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# IOT Based Real time water Monitoring System for Smart City

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**Abstract:- Water is an important resource for life and its existence. Nowadays, due to increase in migration from a rural area to urban areas, the population in cities is increasing rapidly. To satisfy the water requirement and water quality monitoring needs, we are proposing an approach which is based on IoT (Internet of Things). In this paper we present an IoT based model for water level and quality monitoring. The data will be collected using sensors and accessed on real time basis through website. The proposed system consist different sensors like water flow sensor, pH sensor, water control valve, water level sensor and a raspberry PI 0W as a core controller. The data received from the sensors is processed by a microcontroller and sent to the cloud via a wireless communication module.**

***Keywords***:- *Water controlling, water quality monitoring, IoT, cloud computing, Ph sensor, water flow sensor, water level sensor, Raspberry Pi 0W.*

## I. INTRODUCTION

Drinking water is becoming more harmful and contaminated due to urbanization, industrialization and increase in population. Hence there is need of better methodologies for monitoring the water quality. For examining the water quality manual efforts were required for testing. Such approaches take longer time and no longer to be considered efficient. By focusing on the above issues our model develop a low cost system for real time monitoring of the water quality in IOT environment.

### *A. Internet of Things (IoT)*

The Internet of Things (IoTs) can be used for connecting objects like smartphones, Internet TVs, laptops, computers, sensors and actuators to the Internet where the devices are linked together to enable new forms of communication between things and people, and between things themselves. Building IoTs has improved significantly in the past few years. The number of devices connected to the internet are increasing day by day. The cost related with machine to machine communication over mobile networks are usually cheaper than fixed networks. Now people can have connectivity from anywhere and anytime for anything. The Internet of Things is being used in number of sectors, from automation, transportation, energy, healthcare, financial services, wearable devices, security, agriculture to nanotechnology.

### *B. Problem statement*

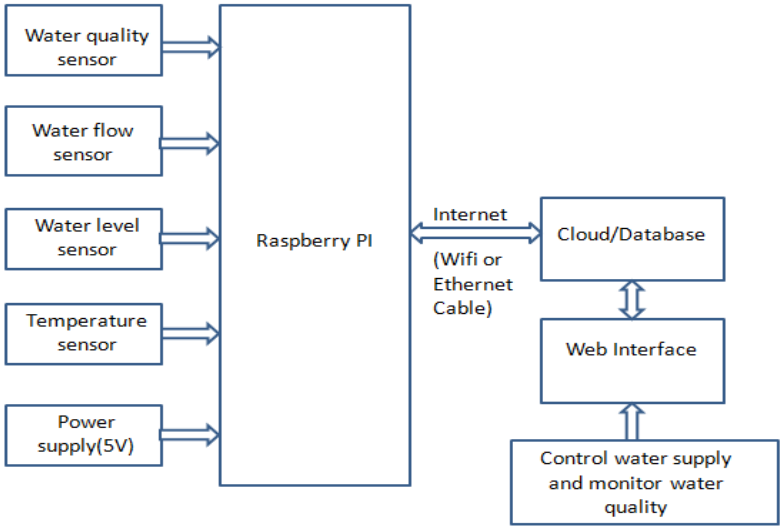
Existing water treatment systems cannot detect the dissolved contaminants such as chemicals. Using traditional approaches of monitoring water quality in the water management system are not safe. Chlorinating is usually used to protect micro-organisms. However, drinking too much chlorinated water leads to Cancer and other diseases. Thus, chlorine is considered as another contaminant as well as pathogen and viruses. Moreover, there is no single instrument that can detect all the possible water parameters such as pH, temperature and conductivity. Thus, our model will help curb water borne diseases by developing a real-time online water quality monitoring system. With this model we can detect all the possible water quality parameters and availability of water in water tank.

### *C. Motivation of project*

Water Pollution is a major global problem. It has been surveyed that water pollution is the leading cause of deaths and diseases worldwide. The records show that more than 14,000 people die daily worldwide. In India predictable 580 people die of water pollution related illness every day. In many developing countries, dirty or contaminated water is being used for drinking without any proper former treatment. The main reason for this happening is the unawareness among public and administration and the lack of water quality monitoring system which creates serious health related issues. Also natural phenomena also change the quality of water and results into contamination of water. The most important aspect for all living organisms is water and it is necessary to preserve water. So water quality monitoring is fundamental step for protection of water resources. Designing this system will help to monitor the quality of water based on information sensed by the sensors

submerged in water tank in order to know the various parameters of water. Using different sensors, this system can collect various parameters from water, such as temperature, pH, water level, water flow.

## II. BLOCK DIAGRAM




## III. LITERATURE SURVEY

| YEAR | PAPER NAME | AUTHOR | DESCRIPTION | LIMITATION |
|---|---|---|---|---|
| 2015 IEEE | Design of water management system | F Ntambi, C P Kruger, B J Silva, G P Hancke | The system consist of 3 wireless sensor sub-system. All communicate with each other wirelessly and send information to gateway connected to a computer which hosts the GUI. | Due to wireless transfer of data sometimes delivery of data is not ensured. There are chances of loss of data. |
| 2016 IEEE | Smart water management using IoT | Sayali Wadekar, Vinayak Vakare, Ram Ratan Prajapati | Water level sensor will provide the level of water present in the water tank and according to the level of water, water motor will automatically turn ON and OFF. Data is displayed on android application. | No quality monitoring is performed, so even if water is available in tank, without performing quality check, water will be supplied. The application needs to be downloaded and updated from time to time. |
| 017 IJIRSET | An IoT based model for smart water distribution with quality monitoring | Joy Shah | The paper focuses on water distribution using water flow sensor and water control valve will help in even distribution of water and provide adequate amount of water. | The model does not use water level sensor, so the availability of water in the tank will not be known. People will not be aware of unavailability of water. |

By considering the limitation of previous models of water management, our model overcomes the drawbacks as it includes use of cloud for storing the sensor data. This will ensure safety of data and prevent data loss. Our model also uses water level sensor which will give real time information about the level of water in the water tank. Quality monitoring will ensure supply of safe water. It displays data on website, so using website over application ensures accessing the data more rapidly and from anywhere.

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## IV. PROPOSED FRAMEWORK

In this proposed block diagram consist of several sensors (temperature, Ph, conductivity, water level, water flow) 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 website using cloud computing.

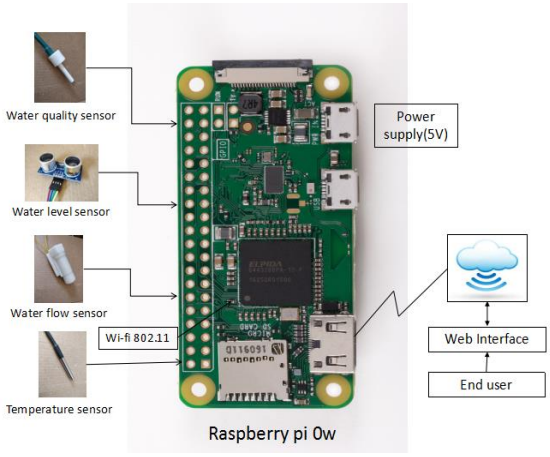


Fig 1:- Architecture diagram of water management system for smart city

*A. Water quality sensor*

The pH meter is used for the quality check if water is safe for drinking. A balanced pH level is very important for human health; it should be approximately equal to 7. It gives Full range pH reading from 1.0 to 14.00. It gives a Single reading and continuous reading modes.

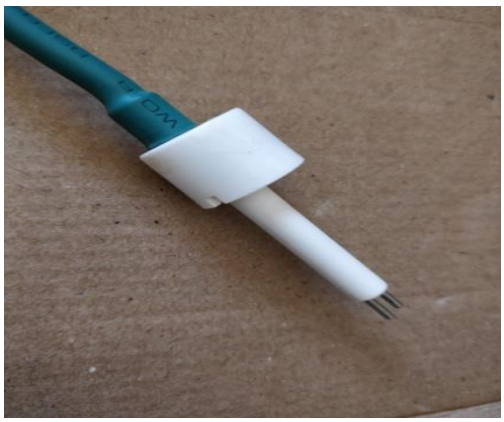

Fig 2:- Water quality Sensor

*B. Temperature sensor*

A device which gives temperature measurement as an electrical signal is called as Temperature sensor. This electrical signal will be in the form of electrical voltage and is proportional to the temperature measurement.

Fig 3:- Temperature Sensor

*C. Water level sensor*

Water level sensor will help us decide if we have enough quantity of water to be supplied. An ultrasonic wave is triggered from the sensor and distance to target is determined by calculating the time required after the echo is returned. The sensor emits a high-frequency pulse, generally in the 20 kHz to 200 kHz range, and then listens for the echo. The pulse is transmitted in a cone, usually about 6° at the apex.

Fig 4:- Water level Sensor

*D. Water flow sensor*

For continues, water flow rate measurement YF-S201 can be used. It has operating temperature range of -25C - 80C which is wide enough for our application to operate successfully.

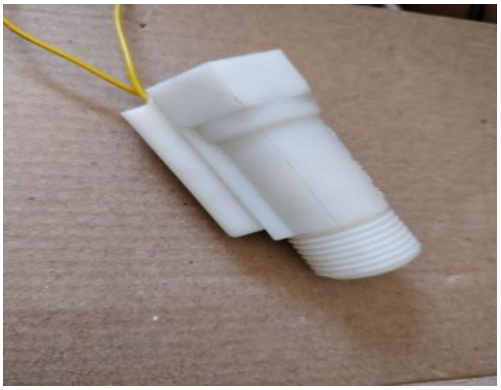

Fig 5:- Water flow Sensor

*E. Water controlling valve*

A solenoid valve is used as a water controlling valve, it is a simple electromagnetic device that converts electrical energy directly into linear mechanical motion. A solenoid valve is the combination of a mechanical valve and basic solenoid. So a solenoid valve has two parts namely Electrical solenoid and a mechanical valve. A solenoid valve is an electromechanically operated valve.


Fig 6:- Water controlling valve

*F. Cloud*

The sensors are controlled by the Raspberry Pi controller which is connected to the internet via Wi-Fi. Using the internet, Raspberry Pi sends and receives the data or command to/from Cloud for performing the real-time operation. A user can control system using web interface.

*G. Microcontroller*

The Raspberry Pi 0W is used as a microcontroller in this system, it has 26 digital input/output pins which we will use for connecting sensors-pH sensor, ultrasonic sensor, Water flow sensor, temperature sensor and solenoid valves, and can be used as outputs, a USB connection and a power jack is also present.

Raspberry Pi Zero W (Wireless) Details:

- 512MB RAM
- Mini HDMI
- USB On-The-Go port
- Micro USB power
- HAT-compatible 40-pin header
- Composite video and reset headers
- CSI camera connector
- 802.11b/g/n Wireless LAN
- Bluetooth 4.1
- Bluetooth Low Energy (BLE)

*H. Node red*

Node-RED is an Open Source project supported by IBM and is a graphical programming language used for building connected objects. For wiring all the things together in IoT Node-RED is used. When binder functions are programmed with Node-RED they are presented in the form of bricks. Thus the data stream passes from one treatment to the other (from one function to the other).

It is easy to use flow-based programming environment that helps IoT developers interact with APIs and different services. As Node-RED includes node.js, it can be run at the edge of the network or in the cloud. Over a thousand flows and nodes exist in the Node-RED library today, which enable connections to all kinds of devices and services. A Node-RED flow works by passing messages between the nodes.

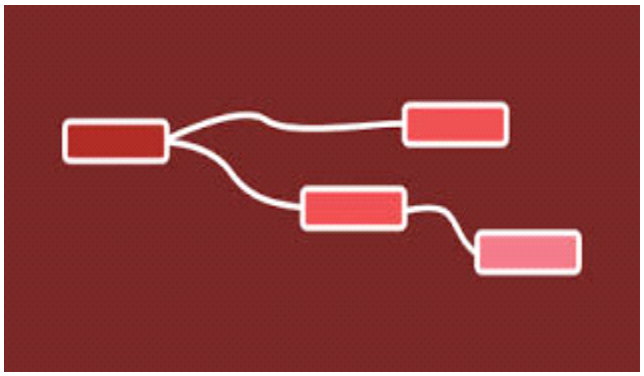

Fig 7:- Node-RED Framework

## V. SYSTEM SETUP AND ACCESS

*Steps to Access Website Offline*

STEP 1: Connect Raspberry-pi to access point.

STEP 2: Users must connect to the same network.

STEP 3: Open browser and enter following URL:

192.168.43.140:1880/ui

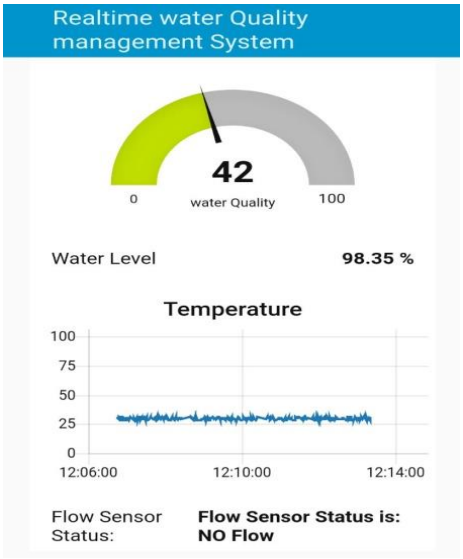


Fig 8:- Offline GUI

*To deploy the system using node-red:*

Open browser and enter following URL

192.168.43.140:1880

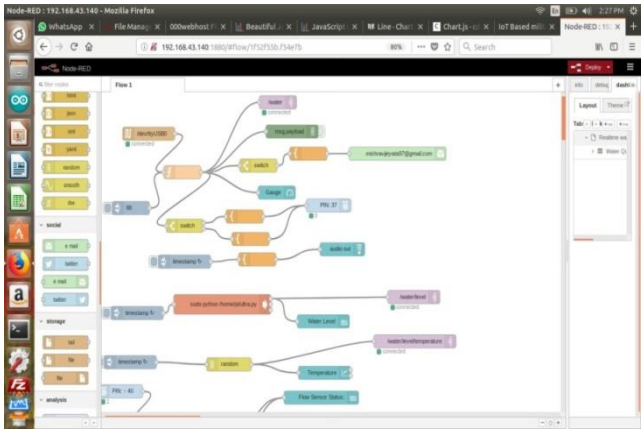

Fig 9:- Node-RED deployment

*Steps to access website online:*

Open browser and enter following URL

http://iotcrunch.in/water/index.html

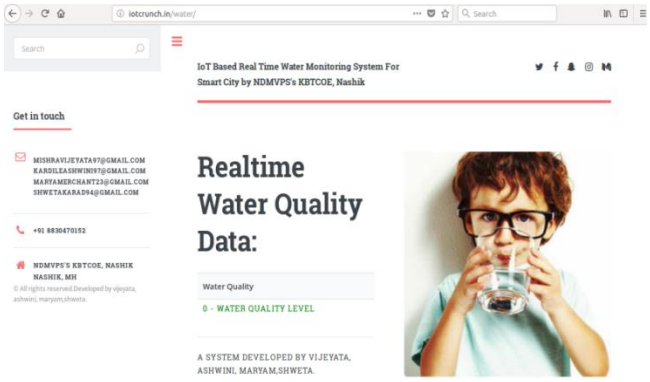


Fig 10:- Website

## VI. MATHEMATICAL MODEL

Let S be a Water Monitoring System such that

S= {I, O, F}

I= set of inputs

O= set of outputs

F= set of functions

Input: Sensor Data

I= {I1, I2, I3, I4}

I1= Water quality sensor

I2= Temperature sensor

I3= Water Flow sensor

I4= Water level sensor

Function:

F= {F1, F2, F3}

F1= get sensor data

F2= store input data on cloud

F3= display data on website

Output:

O= {O1, O2}

O1= if water is contaminated the outlet of water tank will be closed

O2= show data on webpage

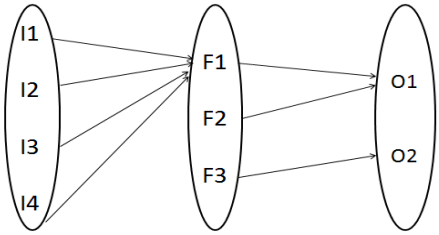


Figure: Venn Diagram

## VII. CONCLUSION

In our proposed system, water quality monitoring is presented. The proposed system is created with the use of different sensors, Raspberry Pi 0W as controller and Cloud for storing the data from Raspberry Pi and sending the command to raspberry PI for measuring water quality and water level. The generated data can be viewed using web interface all over the city. The advantage of the system is to provide the adequate water supply with good quality water to each house, industry, and others. The proposed model can be implemented as a part of the smart city.

## VIII. ACKNOWLEDGMENT

It gives us great pleasure in presenting the preliminary project report on IoT Based Real Time Water Monitoring System For Smart City. We express our heartily gratitude towards Prof. R. R. Shevale for guiding us to understand the work conceptually and also for her constant encouragement to complete this Project work on " IoT Based Real Time Water Monitoring System For Smart City". We also express our thanks to Dr. V. S. Pawar, Head of Deparment of Computer Engineering for providing necessary information and required resources. With deep sense of gratitude, we thank to our Principal Prof. Dr. K. S. Holkar and Management of the NDMVP Samaj's for providing all necessary facilities and their constant encouragement and support.

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