Autonomous Aerial Device For Search and Rescue Assistance

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Louisiana State University Electrical and Computer Engineering Capstone Project

Project Outline

The goal of this project is to design and create a semi-autonomous aerial surveillance device that is capable of improving current emergency response performance. This device must be highly mobile but also stable and reliable, to navigate in emergency environments successfully. To improve control, two modes of operation are available, a fully autonomous mode as well as manual control. The device will be able to provide Urban Search and Rescue teams with the ability to get a birds eye view of disasters, as well as their teams in the field.

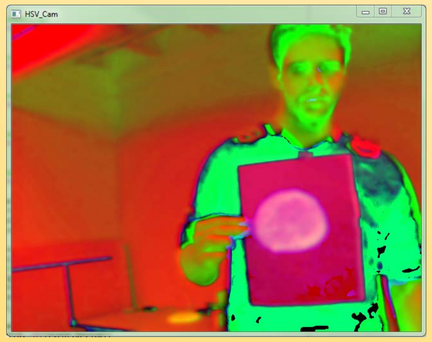
Aerial Device

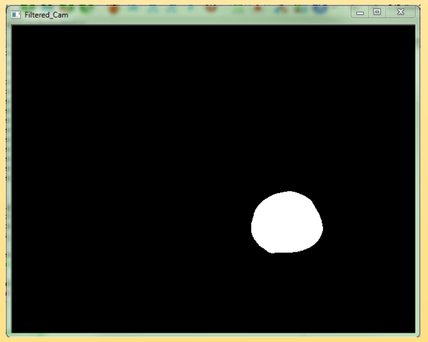
A four rotor device, commonly called a quadcopter, was chosen for the design for numerous reason. When compared to a helicopter, it offers much greater mobility due to the four rotors. In addition, when compared to a plane, the quadcopter has the ability to hover. This makes it superior for scouting and tracking because of increased mobility and control.

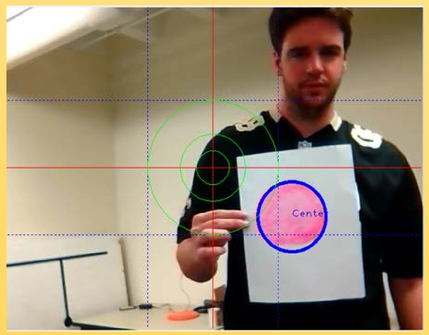
Computer Vision

Using the OpenCV Libraries and Python, classical and state of the art computer vision algorithms were used to find our target in the live video feed. For testing purposes, our target was an orange ball. The computer vision implemented in four steps:

1. Smooth image using Gaussian Blur to reduce noise
2. Convert the image to HSV from RGB
3. Filter the image based on HSV values
4. Perform the Hough Transform on the image to detect circles and draw a circle on the original image





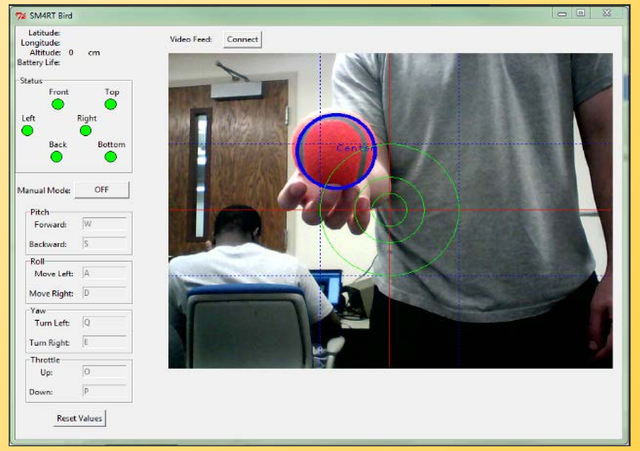


Top Left: HSV image
Top Right: Filtered Image
Bottom Left: Circle detected from filtered image with Hough Transform and drawn on original image at location

Interactive Graphic User Interface (GUI)

An interactive GUI was designed to provide the user an environment to access the live video feed, as well as numerous other options.

- Enable/Disable of autonomous mode
- Proximity sensor data
- GPS position of device
- Customizable movement control hotkeys

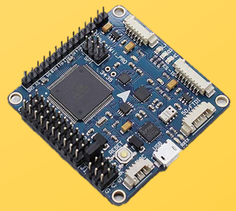


Results

After complete integration of all our systems, we had to test the device. Originally, a camera was to be mounted to the device. Due to input issues from the camera, we were unable to get one attached and synced to our GUI. We instead tested it by using the computer's built in camera. Although we were overall unable to achieve hovering and flight, commands were still sent to the copter based on the target's size and position and screen. These commands resulted in movement from the quadcopter, but without being able to achieve hovering, we were unable to determine if they were the appropriate motions.

Electronics

The device utilizes many electronic components for its various capabilities:



- Ultrasonic range sensors for collision avoidance

- Flight controller with on-board inertial measurements units
- 2.4 GHz Xbee modules for wireless communications of commands

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