IoT Based Real Time Dam Water Level Monitoring System

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Abstract: Water is the crucial part of everyday life. Therefore, the reason behind developing this project is to create the Realtime IoT based water level measurements. The main task of monitoring is done from place nearer to dam site. For communicating with device remotely, we are going to use internet.
The term Internet of Things means making devices work based on connected data through Internet. For above purpose we are using a powerful processor Raspberry Pi which is compatible with various Internet of Things (IoT) services like WebIOPi, Node-RED, ThinkSpeak, Thingsboard, Thingworx etc. Raspberry Pi runs on Raspbian OS which is based on Debian Linux developed by Jessie. Raspberry Pi can programme with Python, JAVA and HTM. This project is modular in which project content can easily replaceable in case of malfunctioning and for maintenance.
For Internet of Things we are using Node-RED an open source platform developed by IBM. User with sufficient knowledge of Javascript, HTML/CSS programming can develop application according to need. Node-RED platform provide a source to develop a Web User-Interface.

Keywords: IoT, PLC(Programmable Logic Control), Water Monitoring.

I. INTRODUCTION

In this project we are going to measure water level of Dam and Running status of Machines present in Dam site. We are going to store data taken by connected water level sensors and on rule basis like threshold value we will send notification by Mail. We created one User Interface dashboard on which respective user can see live status of water level and connected Machine running status. We have used Internet of Things technology to send data to cloud for backup and user can see live detailed Dashboard from anywhere in the world.

First for measurement of water level there are multiple types of sensors can be used. Some examples are as follows:

- Optical
- Vibrating or tuning fork
- Ultrasonic
- Float
- Capacitance
- Radar
- Conductivity or resistance

In our project we have used Ultrasonic sensor and also capacitive type of water level sensor. This sensors will give raw value to attached processors. We have used Raspberry pi and Arduino as processor. We used Node-red as a IoT platform where we are fetching data and do required processing on it.This processors will take raw data from sensors and calibrate it. This data is stored for future use. We have created one dashboard on which current water level of each reservoir shown also current running status of machines like generator is shown.

Objective of Work:

- To monitoring of water level of various Reservoir
- Monitor Running status of Machines at Dam site.
- Store Data to Cloud.
- Implementation of the system that will provide alert to the maintenance Engineer when the water level exceeded beyond the threshold limit or when the water level reaches below the reference limit.

II. PROBLEM STATEMENT

Dams are the major sources of water supply to cities. It is necessary to implement some sort of communication between the metering systems and computer models to provide support in managing the complex systems of the hydro power plants.

Generally, the dams are monitored through traditional surveillance during flash floods. Internet of Things technology focuses on techniques and the water management except the monitoring of level of water in some of the dams which is automatized. Management of water resources through dams becomes complex as the number of users depending on dams is huge and these users may have conflicting interests. This situation gets much complex with the fact that the available resources are limited with high possibilities of droughts and floods. This affects the densely populated areas.

Dam monitoring is a tedious and long-term process which has to be improved step by step. A new system for dam water monitoring and management should be established which can provide water level in real time and can allow us to come to quick conclusions regarding the safety operations of the dams.

Internet of Things (IoT) can be defined as a network of devices which are interconnected. It comprises a set of sensors, communication network as well as software enabled electronic devices that enables end users to acquire accurate data from time to time through the communication channel and allows for data interchange between users and the connected devices.

III. LITERATURE SURVEY

[1] Monitoring system as a tool for risk evslution in water distribution system Alicja Balut, Andrzej Urbaniak 2018 In this paper, we monitor the quality of water and get the result on IOT. And we distribute the water by connecting the flow sensor.

[2] Real-time clustering for priority evaluation in a water distribution system Alexandru Predescu, C˘at˘alin Negru, Mariana Mocanu, Ciprian Lupu 2018 Nowadays with the development of smart infrastructure for water resource management, there is an increased need for efficient operation and management of water distribution infrastructures. In this paper, we propose a system for real-time clustering system priority evaluation in a water distribution system.

[3] Optimal Demand Response Scheduling for Water Distribution Systems Konstantinos Oikonomou, Roohallah Khatami, 2018. As energy intensive infrastructures, water distribution systems (WDSs) are promising candidates for providing demand response (DR) and frequency regulation services in power systems operation. However, models that tap the full flexibility of WDSs to provide the services while respecting the operational constraints of water networks are remained scarce.

[4] Smart Water Distribution Management System Architecture Based on Internet of Things and Cloud Computing Sawsan Alshattnawi, Irbid Jordan, 2017, The fast population growth needs to provide clean and affordable water that meet the human requirements. The water faces a problem in the future because of global climate change. An efficient water management and treatment is necessary to keep water quality and availability.

[5] A Novel Smart Water-Meter based on IoT and Smartphone App for City Distribution ManagementM Suresh, U. Muthukumar, Jacob Chandapillai, 2017, A novel approach to performing automated water-meter reading for update of consumption information from field to the Utilityoffice is described in this paper. The smart metering approach proposed differs from existing commercial methodologies by making use of low cost IoT hardware and smartphone app.

[6] Feasibility Study on Wireless Passive SAW Sensor in IoT enabled Water Distribution System Zhaozhao Tang, Wenyan Wu, Jinliang Gao, Po Yang 2017. Internet of Things (IoT) technology has recently been widely utilized into a variety of industrial applications. Wireless Passive Surface Acoustic Wave (SAW) sensors have attracted great attention in numerous IoT enabled applications. The sensor nodes are not directly supplied by the power supply as it absorbs the energy from the interrogating Radio Frequency (RF) pulses to excite the SAW.

[7] Research on placement of water quality in water sensor in water distribution systems Chengyu Hu 2017, In this paper, we use turbity sensor, ultrasonic sensor, Ph sensor and flow sensor for monitor and distribution of water.

IV. BLOCK DIAGRAM

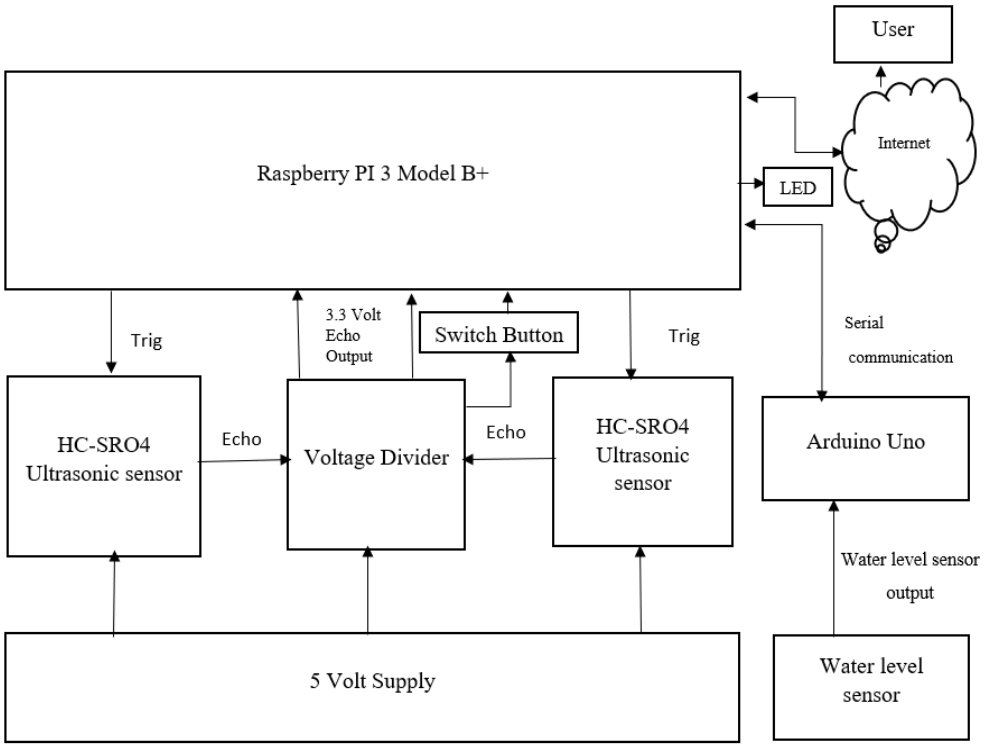

Figure 4.1: Block Diagram Representation of System

The Figure shows a schematic of the project. It shows wiring between various components of project content such as Raspberry Pi, HC-SRO4 sensor, PCB for voltage divider, LED, Power supply, Arduino UNO, Water level sensor, LED, Switch button.

There are lots of processors available like Intel Edison, Banana pi, Raspberry pi, Arduino which are compatible with Internet of things Development. Among these Raspberry Pi is having more Feature & cheapest of all of them. We can easily Program It with python. It is compatible with Web Development Languages such as JAVA, HTML/CSS. Raspberry pi has the integral WiFi. With the internet raspberry pi displays the data on the web page.

The raspberry pi will provide the Trigger signal to the TRIG pin ultrasonic sensor, which enables the module to create the 8-cycle ultrasonic(40kHz) bursts. The Echo pin has 5V output which is not compatible with the raspberry pi. Hence, we are using the voltage divider circuit to convert voltage 3.3V.

HC-SR04 is the ultrasonic sensor. we transmit short ultrasonic pulse and we measure travel time of that pulse from transceiver to liquid and back to transceiver. Ultrasonic pulse will bounce from liquid level since because change of density of ultrasonic pulse travel medium (ultrasonic pulse first travel through air and bounce of liquid with higher density than air).The LED will show the running status of the generator.

Raspberry Pi is capable of taking only digital signals, but in our project, we require input from analog sensor also like water level sensor. To make raspberry compactible with analog input we require to use external Analog to Digital convertors such as MCP3008, MCP3004, ADC2408 etc. which require complex wiring. Instead of this we can plug Arduino Board through USB port of Raspberry which has inbuilt 10bit analog to digital convertor.

V. CONCLUSION

The concept of this project was set out to explore idea of Internet of Things in field of dam such as monitoring of water levels, status of running Machines. We achieved the task of low cost and reliable product for monitoring. we utilize a comparatively low cost and more powerful raspberry pi processor along with HC-SRO4 ultrasonic sensor and also the Arduino Uno along with the Capacitive water level sensor.

We utilize Node-RED application developed by IBM for Internet of Things platform. This thesis also guides us through Node-RED installation procedure on Raspberry Pi. Since Node-RED is an open source platform where user can utilize their ideas to build application based on JavaScript programming. As it's an open source platform one can add number of additional sensors such pressure, temperature, vibration to monitor which gives further development of project in future.

With this we can conclude that this project will monitor the objective data. It has also capability of storing these data over cloud. we can monitor data from anywhere in world provided internet data connectivity at project site.

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VII. REFERENCES

[1] Gouthaman.J, Bharathwajanprabhu.R & Srikanth.A "Automated urban drinking water supply control and water theft identification system" Proceeding of the 2011 IEEE Students' Technology Symposium, IIT Kharagpur pp.87-91, 2011.

[2] S.Leirens, C. Zamora, R.R. Negenborn, and B. De Schutter "Coordination in urban water supply networks using distributed model predictive control" Proceedings of the 2010 American Control Conference, Baltimore, Maryland, pp. 3957–3962, 2010.

[3] Shicheng Dong, Hao Jin "Design of wireless monitoring system for urban water supply based on embedded technology" International Conference on Measurement, Information and Control (MIC), pp.348-351, 2012

[4] Lingjuan Wu, Jennifer Trezzo, Diba Mirza, Paul Roberts, Jules Jaffe, Yangyuan Wang, Fellow and Ryan Kastner IEEE Members."Designing an Adaptive Acoustic Modem for Underwater Sensor Networks".

[5] Peng Jiang , Hongbo Xia , Zhiye He and Zheming Wang "Design of a Water Environment Monitoring System Based on Wireless Sensor Networks" Sensors, ,pp. 6411-6434, 2009.

[6] H.G.Rodney Tan, C.H.Lee and V.H.Mok, "Automatic Power Meter Reading System Using GSM Network", 8th International Power Engineering Conference (IPEC),pp-465-469, 2007.

[7] Ma Ming, "Design of embedded system application platform based on ARM", Manufacturing Automation, vol.34, pp 15-16, 2012.