Purdue Undergraduate Research Conference   2019 Purdue Undergraduate Research Conference

Purdue Autonomous Aerial Vehicle (AAV) Vertically Integrated Project Abstract

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Autonomous Aerial Vehicle (AAV)

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ABSTRACT

Our goal in building this drone is to create a drone based on open source software and components, that has an ability to do various autonomous tasks. There is an increasing number of applications that drones are being used for. With facial recognition, drones can be used for security purposes and many other important applications.

Figure 1 (Drone Applications) *mydronelab.com*

For our drone specifically, a Pixhawk controller is used for the flight control and stability. The Pixhawk controls the attitude, and enables the drone to follow pre-mapped routes. A wireless telemetry system is used to get first person view video from the drone, and to display flight information. The drone is flown primarily using the remote control but can also be operated from the mission planner application on a PC. In order to do image processing and object recognition, a Raspberry Pi controller is attached to the drone and serves as a slave computer that communicates to the Pixhawk via MavProxy. The Raspberry Pi runs an algorithm that identifies an object through the camera and tracks this object by keeping the object within a specified pixel range. To keep the drone positioned over the object, the Raspberry Pi sends commands to the Pixhawk controller through a serial port. The Raspberry Pi will be running an openCV library in order to access the necessary software.

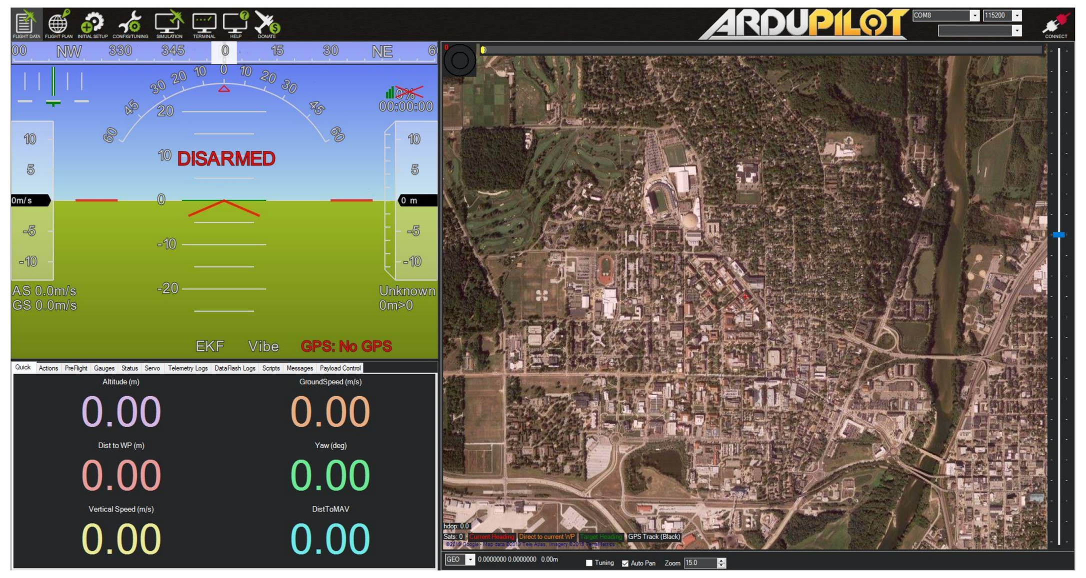

Figure 2 Mission Planner Interface

This technology is becoming very prevalent in our society today in both the private and public sectors. Bringing autonomous abilities to this quadcopter opens up limitless possibilities for the interaction of human and machine and allows further exploration into this realm of technology.

MATERIALS AND METHODS

For the FMU a pixhawk PX4 controller was used. The pixhawk provides has a receiver and GPS that allows the drone to be controlled remotely or flown on a specific flight path. To program and calibrate the pixhawk controller, Mission Planner software was used.

Figure 3 Pixhawk PX4

The Taranis X9-D remote to control the drone when not in mission flying mode.

– Figure 4 Taranis XD-9 Remote

\In the initial testing phase, we tethered the drone to a piece of plywood so that we could test the stability safely without getting more than a few inches off the ground. Once the drone was calibrated, we used the Purdue armory to perform test flights. The drone was programmed to have failsafe modes that would command the drone to return to landing if out of range of remote, or if the battery reached a minimum voltage.

Drone Components:

- Carbon fiber frame
- 1000 kv brushless motors, equipped with 9-inch propellers
- Pixhawk flight controller
- Gps module
- FPV Camera
- Taranis remote
- Raspberry Pi and Raspberry Pi camera for image processing
- Telemetry module for wireless communication via Mission Planner

RESULTS

Ardupilot Mission Planner was used to successfully calibrate the drone settings and connect wireless to computer with the USB receiver.

The drone chassis had an uneven weight distribution, impairing its flight stability. The chassis was improved by shortening the legs of the landing gear, so its weight could be balanced properly.

Flight modes were assigned to have different range of bandwidth by using Ardupilot Mission Planner. Therefore, 6 different values of weight and offset were assigned into the Taranis X9-D remote switches, so it is capable of sending 6 different bandwidth signals which eventually determines the current flight mode. Also, different audio sounds were assigned to each flight modes to prevent from forgetting the current flight mode.

Figure 5 AAV Group Drone

CONCLUSIONS

The pixhawk drone is currently capable of stable flight but needs further testing and development to do facial recognition and autonomous functions. This kind of functionality has many applications as discussed in the introduction. Additional functions of the drone could be developed in the future by mounting a camera with sensors for obstacle avoidance or facial recognition/tracking.

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ACKNOWLEDGEMENTS

We would like to thank our advisor **Professor Samuel Midkiff** and **Professor Charles Bouman** for all the support and guidance they have given us through this project.