EE4001: Final Year Project Continuous Assessment 1

Universal Control Methodology Design and Implementation for Unmanned Vehicles

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24th September 2009

Outlines

- Introduction
  - Goal of the Project
  - Roadmap
- Literature Review
- Evaluation of Materials
  - Platform Choosing
  - Why Co-axial Helicopter
- Actual Work Done
  - Selection of Components
  - Testing of Components
  - Integration of Components
- Summary

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Goal of the Project

- This project aims to develop a universal control methodology which can be universally applied to unmanned vehicles.
  - Design of controller
  - Overall integration
- Win the Singapore Amazing Flying Machine Competition

Roadmap

Semester	Week	Team's Target	My Target
1	1~4	Research + Components' Selection	Research + Selection
	5~6	Components' Testing	Testing + Programming
	7~10	Components' Integration	Integration with IMU/Sensor
	11~13	Model Design + Full Integration	Integration with Vision System
Vacation		Model Construction	Identify Mathematical Model
2	1~8	Flight Tests	Design Control Algorithms
	9	SAFMC	SAFMC
	10~11	Thesis	Thesis
	12~13	Final Presentation of FYP	Final Presentation of FYP

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Literature Review

- Controller Methodology
  - Revised a few NUS control modules:
    - EE2010 – Control
    - EE3304 – Digital Control System
    - EE4302 – Advance Control System
    - EE3302 – Industrial Control System
    - ME4245 – Robotic Control
  - Online research of project related topic, such as Kalman Filter, Extended Kalman Filter, etc.
  - Detailed study of Wang Tao's FYP thesis.
  - Detailed study of Dr Cai's PhD thesis.
  - Read and understand MircoGear's codes.

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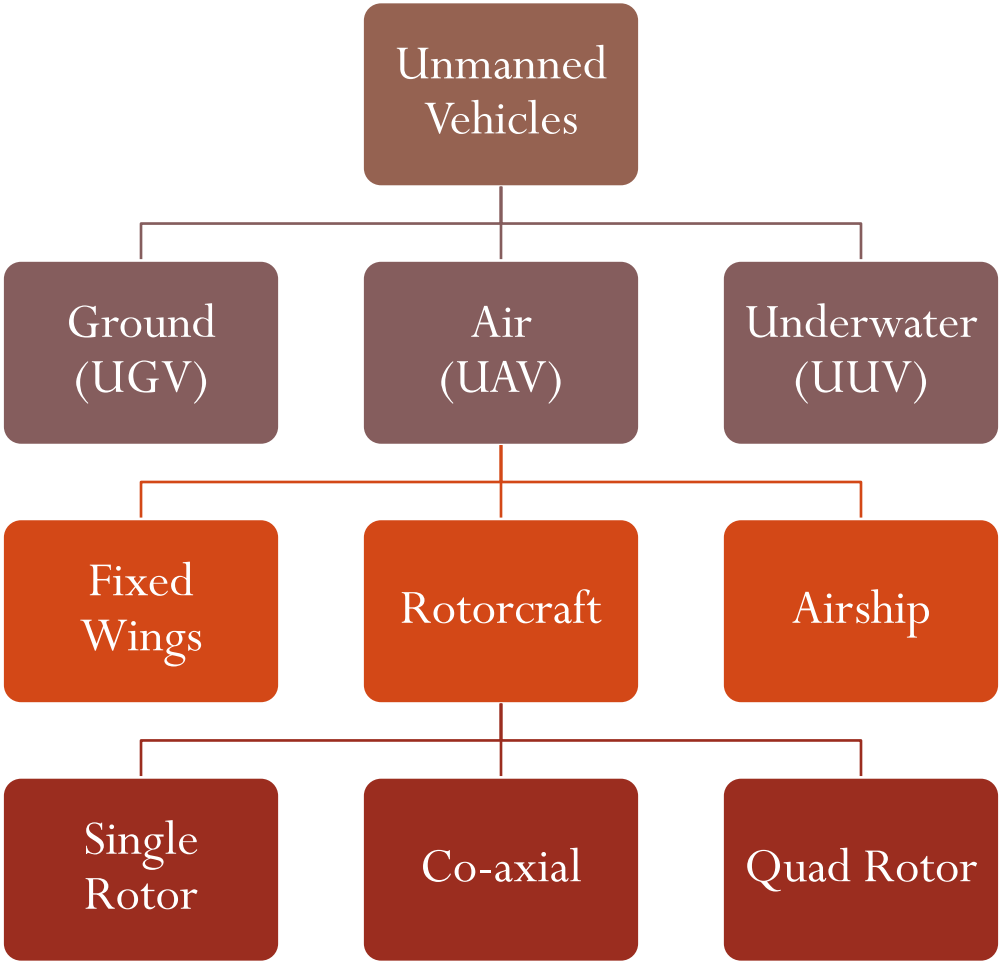
Platform Choosing



Why Co-axial Helicopter

- Generally smaller in size
- Resistant to pitch or roll tilts

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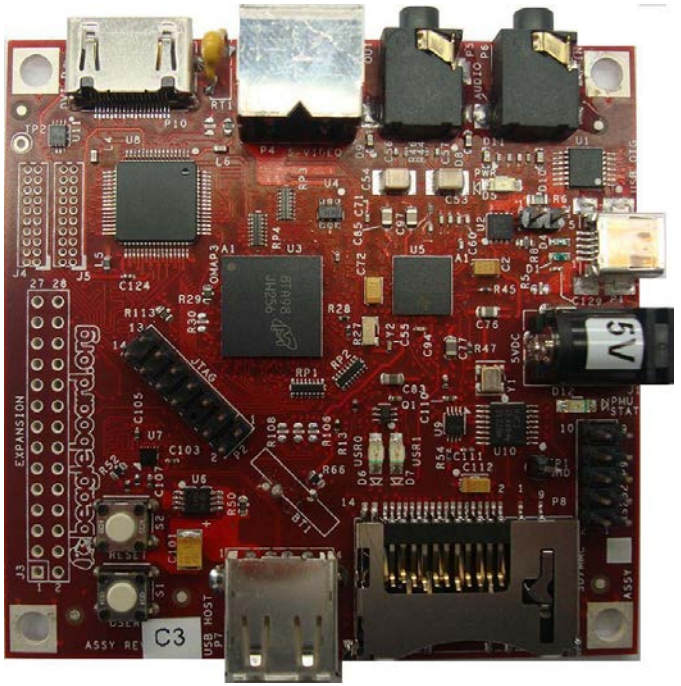
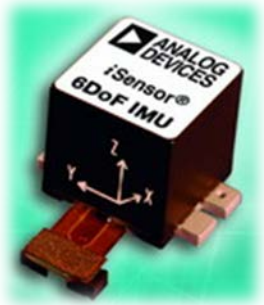
Selection of Components

- Central Processing Unit
  - BeagleBoard
    - OMAP3530 processor
    - Industry's highest performance ARM (600MHz)
    - 3 Serial Ports
    - I2S, SPI, MMC/SD
    - Small: 3" x 3"



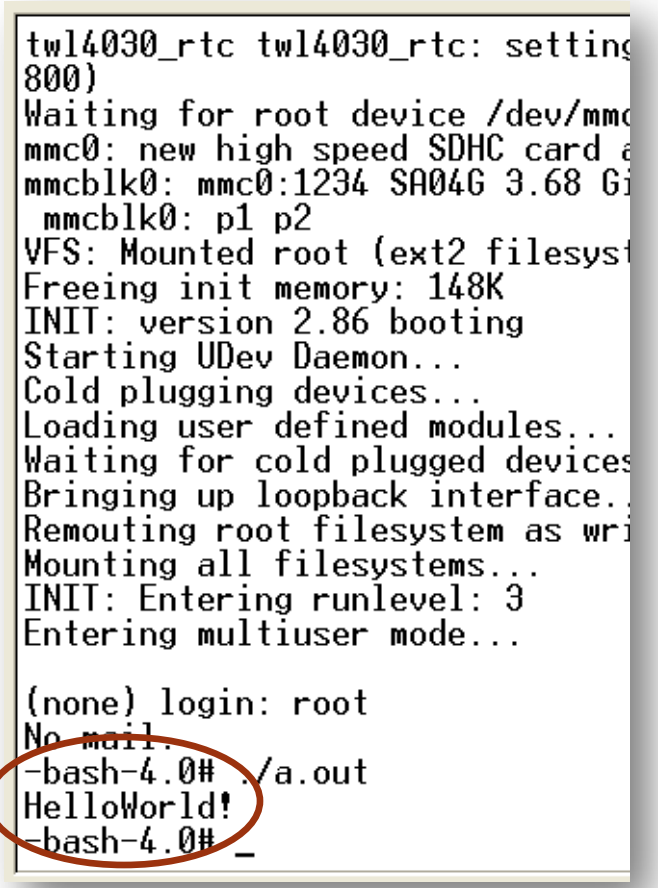
Selection of Components

- Inertial measurement unit:
  - ADIS16405
- GPS:
  - U-blox: LEA-5H
- Wireless modem:
  - Xbee pro 868 MHz
- Ultrasonic sonar:
  - SRF08 sonar sensor
- Servo controller:
  - Pololu servo controller



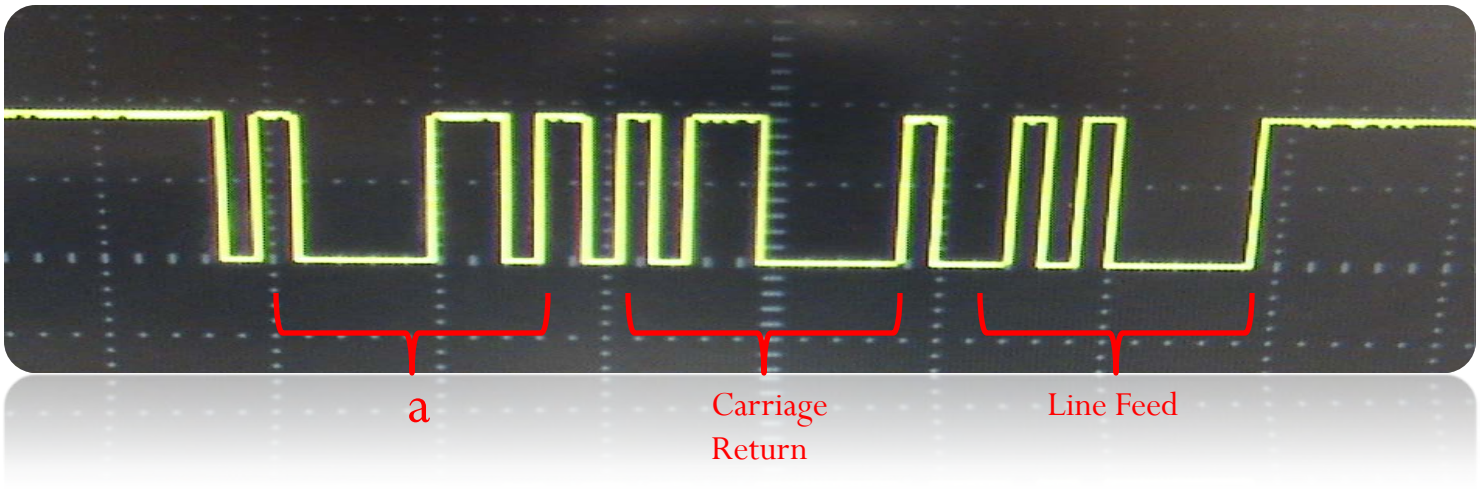
Testing of Components

- Installed 2 different systems on BeagleBoard
  - Angstrom Distribution
  - ACELFS
- Tested with simple C/C++ programs
  - HelloWorld
  - MicroGear
- Tested with 2 different way to compile
  - Compile in Linux
  - Compile in BeagleBoard



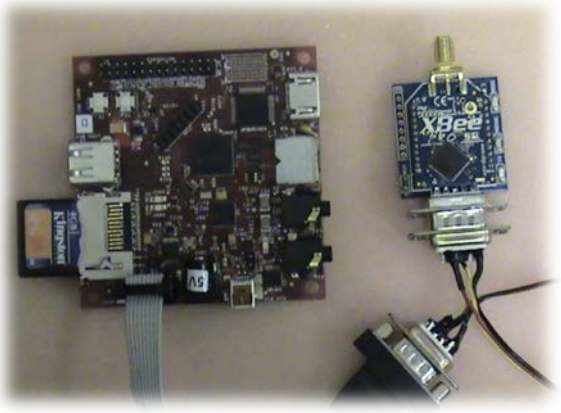
Testing of Components

- Identified first Serial Port
  - Connecting it via a Null Modem Cable to a computer and access it using a terminal program.
- Setup second Serial Port
  - Write simple program output to Serial Port 2 and observe the output with an Oscilloscope.



Integration of Components

- BeagleBoard – Xbee Pro Modem
  - Connect Modems to Serial Port 1 of BeagleBoard and USB Port of computer.
  - Verify the connection via a terminal program.



- BeagleBoard – MNAV100 (IMU)
  - Connect MNAV100 to Serial Port 2 of BeagleBoard
  - Still in process…

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Thank You