Mobile Quad-Copter Carrier

and

Recon Station

Senior Design 1 Fall 2013

Group 7

Brandon Frazer

Ryan Borden

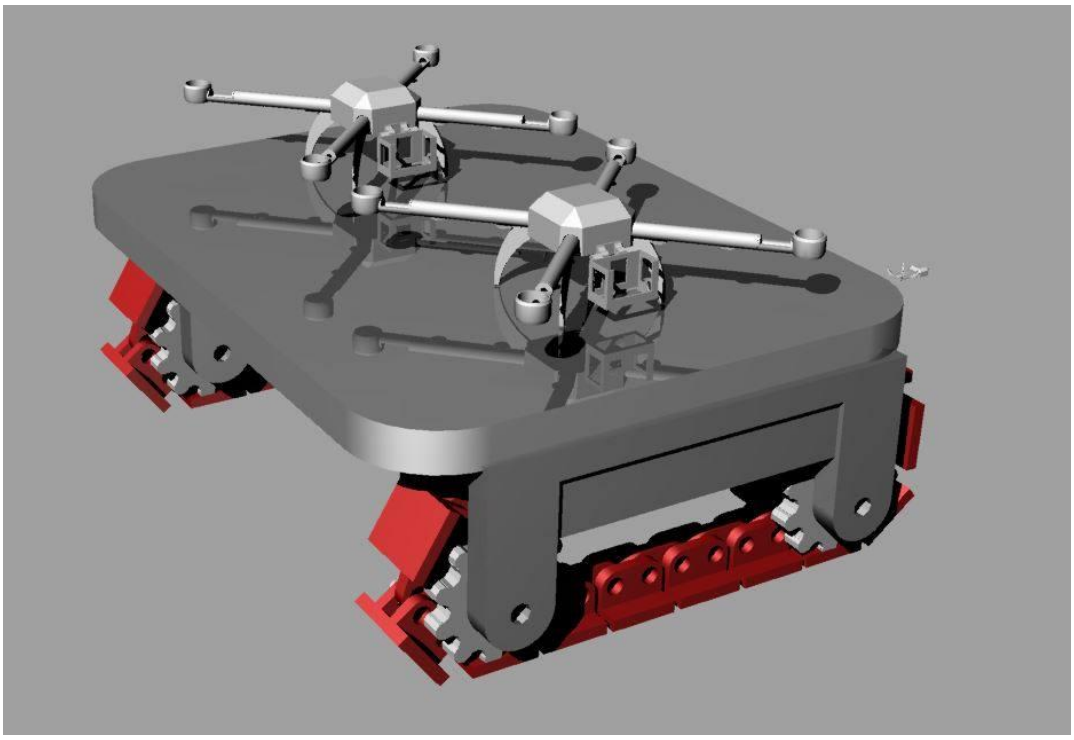
Joseph Howard

Raymond Lueg

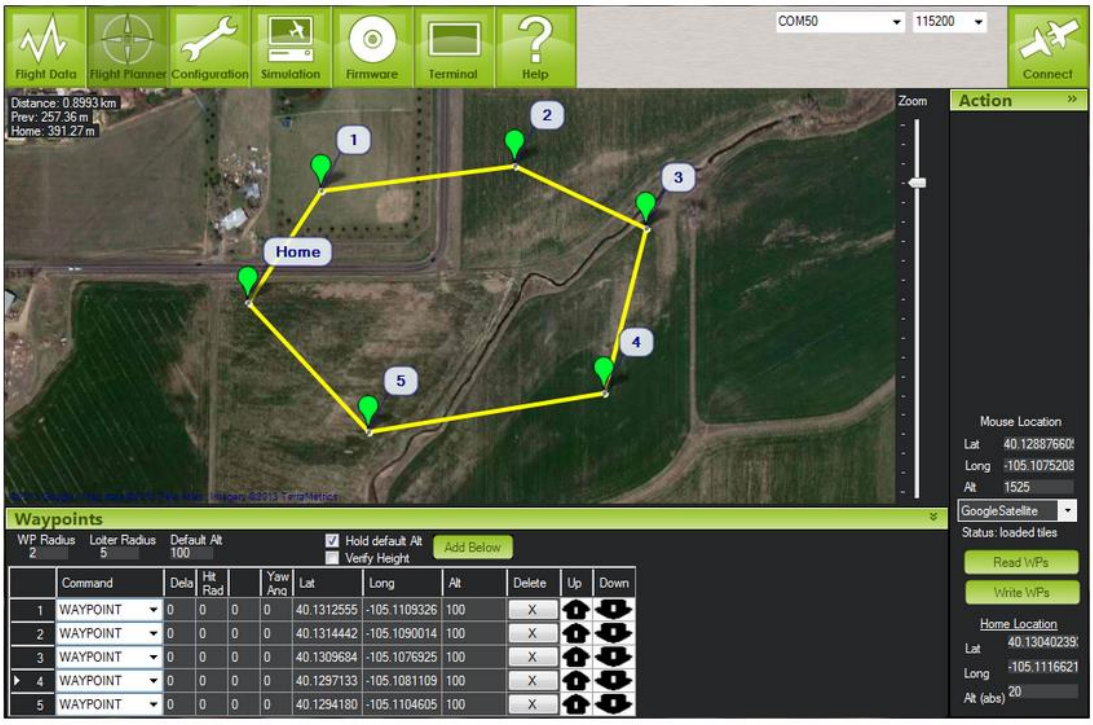
Contributors

- Duke Energy
- Matthew Harrison
- Monica Bertram
- Theta Tau Professional Engineering Fraternity
- Family Members

Prototype Drawings



CAD Drawing for the Quad-Copters and Mobile Landing Platform



Quad-Copter Interface we will be modeling our UI after

Motivation and Goals

The motivation for this project began before the group for senior design had formed. Two of the group members wanted to build a flying air vehicle (FAV) and were leaning towards possibly building quad-copter or quad-copter variant. Another group member wanted to build a ground vehicle because he had previously built a prototype remote control rover for generating interest in engineering with high school students. When the group was discussing the many different ideas for this project, several themes seemed to appear in most of the different ideas. Wireless communication, real-time navigation, a graphical user interface (GUI), obstacle detection, and sustainability were the themes that kept coming up in our discussions.

A quad-copter coupled with a mobile landing platform with navigation, a GUI, and solar powered charging abilities appeared to be the perfect solution. The group also wanted to design something that would be fun, have potential real-world applications, and they wanted something that would be challenging. All four of the group members are electrical engineering majors and have held positions directly relating to engineering with companies such as General Electric, Lockheed Martin, Mitsubishi Power Systems, and OptiGrate. The group also has two 3D printers at their disposal personally owned by two of the group members.

The group believed that with their skills and knowledge, they could build a project that consisted of two quad-copters that could wirelessly communicate with a mobile landing platform with sustainable charging features.

The goals for the final product are to design and build two quad-copters capable of carrying a water balloon each and a guidance system that accurate enough to land on a small platform. The quad-copters will be able to collect and relay telemetry and visual data to an all-terrain landing and charging ground vehicle. The quad-copters and ground vehicle will be able to navigate, negotiate landings, judge remaining flight time, and recharge using a solar array. Range from the base station will be beyond visual contact. There will also be a graphical user interface (GUI) that will be a computer-based system, monitoring the quad-copters and the mobile platform. User(s) will be controlling the mobile platform and the quad-copters. The GUI will also be used to view all of the telemetry and visual data in real-time through wireless communication with the ground vehicle. This will also be where the guidance system lines up the quad-copters for landing by informing the user that they are positioned correctly for landing into the charging ports.

Specifications and Requirements

This project has two components, a quad copter and a mobile platform. The specifications of our project include:

Quad Copter:

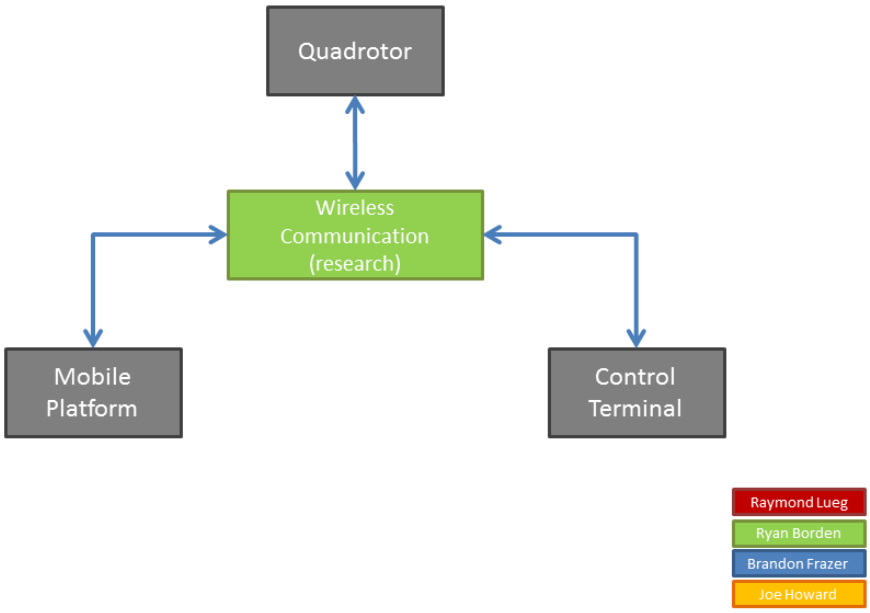
- Cary a payload of under 5 lbs
- Ability to collect data on range, altitude, weather, and temperature
- Wireless communication between the quad copter and the mobile platform at a maximum distance of 1 mile.
- Real time location that is accurate up to 1 foot.
- Automated landing guidance on to the mobile platform that is accurate up to a few inches.

Mobile Platform:

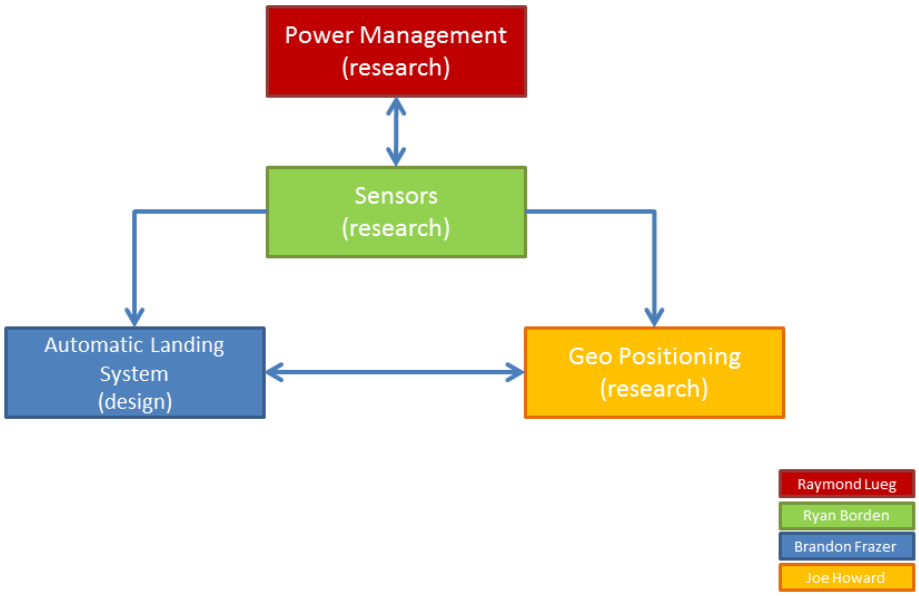
- Ability to charge the quad copter to extend mission range of quad copter.
- Real time location between the quad copter and the mobile base up to 1 foot of accuracy
- Have a user interface to display the information and location from the quad copter
- Automated landing guidance system to allow the quad copter to charge itself
- A turret defense system on the mobile base to protect the quad copter during charging
- Ability to navigate through tough terrain

Block Diagrams

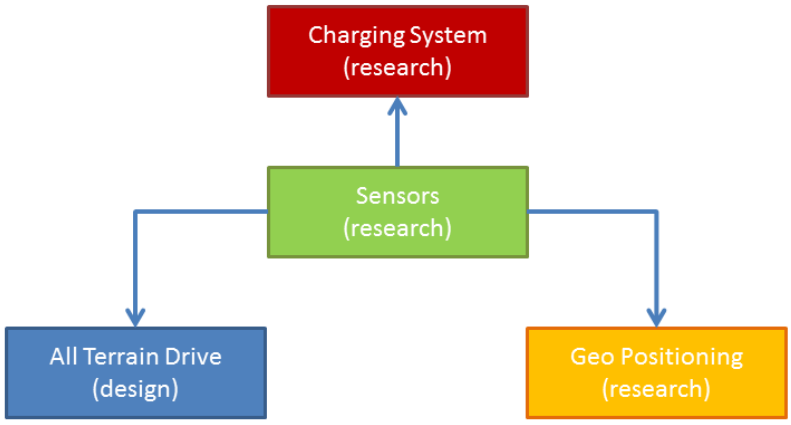
Overall Project Block Diagram



Quadrotor Block Diagram

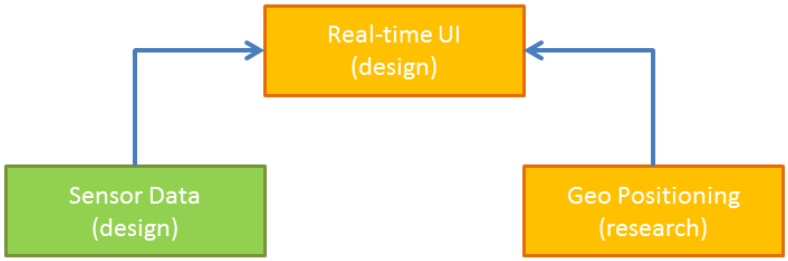


Mobile Platform Block Diagram



Raymond Lueg
Ryan Borden
Brandon Frazer
Joe Howard

Control Terminal Block Diagram



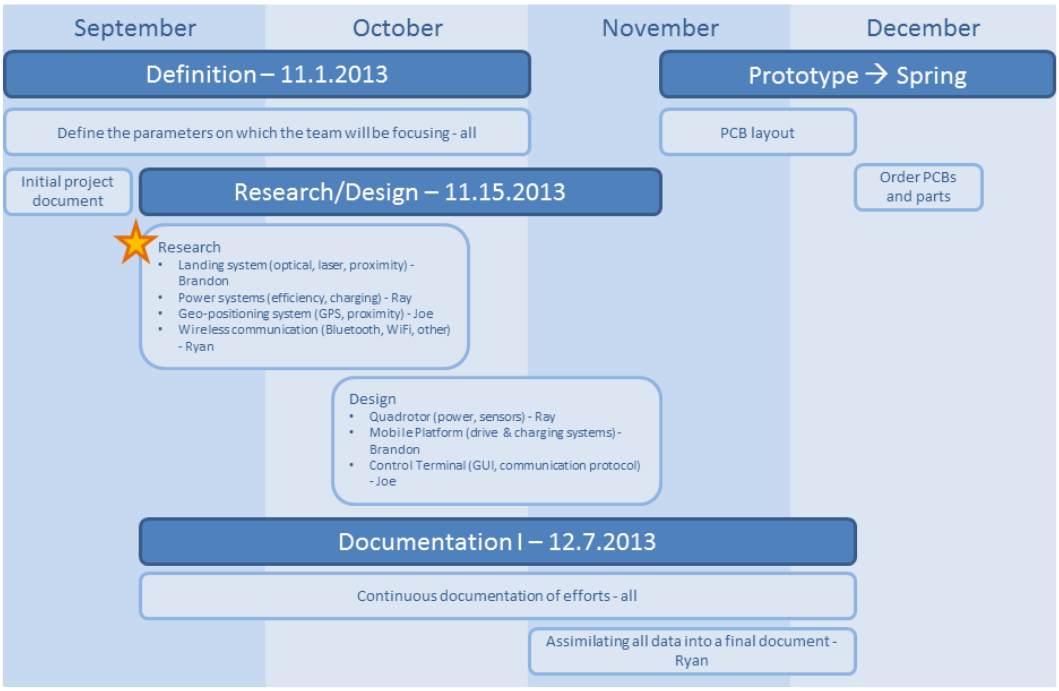
Raymond Lueg
Ryan Borden
Brandon Frazer
Joe Howard

Budget

Project Section	Cost PU	Amount	Total Cost	Acquired	TBA	Total TBA
Quadcopters (x2)						
Rotary Motors	$ 10.53	8	$ 84.24	0	8	$ 84.24
Speed Controller	$ 8.20	8	$ 65.60	0	8	$ 65.60
Flight Controller PCB	$ 29.99	1	$ 29.99	0	1	$ 29.99
Propellers	$ 3.49	10	$ 34.90	0	10	$ 34.90
Wireless Reciever	$ 10.06	2	$ 20.12	0	2	$ 20.12
Servo Connector Wires	$ 1.42	8	$ 11.36	0	8	$ 11.36
Futaba Servo Terminals (10/set)	$ 2.25	4	$ 9.00	0	4	$ 9.00
LIPO Battery Pack	$ 5.65	4	$ 22.60	0	4	$ 22.60
Turnigy Silicone Wire /meter	$ 0.60	10	$ 6.00	0	10	$ 6.00
Altimeter	$ 14.95	2	$ 29.90	1	1	$ 14.95
Self Tapping Secrews (100)	$ 1.95	1	$ 1.95	0	1	$ 1.95
Magnetometer	$ 17.99	2	$ 35.98	0	2	$ 35.98
Quad Copter Development Total:			***$ 351.64***	***TBA Total:***		***$ 336.69***
Mobile Platform						
Planetary Geared Motors	$ 36.95	4	$ 147.80	4	0	$ -
Motor Hub Mounts	$ 7.65	4	$ 30.60	2	2	$ 15.30
Motor Mounts	$ 7.95	4	$ 31.80	2	2	$ 15.90
Vex Tank Tread Kit	$ 29.95	2	$ 59.90	1	1	$ 29.95
Laser Diode (x30)	$ 10.00	8	$ 80.00	0	8	$ 80.00
Plexi for Platform (24"x24")	$ 23.99	1	$ 23.99	0	1	$ 23.99
2800 mAH 12V NiMh battery	$ 39.99	1	$ 39.99	1	0	$ -
Vex Angle Brackets(for motors)	$ 17.99	1	$ 17.99	0	1	$ 17.99
GPS Bee	$ 31.50	3	$ 94.50	0	3	$ 94.50
Xbee Pro (2.4 GHz)	$ 29.00	4	$ 116.00	0	4	$ 116.00
Nerf Rocket Launcher	$ 29.99	1	$ 29.99	0	1	$ 29.99
4-Wheel Drive Motor Controller	$ 24.95	1	$ 24.95	0	1	$ 24.95
Servo for locking landing System	$ 31.49	1	$ 31.49	1	0	$ -
Range Finder	$ 29.95	2	$ 59.90	1	1	$ 29.95
SD Reader	$ 6.95	3	$ 20.85	0	3	$ 20.85
LCD	$ 14.95	1	$ 14.95	0	1	$ 14.95
Mobile Platform Development Total:			***$ 824.70***		***TBA Total:***	***$ 514.32***
Additonal Development Tools						
Breadboards	$ 8.00	4	$ 32.00	4	0	$ -
Chipkit32 Uno MCU Dev Kit	$ 84.85	1	$ 84.85	1	0	$ -
ABS Filament for 3d Printer	$ 30.00	2	$ 60.00	2	0	$ -
Additonal Parts(screws, wires, etc)	$ 150.00	1	$ 150.00	0	1	$ 150.00
PCB Manufacturing	$ 175.00	1	$ 175.00	0	1	$ 175.00
PCB Components	$ 150.00	1	$ 150.00	0	1	$ 150.00
Bedini Motor Deveopment	$ 200.00	1	$ 200.00	0	1	$ 200.00
Soldering Iron	$ 83.99	1	$ 83.99	1	0	$ -
Solder	$ 6.22	2	$ 12.44	1	1	$ 6.22
Solder Paste	$ 10.45	2	$ 20.90	0	2	$ 20.90
Solder Sucker	$ 5.99	1	$ 5.99	0	1	$ 5.99
Solder Wick	$ 5.00	2	$ 10.00	1	1	$ 5.00
Development Tools Total:			***$ 985.17***		***TBA Total:***	***$ 713.11***
Total Project Cost:	***$ 2,161.51***			***Total Cost TBA***		***$ 1,564.12***
Projected Outside Funding	Friends/Family		$ 750.00			
	Duke Energy		$ 500.00			
	Total Funding		***$ 1,250.00***			
	Out-Of-Pocket Costs		***$ 314.12***			

Milestones

Milestones for Senior Design I



Milestones for Senior Design II