

INFRASONIC WILDFIRE DETECTOR

Carlos Santos, Cory Holt, Drew Malinowski, and Meridian Haas

Objective

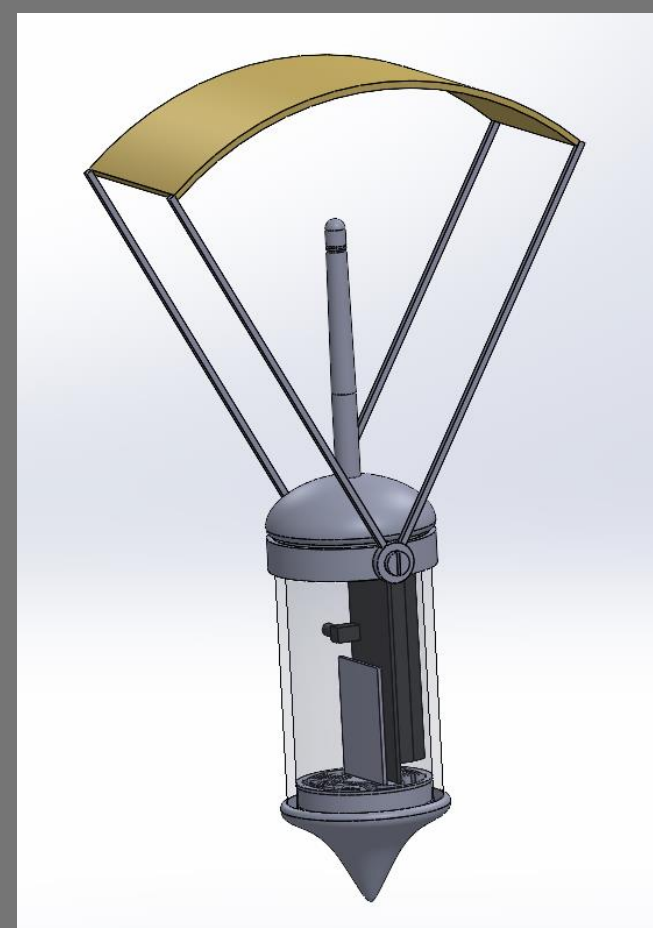
- Create a mesh network of infrasonic wildfire sensors to enable faster and more reliable wildfire detection.

Key Requirements

- Cheap!
- Accurately detects infrasound (0-20 Hz).
- Rigid construction capable of withstanding drops.
- Creates a network of like devices for resilient data transmission

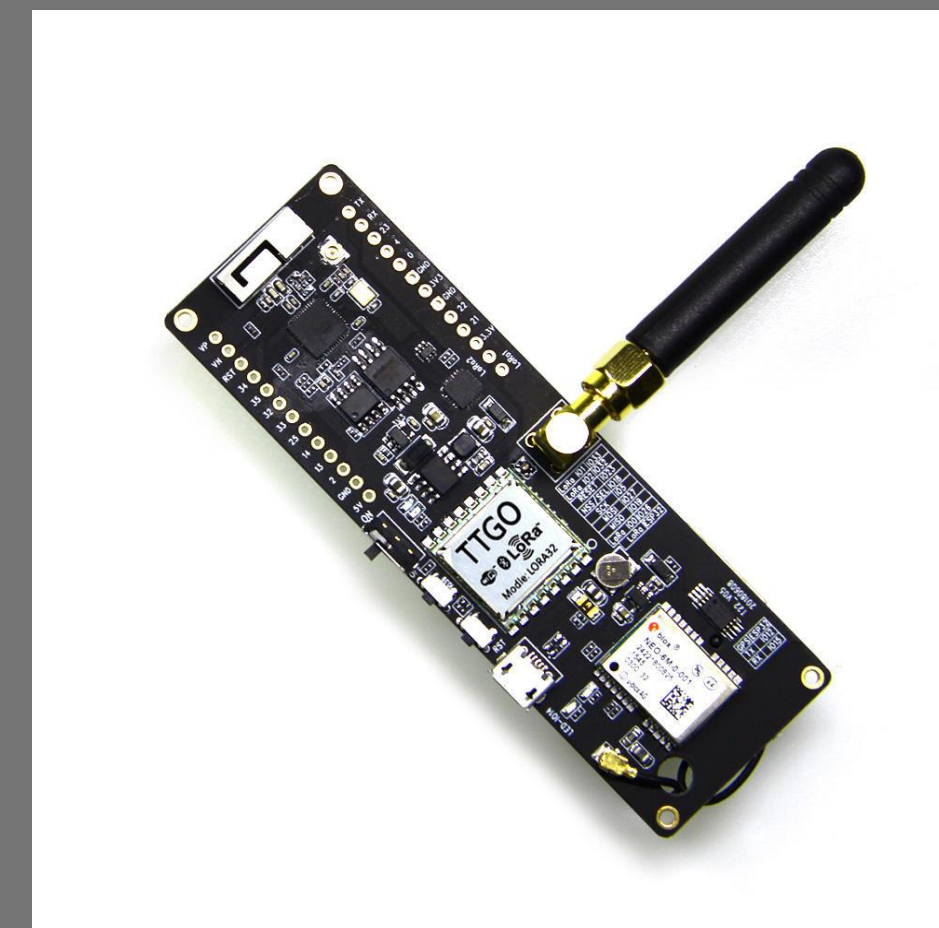
Hardware Design

Enclosure



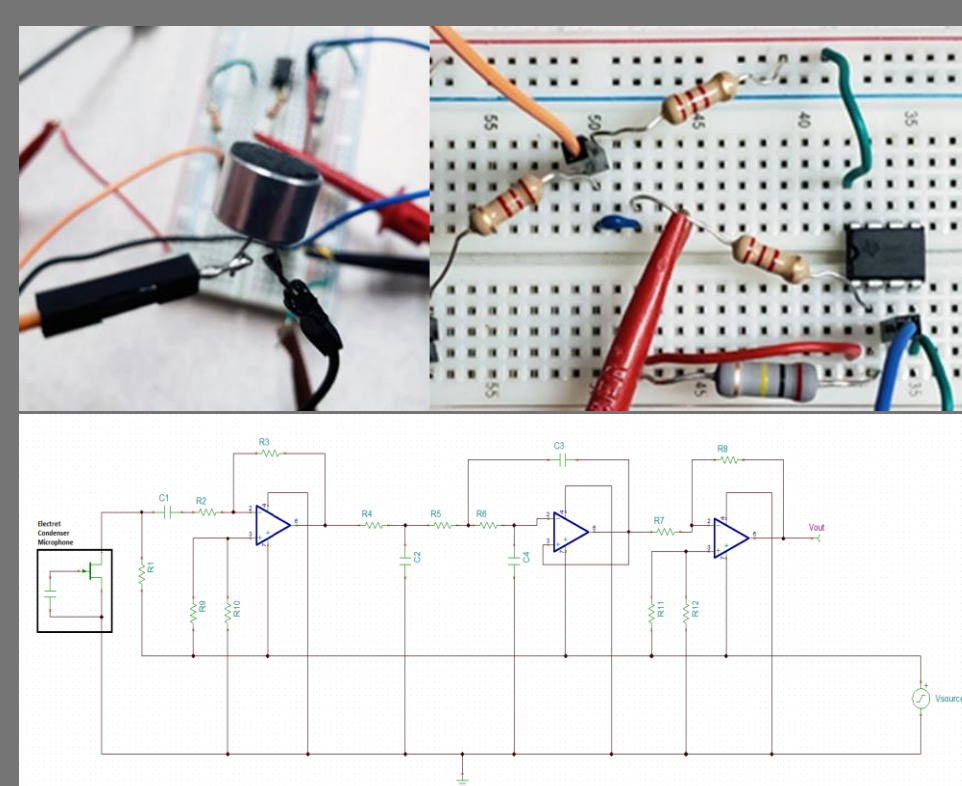
- Parachute design to slow falling speeds
- Shock Absorber for Impact

TTGO T-Beam



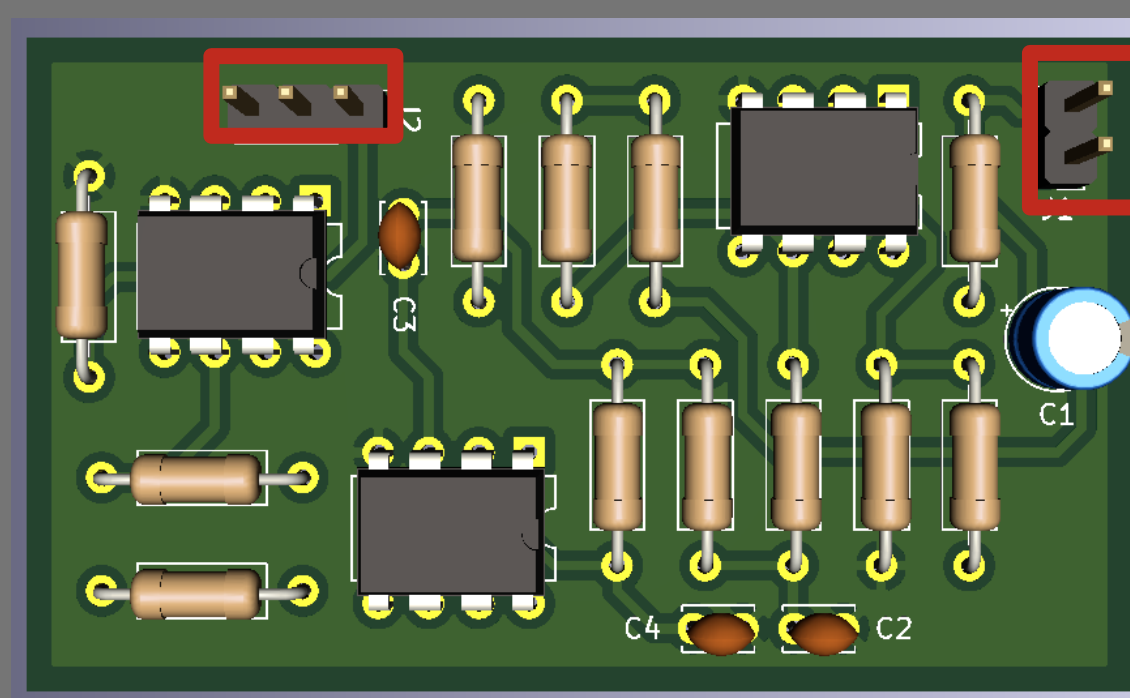
- ESP32 MCU
- LoRa Transceiver
- GPS Module
- WiFi/Bluetooth

Sensor



- Analog preamplifier with low-pass filter
- Isolates acoustic signals from 0-20 Hz

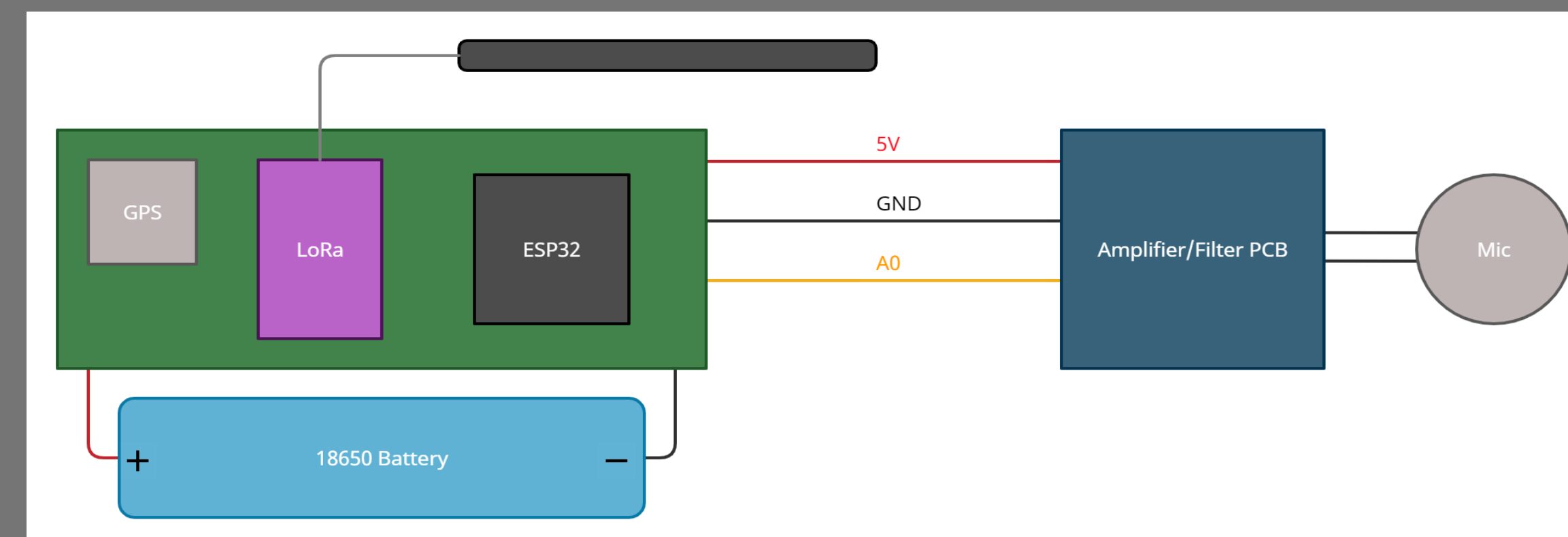
Sensor PCB



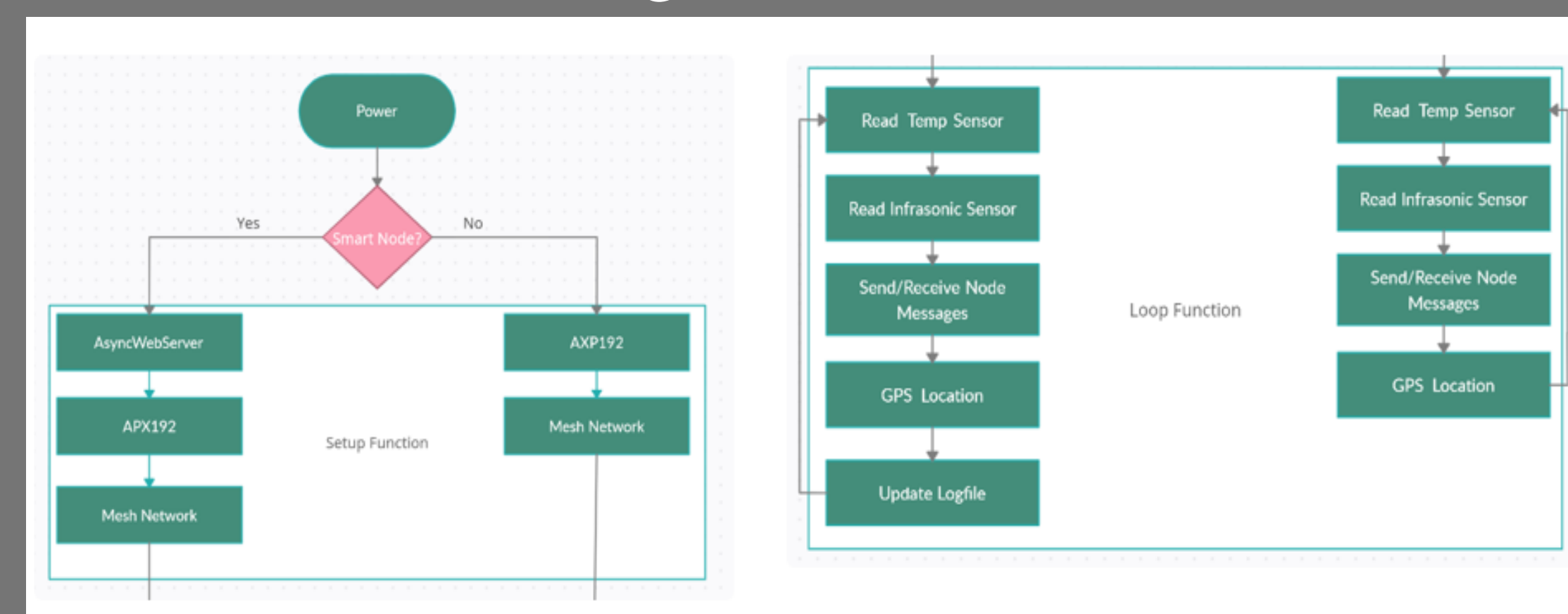
- Cheap components
- Runs on 5 V

System Design

System Diagram



Program Structure

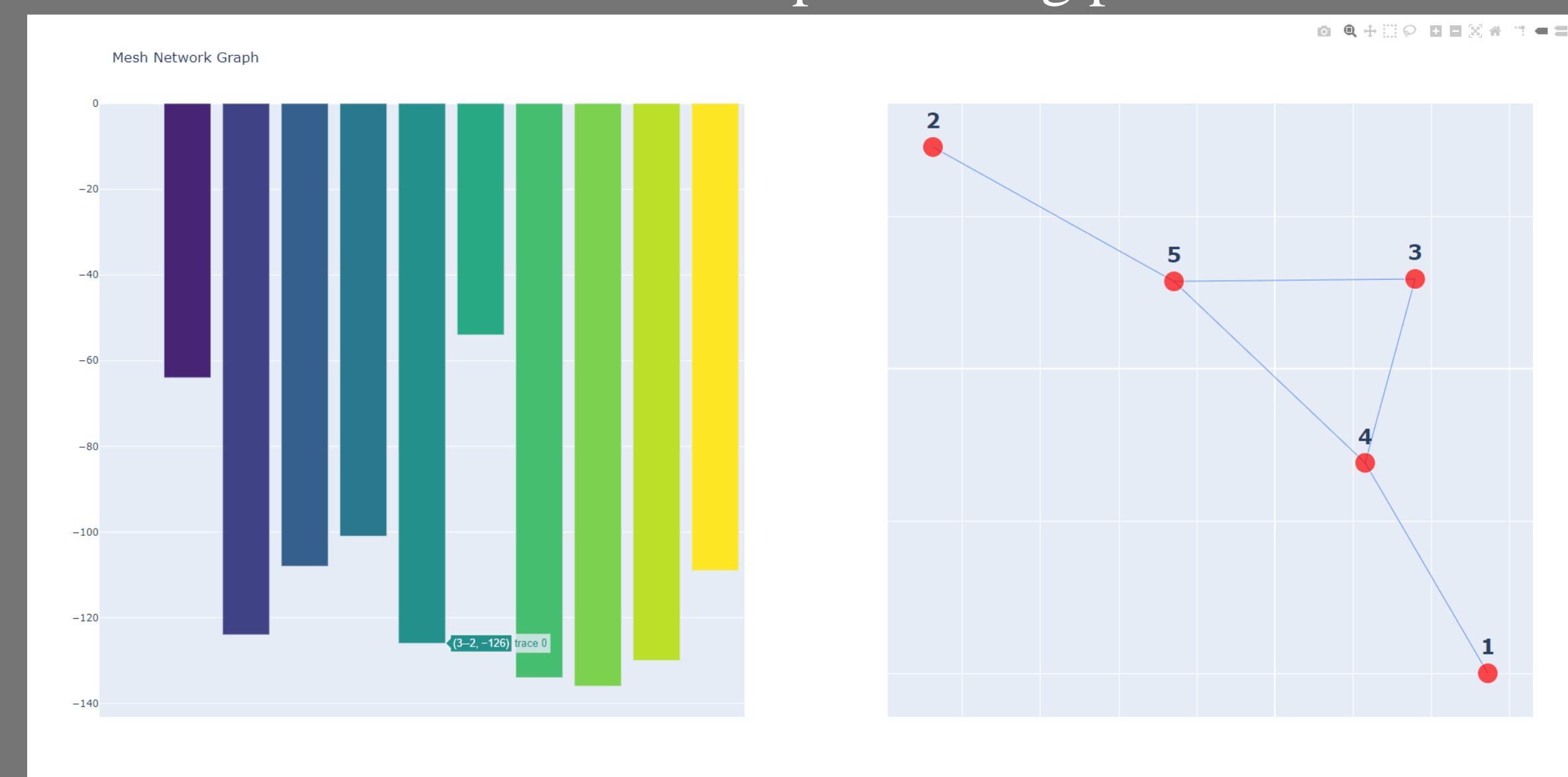


Network

- Mesh Network
- Smart and Dumb Nodes
- Simple radio packets
- Fire/No Fire

Software Validation:

- Mesh Network Tests
 - ~3 mins for 5 nodes (Network Live)
 - ~3 - 5 seconds per routing packet

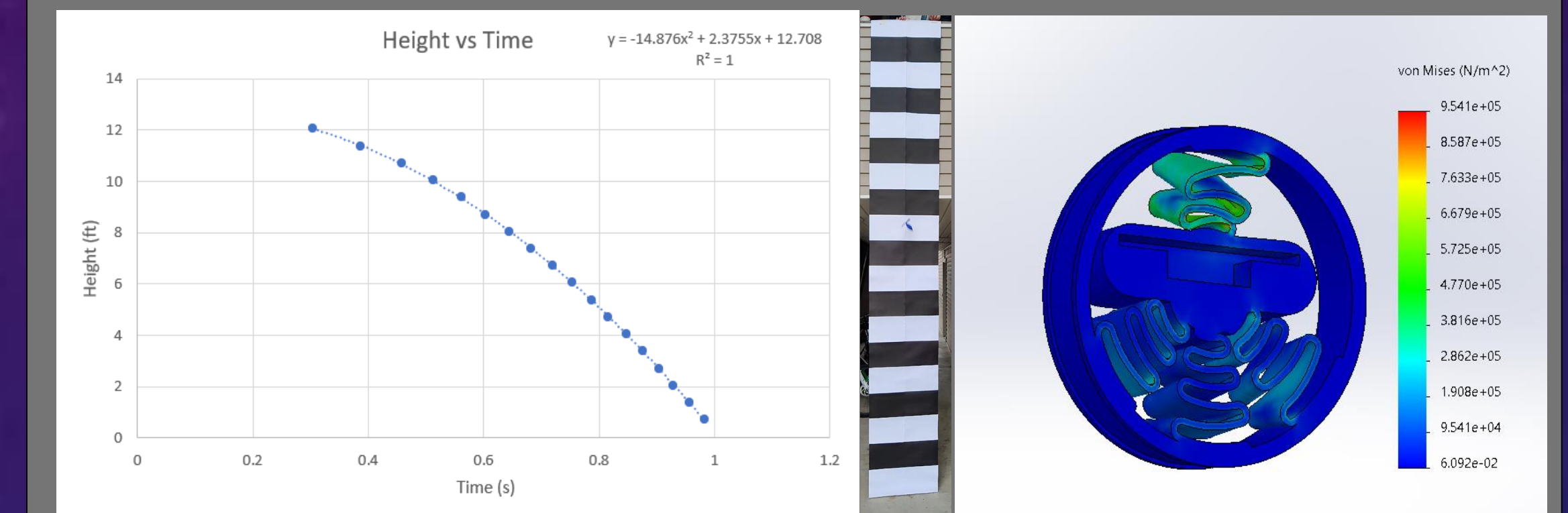


➤ Average dB

➤ Mesh Network Graph

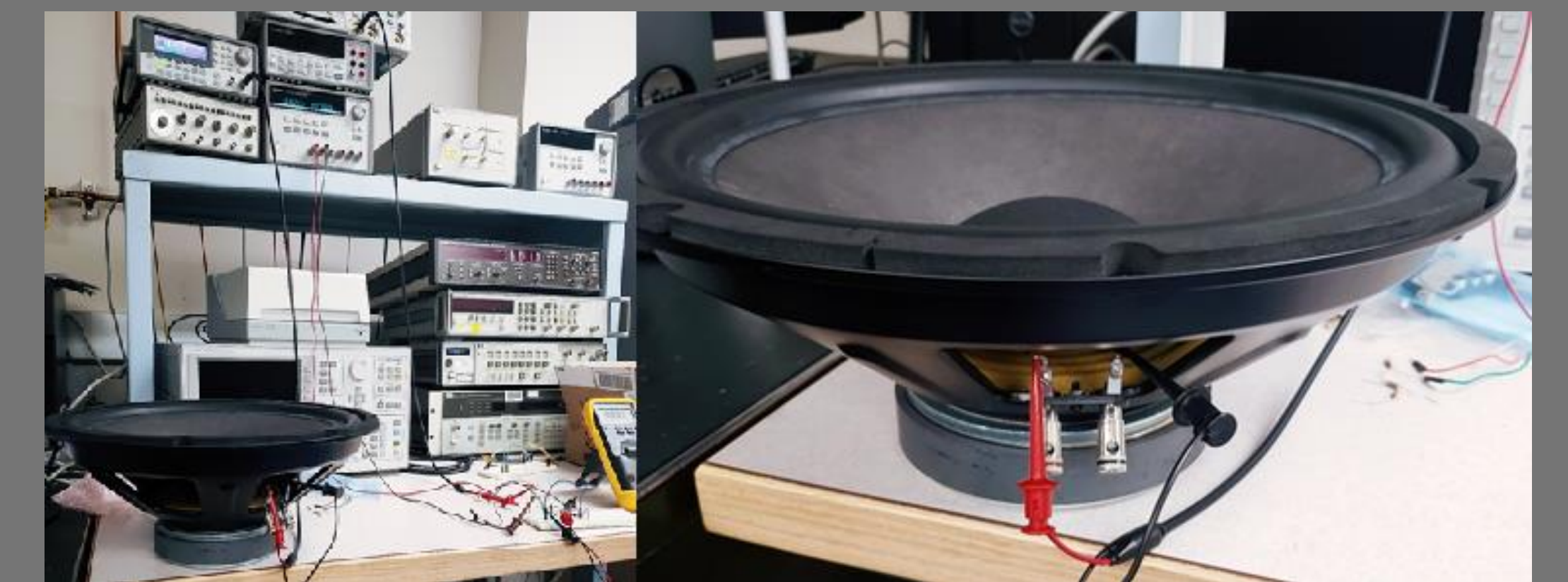
Physical Validation

- Drop Test and Force Simulation in SolidWorks
 - Drop Test showed only an 8% reduce in acceleration from the helicopter blades.
 - Simulation on shock absorber shows deformation.



Sensor Testing

- Using function generator and subwoofer to generate infrasonic acoustic signals and measure sensor readings



Plans for Future

- Sensor testing
- PCB Redesign to better fit enclosure
- 3D Print Full Enclosure Assembly
- Finalize Parachute Size based on Weight
- Parachute Drop Test
- Testing and Code Validation
- Battery Purchase and Testing

Acknowledgements

Joe Stanley
Dr. Herb Hess
Dr. Feng Li

