

System of Networked Sensors for Detection and Characterization of Unauthorized Underground Activity

Objective:

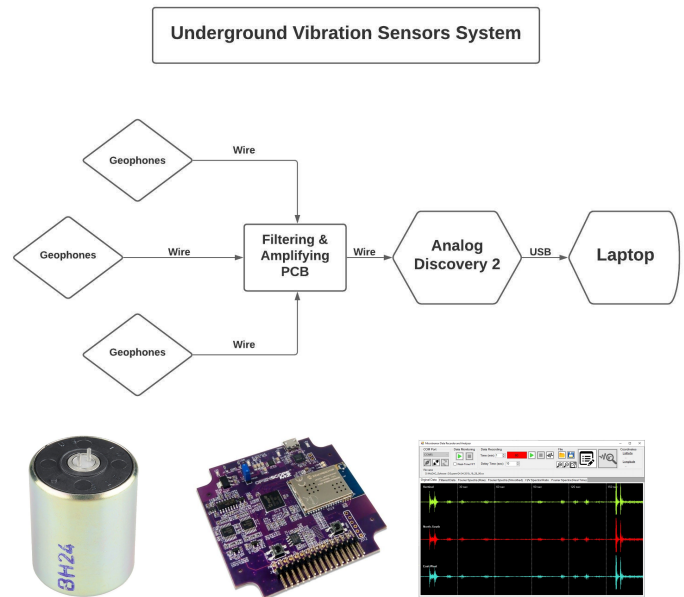
Develop a low cost, portable, and unobtrusive underground vibration detection system which characterizes unauthorized movements through a network of vibration sensors.

Integrate a learning algorithm that will compare sensor data to a predefined signal library and convey a level of confidence of the signal's characterization

Performance goals are to achieve a signal recognition of about 70-80% characterization match, allow User to interpret data from a GUI on a laptop, and able to cover an area of 100m

Technologies include Geophones, Filter and Amplifier PCB, Analog Discovery 2 for real-time spectra analysis, and GUI for a laptop for User to read data information

Design:



Approach:

Use a network of geophones who's data will be filtered and amplified into a signal processing unit that uses an existing learning algorithm to compare the signal to a predefined signal library and exports the characterization and real-time frequency spectra to a GUI on a laptop

1. Test Geophones and assess signal strength and parameters for filtering and amplification
2. Seek out existing learning algorithm and alter it to meet characterization needs for project
3. Record and Integrate a predefined signal library of likely signals that will be expected of unauthorized vibrations (shoveling, footsteps, vehicle movement)
4. Create custom GUI using MATLAB or Python that will display real-time data analysis in time and frequency and characterization of signals detected
5. Assemble and test geophones with PCB and signal processing unit
6. Test learning algorithm with assembled system
7. Provide results of test measurements

Key Milestones:

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|------------------------------|---------|
| ● Project Readiness | 12/1/20 |
| ● Preliminary Design Review | TBD |
| ● Design Validation | 3/15/21 |
| ● Critical Design Review | TBD |
| ● Final Product Presentation | 5/1/21 |