

- Broadcom BCM2387 chipset. 1.2GHz Quad-Core ARM Cortex-A53
- Wi-Fi 802.11 b/g/n Wireless LAN and Bluetooth 4.1
- Memory: 1GB LPDDR2
- Dual Core Video Core Multimedia Co-Processor

## VIII. HARDWARE SETUP

The Raspberry Pi board contains a processor and graphics chip, program memory (RAM) and various interfaces and connectors for external devices. Some of these devices are essential, others are optional. RPi operates in the same way as a standard PC, requiring a keyboard for command entry, a display unit and a power supply.

It also requires „mass-storage", but a hard disk drive of the type found in a typical PC is not really in keeping with the miniature size of RPi. Instead we will use an SD Flash memory card normally used in digital cameras, configured in such a way to „look like" a hard drive to RPi"s processor. RPi will "boot" (load the Operating System into RAM) from this card in the same way as a PC „boots up" into Windows from its hard disk.

1. Begin by placing your SD card into the SD card slot on the Raspberry Pi. It will only fit one way.

2. Next, plug your keyboard and mouse into the USB ports on the Raspberry Pi.

3. Make sure that your monitor or TV is turned on, and that you have selected the right input (e.g. HDMI 1, DVI, etc).

4. Connect your HDMI cable from your Raspberry Pi to your monitor or TV.

5. If you intend to connect your Raspberry Pi to the internet, plug an Ethernet cable into the Ethernet port, or connect a WiFi dongle to one of the USB ports (unless you have a Raspberry Pi.

6. Connect the micro USB power supply. This action will turn on and boot your Raspberry Pi.

## IX. TEMPERATURE SENSOR

### A. *Thermostat*

Thermistors are thermally sensitive resistors whose prime function is to exhibit a large, predictable and precise change in electrical resistance when subjected to a corresponding change in body temperature. Negative Temperature Coefficient (NTC) thermistors exhibit a decrease in electrical resistance when subjected to an increase in body temperature and Positive Temperature Coefficient (PTC) thermistors exhibit an increase in electrical resistance when subjected to an increase in body temperature. 95 percent of the temperature sensors we use are NTC.

- Thermocouple
- Resistance thermometer
- Silicon band gap temperature sensor

### B. *PH Sensor*

PH measurements are predominantly conducted with pH-sensitive glass electrodes, which have, in general, proven satisfactory in measurements of pH. However, the behavior of pH-sensitive glass electrodes often falls short of what precision is required. Since pH fluctuations in marine waters are very small, an absolute accuracy of less than 0.1 pH units and a resolution of at least 0.01 pH units is required. For an assessment of the CO2/CO3 systems even a higher accuracy is necessary.

### C. *Turbidity Sensor*

Turbidity is defined as the reduction of transparency of a liquid caused by the presence of undissolved suspended matter. Turbidity sensors measure the amount of light that is scattered by the suspended solids in water. As the amount of total suspended solids (TSS) in water increases, the water"s turbidity level (and cloudiness or haziness) increases. Turbidity sensors are used in river and stream gagging, wastewater and effluent measurements, control instrumentation for settling ponds, sediment transport research, and laboratory measurements.

### D. Conductivity Sensor

Conductivity measurements are used routinely in many industrial and environmental applications as a fast, inexpensive and reliable way of measuring the ionic content in a solution. Conductivity switches make use of conductivity sensing technology or conductance method for liquid level detection. Conductance method of liquid measurement and control is considered to be very simple in operation. Their working depends upon the electrical conductance or conductivity of the process liquid being measured. The liquid under measurement can typically conduct a current with a low voltage power source having voltage usually less than 20 Volts. "One common way to set up an electrical circuit is to use a dual-tip probe that eliminates the need for grounding a metal tank. Such probes are generally used for point level detection, and the detected point can be the interface between a conductive and nonconductive liquid.

## IX. SOFTWARE

*Smart living:-* Smart Living enables consumers to enjoy the possibilities that life offers, through seamlessly and remotely managing their connected homes from anywhere, at anytime, on any screen in real time.

Essence Smart Living opens up new business opportunities for service providers looking to differentiate their offerings with an easy to install, DIY app-based self-managed, simple to use and comprehensive Smart Home solution enabled by Internet of things and M2M communication technologies.

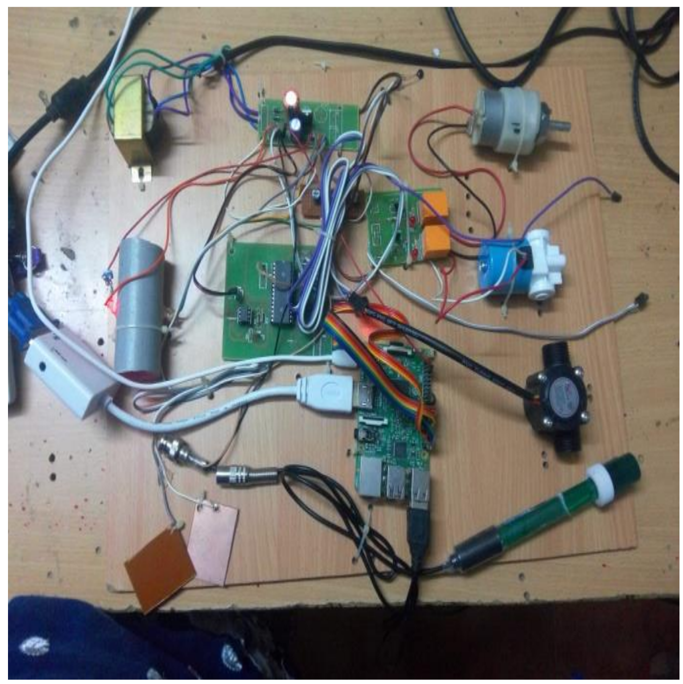
## X. PYTHON IDLE

IDLE is Python"s Integrated Development and Learning Environment.
IDLE has the following features:

- coded in 100% pure Python, using the tkinter GUI toolkit
- cross-platform: works mostly the same on Windows, Unix, and Mac OS X
- Python shell window (interactive interpreter) with colorizing of code input, output, and error messages
- multi-window text editor with multiple undo, Python colorizing, smart indent, call tips, auto completion, and other features
- search within any window, replace within editor windows, and search through multiple files (grep)
- debugger with persistent breakpoints, stepping, and viewing of global and local namespaces
- configuration, browsers, and other dialogs

## XI. RESULTS

The Water quality monitoring is important for several applications such as environment monitoring of pond and ecosystem, drinking water distribution and measurement, Contamination Detection in Drinking Water etc. such applications need a separate technique for monitoring the water quality. In our proposed system, we can monitor the water quality parameters on the internet by using cloud computing. The water quality parameters values are stored in separate web server on the cloud.

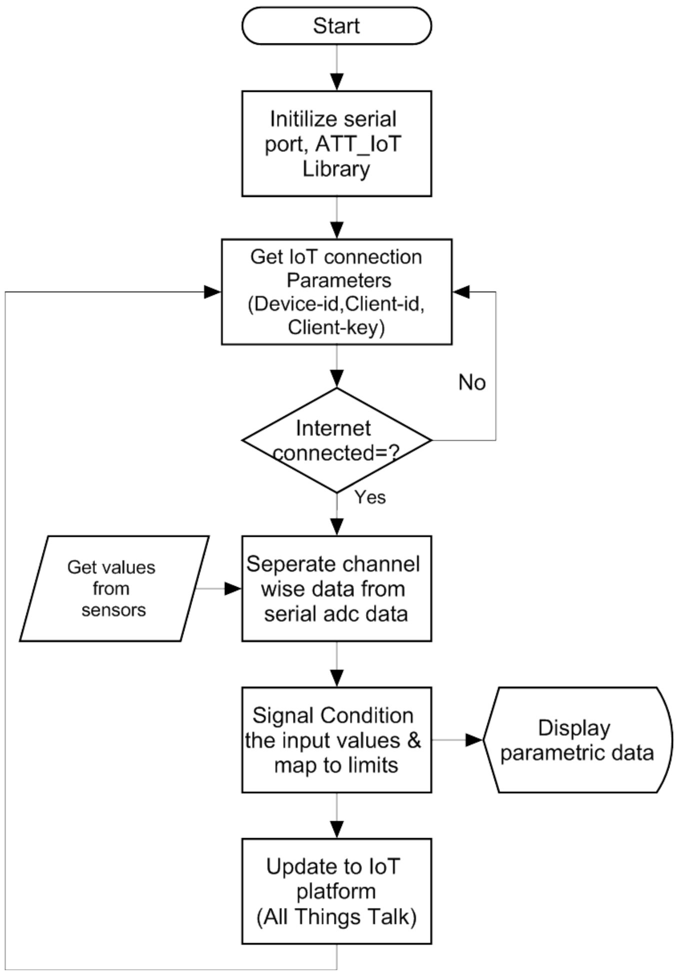


## XII. CONCLUSION

In this paper, the design and development of the real- time monitoring of the water quality parameters in IoT environment is presented. The proposed system consists of several water quality parameter sensors, Raspberry PI core controller and an IoT module. These devices are low cost, more efficient and capable of processing, analyzing, sending and viewing the data on cloud and also through WIFI to mobile device. The implementation of this system is suitable for environment monitoring and the data can be viewed anywhere in the world.
In the future, we plan to implement biological parameter of the water and install the system in several location of pond and

also in water distribution network to collect water quality data and send to water board.

*A. Flow Chart*




## REFERENCES

[1]. Alif Syarafi Mohamad Nor, Mahdi Faramarzi, Mohd Amri Md Yunus, and Sallehuddin Ibrahim "Nitrate and Sulfate Estimations in Water Sources Using a Planar Electromagnetic Sensor Array and Artificial Neural Network Method," IEEE sensors journal, vol. 15, no. 1, January 2015.

[2]. D. M. Surgient. (2014). "The Five Defining Characteristics of Cloud Manufacturing," eBook.

[3]. "A Low-Cost Sensor Network for Real-Time Monitoring and Contamination Detectionin Drinking Water Distribution Systems ", Theofanis P. Lambrou, Christos C. Anastasiou, Christos G. Panayiotou, and Marios M. Polycarpou, IEEEsensors journal, vol. 14, no. 8, August 2014.

[4]. A. Aisopou, I. Stoianov, and N. Graham, "In-pipe water quality monitoring in water supply systems under steady and unsteady state flow conditions: A quantitative assessment," Water Res., vol. 46, no. 1, pp. 235–246, 2012.

[5]. "Online Drinking Water Quality Monitoring: Review on Available and Emerging Technologies", Muinul H. Bann, Syed Imran, Alex Francisque, HomayounNajjaran, RehanSadiq, Manuel Rodriguez&MinaHoorfar Journal: Critical Reviews in Environmental Science and Technology. Volume 44, Issue 12, June 2014, pages 1370-1421