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Intelligent Water Quality and Water Supply Management System for Smart City using ARM

Mr.D.B Rane[1], Shital Ghuge[2], Payal Chaudhari [3], Pooja Tejimkar[4]

[1]Assistant Professor Dept. of Electronics Engineering, Pravara Rural Engineering college, Loni, India

[2,3,4]B.E. Student, Dept. of Electronics Engineering, Pravara Rural Engineering college, Loni, India

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Abstract - *During the past decade, water needs have increased unpredictably in India. Increasing demand of water supply has become a major challenge for the world. Wasteful usage of water, climatic changes and Urbanization has further depleted the resource. Conservation and management of the resource must be given utmost importance. In this paper, we present an IoT design for water monitoring and control approach which supports internet based data collection on real time bases. The system addresses new challenges in the water sector -flow rate measuring and the need for a study of the supply of water in order to curb water wastage and encourage its conservation. We also measure the quality of water distributed to every household by deploying pH and conductivity sensors. The traditional water metering systems require periodic human intervention for maintenance making it inconvenient and often least effective. For shortcoming of the existing models for a ubiquitous usage of wireless systems for smart quality monitoring and communicate data wirelessly.*

Key Words: **IOT, PH sensor, RTC, Water Level, ARM7 LPC2148**

1. INTRODUCTION

Water is an important resource for all the livings on the earth. In that, some people are not getting sufficient amount of water because of unequal distribution. We can use this approach so that everyone gets the equal amount of water. It is also used to avoid the wastage of water during the distribution period. In the previous method, the employee will go to that place and open the valve for a particular duration, then again the employee will go to the same place and close the valve, it is waste of time. The proposed system is fully automated. Here human work and time are saved. To ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed. In this project, we will implement the design of IOT base water quality monitoring system that monitors the quality of water in real time. This system consists some sensors which measure the water quality parameter. The real-time monitoring of water resources information will benefit the water resources management department and the public. The primary concept of real-time IOT based water resources information system is to provide comprehensive and accurate information. The system is developed through defining some explicit water resource parameters then, Water level and flow parameter are defined for water measure & management, followed by a sensor network for water resources information monitoring is constructed based on IOT.

Water quality is affected by both point and non-point sources of pollution, which include sewage discharge, discharge from industries, run-off from agricultural fields and urban run-off. Other sources of water contamination include floods and droughts and due to lack of awareness and education among users. The need for user involvement in maintaining water quality and looking at other aspects like hygiene, environment sanitation, storage and disposal are critical elements to maintain the quality of water resources.

1.1 *Internet of Things (IoT)*

pH sensor: The pH of a solution is the measure of the acidity or alkalinity of that solution. The pH scale is a 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 numbers of devices connected to the internet are increasing day by day. The costs 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.

1.2. LITERATURE REVIEW

[1]Nikhil Kedia entitled "Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project." Published in 2015 1st International Conference on Next Generation Computing Technologies (NGCT-2015) Dehradun, India. This paper highlights theentire water quality monitoring methods, sensors, embedded design, and information dissipation procedure, role of government, network operator and villagers in ensuring proper information dissipation. It also explores the Sensor Cloud domain. While automatically improving the water quality is not feasible at this point,

efficient use of technology and economic practices can help improve water quality and awareness among people.[1]

[2]Jayti Bhatt,Jignesh Patoliya entitled "Real Time Water Quality Monitoring System".This paper describes to ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed. In this paper, we present the design of IOT based water quality monitoring system that monitor the quality of water in real time. This system consists some sensors which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and this processed values are transmitted remotely to the core controller that is raspberry pi using Zigbee protocol. Finally, sensors data can view on internet browser application using cloud computing.[2]

[3]Sokratis Kartakis, Weiren Yu, Reza Akhavan, and Julie A. McCann entitled "Adaptive Edge Analytics for Distributed Networked Control of Water Systems" This paper presents the burst detection and localization scheme that combines lightweight compression and anomaly detection with graph topology analytics for water distribution networks. We show that our approach not only significantly reduces the amount of communications between sensor devices and the back end servers, but also can effectively localize water burst events by using the difference in the arrival times of the vibration variations detected at sensor locations. Our results can save up to 90% communications compared with traditional periodical reporting situations.[3]

2. PROPOSED SYSTEM

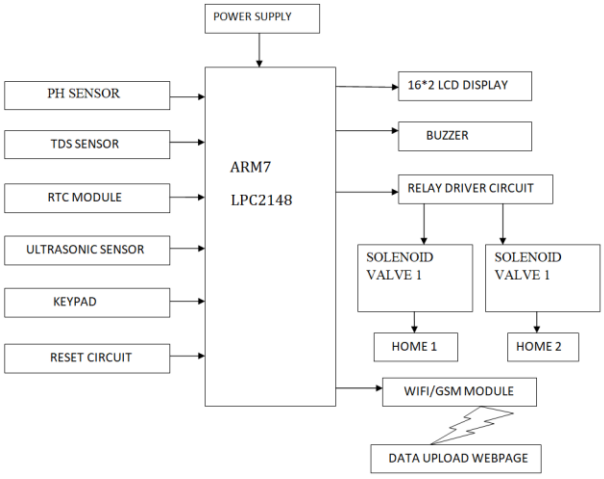

Fig 1: **Block Diagram of System**

In this, we present the theory on real time monitoring of water quality & supply management in IoT environment. The overall block diagram of the proposed method is explained. Each and every block of the system is explained in detail. In this proposed block diagram consist of several sensors (pH, TDS, ultrasonic, RTC) is connected to ARM7 controller. The controller are accessing the sensor values and processing them to transfer the data through internet. The sensor data can be viewed on the internet web server.

A. ARM7 LPC2148 Microcontroller:

The LPC2148 ARM Header Board is a Low Cost Board that can be used to quickly evaluate and demonstrate the capabilities of NXP LPC2148 (ARM7TDMI) microcontroller. The Header board is designed as DIP package with access to all Port pins for external connection. The LPC2148 ARM Header Board consists all basic components required to function the microcontroller. The board is populated with voltage regulators ,RTC crystal ,Main Crystal and necessary de-coupling capacitors.

Fig -2: **ARM7 LPC2148 Microcontroller**

B. pH sensor:

The pH of a solution is the measure of the acidity or alkalinity of that solution. The pH scale is a logarithmic scale whose range is from 0-14 with a neutral point being 7. Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. It operates on 5V power supply and it is easy to interface with controller. The normal range of pH is 6 to 8.5.

Fig -3 pH sensor

C. TDS Senor:

-This is a digital TDS meter tester for testing the purity of water, Micron Rating: 0.3, Filter Material: Polypropylene (PP)

-This item can be used in water purifiers and filters, food (vegetable, fruits) drink quality monitoring, pools, spas, aquariums and hydroponic

-Measures total dissolved solids (TDS) and temperature

-Automatic temperature compensation (ATC)

-Water-resistant housing

-Measurement Range: 0-5000 ppm

Fig -4 TDS sensor

D. Ultrasonic sensor HC05:

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.

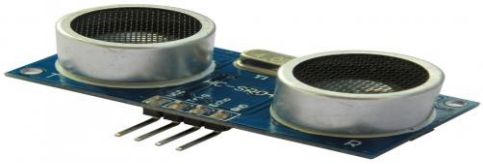

Fig -5 Ultrasonic sensor

E. Solenoid 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.

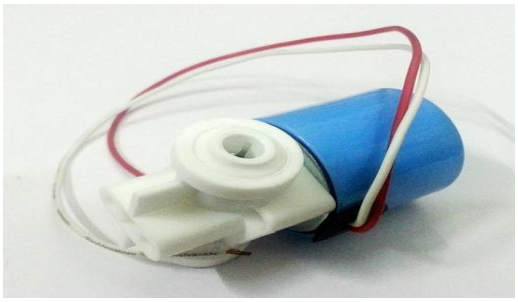

Fig -6 Solenoid valve

F. LIQUID CRYSTAL DISPLAY:

This is the first interfacing example for the Parallel Port. We will start with something simple. This example doesn't use the Bi-directional feature found on newer ports, thus it should work with most, if not all Parallel Ports. It however doesn't show the use of the Status Port as an input for a 16 Character x 2 Line LCD Module to the Parallel Port. These LCD Modules are very common these days, and are quite simple to work with, as all the logic required running them is on board.

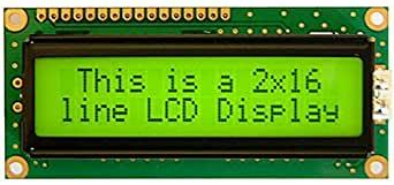

Fig -7 LCD Display

G.SIM800 GSM Module:

SIM800 can be controlled/configured using simple AT commands. A host microcontroller can send AT commands over the UART interface and control the SIM800.SIM800 operates on a supply in the range of 3.4 to 4.4V.It can be used for sending/receiving messages, making calls, sending/receiving data over the internet, etc. This makes it useful for applications such as home automation, agriculture automation, etc

Fig -8 GSM Module

3. CONCLUSIONS

In our proposed system, water quality & supply monitoring over IOT is presented. The proposed system is created with the use of different sensors, ARM7 as controller and GSM module to access internet. 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. The system can monitor water quality automatically, and it is low in cost and does not require people on duty. So the water quality testing is likely to be more economical, convenient and fast.

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