Authentication using Raspberry Pi

1st Dr.B.Anjanee kumar
Dadi Institute of Engineering & Technology
JNTUGV
Visakhapatnam, India.

2nd Bandaru Jayanth
Dadi Institute of Engineering & Technology
JNTUGV
Visakhapatnam, India.

3rd Koidala Nikhil
Dadi Institute of Engineering & Technology
JNTUGV
Visakhapatnam, India.

Abstract- ***The Water Leakage and Theft Detection System using IoT described in this project utilizes Raspberry Pi , water flow sensors and Node MCU microcontrollers to monitor water flow within pipelines, applying principles of fluid mechanics and kinematic physics to detect leaks and irregularities. This data is wirelessly transmitted via a sensor network to an IoT platform for continuous real-time monitoring. In case of anomalies, such as leakages or unauthorized water usage, the system sends alerts and notifications via GSM technology, enabling quick response and location identification. A user-friendly mobile interface simplifies access to the system's data and alerts, offering benefits like early leak detection, reduced water losses, cost savings, and enhanced water resource management, ultimately contributing to more efficient and sustainable water distribution systems.***

Keywords-Raspberry Pi, Node MCU, Water Flow Sensors, GSM Module.

I. INTRODUCTION

The nation's progress has historically depended heavily on oil and gas, therefore monitoring the pipeline carrying these resources has drawn a lot of attention. Conversely, future water scarcity has always been disregarded. Many people waste water because they are unaware that no significant action has been taken globally to stop water loss. A few nations have used various platforms and strategies to stop water leaks, including China, Germany, the United Kingdom, and the United States. The best monitoring strategy will depend on the complexity of the pipeline network, the surrounding weather, and the factors that contribute to the formation of particular faults.

About two thousand slum dwellings, 90% of which are illegal, are located in Mumbai on either side of the water pipeline.
Each year, water theft and illicit connections cost the Brihanmumbai Municipal Corporation an estimated Rs. 400 crore in damages.The poor condition of the aging pipelines had also resulted in numerous pipeline busting accidents in Mumbai.The pipeline network has been subjected to manual surveillance by Thane Municipal Corporation due to significant water leaks and tampering with the pipeline BMC. However, because of inevitable human mistake, water loss persists, leading to a lack of water supply and the consequent low pressure water delivery that results in frequent water cuts.

This initiative offers an affordable and straightforward method of pipeline monitoring. Not only does it offer surveillance, but it also uses SMS to alert concerned staff members to the approximate location of leaks. Once the water pressure drops below the acceptable level, the appropriate action is taken.

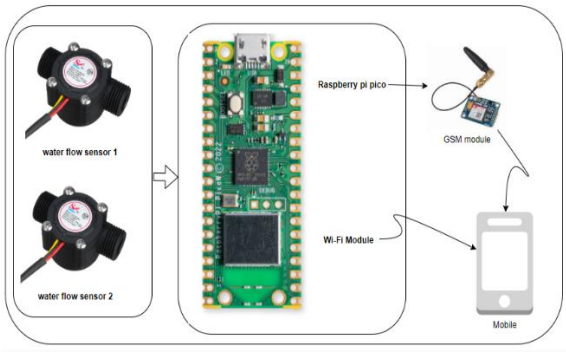
II. PROPOSED MODEL

There are several ways to monitor public water supplies to prevent fraud and tampering. The Raspberry Pi, LCD and flow sensors are set up in this system to show the amount of water in pipelines. Water must be released in accordance with official directives, such as when alternate days of supply are offered and only for a set amount of time, not every day. Using an IOT module attached to a controller, all the details will be shown on the web server.

In order for the appropriate action to be taken by the authorities in the event of misuse this water board system is cutting edge, trouble-free, and fit and forget. Malfunctions can be prevented by utilizing all of these. As water travels through the pipeline, the signal processing unit measures the flow rate. The sensor functions within a predetermined range. The water flow sensor will identify any difference in the water flow caused by any water being pumped through a motor.

The desired input signal for the ADC is provided by the signal conditioning device. The Analog to Digital Convertor (ADC) transforms the analog signals produced by variations in the water flow detected by the water flow sensor into digital signals, which are then supplied to the Microcontroller. The transmitter signal for the connection to the water supply board is enabled by this microcontroller.

This allows for the avoidance of manual supervision in extremely remote locations. MathWork developed ThingSpeak, a cloud network that can gather data from private channels like individual sensors and is supported by MATLAB software. It can use the Internet of Things platform to disseminate the data with public channels. The ability of the cloud to analyze data collected is maybe the most fascinating feature.



III. IMPLEMENTATION

A. Raspberry Pi

A new addition to the Raspberry Pi Foundation's lineup of reasonably priced and adaptable computing solutions is the Raspberry Pi Pico, a microcontroller board. With its dual-core Arm Cortex-M0+ processor, the RP2040 chip, the Pico microcontroller, which was introduced in early 2021, is unique in that it is small and reasonably priced. A wide range of projects, from embedded systems to educational applications, may benefit greatly from the Pico's versatility and 2MB of onboard flash memory. The reason for its appeal is because it's easy to use, can be programmed in MicroPython and C, and has GPIO pins for easy interface with sensors, actuators, and other components. These features enable both hobbyists and experts to go deeper into the field of embedded systems developers and physical computing.

B. Node MCU

NodeMCU is a versatile open-source IoT platform based on the ESP8266 Wi-Fi module. It combines the capabilities of a microcontroller with built-in Wi-Fi, making it ideal for Internet of Things (IoT) projects. NodeMCU features a Lua-based firmware that simplifies programming, allowing developers to focus on their applications. It supports GPIO, PWM, I2C, and SPI interfaces for seamless integration with various sensors and devices. With its compact size and cost-effectiveness, NodeMCU is widely used for home automation, smart devices, and DIY projects, offering a convenient solution for connecting devices to the internet and creating interconnected systems.

C.GSM Module

The GSM (Global System for Mobile Communications) module is a vital component in communication technology, enabling devices to connect to mobile networks. Commonly used in applications like IoT, tracking systems, and remote monitoring, GSM modules facilitate two-way communication through SMS or data transmission. They are compact, making

D.YF-S201 Flow Sensor

The YF-S201 flow sensor is a compact and reliable device commonly used for measuring the flow rate of liquids. With its hall-effect sensor and impeller design, it provides accurate and consistent readings. The sensor is easy to integrate into various applications, such as water flow monitoring systems or irrigation setups. Its durable construction ensures longevity and reliability, making it a popular choice among DIY enthusiasts and professionals alike for projects requiring precise liquid flow measurements.

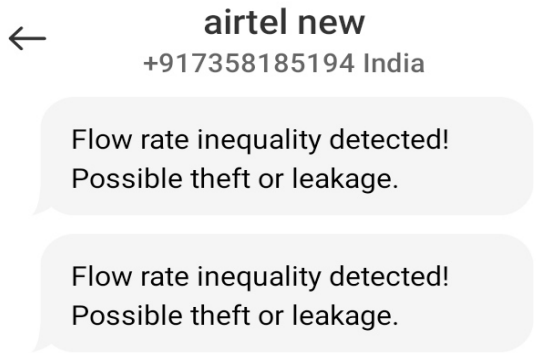
IV.RESULT

Water pressure sensor not only continuously monitor the pressure but also data is uploaded on CLOUD server every after 15 seconds. CLOUD is capable of showing the readings in the form of graph which gives idea of situation more quickly. It is also capable of performing data analysis which is helpful in identifying most repetitive leakage pattern. From the position of the sensor, location of leakage can be recognized which is helpful to decide either short term or long term solution. Prototype will show only two sensors, but practically more than one sensor along with RPi can be mounted over the pipeline.

If number of observatory points over the pipeline are increased then location of the leakage will be able to be determined more accurately. Graph shows readings taken by pressure sensor mapped against time. Every after 15 seconds output noted by sensor is updated on cloud server by RPi kit. This gives immense flexibility for a concerned staff which may observe the readings from remote place.

Pictorial representation brings the drop into pressure into notice more easily. Right now only pressure sensor output is shown. Number of graphs will be increased as we go on increasing number of sensors all over the pipeline.

Referring to these graphs cloud also can do some analysis part which is helpful in determining patterns for a specific place where leakage occurs repetitively. Once such places are known permanent solution can be implemented to avoid further leakage.



V.CONCLUSION

SMS is generated using GSM900A kit to alert the concerned faculties. Live data i.e. both sensor's output will be updated on ThingSpeak. RPi will be taking the preliminary measure in order to reduce the water loss due to leakage before manual intervention is applied. More than one kit will be mounted all over pipeline for monitoring purpose where each kit will include Raspberry Pi, Water flow sensor and a gsm module. To know exact location of leakage between two observatory kits one portable kit will be designed, so that without digging the ground crack or leakage can be determined.

FUTURE SCOPE

The future scope of a water tampering and leak detection project, incorporating AI, holds significant promise for enhancing water management systems. By leveraging AI algorithms, the system can evolve to intelligently analyze water usage patterns, detect anomalies, and identify potential leaks or tampering more accurately. Real-time monitoring and predictive analytics can be implemented to provide early warnings and prevent substantial water loss. Moreover, the integration of auditory AI could introduce advanced sound analysis techniques, allowing the system to recognize specific acoustic patterns associated with leaks or tampering, thereby improving the overall detection accuracy. As technology advances, this combination of water monitoring, AI, and auditory analysis holds great potential for creating more resilient and efficient water supply networks.

REFERENCES

1] Gouthaman. J, Bharathwajanprabhu. R & Srikanth. A, Automated urban drinking water supply control and water theft identification system Students' Technology Symposium,2011 IEEE,14-16 Jan,pp.87-91,2011.

[2] Stancel, E, Stoian, I,Kovacs, I, &Gyurka, B.Z, Urban water supply distributed control system, IEEE International Conference on Automation Quality and Testing, Robotics,2008,Vol.3,pp.316-320,2008.

[3] Mr.PrashantPalkar , Prof. (Dr.) Shrinivas Patil, Prof. Mrs. Pooja Belagali, Mr. Ashish Chougule, Automation in drinking water supply distributed system and testing of waterIOSR Journal of Electronics & Communication Engineering (IOSR-JECE),pp.36-38.

[4] J.P.Shritharanyaa, A.jagadeesan, A.lavanya, Theft identification and automated water supply system using embedded technology, IJAREEIE, Volume. 2, Issue 8, August 2013.

[5] N.R Kolhare, P.R Thorat,(2013) An Approach of Flow Measurement In Solar Water Heater UsingTurbine Flow Meter, International Journal of Engineering Research & Technology (IJERT), Volume. 2,pp. 1-4.

[6] S.Leirens, C. Zamora, R.R. Negenborn, and B. De Schutter Coordination in urban water supply networks using distributed model predictive control Proceedings of the 2010 American Control Conference, Baltimore, Maryland, pp. 3957–3962, 2010.

[7] Andrea Cataldo, Giuseppe Cannazza, Egidio De Benedetto, and Nicola Giaquinto "A New Method for Detecting Leaks in Underground Water Pipelines",IEEE sensors journal, vol. 12, no. 6, June 2012

[8] Paul W. Fieguth, Sunil K. Sinha, "Automated Analysis and Detection of Cracks in Underground Scanned Pipes" IEEE 0-7803-5167-2/99- 1999

[9] Abdullah Kadri, Adnan Abu-Dayya, Riccardo Stefanelli, Daniele Trinchero, "Characterization of an Acoustic Wireless Sensor for Water Leakage Detection in Underground Pipe" IEEE 978-1-4673-2821-0/13 © 2013

[10] MengYuan, Ping Liu, Bo She, Youliang Tang, Yan Xu, "Research of MEMS Piezoresistive Pressure sensor" IEEE 978-1-4244-9088-2/10 ©2010

[11] Kiat Siong Ng, Pei-Yin Chen, Yuan-Chi Tseng, "A Design of Automatic Water Leak Detection Device", IEEE 978-1-5090-6252-2/17 ©2017

[12] O. Hunaidi, M. Bracken, T. Gambino, and C. Fricke, "Acoustic methods for locating leaks in municipal water pipe networks," in Proc. Int. Conf. WaterDemand Manag., Dead Sea, Jordan, 2004, pp. 1–14.

[13] J. R. Andrews, Time Domain Reflectometry and Time Domain Transmission Measurement Fundamentals, Boulder, CO, Nov. 2004.

[14] P. Kiran Kumar Reddy, "Underground Pipes Detection using Ground Penetrating Radar Signals" Research India Publications, Advances in Computational Sciences and Technology ISSN 0973-6107 Volume 10, Number 8 (2017) pp. 2435-2448

[15]Kurtz D. W., "Developments in a free-swimming acoustic leak detection system for water transmission pipelines," ASCE Conf. Proc., vol. 25, no. 211, 2006.

[16] Schempf H., Mutschler E., Goltsberg V., Skoptsov G., Gavaert A. and Vradis G., "Explorer: Untethered real-time gas main assessment robot system,"Proc. of Int. Workshop on Advances in Service Robotics (ASER), 2003.