



**PIPE
GUARD**

User Manual

1. Introduction:

PipeGuard is an innovative, AI powered system that is designed to detect leakages in many pipe types. By combining sensors with cloud analytics to prevent resource waste, reduce environmental risks, and optimize pipe maintenance. Through real-time pipe monitoring, PipeGuard helps the facility’s operators balance between reliability, meeting sustainability goals, conserving water, preventing dangerous spills and minimizing resource loss.

1.1 Scope

This user manual covers four stages of the project’s life cycle
Deployment: Product overview, hardware and software setup and overall function.
Monitoring: Real-time leak detection with instant alerts via dashboard/notifications.
Maintenance: Scheduled checks and troubleshooting guide.
Support: Warranty coverage and assistance for the ongoing operation of the system

1.2 Organization

This organization section includes the manual’s structure to guide the users through the project installation to monitoring and control

Section	Included content
Introduction	Purpose, Scope and Organization
Product Overview	Components, Features and Functions
Installation	Hardware and Software setup
User Operation	How to use product
Maintenance	Cleaning and Dated maintenance checks
User Interface	Detection process, alerts and reports (SCADA)
Trouble shooting guide	Error mitigation
Warranty Information	Coverage, Claims, and additional services
FAQ’s	Answers for frequently asked questions

2.Product Overview

2.1 Key Features

AI-Powered Leak Detection:

Our product utilizes AI and the machine learning algorithms to analyze the data from the sensors and predict the potential leakage or errors that before the problem escalates in the network.

Sensor Network Integration:

In our system we use three types of sensors, ultrasonic sensors, pressure, and capacitance for different functions like having

Dynamic Ultrasonic Scanning: which is a ring having a transmitter and a receiver that moves and scans the pipes once each couple of days (duration can be customizable based on the need and sensitivity of the system)

Stable Pressure and (if underground) Capacitance Sensor:

These sensors are installed in a fixed position in the pipes and their main objective is adding another layer of verification for the AI to use when monitoring the pipes. In addition to that, they are also connected to the buzzer directly to alert if a leak occurs quickly and doesn't need deep analyzation of the machine learning algorithms

Real-Time Leak Alerts:

As mentioned, pressure and capacitance sensors are always operating to detect sudden changes and send immediate alerts.

User-Friendly Interface:

The sensors are connected to the SCADA (Supervisory Control and Data Acquisition) software to monitor the exact location of the potential leakage and shows clear alert of any information with a buzzer if a leak did happen.

Energy-Efficient Operation:

There is only one charging station in each zone which is connected to the solar panels. Other than that, the rings moves not every day, but rather once every few making the system less power consumption.

2.2 Components

The table contains components needed in each set

Component Name	Description
Ultrasonic Ring	Moving sensor that scans pipe structures every 3 days
Pressure Sensor x2	Monitors pipe pressure at certain locations continuously
Capacitance Sensor(optional) x2	Detects changes in material due to leaks or moisture buildup.
AI system (for all the system)	Central unit that analyzes sensor data, predicts leaks, and sends alerts.
Cloud	Stores all the data and allow remote access
Arduino microcontroller	Brain of the system, transmits the data between the sensors and the AI system
Charging Station	Recharges the ultrasonic sensor

3.Installation

System Installation Guide:

1-Prepare the site for installation:

Finalize the pipeline mapping and sensor placement plan

Ensure there's a stable power supply

Clean the pipes for accurate readings

2- Install and Attach the Sensors:

Install the Ultrasonic ring

Confirm it moves at an efficient speed for monitoring

Attach pressure and capacitance sensors with clamps

Check their orientation and placement

3-Connect Sensors:

Connect the fixed sensors to power supply

Connect the sensors wired or wirelessly to the microcontroller

4- Configure the Arduino by installing the pre-programmed code into it and check that signal are read correctly

5-Connect the system to AI and cloud via WiFi pr Ethernet and make sure we have a stable network connection that can handle real time monitoring

6-Test the values and run an initial ultrasonic scan

7-Finalize and Secure the Components

4. User Operation

1. Check the Power Supply: By checking the power supplied to Arduino and charging stations

2. Access Monitoring System or Dashboard:

- Open the dashboard or SCADA provided with the system.
- Log in using your assigned username and password.
- You'll now see:
 - Real-time pressure and capacitance data.
 - Leak status (Normal / Leak Detected).
 - Last ultrasonic scan result.

3. Review and Understand the Scanning information:

by reading the reports to understand areas where potential leaks may develop Use the data to monitor pipe health and plan preventive action.

4. Respond to Alerts:

- If a potential leak is detected and a notification is sent
- The dashboard will detect the location and the type of issue
- Contact your maintenance team to inspect and resolve the problem

5. Keep an eye on the System

- While everything is automatic, make sure you check that the sensor returns to the charging station after scans
- Restart the system if you notice lags

5. Maintenance:

- Wipe the sensors (ultra sonic, pressure device, capacitance) from the dust and dirt (because they're exposed on the pipes) weekly
- Clean the internals for preventing overheating and corrosion of sensors yearly
- Maintain the main components by checking its battery usage, detection ability and any visible physical damage yearly
- Exchange any necessary components that reached the end of its life span after the yearly maintenance check
- Oiling the ultrasonic for the stain monthly
- Check cable's connection and seal integrity weekly
- Check and conduct connectivity, model performance and alert tests weekly
- Calibrate the sensors

6. User Interface

6.1 Detection process and reports:

SCADA dashboard

- Status Ribbon: sensory activity/ charge
- Pipe line map
- Alert management

Mobile interface

- notifications for critical alerts
- email for update reports

6.2 Interventions

Critical Leak: Immediate intervention (shutdown, maintenance crew)

Minor Anomaly: Investigate within 24 hours (reported and investigated)

Normal: No action needed.

7. Warranty information

7.1 Limited warranty coverage:

Our Ai detection system comes with a 5 years warranty from the date of installation, that covers:

- a) mechanical failure of ultrasonic ringing movement
- b) manufacturing defecting things in sensors
- c) power issues such as batteries
- d) communication failures

7.2 What's not covered?

- a) flooding and accidents damages
- b) tearing and wearing of exposed components (sensors, wires, casing seals)

7.3 How to make a warranty claim:

After the system experiences an issue, get in touch with the support team:

Email: (pipegaurd@gmail.com)

Number: +962 79### #### #

present proof of purchase in the form of an invoice or receipt

explain the problem (pictures and videos are welcome)

return/service Instructions (providing instructions for return replacement, or remote servicing)

7.4 Additional services:

The 5 years warranty plans include:

annual system checkups

faster repair or replacement

free Software and ai updates

discount on new parts

8. FAQ's

Q1: What types of pipes is this system compatible with?

A: The system works with most pipe materials and diameters (1–24 inches). For specialized pipelines, contact our team.

Q2: How far apart should sensors be installed?

A: For optimal detection, place sensors every 2m (or further for low-risk areas). Refer to the installation guide for pipe-specific spacing.

Q3: Can I install this system outdoors or in harsh environments?

A: Depends on specific infrastructure, but all components are protected from water, dust or extreme temperatures use protective enclosures (sold separately).

Q4: Is my data stored securely in the cloud?

A: Yes, all data is safely encrypted and compliant with security standards as each system will have a unique code.

Q5: How much historical data is retained?

A: 6 months after installation

Q6: How do I request on-site technical support?

A: Call +0797123345 or send a request via the email. Response time 12–24 hrs.

Q7: Can I expand the system to monitor additional pipelines later?

A: Yes, simply purchase our extra sensors extension and pair them via the dashboard.