EcoHawk: YOLOv11 Low-Altitude Drone System for Simultaneous Detection, Geospatial Quantification, and Risk Mapping of Invasive Species With Real-Time Authority Notification

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In this project, the researcher developed the engineering goal of creating a real-time drone system that would fly over an area, state the location of each invasive plant, create a risk assessment map, and alert the authorities in order to reduce the number of areas with a high concentration of invasive plants. Previous studies demonstrate a step toward stronger invasive identification efforts, but all with a lack of accessibility for the average person to control, with the ability to only identify one invasive plant. The experimenter assembled a drone using a soldering iron, 4 motors, a drone frame, a custom 3D printed vibration dampening plate, and a Pixhawk and trained a machine learning model with 13,000 images to identify 16 invasive plant species. A Raspberry Pi was attached to the drone for onboard machine learning identification. An ultrasonic sensor was also integrated for obstacle avoidance. This system was tested on five different public parks and compared to expert derived ground truth data to determine how feasible this solution would be in the real world. All identifications with an interactive map are displayed on a web browser interface for authority use, with priority levels displayed for each location. From these procedures, the conclusion was developed that the drone would perform well in an actual situation, with the drone only missing 1-2 detections in each location and attaining a top-5 accuracy score of 0.89, which is higher than the average CLS model. In a real world setting, this could be used to reduce the economic burden and health impacts of invasive plant species, allowing for a transition to data driven eradication.

Awards Won:
Fourth Award of $600