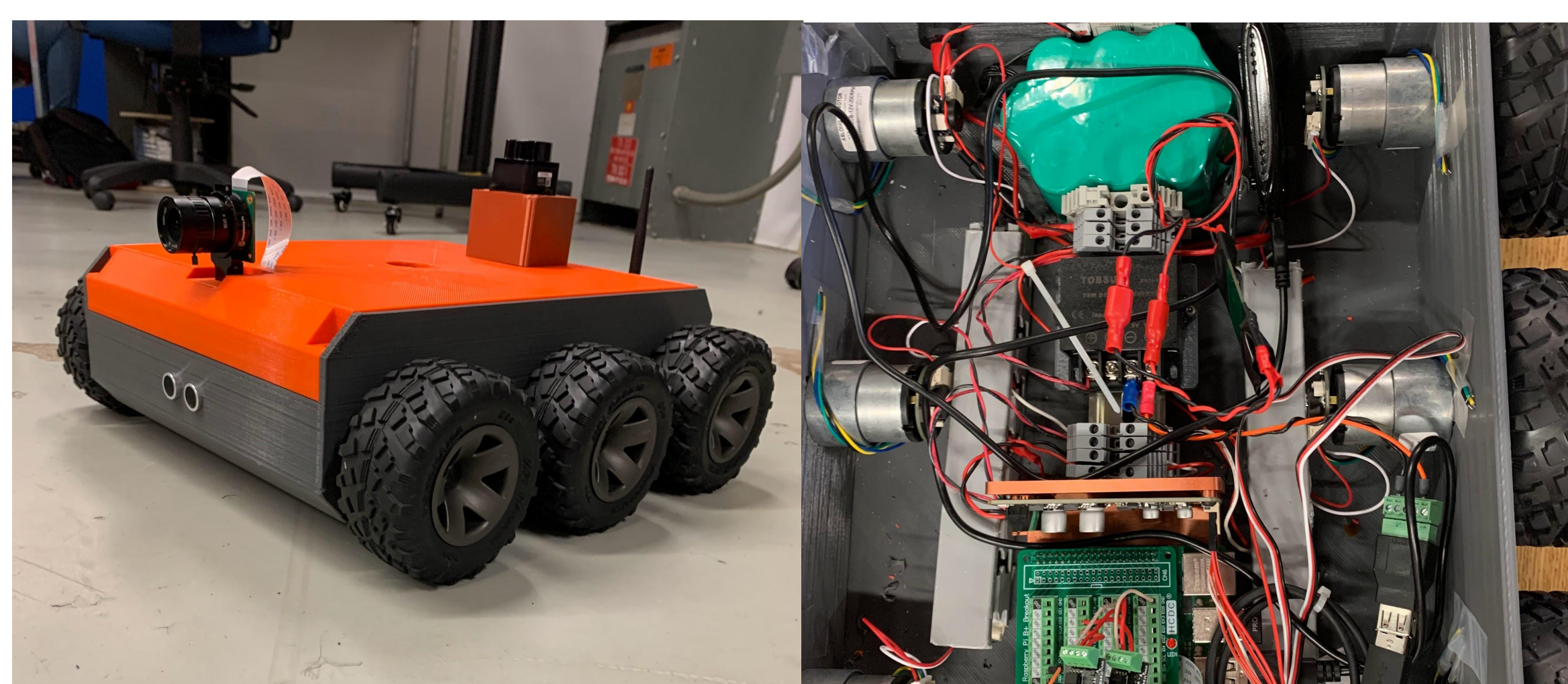


# H.E.R.M.E.S – HElpful Robotic MESsenger

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## Overview

The overall goal of HERMES is to travel into the accelerator tunnels for routine surveillance reducing the radiation exposure to Fermilab employees. HERMES was a project started by a senior design team at NIU. The goal of the project was to add to HERMES by implementing new sensors, algorithms and making HERMES more user-friendly.



HERMES modified with multiple mounts for camera, ultrasonic sensor and wifi adapter

HERMES internals after rewiring

## Parts



- Intel Realsense D435i - Provides high quality images and distance measurements allowing for depth sensing applications (Figure A)
- A2 RPLidar - Generates point cloud data, enabling 2D mapping and localization (Figure B)
- Parallax Ultrasonic Sensor - Used for proximity sensing and object detection (Figure C)
- HQ Pi Camera - used for high quality images and video stream (Figure D)



## Recent Accomplishments

Established network connection to the Fermilab network to allow wireless communication following safety protocols making HERMES more user-friendly. HERMES will now be able to be used in the tunnels without the need for a tether.

Programmed the ultrasonic sensor to measure accurate distance. The Realsense depth camera with the ultrasonic sensor will help with object detection within the tunnels.

Wrote test programs for the Intel Realsense camera and was able to detect AprilTags. This will allow for mapping and localization within the tunnels.

Combined ultrasonic sensor, camera, AprilTags and algorithms for image-based object recognition, enabling basic object detection and autonomous movement.

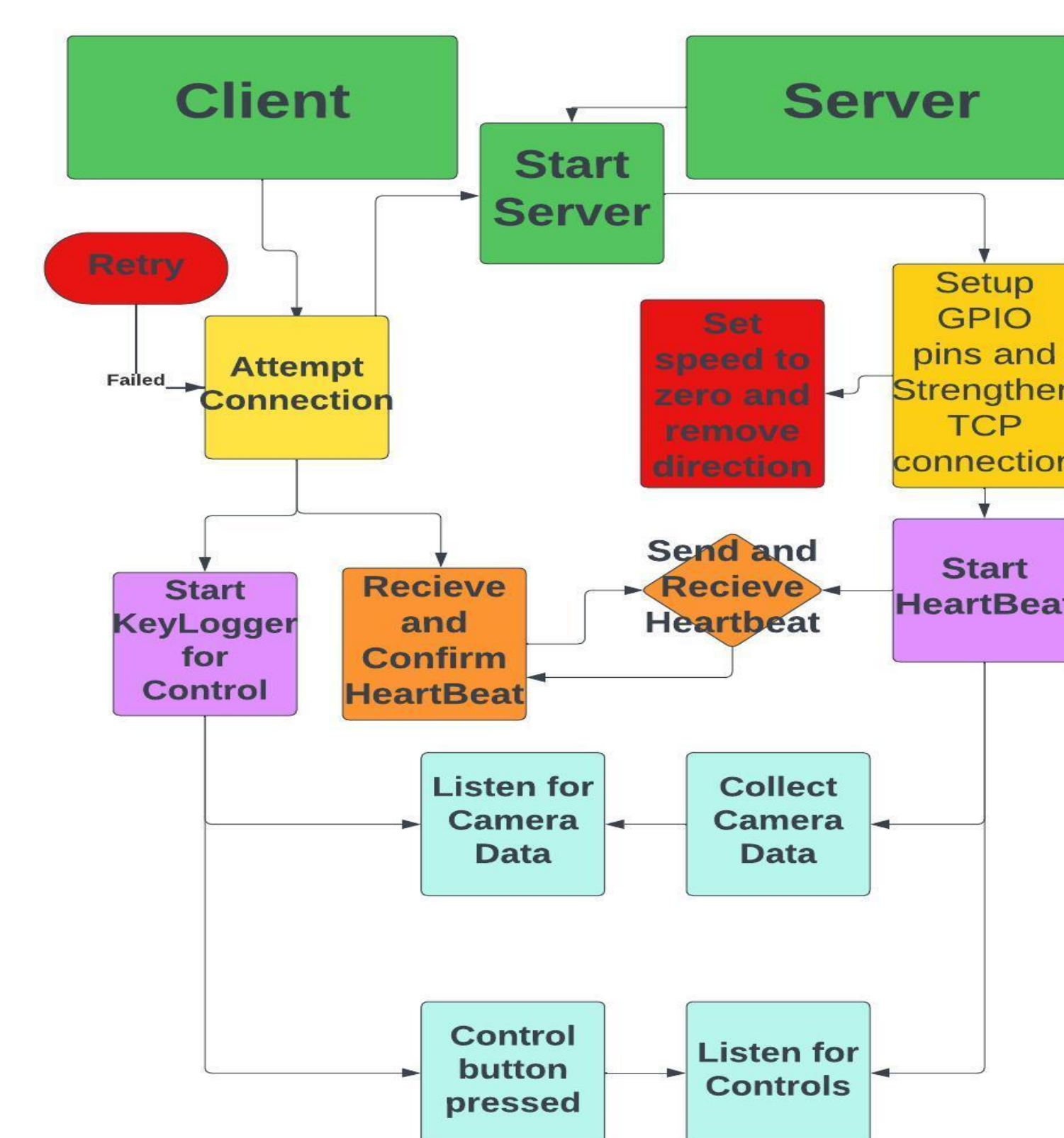
Redesigned chassis to be able to hold ultrasonic sensor, the wifi adapter and the HQ camera without exposing internals improving HERMES safety.

## Next Steps(or rolls) for HERMES

HERMES' end goal is to be an autonomous "tunnel detective". The next iteration of HERMES will be run on a Nvidia Jetson Nano. This will allow more computational power and the ability to leverage the built-in GPU for machine learning. AprilTags will also be placed in the tunnels to allow mapping of the area.



HERMES looking at an AprilTag



Code Architecture diagram

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