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Smart Water Metering System

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Abstract: In urban areas the water supply to residence and commercial establishments are provided at a fixed flow rate. There are incidents of excess water needed by certain customers/users. In this project it is proposed to develop an embedded based remote water monitoring by recording the flow rates at the consumer/user end. In order to implement the proposed water supply system, each consumer end should be provided with an embedded based water flow monitoring system consisting of a microcontroller to record the flow rate using a flow sensor and it is also provided with an electrically operated solenoid valve to supply water to the consumers. It is proposed to employ a NodeMCU MODEM so that if the water reaches the Threshold value message will be delivered saying that water bill has been generated.

Keywords: Water meter, flow rate, water supply, embedded microcontrollers.

I. INTRODUCTION

Nearly the third quarterly portion of the earth which estimates up to 71% portion of it is covered with water. But out of which only 0.08% fresh water is available for human purposes and for living beings. The main sources of fresh water available for living purposes and for human use is the surface water available as a result of rainfall which also recharges the lakes, different water resources like aquifers. Water scarcity is the problem faced by the living creatures throughout the history and whose intensity has increased during the last centenary. It's estimated by next decade approximately 25% of the population of earth will live in perpetual scarcity of water. As per Swedish expert Falken Mark, "When water availability is less than 1,000 cubic meter per person per day water stress occurs. Culmination of huge and increasing population and evenly increasing demands for water and uneven accessing to it is the main cause of water scarcity." Apart from agricultural purposes, the major share in utilizing available fresh water is industries. Industrialization and urbanization brought more use for water especially at nuclear plants for cooling and also at big factories. At this stage it is imperative, for proper management and distribution of water, to conserve the water resource, which will subsequently lead to not only to substantial improvement in human life and condition but also will benefit the different management organs of the biomes and ecosystems. New strategies need to be implemented in order to avoid setbacks and to fill up the lacuna which generally occurs during the distribution of water for various purposes in the allocation of water resources. With this thought, the project focuses, explicitly, on monitoring the usage of water. As monitoring will help further for controlling and distributing the water resource evenly according to the region and availability of resource as per area. When water will have charged according to usage and after certain limit the usage exceed, people will start using water carefully.

II. LITERATURE SURVEY

In order to reduce the labor cost and reduce the water use of agriculture and improve the utilization of water resources, an intelligent controller of low voltage solenoid valve based on ZigBee in [1]. The intelligent controller will collect the solar energy as a source of energy and monitor the command information of the monitoring center of the system in real time. It will also collect the data of soil moisture, pipe pressure, pipe flow, and control the irrigation electromagnetic valve at the same time so as to realize the purpose of accurate irrigation, appropriate irrigation, reducing water loss, unattended operation and automatic control of irrigation system. Water is a vital resource for life and for the economy. Nowadays, one of the most serious challenges to solve is to manage water scarcity. As the importance of water usage optimization in monetary point of view is not that pronounced, we lack the incentive to invest in implementing technologically advanced systems for organized distribution of water.

The development of a meticulous water distribution system described in [2] at a city level that will guarantee a continuous supply of water, overcoming some major issues like unaccounted supply to entities and Non-Revenue Water (NRW). A centralized control room equipped with a local computing machine and a Human Machine Interface (HMI) to monitor and control the city's water system is proposed. A smart tariff system should be exercised with an IoT-

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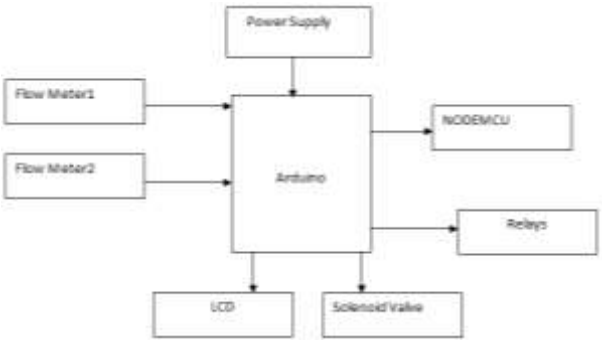
enabled mobile-friendly web portal developed for accessing various water usage statistics accompanied with an option of paying water bills online. In this volumetric, limit based model, the quota assigned to each entity is decided dynamically based on various supply and demand parameters including the availability of water with changing seasons. Adaptive learning through machine learning algorithms was used for the same. Unbilled, unauthorized consumption, apparent losses (water theft and metering inaccuracies) and transportation losses was curbed by monitoring from a remote location via IoT. Higher degree of theft and leakage was concluded using loss detection technique using the differential flow data. Here, a novel, cost-effective, realtime monitorable and controllable system is proposed with an analysis on a model simulation being performed for optimal water distribution. [3] presents an IoT device which helps to manage and plan the usage of water. This system can be easily installed and maintained for long run. The Laser sensor is placed on the tank which continuously monitors the water level in real time. This information will be updated in the cloud and user can analyze the amount of water. According to the level of water in the tank, the motor functioning is automatically controlled. When the water level falls below the threshold level the motor will be again turned on automatically.

Our society relies on extensive pipeline networks to transfer and deliver water, oil, etc. In many cases the pipeline extends over hundreds of miles and run through inhospitable environments. The pipes are often subject to erosion over time due to the parametric conditions. In addition, pipes carrying valuable commodity may be subject to theft, sabotage, etc. Leakage not only would waste resources, but also can be harm and hazardous. Therefore detecting leakage and containing its negative effect is very important. Current pipeline monitoring systems are inefficient and costly. They lack responsiveness and often report the problem after significant fluid is spilled. Furthermore, current systems involve mobile equipment and significant manpower. [4] describes the design of a wireless sensor networks that continuously monitor a pipeline and provide an early warning when leakage starts. The proposed leak detection system employs non-intrusive methods to track the flow speed and interprets the drop of flow volume as indication of liquid loss through a crack in a pipe. The system is composed of a set of ultrasonic transducers that are mounted around the pipe in multiple locations. The system combines the transit-time and Doppler based flow speed measurements in order to deal with various liquid characteristics. The data collected by the individual components are sent over multi-hop routes to a basestation over radio links for further analysis. The simulation results have confirmed the effectiveness of the proposed system.

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. [5] presents 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. This paper 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. Internet of Things (IoT) has provided promising opportunities to create powerful industrial and domestic applications. One of its main applications is smart metering. Water is the most precious resource that must be used responsibly. Information about the usage of water can reduce the water wastage and will help in water management. [6] propose the architectural framework for IoT based water meter. Water flow and heat measurements are taken by water meter (STUF-280T) which is based on ultrasonic flow measurement technology. We have described the Mediatek Cloud Sandbox which we are using as a cloud platform. For water meter to communicate with the cloud we have used LinkIt ONE development board which is an open source platform for prototyping IoT devices. As data will be stored and analyzed on the cloud, this system will be very economical. Also user can access, analyze and share data anytime, from anywhere.

III. SYSTEM DESIGN AND ARCHITECTURE

1. Block diagram



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Methodology:

- The proposed model monitors the quality of water basically consists of flow meter, microcontroller, Solenoid valve and relays.
- The block diagram of the system is shown in the above figure. Hall effect-based flow meter is to measure the flow rate of the water.
- Arduino uno will act as a microcontroller-based device. The flow meter measures the flow rate of the water and generates a pulse signal accordingly. The flow meter is wired with Arduino so as to sense the pulses from flow meter.
- The flow rate is sensed by the signal conditioning unit when the water is passed. The sensor operates under certain predefined value.
- When the meter reaches the threshold value a bill will be generated and it is sent as an message via NodeMCU.
- When the water is ON by automatically Switching ON/OFF the solenoid valve we can control the flow of water whenever necessary
- The Rain Water harvesting has been used in this project. So that Rain water is stored in the small tank and when it is supplying from the rain tank then it will be not added to the bill.
- When the Water bill is generated for each tenant/user then only the water from the main tank is considered and not the rain water which is sent to the tank.

IV. CONCLUSION AND FUTURE ENHANCEMENT

The flow of water through the domestic purpose can be monitored, In the proposed system a prototype for water Billing has been implemented. Each consumer will get a separate bill based on the usage and all these data is sent to the users mobile through NodeMCU.

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