



Machine Learning-Based Approach for Anomaly Detection in Water Supply Systems Using Transient Pressure Signals

PHD PROGRAMME IN CIVIL ENGINEERING

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Objective

The main objective is to develop and demonstrate the application of a machine learning-based approach for anomaly (i.e., burst, air pockets, blockages) detection in water supply systems using small transient events.

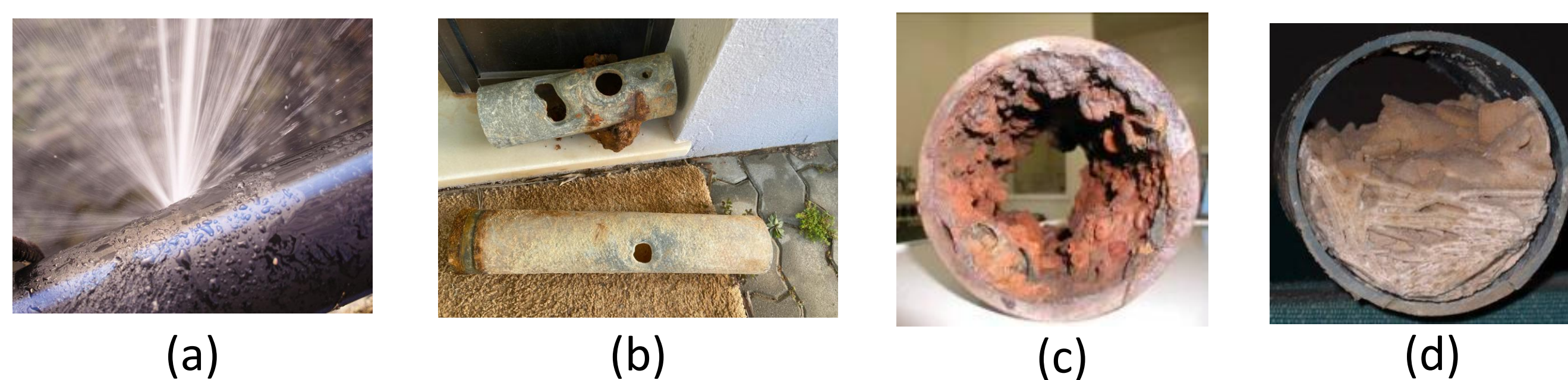
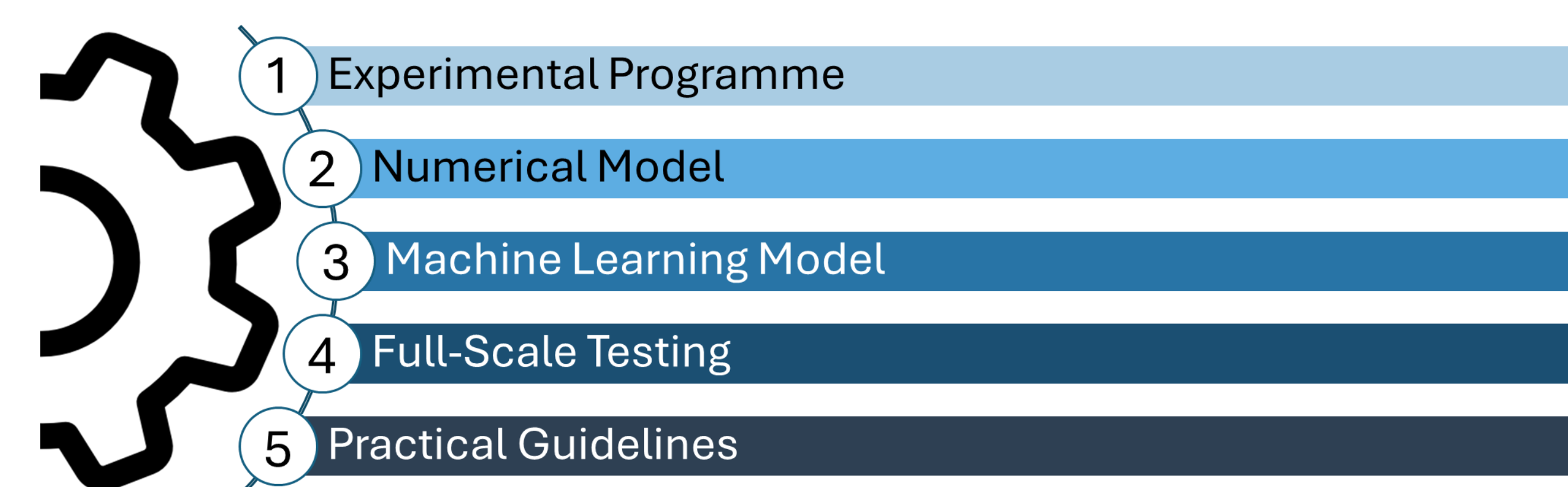


Figure 1: (a-b) pipe burst and (c-d) pipe blockage.

Methodology



1 | Experimental Programme

Data collection in two laboratory pipe rigs for several types of anomalies during the occurrence of small transient events.

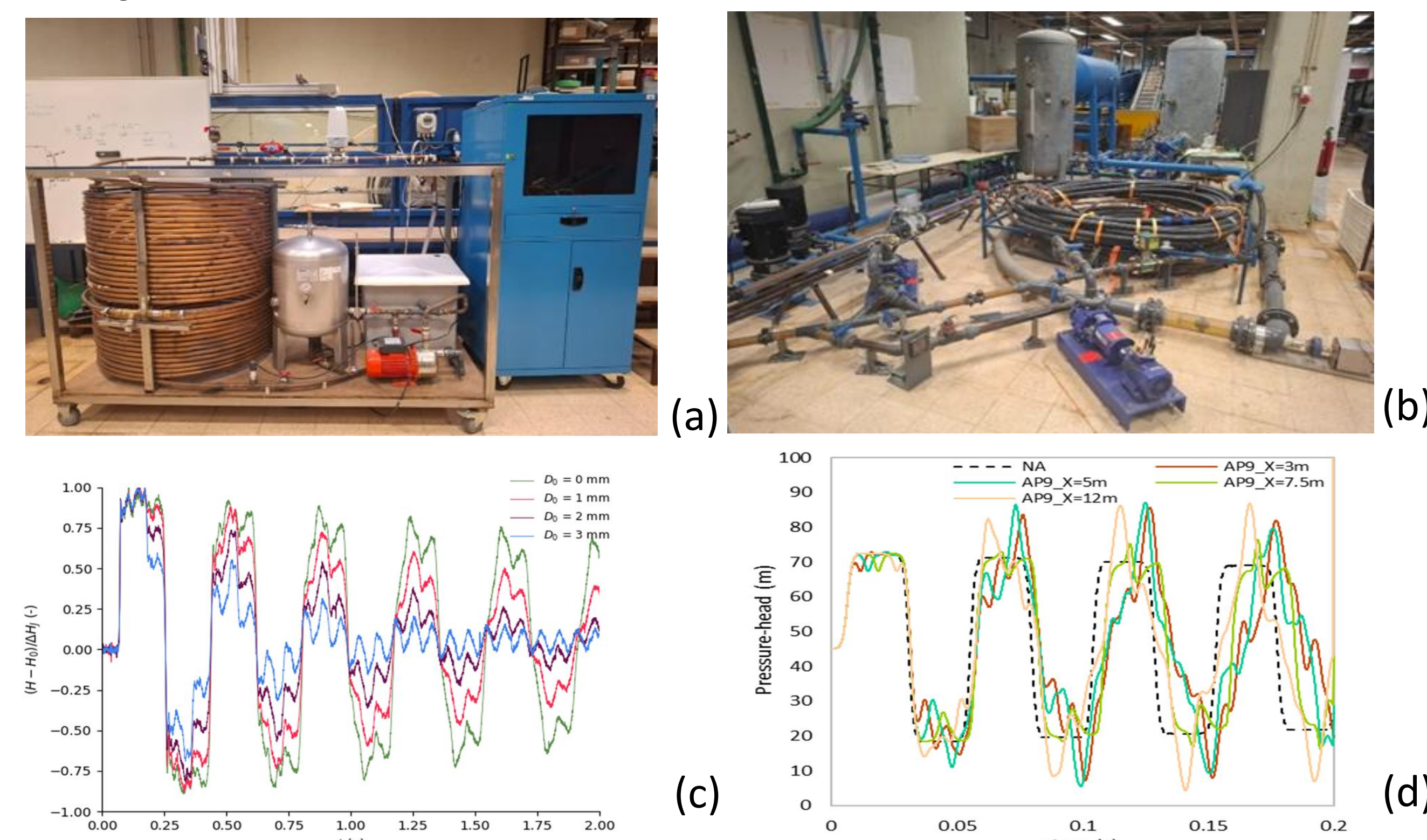


Figure 2: a) copper pipe rig; b) polyethylene pipe rig; c) pressure signal with a leak; d) pressure signal with an air pocket.

2 | Numerical Model

Construction and calibration of numerical models using experimental data to generate artificial data, and the construction of a large dataset.

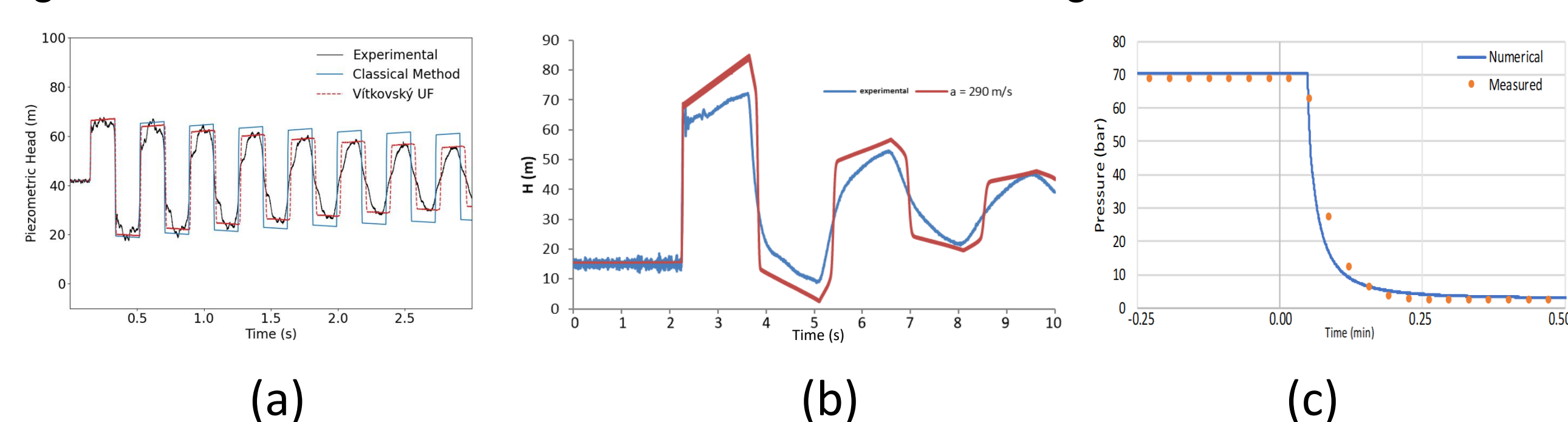


Figure 3: Calibration: a) copper pipe; b) viscoelastic pipe; c) pump system.

3 | Machine Learning Model

Implementation, training, testing and validation of machine learning algorithms to detect different anomalies and their size and location in water distribution systems.

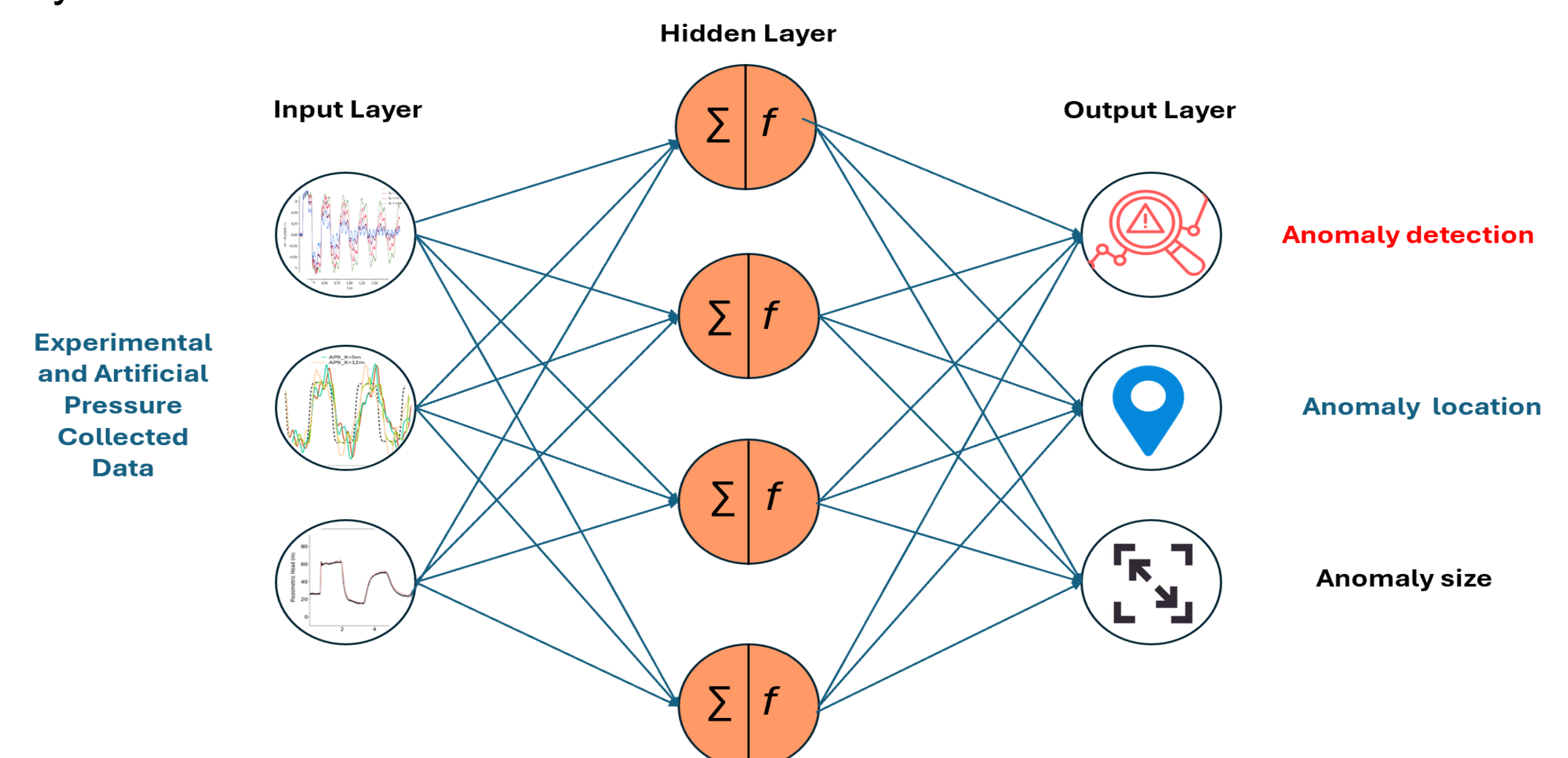


Figure 4: Neural network for the machine learning model.

4 | Full-Scale Testing

Development of full-scale testing to consolidate the proposed methodology and to acquire know-how on field testing and validation in full-scale conditions.

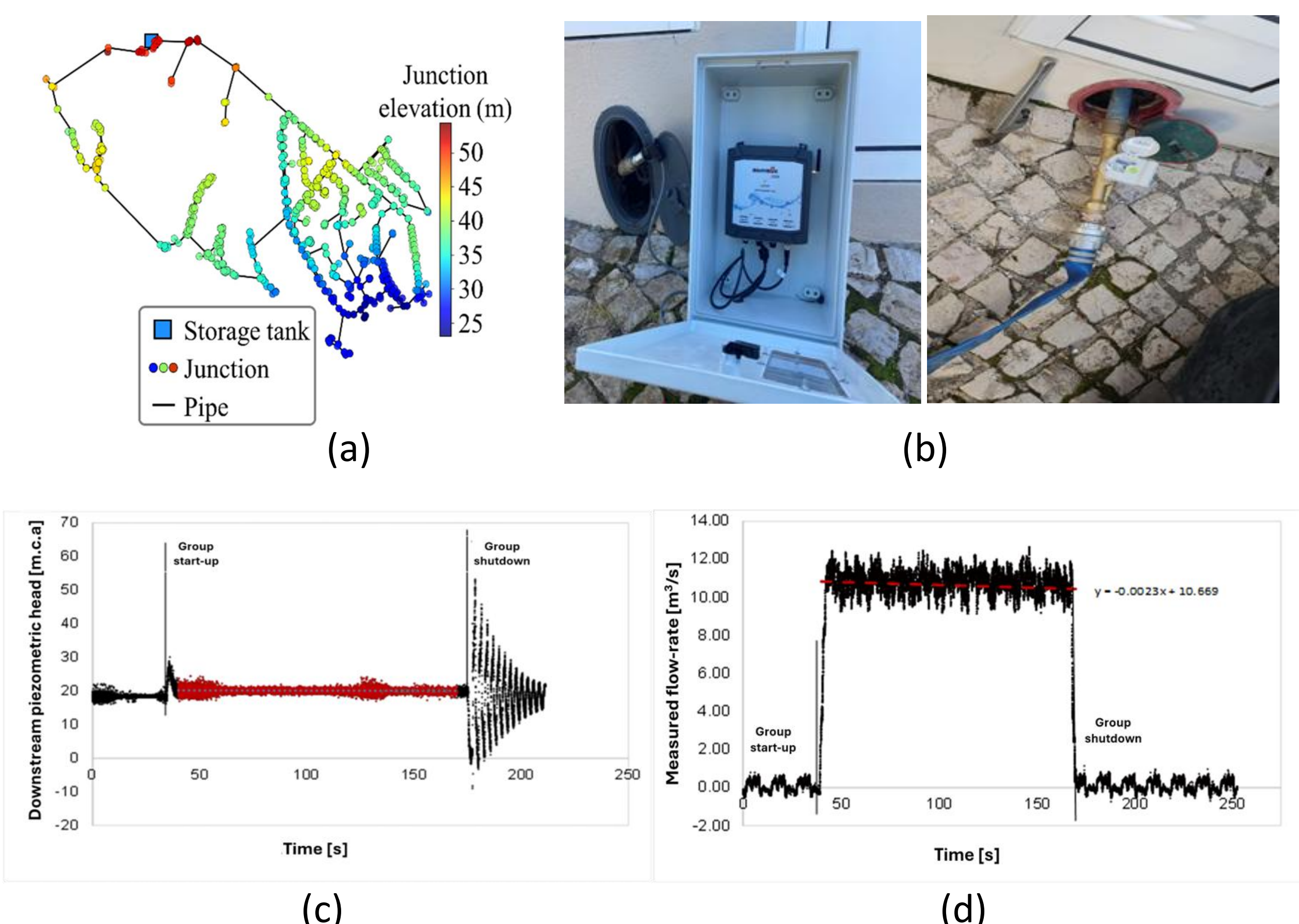


Figure 5: a) tests in a water supply system b) instrumentation c) piezometric-head measurements and d) flow-rate measurements.

5 | Practical Guidelines

Development of full-scale testing to consolidate the proposed methodology and to acquire know-how on field testing and validation in full-scale conditions.



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