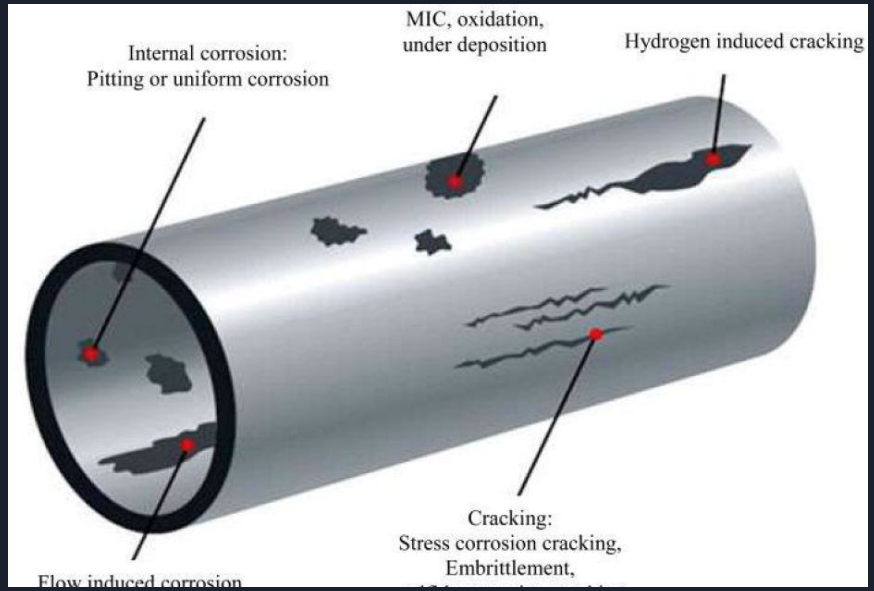
Pipe Inspection Gauge

By Tahseen Hussain, Junyi Wu, Yijie He

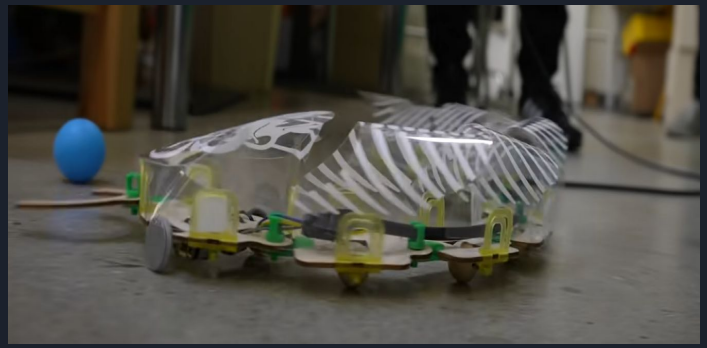
Problem Definition

Natural gas pipelines within residential areas have cracks and fissures that are difficult to identify. This causes delays in natural gas flow and large CO2 leakages.

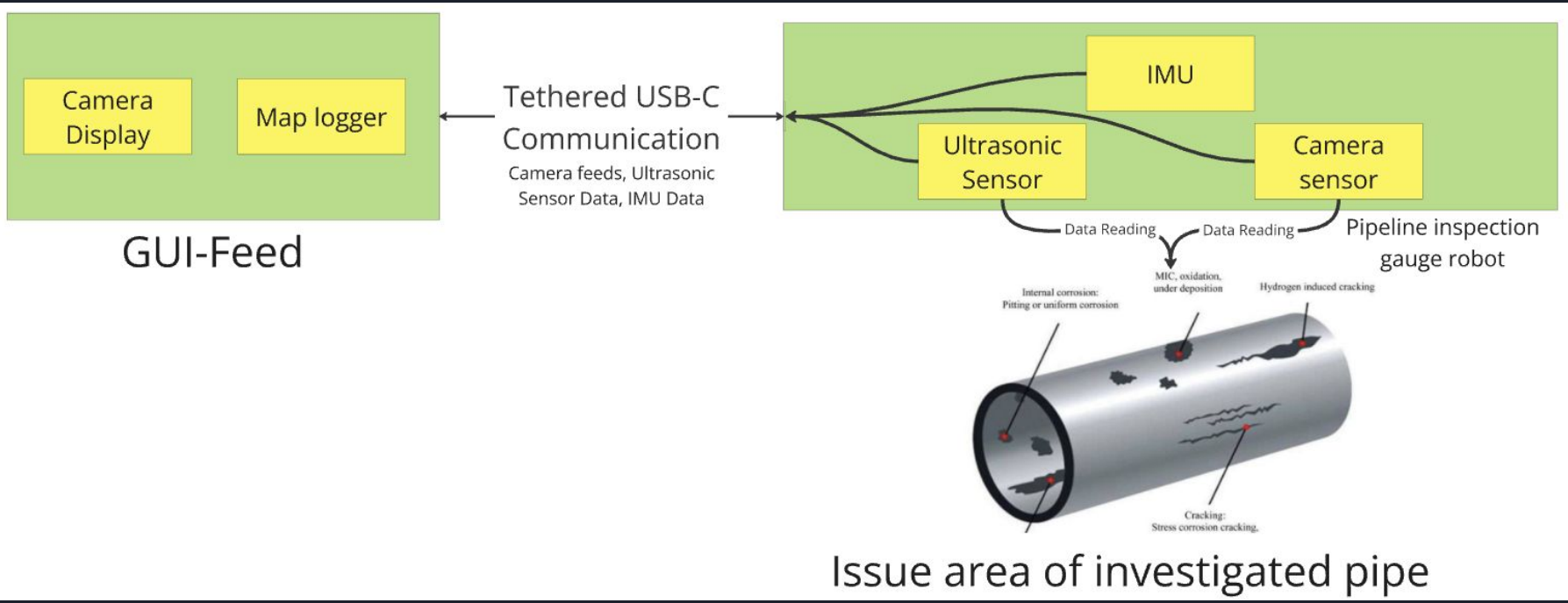


Proposed Idea

A tethered snake-robot outfitted with an IMU, an ESP32-CAM, an ultrasonic sensors and lighting LEDs that provide feedback to a GUI for users to visually identify pipe cracks. This is intended to work on long distance tunnels so having it tethered enables that long-distance communication

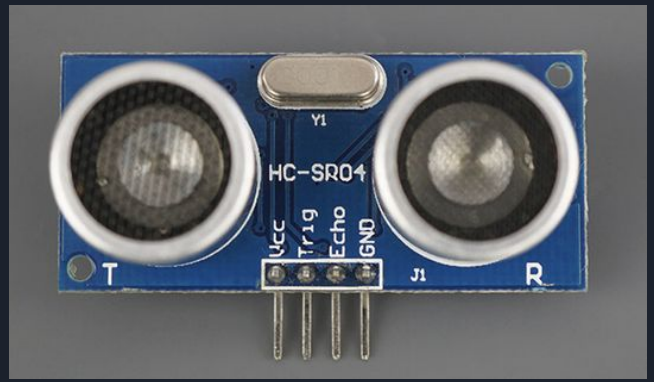


Functional Flowchart



Technical Description

- Camera Module: Camera feedback so a user can identify pipe cracks visually, multiple for 360 degree view.
- IMU: When the user identifies pipe cracks, the IMU will feed locational information back to a map logger to store the location
- Ultrasonic Sensor: Fluctuations in ultrasonic sensor readings can indicate pipe fissures
- Lighting LEDs: For environment illumination
- GUI: All-in-one package for displaying the camera feed, mapping data, and ultrasonic data



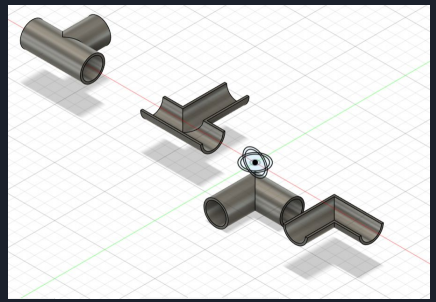
Testable Hypothesis

Our device will have solved the problem if it meets the following requirements:

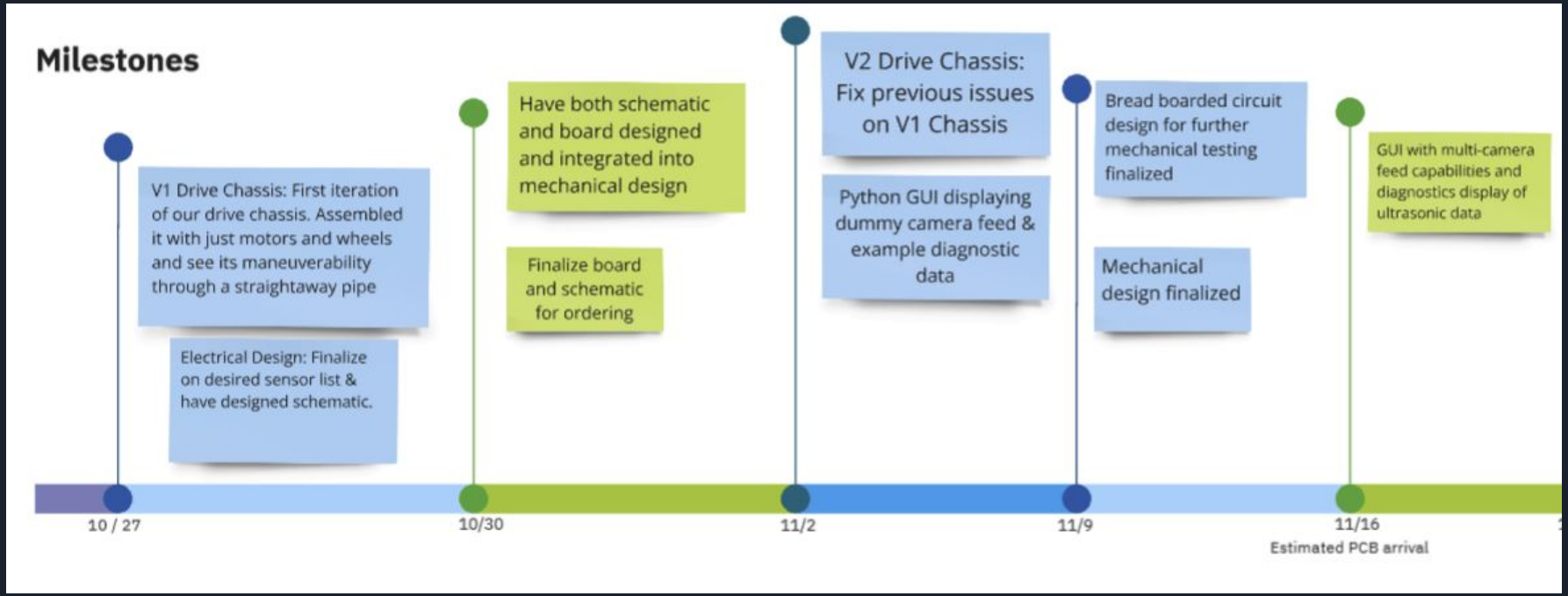
1. 3D print 8-inch diameter pipes and address any leaks (by drilling or painting the inside).
2. Use a controller to navigate a robot inside the 3D-printed pipe.
3. Have a GUI displaying a live camera feed for human visual identification of pipe cracks created in the previous step (minimum size 15x15mm).
4. In the GUI generate a 2D map marking the locations of detected cracks after the investigation.

Pipeway types we plan to test on

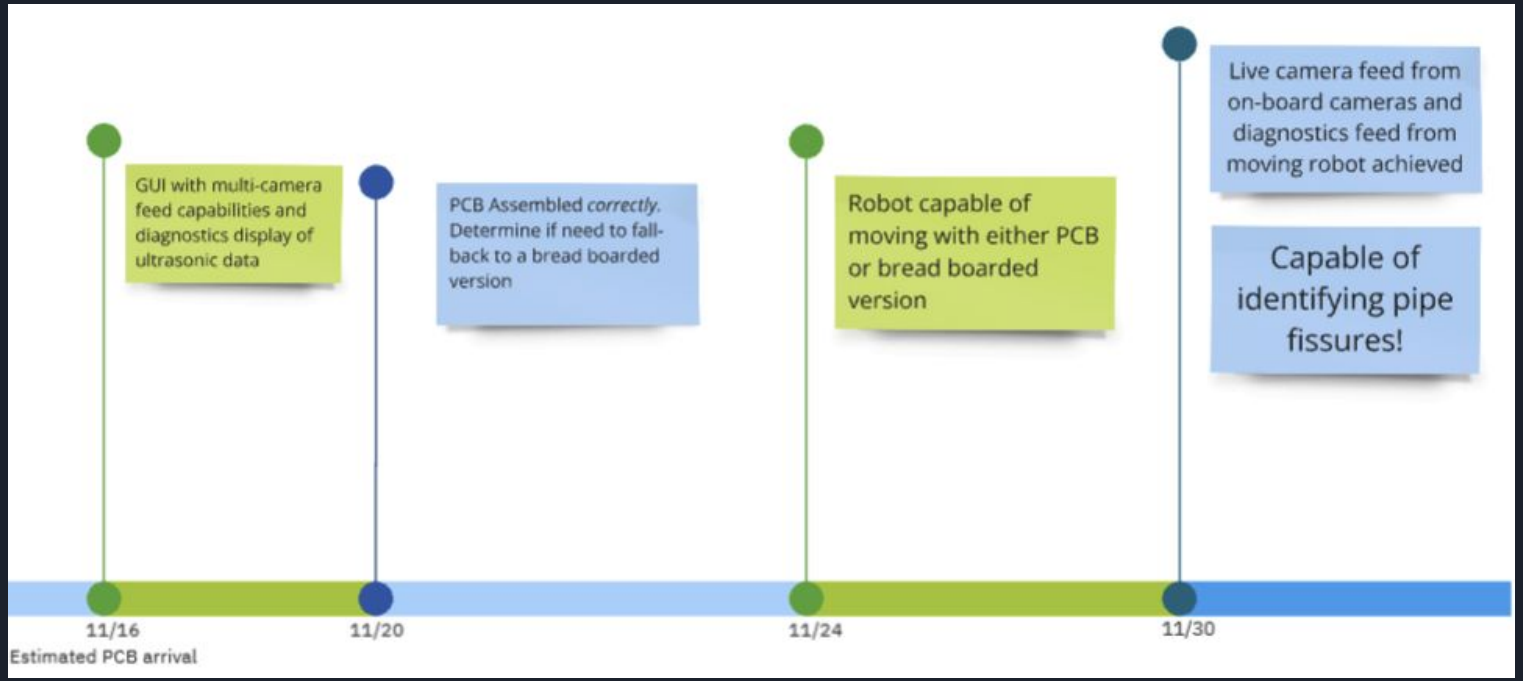
1. Straightaway
2. T-Junction
3. Right Angle



Milestones Page 1



Milestones Page 2



References, Citations, Helpful Resources

Paper on pipe failure repairs: https://pubs.acs.org/doi/10.1021/acs.est.0c07531

What is pigging: https://www.google.com/search?client=firefox-b-1-d&q=PIG+pipe+line+inspection+gauge

Snake robot: https://www.youtube.com/watch?v=qevIIQHrJZg

https://www.kiwico.com/us/store/dp/lots-of-bots-robotics-engineering-bundle-pack/4702

https://www.youtube.com/watch?app=desktop&v=058hRtaCWC0

Questions ?