Explosive Vapor Sensors for Cyber Physical Systems to Protect Crowds

SenSIP Algorithms and Devices REU

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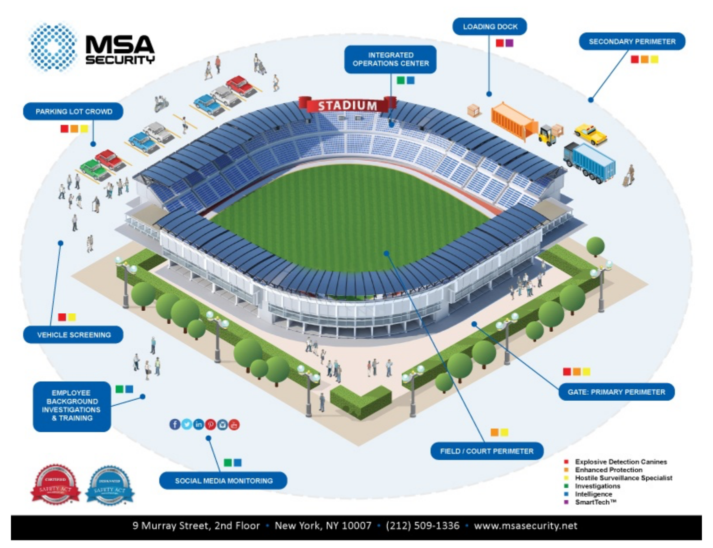
ABSTRACT

- Low-cost sensors to detect explosive vapors and gases.
- Detect improvised explosive devices (IEDs)in an open area.
- Non stationary sensor systems, detect very small amount of gases, such as ammonia (NH_3).

MOTIVATION

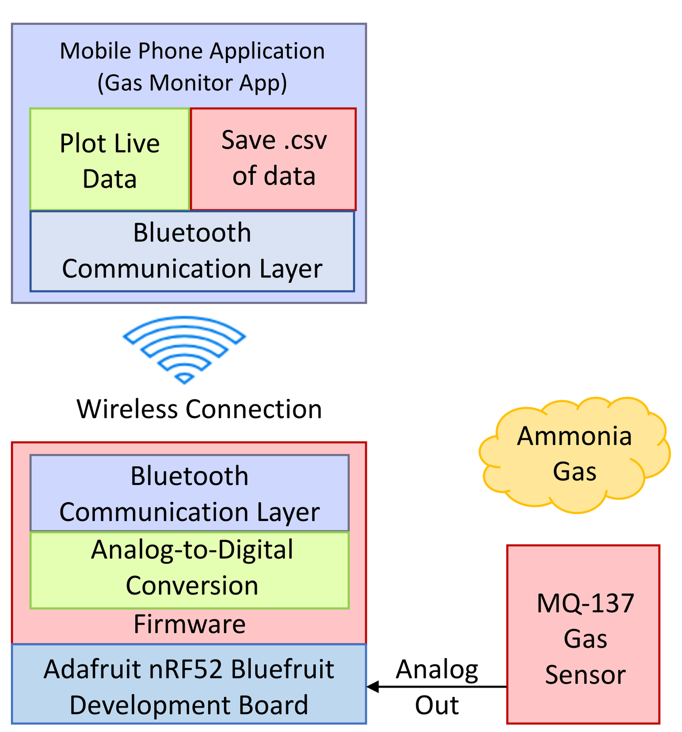
- There are ways ways to detect IEDs in closed areas, but not in an open area.
- IED detection can be expensive and it is also non-stationary.
- Low-cost sensors will be distributed to be able to detect gases in an open area.

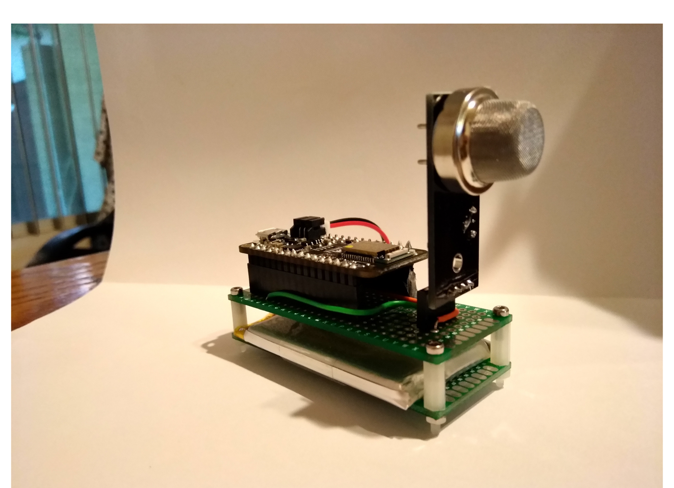


PROBLEM STATEMENT

Low-cost Sensor Explosive Detection

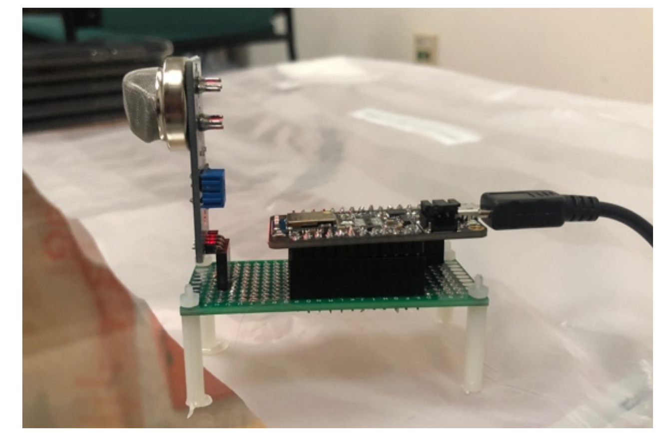
- Low-cost gas sensors made with off the shelf parts.
- Gas sensor app to detect concentration over time.

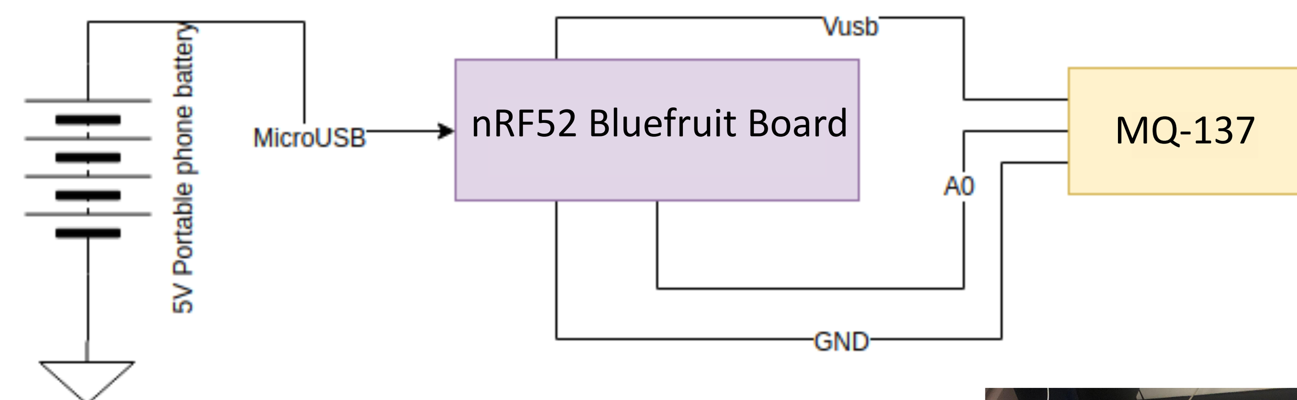




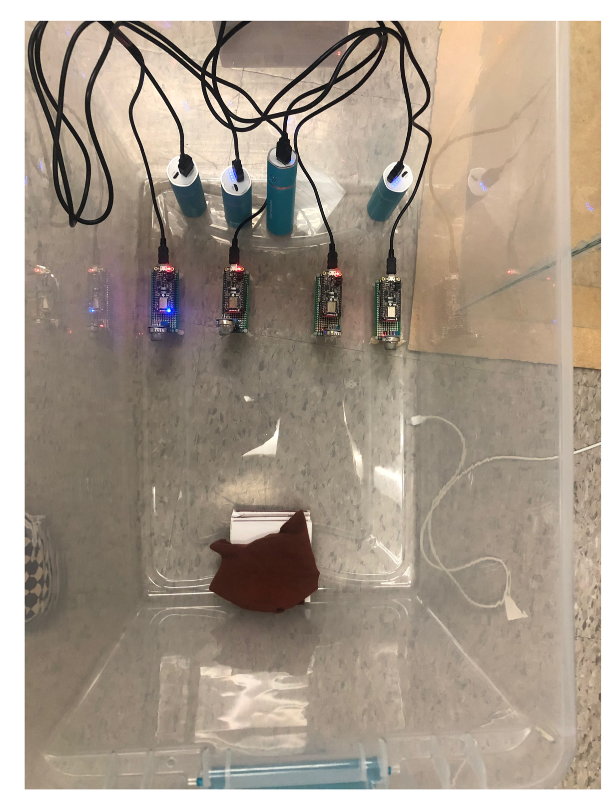
EXPERIMENTAL METHODS: SENSORS

Sensor Prototype:

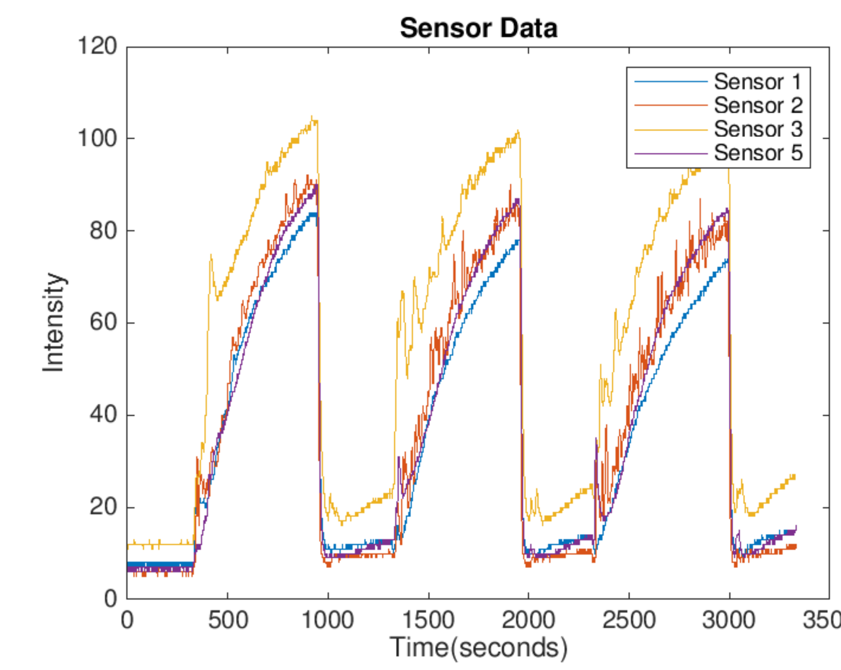


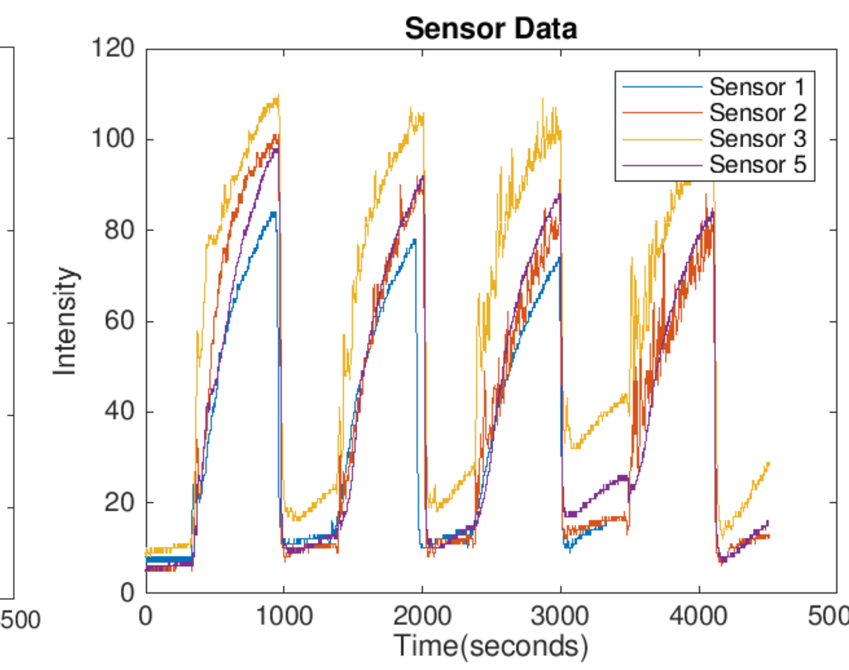


- Different sensor placements with different distances for gas detection.
- Record sensors with Gas Monitoring app to see gas detection.
- Record sensors with no source in a closed space, then add source to closed space to see gain in graph, remove source.



PRELIMINARY RESULTS





- All sensors seem to have similar sensitivity besides sensor 3, it seems to be more sensitive.
- Sensors seem to be consistent

CHALLENGE STATEMENT

Although all sensors respond to ammonia, they read different values even when concentration is the same. This is due to different offset and sensitivity of the sensors. To establish common baseline, calibration of sensors need to done prior to deployment. Calibration step will be used to locate the source when many sensors from different locations provide readings.

- Solve for difference in gain and offset with data points with graph.
- Use one sensor as baseline and have them read the same, and have data points lay on top of each other.

REFERENCES

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D. S. Moore, “Recent Advances in Trace Explosives Detection Instrumentation,” *Sensing and Imaging: An International Journal*, vol. 8, no. 1, pp. 9–38, 2007.

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Sensor Signal and Information Processing Center
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