Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 10, October-2019

Leak Detection System using Arduino

1st Manav Sandeep Mehta
Information Technology
Shah and Anchor Kutchhi Engineering College
Mumbai, India

2nd Rohit Ratanjyoti Misra
Information Technology
Shah and Anchor Kutchhi Engineering College
Mumbai, India

***Abstract*—Wastage and theft of water has become one of the major issues in India, a major source of wastage is leakage in the pipelines which are not noticed immediately. India contains over around 17 percent of the global population but only 4 percent of freshwater access and this will result in major water shortage in the country, whose effects will be compounded by climate change in the future. Internet of Things is the idea of connecting remote devices together using the internet. This project aims to reduce water theft and leakage by using a system consisting of flow sensors, solenoid valves and a GSM module connected to an Arduino board which sends the data to the server which displays the results on a dashboard resulting in the real time monitoring of the flow rate of water on both ends of the pipe. It uses the solenoid valve to immediately shut off the water supply if there is a difference in the flow rate between the ends of the pipe and alerts the authority with a SMS using the GSM module with the last recorded flow rates and the location of the system.**

Keywords*—Arduino, Flow Sensor, GSM Module, Internet of Things, Leak Detection, Solenoid Valve

I. INTRODUCTION

India is under the threat of facing severe water scarcity due to climate change and wastage of water. The current system consists of water being delivered from the reservoirs to their destinations using a vast network of pipelines. This network is spread across the nation and it is not feasible to monitor the entire network constantly with the current technology. A large part of this wastage can be attributed to the issue of leakage in pipes (on the faucet end or along the joints). Every year we hear reports of pipeline bursts within cities and villages, these bursts occur at random times and at random locations and many a times the water flowing through these pipes get wasted to the drain as there are no ways to immediately restrict the flow of water through these damaged pipes. Another issue of unmonitored water flow is water theft wherein someone may acquire an illegal water connection by modifying a section of the pipeline network to allow a source from the main line to their places/residences causing the legal consumer of the line to end up paying extra for water usage that they themselves haven't used/consumed. The current methods in use to deal with such problems, although effective, are time consuming and delayed. As a result, even though, the issue is taken care of eventually, the wastage still occurs. A feasible solution to this problem could be the provision of real-time monitoring along with an automated flow shutdown system, wherein an official can monitor water flow of the entire pipeline network in real-time and take necessary steps to prevent said wastage and theft, and the automated system can help instantly restrict water flow so that wastage can be reduced. Using automated monitoring through IoT we can setup a multi-node communication network that monitors water flow through the node and communicates it to the next node in the network and also to the central server so that any discrepancy in distribution is instantly reported and acted upon. This Paper introduces a Leak Detection System which forms a nodal network of systems to monitor water flow in real time and can provide a timely alert with the location in case of any irregularities or issues and automatically restricts the flow of water through that particular location until the issue is resolved. These alerts are then sent to the next node on the network as well as to a central server which keeps a log of such activities and displays it onto an online dashboard containing a map of the network. This system will use the existing Global System for Mobile Communication (GSM) for sending data to the Server and nodes.

II. PROPOSED SYSTEM

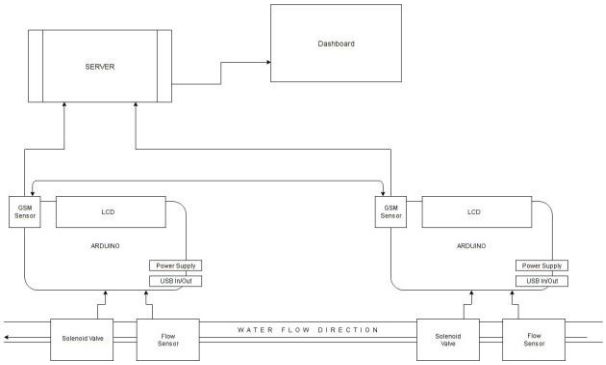

Fig. 1. Block diagram of the proposed system

A. Components Used

- Arduino Uno:
  It is an Open Source microcontroller board based on the ATmega328P microcontroller. It consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, 16 MHz quartz crystal, USB connection (USB A to B), a power jack and a RESET button. It can be powered with a USB cable or power it with an AC- DC adapter or battery to get started. It can accept 7V-20V power supply and can operate on a maximum voltage of 5V.
- SIM800L:
  This module supports quad-band GSM/GPRS (General Packet Radio Service) network for connecting to the internet with HTTP and SMS message data remote transmission. The module also has built in TCP/IP stack that can be easily accessed

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 10, October-2019

via AT commands. This comes in handy for persistent data logging on low band- width networks required in this project. The SIM800L communicates with the microcontroller via UART port, supports command including 3GPP TS 27.007, 27.005 and SIMCOM enhanced AT Commands. The SIM800L supports quad-band frequencies 850/900/1800/1900MHz.

- Flow Sensor:
  The Water Flow Sensor is an instrument that uses Hall effect to measure linear, nonlinear, mass or volumetric flow rate of a liquid or a gas. The flow sensor consists of a plastic valve body, a rotor, and a hall-effect sensor. When water or gas flows through the rotor, the rotor rotates, the speed of the rotor changes with different rate of flow. The hall-effect sensor records these rotations as pulses and according to the pulses outputs the amount of water or gas flowing through the sensor. It operates on a maximum working voltage of 5V and minimum of 4.5V.
- Solenoid Valve:
  It is an electrically operated valve with one inlet port and one outlet port and a central core which consists of a core spring holding a valve seal. The valve seal prevents the flow of fluid or gas through the valve in the de-energized condition. When a strong flow of water passes through the valve its pressure pushes the seal upwards and enables the passage of water. In the energized state the core spring pulls up the valve seal and opens the valve for regular fluid flow. The Solenoid Valve operates on 12V. Since the Arduino UNO is unable to provide 12V of charge, to keep it powered we attach a Motor Driver circuit along with it to provide it with the desired voltage.
- LCD:
  The 16x2 LCD is a very basic electronic display module. It has 16 characters per line and there are 2 such lines. Each character is displayed in a 5x7 pixel matrix. This module has 2 registers viz Command and Data. The command register stores the command instructions given to the LCD and the data register stores the data to be displayed [1].

III. WORKING

The proposed method is to use an IoT system to automate most of the water leak detection system. In this method a system consisting of Arduino, flow sensor, solenoid valve and

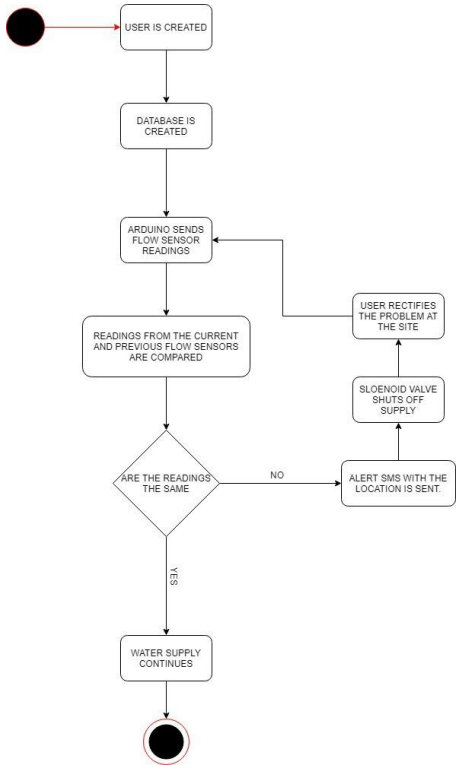

Fig. 2. Flow chart of the proposed system

GSM sim is connected to each end of the pipe which is saved in the database. The water flow through the pipes is recorded by the flow meter. This has an IoT sim card which sends the usage data to the server. The system checks the and compares the flow meter reading from the flow sensor at both ends of the same pipe. If the readings from both the sensors match the solenoid valve allows the water flow to continue, in case the readings do not match the solenoid valve shuts down the water flow at both ends of the pipe. Following closing the solenoid valve the sim card sends a message [2] to the concerned authority with the GPS coordinates of the shutdown valves. It is possible to remotely open the valve through the dashboard after the problem is fixed.

IV. OBJECTIVE

This project is a model to develop a modern, efficient leak detection system with fast and accurate data transfer with location reporting. It uses Arduino and a slew of sensors to keep the cost down and fetch the water flow readings continuously, to measure the flow and amount of water passing through also with shutting down the water flow immediately when a leak is detected. Leaks can be caused by damage in the pipes or illegal water siphoning by creating openings in the pipes. For analysis the data is stored can be accessed by the concerned authorities to identify the area where the most leaks or thefts occur. This system also has a dashboard which show the locations of the connections on a map in real time. The connections have a icon representing the state they are in, green being the water flow is occurring and red being the water flow

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 10, October-2019

has been stopped. This project is useful for reducing water waste due to leaks and water thefts and provide real time monitoring of the system.

V. FUTURE SCOPE

- Water Quality Monitoring can be implemented in this system by measuring 5 different parameters- ph level, temperature, conductivity, carbon dioxide level and turbidity [3].The system can stop water flow if the quality of water flowing through deteriorates. Monitoring of the water quality is simplified using the existing GSM network [4] and authorities can be alerted immediately.
- A Penalty system can be implemented, if the authorities do not take action with a specified time period after being alerted, the concerned authority are automatically penalized for each day over the time.

VI. CONCLUSION

The system makes use of IoT for leak detection in real time. The system is highly scalable and low cost. All implemented systems connected are connected to the server and can be monitored by the dashboard. This system greatly reduces water wastage in case of a leak by immediately stopping the flow of water through the pipe.

REFERENCES

[1] M. Mehta, R. Misra, A. Chaugule, and J. Gupta, "Automated water me- tering system." *International Journal of Advanced Research in Computer Science*, vol. 10, no. 2, 2019.

[2] M. M. Rahman, M. O. Islam, M. S. Salakin *et al.*, "Arduino and gsm based smart energy meter for advanced metering and billing system," in *2015 International Conference on Electrical Engineering and Information Communication Technology (ICEEICT)*. IEEE, 2015, pp. 1–6.

[3] A. D. Ghorpade, A. Ghosh, J. Athmi, S. Vyshak, and C. Raji, "Solar powered smart water quality monitoring system using iot."

[4] M. Hemanth Kumar, S. Karthikeyan, G. Manjunath, and M. Rakshith, "Solar power environmental air pollution & water quality monitoring system based on iot," 2018.