Artificially Intelligent Route Building Unsupervised Drone

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Introduction

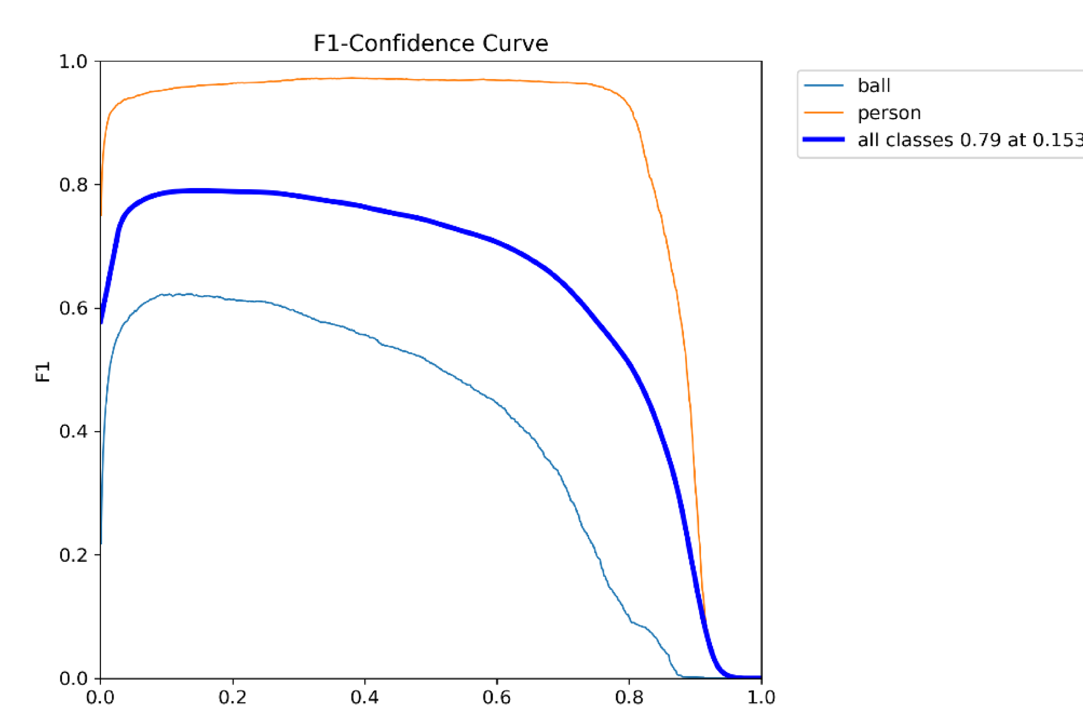
This project focuses on developing an artificially intelligent quadcopter, called AIRBUD, to serve as a control test bed for object identification, tracking, and path prediction. The quadcopter must exhibit swift maneuverability, precise object detection using AI algorithms and depth maps, accurate path prediction based on constant acceleration models, and a custom flight control system for responsive and stable flight. Safety measures include an emergency switch for manual control, operational limitations based on weather conditions, and protocols for handling false positive object detections to ensure safe and effective operation of the drone.

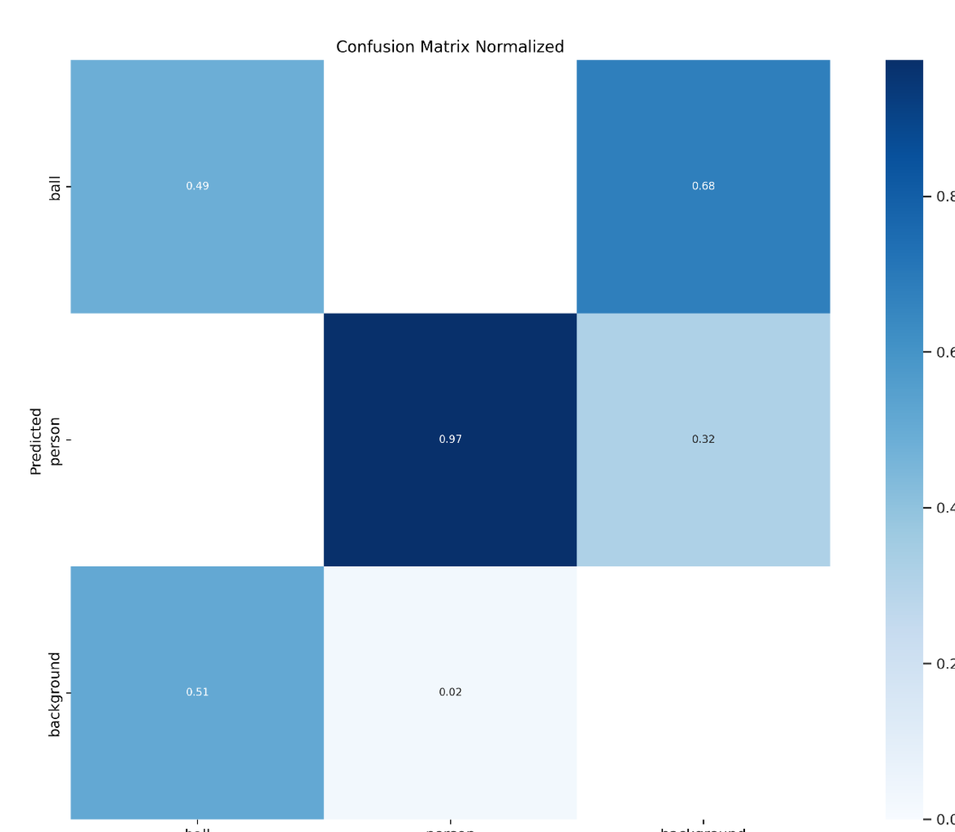
Objectives

Maneuverability: Implement quick maneuverability for AIRBUD's operational capabilities. The quadcopter will have appropriate reaction times for objects that come into its field of view.
AI Object Detection: Implement an artificial intelligent mode in AIRBUD's decision-making processes. This includes training and inferencing real-time data.
Object tracking: Develop and implement custom control algorithms that enable AIRBUD to detect and track objects.
Communication System: Develop and implement a communication network between the ZedX Mini camera, the onboard Jetson, and the CubeOrangePlus to transfer necessary data and control the movement of the quadcopter.
Safety: Prioritize safety in AIRBUD's operations by implementing an emergency switch to give manual control to the user.

Milestones

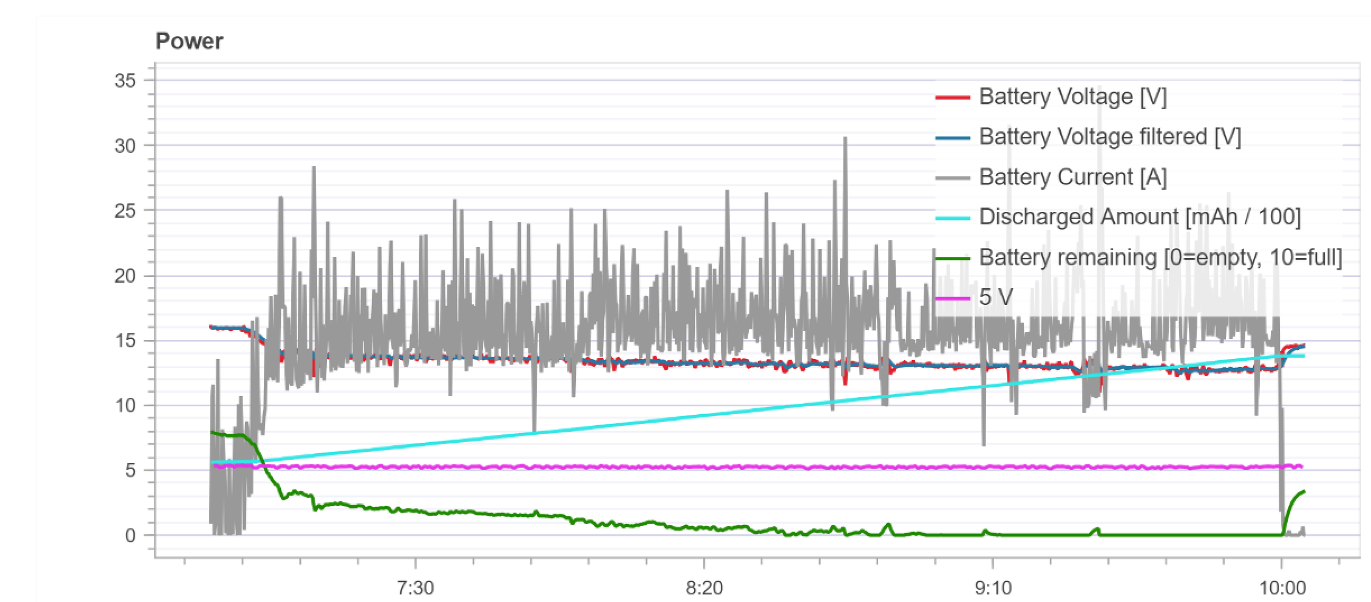
- Create a quadcopter design that will handle 2.5 kg, while allowing control to an RC controller and an onboard controller.
- Complete the communication process between the Jetson, ZedX mini, and the CubeOrangePlus through ROS so that messages from the camera can be received by the flight controller.
- By utilizing YOLOv8 as the object detection algorithm, we can extract bounding box information and class IDs. This data can then be used as input for a control algorithm, enabling the drone to be flown with a focus on object tracking.
- Develop a control system to take in bounding box estimates from object detection and provide control signals to the actuators to follow and track the target.

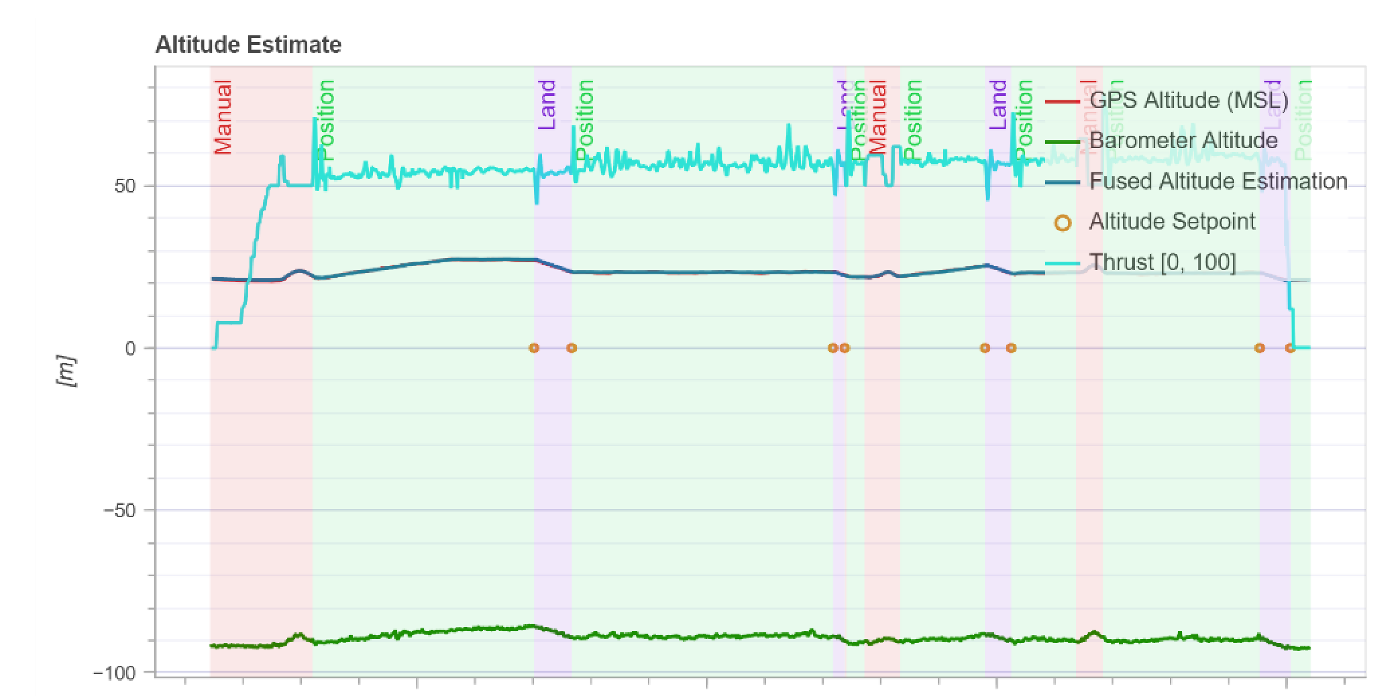




Assessments

To test this project, both simulation and physical testing will be conducted. To test control system designs and to ensure that the drone will fly with expected behavior, tests are run on a simulation in hardware (SIH) program within the flight controller. Here the drone can be fly virtually with different applied parameters. Physically, the drone will be flow outside and be expected to detect a ball, send signals to the motors to follow the ball, and complete a tracking control objective. The response time for these actions along with the battery life will be monitored to see how they perform during flight. Additionally, during flight rogue objects will be tested along with the balls to ensure the AI algorithm is properly identifying desired objects.





Acknowledgments

We would like to thank the Office of Undergraduate Research for providing us with a SPARK Grant to assist in our project. We would also like to thank Dr. Sergey Drakunov and the entire Engineering Physics Propulsion Laboratory for their mentorship and resources.