M.KUMARASAMY
COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
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ISO 9001:2015 Certified Institution
Thalavapalayam, Karur – 639 113.

A Minor Project II Report
on

WATER LEAKAGE DETECTION SYSTEM WITH AUTOMATIC STOPPING MECHANISM

Submitted by

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M.KUMARASAMY COLLEGE OF ENGINEERING

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THALAVAPALAYAM, KARUR-6369113.

MAY 2024

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(Autonomous Institution, Affiliated to Anna University, Chennai)

BONAFIDE CERTIFICATE

Certified that this Report titled **"WATER LEAKAGE DETECTION SYSTEM WITH AUTOMATIC STOPPING MECHANISM"** is the bonafide work of **ADHINI P V (927622BEE003), AGILESH S (927622BEE005**), **ARAVIND S (927622BEE006)** who carried out the work during the academic year (2023-2024) under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other project report.

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Submitted for Minor Project II (18EEP202L) viva-voce Examination held at M.Kumarasamy College of Engineering,Karur-639113 on ……..

DECLARATION

We affirm that the Minor Project II report title **"WATER LEAKAGE DETECTION SYSTEM WITH AUTOMATIC STOPPING MECHANISM"** being submitted in partial fulfillment for the award of **Bachelor of Engineering in Electrical and Electronics** is the original work carried out by us.

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VISION AND MISSION OF THE INSTITUTION

VISION

- ✓ To emerge as a leader among the top institutions in the field of technical education

MISSION

- ✓ Produce smart technocrats with empirical knowledge who can surmount the global Challenges.
- ✓ Create a diverse, fully-engaged, learner - centric campus environment to provide Quality education to the students.
- ✓ Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To produce smart and dynamic professionals with profound theoretical and practical knowledge comparable with the best in the field.

MISSION

- ✓ Produce hi-tech professionals in the field of Electrical and Electronics Engineering by inculcating core knowledge.
- ✓ Produce highly competent professionals with thrust on research.
- ✓ Provide personalized training to the students for enriching their skills.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

- ✓ **PEO1:** Graduates will have flourishing career in the core areas of Electrical Engineering and also allied disciplines.
- ✓ **PEO2:** Graduates will pursue higher studies and succeed in academic/research careers
- ✓ **PEO3:** Graduates will be a successful entrepreneur in creating jobs related to Electrical and Electronics Engineering /allied disciplines.
- ✓ **PEO4:** Graduates will practice ethics and have habit of continuous learning for their success in the chosen career.

PROGRAMME OUTCOMES(POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree program, the students will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of solutions: Design solutions for Complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6:The Engineer and Society: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7:Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member orleader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

The following are the Program Specific Outcomes of Engineering Students:

- **PSO1:** Apply the basic concepts of mathematics and science to analyse and design circuits, controls, Electrical machines and drives to solve complex problems.
- **PSO2:** Apply relevant models, resources and emerging tools and techniques to providesolutions to power and energy related issues & challenges.
- **PSO3:** Design, Develop and implement methods and concepts to facilitate solutions for electrical and electronics engineering related real-world problems.

Abstract (Key Words)	Mapping of POs and PSOs
Advanced water leak detection, Automatic Stopping mechanism, sends real-time alerts, user-friendliness	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 PSO1, PSO2, PSO3

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We are glad to thank all the **Faculty Members** of **Department of Electrical and Electronics Engineering** for extending a warm helping hand and valuable suggestions throughout the project.

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TABLE OF CONTENTS

ABSTRACT

The water leakage detection system with automatic stopping mechanism utilizes Arduino, a servo motor, a valve, and a water flow sensor to prevent water damage caused by leaks. The system operates by continuously monitoring the flow of water using the water flow sensor. When an abnormal flow rate is detected, indicating a potential leak, the Arduino triggers the servo motor to actuate the valve, shutting off the water supply to prevent further leakage. The Arduino is programmed to constantly monitor the output of the water flow sensor. If the sensor detects a flow rate exceeding a predefined threshold or experiences a sudden change in flow rate, the Arduino interprets this as a potential leak. In response, it sends a signal to the servo motor to rotate, closing the valve and cutting off the water supply. This system offers an automated solution for detecting and stopping water leaks, providing timely intervention to mitigate water damage. Additionally, the use of Arduino allows for flexibility in programming and customization, enabling adaptation to various plumbing setups and environmental conditions.

SAMPLE PICTURES

CHAPTER 1

SURVEY FORM ANALYSIS

1.1 NAME AND ADDRESS OF THE COMMUNITY:

S. Priya Dharshini, 136C, Thalavapalaiyam, Karur.

S. Indhira, 108C, Thalavapalaiyam, Karur.

R. Yagesh Raj, 4/394, Narasingan Street, Cuddalore.

U. Uthayan, 2/259, Kolayanur, Ariyalur.

Kumar,2/13, Mariamman Street, Namakkal.

Dhandapani, 5/467, Thuraiyur road, Namakkal.

1.2 PROBLEM IDENTIFICATION:

Unable to find water leakage occur in the underground.

Large amount of water is wasted due to slower process of finding the area of water leakage.

Older pipelines in buildings are getting damaged and the water gets leaked from the pipe.

1.3 PROPOSED SOLUTION:

Using sensors to find the water leakage occurs in the underground.

The project provides automatic instant valve closing system after finding the water leakage which reduce wastage of water.

CHAPTER 2
LITERATURE REVIEW

Paper 1: Flow Sensors in Industrial Processes: Enhancing Performance and Reliability

Inference: Highlighting industrial applications, this review explores how flow sensors contribute to enhancing the performance and reliability of various industrial processes, offering insights into their diverse roles.

Paper 2: Pressure Sensor Applications in Water Leakage Detection Systems: A Comprehensive Literature Review

Inference: This literature review critically examines the role of pressure sensors in water leakage detection systems, exploring the technological advancements, methodologies, and challenges associated with their implementation. It provides valuable insights into how pressure sensor technologies contribute to the effectiveness and reliability of water leakage detection, offering a foundation for further research and development in this domain.

Paper 3: Sensing the Drops: A Synoptic Analysis of Sensor Technologies in Water Leakage Detection

Inference: Examining a spectrum of sensor technologies, this literature review elucidates their strengths and limitations in water leakage detection systems, paving the way for informed decisions in selecting appropriate sensors for specific environmental conditions

Paper 4: Geared Motor Applications in Manual Valve Actuation: A Comprehensive Literature Review

Inference: This literature review explores the diverse applications of geared motors in manually operated valve systems, providing insights into their efficiency, reliability, and adaptability across various industrial and commercial settings.

Paper 5: Arduino-Based Water Leakage Detection Systems: An In-Depth Review

Inference: This literature review explores the diverse applications and innovations associated with Arduino-based water leakage detection systems, shedding light on the versatility and effectiveness of Arduino micro controllers in addressing water infrastructure challenges.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 BLOCK DIAGRAM

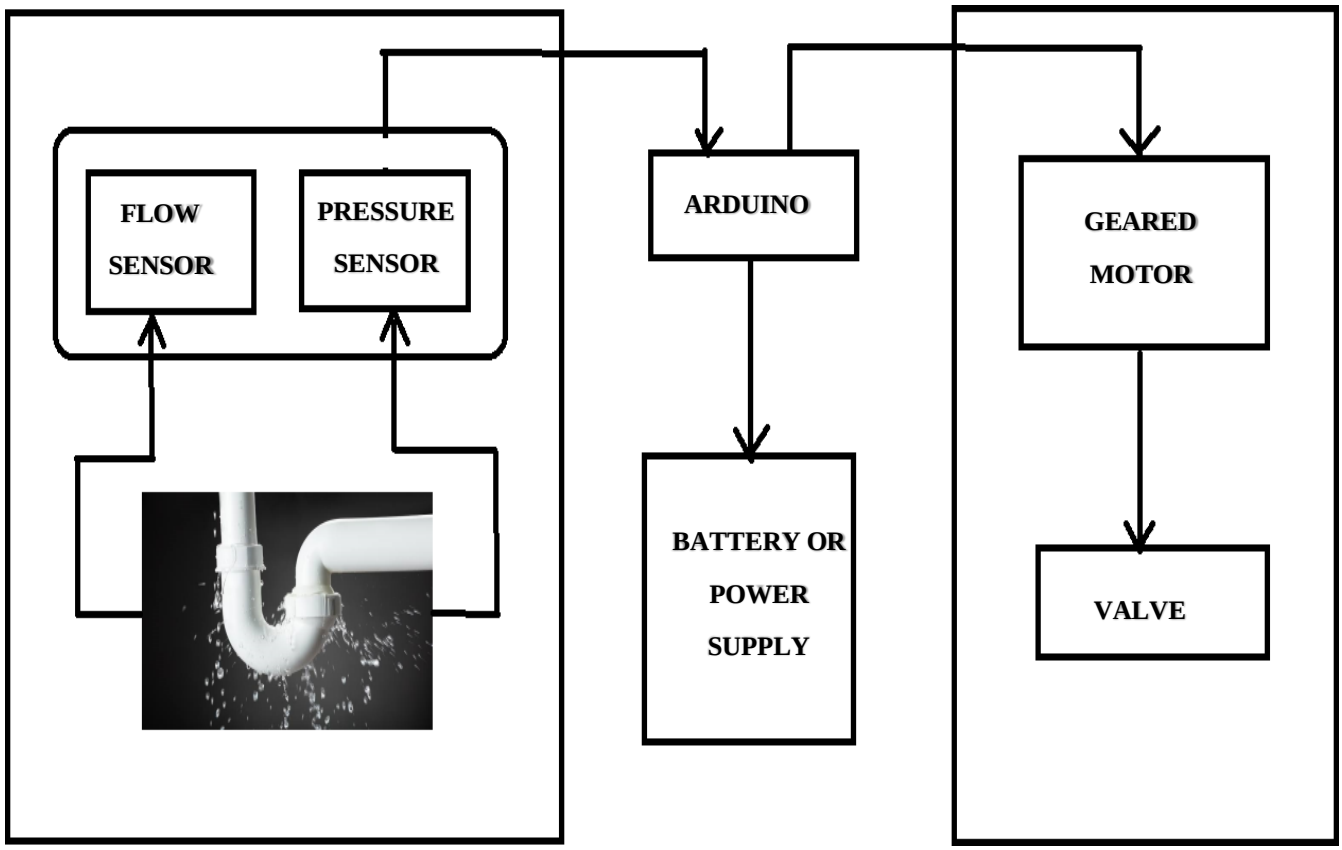

Fig no 3.1: Block Diagram of Project

3.2 DISCRIPTION OF PROJECT

The water leakage detection system with automatic stopping mechanism is designed for detecting the water leakage using two sensors. There are flow sensor and pressure sensor. It will detect the leakage and send the signal to Arduino micro controller. Arduino did not able to understand the signal form the sensor so we use Analog to Digital converter here for understand the signal to Arduino. Main purpose of the Arduino to control the whole circuit. Arduino act as a switch to control the supply for Geard motor. When Arduino receives the signal from the sensors it gives the supply to the Geard Motor. When the signals cut of from the sensor it cuts the supply. We did not able to rotate the shaft of the Geard motor manually. When we giving the supply the Geard motor the shaft starts to rotate. A manual valve mechanically coupled to the Geard motor shaft. When the Geard motor receives the supply the shaft starts to rotate a manual valve also rotates due to coupling with shaft. Due to the rotation of manual valve the shaft closes the valve.

In recent days we using some meter to detect the water leakage in the underground. Before the detection of leakage it takes some time. During the time period, there will be some amount of leakage of water by using “Water leakage detection system with automatic stopping mechanism” to detect the water leakage instantly. So we able to save the leakage of water.

By using “Water leakage detection system with automatic stopping mechanism” we able to detect the under ground water leakage in huge Metro Politian, Industrial, City areas etc…

3.3 ESTIMATED COST ANALYSIS OF PROJECT

3.3: Table 1: cost estimated analysis of the project

S.NO	COMPONENT DESCRIPTION	QUANTITY	COST
01	**BATTERY**	3	600
02	**MANUAL VALVE**	1	283
03	**FLOW SENSOR**	1	550
04	**ARDUINO**	1	810
05	**SERVO MOTOR**	1	250
		TOTAL	2493

CHAPTER 4

HARDWARE IMPLEMENTATION

4.1 COMPONENTS DESCRIPTION

ARDUINO BOARD:

The Arduino microcontroller acts as the brain of the system. It processes signals from the water flow sensor, executes the logic to detect leaks, and controls the servo motor to operate the valve. The Arduino is programmable, allowing for customization of thresholds and responses based on specific requirements.

WATER FLOW SENSOR:

The water flow sensor is responsible for measuring the flow rate of water through the pipe. It typically consists of a rotor, which spins as water flows through it, and a Hall effect sensor, which generates electrical pulses corresponding to the flow rate. The Arduino reads these pulses to determine the current water flow rate.

VALVE:

The valve is a mechanical device that controls the flow of water in the system. It can be either normally open or normally closed and is operated by the servo motor. When a leak is detected, the Arduino signals the servo motor to adjust the valve position, stopping the flow of water to prevent damage.

SERVO MOTOR:

The servo motor is used to actuate the valve based on the signals from the Arduino. Servos are precise and can be controlled to rotate to specific angles, making them ideal for opening or closing a valve.

4.2 HARDWARE KIT

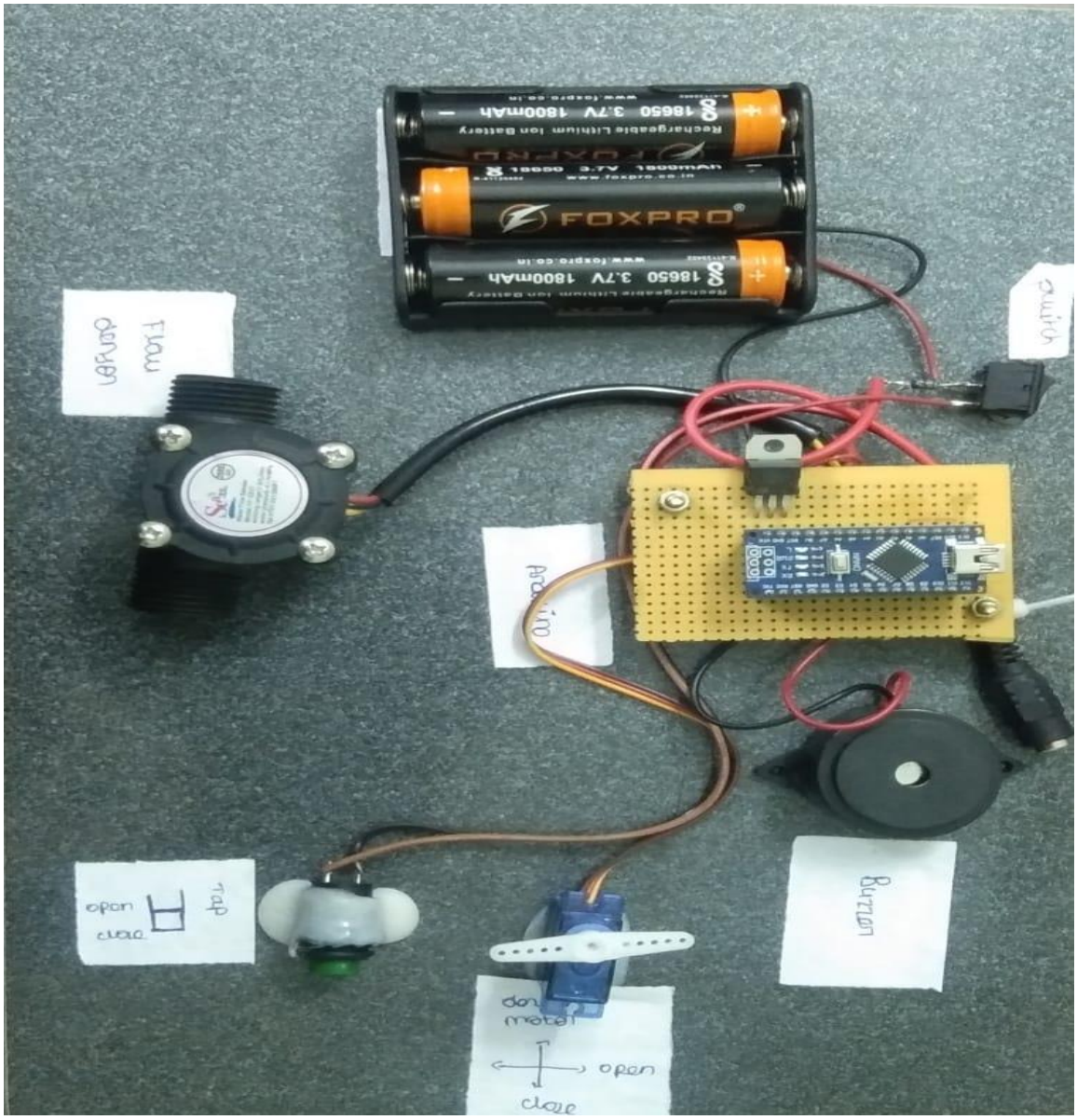

Fig.no.4.2 (a) Output model 1

- The water leakage detection system uses a water flow sensor to continuously monitor flow rates. When the Arduino detects abnormal flow indicating a leak, it signals the servo motor to close the valve, stopping the water supply. This automated response prevents further leakage and potential damage.

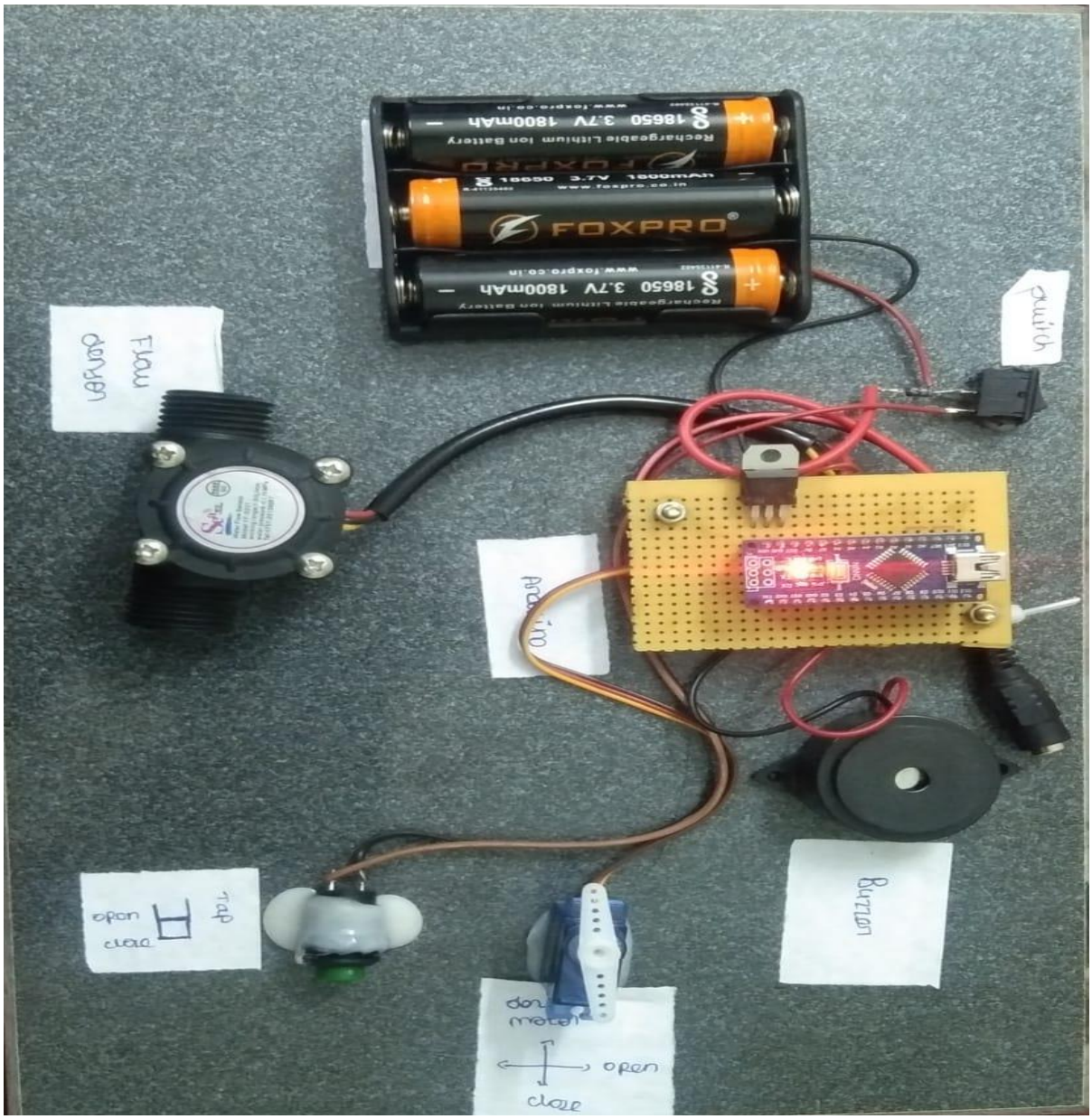

Fig.no.4.2 (b) Output Model 2

4.3 WORKING PRINCIPLE

The water leakage detection system with an automatic stopping mechanism uses an Arduino, a water flow sensor, a valve, and a servo motor to detect and respond to water leaks. Here's a detailed explanation of how it works:

- **CONTINUOUS MONITORING:** The system starts with the water flow sensor, which is installed in the water pipe. This sensor measures the rate at which water flows through the pipe. It typically uses a rotor and a Hall effect sensor to generate electrical pulses corresponding to the flow rate. Each pulse represents a specific volume of water passing through the sensor.
- **DATA PROCESSING AND LEAK DETECTION:** The pulses from the water flow sensor are sent to the Arduino, a microcontroller that serves as the system's brain. The Arduino is programmed to continuously monitor these pulses and convert them into a flow rate, usually measured in liters per minute. The Arduino software includes predefined thresholds for normal water flow based on typical usage patterns. If the flow rate exceeds these thresholds or if there are sudden changes in the flow rate (e.g., a sudden increase that doesn't match normal usage patterns), the Arduino interprets this as a potential leak.
- **LEAK RESPONSE ACTIVATION:** Upon detecting an abnormal flow rate that indicates a leak, the Arduino triggers an automatic response. It sends a control signal to the servo motor, specifying the angle through which the servo should rotate.The servo motor is connected to a valve that controls the water supply. Servos are chosen for their precision, as they can rotate to specific angles based on the signal from the Arduino.
- **VALVE OPERATION:** The servo motor receives the signal from the Arduino and rotates to close the valve. The valve is designed to either stop or allow water flow based on its position. When the servo motor rotates, it moves the valve to the closed position, effectively shutting off the water supply.This action stops the water flow immediately, preventing further leakage and potential water damage to the surrounding area.

- **SYSTEM RESET AND MAINTENANCE:** After the issue has been identified and fixed, the system can be reset. The valve can be manually or automatically reopened by sending a new signal to the servo motor from the Arduino, restoring normal water flow. Regular maintenance and testing ensure that the system remains functional and responsive. The Arduino can be reprogrammed if needed to adjust the sensitivity or response mechanisms.

The water leakage detection system with an automatic stopping mechanism employs four main components: an Arduino, a water flow sensor, a servo motor, and a valve. The water flow sensor is placed in the water line to monitor the flow rate continuously and sends pulse data to the Arduino. The Arduino processes this data to determine if the flow rate exceeds normal levels, which would indicate a leak. If a leak is detected, the Arduino sends a signal to the servo motor. The servo motor then actuates and rotates to close the valve. The valve, controlled by the servo motor, shuts off the water supply to prevent further leakage. This system provides an efficient, automated solution for leak detection and prevention, ensuring quick response and minimizing water damage. Each component is critical: the Arduino for processing and control, the flow sensor for monitoring, the servo motor for actuation, and the valve for stopping the water flow.

CHAPTER 5

FUTURE SCOPE & ITS IMPLEMENTATION PLAN

FUTURE SCOPE:

- In future there will be more efficient, sustainable, and responsive water management systems.
- Using advance sensors to detect the water leakage in big commercial areas.
- When the water leakage occurs It will detect and close the valve manually. But in future the valve rotation is controlled automatically.
- It will be implemented in all residential areas.

IMPLEMENTATION PLAN:

- Assemble and test components in a controlled environment.
- Install system at the desired location, typically near water supply lines.
- Integrate system into existing plumbing, ensuring proper connections.
- Establish a centralized area for system monitoring and maintenance.
- Implement remote monitoring capabilities for real-time status updates and alerts.
- Ideal for housing control units and accessing water supply lines.
- Install system components near outdoor water sources for comprehensive coverage.
- Set up a dedicated area for system management, software updates, and troubleshooting.
- Incorporate system control and monitoring features into smartphone applications for user convenience.

IMPLEMENTATION PICTURES

Figure (a) Implementation picture 1

Figure (b) Implementation picture 2

IMPLEMENTATION VIDEO LINK

https://drive.google.com/file/d/14GsK9mCB0cMo4A_k978n8usNilGC8zaH/view?usp=drivesdk

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