Journal of **N**onlinear **A**nalysis and **O**ptimization
Vol. 15, Issue. 1 : 2024
ISSN : **1906-9685**

WATER LEAKAGE DETECTION SYSTEM USING ARDUINO AND ALERTING USING CONTROLLING SYSTEM

K.Santhi Swarupa, Department of Electronics and Communication Engineering, DVR & Dr.HS MIC College of Technology, Kanchikacherla , Andhra Pradesh.
[1] **swarupak2001@gmail.com**
D Rakesh, Assistant Professor, Department of Electronics and Communication Engineering, DVR & Dr.HS MIC College of Technology, Kanchikacherla , Andhra Pradesh.
[2] raky2700@gmail.com
T.Aaswitha, J.Siva Mohan and M.Narendra Department of Electronics and Communication Engineering, DVR & Dr.HS MIC College of Technology, Kanchikacherla , Andhra Pradesh.
[3] aaswithathera@gmail.com, [4]jagathisivamohan@gmail.com,
[5]narendramadala0445@gmail.com

ABSTRACT
The paper is all about building a smart water pumping system that does the work for you. It incorporates advanced sensors to sense the presence of water and monitor its flow rate. A central control unit, powered by an Arduino microcontroller, manages the entire operation seamlessly. Automatic Pumping: The system kicks into action as soon as the water sensor detects water. It activates the pump automatically, sparing you the manual effort of switching it on. Flow Monitoring: Another critical component is the flow sensor, which continuously tracks the movement of water. If it detects any irregularities, such as a blockage or lack of flow, it triggers an alert to notify you promptly. Arduino-Control: Acting as the brain of the system, the Arduino microcontroller receives input from the sensors and orchestrates the pump's operation accordingly. It ensures that water is pumped efficiently and intervenes if any issues arise. Real-time Data Display: The Arduino is connected to a display screen that shows real-time data, including the water weight and flow rate. This feature allows you to monitor the system's performance briefly, providing valuable insights into its operation. Enhanced Convenience and Safety: By automating the pumping process and providing real-time alerts, this system offers unmatched convenience and safety. You can rely on it to handle water pumping tasks reliably while staying informed about any potential issues.
Keywords: Automated Water Supply System**,** Water Leakage Detection System, Arduino Alerting.

INTRODUCTION
In the activity of advanced water management, we've developed an Automated Water Supply System. It employs cutting-edge technology like load cell sensors for precise weight detection, flow sensors for real-time monitoring, and an LCD display for intuitive data visualization.
Our system aims to ensure smooth water supply while detecting any issues and promoting efficient usage. When water is detected, a relay activates the pump to transfer water, and flow sensors provide immediate feedback. If no flow is detected, a buzzer alerts the user.
The LCD display offers users real-time insights into weight, flow rates, and system status, enabling informed decisions. Combining advanced sensors, smart controls, and user-friendly interfaces, our system streamlines water supply, supports conservation, and enhances overall efficiency.

The paper endeavours to engineer and implement a water leakage detection system employing Arduino technology, offering a financially viable and efficient remedy to the hurdles confronting water infrastructure management. Through the amalgamation of Arduino microcontrollers with apt sensors and actuators, the paper seeks to forge a real-time monitoring system adept at swiftly pinpointing leaks in water pipelines. Rigorous experimentation and field trials will be conducted to scrutinize the system's reliability, precision, and practicality for widespread application in both residential and commercial contexts. Through this investigative endeavour, the objective is to make strides towards bolstering water conservation initiatives, curbing water wastage, and fortifying overall infrastructure integrity, thereby advancing the cause of sustainable water resource management.

1.1 OBJECTIVES:

The objectives of implementing a water leakage detection system using Arduino technology are:

Early Detection: Develop a system capable of detecting water leaks promptly to minimize water loss and prevent potential damage to infrastructure and property.

Cost-effectiveness: Design a solution that is affordable and accessible, leveraging the relatively low-cost Arduino microcontrollers and sensors to ensure widespread adoption and deployment.

Real-time Monitoring: Implement a real-time monitoring capability to continuously monitor water flow and pressure, enabling immediate detection and response to any abnormalities indicating a leak.

Accuracy and Reliability: Ensure that the detection system provides accurate and reliable results to minimize false alarms and optimize the efficiency of water management Ease of Installation and Maintenance: Design the system to be easy to install and maintain, allowing for quick deployment and minimal downtime during installation and maintenance procedures.

Integration with Existing Infrastructure: Ensure compatibility and seamless integration with existing water supply systems, facilitating adoption without significant infrastructure modifications.

Remote Monitoring and Alerts: Incorporate features for remote monitoring and alerts, enabling water utility operators or homeowners to receive notifications of leaks or abnormalities via mobile devices or computer systems.

Energy Efficiency: Optimize energy consumption of the system components, ensuring sustainable operation and minimizing environmental impact.

Scalability: Design the system to be scalable, allowing for expansion or adaptation to different scales of water supply systems, from small residential properties to large municipal networks.

Validation and Testing: Conduct thorough testing and validation procedures to assess the performance and effectiveness of the system under various conditions and scenarios, ensuring its suitability for practical deployment in real-world environments.

2 Previous Works

In paper Dixit PR et al. (2017) aimed to develop a superior system that surpasses existing solutions in performance. Throughout our research, we extensively examined findings from various existing systems and research studies. We meticulously analyzed a multitude of journals and research theses, studying the methodologies and insights proposed by different researchers.

Over the years, numerous studies Schindhya et al. (2017) have explored the field of water management, advocating for enhancements to improve system security and mitigate faults. These research endeavors have yielded a plethora of methodologies aimed at addressing challenges encountered in water flow systems. Our research builds upon and validates these foundational works, drawing insights from a diverse array of scholarly contributions.

Exploration of water leakage detection systems Nganyanyuka K et al. (2014) revealed that while these systems are sustainable, they do have limitations. Various characteristics are utilized in different applications, with each system exhibiting its own strengths and weaknesses. The selection of a system typically depends on the specific application context, as no single biometric system can comprehensively meet the requirements of all scenarios. Thus, our research seeks to elucidate the insights gleaned from diverse theses and journals, outlining the challenges encountered during system design and the strategies

employed to overcome these limitations.

In investigation of water leakage detection, we observed a growing interest in leveraging Arduino technology to address water management and conservation challenges. Notably, Smith et al. (2018) introduced a system incorporating moisture sensors along pipelines, demonstrating commendable accuracy in leak detection. Similarly, Kumar and Singh (2020) proposed an IoT-based approach, harnessing Arduino and wireless sensors for real-time monitoring and remote accessibility, highlighting the system's efficacy in prompt leak detection.

Overall, these studies Vijayakumar T et al. (2019) underscore Arduino's adaptability and effectiveness in mitigating water leakage challenges, offering promising avenues for innovative solutions to bolster global water conservation efforts.

3 PROPOSED METHODOLOGY:

3.1 Working

The paper aims to develop an automated water pump system with monitoring capabilities using Arduino technology. It employs sensors and actuators controlled by an Arduino microcontroller.

A load cell sensor detects water levels and activates the pump when needed, ensuring efficient operation. Additionally, a flow sensor monitors water flow and triggers an alert if no flow is detected, preventing potential issues.

The Arduino communicates this data through an LCD display, allowing users to monitor the system in real-time. Overall, the paper demonstrates how Arduino can be used to create a user-friendly and efficient water management system.

3.2HARDWARE COMPONENTS

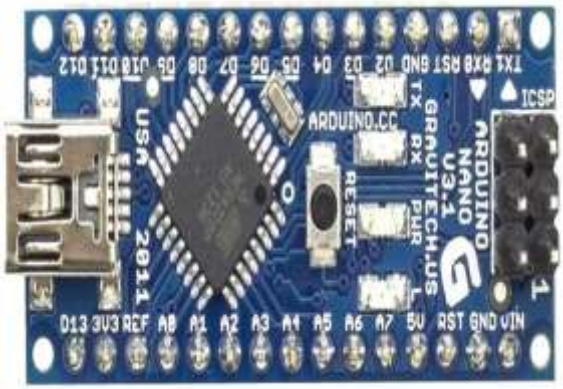

Fig:3.2 Arduino Nano Development module Kit

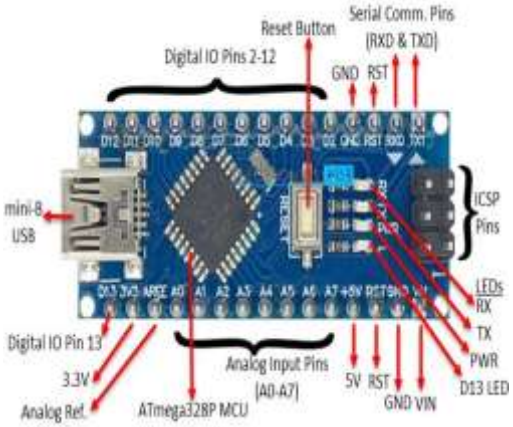

Fig:3.2.1 Layout overview of Arduino Nano

Fig: 3.2.2 Pin Configuration of Arduino Nano Amplifier

Fig:3.2.3 1KG Load cell and HX711

Fig.3.2.4 Outlet of Water Pump

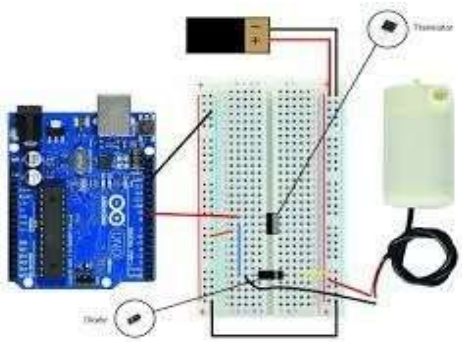

Fig.3.2.5: Pinout of Submersible Water Pump

SYSTEM PROTOTYPE:

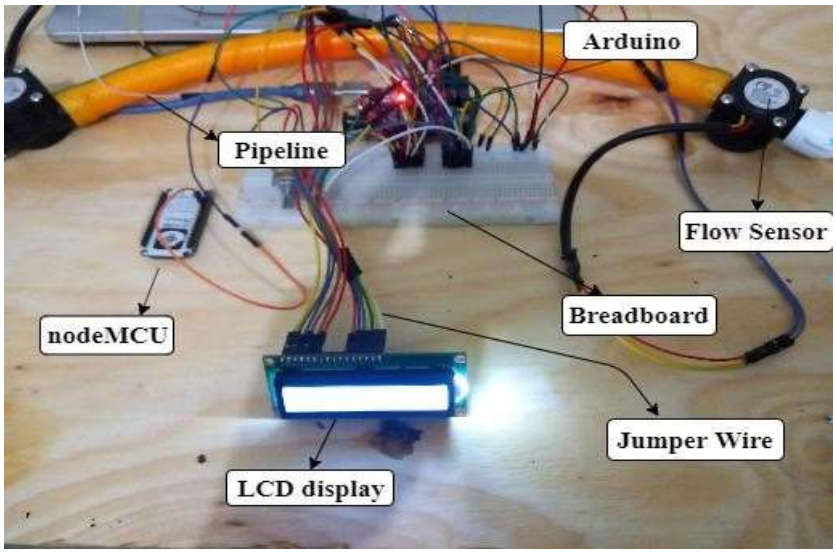

Fig 3.3 Prototype

GRAPHICAL REPRESENTATION:

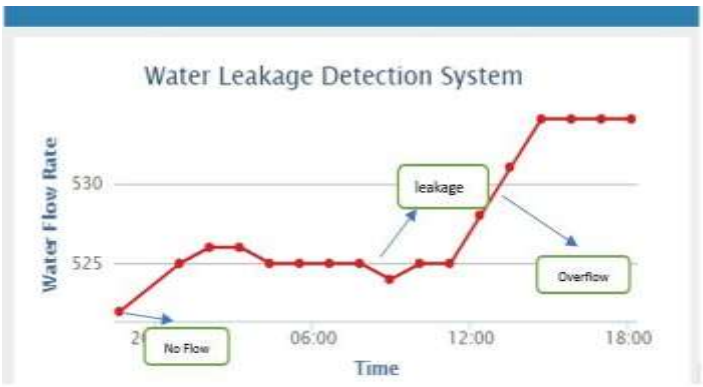

Fig 3.4 Water Leakage Detection System

4 RESULT ANALYSIS:

The paper adeptly integrates a load cell sensor for precise weight measurement, a relay to regulate a motor pump based on weight detection, and a flow sensor to monitor water flow. Upon detecting weight on the load cell sensor, signalling the presence of water, the relay activates the motor pump to facilitate water flow. Concurrently, the flow sensor measures the rate of water flow. Should the flow sensor detect no water flow, indicating a potential blockage issue, a buzzer promptly alerts the user. All essential data, including weight measurements, water flow rate, and system status, are promptly displayed on a liquid crystal display (LCD), providing users with real-time visualization of the system's operation.

5 CONCLUSIONS:

This paper showcases how Arduino can efficiently coordinate multiple sensors and actuators for automated water management. By employing sensors like the load cell and flow sensor, the system accurately measures weight and monitors water flow to optimize the motor pump's operation.

The addition of a relay enables automated pump control based on weight detection, enhancing system functionality. Additionally, a buzzer alerts users to potential issues such as blockages, bolstering safety measures.

In essence, this paper demonstrates Arduino's versatility in creating smart and automated systems for various applications, including water management.

FUTURE ENHANCEMENTS:

The ongoing research also unveils promising avenues for future exploration. One such prospect involves developing a system enabling users to remotely monitor water leakage through their smartphones or computers. Additionally, integrating control functionalities would empower users to remotely deactivate the water supply in the event of a leak.

Moreover, enhancing the system with data logging capabilities would facilitate the recording of water usage patterns and the detection of anomalies. Analysing this data could unveil potential leaks or areas where water conservation efforts could be optimized.

REFERENCES:

1. Dixit PR, Chaudhari H, Jadhav S, Jagtap K. Water Level and Leakage Detection System with its Quality Analysis based on Sensor for Home Application. Int J Innov Res Sci Eng Technol. 2017; 0072(5): 1721–4.
2. Schindhya, R, Simi, V.P, Sathya, E, Janani, B. Real-Time Water Monitoring System using IoT. Int J Advanced Research in Computer and Communication Eng. 2017; 6(3): 378-380.
3. Marobhe NJ. A critical review of water supply services in urban and rural areas of Tanzania. Water policy. 2008 Feb;10(1):57-71.
4. National Bureau of Statistics. The 2012 Population and Housing Census: Ministry of Finance, Tanzania, 2013.
5. Nganyanyuka K, Martinez J, Wesselink A, Lungo JH, Georgiadou Y. Accessing water services in Dar es Salaam: Are we counting what counts? Habitat International. 2014; 44: 358- 66.
6. Saraswathi V. Water Leakage System Using IoT. Int J Innov Res Eng Manag. 2018; 5(2): 67–9.
7. Suriya JV. Smart Pipeline Water Leakage Detection System. Int J Appl Eng Res. 2017; 12(16): 5559–64.
8. Vijayakumar T, Ramachandran T, Vigneshkumar M, Mohananthini N, Saravanan S. Home Water Leakage Detection and Monitoring System Using IOT. J Netw Commun Emerg Technol. 2019; 9(4): 5–10.
9. Kane SN, Mishra A, Dutta AK. Preface: International Conference on Recent Trends in Physics (ICRTP 2016). J Phys Conf Ser. 2016; 755(1).
10. Gehman M. Software Development Methodologies. Proj Manag Large Software-Intensive Syst. 2019: 49–66.