Brainstorming

* Project Management
* Design
* CAD/Solidworks Intensive
* 3D printing
* Electronics
* Coding in python
* Timeline
* Budget
* Sailing
* Boats?
* RC boat with AI vision
* Tool for Sailing
* GPS buoys RC controlled

Design Requirements:

* Physical
  + Floats on Water
  + Passively Stable
  + Multi Hour run-time
  + Energy Efficient Propulsion Method
  + Can handle high 20+ mph winds
  + Flashing Lights on top
  + GPS on top
  + Waterproof Container for Electronic
* Electronic
  + Can accurately pinpoint GPS position
  + Can give Compass heading
  + Can be remote controlled
* Software
  + Self Correcting Position
  + Can adjust position based
  + Autonomous
* Optional
  + Arduino Controlled wind sensor
  + Automatically update position based on wind sensor
  + Can give output on phone
  + Can record Water Temp
  + Looking like an oil rig at the top to fit A&M
  + Can have second arduino talk to buoy

Parts List

* GPS and compass module - BN 880 - <https://www.amazon.com/Geekstory-Navigation-Raspberry-Aircraft-Controller/dp/B078Y6323W/ref=sr_1_4?crid=3LY5I7BGWAFUM&keywords=bn+880&qid=1642658029&sprefix=bn+880%2Caps%2C103&sr=8-4>
* Microcontroller - Arduino Uno R3 - <https://www.amazon.com/Arduino-A000066-ARDUINO-UNO-R3/dp/B008GRTSV6/ref=sr_1_3?crid=2GMJQURZQJ01&keywords=arduino+uno+r3&qid=1642644439&sprefix=arduino+uno+r3%2Caps%2C127&sr=8-3>
* Waterproof Container - <https://www.amazon.com/LeMotech-Waterproof-Electrical-8-7x6-7x4-3-220x170x110mm/dp/B098Q9YX46/ref=sr_1_7?crid=1KSNO0HOHVLNP&keywords=waterproof%2Bproject%2Bbox%2Bip67&qid=1642716202&sprefix=waterproof%2Bproject%2Bbox%2Bip67%2Caps%2C111&sr=8-7&th=1>
* Aquarium Pump -

<https://www.amazon.com/Submersible-Brushless-Fountain-Circulation-Aquarium/dp/B08HHW3Y16/ref=sr_1_18_sspa?crid=1R07YHXPNKHT5&keywords=12v%2Bwater%2Bpump%2Baquarium&qid=1642569369&sprefix=12v%2Bwater%2Bpump%2Baquarium%2Caps%2C91&sr=8-18-spons&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUExQjNJREdIRVVCOUY1JmVuY3J5cHRlZElkPUEwMTYzMjEzUVg3UDFCVFJRQzgxJmVuY3J5cHRlZEFkSWQ9QTA3MTc0MjcyUjBTREkwTzVZRUhTJndpZGdldE5hbWU9c3BfbXRmJmFjdGlvbj1jbGlja1JlZGlyZWN0JmRvTm90TG9nQ2xpY2s9dHJ1ZQ&th=1>

* Relays - <https://www.amazon.com/ANMBEST-Optocoupler-Trigger-Expansion-Raspberry/dp/B08PNW9NV4/ref=sr_1_2_sspa?crid=3T7CHD9Z6B4YR&keywords=arduino%2Brelay&qid=1642656425&sprefix=arduino%2Brelay%2Caps%2C109&sr=8-2-spons&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEyUkxSS0pGSEQyMVY3JmVuY3J5cHRlZElkPUEwNDI1NzAwMU9FTlpGRUdEMEExMCZlbmNyeXB0ZWRBZElkPUExMDMxMzAwMUZERjFNVVVJM05VTiZ3aWRnZXROYW1lPXNwX2F0ZiZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU&th=1>
* Radio Transceiver - NRF24L01+PA+LNA - <https://www.amazon.com/HiLetgo%C2%AE-NRF24L01-Wireless-Transceiver-Compatible/dp/B00WG9HO6Q/ref=sr_1_9?crid=1OS1EJHC87RT0&keywords=NRF24L01%2BPA%2BLNA&qid=1642713587&sprefix=nrf24l01%2Bpa%2Blna%2Caps%2C80&sr=8-9>
* PVC Tube - 1/2 in
* ZipTies
* Pool Noodles - <https://www.amazon.com/Oodles-Noodles-Deluxe-Foam-Pool/dp/B01LZ8FAHO/ref=sr_1_3_sspa?crid=12S2X0H9KYGOC&keywords=pool%2Bnoodle&qid=1642718080&sprefix=pool%2Bnoodle%2Caps%2C260&sr=8-3-spons&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUExSU5ZQ0VYWjhMSExEJmVuY3J5cHRlZElkPUEwMDIzODEyMTFaN1lNQ05COUM1WCZlbmNyeXB0ZWRBZElkPUEwMDkzNTEzMURURlhFRkpUTU9ESiZ3aWRnZXROYW1lPXNwX2F0ZiZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU&th=1>
* Light - 12V License Plate Light

<https://www.amazon.com/License-Waterproof-Taillight-Trailer-Trucks/dp/B0813HRPY6/ref=sr_1_12?crid=1BE20BA84JLJB&keywords=12v+small+waterproof+lights&qid=1642656892&sprefix=12v+small+waterproof+lights%2Caps%2C192&sr=8-12>

* Battery - 12V 5Ah Sealed Lead Acid

<https://www.amazon.com/Mighty-Max-Battery-ML5-12-Rechargeable/dp/B079ZCJYP3/ref=sr_1_13?crid=3LFVS9JN1G5S5&keywords=12v%2Bbattery&qid=1642647171&sprefix=12v%2Bbattery%2Caps%2C116&sr=8-13&th=1>

* Barrel Plug Connector - <https://www.amazon.com/43x2pcs-Connectors-Security-Lighting-MILAPEAK/dp/B072BXB2Y8/ref=sr_1_4?crid=3RISKH840TCSW&keywords=2.1mm+DC+Plug&qid=1642715023&sprefix=%2Caps%2C91&sr=8-4>

Steps:

1. Plan Design and Electronics
2. Choose Parts and Method of Manufacturing
3. Buy Parts
4. Start testing parts individually
5. Begin assembling all of the different parts individually

Milestones

1. Buoy capable of calculating and communicating GPS location
2. Buoy capable of calculating how to get to ideal location
3. Buoy capable of getting to ideal location

Design Decisions:

* PETG is better than PLA for 3D printing things that will be on the water
* Structure at the top needs to be tall for easy visibility
* Structure Top has a oil rig design to allow easy passage of air through it
* Buoy resembles an OIl Rig for Texas A&M Sailing team
* 4 aquarium pumps was determined to be easiest method of propulsion
* Aquarium pumps are the most waterproof propulsion method at this scale
* 15W 12V DC motors were determined to be minimum power output for movement in bad weather conditions
* A Tall and skinny 12V sealed Lead Acid battery is best to lower center of mass of the buoy
* Hooks and Rope was determined to be easiest method of attachment for battery due to 3D printing Constraints
* Zip Ties holding aquarium pumps are the most simple way of securing pumps to the base
* Legs for Buoy were thought to be necessary but were removed because of their fragility and added complexity
* A PVC tube will be used to guide wires from the top of structure to the electronics box
* The placement of the electronic box was decided to help deter water intrusion while keeping it fairly accessible for easy dubbuging
* Arduino can take 12v DC input voltage so no need to change power supply
* Relay will work of 12v DC and receive 5v signal from the arduino
* License Plate Lights will be used because they are waterproof,relatively cheap and run on 12v
* We need to turn on 4 pumps, the 4 lights as one so need 5 relays total
* Buy an SD card reader to help troubleshoot and record useful data
* SD card reader will go on groundstation to free up pins on buoy
* Compass Declination: 0.04596033696918401
* As of 2/08/22, electronic concept has been tested and proven to be good

Time Spent

01/16/22 - 2 hours

01/17/22 - 9 hours

01/18/22 - 5 hours

01/19/22 - 5 hours

01/20/22 - 7 hours

01/21/22 - 3 hours

01/23/22 - 2 hours

01/29/22 - 5 hours

01/30/22 - 12 hours

01/31/22 - 2 hours

02/04/22 - 3 hours

02/05/22 - 3 hours

02/08/22 - 2 hours

02/11/22 - 5 hours

One thing that helps organize a project is to perform a risk assessment, ie make a list of things

that could go wrong and think about mitigations. The right way to do it is to make a list and then

rank the risks using a probabilistic approach (low probability medium high probability) combined

with a ranking of the consequence (catastrophic serious mild). You deal in priority with the

catastrophic ones x high probability, etc…

I am listing here some risks:

- Structure too small to be visible (need a test to see what’s needed)

- Buoyancy issues: the buoy is too heavy (almost sinks) or more likely too light/top heavy

(keeps falling on its side). Need contingency plan here with ability to modify

buoyancy/center of mass. Need to be able to stand back up by itself if knocked down?

- Accessibility of the electronic box, how easy is it to remove the superstructure?

- Would leaks in the buoy sink it? are you 3D printing it (pretty big)? Do you have separate

compartments to mitigate the impact of a leak?

- The motors make the buoy spin and/or it doesn’t move in a controlled way and/or too

slowly. It may be helpful to think that propulsion will be finalized once the size/mass is

defined.

- The wind/drifting will likely force the motors to be constantly working if the geo-

positioning works. Does it have enough battery to last long enough (one afternoon/one

day?)

- Are the motors meant to be working continuously?

The less complex alternative to this project could be a “fixed” bouy with a wind

anemometer/solar power giving wind info on the water you can read on your phone via an aps.

Buying Schedule:

01/23/2022 Order Date - 01/26/2022 Delivery

Bought: GPS, Connectors, Connectors, 1 arduino, 1 SD card reader

02/09/2022 Order Date - 02/11/2022 Delivery

Bought: Relays, Lights, Battery

Pins Used on arduino:

GPS: 2 digital, 2 analog, 1 ground, 1 5V

Relay: 5 digital

Radio: 5 digital, 1 3.3 V

Define Pins:

**Digital - 14 pins - 12 usable**

Pin 0: Arduino - RX - Do Not Use

Pin 1: Arduino - TX - Do Not Use

Pin 2: GPS/Compass - RX - red

Pin 3: GPS/Compass - TX - green

Pin 4: Radio - CE

Pin 5: Radio - SCK

Pin 6: Radio - MISO

Pin 7: Radio - CSN

Pin 8: Radio - MOSI

Pin 9: Relay - Motor N

Pin 10: Relay - Motor E

Pin 11: Relay - Motor S

Pin 12: Relay - Motor W

Pin 13: Relay - Lights

**Analog - 6 pins**

Pin A0:

Pin A1:

Pin A2:

Pin A3:

Pin A4: GPS/Compass - SDA - black

Pin A5: GPS/Compass - SCL - blue

**Power - 3.3 V - 5 V - GND**

Pin 5V - GPS/Compass - VCC - yellow

Pin 3.3V - Radio - VCC

Pin GND - GPS/Compass - GND - white

Pin GND - Radio - GND

Team:

Mechanical Engineers:

Victor Malbrel (Team Lead)

Chris Coon

Ani Tummalapalli

Wokwi Arduino simulator