https://github.com/jtsalisbury/ipaq

IPAQ

Image Processing Autonomous Quadcopter

Team 3


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Standards

- Federal Aviation Administration (FAA) Unmanned Aircraft Systems standards (UAS)

Problem Statement

- No affordable, open-source, reliable software available currently to fly a drone autonomously through obstacles via cameras, image processing, and LIDAR
- Autonomously flying drones could be leveraged for search and rescue operations, reducing the need for human interaction in dangerous areas by allowing an autonomous drone to search without first responders needing to be physically present

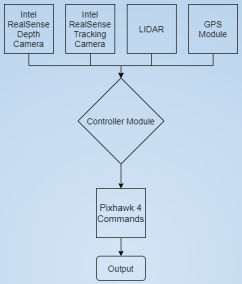
Design

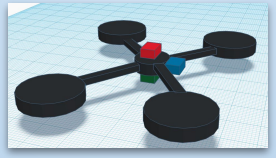
1. Four inputs to the system: Tracking camera, depth camera, LIDAR, and GPS
2. LIDAR sends a list of distances and thetas of nearby objects to controller module
3. Tracking and depth camera send input data to an image processing model that detects objects and sends this data to controller module
4. Controller module combines the data and makes a decision on course of action

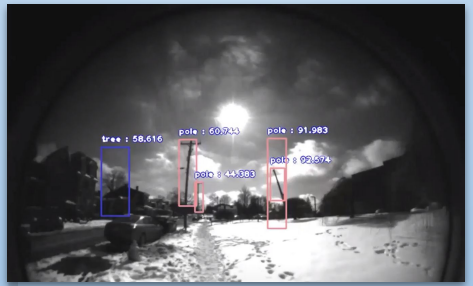
Materials

- NVIDIA Jetson Xavier NX
- RPLIDAR A2
- Intel RealSense Tracking T465 & Depth Camera T435
- Quadcopter
- Pixhawk 4 flight controller

Artifacts







Obstacles

- COVID-19 resulted in difficult working conditions when it came to collaborating on hardware
- Design for a drone makes it difficult to test module accuracy and efficiency without a drone or flight controller (ie accurate GPS location, etc)
- Difficulty setting up GPU functionality to efficiently train the image processing model

Accomplishments

- Image processing model that successfully detects trees and poles
- LIDAR module that converts input data to be interpreted by the controller module
- Controller module that merges all inputs and outputs a decision to avoid obstacles and maintain motion of the quadcopter
- Simulation that shows

Future Improvements

- Simulate program on physical quadcopter
- Include more training data in the image processing model to improve range and accuracy
- Increase range of motion of quadcopter by including more courses of action from the controller module