ECE 568 – Final Project Report

Facial Recognition System on Aerial Vehicle

Team: Himal Agrawal (agrawalh@purdue.edu), Maria Nieves Brunet (mbruneta@purdue.edu), Joseph Yanos (yanosj@purdue.edu)

At the conclusion of the project, the objective of developing a remotely controlled aerial vehicle to perform facial recognition has been achieved. A remotely controlled quadcopter has been built and is fully functional. The quadcopter features a camera and transmitter that relay live video to a laptop. The video feed can be analyzed in real time, and correctly identifies all three team members using facial recognition.

The first step in the process was to design the quadcopter and select the components. This step was led by Himal Agrawal and all teammates assisted. First a custom frame for the quadcopter was designed using Catia software. After performing background research on quadcopters and the available technology, the motors, flight controller, power distribution board, electronic speed controllers, battery, transmitter, camera and other components were chosen. This required analysis of the total weight of the quadcopter to ensure the thrust provided by the motors would be sufficient. Additionally, the power draw of the motors was considered to ensure the battery could support a long enough flight time.

With all the components selected, the next step was the assembly and testing of the quadcopter. The frame was fabricated from carbon fiber to provide a lightweight and rigid base for the other components. Then all the components were integrated and attached to the frame. The flight controller is a microcontroller that manages the operation of the quadcopter, and it had to be configured correctly. This included calibrating the motors, configuring the transmitter settings, and PID tuning. The communication protocol between the transmitter and quadcopter also had to be selected. Ultimately, I-bus was selected. This is an asynchronous serial protocol, and it provided lower latency in the control of the quadcopter. Extensive troubleshooting was performed to overcome issues with the flight controller board design and component failures. Multiple PID loops are used to control the flight of the quadcopter. The final step in the process was to iteratively test and tune the PID gains to achieve stable and controlled flight of the quadcopter. All team members contributed extensively to this phase in the process.

In parallel to creating the quad copter, the software for facial recognition was developed. The first step was to review the techniques used for facial recognition and the available open sources resources. The openCV library provides extensive tools for implementing facial recognition. Software was written to analyze a live video feed and perform facial recognition. Using a set of still photos, the software was trained to recognize each team member. Maria Nieves Brunet and Himal Agrawal led this work.

Finally, the quadcopter was tested with the camera-transmitter attached to it and relaying the received video to a nearby laptop or raspberry pi. The quadcopter was flown nearby to team members and the software correctly identified them. Due to a lack of time, the range and speed of the quadcopter were not tested but the full functionality was achieved. The most significant improvement would be to change to a higher resolution camera and higher power video transmitter to improve the range and quality of the video stream to improve the facial recognition abilities. Future work could include making the flight of the quadcopter fully or semi-autonomous to make it more suitable for surveillance tasks.