

FireWatch: Infrasonic Wildfire Detection Device

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Problem Definition

- Currently, wildfires are detected by human senses, seeing and smelling smoke.
- Research has found that wildfires can be detected by sensing ultra-low frequency sound waves.
- Due to increasing technology, cheap and easily deployable fire sensors are now a possibility.
- We want to design a device to fill this need.

Goals

- **Short Term:**
 - Mesh networking, infrasonic detection and signal processing.
 - 12-inch cube capable of withstanding drops, wildlife, and natural elements.
- **Long Term:**
 - Batch of 100+ small devices airdropped into remote locations
 - Little to no maintenance



Wildfire Research

Crown Fires



Figure 10

Initial crown fire.

Crown Fires

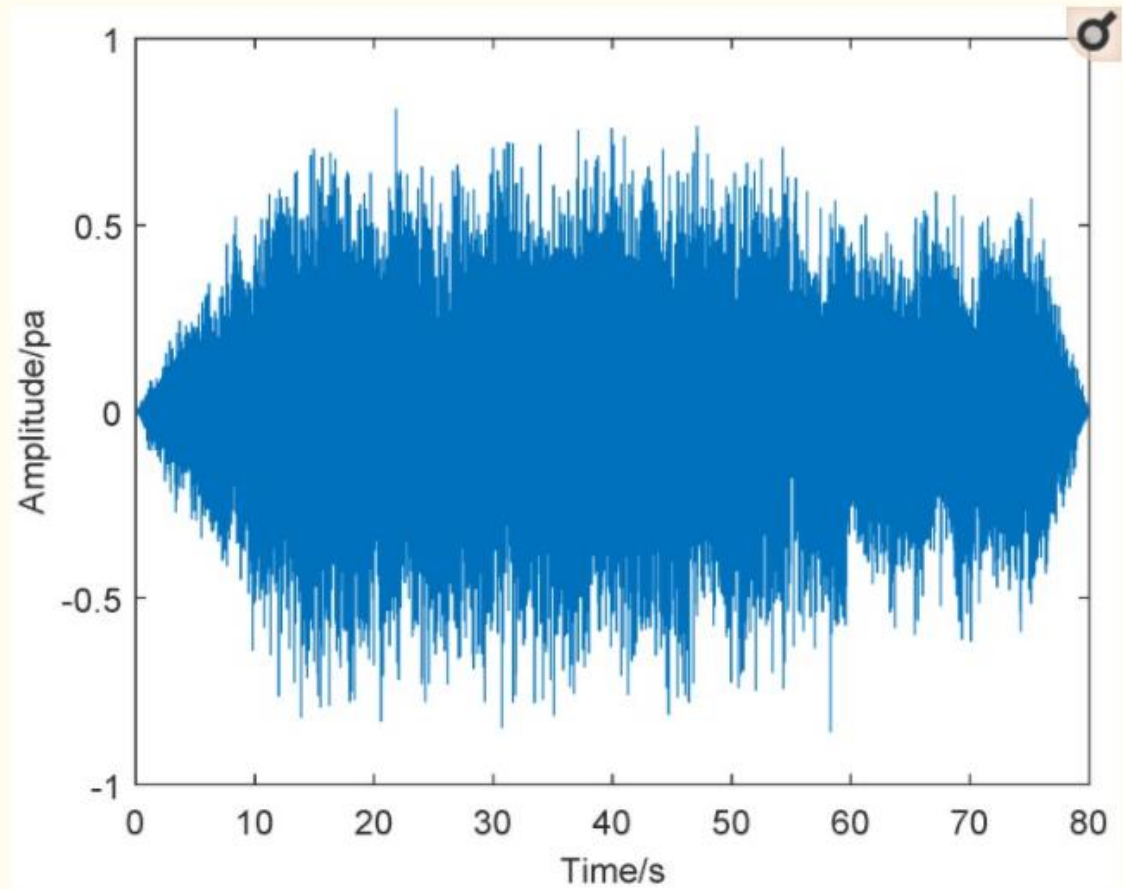


Figure 11

Time-domain sound signal.

Crown Fires

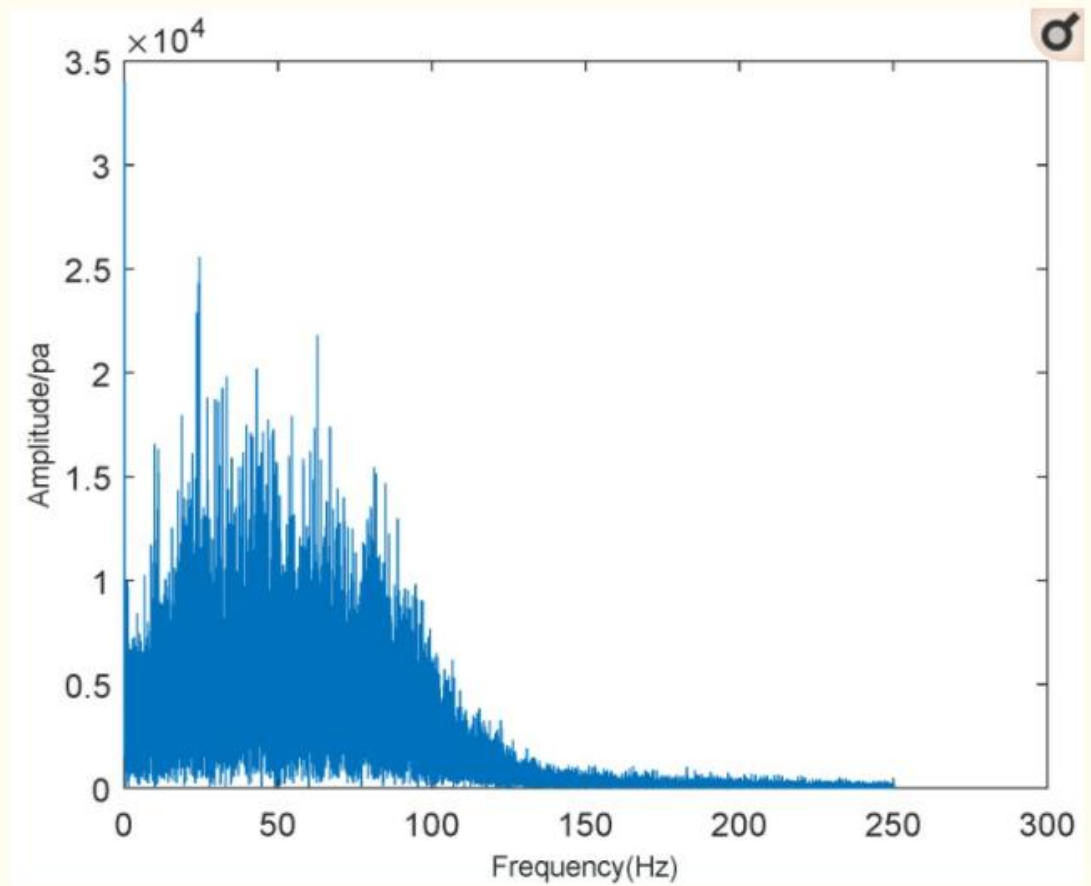


Figure 12

Frequency-domain sound signal.

Surface Fires



Figure 16

Surface fire.

Surface Fires

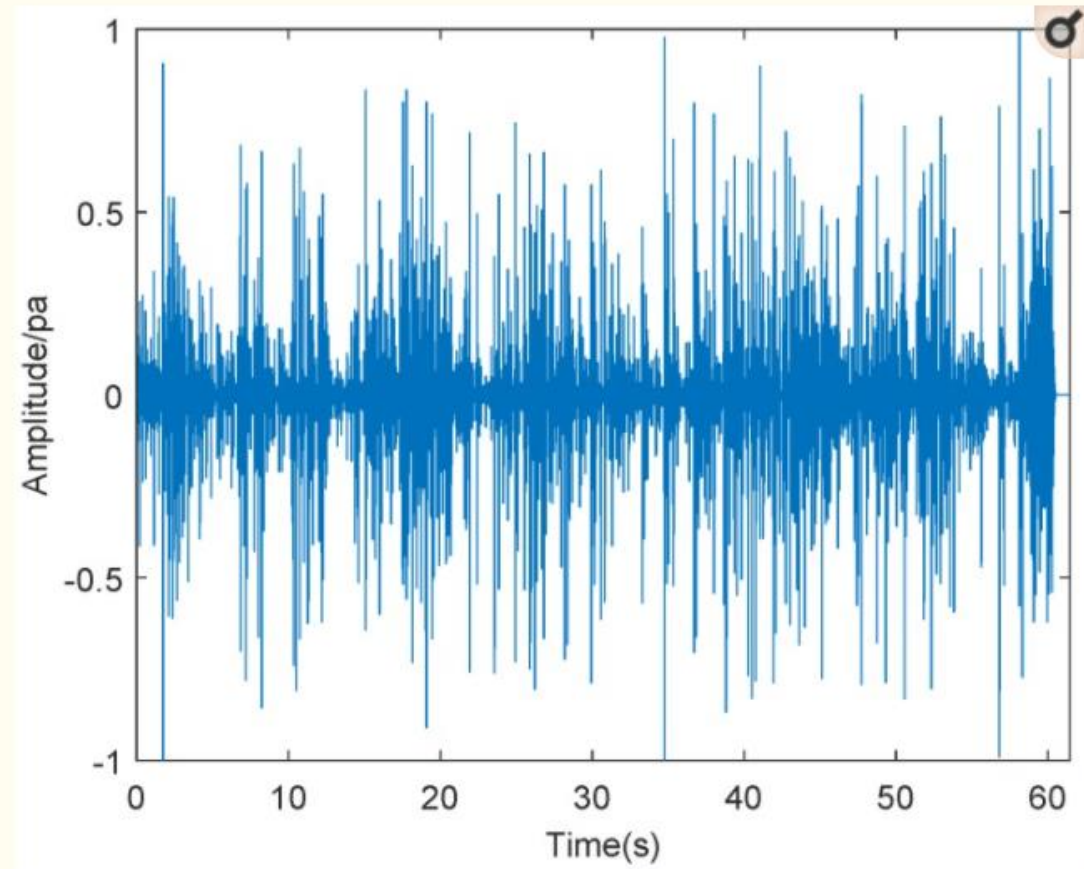


Figure 17

Time-domain sound signal.

Surface Fires

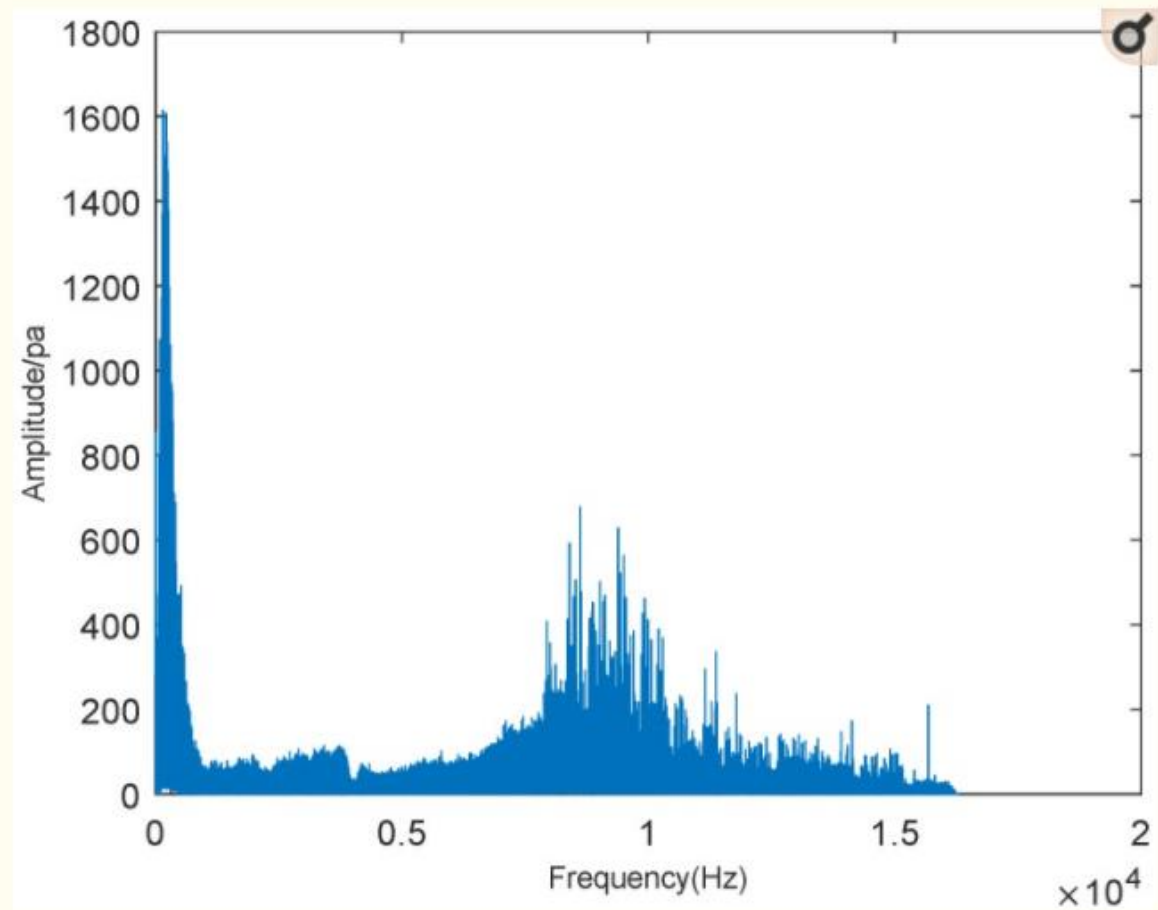


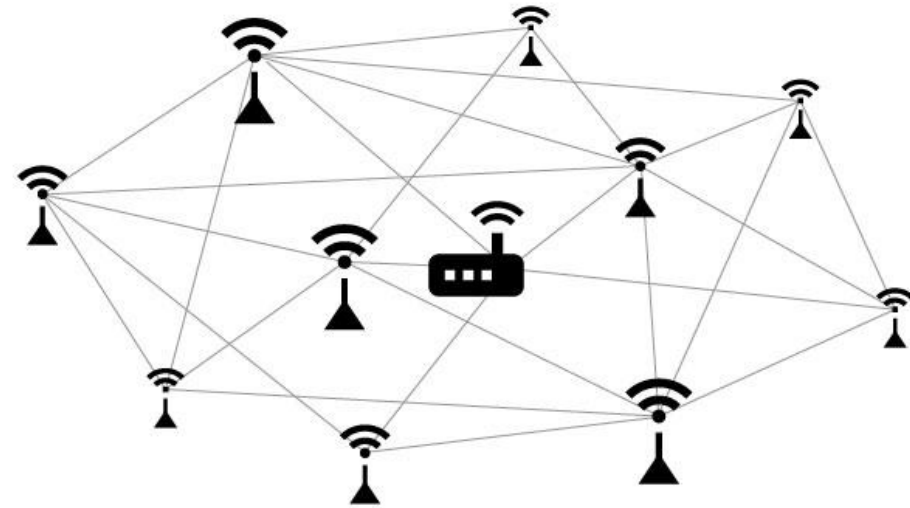
Figure 18

Frequency-domain sound signal.

A large, vibrant red speech bubble is the central focus of the image. Inside the bubble, the words "Hardware & Software" are written in a clean, white, sans-serif font. The bubble is positioned slightly to the right of the center. The background is white and features several thin, light gray curved lines that sweep across the frame, creating a sense of motion or a stylized wave. A dark gray, curved shape is visible behind the left side of the red bubble, suggesting it is part of a larger graphic element.

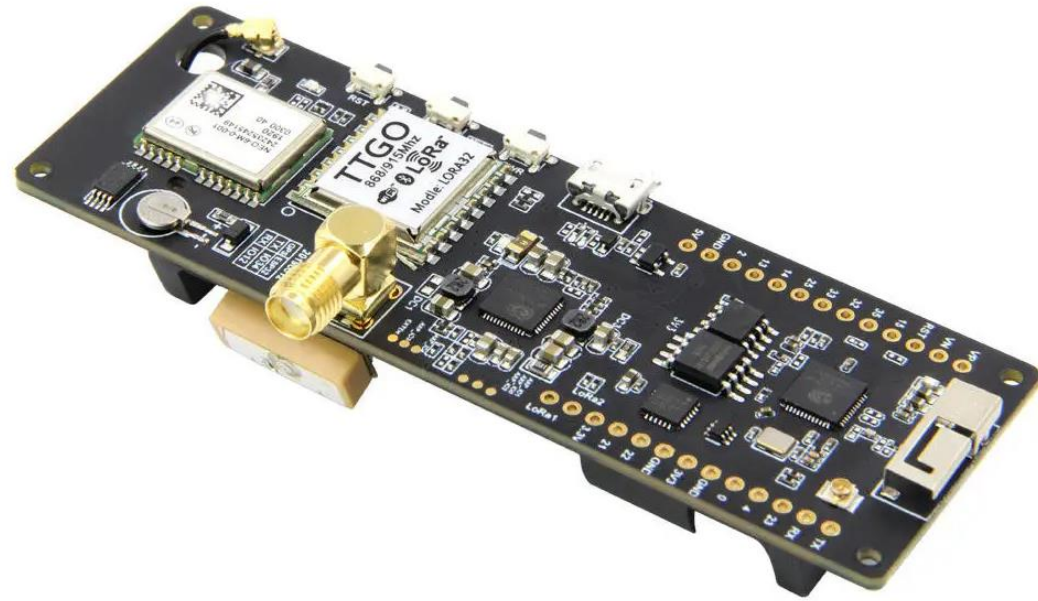
Hardware & Software

Mesh Network



- Network made of smart and dumb nodes
- Smart Node
 - GPS, Infrasonic Sensor, Microcontroller, Lora Radio, Internet Connection, User interface
- Dumb Node
 - GPS, Infrasonic Sensor, Microcontroller, Lora Radio

T-Beam Dev. Board

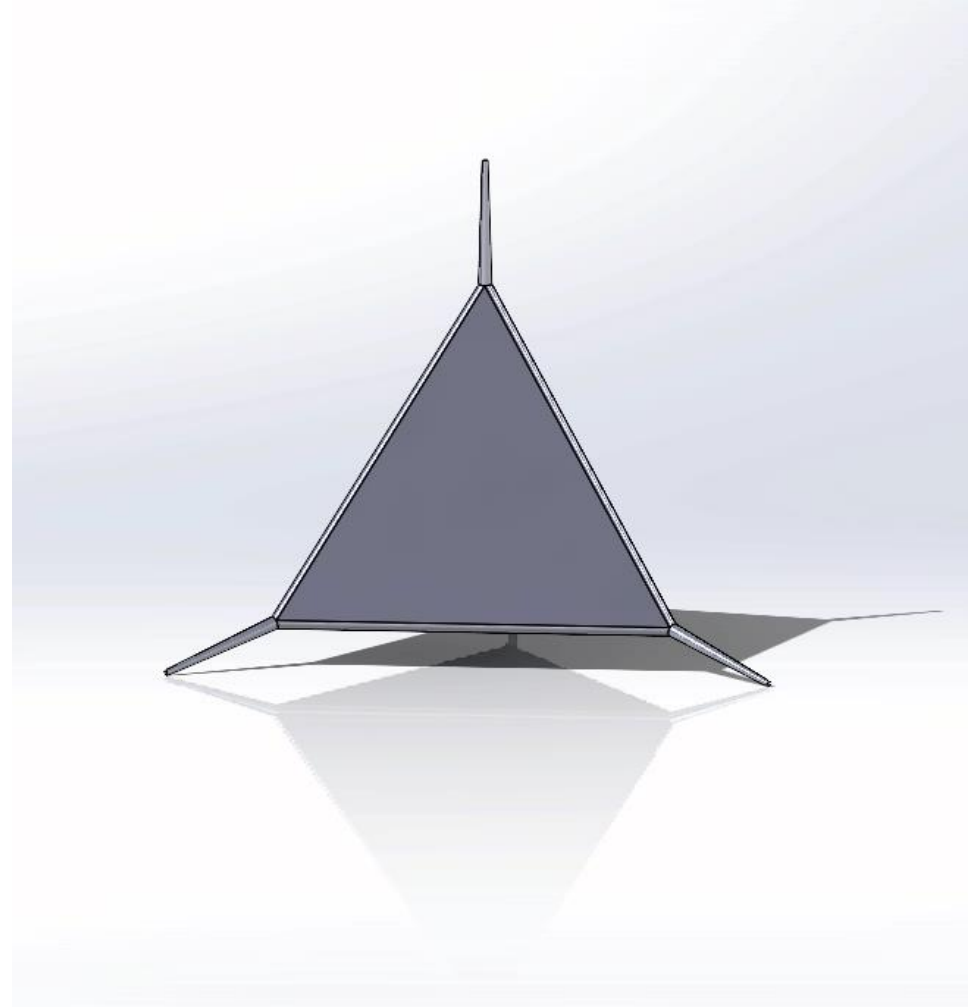


- **Microcontroller – ESP 32**
- **Connectivity – LoRa Radio, WiFi, Bluetooth LE**
- **GPS**
- **On-board battery and charging circuitry**

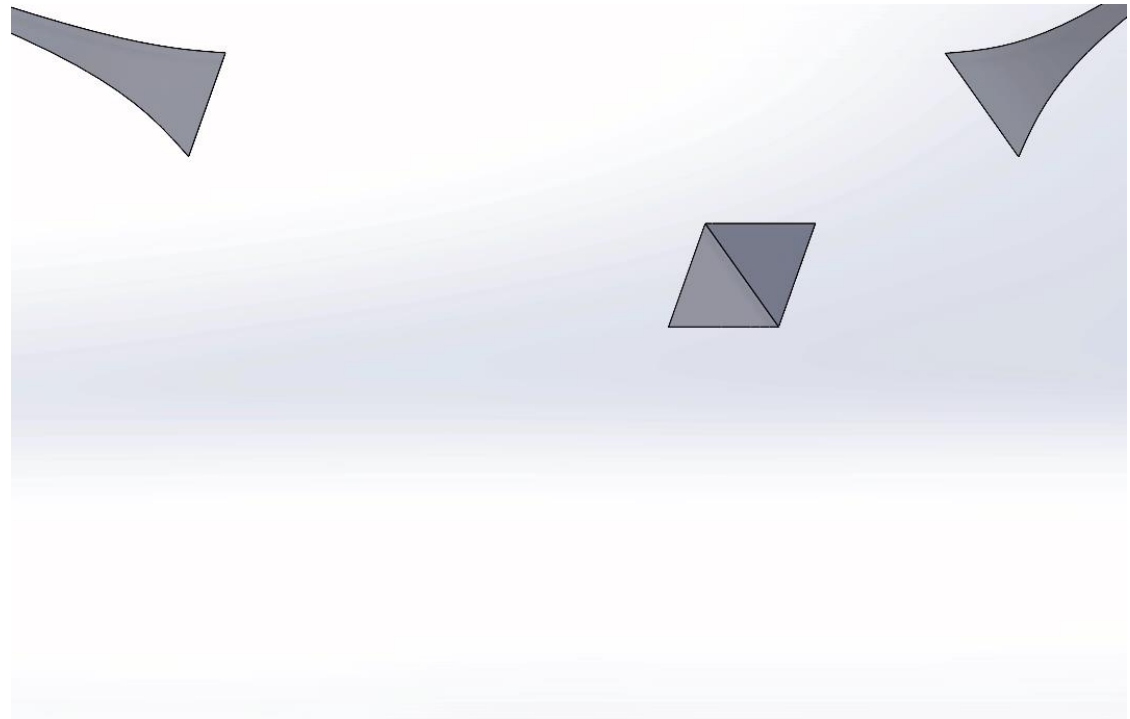
A large, vibrant red speech bubble is the central focus of the image. Inside the bubble, the text "3D Concept Models" is written in a clean, white, sans-serif font. The bubble is positioned slightly to the right of the center. The background is white and features several thin, light gray curved lines that sweep across the frame, creating a sense of motion and depth. A dark gray shadow is cast by the bottom-left edge of the red bubble, giving it a three-dimensional appearance.

3D Concept Models

4 Equal Sides



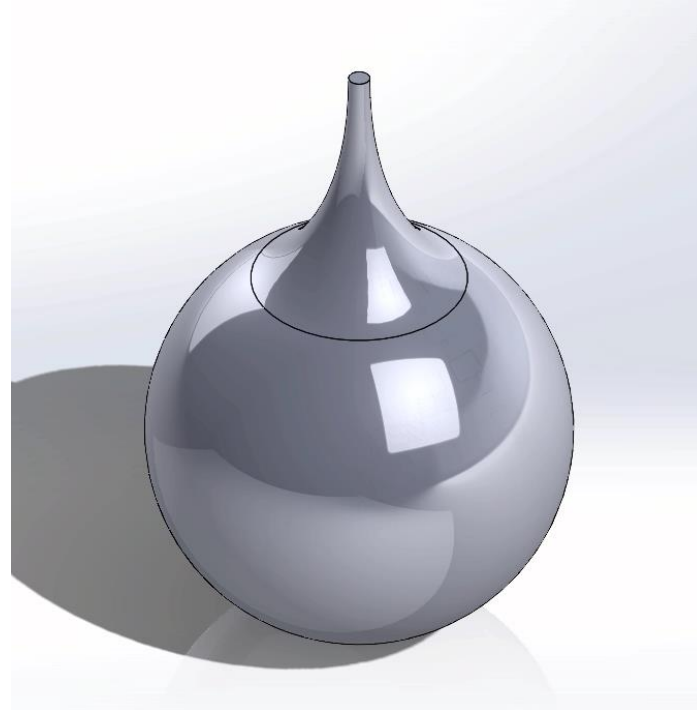
4 Sided with
Shape Being the
Antenna



Another Idea
That Can Land
Any Direction



Aerodynamic
Idea



Helicopter Leaf Design





Roles

- **Drew Malinowski**
 - Sensors and Signal Processing
- **Carlos Santos, Cory Holt**
 - Microcontrollers and Mesh networking
- **Meridian Haas**
 - Rugged enclosure design

A large, vibrant red oval is centered on the page, containing the word "References" in a clean, white, sans-serif font. The background is white, featuring a series of thin, light grey concentric circles that create a subtle ripple effect. A thick, dark grey, curved swoosh or brushstroke element is positioned to the left and bottom of the red oval, partially overlapping it. The overall design is modern and minimalist.

References

Links

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6929188/>
- **T-Beam Dev. Board:**
https://www.banggood.com/LILYGO-TTGO-T-Beam-v1_0-ESP32-LoRa-433-or-868-or-915Mhz-WiFi-GPS-NEO-6M-18650-WiFi-bluetooth-Board-Module-p-1609523.html?rmmds=detail-left-hotproducts_1&ID=510803&cur_warehouse=CN

