Review Paper on Water Monitoring and Leakage Detection

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***Abstract*:- Water is one of the most important natural resources essential for survival and it is supplied to cities through pipelines from water sources such has rivers and lakes. Non Revenue Water (NRW) is the amount of water which has been produced and lost before reaching the customer. It may be due to leaks, illegal connection and faulty meters.**

Bearing in mind that water leakage is a global issue that has already grown to become a critical issue in many areas, the main objective of the paper is to develop a leak and water monitoring system, using the concept of IoT, flow sensor that can be used for detecting the leak and solenoid valves placed in different parts of pipeline cam obstruct the water flow until the defective part of the pipeline is repaired. And further the leak occurred shall be informed to concerned authorities wirelessly.

I. INTRODUCTION

Water is vitally important to every aspect of our lives. Water represents a primary necessity for living things and is essential for agriculture, industry etc. Water management plays an important role in the society. In modern world, water leakage is considered as one of the largest and most serious problem. In developing country like India, loss of water in domestic sector on account of leakage is approximately 30 to 40% of the total flow in the distribution. By using water monitoring system, we avoid the water wastage, power consumption and easily preserved water for next generation.

Water pipelines leak detection; pipeline systems are responsible for transporting vital materials such as water, oil and gas. Any leakage in the pipe causes major financial losses and possible environmental damages. Leaks in water pipes may allow contaminants to enter water systems thereby reducing water quality and threatening the health of water users.

Leakage detection has historically assumed that all leaks rise to the surface and are visible. Leakages are mainly caused by generally aged and consequently breakable water distribution infrastructures. As pipes are not directly visible and accessible, the identification of leakages is not obvious. Losses from water supply system force water agencies to draw more water from lakes and streams there by putting more stress on aquatic ecosystems. Once a leak is detected, the water utility must take corrective action to minimise water loss in the water distribution system. Accurate location and repair of leaking water pipes in a supply system reduces these losses. Leaks reduce the reliability of water supply network. This may lead household and businesses to locate elsewhere, find alternative sources of potable water and otherwise find costly ways to protect themselves from the risk of unreliable water supplies.

II. RELATED WORK

Pipeline leakage detection is also affected by the soil type, density, depth, and surface coverage. Water pressure, pipe material and diameter have a significant impact on the detection accuracy due to the interference of frequency.

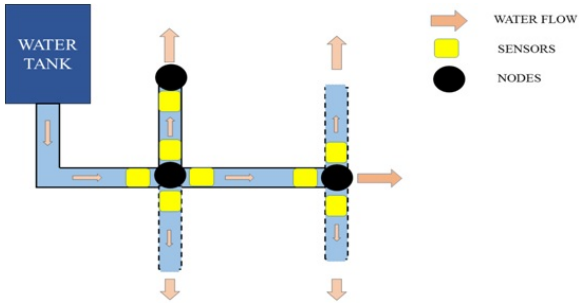

Figure 1: Generalized pipeline structure

A pipeline structure consist of multiple branches and nodes as shown in fig 1. Such structure can be broken down into elemental structure which consist of two branches and three nodes. At the point where two or more sub-pipes branch, a microcontroller is placed which takes in data from the sensor placed at each sub- pipes adjacent to it. In the structure water flow rate is measured using water flow rate sensor at inlet and outlet of a pipe. These flow sensors in turn are connected to microcontroller unit. The sensor does not obstruct the water flow but just collects the data of flow rate. Solenoid valve is an electromechanical device which is used to regulate the flow of liquid. The solenoid coil operates the valve as if it is being operated by the human being. When flow of certain quantity of liquid is required it opens the valve to required extent and when the flow is not required it shuts the valve entirely. The solenoid valve will be connected to microcontroller by interfacing with the relay module. The microcontroller units communicate with each other wirelessly. When a leak exist in a pipe, there would be a considerable difference in flow rates measured by two controllers. This can be used to detect leaks.

III. LITERATURE SURVEY

Deepiga and Sivasankari [1] have designed the water monitoring systems such as tank water level sensing monitoring, water pollution monitoring and water pipeline leakage sensing monitoring. The microcontroller based water level monitoring is used to indicate the level of water in the tank to agent. Leak detection in water pipelines, the pressure is calculated using force sensitive resisitors (FSR) generated from a leak. It will be indicated by an increase in the LED meter and a rushing sound of water in the pipe which can be heared in the headset.

Adsul and Kumar [2] have proposed a wireless leakage detection system using various sensors and microcontroller which makes system portable and non destructive techniques (NDT). In the system, the parameters like humidity, temperature, pressure, sound detection and gas detection around leakage areas are detected using sensors and arduino microcontroller.

Jayalakshmi and Gomathi [3] have proposed the design and implementation of a water leakage monitoring and detection system to monitor and detect leak with help of wireless sensor. The objective of an enhanced system is to detect possible underground water leakage for residential water pipes that are monitored from a personal computer.

Daadoo and Daraghmi [4] have focused on an application of wireless sensor networks for leakage detection in underground water pipes to overcome the problem of water dispersion. To address the problem and simplify the leakage identification process, the authors have designed a wireless network system making use of mobile wireless sensors.

Myles [5] has explained the background theory and practical application of a fibre optic based technology that uses Brillouin acoustic scattering to detect subtle changes in temperature in the cable. The paper will outline the background physics of the method, and provide results from a case study for leak detection of a brine pipeline.

Sithole et al., [6] have presented a practical low cost Smart Water Meter device (SWMD) which is capable of determining possible leakages. Flow Meter sensors have been deployed to measure the quantity of water consumed by a consumer.

Medina et al., [7] have introduced a technique based on signal analysis for leak detection in water supply systems. The paper presents the feature extraction from pressure signals and their application to the identification of changes related to the onset of a leak. Example, signals were acquired from an experimental laboratory circuit, and features were extracted from temporal domain and from transformed signals.

Martini et al., [8] have presented the control of water leaks in water distribution networks represents a critical issue for all utilities involved in drinking water supply. The work deals with the detection of water leaks by using vibration monitoring technique. The objective of the paper is to develop a system for automatic early detection of burst leaks in service pipes.

Choi et al., [9] have proposed new leak detection and location method based on vibration sensors and generalised cross correlation techniques. The paper explain the theortical variance of the time difference estimation error through summation in the discrete frequency domain and find the optimal regularization factor that minimises the theoretical variance in practical water pipe channels.

Kei [10] describes about the service that install sensors at arbitrary intervals on water pipes in order to capture vibration caused by water leak, sends the acquired data to the cloud computer via wireless network or public switched telephone networks and identifies the leak location with high precision based on the results of data analysis.

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