PIPYNS

team 5

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Background & Motivation

Residential home flooding due to pipe failures is a common issue across the world. In the US alone, 1 in 60 insured households experience a pipe failure each year. The aftermath is very costly with an average insurance claim estimated at $12,000 [1].

Due to lack of visibility and access to the plumbing system, it can take significant time for homeowners to respond to pipe bursts.

Objective

Develop a system capable of detecting and responding to a pipe burst within the context of a residential home.

Users should be able to interact with the system through some interface to facilitate control and response.

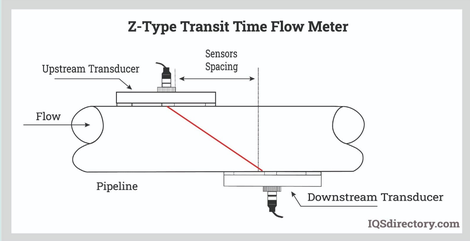
Working Principle

Ultrasonic Transduction

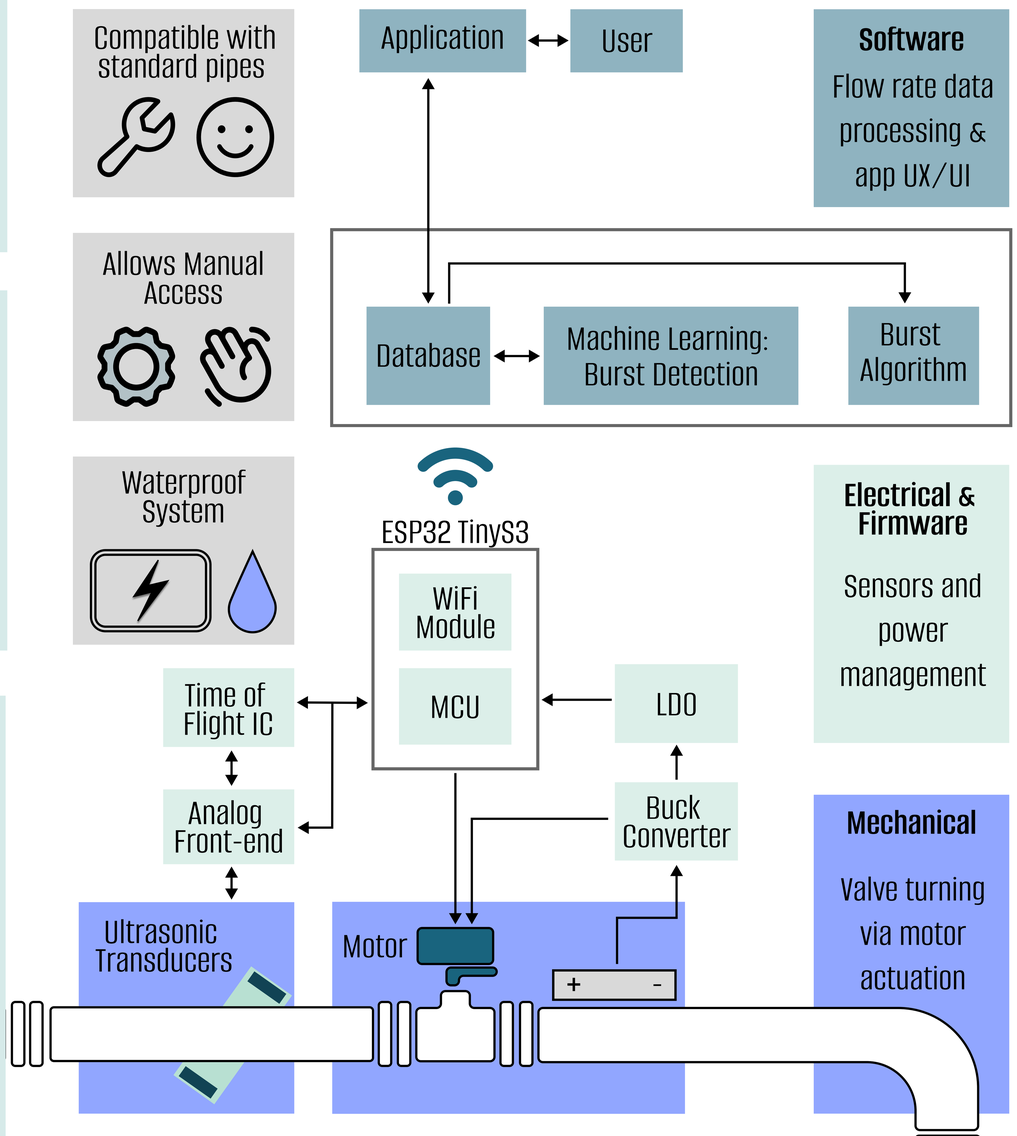
- Penetration of rigid material using high-frequency ultrasound
- Differences in directional Time-of-Flight are proportional to fluid flow
- Technique used in a variety of industry applications and commercial flow meters
- Early design alternatives involved turbine flow meters and external moisture sensors

[2]

$$v = \frac{\Delta TOF \times c^2}{2 \times l}$$



[3]



What is PIPYNS?

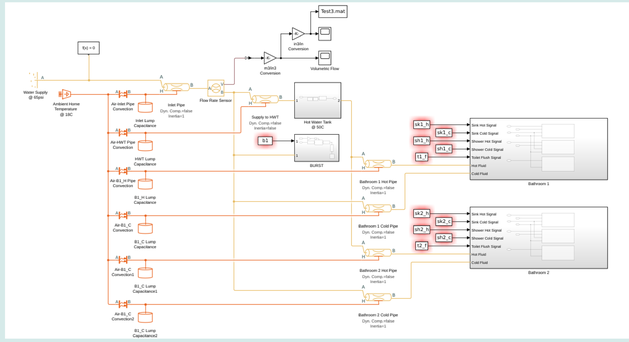
Pipyns is an affordable system designed to give home-owners the ability to monitor their house water system.

With its easy installation, it can both provide flow data and shut off the post-meter control valve automatically when a burst is detected.

Paired with its companion app, users can be informed anywhere — whether at home, on holiday, or otherwise.

Data & Algorithm

- Modeling of residential plumbing system to obtain representational data
- Includes thermal and inertial effects



- Logistic Regression ML to detect bursts
- Trained and validated on representational data as PoC
- Considers both the timing and magnitude of sensor readings

Design Considerations

User Interactions

- The system must have a way to communicate with the user.
- There should be delay before the system actuates automatically to prevent blocking of user-intended water usage.

System Environment

- Electronics must be protected in a burst scenario.
- Building codes and standards must be accounted for [4] [5].

References & Acknowledgments

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