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Water Leakage System Using IoT

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ABSTRACT
In this paper, we investigate the design of a water level sensor device that is able to detect and control the level of water in a certain water tank or water Lorries. The system firstly senses the amount of water available in the tank by the level detector part and then adjusts the state of the water pump in accordance to the water level information There has been wastage of water daily through the pipeline leakages due to it full water were never arrived to the taps. The existing system are still lacking abilities to detect accurate estimation of water leakage in water lorries .The aims are to perform a small-scale study of existing pipeline leakage detection system, to develop a real-time prototype pipeline leakage alert system and to validate the proposed prototype through experimentation. Mobile phone can be configured as the alerts transmitter of the system to the user in cases water leaks.

Keyword
Internet of Things (IoT), Pipeline leakage, Arduino, GSM

1. INTRODUCTION
Water is a precious natural resource with fixed quantum of Availability. [1]. This number is decreasing every year which is evident as it was 1816 m3 in 2001 and 1545 m3 in 2011 [2].We lack the incentive to invest in the installations and implementation of technologically advanced systems for the organized distribution of water. This vicious cycle has deeply impacted the water management system causing unrecorded and abysmal losses in water quantity. This paper aims at developing a meticulous water management system at a city level that will guarantee measured, recorded and continuous supply of water with 24x7supply of water, overcoming the major issues of unaccounted supply to entities and Non-Revenue Water (NRW) [3].

2. RELATED WORKS

2.1 Smart Water Management Using IOT
This project helps us to manage the water level and where we can use in the Society easily. The level of water is maintained by sensor which is presented inside the tank and the data will stored in the cloud using mobile application. Users can view the level of water thorough mobile phones, according to that motor will be work automatic and manual. If the water level is low automatically motor gets switched on if it’s up to fill then it will shut down the motor. In our proposed system, Using Mobile phones we can monitor the water level and we can control from anywhere and anytime. It can also used in different industries to maintain the different type of liquids in the tank they can view and maintain the update information through the mobile application. User can also get alert notification according to their fixed criteria. It can also be implemented for flood propane like install this facility in Dams and bank of rivers etc.

3. WATER DISTRIBUTION AND SENSOR NETWORKS
Water security is currently a hot topic. Water demands are not being met in regions of the world; both developed and underdeveloped; where climate change and economic water scarcity are two issues that have the largest impact. The former sees areas of the planet less able to generate enough water for its people, whereas in economic scarcity the principality is unable to build or maintain a water distribution network to continuously meet demands. Drought prone areas such as California in the USA have had severe water restrictions in place for some time. Wet countries, such as the UK, have been experiencing what has been termed wettest droughts over the past few years. Notwithstanding the 7.5bn investment in UK water distribution networks, 3.3bn litres of water were lost per day in 2010 [1].The use of sensing systems to identify water leakage have been around for some time [2], but their uptake has not been prolific. ICT to support WDN typically consists
of remote or online battery-powered telemetry units (data loggers) that record water data such as flow and pressure, over numbers of minutes, then aggregate this data and send to a server periodically - typically via the mobile phone networks. Contemporary approaches use Wireless Sensor Network (WSN) [2], [3], [4], [5], [6] technologies to monitor the status of the water network and detect leakage or water bursts closer to real-time. The main drawbacks of these approaches are:

(a) the analysis of the data takes place offline, in base-stations or servers meaning that optimal real-time decision-making for control would be unrealistic and

(b) the sensor nodes require a lot of energy, which place supper bounds on the amounts of data that can be sensed and relayed for analysis. The latter issue particularly impacts on what is important to water companies, leakage localization. Given the cost of digging up roads to fix leaks, timely and accurate determination of the location of a leak is now more important than identifying all leakages. However, to carry out localization high-fidelity sensing and analytics are required to triangulate leakage accurately; current systems are not quite there yet.

4. SMART WATER DISTRUBUTION SYSTEM

Due to vast increase in population globally and also because of climatic changes the fresh water resource is under stress. A smart water distribution system would a real time network with flow sensors and other devices would continuously monitor the distribution system. Many different parameters like pressure flow rate, temperature can be monitored. Existing distribution system includes large amount of leakage rates. Locating/ finding illegal connections are very much tedious. Updating the current basic infrastructure can be very expensive. The quality of the water at the source is also of utmost importance to the public. When such a smart monitoring system is integrated with natural resources like rivers climatic conditions like forest fires, floods comes into picture. Five major key aspect of the smart water system like demand management, leakage management, asset management, water quality and automated tariff as discussed.

4.1 Asset Management

As the system infrastructure grows more appropriate asset management system is required. More and more underground pipelines needs to be put in place. The total lifespan of this pipe lines is also limited which leads to potential point of failures. So the lifespan of the existing pipelines needs to be optimized and pre-empt the failure of critical pipelines. As the pipelines are buried underground they are prone to corrosion. More advanced technological enhancement is required in the design of the pipelines.

4.2 Leakage Management

As far as leakage detection is concerned more manpower is required to take a survey of existing pipelines which is again time consuming. The system will try to minimize the impact on the customers there by reducing the time required to detect the potential region of leaks.

4.3 Demand Management

In the case of demand management the water supply department is in position to know the region with highest demand for water. Simply increasing the water pressure when there is no demand would lead to pipe burst. This would in turn increase the total revenue. Based on the knowledge of the demand, the water pressure can be optimized according to the demand and head losses. This also has the positive side-effect that energy consumption is reduced for pumping the water, while still meeting minimum pressure and water quality objectives.

4.4 Water Quality monitoring

The water quality monitoring is required so that we could minimize the impact on the health of customers. Smart sensor array could be placed in the network which provides real time monitoring of the water. Water quality parameters like pH, turbidity can be taken into account.

4.5 Automatic Tariff

The water supply department would also provide for automatic tariff generation for customers on monthly basis. The customers would also be able to e-processed their payments easily. Besides having monthly tariff, water supply department will provide daily basis data to customers so that customers can control their water.

4.6 WSNs for Water Monitoring

Wireless sensor nodes are energy-constrained devices, and hence their limited resources should be used efficiently. In this direction, several works consider the problems of sensor activation and transmission scheduling towards maximizing network lifetime. In several scenarios, it has been shown that this objectives equivalent to balancing the residual energy of the nodes. Indicatively, in seminal work [11], energy consumption is modelled as a function of the traffic flow routing decisions. In this setting, the problem of maximizing network life time can be cast as a linear optimization problem and the author's proposed the flow augmentation algorithm to solve it efficiently. It is also shown that energy balancing is a good approximation to network lifetime maximization. In [12] the authors consider different scenario that each sensor node may either transmit data to its one hop neighbours with unit energy consumption, or directly to the sink node through long range communication but at higher energy cost. In this context, it is shown that the problem of maximizing network lifetime is equivalent to the problems of flow maximization and energy-balancing. A similar topology is considered in [13], [14], where network lifetimes also pursued by balancing energy consumption in the network. WSNs enable us to detect pollution and pipeline leakages in water distribution networks, by monitoring system parameters, such as water quality and pressure in pipelines. However, the fact that water pipelines are located underground and hence are not easily accessible introduces additional challenges, concerning energy efficiency and sensor placement. Deriving the optimal sensor placement for water quality monitoring is a challenging task. Due to budget constraints, a limited number of sensor nodes is deployed in the most representative positions of the network [15]. Existing works cover adverse set of objectives [16], [17], [18], such as minimizing the population exposed to the contaminant and the detection time. Due to the binary nature of placement decisions, such problems are generally solved by mixed-integer programming. In general, the problem is particularly difficult, and the solution is achieved by heuristic algorithms [19]. An alternative to deterministic placement of sensor nodes is the uniform deployment of a dense sensor network over the area of interest. In dense sensor networks, redundant sensor nodes are deployed to account for the failure of individual sensor nodes. In this case, not all sensor nodes have to be active to monitor ,and hence scheduling the sleep and activation periods of sensor nodes can provide significant energy benefits. For instance, in sensor coverage problems, such mechanisms are used to maximize network lifetime while guaranteeing that all target demands are covered [20]. Besides, scheduling the activation sleeping periods has been also considered to maximize the lifetime of a query-based WSN in [21]. In summary, here we consider a different strategy space, namely the optimal activation of sensor nodes under compressive sensing, so that network connectivity and monitoring quality in each monitoring timeslots guaranteed.

5. PROPOSED SYSTEM

The proposed model to forecast and monitor the consumption of water basically consists of flow meter, microcontroller, micro computer and cloud infrastructure. The block diagram of the system is shown in the fig. 1(a). Hall effect based flow meter is to measure the flow rate of the water. Arduinouno and Raspberry Pi will act as a microcontroller and microcomputer based devices respectively. 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. Raspberry Pi a micro-computer receives the data from Arduino micro-controller which is connected to the flow meter. The raspberry pi is programmed to read the arduino signal, process the data and stores in raw data files. The raspberry Pi is also programmed such that it processes the raw data and uploads them onto the web server. In order to process request from large number of customers Apache Flink on the cloud processes the data in appropriate format and stores in the database. The end users via web interface are able to visualize the data. The data from the database will then be utilized by data prediction algorithm for making predictions as needed by the users. The request for the prediction comes from the users via the web interface.

6. RESULTS

6.1 Alert System by using GSM via SMS

The system is being tested and alert system sends the message through mobile phone. The results show that the alert message has been sent after being recognized at certain level. The user will acknowledge the message and act with actions.

6.2 Experiment Testing

An experiment testing has been conducted to see the result of how geophone sensor is working. Geophone sensor is set up at the edge of the pipe which is connected to the circuit, Arduino Mega 2560, SIM900 GSM shield and Arduino software by using Arduino USB cable.

7. CONCLUSION

The flow of water through the domestic pipeline can be monitored, forecasted and visualize from anywhere in the world using internet through computer or Smartphone. The collected data can be analysed for making predictions to the users and also for demand management, asset management, and leakage management. With water as a flowing liquid the system has been tested successfully. The work can be extended to forecast data for larger communities with customer satisfaction involving low cost and better performance of the overall system.

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