Intelligent Water Distribution & Monitoring System

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Abstract

This project deals with intelligent water distribution system, as the name says it is all about management of water supply throughout the scale, right from small societies, townships to entire city infrastructure and also for irrigation water reserve management. Major jobs of the water distribution organization is to support the water in the tank and also produce the water bills to the different households which engags human efforts. This proposed scheme can be computerized using the Internet of things devices.

We have used IBM IoT Platform, IBM Nodered and IBM Cloudant DB technologies to implement water monitoring and billing system. The proposed system continuously monitor the main tank water level and automatically switch on/off the motors according to the tank water level and alert the admins. It supervise the water flow of the specific homes and store the flow rate of each in the Cloudant DB to generate the water bills. Finally the authorized used can view the Tank water level and the bills in the dashboard.

Introduction

Water is a one of the primary resource and is very much essential for agriculture, industry and for all the creature existence on earth including human beings. Lots of peoples don't realize the importance of drinking good and enough water. More water are wasted by many uncontrolled way. This problems is quietly related to poor waters allocation, inefficient use, and lack of adequate and integrated water management. Therefore, efficient used and water monitoring is potential constraint for houses or office water management systems. Every living things on earth needs waters to survivals. It is known that our body is consists of more than 70 percent water. We use cleaned waters to drink, grow crop for foods, operate factory, and for swim, surf, fish and sail. Waters is vitally important to every aspect of our live. To monitoring the quality of water will help protect waterways from contamination. Farmers has used the information to help better manage their lands and crops management. Our local, state and national government use monitoring information to help control pollution levels. By using this advanced water monitoring system, we can avoid the water wastage, more power consumption and we can easily prevent the water for our future generation. In 2003, America clean water foundations had established water monitoring day as a global educational outreach programs which aims to build public understanding and involvement in protecting waters resources around the world. Tank Water Level Monitoring, is use to avoid overflow and intimate levels of waters in the tank. Water controlling system implementation make potential significances in home application. The existing automated methods of level detections is described and that can be use to make a device on/off. Moreover, the common techniques of level switch for home appliances is to start the feed pump at a very low level and allow it until it reaches a higher water levels is reached in the water tanks. This is not properly supported for adequate controlling systems. Besides this, liquid level control systems are

widely used for monitoring of liquid level, reservor, sils, and dams etc. Water pollution monitoring can help with water pollutions detections, discharge of toxic chemical and contamination in waters. And also check the quality by using Temperature, pH and turbidies are the typical parameter collected in river/lake water pollution/quality monitoring systems.

The goal of this work is to prepare and manage a Wireless Sensor Network (WSN) that helps to monitor the quality of water with the help of information monitor by the sensor in water, so as to keep the water resource described for domestic usage and to be able to take necessary actions to restore the health of the degraded water body. Water pipeline monitoring detection, Pipeline system are monitor for transporting more materials such as water, oil and gas. Any leakage in the water tank can cause financial losses and environmental damages. Currently, buried pipelines are only monitored at the important locations, which can be spaced several distances apart. A proposed system with a higher spatial monitoring would provide necessary operators with a better understanding of their locations and network. In hidden pipeline observation all these sensor nodes are employed in soil.

Change in occurrences indicate the change in flowrate of water level. This information obtained and recorded in the database enabling the authorized user to access the information easily. This information can be used at the time of bill generation. The major objectives of the proposed work are listed as:

- Monitoring of water level using the water flow sensors.
- Notifying the authorized person about the bill in system and updating the information in the database, hence providing an easy way to generate the bill at definite time intervals.
- Offers easy care of the water distribution systems for the authority

Following section deals with literature survey, proposed architecture and implementation and results and future scope of the system.

Literature Survey

According to recent survey, growth in population caused cities to face water distribution issues. Many communities suffer from insufficient water supply for their day to day needs. Lack of monitoring and controlling water distribution becomes a serious problem. Some areas in a city will have enough supply of water while other areas do not have. This is due to some problems in the distribution line such as damage pipeline cause by over pressure or low water pressure where in water cannot reach consumers located on a high-ground areas or far away from the pumping stations or water tank. All of these issues concerning water distribution are because of lack in real-time monitoring and controlling mechanism and due to its manual or traditional operation. Today, cities are now transforming and started to adapt smart technologies for sustainable communities. As they participate for economic advancement and the facilities that increase to their vibrancy, water has become a priority in their checklists [1]. Creating water sustainability requires a multidisciplinary approach. It also requires state of the art equipment to facilitate the operation and management especially in collecting and analyzing data to initiate an action for smart management, planning and decision making.

F Ntambi, C P Kruger, B J Silva, G P Hancke [2] in their paper titled "Design of water management system" discussed about the system which 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. They have mentioned the limitation that due to wireless transfer of data sometimes delivery of data is not ensured. There are chances of loss of data.

Sayali Wadekar, Vinayak Vakare, Ram Ratan Prajapati [3] in the paper titled "Smart water management using IoT" mentioned that 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. Limitation are that 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.

Joy Shah [4] in his paper titled "An IoT based model for smart water distribution with quality Monitoring" discussed that 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.

System Architecture of Water Monitoring System

In this proposed block diagram shown in Figure 1 (a) (adapted from Rupalir Shevale et. al IOT Based Real time water Monitoring System for Smart City) 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.

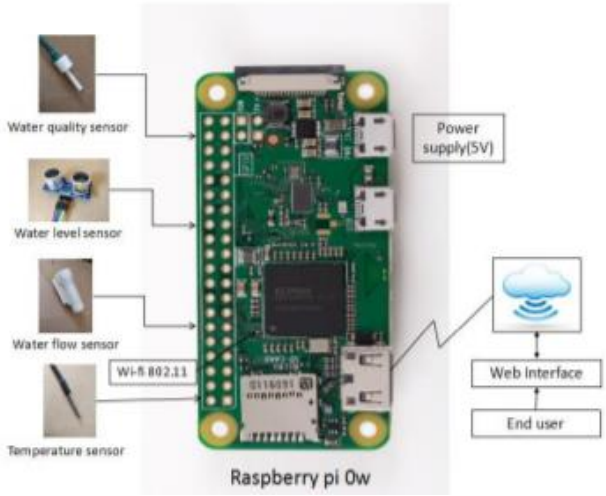


Figure 1 (a): Architecture diagram of water management system for smart city

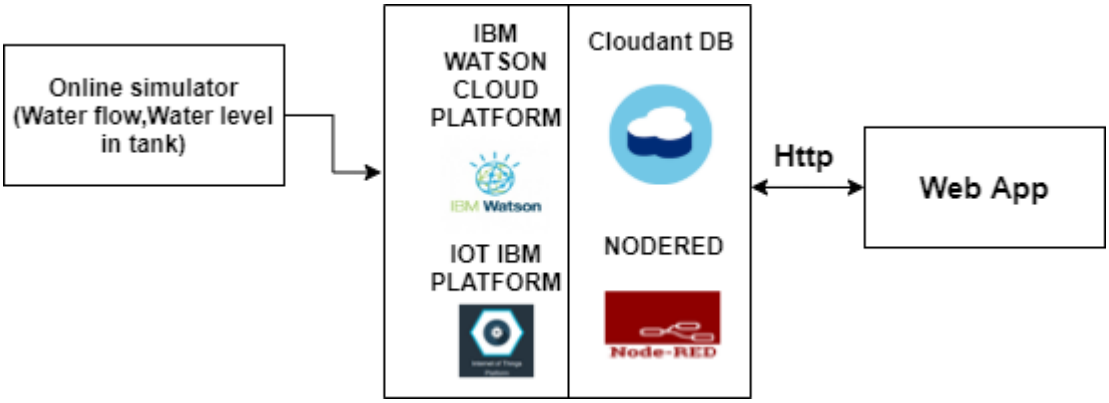


Figure 1 (b): Architecture of Water Monitoring

In Figure 1 (b) depicts, It defines the overall architecture of water monitoring system. A sensor is a hardware device that produces a measurable response signal to a change in a physical condition such as temperature, pressure and humidity. The continual analog signal sensed by the sensors is digitized by an analog-to-digital converter and sent to the embedded processor for further processing.

By using this concept we easily avoid overflowing and the water level will be indicate to user on monitoring. Automatic Water level sensing would help in reducing the home power consumption.

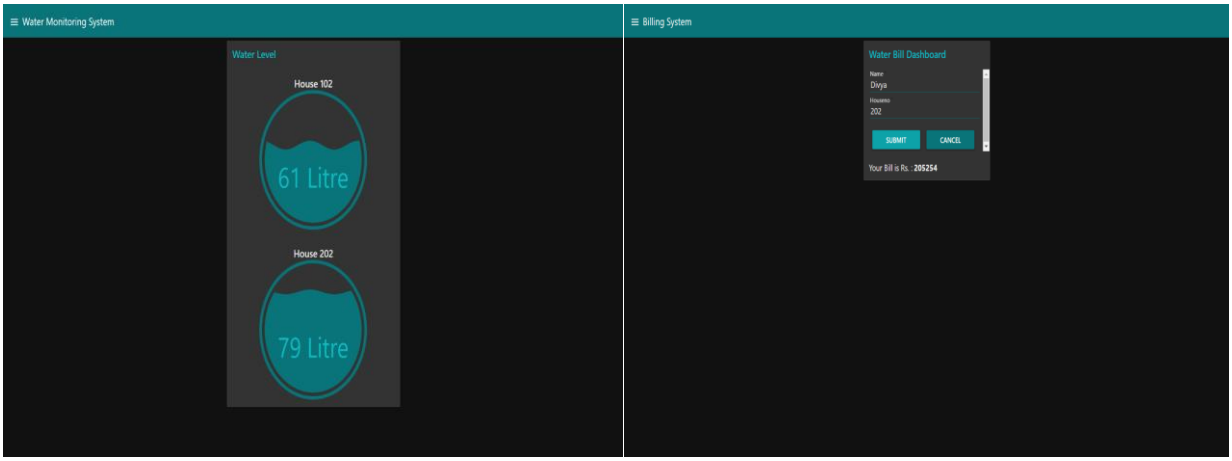
Water Monitoring and Bill Generation

A sensor node can have one or several types of sensors integrated in or connected to the node. First the water level indicator is used to indicate level of water in the tank. Following flow was maintained to automatically monitor and generate the bills for individual houses:

- Main tank water level and Water flow to individual houses is continuously updated to IBM IoT platform (Use Online simulator sensor for water flow and water level)
- Create a Node-RED flow to get the data from IBM IoT platform and store it in cloudant DB.
- Display the tank water level in the UI
- Retrieve the flowrate of individual houses and generate bills and display them in UI.

Intelligent water monitoring and water bill generation are shown in the Figure 2 (a) & (b). IBM technologies were used to simulate water monitoring and bill generation. Simulated devices were created to generate the water level and finally using Node-RED interface web based tool were created to monitor the water level by the authorized users. Node-RED is an Open Source project supported by IBM and is a graphical programming language used for building connected objects. For wiring in a simulated environment all the things together in IoT Node-RED are 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.



(a) (b)

Figure 2 (a): Water level Monitoring; (b) Generation of water bill

Conclusion & Future Scope

The final outcome of the project is a novel smart system that monitors the water level in water distribution system and generate the water bills. It also records the data regarding flow rate and total water flow in database. The project has given a cost effective solution for real time water monitoring and bill generation. Following tasks are completed:

- Water level is monitored thereby enabling the authority to respond to the level at the earliest.
- The data received at the server node was analyzed and updated to the database periodically.
- The data entered into the database can be used for bill generation.

There is a scope for future work in every project in order to improvise the project and convert it into a product which can be used. Some of the future scopes of this project are as follows

- There is a possibility of leak in the water tank, we may determine the exact location of leak by using more number of sensors.
- Chatbot and SMS facilities may be incorporated to give the real-time assistance.
- The database can be improved.

References

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