UAV Autonomous Landing

Team Expeditus

Dept. of Computer Science, SDSMT

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Team

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Sponsor
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Goal
Software to autonomously take-off, navigate to set waypoints, return to launch pad, and land

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

Testing

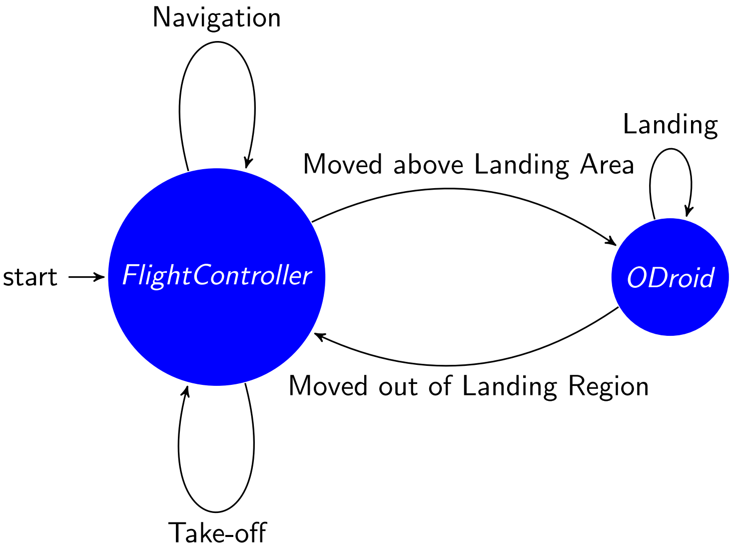
Phase I

- Manual Flight of UAV
- Autonomous Flight of UAV

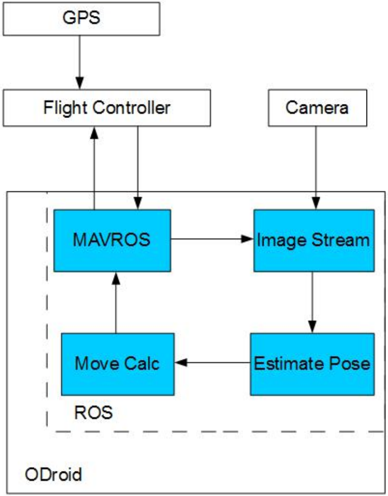
Phase II

- Autonomous Landing in Simulation
- Autonomous Landing of UAV
- Autonomous Take-off, Navigation, and Landing of UAV

Approach - UAV



Approach - Software



Approach - Landing Vision

Put some stuff here about the landing vision approach, maybe a picture or two

Approach - Landing AI

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 - Software

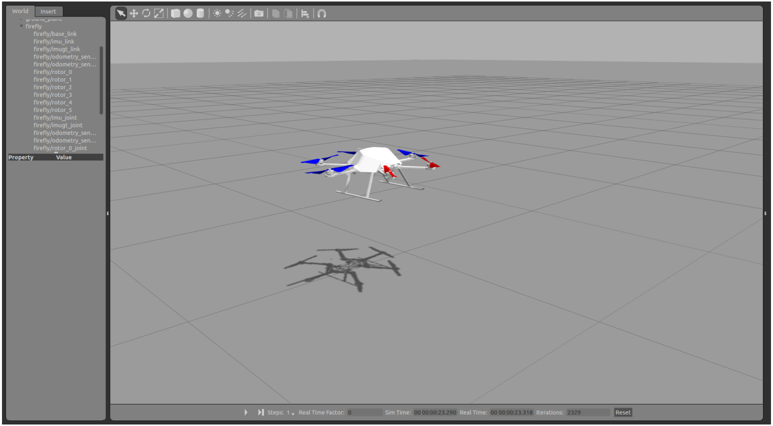
Development OS: Ubuntu 14.04
Language: C++

Software Tools

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

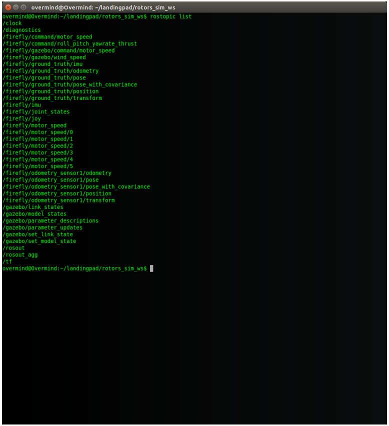
Simulation & Testing:

- Rotors Sim package - Provides Models for Gazebo



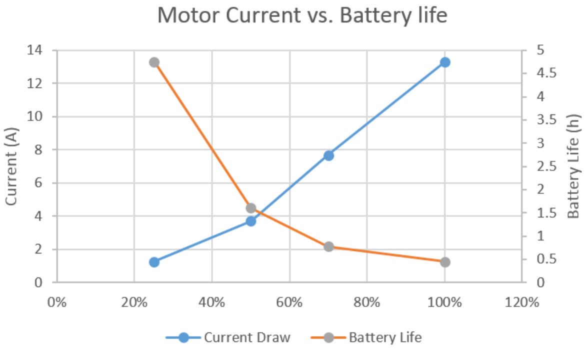
Development - Software Contd.

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



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 2557g / 5820g = 44%

Development - Hardware Continued...

Computational Constraints

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

Work Accomplished

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

Setbacks/Risk

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

Conclusion

Conclusion-y stuff here

Questions?