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UNDERGROUND PIPELINE WATER LEAKAGE MONITORING BASED ON IOT

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Abstract

In major problem in water supply network system is water leakage. The huge amount of water wasted daily in home, industry and etc. In most of water wastage due to pipeline leakage, normal pipeline system leakage may easy to find but underground pipeline leakage not easy to find compared to normal pipeline system. In normal leakage approximately 4000 drop of water wasted in pipeline, which is equal to one liter. The main objective of this system is reduce the wastage of water and saves the water to next generations. In this system consists of two main things one is monitoring the pressure level of water and another one is send the alert message to user when water leakage occur in pipeline.

Keywords: Underground Pipeline, Water management, leakage, IoT

1. Introduction

Water represents the primary need for organisms and its play an important role in our daily lives. The earth has 71 percent of ocean water and 3 percent of drinking water, in its human directly accessible water 1 percent. The problem of water in the modern world considered one of the largest and most serious. So we need to decrease the spillage of water and save the water for future generation .All the peoples are wasted water on daily basis, no one understand the essential of water [1]. Most of water wasted in pipeline leakage, especially underground pipeline system because it's not easy to find. Percolation is the greater problem that fall in pipelines due to abortion [2].

According to the survey 2,000 to 20,000 gallons of water wasted in home due to slip [3]. In [4] Zigbee based leakage detection system is developed, so the system flow rate of water is monitor the particular distance. Hybrid mechanism (combination of RTTM and WPM) method via pipeline leakage are detected, it's described in [5]. Water corporation system supplies the water from source to any other place through a complex pipeline system, so leakages are

increased [6]. In [7] RF based water leakage detection system are described. In this system all the data's are send to user, but user get the data's only the fixed distance.

The oil pipeline spill could cause serious environmental problems and economic losses [8].It is very important to find the leak timely and accurately [9]. Several methods are used to detect leaks in buried water pipes, including ground-penetrating radar [10]. The HE Magnetic Flow Leak (MFL) method for nonlinear testing is commonly used to investigate defects in ferromagnetic tubes such as gas pipelines [11, 13]. Existing central the heat supply pipe network basically accepts the buried pipe [12]. Plastic tubes are widely used for distribution and transportation Petroleum, natural gas and water [14].

In this paper, pipeline leakage monitoring system is developed which based on IoT. This system consists of flow sensor and Wi-Fi module. The rest of the paper is standardized as follows: The proposed Pipeline structure is discussed in section 2. In section 3 discussed the architecture of system. The system arrangement and examination are given in section 4. The conclusion is given in the last section

2. Proposed system

To overcome the problem occurred in underground pipeline system, we are proposed the underground pipeline leakage detection system with based on IoT. The proposed system consists of flow sensor, arduino, buzzer, GSM module and LCD. Flow sensor for sense the pressure level of water, buzzer for beep alert, LCD monitor the data's like pressure level of two flow sensors and shows the message "LEAKAGE DETECTED" when leakage occur in pipeline, this message for local people. GSM module is help to send the alert message to main server room if water leakage present in pipeline. Arduino controller used to control the entire device and get the data from connected device [15]. In this system two flow sensors are used, one is connected in starting point of the pipeline and second one is connected in end point of the pipeline. All of these devices connected to arduino and water pumped into the pipeline, at same time monitor shows the flow rate of water like as flow sensor 1 and flow sensor 2 data's. If there is leakage present in pipeline, water flow rate of flow sensor 2 is differing from flow sensor 1. LCD display the "leakage detected' message and buzzer make the beep sound and arduino send the warning SMS to the user with the help of GSM modem.

3. System architecture

The system helps to detect the underground leakage in real time. As in Figure 1 all the devices are connected and controlled by controller. Buzzer, LCD is connected in output pin of arduino and flow sensors are connected to arduino input pin. GSM module connected in UART pin of arduino. System Architecture shows in Figure1

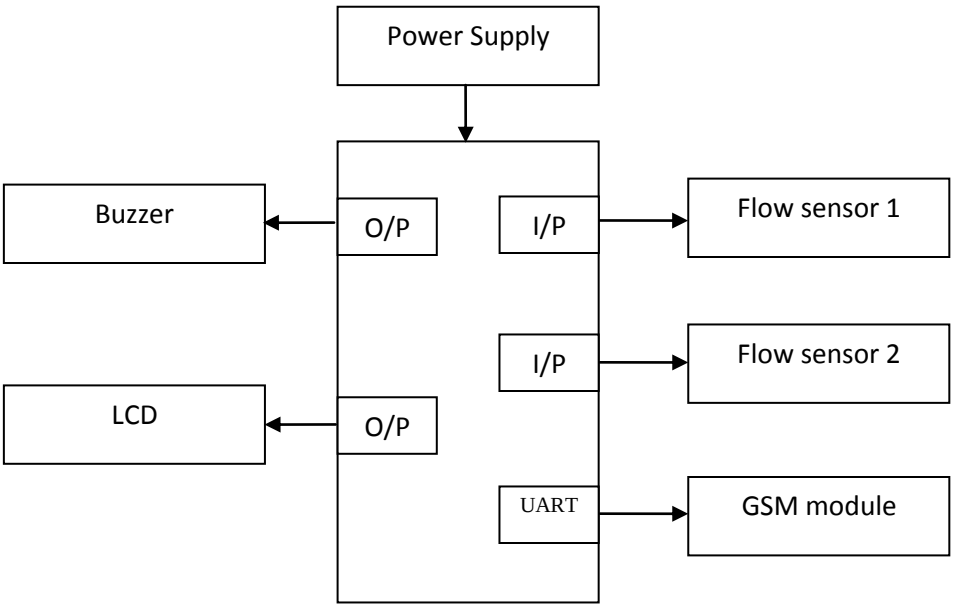

Figure. 1: System Architecture of pipeline leakage monitoring

Arduino mega:

Arduino mega is the heart of the system. It controls all devices. Get the data's from devices and send to the user using GSM Module. The operating voltage range 5V. Figure 1.1 shows Arduino. It has

- 54 I/P & O/P pins
- 16 Analog I/P
- 4 UART
- 16 MHZ crystal oscillators

Figure. 1.1: Image of Arduino

Flow sensor:

In this system YF-S201 flow sensors are used. It's used to measure flow rate of water. Figure 1.2 shows flow sensor

Q=V*A where,

Q-Flow rate of the water

V-Velocity of the water

A-Cross-sectional area of the pipe

Figure. 1.2: Image of Flow sensor

Buzzer:

A buzzer is a device which is makes the beeping noise. It consist of two pins in outside, there are power and ground. Inside consists of Piezo element, which is consists of ceramic disc with covered by vibration metal. When the power is supply to the buzzer, ceramic disc expand. Figure 1.3 shows Buzzer.

Figure. 1.3: Image of Buzzer

(LCD) Liquid Crystal Display:

It consists of liquid crystal, if current apply to the crystal when it's activated monitor the output. Figure 1.4 shows the LCD.

Figure. 1.4: Image of LCD

GSM Module:

The SIM900A is a dual-band GSM/GPRS solution. SIM900A delivers GSM/GPRS 900/1800MHz performance for SMS and Data in a small form factor with Low power consumptions. It controlled via AT commands. Figure 1.5 shows the GSM Module.

Figure. 1.5: Image of LCD

4. Results and Discussion:

In these system is to design and monitor flow rate of water inside the pipeline and detect the water leakage. All the devices are connected to arduino as proposed pins. The proposed systems are tested and output is verified. The flow rate of water is equal in flow sensor 1 and flow sensor 2, which means no leakage in pipeline. The user gets the alert message when the leakage present in the pipeline. Figure E shows the hardware setup of the system. Figure F shows the simple output of leakage and figure G shows the warning message.

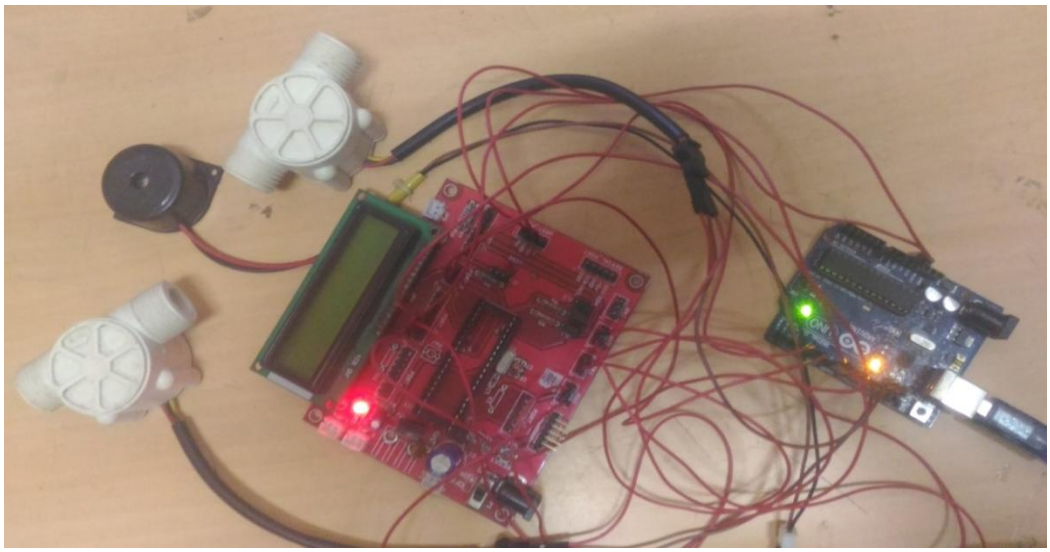

Figure. 1.6: Hardware setup of the system

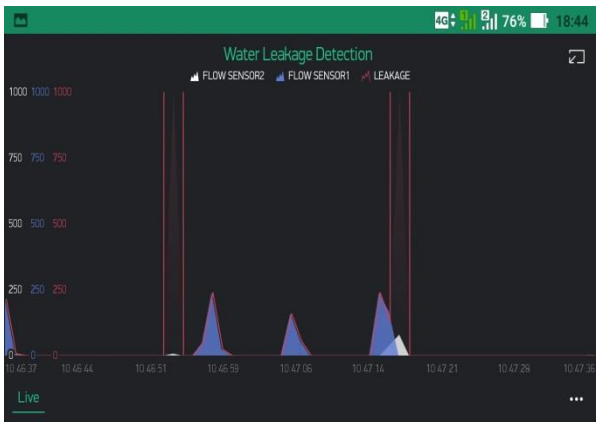

Figure. 1.7: The simple output of leakage

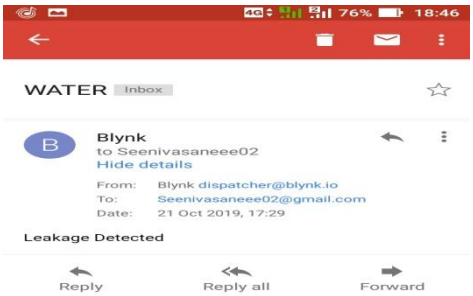

Figure. 1.8: Leakage warning message

5. Conclusion

The design of a system for detects the water leakage in underground pipeline with continued monitoring. The water leaks can be detected immediately in the underground pipes by using this system, so reduced the wastage of water and money. The proposed objectives are achieved; user can able to monitor the pressure level of water inside the pipeline and warning message is send to user when water leakage in pipeline. The main aim of the system is reduce the leakage of water, so more benefits for both consumers as well as Water Corporation. Using the system water wastage can be reduced and saves the water for next generations.

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