IoT Based Smart Water Distribution System

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Abstract— This paper presents an IOT antithesis which help to evaluate and plan the nature of water. With increase in population, urban areas have expanded, water becomes one of the major problems in a city particularly water distribution, interfered with water supply, water protection, water utilization and furthermore the water quality. To overcome water supply related problems proper monitoring and controlling system must be implemented. The developed system consist of IOT devices, water Flow Sensors, water level sensor, and relay switch, Solar Panel, Node MCU, Charge Controller, LCD, Solenoid valve and SMPS. It aims to design and develop a low cost reliable and efficient technique to improve water distribution in the community. A prototype was developed to simulate the operation of a water distribution. Also, a web application was created as a front-end system for monitoring the status of the different pumping stations as well as controlling. Here water flow Sensors are fixed in the inlet of every user, when the system is turned on the amount of water utilized by each user is monitored and controlled by using micro controller by counting the pulses from all channels continuously. Depending upon the availability of water in the reserve tanks, the maximum amount of water which is the threshold value will be set for the individual users. The valve can turn on/off by the Micro controller unit to stop the water supply whenever the flow rate exceeds a predefined threshold. The Node MCU is which managed the system to keep the track of the usage of water by individual users in real time and will be handled by the admin and User to track real time usage.

Keywords: IoT, Water Distribution System, Electronic Flow Meter, Arduino, Wi-Fi, Water Level Sensor, Solenoid Valve

I. INTRODUCTION

Water is one of the most important resource for all the livings on the earth. In that, some people do not obtain sufficient amount of water because of unequal distribution. So, it should be supplied properly as well as carefully and at right time to fulfill the daily activities. The primary objective is to design and develop a low cost, reliable, profitable and efficient technique to make appropriate water distribution by continuous monitoring and also controlling it from central server so as to solve water related complications. This system use the flow sensor which can measure the water flow and if the necessary quantity of water flow through the pipe then water flow can be stopped automatically. The calculated values from the sensors can be processed by the Microcontrollers and uploaded to the internet through the Wi-Fi module (ESP 8266). Analysis we can do by this process, how much water is used in certain time, in a day or in a month. Alerts messages and data generated by the sensors are transmitted over the Internet to a cloud server and can be received by user terminal owned by consumers. The data which is obtained from the sensors can be shown on the internet and provides facilities for screening the data on mobile phones or web application. This system will update water level related notifications to web servers using internet, which means that there is no need to come directly to the measurement site. Water supply management will be done according to water level present in Dam. This system sends the data to the central office using web server for database maintenance. The data base is secured by providing a password protected access. The user will be notified to pay the bill according to the water usage. The incoming water is measured in volumetric rate like liters per minute. The volume of water is measured with a flow sensor interfaced to Arduino. The focus of this paper is the use of IoT technologies for the development of intelligent water management system for Apartment in monitoring the status of the different water tanks and pumping stations as well as water pressure. Controlling system is also included to the proposed system to avoid tanks from over filling and under filling. A prototype was developed. In particular, Arduino micro-controller and other IoT devices were used for monitoring and controlling. Also, a web application was developed as front-end for monitoring the status of the operation.

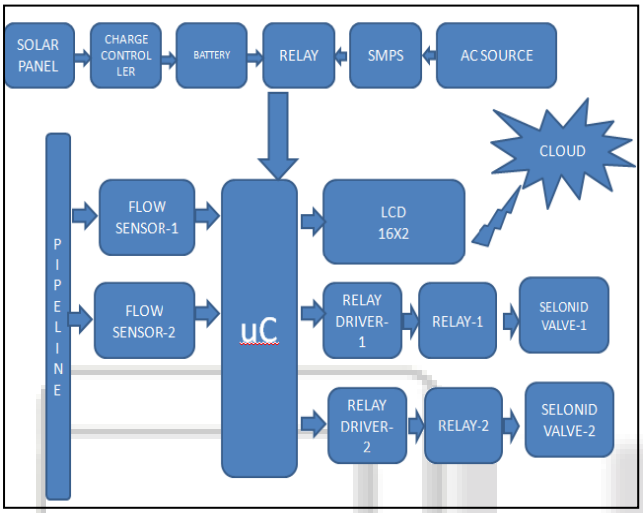
II. BACKGROUND STUDY

We have studied the problems of water distribution water conservation, water consumption , interrupted of water supply and how it is monitor and control the water supply. We have gone through various research papers which gives information on smart water distribution.

An IoT-based water distribution system approach to monitor the level of water in overhead tank, flow rate of water, quantity of water based on the measurements accumulated from the flow meters and as well as proper distribution of the water resource. Internet of Things (IoT) technology is implemented to monitor the water distribution system wirelessly and to monitor the wastage of water. The proposed methodology is realized through the use of real-time systems and sensors, where data are collected from individual houses then processed in real-time and finally the gathered information is displayed in the website. As per the literature survey, in 2017 Ahmad T. Jaiad has proposed the strategy to concentrate on persistent and constant supervision of water supply in IOT scheme. Water distribution with constant supervising formulates a legitimate dispersion so quantity of water in tanks, flow rate, variation from the norm in supply line can be made. Internet of things is only the method of substantial items embedded with electronics, sensors, programming, and system network. Monitoring should be possible from any place as central server. Utilizing Ada natural product as free disjoin information constantly pushed on cloud so information can be seen continuously. Utilizing typical sensors with controller and raspberry pi as Minicomputer can supervise information and moreover control task from cloud with skilled customer server communication. This framework is

centered on, Internet of things which is new state of affairs to make city as a smart city with various applications. Principle target to implement this scheme is to sketch out and make up a negligible effort dependable and productive system to make appropriate water conveyance by consistent checking and furthermore controlling it from a central server with the goal that water related problems will be taken care. Arduino collects the data from sensors and forward it raspberry pi. The important issues of water distribution process which includes overflow, over utilization and water quality are solved.

III. BLOCK DIAGRAM



A. System Design

1) System View:

This system uses Arduino, ultrasonic sensor, water flow sensor. The system can measure the water level and give measurement to central office.

2) ARDUINO:

Arduino is a computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. These systems provide sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ("shields") and other circuits.

3) Water Flow Sensor

The water flow sensor consists of a plastic valve from which water can pass it. A water rotor along with a Hall Effect sensor is present to sense and measure the water flow. When water flows through the valve it rotates the rotor. By this, the change can be observed in the speed of the motor. This change is calculated as output as a pulse signal by the Hall Effect sensor and get back to the signal microcontroller. Thus, the rate of flow of water can be measured.

The main working principle behind the working of this sensor is the Hall Effect. According to this principle, in this sensor, a voltage difference is induced in the conductor due to the rotation of the rotor. This induced voltage difference is transverse to the electric current. When the moving fan is rotated due to the flow of water, it rotates the rotor which induces the voltage. This induced voltage is measured by the Hall Effect sensor and displayed on the LCD display. The water flow sensor can be used with hot waters, cold waters, warm waters, clean water, and dirty water also. These sensors are available in different diameters, with different flow rate ranges.

4) Solenoid Valve

The solenoid valve is controlling equipment controlled by electromagnetism. It is an automatic basic element to control. The flow rate of liquid. It belongs to the actuator but does not limit to the hydraulic pressure and pneumatic control.

In the industrial control system, the solenoid valve is used to regulate the direction, flow rate, speed and other parameters of the medium to liquid saving proposed.

The solenoid valve can co-ordinate with different circuits to realize the control precision and flexibility being a guaranteed system.The solenoid valve is designed by the solenoid coil and magnetic core. It is the valve body containing several holes. When the coil is getting through or cut off with power, the operation of the magnetic core will result in that the fluid passes through the valve body and is cut off so as to reach the goal of changing the fluid direction. The electromagnetic component of the solenoid valve is constituted by the fixed iron core, movable iron core, coil and so on and it is operated by 12 volts dc. The valve body of solenoid constituted by the slide valve core, slide valve harness and spring base. The solenoid coil is installed on the output valve directly outlet while the valve body is enclosed in the sealed pipe, so as to constitute a simple and compact combination.

5) Wi-Fi module:

The ESP8266 WiFi Module is a self SOC with integrated TCP/IP protocol s that can give any microcontroller access to your WiFi network.

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IV. HOW TO USE CLOUD

The cloud simply refers to software and services that run on the Internet instead of your computer. When you use the cloud, your computer communicates with a network of servers. Some of the servers are specialized for storage, while others use their computing power to run applications.

V. MAIN USES AND DOMAIN

- Wireless solution for monitoring city wide water distribution network parameters.
- Smart city - Smart water networks

VI. FEATURES AND TECHNICAL SPECIFICATIONS

- Controls and monitor water distribution network from water storage points to consumers
- Water meters would monitor the amount of water consumed at every household level and helps the authority to generate monthly bills - informs user about the quality of water at the source side and also at the intermediate distribution points- it also identifies, if there are any leaks in the distribution lines and informs authority quickly to take necessary actions promptly
- Measurement of water pressure and level at every storage and distribution points – Inflow and outflow rate at every storage point
- Modulating type valve that controls the water flow and also avoids overflow from the storage tanks
- Variable Frequency Drives (VFD) to control the water pump speed based on the pressure developed in the pipeline
- Wireless transmission of data collected from all the sensors and actuators – analytics performed on the data that is received in the data control center and information of the entire water distribution network would be available in the dash board for the water board authority, site engineer and the consumers

VII. CONCLUSION

On the basis of analysis and design, the system provides an eco- friendly and energy efficient system. An analysis of water usage through various outlets in a house was provided in order to educate residents on cutting down wasteful usage.

This data is provided to the cloud server via Wifi module ESP8266.

This paper demonstrates the successful implementation of an internet-based approach to monitor water supply and usage on a real time basis.

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