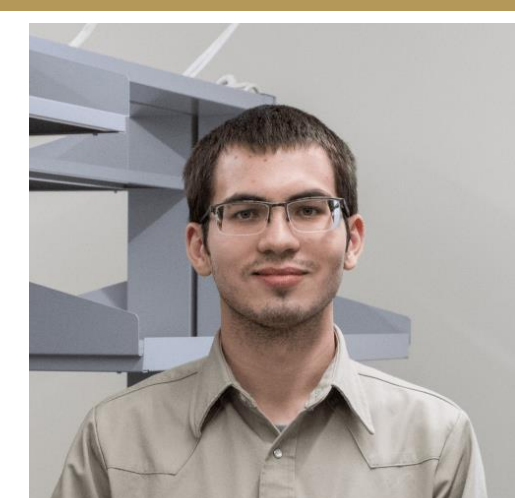


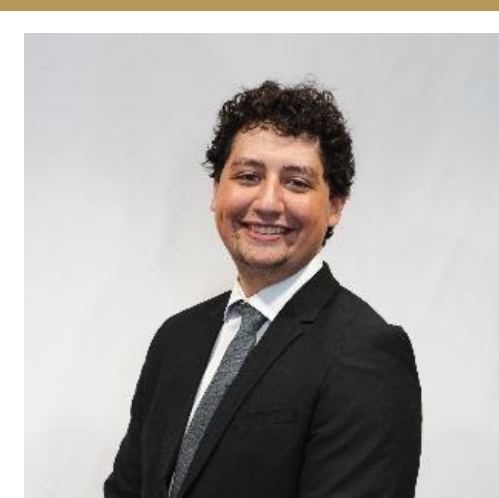
Erich Ellsworth, Aidan McSpadden, Jaxon Castillo

Sponsored by: Dr. Damian Valles and the Translational Health Research Center

Meet the Team



Erich Ellsworth
(PM)
Long Range
Communication
System



Jaxon Castillo
Direction
Aware Scream
Detection



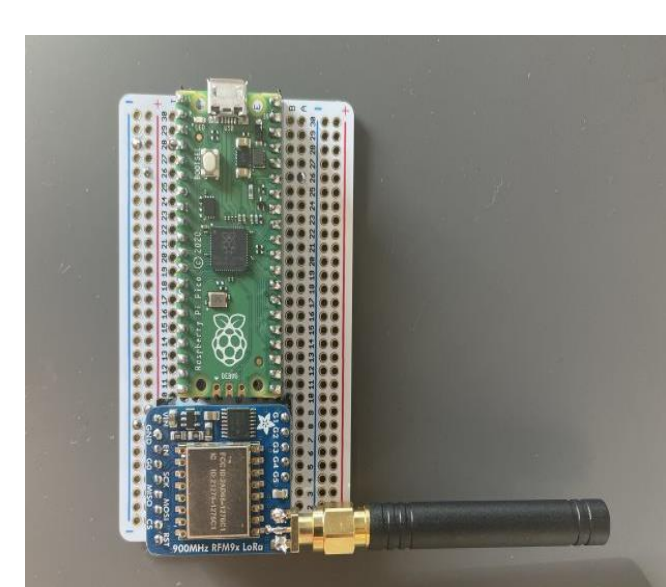
Aidan
McSpadden
3D LiDAR
Mapping

Project Background

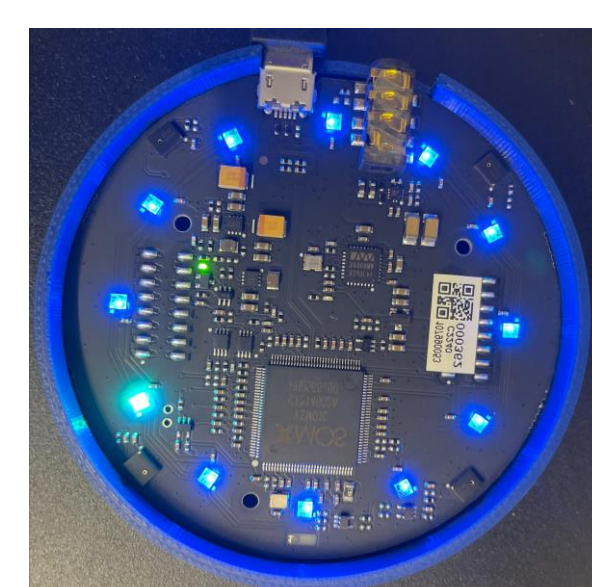
- Fire-Bot is a robotic platform designed to assist firefighters locate victims inside of burning buildings.
- Our project seeks to improve Fire-Bot's capabilities by enhancing its ability to detect people, navigate buildings, and communicate to first responders.

Subsystems

- **Long-Range Communication System:** Augments Fire-Bot's WiFi based communication with a LoRa-based encrypted link.
- **Direction Aware Scream Detection:** Allow for Fire-Bot to detect direction from a heard scream.
- **3D LiDAR Room Mapping:** 3D room mapping and obstacle avoidance.



LRCS

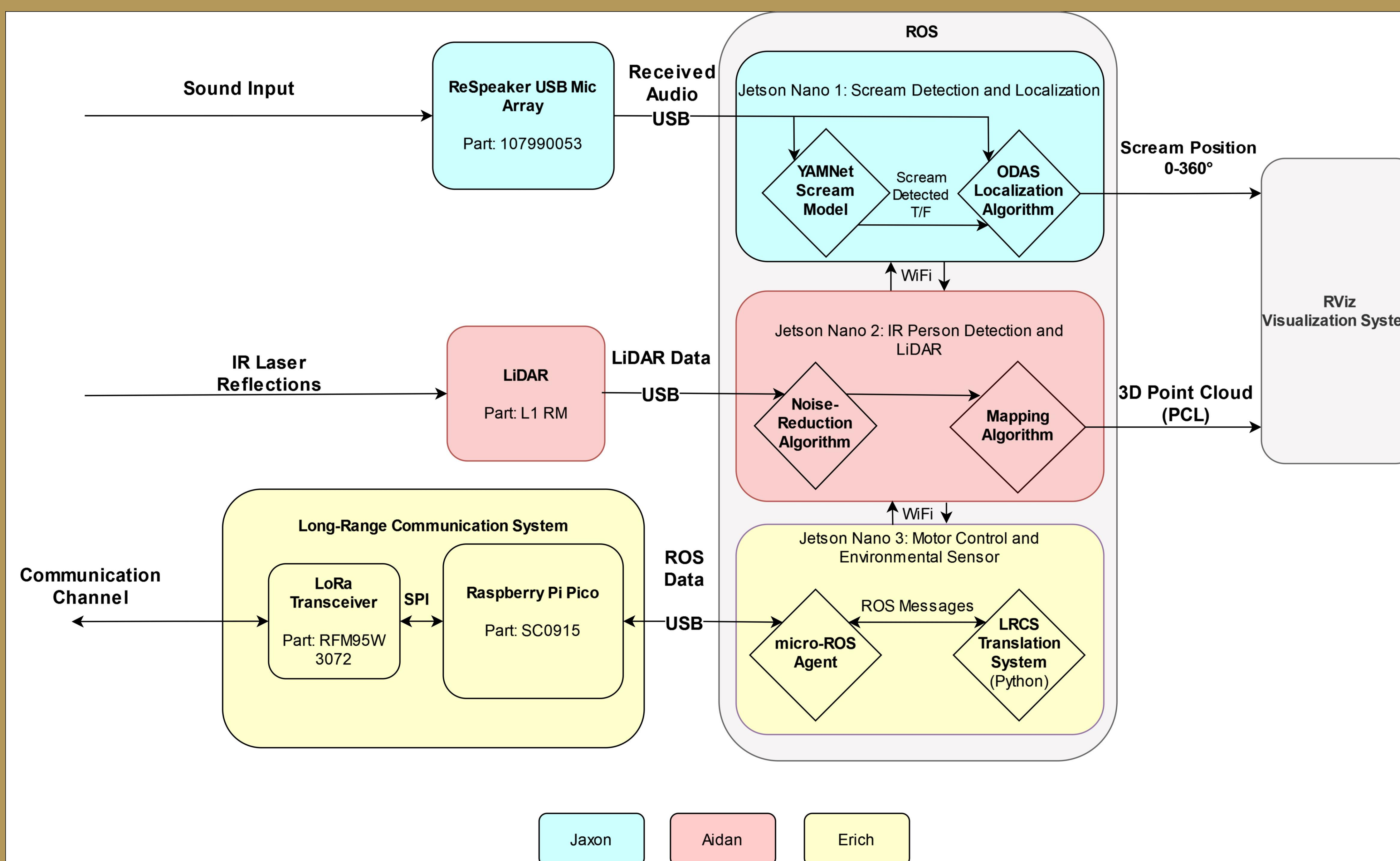


4-Mic Array



3D LiDAR

Block Diagram



Jaxon Aidan Erich

Requirements

- **Long-Range Communication System:**
 - Data transmission reliability shall be greater than 75% at 1 km Line-of-Sight.
 - Data transmission reliability shall be greater than 75% through 1 floor.
- **Direction Aware Scream Detection:**
 - Accurately detect direction of source relative to the rover in a noisy environment.
 - Accurately detect direction of source up to 15 yards in a noisy environment.
- **3D LiDAR Room Mapping:**
 - Successfully detect hazardous objects within 5 feet of front of rover.
 - Map a room using SLAM while rover is in motion

Subsystem Test Results

| Test | Measured Result | Outcome |
|---|--|---------|
| Data transmission reliability shall be greater than 75% through 1 floor. | Received 8 out of 10 ROS messages through 1 building floor. Average SNR was -13.2 dB. | PASS |
| Accurately translate ROS messages to and from LoRa packets. | Translated 10 out of 10 ROS messages successfully. | PASS |
| Direction finding reliability shall be greater than 70% (15 ft, w/ scream at 100 dB, noise 80 dB) | Found accurate direction within 20° (5 ft) 8/10 times | PASS |
| Scream detection reliability shall be greater than 90% | Detected 10/10 screams successfully | PASS |
| LiDAR Maximum and Minimum range test | Found LiDAR minimum range to be 4" in all directions and maximum 48" laterally and 70" vertically | PASS |
| Mapping Test | LiDAR was able to map a room using SLAM. Reliability suffered after prolonged use and sudden movements | FAIL |

Acknowledgements

- Sponsor: Translational Health Research Center.
- Faculty Sponsor & Advisor: Dr. Damian Valles