Ballistic Parachute Recovery System for Unmanned Aerial Vehicles

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1 ### *Objectives and Goals*

- Design a recovery system intended for implementation on Unnamed Aerial Vehicles (UAVs)
- Safely recover a UAV in potentially unsuitable conditions for proper flight

2 ### *Study Overview*

- Design constructed to help meet current Federal Aviation Administration regulations
- Arduino Microcontroller utilized to operate sensors monitoring values of interest

**3** ### *Monitored Components*

Remaining "fuel"

- Connect voltmeter to main battery source of UAV to determine sufficient power for motor control
- The voltage sensor is used to ensure problem power to voltage dependent motors

Acceleration

- Read accelerometer values from independent recovery system to determine if UAV is in a safe flying state
- Free fall of a UAV system would constitute as an unsafe flying state

Remain within airspace

- An external GPS module is connected to the recovery system of which maps a given size airspace for flight
- Variable sized airspaces can be programmed
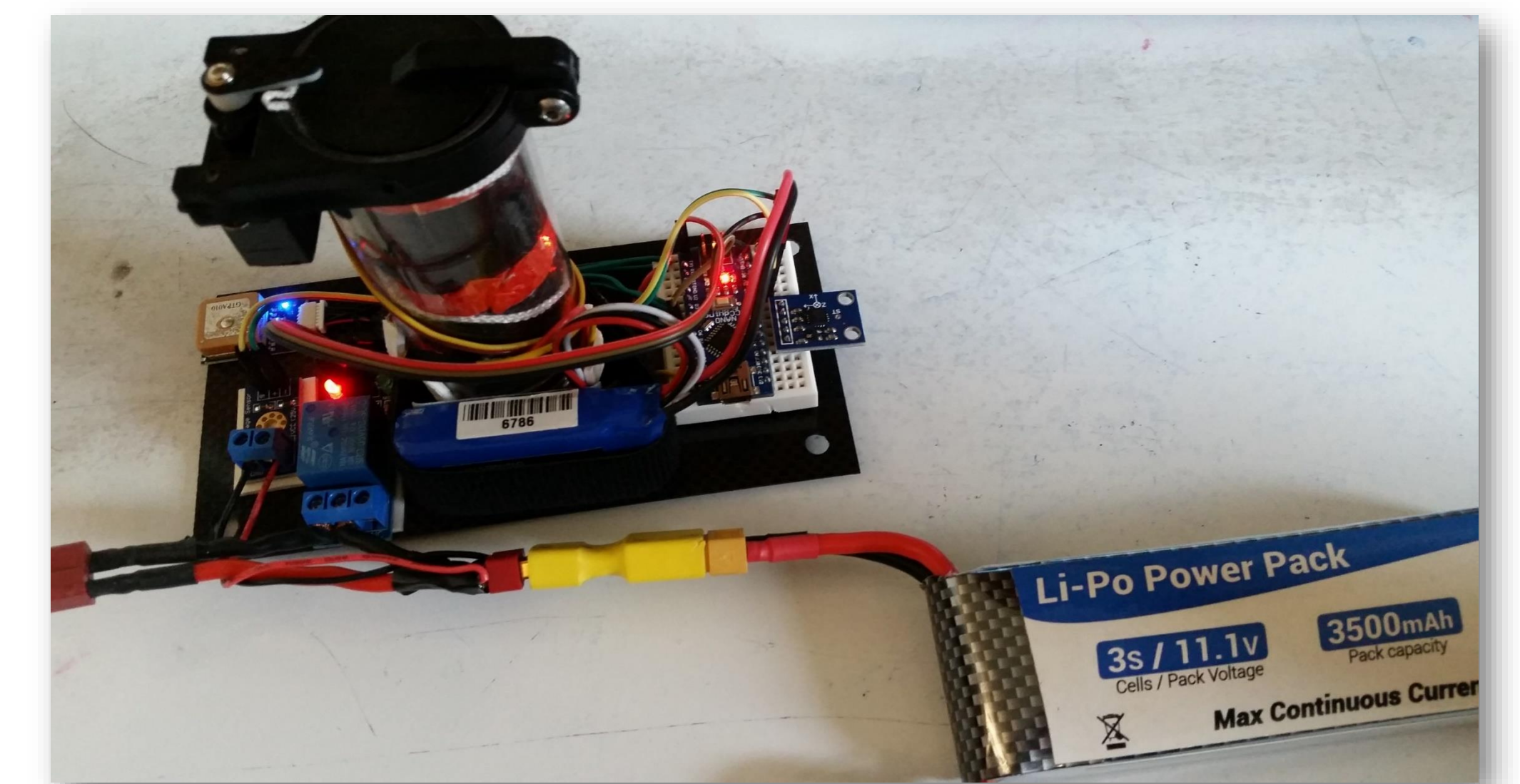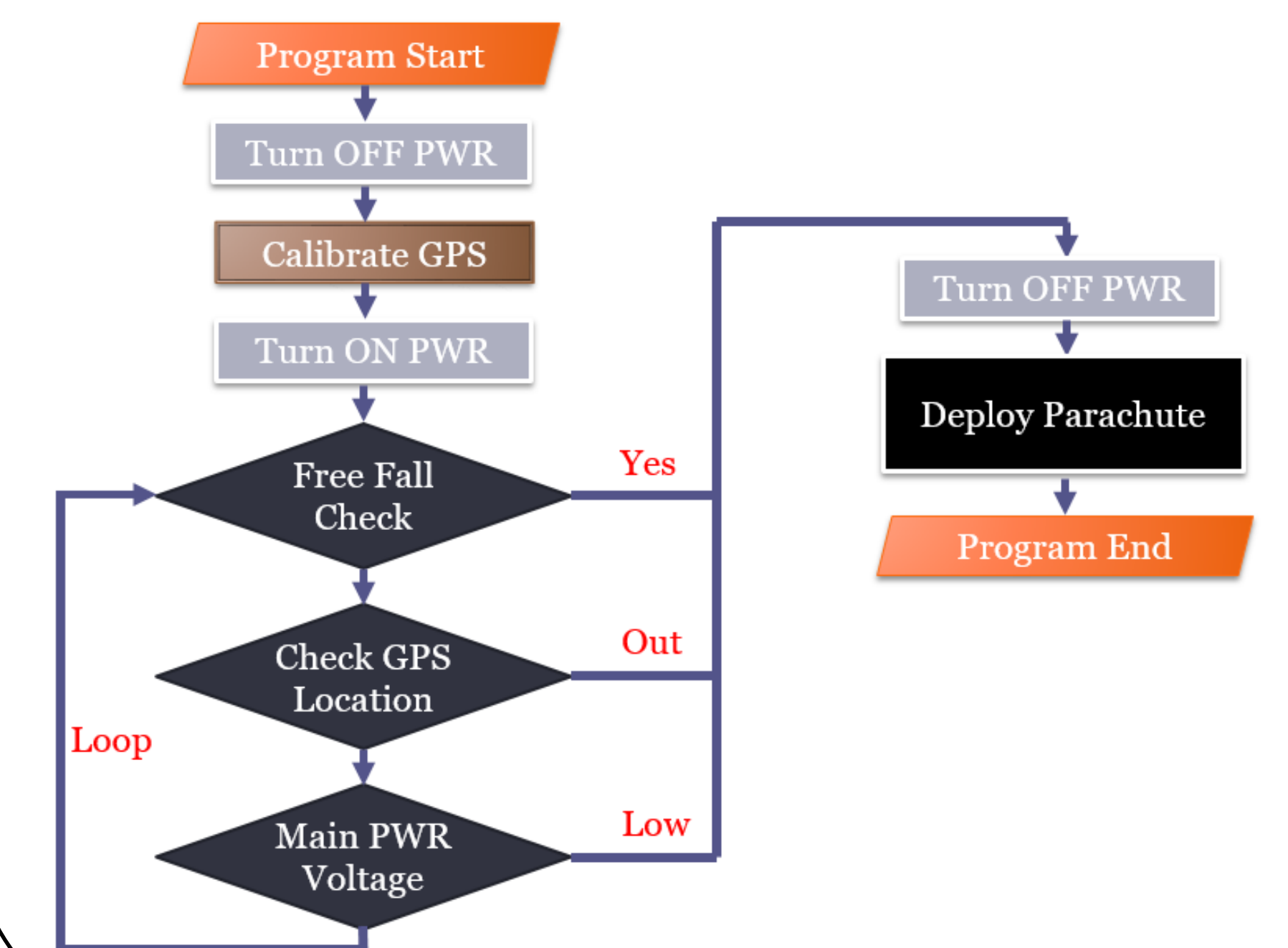- Aids in FAA regulation regarding "Line of Sight" requirement

Hardware Configuration

Main Battery Power | **Recovery System Power**
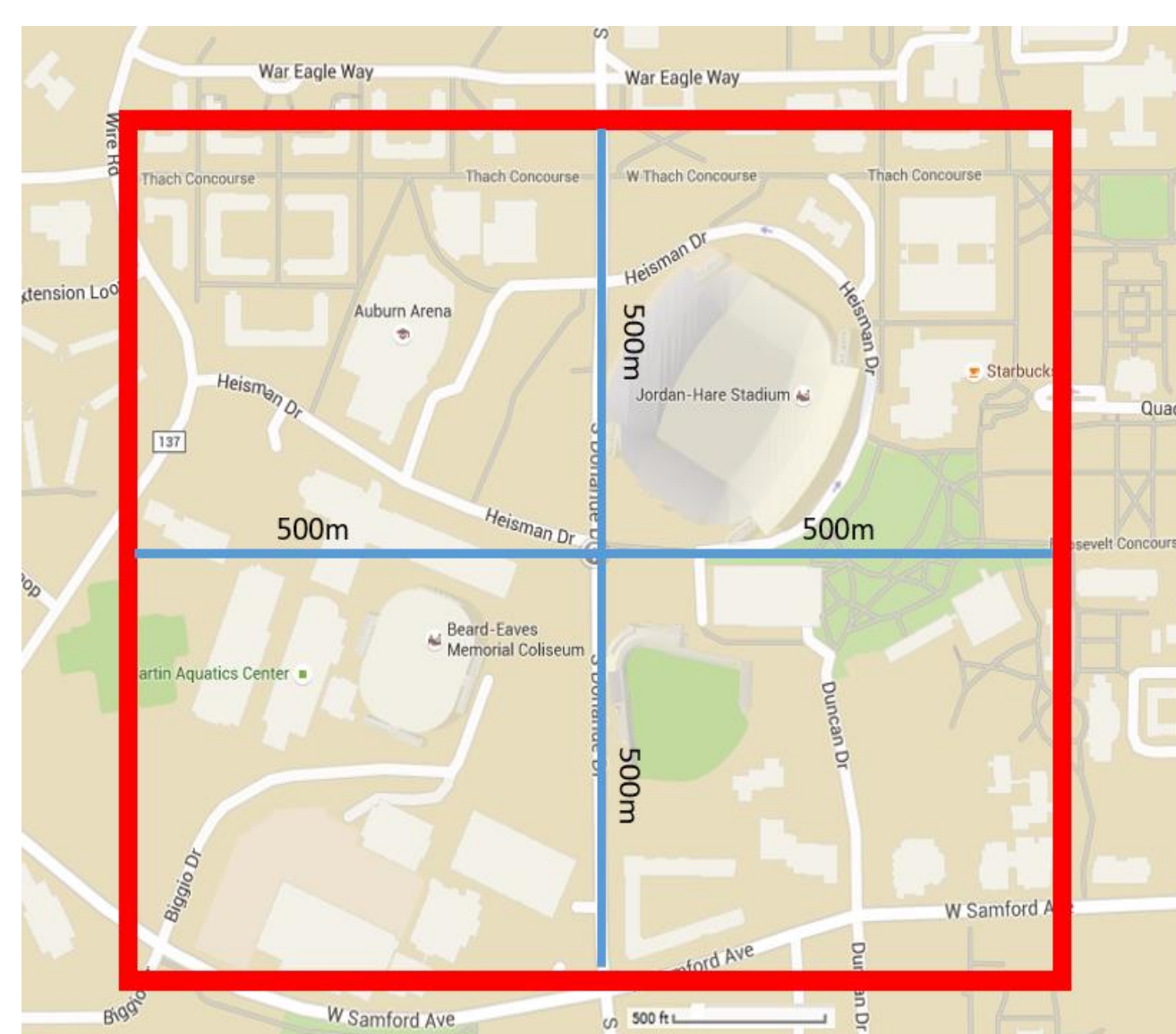
Software Configuration
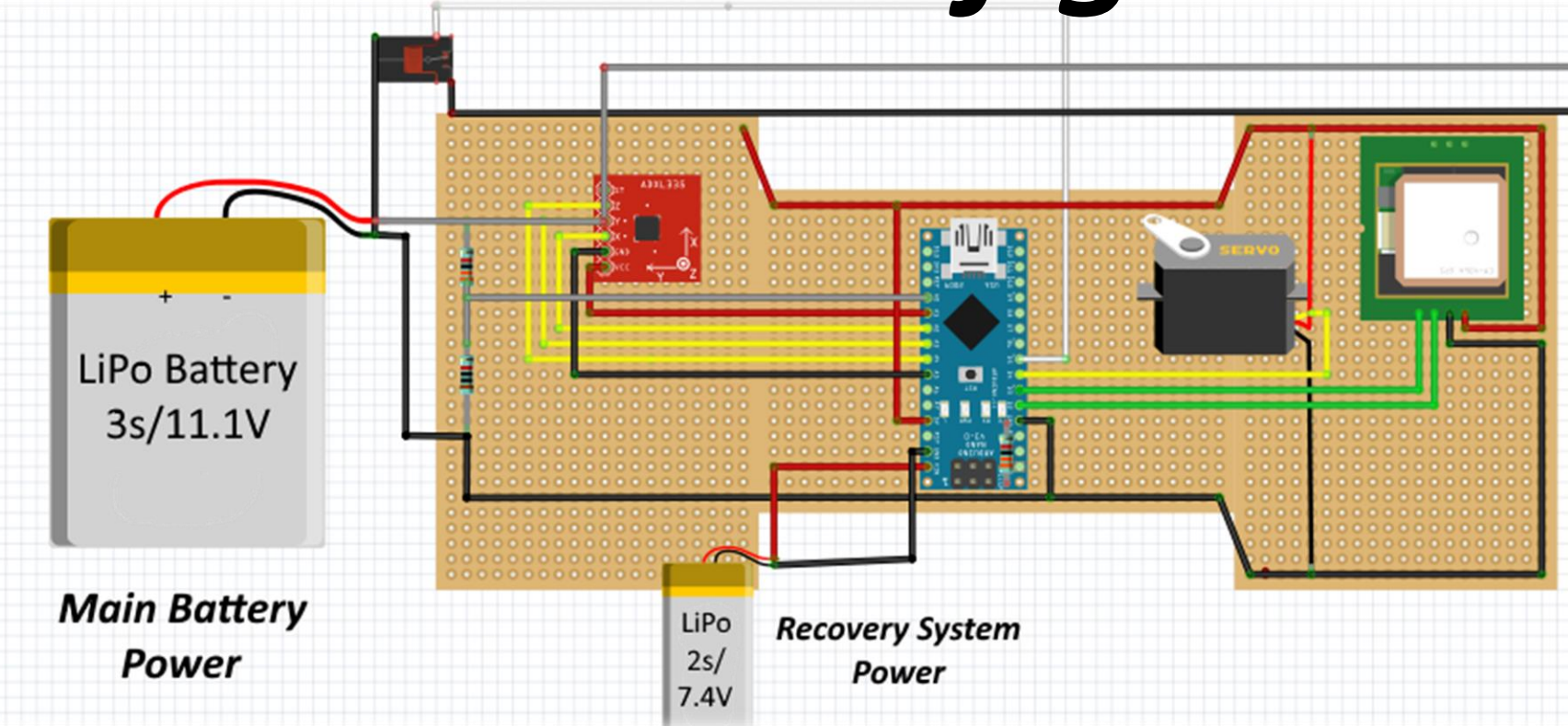
Design Components

Make	Model	Summary
Arduino	Nano	The arduino nano is used to connect the system together and control all components.
Adafruit	GTPA010	This component will serve as the GPS signal device for the system. This is how the system can determine if the aircraft is outside a given airspace.
Turnigy	Micro Servo TGY-90S	The servo motor will act as a release mechanism for the spring loaded parachute. When deploying the parachute, the servo will be release.
Sparkfun	ADXL330	The accelerometer will be used to measure forces acting upon the aircraft. If the forces are 0, then the aircraft is in free fall.
Uxcell	25V Voltage Sensor	The uxcell sensor will determine instantaneous voltage from the main battery supply. If the battery falls too low, the recovery system will cutoff power and take over.
Uxcell	5V Relay	The relay will be used to cut main power to the aircraft when operating conditions are inadequate for flight.
Turnigy	7.4V LiPo	LiPo battery is used to power the recovery system separately than main power.

"... the unmanned aircraft must remain within Visual Line-of-Sight of the remote pilot..."

- Federal Aviation Administration