DRONE DETECT

STUDENTS: David Phan, McCoy Spink, Spencer Madrid, Sean Budomo, Shuting Shao, Shoh Schulz, Gokul Gopakumar

Introduction to Drone Detect

Goal: Implement a bistatic, forward scatter radar system capable of detecting and gathering information on low flying drones.

Forward Scatter Radar (FSR)

A type of bistatic (separate transmitter and receiver) radar, that uses the shadow a target casts of the RF signal rather than the refraction of the signal. This makes **stealth aircraft detection** and **doppler signal extraction** possible.
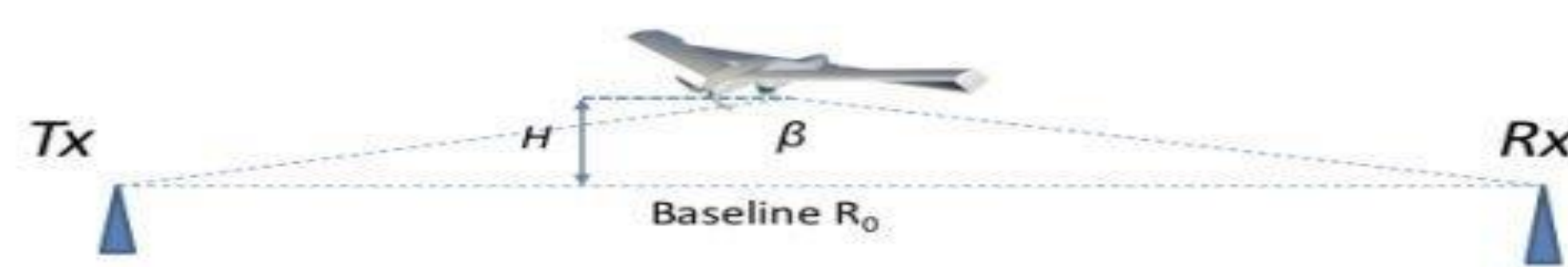

Above: Basic FSR setup/function. An object passes the baseline between the TX and RX antenna and the object's "shadow" is detected.

Success Criteria

- Send and receive sinusoid signal that complies with FCC regulations
- Detect objects passing through the baseline
  - Targets of cross-sectional area > 1 ft^2
  - Angle of approach 90°
- Extract Doppler information from moving target (velocity)
- Create a GUI to show relevant frequency and system data in real time

Methodology

Drone Detect consists of the Antenna Array and Signal Processing Graphical User Interface (GUI).
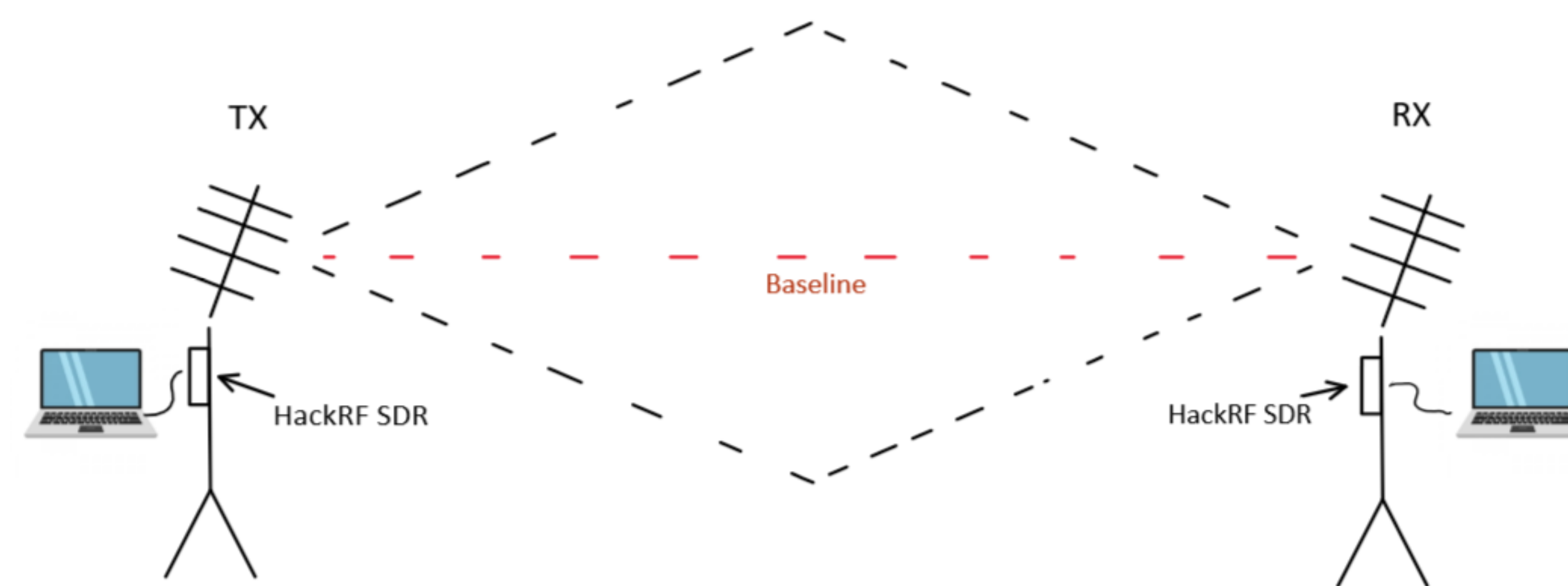
Above: Antenna Array, both sides consisting of an Antenna and HackRF SDR, and the SDRs connected by an SMA Coaxial Cable
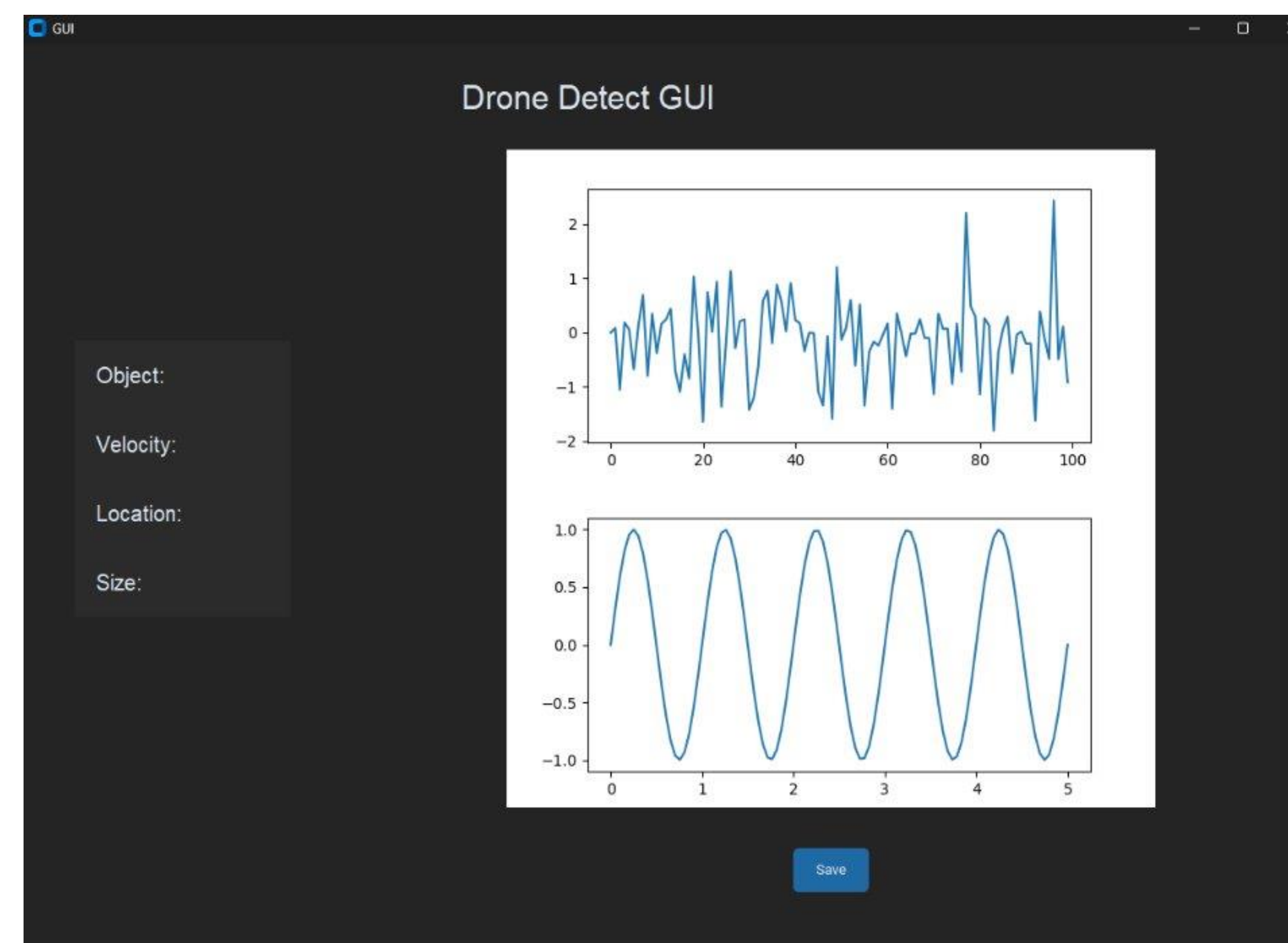
Above: Signal Processing GUI on-screen display

Above: *(Left)* TX antenna, 916-CW-RCL-SMA Monopole Antenna with Ground Plane and *(Right)* RX antenna, RFSPACE TSA400 Antenna with Ground Plane.

Left: Antenna array during outdoor testing

Future Work, References, and Acknowledgments

- Improve speed of real-time GUI
- Optimize sensors to allow for more accurate readings
- Implement more complex signal processing to allow:
  - Identifying target angle in relation to baseline
  - Adjust resulting velocity calculation based on the angle

[1] "Radar: Introduction to Radar Systems - Online Course." *Radar: Introduction to Radar Systems - Online Course | MIT Lincoln Laboratory*, www.ll.mit.edu/outreach/radar-introduction-radar-systems-online-course. Accessed 15 May 2024.
[2] Hristov, Stanislav, et al. "Target shadow profile reconstruction in ground-based forward Scatter Radar." *2015 IEEE Radar Conference (RadarCon)*, May 2015, https://doi.org/10.1109/radar.2015.7131113.