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IoT based Water Distribution Control and Monitoring System

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***Abstract*: The expanded living spaces in provincial and urban territory require great quantity water dissemination administration framework. So, there is a basic prerequisite to outline a programmed water supply framework to accomplish rise to measure of water conveyance to every one of the natural surroundings. The billing system is design and development based on real time monitoring of the water quality and quantity in Internet of Things. If a person fails to pay water bill, then there is no automated system which can restrict the water supply to their houses. The "Prepaid and Postpaid Water Distribution Controller" override the problem prevailing in the existing manual process.**

***Keywords*: IoT, Water Quantity, Water Billing Meter, Automatic Billing**

1. Introduction

Water is one of the most important natural resource and water scarcity is the most challenging issue at a global level. 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 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 wastage of time. The proposed system is fully automated. Here human work and time are saved.

The "Prepaid and Postpaid Water Distribution Controller" has been developed to override the problem prevailing in the existing manual system. This system is designed for the municipal corporations to carry out drinking water operation in smooth and effective manner.

In this system the user has two modes of payment. In pre-paid mode the user has to pay predefine amount of bill which consist of water consumption limit. After consumption of water the system blocks the supply and notify user for that. After recharging, the system starts water supply again. In post-paid mode, the bill is generated according to the amount of usage of water by user and here also system is capable of blocking of supply if the failure in payment. We will install this Digital Water Management System to each and every consumer. And these water meters are connected to Internet via Wi-Fi module which will takes the data from those meter and send it to the server. It also consists of Flow Sensor, Solenoid Valve, Microcontroller, GSM module.

2. Current system

Fig. 1. Current system

Municipal corporation water distribution is performed on manual process and become difficult to monitor the utilization of water at a consumer level. The existing system is fully based on manual system where an employee is sent to take reading from customer water meter. After that office generate bill for that reading and bill is sent to the customer. This is very long process for collection of wages and due to maximum human interaction, the accuracy level is poor. And there is no proper management system to monitor the customer who doesn't pay bills but still consumes water from the supply.

There is no pre-intimated or pre-planted water distribution system to stop the wastage of water from any accidental pipe leakage and repairing has been done manually, due to this it is unable to maintain the record of water. Current water tank systems are not able to monitor the level of water in a tank. In current system municipal corporation officer collect the reading and according that it will generate the bill. Municipal Corporation have to invest extra money on billing because it need human resources and human effort.

Municipal Corporation spends money every year on Filtering and purification of water for the commercial and residential use. In addition, they also spend money on the maintenance and repairing of those traditional analog water meters.

Municipal Corporation Water Distribution System is manual system and have no system to monitor the consumption of water. Each individual has their own capacity for usage of water but everyone has to pay same amount for their consumption. And if any person fails to pay water bill then there is no system which can restrict the water supply to their homes.

3. Literature survey

The paper "Implementing Pre payment Water Metering System Oct 1997"by Peter Smith, Helgard Muller, Steyn van Blerk, G Ballot Marx, Peter D Pyke, Philip A de Wet, Andries G Visser, Douglas Smith [1], In order to inform the recommendations for decision making and to increase understanding of the socio-economic environment in which community water supply schemes are managed a literature survey was also carried out. An analysis of surveys reported by WHO in 1990 rated poor cost recovery as the most severe constraint on the attainment of sustainable water supplies in Africa. However, cost recovery can only be implemented successfully when customers are satisfied they are getting value for money. To ensure this, other major constraints militating against a quality service must also be overcome. These constraints are predominantly organizational rather than technical. When cost recovery is not implemented, the rich and influential receive more by way of subsidy than the poor, communities are misled into believing that water provision is cheap, and the Govern Men vs. budget is spent operating existing schemes rather than implementing new ones. Conversely paying for water encourages a relationship of accountability between the water service provider and their customers. As a result, water schemes where communities pay the operating and maintenance costs are the ones which provide the most reliable service. Willingness to pay depends on proper consultation and community empowerment. One important way of empowering communities is by giving individual households a choice between a number of options. Higher levels of service, including individual household yard taps, are substantially costlier to build, operate and maintain than basic levels of service, in normal circumstances these additional costs are recovered by a substantial increase in demand. However, when low income households obtain individual yard taps and pay for the water, the demand does not increase significantly. As a result, the tariffs required to achieve full cost recovery become unacceptably high for the majority of customers. intermediate levels of service, such as distributed storage tanks and privately operated shared yard taps, should be promoted.

The paper "IoT Based Water Management System for Smart City" by H Amatulla Patawala [2], 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. 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.

The paper "Water Quality Management: Can We Improve Integration To Face Future Problems" by Laszlo Somlyody [3], Water quality comprises all the properties of water besides its quantity. In practice, it is given by a large number of physical, chemical, biological, and other parameters. The actual characterization of water quality is never unambiguous; dominating parameters depend on uses (such as domestic, industrial, agricultural, recreational, and others), problems (hygiene, oxygen, household, eutrophication, salinization, acidification, toxics, etc.), space and time, and the subjective judgement of the analyst which cannot be excluded. Water quality management is a commonly used and somewhat vague expression referring to the (systematic) usage of a set of technical and non-technical measures and activities, to maintain or improve quality according to the requirements of water uses and to "protect" eco systems. Water quality management is at the interface of water resources management and environmental management, which draws from hydrology, biology, chemistry, ecology, engineering, economics and other sciences and disciplines.

The paper "Water Quality and Quantity Management" by Natural resources Northern and yorke government of South Australia [4], Description of the attributes of water quality and quantity. Parameters of water quality are: Salinity – driven by a combination of climate and human activity, salinity in the region is related to regional groundwater and direct surface runoff. Salinity is flow dependent and seasonably variable. Nutrients – particularly phosphorus, are related to catchment management. High nutrient levels can trigger excessive aquatic plant and algal growth, resulting in a decline in dissolved oxygen in the water. Sediment – also an indicator of catchment management, an increase in sediment loads can result in reduced growth of aquatic plants due to poor light. Temperature – clearance of the riparian zone canopy species can increase temperature.

Some key indicators for water quantity are: Groundwater levels and pressure, Volume of extraction as a proportion of sustainable yield Water levels in permanent pools, Volume of water capture in dams or diversions as a proportion of sustainable yield, Proportion of total catchment which is free flow(unregulated).

The report "Technical Report on Water Quantity and Quality" by B.J. de Haan, A. Beusen, C. Sedee, D.W. Pearce, A. Howarth, D.W. Pearce, A. Howarth [5], The water resources available to satisfy the European water demands are restricted by social-economic and environmental factors. The preferred source for water supply is ground water as it has good and stable quality. Most water abstracted, however, is surface water. Where it is abundant, it suitable for irrigation purposes. Ground

water is the main source for drinking water. Ground water demands are increasing and so are the environmental concerns as to water withdrawal. As a consequence, some regions in Europe have water problems. The preferred source of water for public water supply, small industrial water needs and the irrigation of private plots, is groundwater. Ground water recharge and also the total of locally available water resources are governed by net precipitation, being the difference of precipitation and the actual evapotranspiration. Simple mathematical relations can be used to quantify potential and actual evapotranspiration. The difference between the two represents the existing agricultural water needs. We applied a GIS approach to quantify water needs for public and industrial water supplies and water needs for irrigation in the various European regions. Comparing calculated water needs and the availability of groundwater and local surface water, based on net precipitation, indicates areas where water shortages may be expected and where a minimum amount of water will be needed. Those areas generally correspond relatively well to areas with water problems as indicated by an inventory carried out among European national governments. Ground water overexploitation for irrigation is probably a regional scale problem.

4. Proposed system

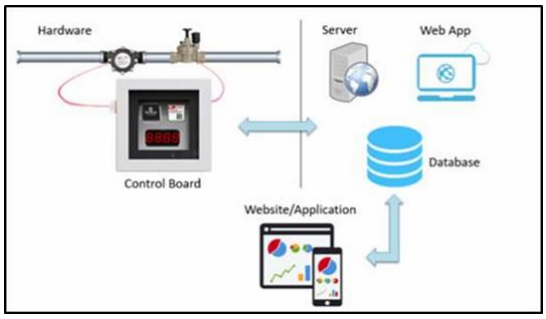

Fig. 2. Schematic of proposed system

The Water distribution and it's control over billing cycle is most challenging task for government. Municipal Corporation Water Distribution System is manual system and it is difficult to monitor the consumption of water centrally. If any consumer fails to pay bill, then there is no system which can restrict the water supply for consumer's house. Existing system fails to monitor the quantity of water. Unpaid bill recovery costing are more than actual bill which waste man hours cost.

The proposed system is fully automated. 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. Prepaid and Post-paid Water Distribution Controller will monitor the flow and consumption of water by each family. We get real time data of consumption and can control the valve to restrict flow of water. 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. We can use this approach so that everyone gets the equal amount of water. Customer can interact with web-based portal or with mobile application to monitor the usage and for payment of bills or to stop or start the service.

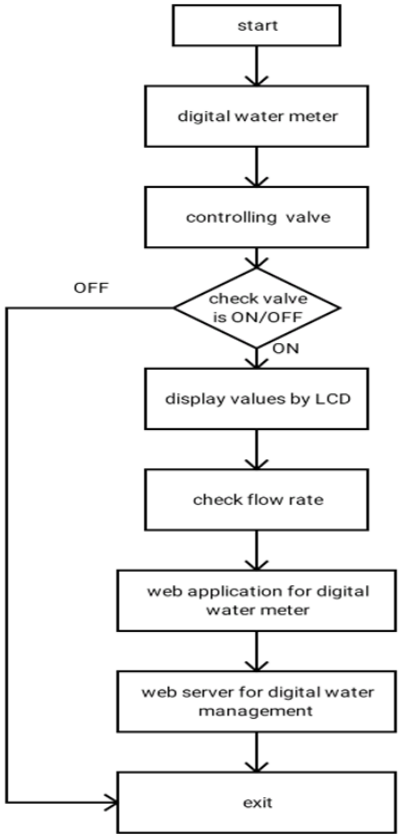

Fig. 3. Flowchart

5. Working mode

There are two modes in the system. Pre-paid mode and Post-paid mode. In Pre-paid mode first we have to pay some amount than according to that municipal corporation will allow that much amount of water supply. If pre-paid balance will over, then water supply is automatically stop. Second mode is Post-paid mode in this mode customer use the water and according to that bill is generated.

6. Conclusion

The successful implementation of an IoT based approach to measuring water quantity on a real-time basis. A flow sensor for is used to measuring the flow of water and consumption, Solenoid valve for automatic valve control, it will eliminating the drawbacks of existing water metering systems. Water metering system will be used for automated Prepaid and Postpaid billing which eliminating the drawbacks of traditional water metering systems.

In future, proposed system can be made fully autonomousby embedding the Internet of Things (IoT). The use of IoT based

water distribution system we can include the Turbidity sensor, pH sensor, Water Hardness Sensor, Water Conductivity Sensor and Fluoride Sensor for Quality of water. Detecting the more parameter for secure purpose.

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