

UAV Autonomous Landing

Team Expeditus

Dept. of Computer Science, SDSMT

October 21, 2015

UAV Autonomous Landing Project

Team Expeditus

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Sponsor

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Goal

- receive a set of waypoints
- autonomously take-off
- navigate through waypoints
- return to launch pad
- land on the pad with the correct orientation

Limitations

- landing platform is a fixed position
- landing platform is a stable, horizontal surface
- environment is ideal(no wind, gps available, no obstacles)

Phase Objectives

Phase I

- Build UAV
- Flight Controller Operating Correctly
- Simulation Environment Available

Phase II

- Autonomous landing ready for simulation
- Autonomous landing ready for UAV

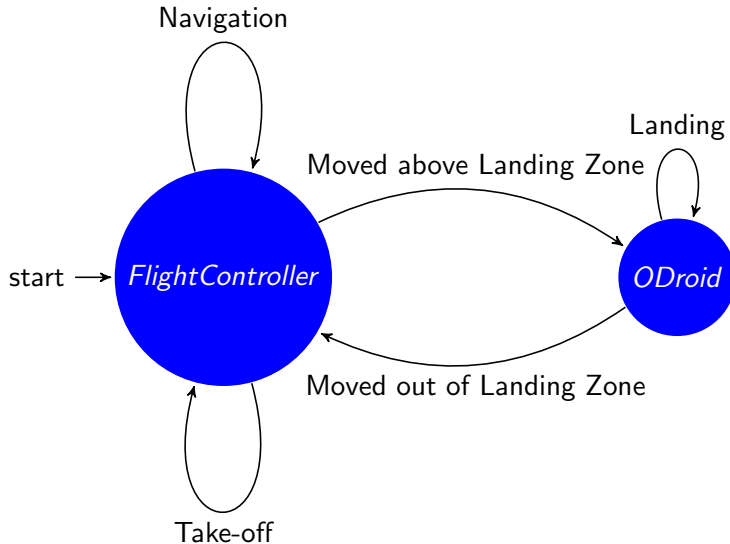
Phase I

- Test manual flight of UAV
- Test of flight controller autonomy on a course

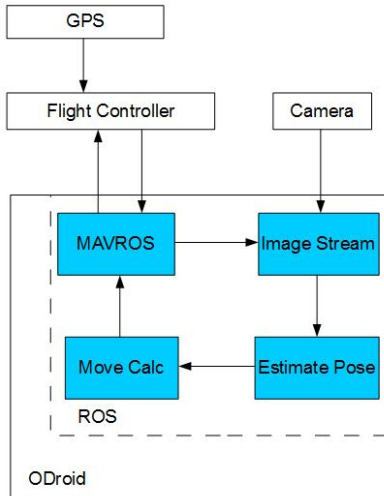
Phase II

- Test of simulated landing
- Test of UAV autonomous landing on landing pad
- Test of UAV task integration

Approach - UAV

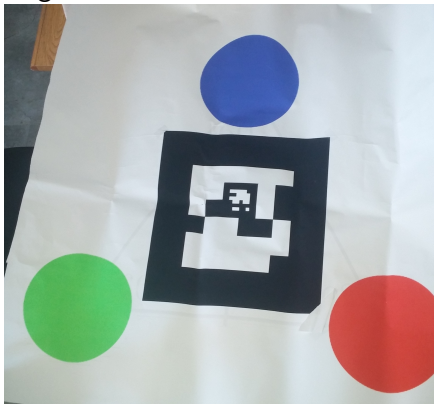


Approach - Software



Approach - Landing Vision

- AR/QR tags for orientation and range.
- Colored blobs or LEDs for orientation.
- Example of AR Tag and colored circles similar



Artificial Neural Network (ANN) Approach:

- Use Flight Controller to reach landing pad waypoint
- Switch to landing mode using ANN
- Land on landing pad or get within some distance to switch to vision

Development OS: Ubuntu 14.04

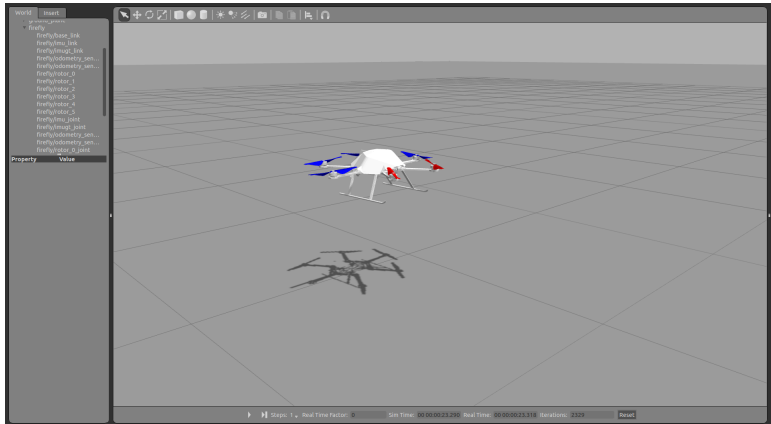
Languages: C++ and Python

Software Tools

- Robot Operating System(ROS)
- Gazebo
- APM Planner

Simulation & Testing:

- Rotors Sim package - Provides Models for Gazebo



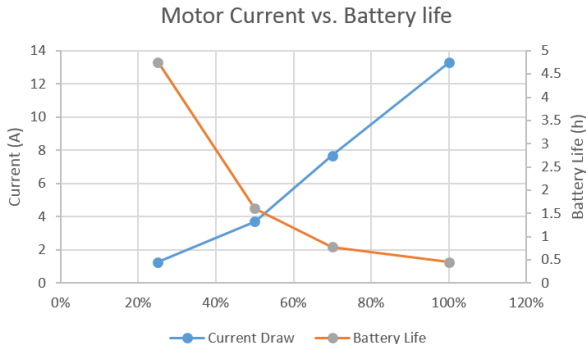
Development - Software Contd.

- MavRos - Communication with Pixhawk through ROS
- Testing - All components will be tested in simulation before being deployed on UAV

[illegible]

Hardware Constraints

- 6000mAh Battery
- Power ODroid + Peripherals
- Power 6x DC Motors



Development - Hardware Continued...

Item	Quantity	Total Weight
DC Motor	6	372g
Frame	1	1300g
Battery	1	680g
Camera	2	140g
ODroid	1	48g
GPS Module	1	17g
Total		2557g

1 Motor at 100% produces 970g of lift

Maximum Lift = 5820g

Motors must run at $2557\text{g} / 5820\text{g} = 44\%$

Computational Constraints

- Images: 976 x 582 pixels at ≥ 5 images/sec
- Processing 1 image thus requires $\sim 570,000$ operations
- ODroid has 8 cores at 1.4 GHz
 - Ideal throughput ~ 10 Billion operations/sec

Cost

Build 1		Build 2	
Item	Cost	Item	Cost
Controller	\$199.99	Controller	\$199.99
ODroid	\$75.95	ODroid	\$75.95
Sensors	\$167.23	Sensors	\$167.23
Frame Kit	\$242.48		
Power Kit	\$119.98		
Radio Set	\$100.00		
Extra Parts	\$95.15		
TOTAL	\$1000.78	TOTAL	\$443.17

General

- Review previous iteration documentation & code
- Begin pilot training for manual control
- Review Landing Pad model with Landing Pad teams

Setup Development Environment

- Ubuntu 14.04
- Gazebo/Rviz
- ROS - Jade Distro

Inspect Current Quadrotor

- Identify missing or non-functioning components
- Generate order list

Risk

- Reliance on Flight Controller
- Dependency on external team for Landing Pad
- No UAV Backup

Setbacks

- Non-functional components
- Little carry-over from previous year

Team Expeditus

- has adapted focus of tasks based on conditions
- is making progress on those tasks
- is on track to complete Phase I goals



Questions?