

Testing Autonomous Hover Algorithms using a Quad Rotor

In conjunction with the Distributed [Multi-Vehicle] Space System Lab



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The Customer:

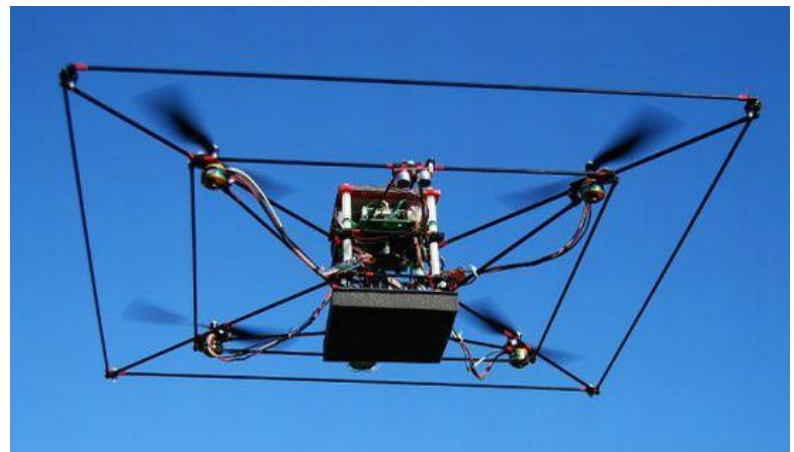
Distributed Space Systems Lab

The Customer: Professor Mesbahi heads up the Distributed Space Systems Lab which focuses on numerous areas of controls in engineering such as: guidance, navigation and control of both single and multi-platform aerial (and space) systems. The Lab has one Quad Rotor that has only flown under direct remote control.

The Goal: To autonomously fly a Quad Rotor helicopter to a specified waypoint in 3D space using both an onboard IMU and the overhead Vicon positioning system. Later goals include replacing the Vicon system with onboard GPS and ultrasonic range finder for outdoor flights.



Professor Mesbahi



A modified Dragonfly Quad Rotor

Performance Criteria

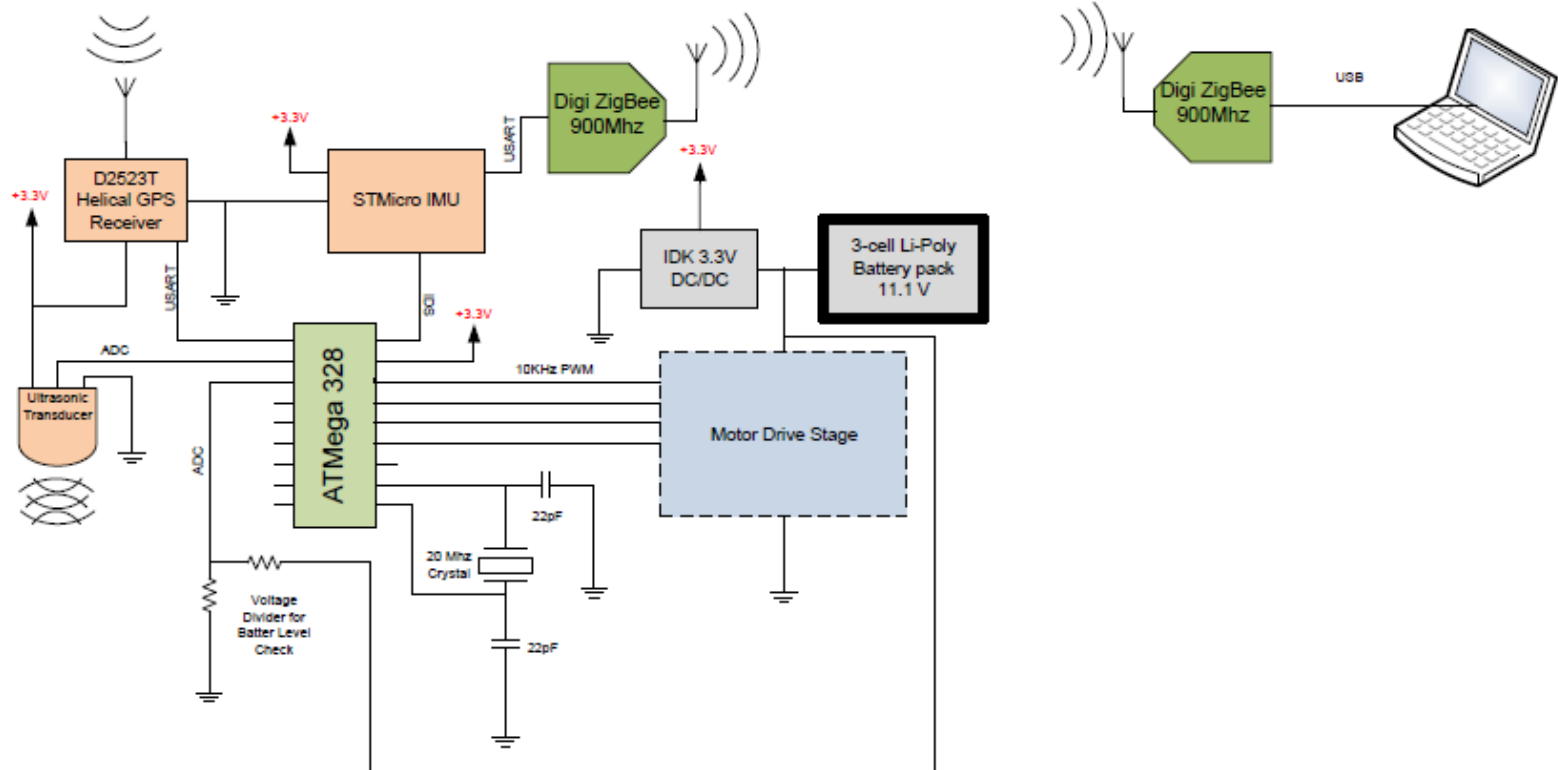
The physical system when flying should encounter constraints such as battery duration, range of wireless communication, max takeoff weight, wind conditions, position tolerance, etc...

We are also looking into component lag times and how they effect our system design.

However, no 'performance' requirements were set other than precision hover autonomously at a specified location in 3D space.

Systems & Plant Identification

The use of Gumstix for internal control has been used, however, we found that it would be easier to develop our own integrated circuit using an IMU.



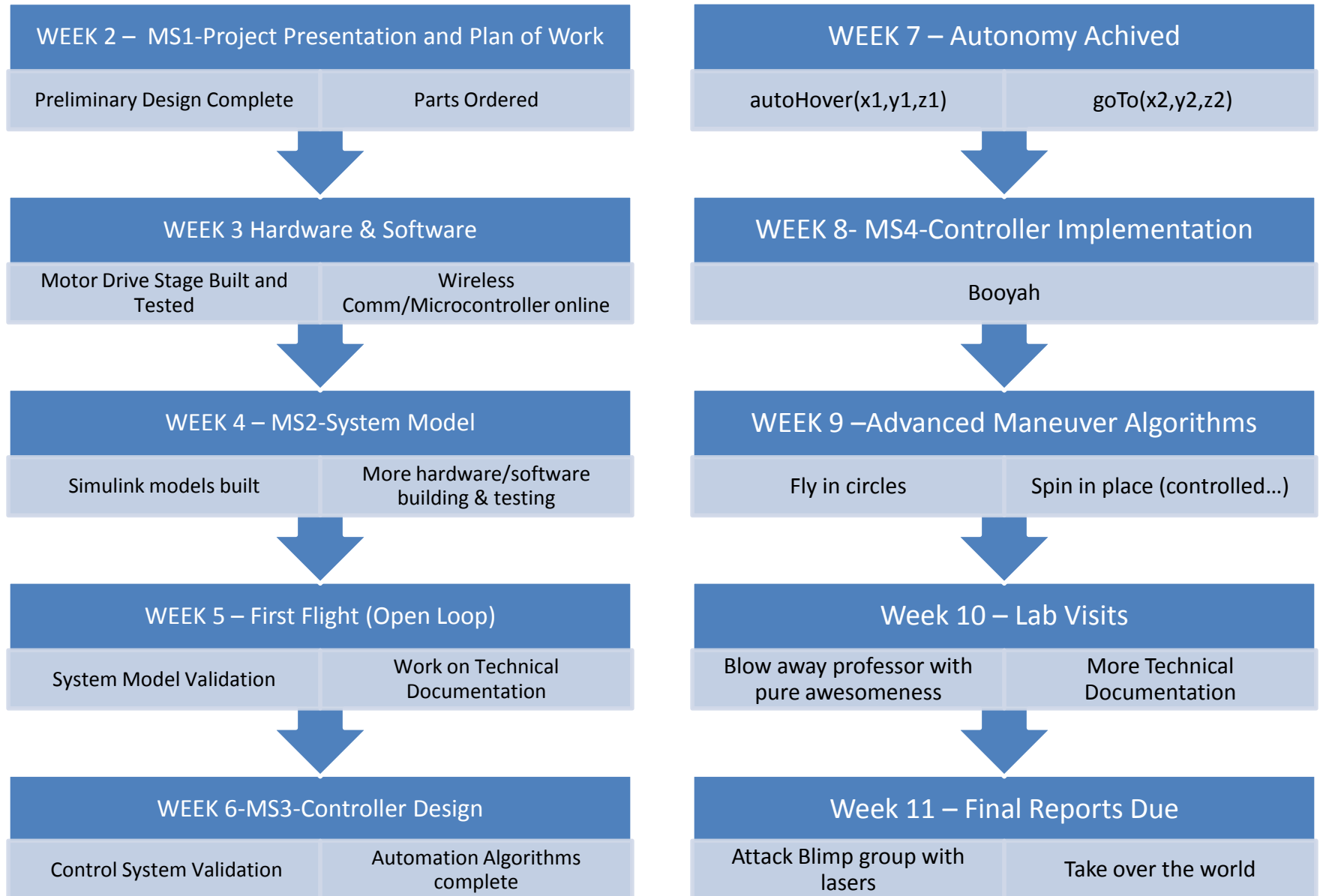
Cost: 2 Quad-rotor Systems

Draganflyer Airframe	DF-COMPLETE-AIRFRAME	rctoys.com	\$119.95	1	\$119.95
Draganflyer Frame Bracing	DF-FRAMEBRACING	rctoys.com	\$14.95	2	\$29.90
2100mAh 11.1v LiPo	TP-2100-3SPL2	rctoys.com	\$47.99	2	\$95.98
Deans Battery Connector Pair	DE-ULTRA	rctoys.com	\$3.55	2	\$7.10
900MHz Dipole Antenna	WRL-09143	Sparkfun	\$7.95	4	\$31.80
Digi XBee Pro 900	WRL-08768	Sparkfun	\$44.95	4	\$179.80
XBee Explorer USB	WRL-08687	Sparkfun	\$24.95	2	\$49.90
Ultrasonic Range Finder	SEN-08502	Sparkfun	\$27.95	1	\$27.95
GPS Reciever	GPS-09566	Sparkfun	\$79.95	1	\$79.95
GPS Interface Cable	GPS-09123	Sparkfun	\$2.95	1	\$2.95
Atmel ATmega328P	COM-09061	Sparkfun	\$4.30	2	\$8.60
STMicro iNEMO IMU	497-10048-ND	Digikey	\$250.00	1	\$250.00
3W 3.3v DC-DC Regulator	445-2474-ND	Digikey	\$11.37	2	\$22.74
20.000 MHz Crystal	300-8507-ND	Digikey	\$0.63	2	\$1.26
22pF Ceramic Cap	BC1005CT-ND	Digikey	\$0.08	10	\$0.76
6-pin header	609-3218-ND	Digikey	\$0.37	2	\$0.74
Optoisolator	160-1370-5-ND	Digikey	\$0.75	10	\$7.50
PTC Fuse	F3189-ND	Digikey	\$0.84	4	\$3.36
Motor Drive Stage	Many Parts	EE Store	\$10.00	2	\$20.00

Total

\$940.24

Project Plans



Thank you

