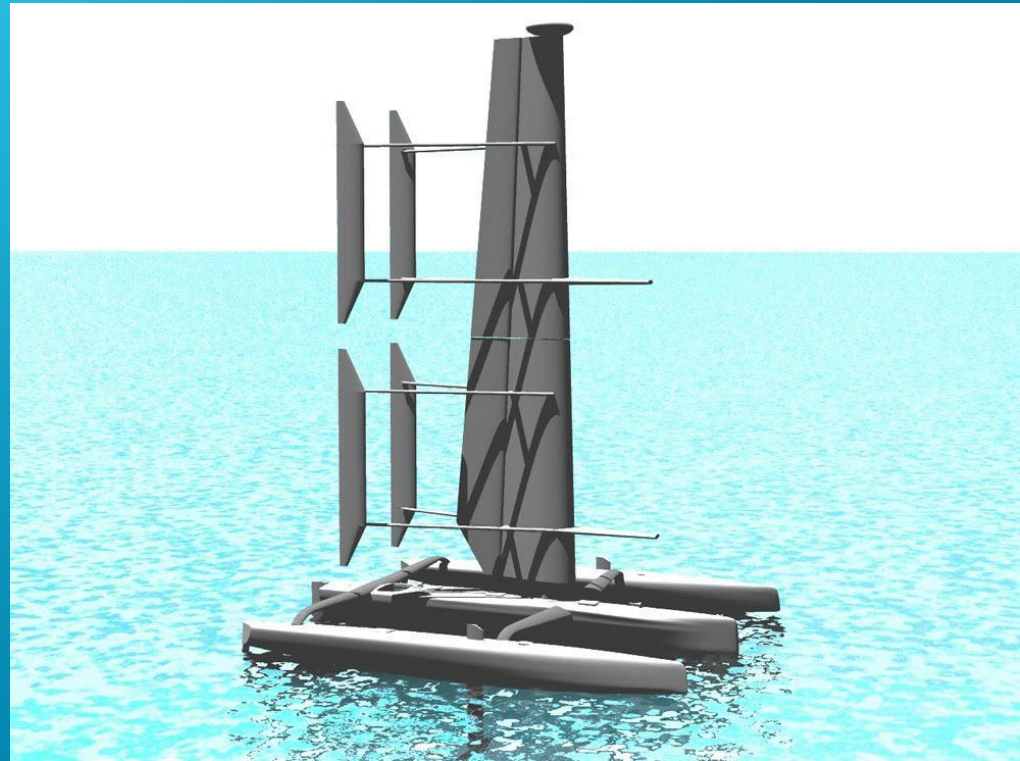# Autonomous SailBoat

Unmanned Penguin Tracking System

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Outline

- **Objectives**
- **Concept of Operation**
- **Overall Structure**
- **Sensor and Navigation**
- **User Interfaces**
- **Energy Harvest System**
  Power supply
  Power storage
- **Schedule**

Concept of Operation

penguin will have a tracker to get its position, human can control the boat based on that data

the boat will gain energy from different source as it sails
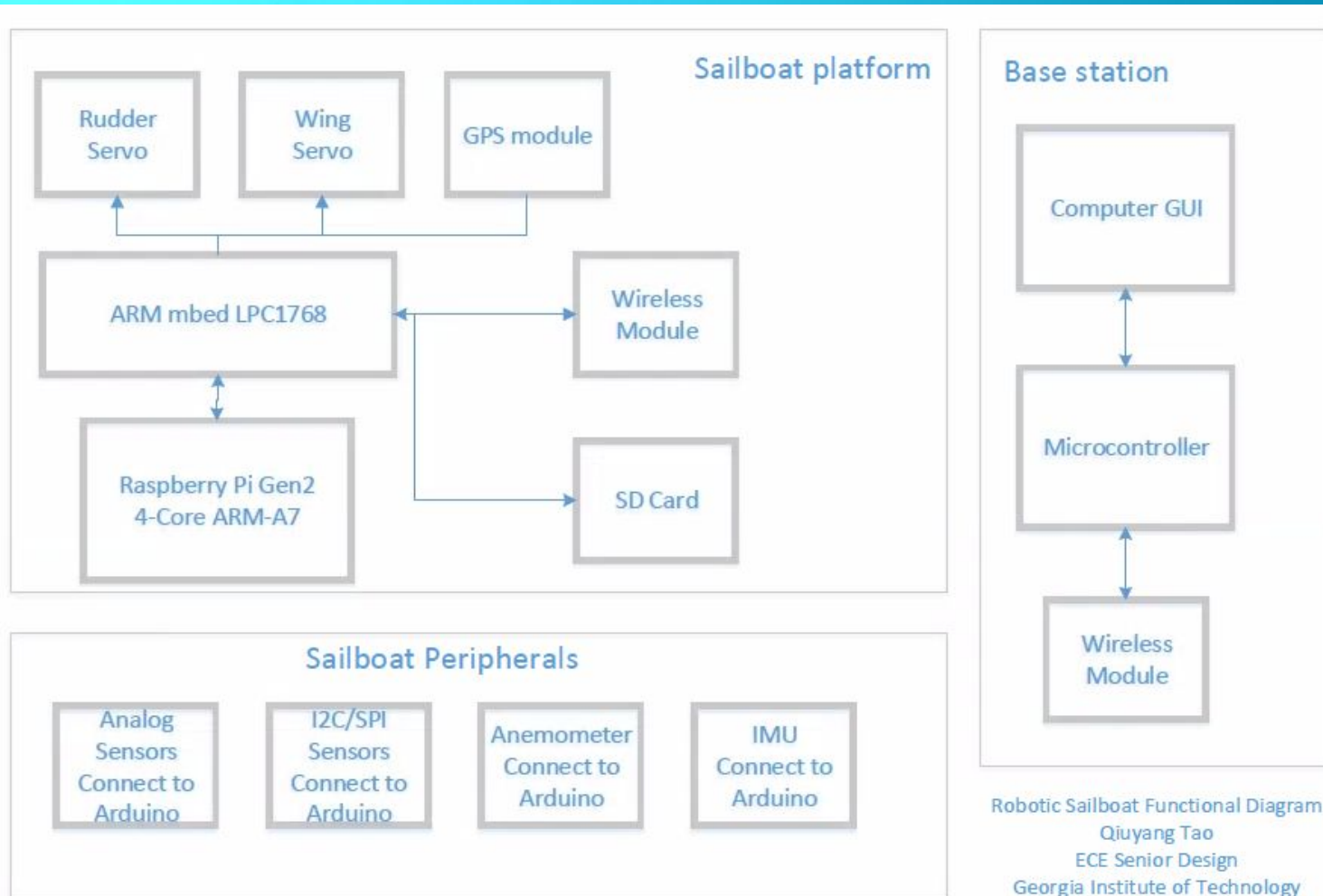
PC base station GUI

the boat will send its information to the Base station (position, battery etc)

the base station will send control signal and desired destination

the boat will collect different info about penguin as it goes

Overall Structure

Robotic Sailboat Functional Diagram
Qiuyang Tao
ECE Senior Design
Georgia Institute of Technology

Sensor and Navigation

- GPS and Inertial Measurement Unit (IMU)
  i. Connection and signal reading on mbed
  ii. data storage and processing

- Sample signal
  #YPR=95.28,12.33,-3.90 (from IMU)
  $GPGGA,014949.00,3346.54399,N,08424.50320,W,
  1,07,1.18,318.6,M,-31.2,M,,*6F (from GPS)

- Penguin tracking receiver
  i.e. RF receiver, voice signal processing, video recording

Sensor and Navigation

- ## Set path and destination
  @SET=PATH, Latitude, Longtitude, Task id

Example
    @SET=PATH, 33.776318, -84.407590, 3
    Current Path: Longtitude, Latitude

            0.000000, 0.000000

            0.000000, 0.000000

            33.776318, -84.407590
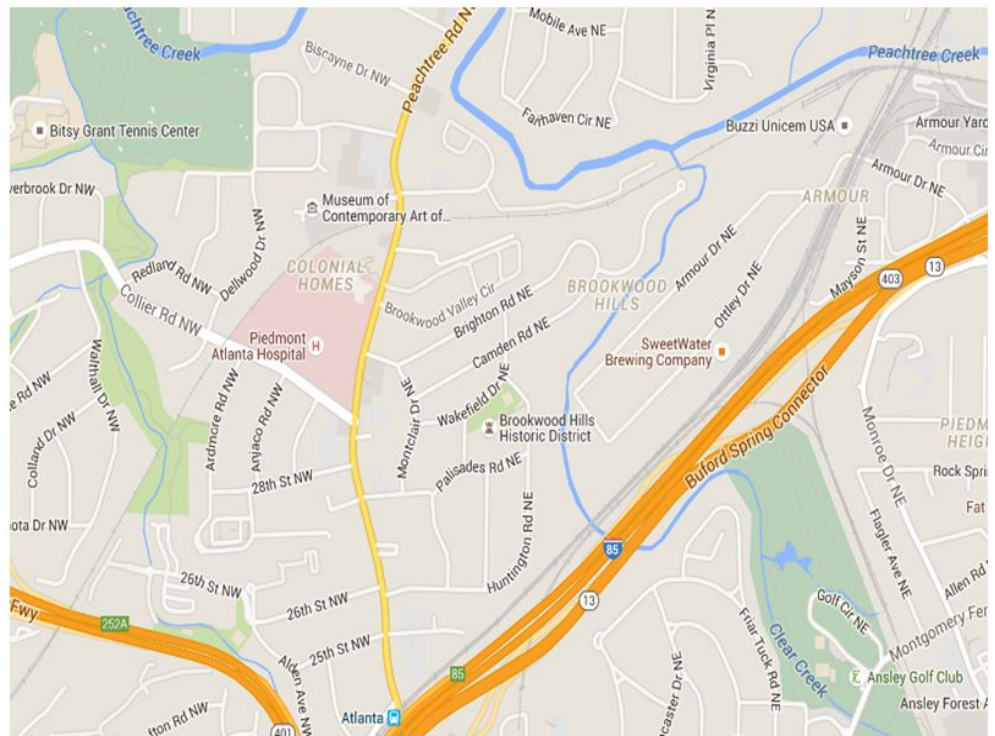
            0.000000, 0.000000

            0.000000, 0.000000

    DONE

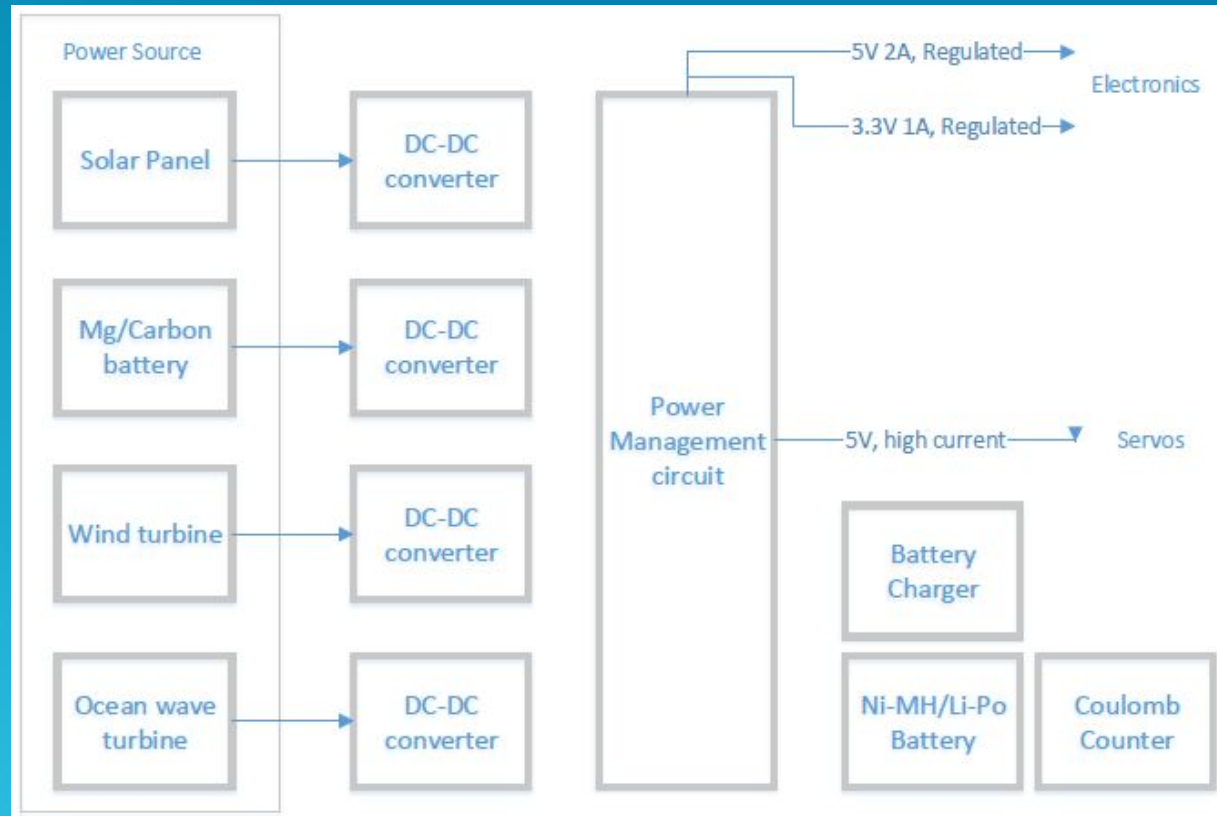# User Interface

- GUI

Boat Info (position, battery life, etc)

Show selected destination

User Interface

- Communication between GUI and Boat
  - i. Make sure GUI and Boat can exchange info both way using a wireless module
  - ii. for testing, start with direct connection, add wireless module later

- **Energy Harvest System**

- **Current concerns:**
    Sufficient energy supply
    Safety: waterproof, reverse current
    Maximum efficiency (Max Power Point Tracking)

Energy Storage
NiMH & Li-ion Batteries

	NiMH	Li-ion
Life Cycle (to 80% of initial capacity)	300-500	500-1000
Operating Temperature	-4 to 122F	14 to 122F
Self-Discharge (charge/month)	30%	3%
Energy Density (Wh/kg)	60-120	110-160
Weight	12.75g	17g
Cost ($)	2.25	5.19
Load Voltage(V)	1.2	3.7

- **Energy Storage**

  Panasonic eneloop NiMH battery:

  Up to 2100cycles, low self-discharge rate

  Against cold temperatures, can be used at -20°C

cited from:　http://www.panasonic-batteries.com/eu/news/panasonic-launches-eneloop-rechargeable

Specifications - 1

Sustainability	
Uninterrupted Operation at 20 °F	
Hardware	
Data Collection & Navigation Unit	
Operating Voltage	5V
Clock Speed	96MHz
Memory	32KB RAM, 512 KB FLASH
Dimension	Maximum: 55.25mm x 26.35mm
Processing Unit	
Clock Speed	900MHz
Power	5V @ 700 mA
RAM	1GB

loop-

Specifications - 2

Dimension	Maximum: 54mm x 26mm x 20mm
GPS	
Horizontal Position Accuracy	2.5m
Power	3.3V
Update Rate	max 5Hz
Dimension	25.5mm x 31mm
Wireless Module	
Date Rate	~150kb/s
Usable Range	~10km
Frequency	900MHz
Power	3.3V @ 210mA

Schedule
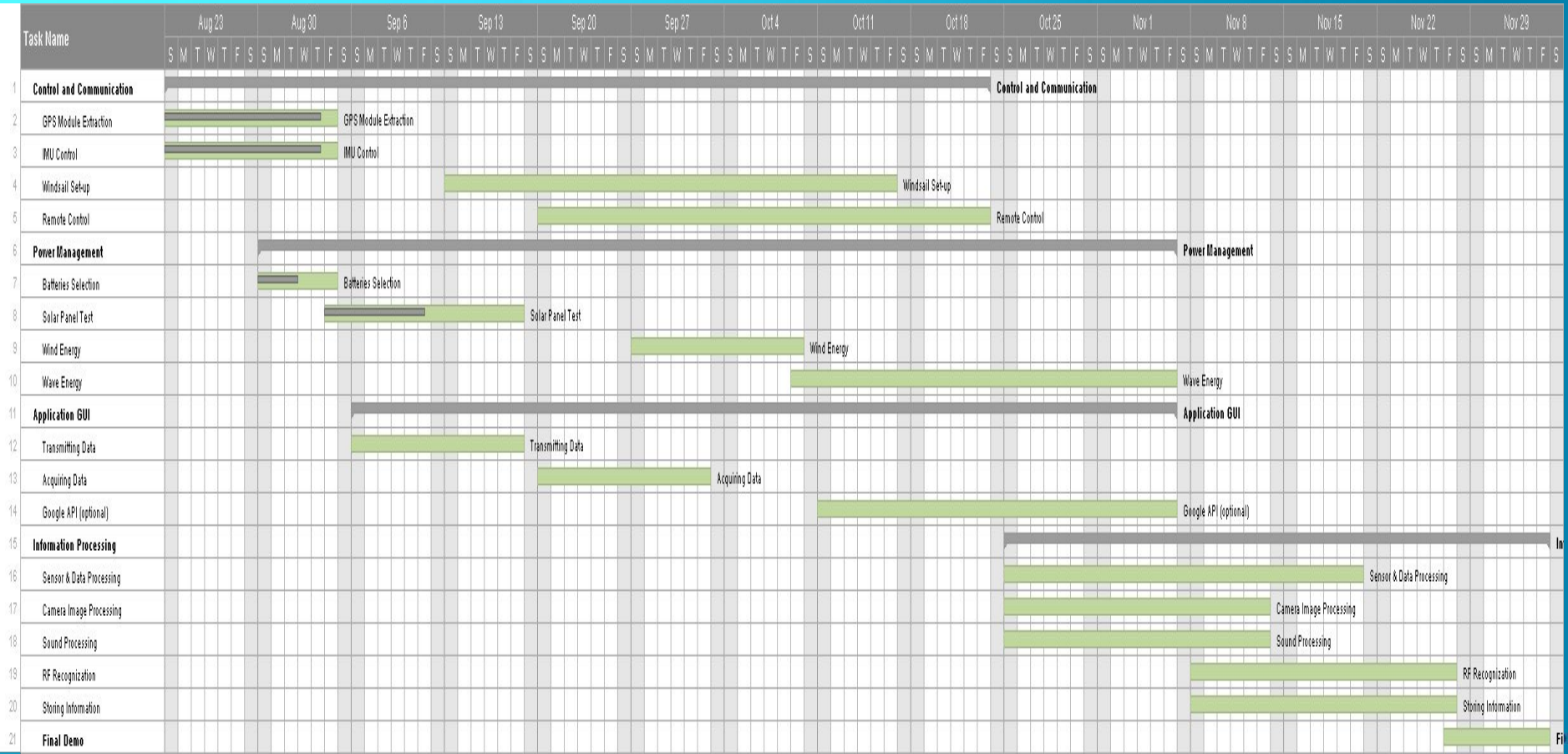
Question and Suggestions?