Design Review Presentation

Scientific Shark

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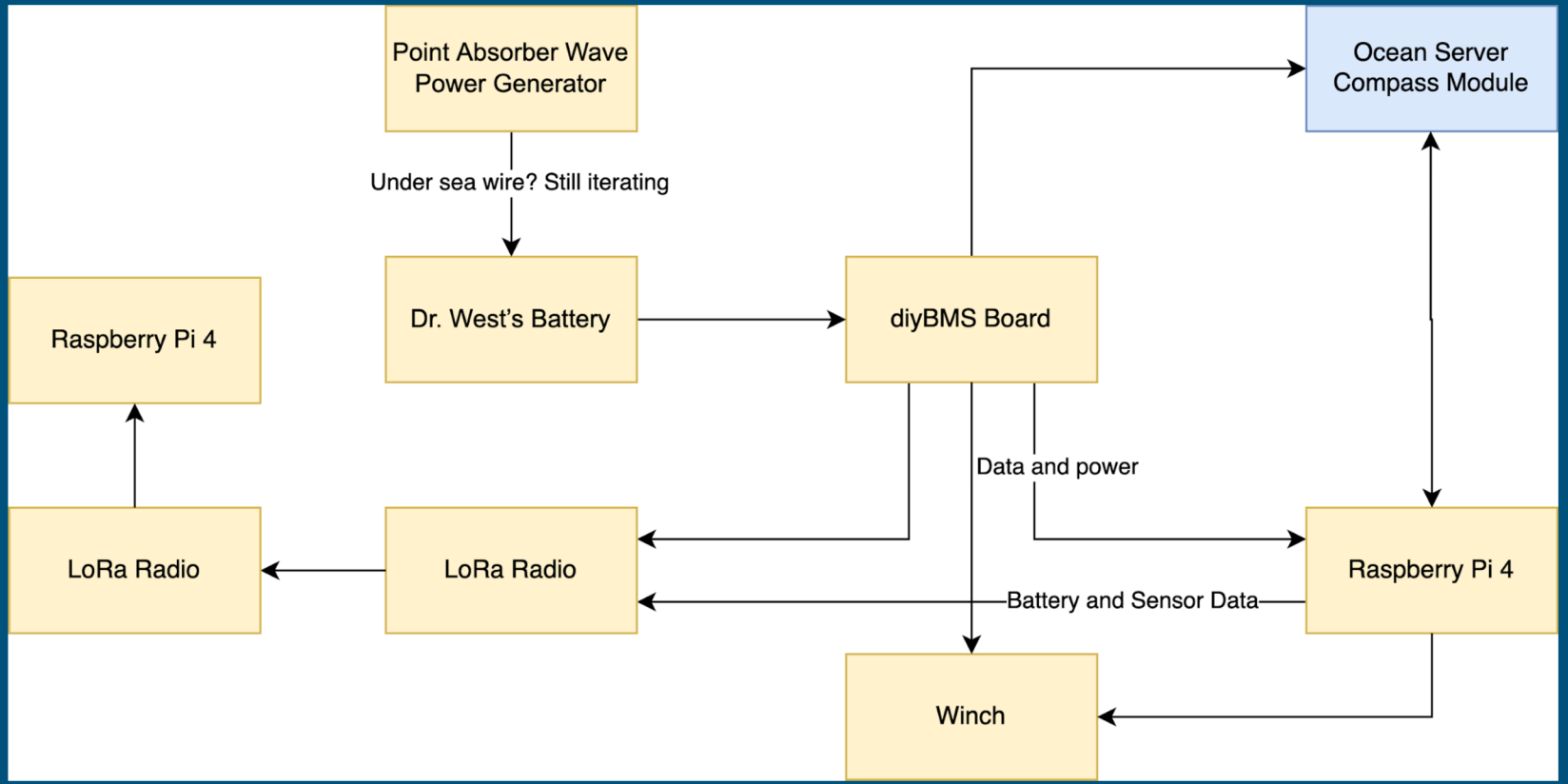
Background

- Prince William Sound, Gulf of Alaska
- Exxon-Valdez Oil Spill (1989)
- Environmental monitoring: Autonomous moored profiler
- Current Problems:
  - Remotely charge battery
  - Data transmission capability
  - Proprietary system

Agenda

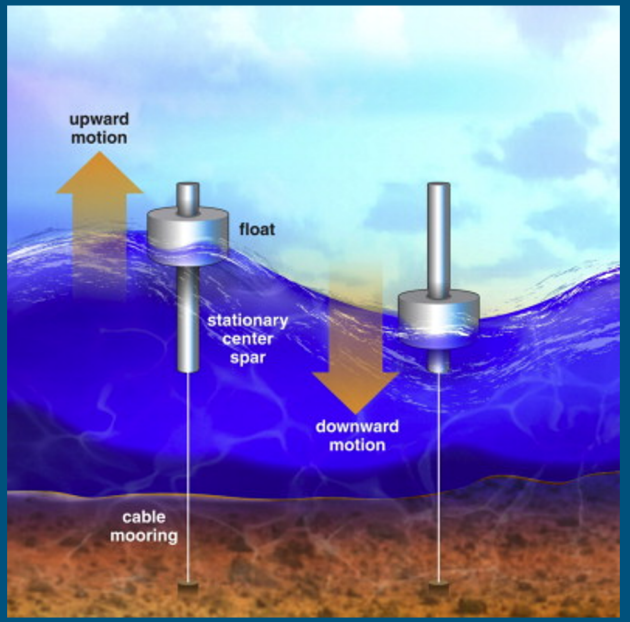
- High Level Overview of Prototype
- Power Generation
- Battery Communications
- Example Sensor, Compass
- Wireless Communications
- User Interface
- Path to Completion, Schedule
- Cost Analysis

Block Diagram of Planned Prototype



Power Generator

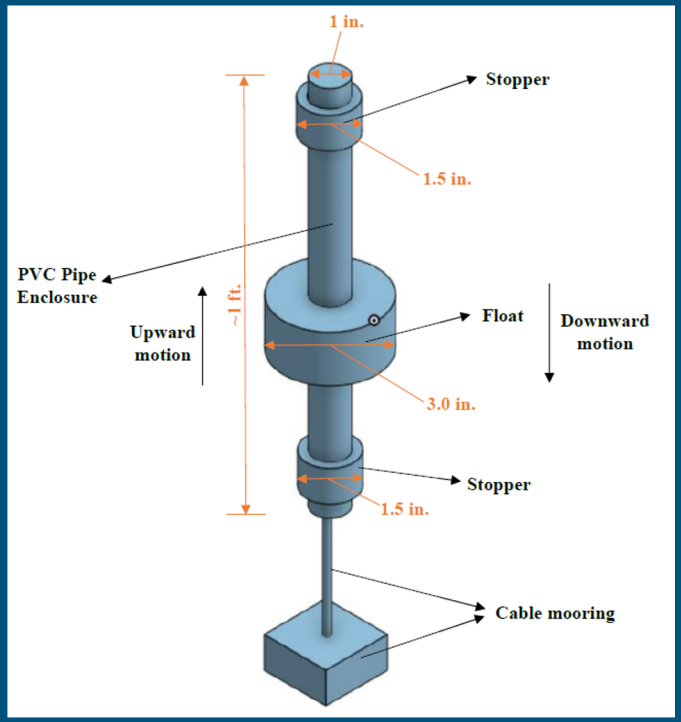
- Point absorber instead of wave attenuator
- Structure
  - Buoy
  - Magnets in the middle tube
  - Stator float moving based on waves
  - Plates (doughnuts) to keep stator in place
  - Mooring to the seabed
- Generator -> Charging system -> Battery

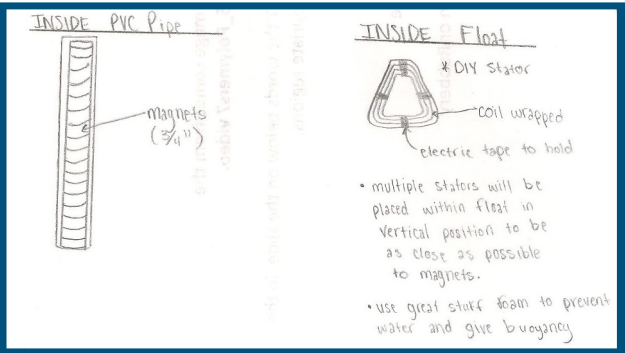


Visual example of point absorber

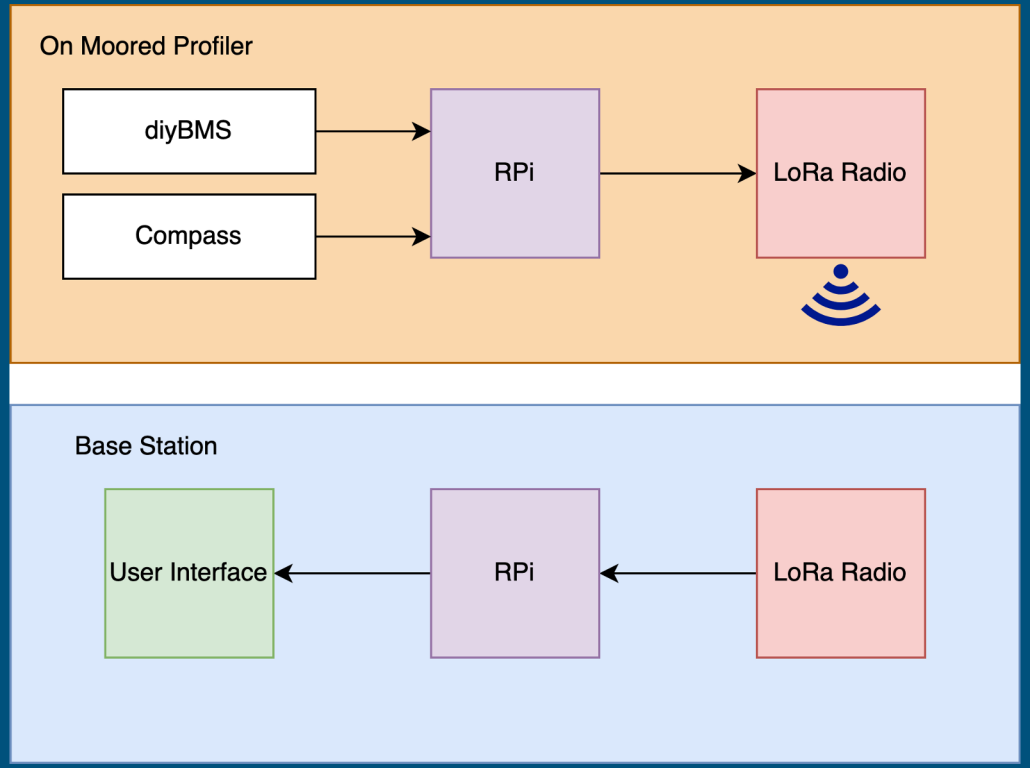
Power Generator Visual

- Inside PVC:
  - Magnets stacked within
- Inside Float:
  - DIY coil stators
- 3D print custom doughnuts and float
- Mooring:
  - Cable and weight

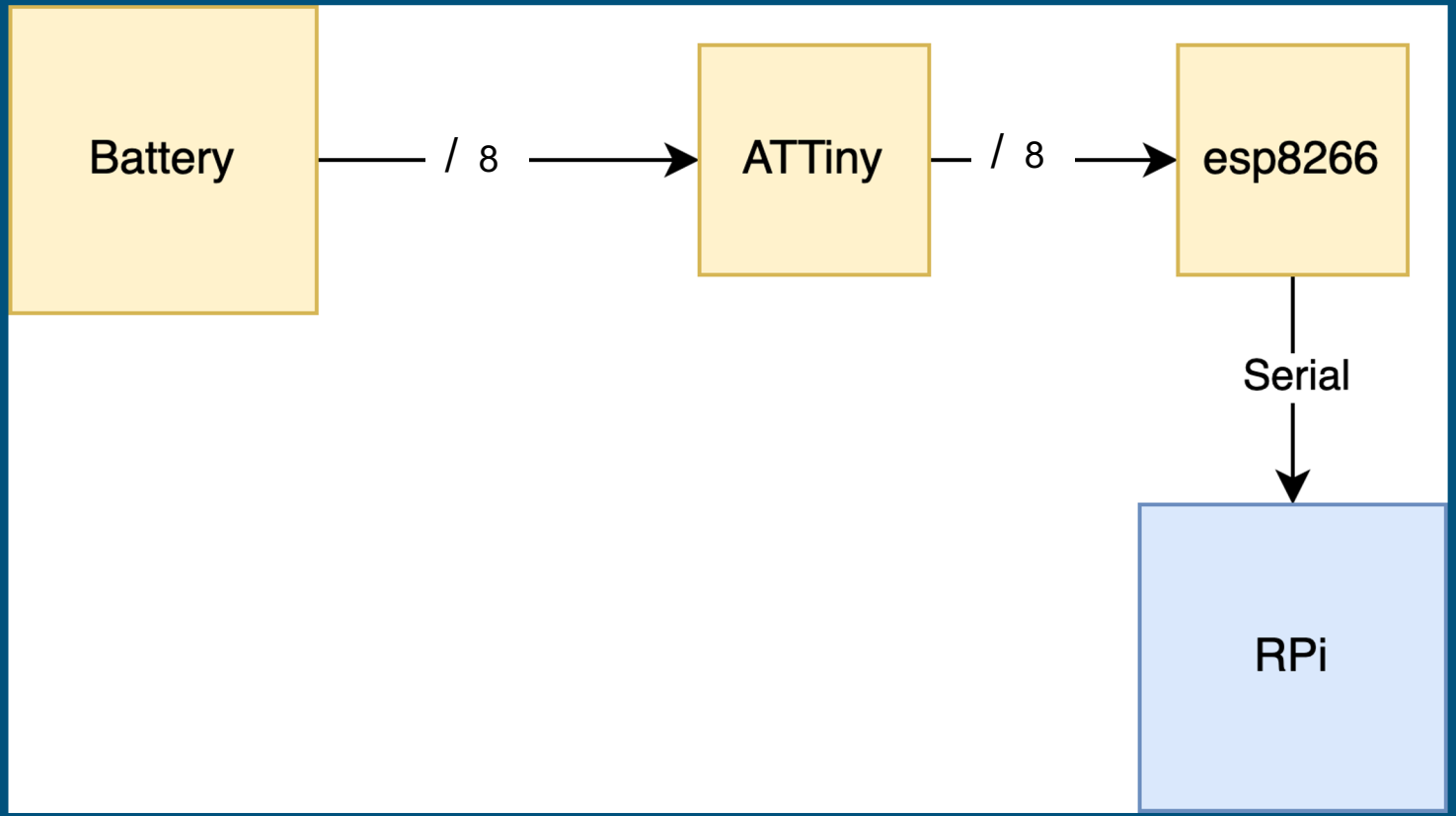




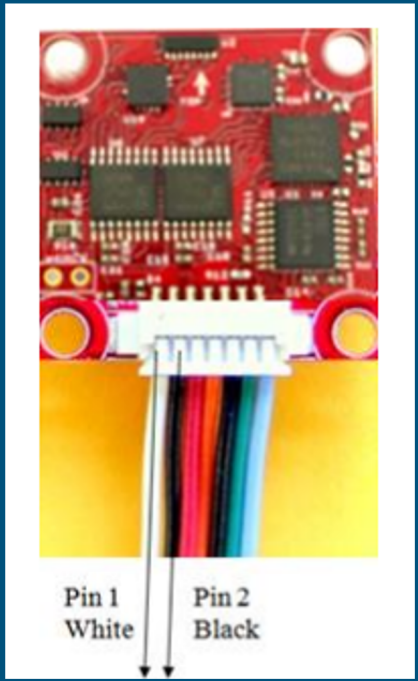
Software/Hardware Integration



Battery Communication



Compass



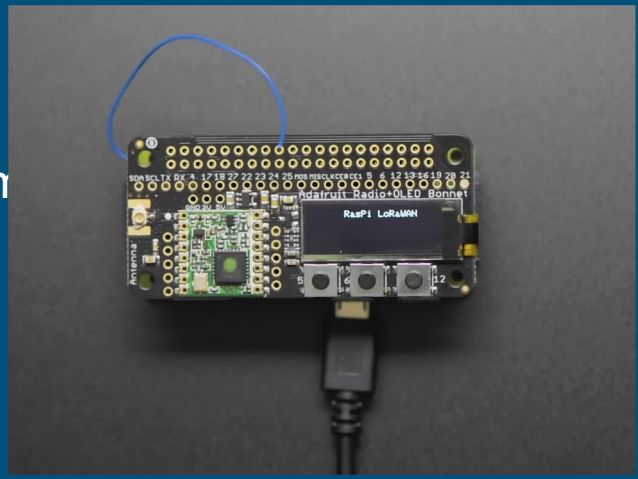
OS Compass

Order	Bit value (base 10)	Parameter Name
1	1	Azimuth
2	2	Pitch Angle
3	4	Roll Angle
4	8	Temperature
5	16	Depth (feet)
6	32	Magnetic Vector Length
7	64	3 axis Magnetic Field readings, x,y,z
8	128	Acceleration Vector Length
9	256	3 axis Acceleration Readings, x,y,z
10	512	reserved
11	1024	2 axis Gryo Output, X,y (discontinued Part)
12	2048	Reserved
13	4096	Reserved

List of parameters from the compass

Radio

- Long range (LoRa) transmission of packets, low power consum
- I2C protocol, 915 MHz but can be configured to other frequencies
- Can utilize LoRaWAN (longer distance)

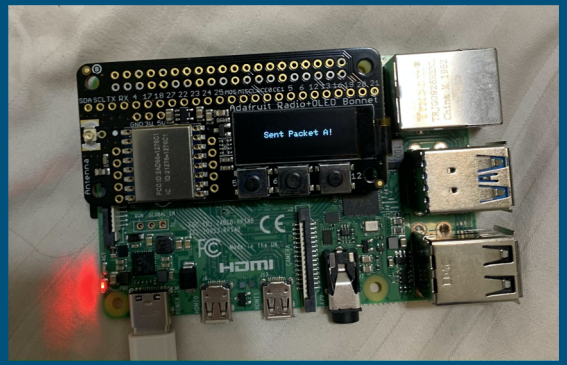


Adafruit LoRa Radio Bonnet RFM95W

Still need to:

- Send/receive information from battery management system and compass

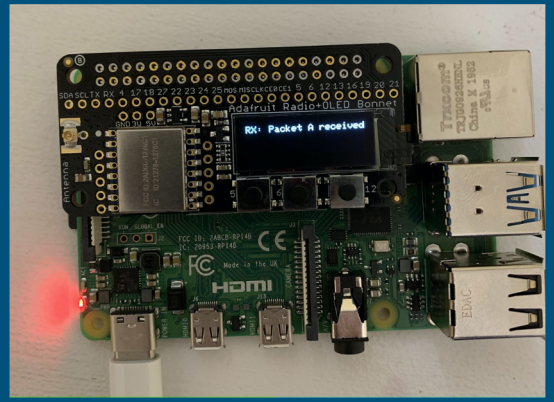
Radio



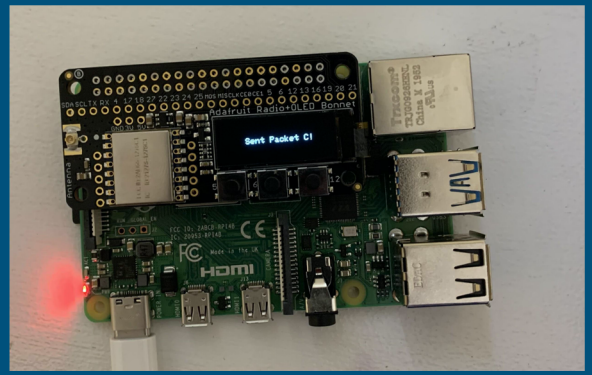
Radio 1 sends packet A

~4s

~1km



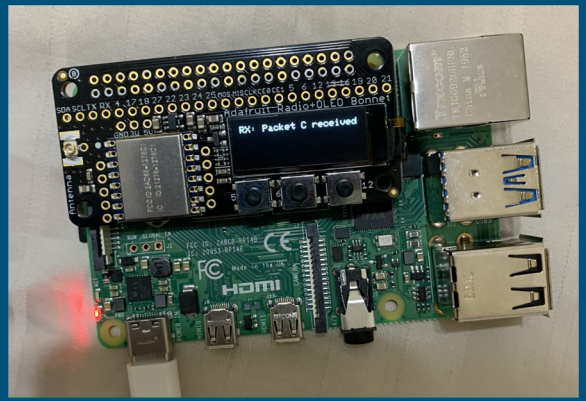
Radio 2 receives packet A



Radio 2 sends packet C

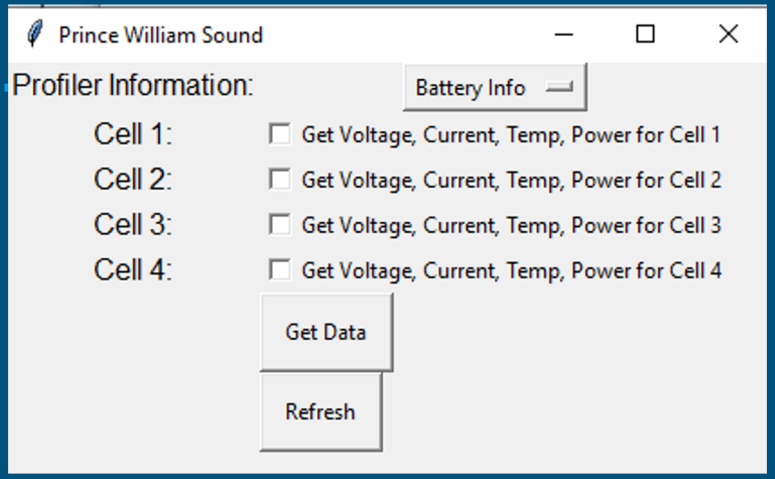
~4s

~1km



Radio 1 receives packet C

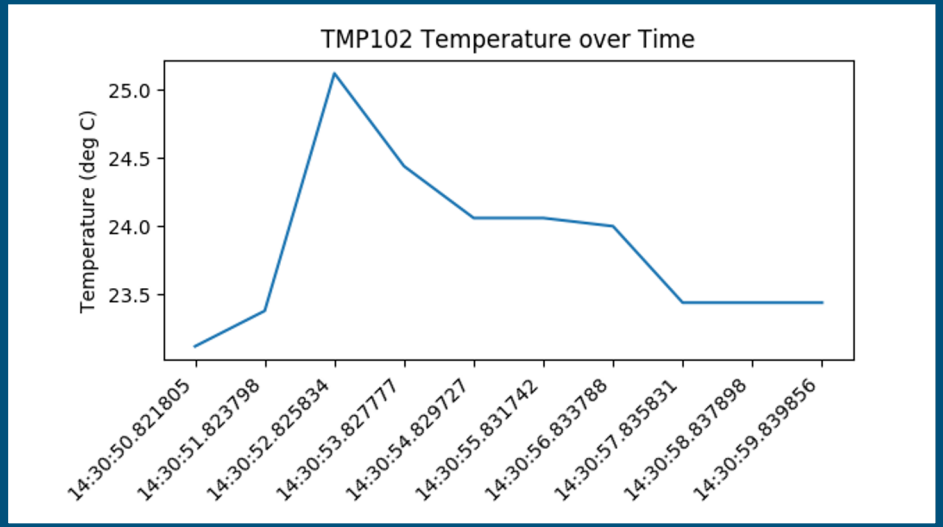
User Interface



Battery Used: 70%.

	Voltage (Volts)	Current(Amps)	Temperature(C)	Power (W)
Cell 1	3.80	4.36	21	100
Cell 2	3.75	5.12	25	205
Cell 3	3.78	8.15	49	125
Cell 4	3.48	7.20	20	198

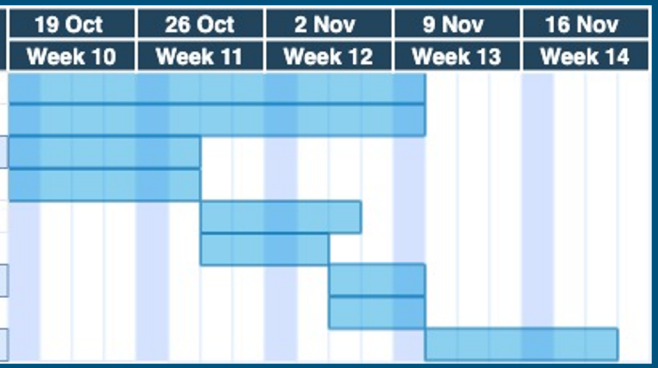
Current GUI example



Future GUI plans

Pathway to Success: Schedule

Task Name	Assigned	Days	Start	ETA
Iterate on user interface	CompE	23	18 Oct	10 Nov
Integrate radios, compass, battery communications	CompE	23	18 Oct	10 Nov
Ordering/waiting for parts	All	7	18 Oct	25 Oct
Establish serial communications (esp. esp8266)	CompE	7	18 Oct	25 Oct
Communicate with compass	CompE	8	26 Oct	3 Nov
Point absorber assembly	EE	7	26 Oct	2 Nov
Winch Integration	All	7	3 Nov	10 Nov
Charging system	EE	7	3 Nov	10 Nov
Finalize expo prototype and presentation	All	8	10 Nov	18 Nov



Cost Analysis: Bill of Materials

Topics	Materials	Quality	Total Price
Power Generator	Magnet	10	$89.30
	Temflex 3/4 in. x 60 ft. 1700 Electrical Tape Black	1	$1.78
	Rare Earth 3/4 in. x 1/4 in. Disc Magnet (4-Pack)	1	$190.42
Battery Communication	Raspberry Pi 4 15W Power Supply	1	$8.47
Radio Communication	Adafruit LoRa Radio Bonnet with OLED	2	$80.22
		Total	$370.19

Reference

https://ocean-server.com/wp-content/uploads/2018/08/OS5000_Compass_Manual.pdf

Thank You!
Any Question?