Bubbles Under The Sea

The Greatest Underwater Submarine to Exist

Introductions

Group 19

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OUTLINE

1. Introduction and Motivation
2. Project Goals/Objectives, Specifications/Requirements
3. Overall Design
    a. Problem Approach (sub-outline)
    b. Block Diagram
4. Hull (Pressure and Aesthetics)
5. Ballast
6. Electrical Networking (Motors, Light, PCB)
7. On-board Pi interface and Camera and Sonar Sensor
8. Umbilical and Controller and land battery
9. Project Budget and Financing to date and end of project
10. Progress chart (with percentages)
11. Chart with expected date of completions

Motivation

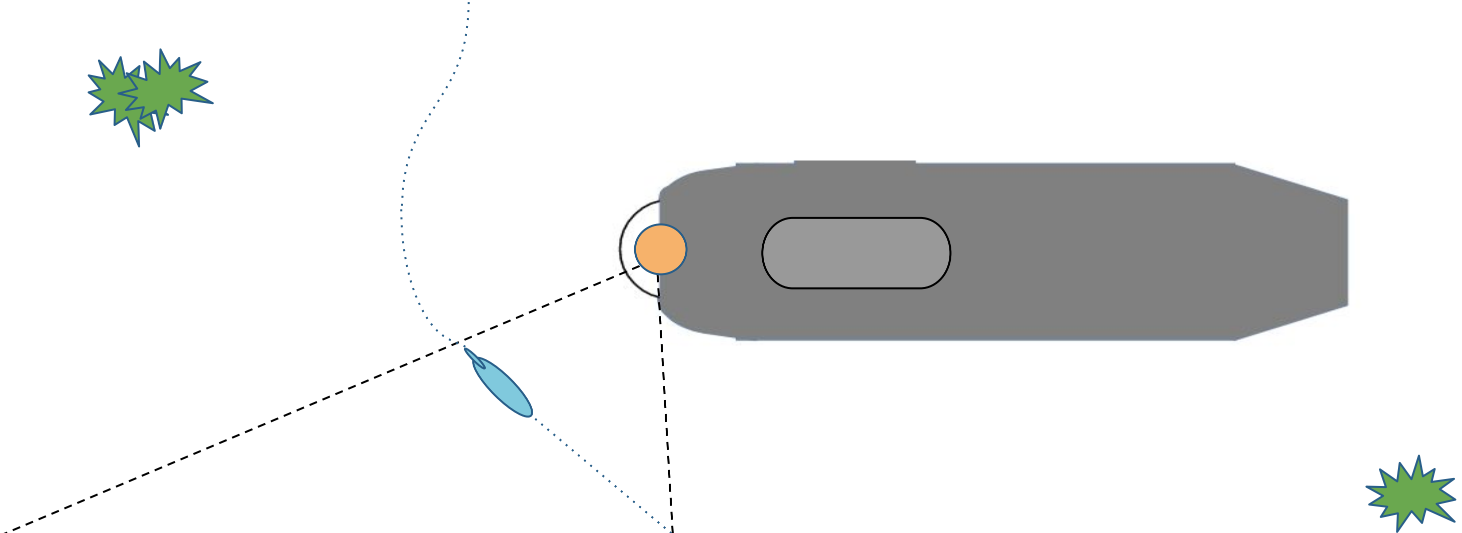
- Remote controllable submarines are used for exploration and visual inspection purposes.
- One of the main motivations of the project was to be able to put the underwater landscape in the hands of the disabled. A vast amount of people have lost the ability to see what it's like underwater due to unfortunate accidents or events and with our Project we would be able to supply an affordable way to give back that ability.
- Most that are on the market cost well over $1000!
- Those below that amount have fixed view cameras, and static lights.
- We aim to improve the exploratory experience!

Goals and Objectives

- A rotatable camera that can be adjusted via the controller
- Adjustable headlight
- Reduced video latency
- Touchscreen integration

Potential Use Cases

- If an interesting creature passes the submarine at an oblique angle, the camera can be turned to follow it, as opposed to turning the whole submarine.
- If something interesting is to the sides, top, or bottom of the submarine, some areas can be seen using the rotating camera as opposed to none.
- Adjustable headlights provide more options to how people view dark underwater areas. With the lights adjustable, sensitive fish won’t be frightened by bright lights, and image bloom can be minimized.

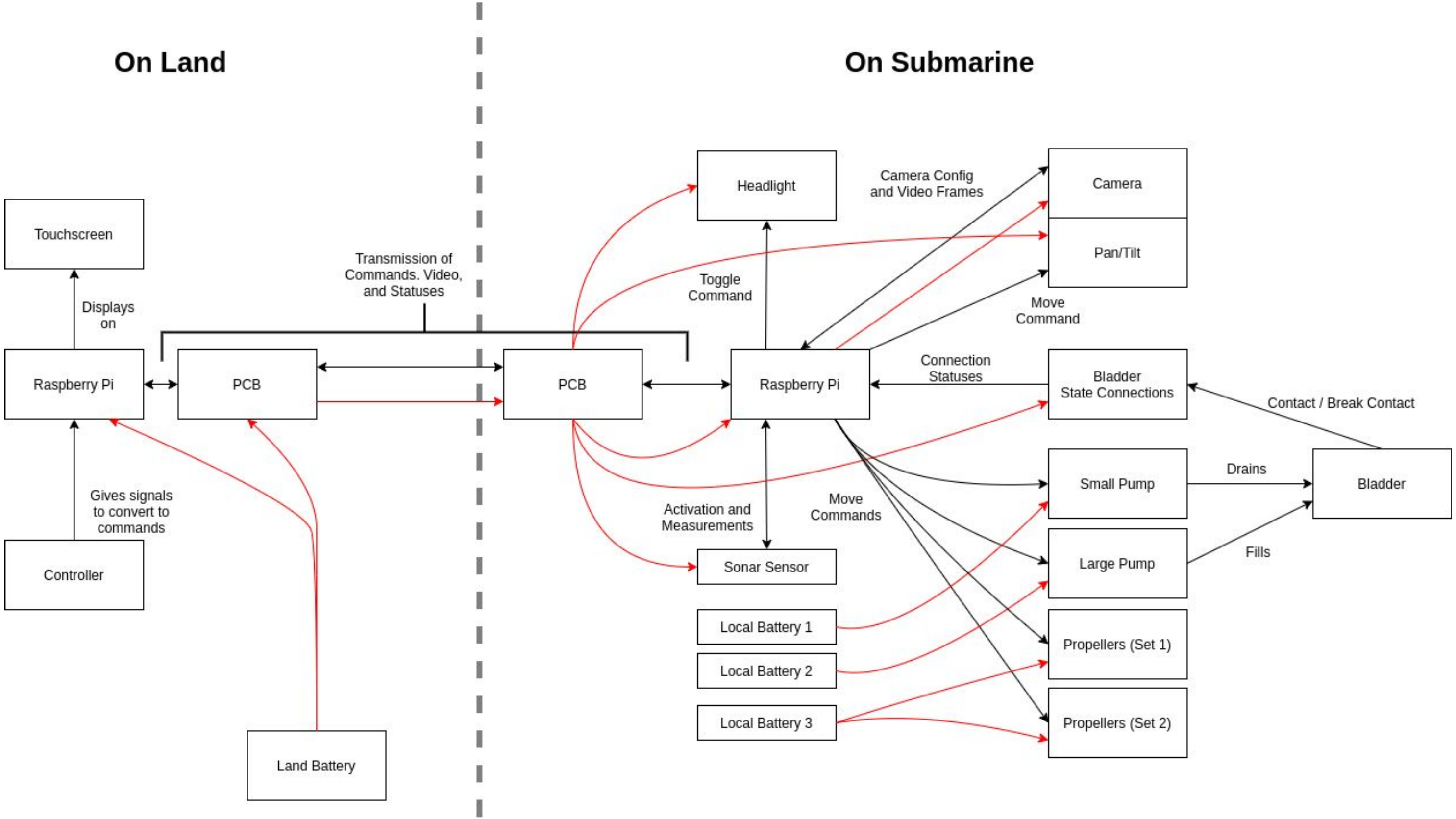


Specifications

Component(s)	**Parameter**	**Specification**
Ethernet Cable and Ballast	Diving Depth	5 m
Pan/Tilt Mechanism	Controllable Angle	Can use the controller to pan and tilt the camera in a 75° cone.
Controller Screen	Framerate	30 frames per second
Battery	Discharge Time	1 hour
Ethernet Cable	Length (explorable range)	15 m
Propeller Motors	Speed	3 m/s
Headlight	Adjustable Brightness	150 - 1000 lumen
Hull	Temperature Resistance	4 - 33° C*

*Temperatures verified by datasheets.

Block Diagram



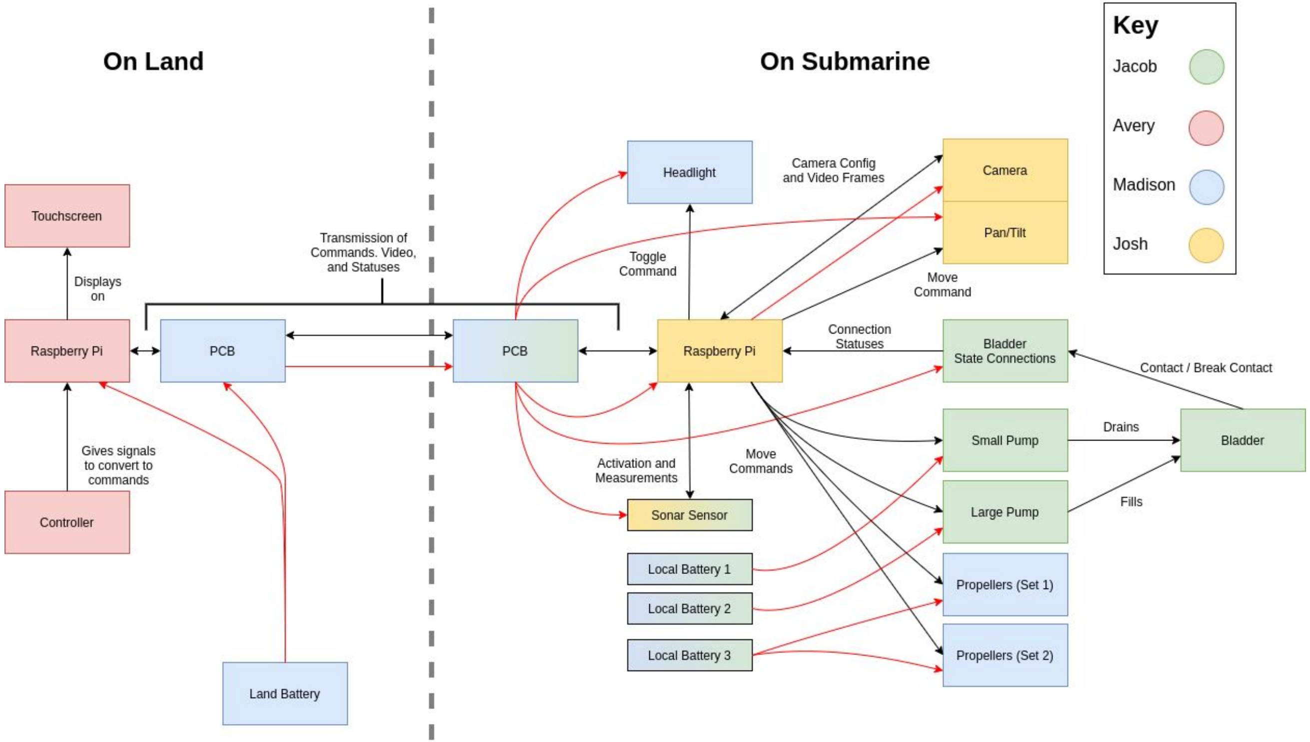
On Land

On Submarine

Touchscreen
Displays on
Raspberry Pi
Gives signals to convert to commands
Controller
PCB
Land Battery
Transmission of Commands. Video, and Statuses
PCB
Headlight
Toggle Command
Raspberry Pi
Activation and Measurements
Sonar Sensor
Local Battery 1
Local Battery 2
Local Battery 3
Camera Config and Video Frames
Camera
Pan/Tilt
Move Command
Connection Statuses
Bladder State Connections
Contact / Break Contact
Move Commands
Small Pump
Drains
Bladder
Large Pump
Fills
Propellers (Set 1)
Propellers (Set 2)

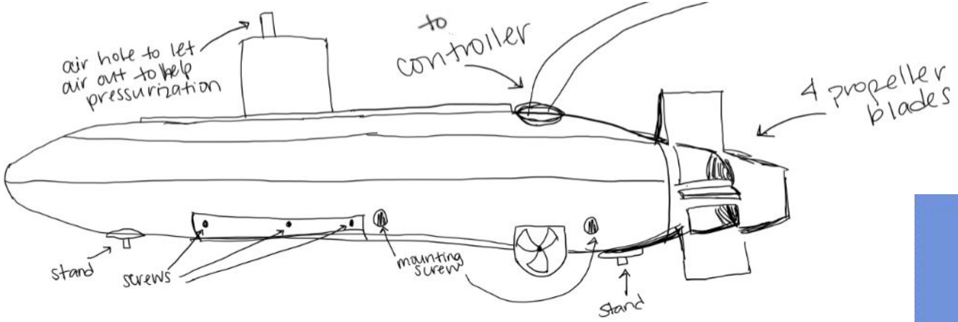
Design Approach and Work Layout

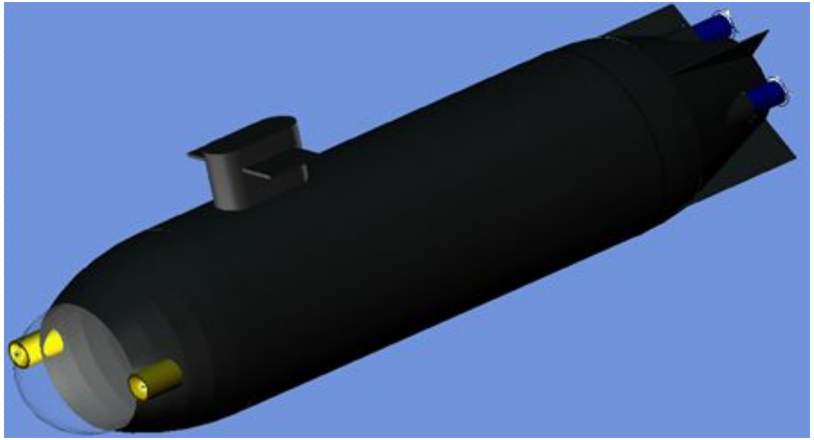
Work was split amongst group members based off of what key systems they felt capable of working on. The interplay between the major systems also necessitates and is used to show teamwork capabilities.



Hull

Before electrical designs could be made for the ballast system, or special pieces made, calculations were made to verify if the combination of the artistic renderings below and the selected parts could be accommodated. This includes understanding the pressure that the hull must resist as well as how the shape and dimensions affect the buoyancy.

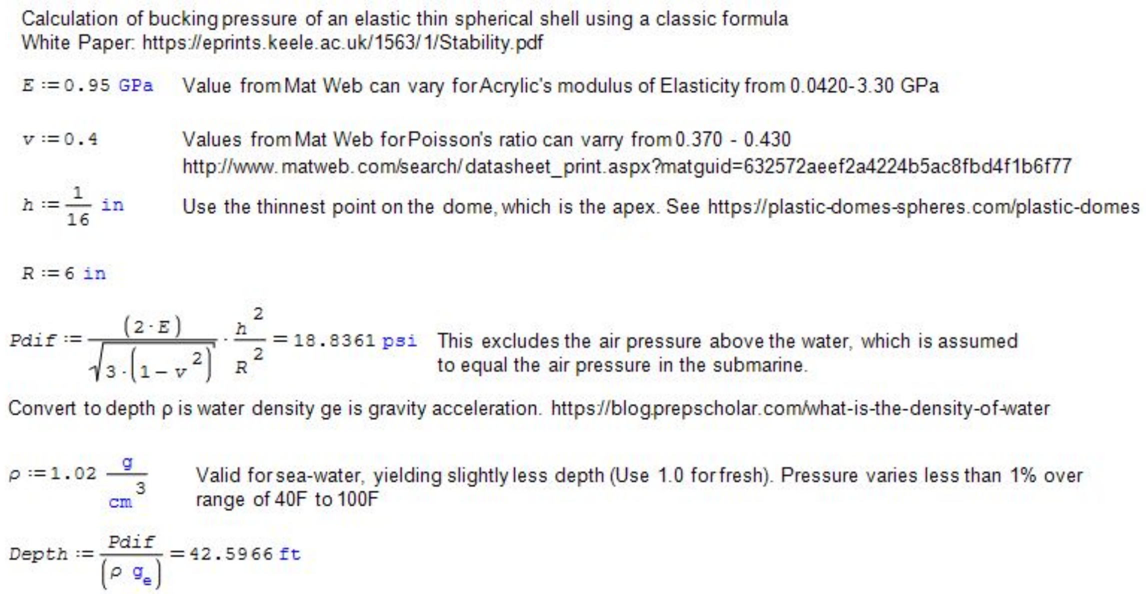




Note: After these drawings were made, it was determined that the variable headlights should be directly drivable LEDs and not flashlights.

Dome

Here is an example of calculating the pressure on the most sensitive piece - the plexiglass dome from EZTopsWorldWide. The remainder of the hull is comprised of a PVC pipe (rated for 160 psi) and custom 3D printed pieces which are thick enough to withstand the pressure.



Calculation of bucking pressure of an elastic thin spherical shell using a classic formula
White Paper: https://eprints.keele.ac.uk/1563/1/Stability.pdf

$E := 0.95\ \mathrm{GPa}$ Value from Mat Web can vary for Acrylic's modulus of Elasticity from 0.0420-3.30 GPa

$v := 0.4$ Values from Mat Web for Poisson's ratio can varry from 0.370 - 0.430
http://www.matweb.com/search/datasheet_print.aspx?matguid=632572aeef2a4224b5ac8fbd4f1b6f77

$h := \frac{1}{16}\ \mathrm{in}$ Use the thinnest point on the dome, which is the apex. See https://plastic-domes-spheres.com/plastic-domes

$R := 6\ \mathrm{in}$

$$Pdif := \frac{(2 \cdot E)}{\sqrt{3 \cdot \left(1 - v^2\right)}} \cdot \frac{h^2}{R^2} = 18.8361\ \mathrm{psi}$$

This excludes the air pressure above the water, which is assumed to equal the air pressure in the submarine.

Convert to depth ρ is water density ge is gravity acceleration. https://blog.prepscholar.com/what-is-the-density-of-water

$\rho := 1.02\ \frac{\mathrm{g}}{\mathrm{cm}^3}$ Valid for sea-water, yielding slightly less depth (Use 1.0 for fresh). Pressure varies less than 1% over range of 40F to 100F

$$Depth := \frac{Pdif}{\left(\rho\ g_e\right)} = 42.5966\ \mathrm{ft}$$

Dome

The dome will be of a suitable thickness (0.25” avg.) to avoid breaching. Despite reading from other sources that the apex of the dome is the area most susceptible to breaching, there is reason to believe the dome will easily survive. The company has a white paper on their site where they worked with students from the Puget Sound Naval Shipyard to conduct hydrostatic pressure tests on domes similar to our intended size. The dome they tested had a 10.16 cm (4”) diameter, a 0.635 cm (0.25”) thick flange, and was 5.08 cm (2”) tall. They noted that it could withstand pressure up until 600 psi, which would be a depth of 365 m (1200 ft), and is well beyond our desired testing range.

The calculations shown on the previous slide make assumptions about the material chosen, as the exact plexiglass used by the company isn’t advertised. The paper discusses a similar test ran on a dome made of lexan, which resisted until 579 m (1900 ft). Our dome has also been calculated with measurements meant to accommodate the size of the pan/tilt mechanism.

The white paper can be found here: https://www.eztopsworldwide.com/EZ-TOPS%20Dome%20Test.pdf

Buoyancy Calculations

The buoyancy of the submarine also had to be calculated. Purchasing a heavy part may mean the submarine will never be buoyant, so it was important to verify that all the parts chosen would be usable together. For this reason, a portion of the electrical power will be coming from the on-land battery.

The displacement of the submarine was found by adding the total air volume and total solid volume of the hull components and dome, getting a weight from this and adding the weights of the internal components to get a final value.

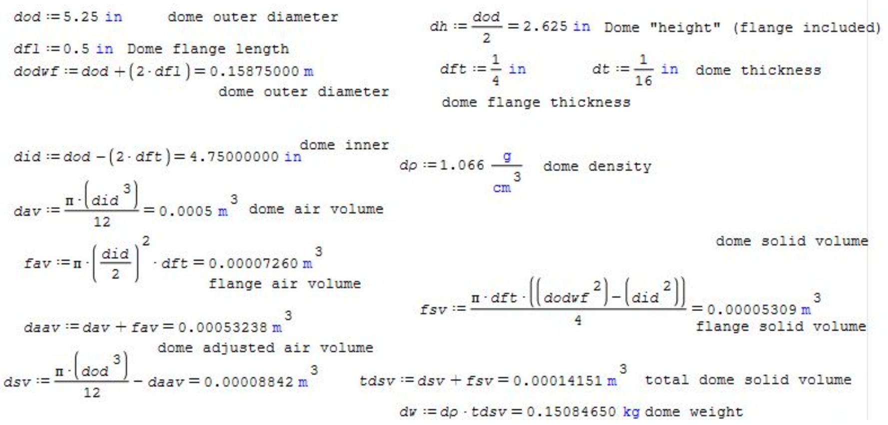
Sub displacement in air = $\sum v_a \rho_a + \sum v_h \rho_h + v_d \rho_d + \sum w$

va = air volume
pa = air density
vh = solid hull volume
ph = solid hull density

vd = solid dome volume
pd = solid dome density
w = internal weights

Neutral buoyancy is achieved when the displacement in water is equal to the displacement in air.

On the right is a sample of the calculations, in this case it is calculating the weight of the dome and the air inside.



$dod := 5.25\ \mathrm{in}$ dome outer diameter

$dfl := 0.5\ \mathrm{in}$ Dome flange length

$dodwf := dod + (2 \cdot dfl) = 0.15875000\ \mathrm{m}$ dome outer diameter

$dh := \frac{dod}{2} = 2.625\ \mathrm{in}$ Dome "height" (flange included)

$dft := \frac{1}{4}\ \mathrm{in}$ dome flange thickness

$dt := \frac{1}{16}\ \mathrm{in}$ dome thickness

$did := dod - (2 \cdot dft) = 4.75000000\ \mathrm{in}$ dome inner

$d\rho := 1.066\ \frac{\mathrm{g}}{\mathrm{cm}^3}$ dome density

$dav := \frac{\pi \cdot (did^3)}{12} = 0.0005\ \mathrm{m}^3$ dome air volume

$fav := \pi \cdot \left(\frac{did}{2}\right)^2 \cdot dft = 0.00007260\ \mathrm{m}^3$ flange air volume

$daav := dav + fav = 0.00053238\ \mathrm{m}^3$ dome adjusted air volume

$dsv := \frac{\pi \cdot (dod^3)}{12} - daav = 0.00008842\ \mathrm{m}^3$ dome solid volume

$fsv := \frac{\pi \cdot dft \cdot ((dodwf^2) - (did^2))}{4} = 0.00005309\ \mathrm{m}^3$ flange solid volume

$tdsv := dsv + fsv = 0.00014151\ \mathrm{m}^3$ total dome solid volume

$dw := d\rho \cdot tdsv = 0.15084650\ \mathrm{kg}$ dome weight

Movement (Ballast)

Once the buoyancy had been calculated, the bladder and pumps could be selected, and a system to fill the bladder and detect it’s fill status could be designed.

- Bladder needs to be sealed and easily drained/filled
- Pump needed to be able to fill the bladder

Movement (Ballast)

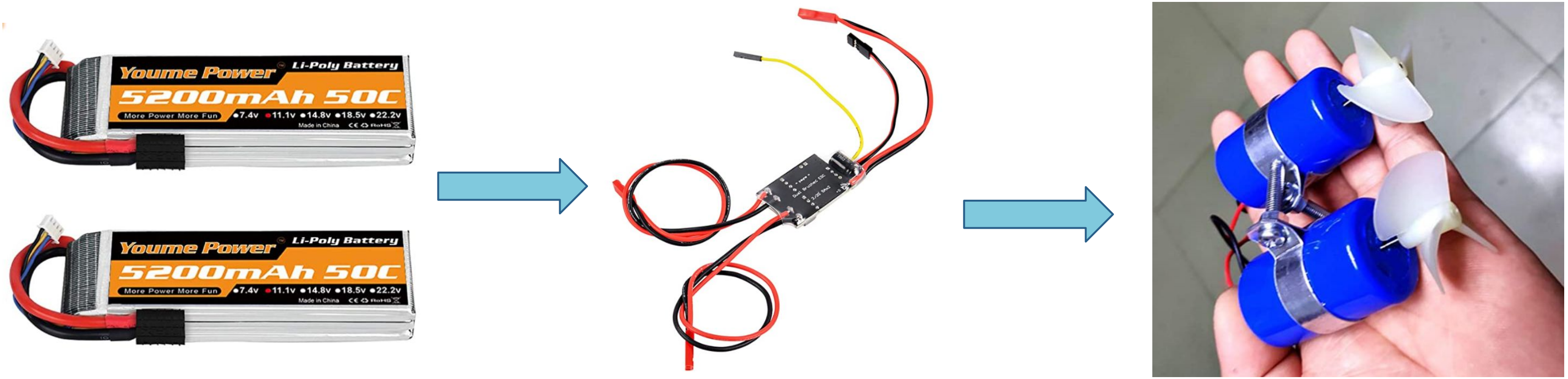
- Exfil pump needs at least 37 PSI force
- Higher Power requirement for stronger pump

Ballast Progress and Budget

Part	Cost	Purpose	Status
HEEPDD 5V Pump	$11.09	Inflow Pump	Acquired
Ironton 12V Pump	$52.99	Exfil Pump	Acquired
11.1V 5.2A/h Battery	$65.69	Exfil Pump Power Supply	Shipping
Bladder	$12.99	Bladder	Shipping

Movement (Propellers)

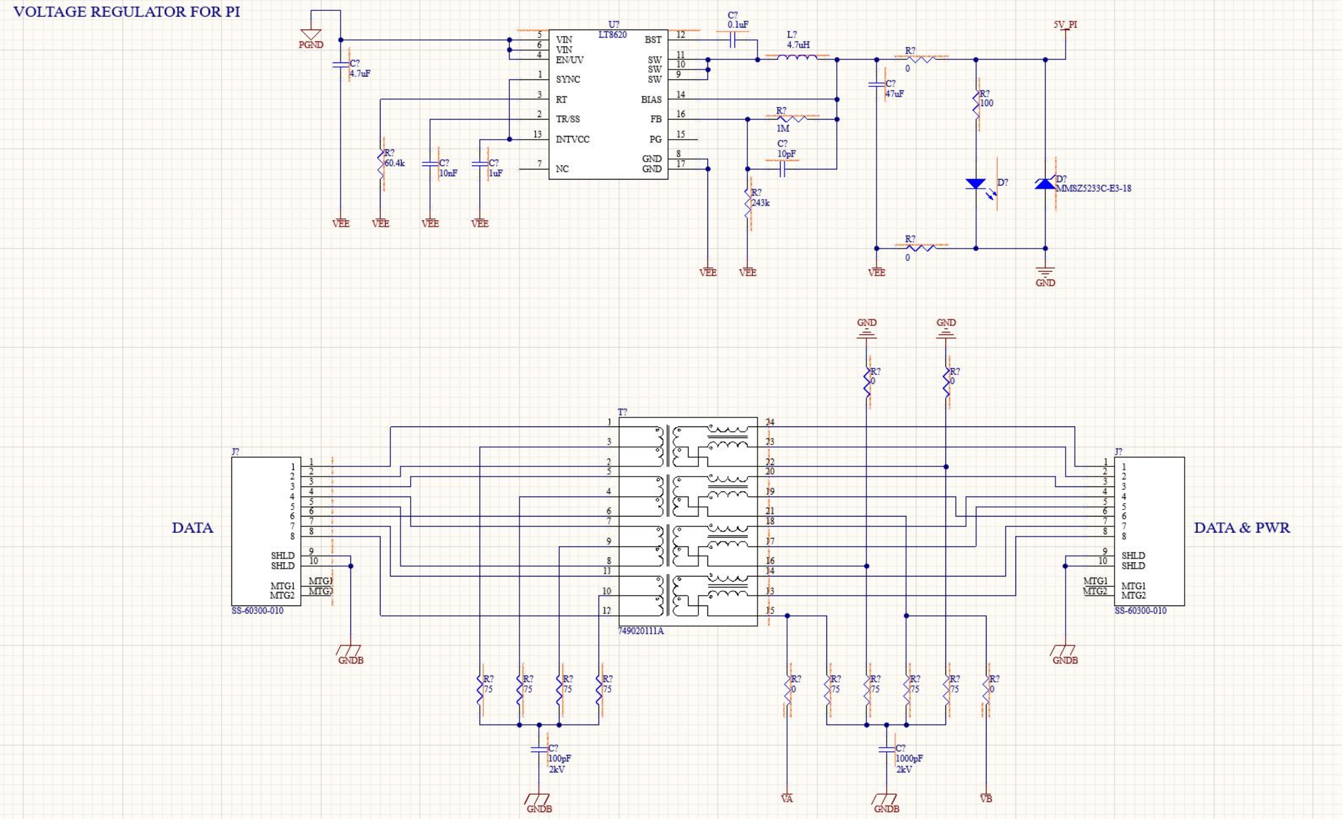
- Two sets of 2 motors
- Each set of motors has its own speed controller, which will be controlled by the controller via the on board raspberry pi
- One battery per set of motors



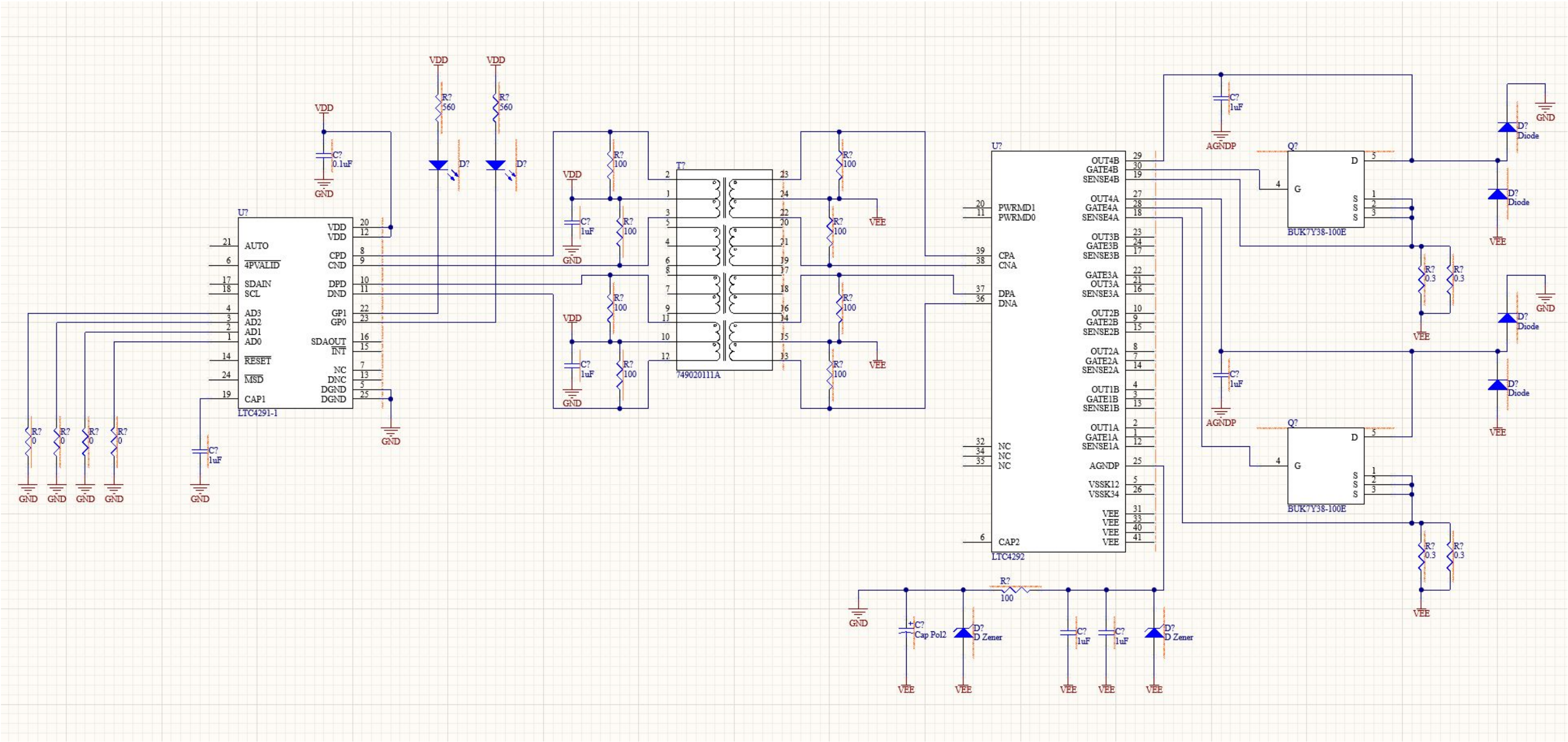
Madison's Budget

Part	Cost	Purpose	Status
Motors	$50 ($25/pair)	Propel drone through water	acquired
Speed Controllers	$34 ($17/pair of motors)	Allow controller to turn motors on/off	acquired
Batteries on board (3)	$120	Power motors and large pump	acquired
Battery charger	$20	Charge batteries	acquired
Ethernet cable	$35	Allow data and power to be transmitted	acquired
Battery on land	$60	Power components	acquired

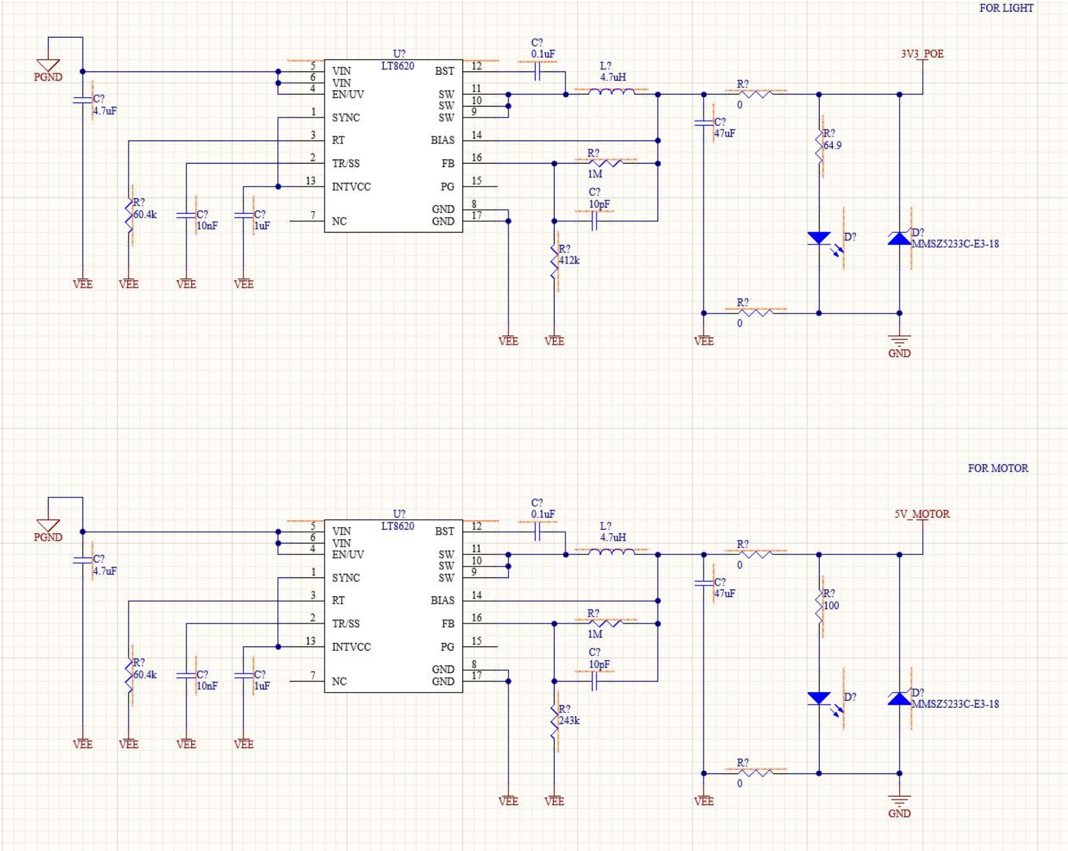
On-board PCB - sheet 1



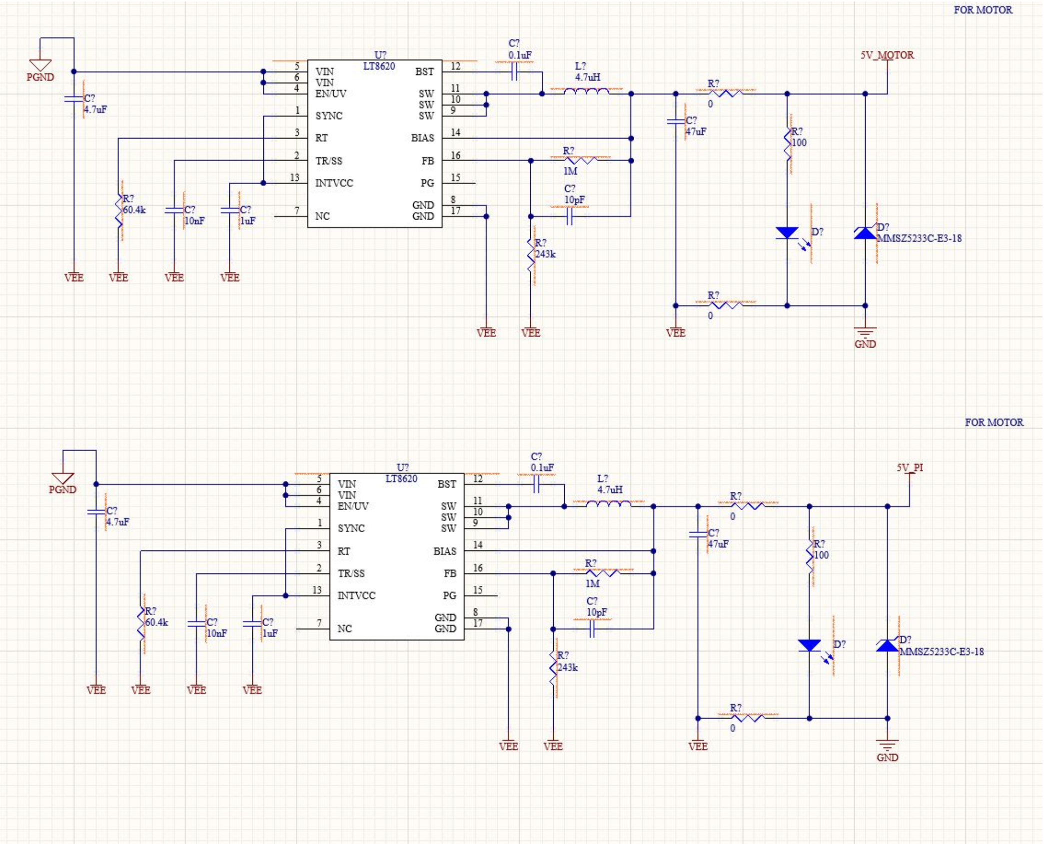
On-board PCB - sheet 2



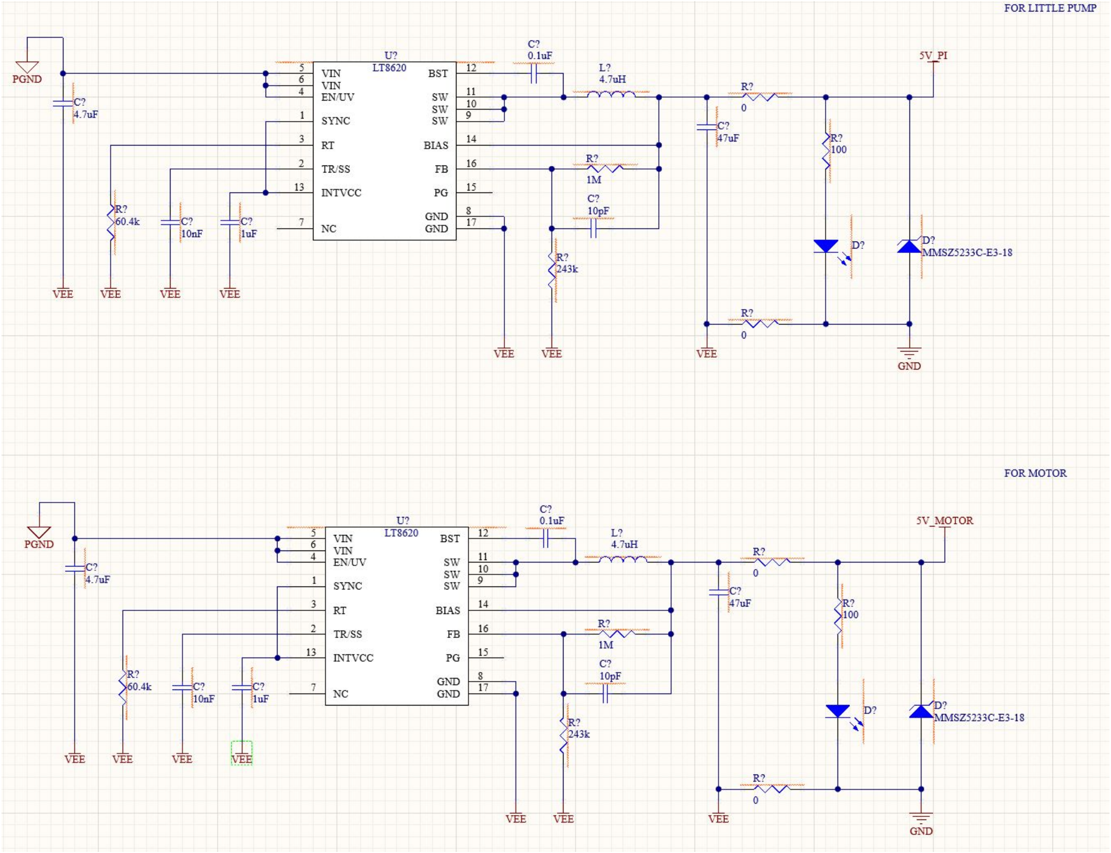
On-board PCB - sheet 3



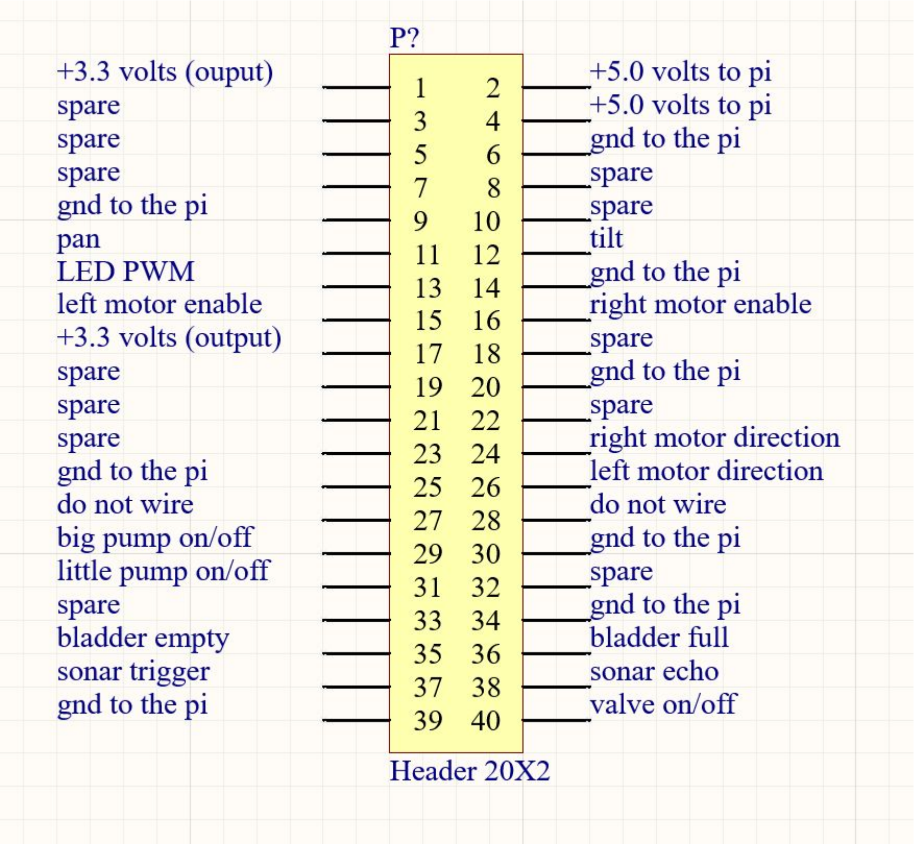
On-board PCB - sheet 4



On-board PCB - sheet 5



On-board PCB - sheet 6

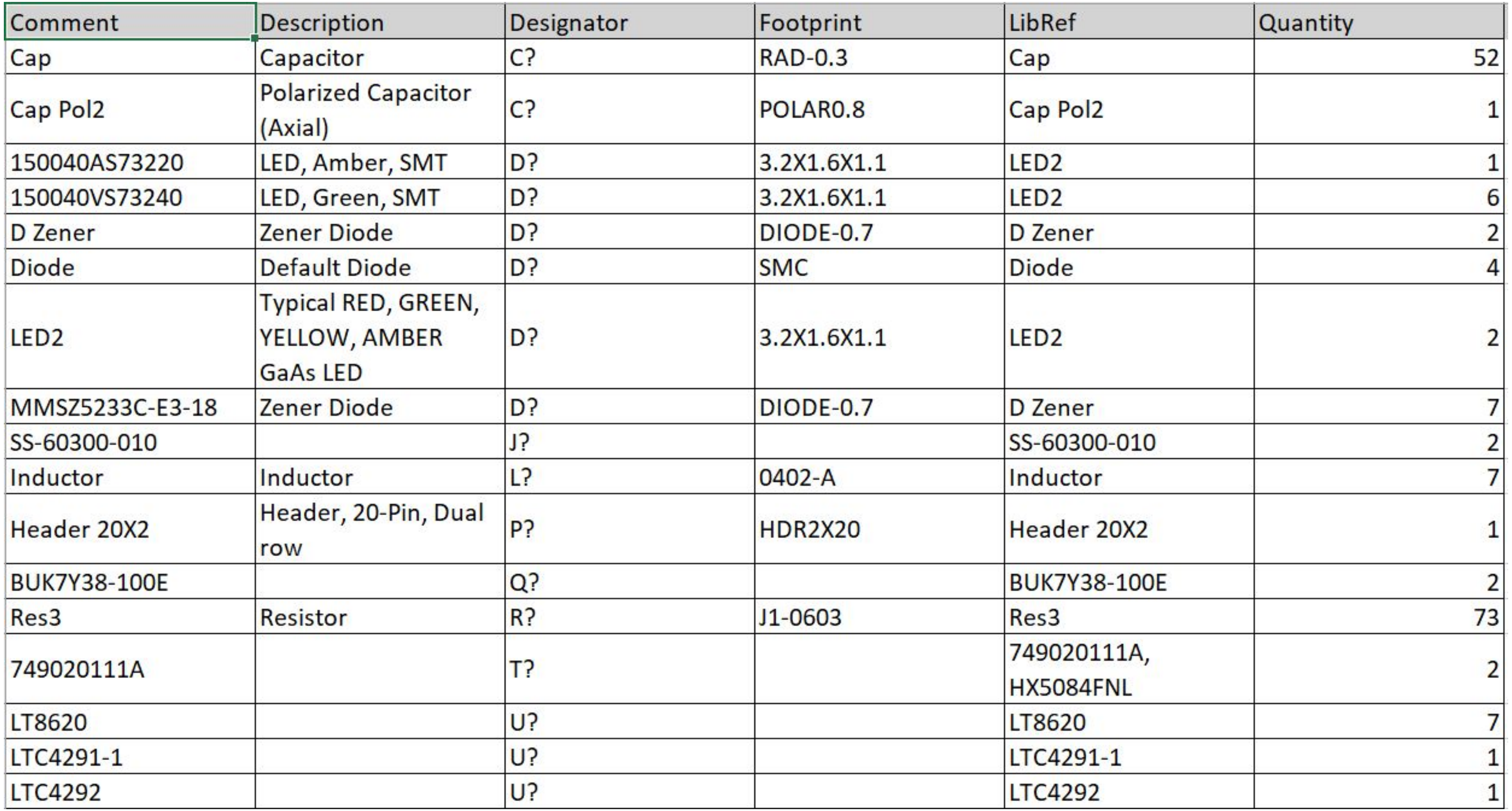


P?

+3.3 volts (ouput)	1	2	+5.0 volts to pi
spare	3	4	+5.0 volts to pi
spare	5	6	gnd to the pi
spare	7	8	spare
gnd to the pi	9	10	spare
pan	11	12	tilt
LED PWM	13	14	gnd to the pi
left motor enable	15	16	right motor enable
+3.3 volts (output)	17	18	spare
spare	19	20	gnd to the pi
spare	21	22	spare
spare	23	24	right motor direction
gnd to the pi	25	26	left motor direction
do not wire	27	28	do not wire
big pump on/off	29	30	gnd to the pi
little pump on/off	31	32	spare
spare	33	34	gnd to the pi
bladder empty	35	36	bladder full
sonar trigger	37	38	sonar echo
gnd to the pi	39	40	valve on/off

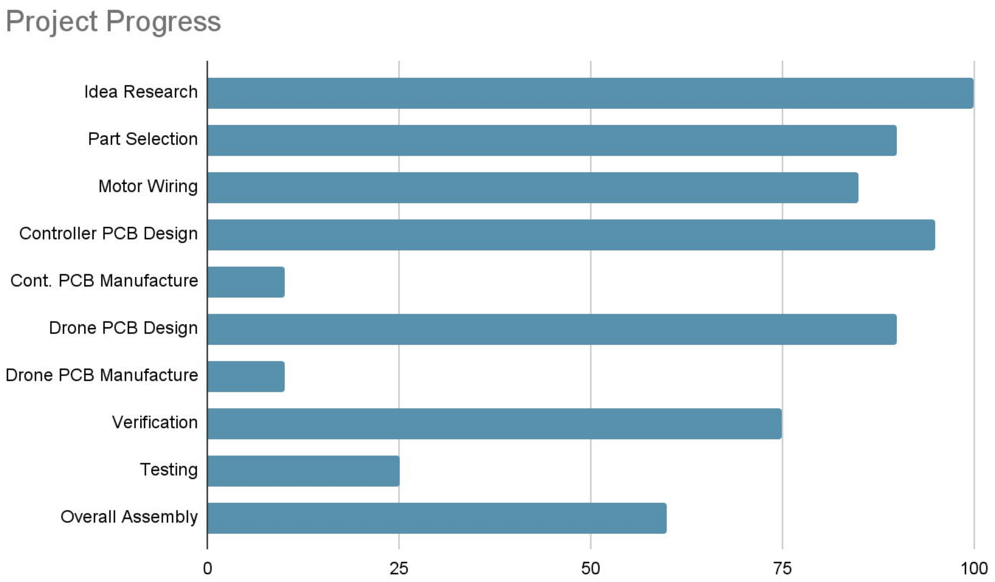
Header 20X2

Droneboard PCB BOM



Comment	Description	Designator	Footprint	LibRef	Quantity
Cap	Capacitor	C?	RAD-0.3	Cap	52
Cap Pol2	Polarized Capacitor (Axial)	C?	POLAR0.8	Cap Pol2	1
150040AS73220	LED, Amber, SMT	D?	3.2X1.6X1.1	LED2	1
150040VS73240	LED, Green, SMT	D?	3.2X1.6X1.1	LED2	6
D Zener	Zener Diode	D?	DIODE-0.7	D Zener	2
Diode	Default Diode	D?	SMC	Diode	4
LED2	Typical RED, GREEN, YELLOW, AMBER GaAs LED	D?	3.2X1.6X1.1	LED2	2
MMSZ5233C-E3-18	Zener Diode	D?	DIODE-0.7	D Zener	7
SS-60300-010		J?		SS-60300-010	2
Inductor	Inductor	L?	0402-A	Inductor	7
Header 20X2	Header, 20-Pin, Dual row	P?	HDR2X20	Header 20X2	1
BUK7Y38-100E		Q?		BUK7Y38-100E	2
Res3	Resistor	R?	J1-0603	Res3	73
749020111A		T?		749020111A, HX5084FNL	2
LT8620		U?		LT8620	7
LTC4291-1		U?		LTC4291-1	1
LTC4292		U?		LTC4292	1

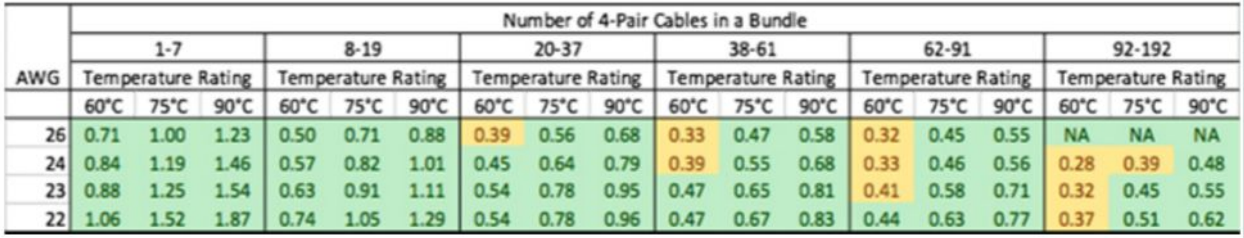
Submarine's Electrical Progress



Power Over Ethernet

Source	Voltage	Current
Small ballast pump	5	0.17
Raspberry Pi	5	3
Flashlight	3.3	0.03
Pan/Tilt & sonar	5	6
Total	19 V	3.2 A

Figure 1: NEC 2020 Table 725.144 adjusted for 45°C ambient temperature

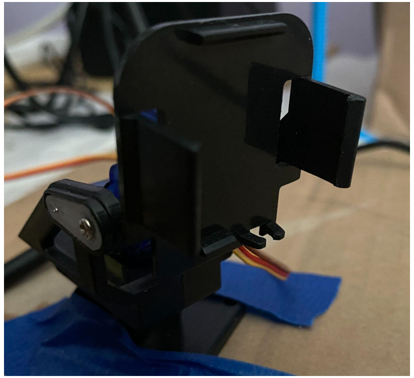


AWG	Number of 4-Pair Cables in a Bundle																	
	1-7			8-19			20-37			38-61			62-91			92-192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	0.71	1.00	1.23	0.50	0.71	0.88	0.39	0.56	0.68	0.33	0.47	0.58	0.32	0.45	0.55	NA	NA	NA
24	0.84	1.19	1.46	0.57	0.82	1.01	0.45	0.64	0.79	0.39	0.55	0.68	0.33	0.46	0.56	0.28	0.39	0.48
23	0.88	1.25	1.54	0.63	0.91	1.11	0.54	0.78	0.95	0.47	0.65	0.81	0.41	0.58	0.71	0.32	0.45	0.55
22	1.06	1.52	1.87	0.74	1.05	1.29	0.54	0.78	0.96	0.47	0.67	0.83	0.44	0.63	0.77	0.37	0.51	0.62

Vision (Camera)

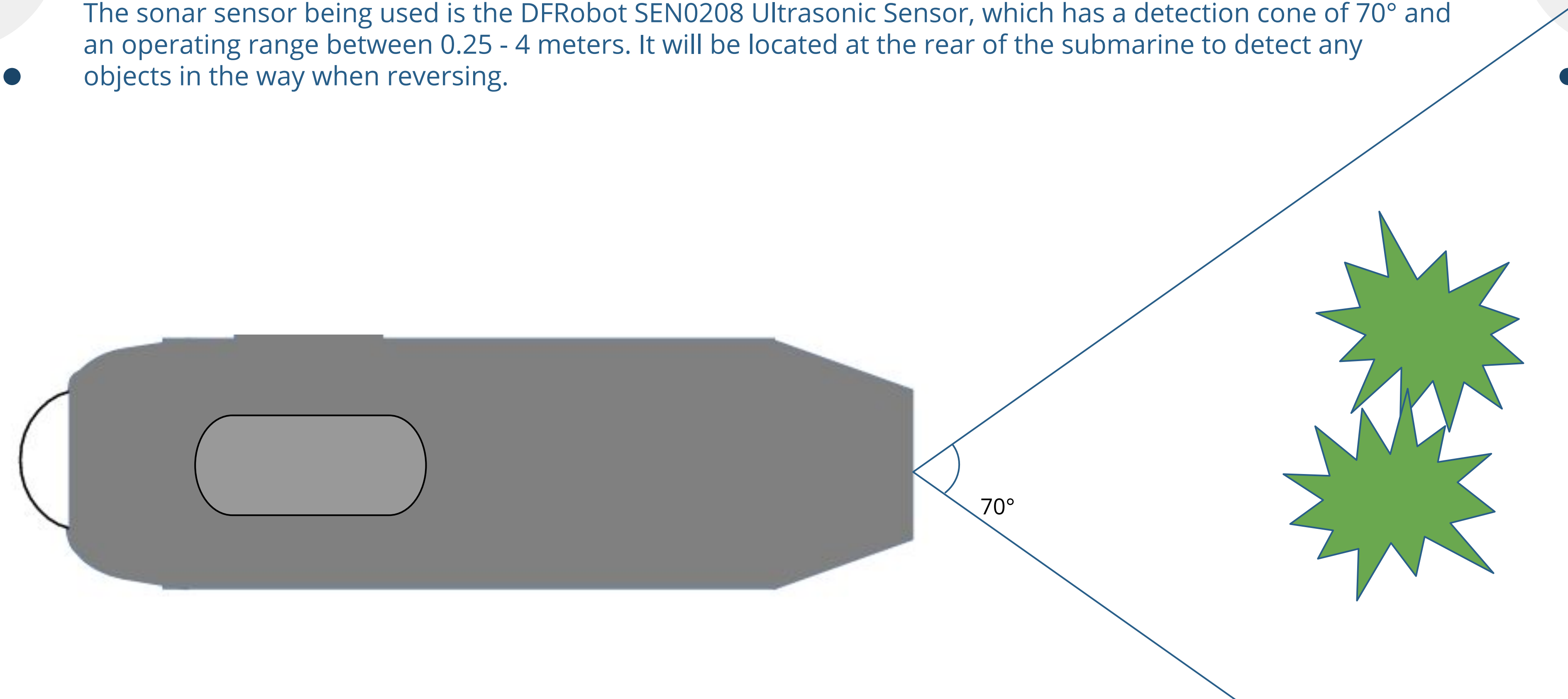
The Raspberry Pi Camera Module V2 was chosen for:

- Ease of interaction (it's meant for the Pi)
- Low price-point (less costly to replace)
- Small size (easily fits within submarine, and pairs with pan/tilt nicely)
- Capturing 1080p30 video
- Has a number of programmable options for image quality such as white-balancing and color-balancing.
- Frames can be captured using the C++ version of the OpenCV library, and then transmitted via UDP to the controller.



Ultrasonic Sensor

The sonar sensor being used is the DFRobot SEN0208 Ultrasonic Sensor, which has a detection cone of 70° and an operating range between 0.25 - 4 meters. It will be located at the rear of the submarine to detect any objects in the way when reversing.



Raspberry Pi

The Raspberry Pi 4B+ was selected for its compatibility with the Raspberry Pi Camera Module v2 along with its gigabit ethernet capabilities and multiple interface types (USB, HDMI, MIPI-CSI). Additionally, the Raspberry Pi is well supported, and its size and price point were also influential in its use inside both the submarine itself and when paired with the controller.

Additionally, the Raspberry Pi was chosen over microcontrollers due to the flexibility that the OS provides. We use Raspbian on both Pis, and as such are given:

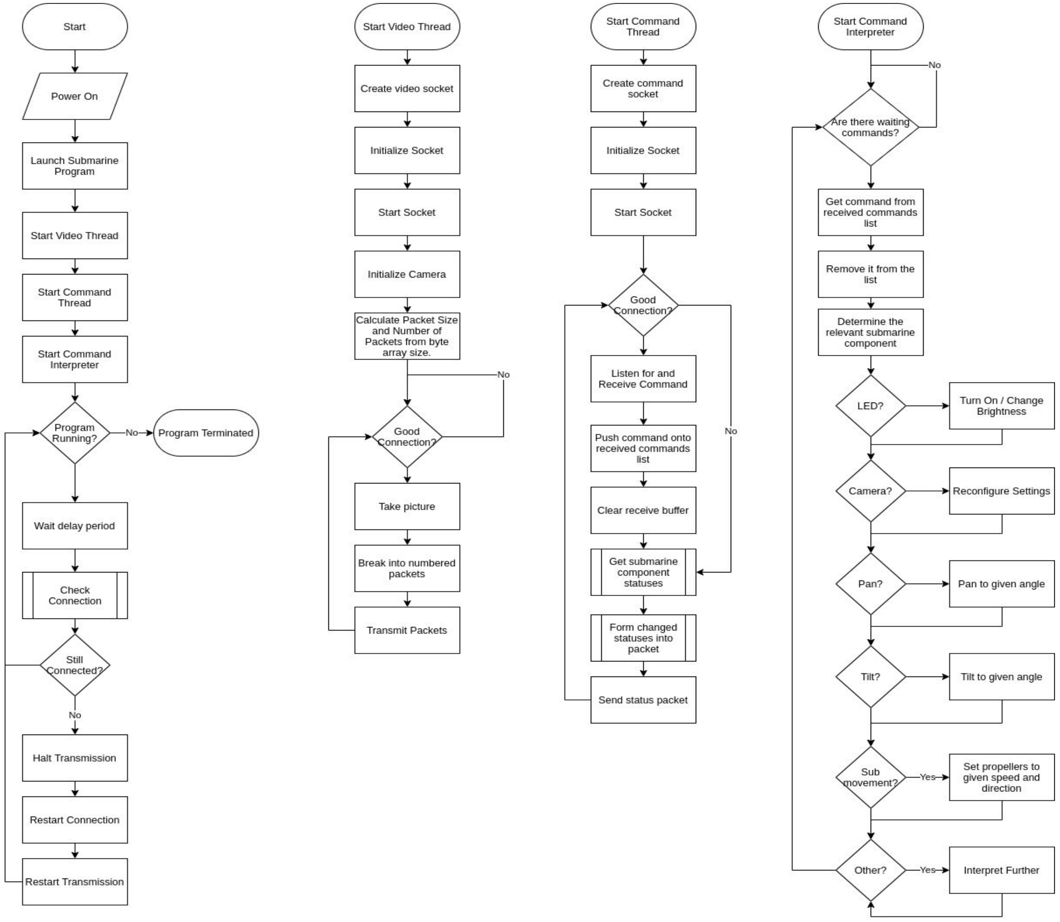
- Greater programming language freedom
- Use of potentially cross-language libraries (especially when dealing with GPIO)
- The use of existing libraries
- Optimized thread handling and networking
- The ability to SSH into either Pi should diagnosis be needed during testing
- Can Run the VLC using the OS of the Raspberry Pi

Submarine I/O Map

Pin	Functionality	Direction	Pin	Functionality	Direction
11	Pan	Out	29	Big Pump On/Off	Out
12	Tilt	Out	31	Little Pump On/Off	Out
13	LED PWM	Out	35	Bladder Empty	In
15	Left Motor Enable	Out	36	Bladder Full	In
16	Right Motor Enable	Out	37	Sonar Trigger	Out
18	Left Motor Direction	Out	38	Sonar Echo	In
22	Right Motor Direction	Out	40	Valve On/Off	Out

The I/O Map for the on-board Raspberry Pi. Orange indicates 3.3V, Red indicates 5V, Black indicates Grounds, and Grey are reserved / unused pins.

Software Diagram (Submarine)



Start
Power On
Launch Submarine Program
Start Video Thread
Start Command Thread
Start Command Interpreter
Program Running?
No
Program Terminated
Wait delay period
Check Connection
Still Connected?
No
Halt Transmission
Restart Connection
Restart Transmission

Start Video Thread
Create video socket
Initialize Socket
Start Socket
Initialize Camera
Calculate Packet Size and Number of Packets from byte array size.
Good Connection?
No
Take picture
Break into numbered packets
Transmit Packets

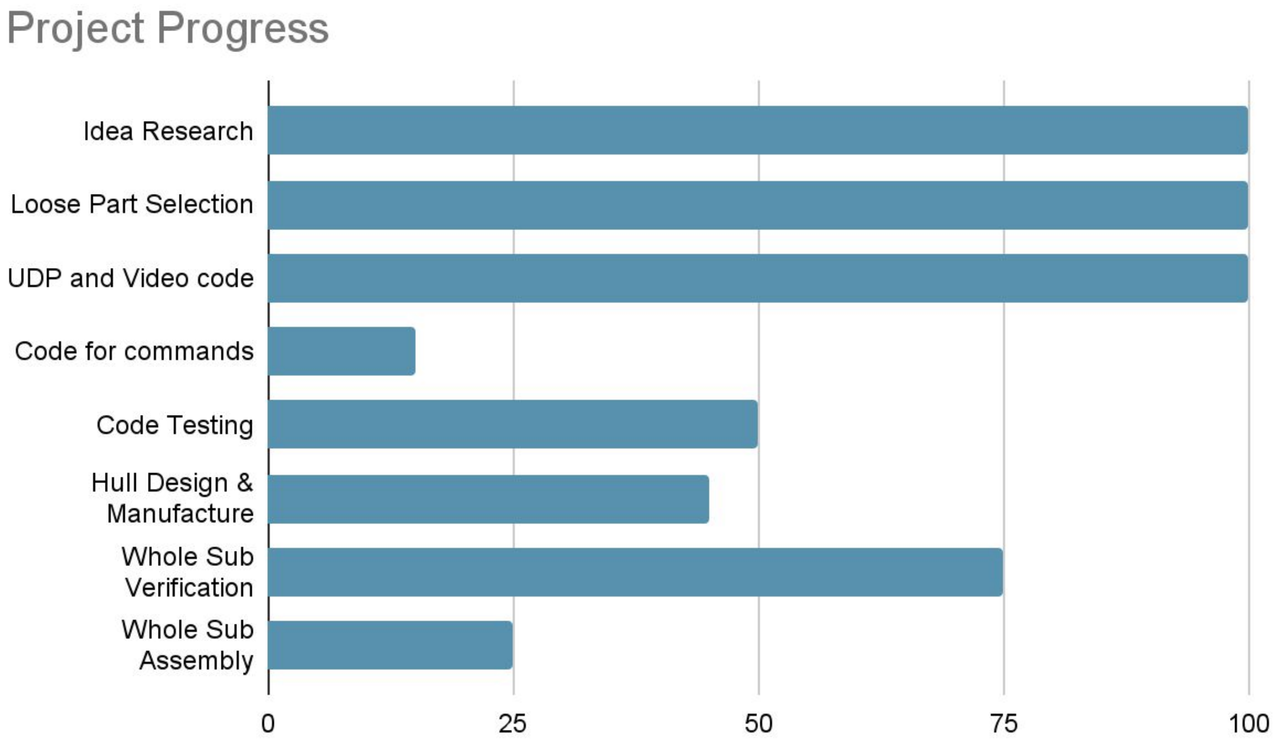
Start Command Thread
Create command socket
Initialize Socket
Start Socket
Good Connection?
No
Listen for and Receive Command
Push command onto received commands list
Clear receive buffer
Get submarine component statuses
Form changed statuses into packet
Send status packet

Start Command Interpreter
No
Are there waiting commands?
Get command from received commands list
Remove it from the list
Determine the relevant submarine component
LED?
Turn On / Change Brightness
Camera?
Reconfigure Settings
Pan?
Pan to given angle
Tilt?
Tilt to given angle
Sub movement?
Yes
Set propellers to given speed and direction
Other?
Yes
Interpret Further

Hull and Camera Budget

Item	Purpose	Weight/Item (kg)	Price/Item	Count	Price for Parts
Raspberry Pi 4B+ (8GB)	Control	0.15	$75.00	1	$75.00
Raspberry Pi Camera Module	Camera	0.0034	$29.95	1	$29.95
Pan/Tilt Mechanism	Pan/Tilt	0.02	$6.95	1	$6.95
DFRobot SEN0208 Ultrasonic Sensor	Detection	0.054	$1.00	1	$1.00
Internal Mounting Plate	Mounting	?	?	1	?
6-inch plexiglass dome	Hull	0.1508	$34.50	1	$34.50
8"*2' Schedule 40 Plain End Charlotte PVC Pipe	Hull	4.9315	$29.31	1	$29.31
3d printed ogive (dome mount)	Hull	2.084	?	1	expensive!
3d printed conning tower	Hull	0.94355	?	1	expensive!
3d printed engine mount	Hull	1.9729	?	1	expensive!
					$176.71

Hull and Submarine Coding Progress



UDP

The submarine will be utilizing UDP to communicate to the controller. UDP is well known for being a fast, “fire and forget” protocol, which serves as the foundation for the more sophisticated Real-time Transport Protocol (RTP). This is ideal, as priority lies in the controller receiving image data and the submarine receiving command data in their respective sockets.

No time is lost with acknowledging sets of packets, as packets are sent in character arrays containing their packet numbers. These can then be directly inserted into the image, meaning any lost data can be quickly overridden by the next incoming packet set. A similar setup has been used for the transmission of submarine component statuses such as the pumps, as well as the commands being received by the submarine.

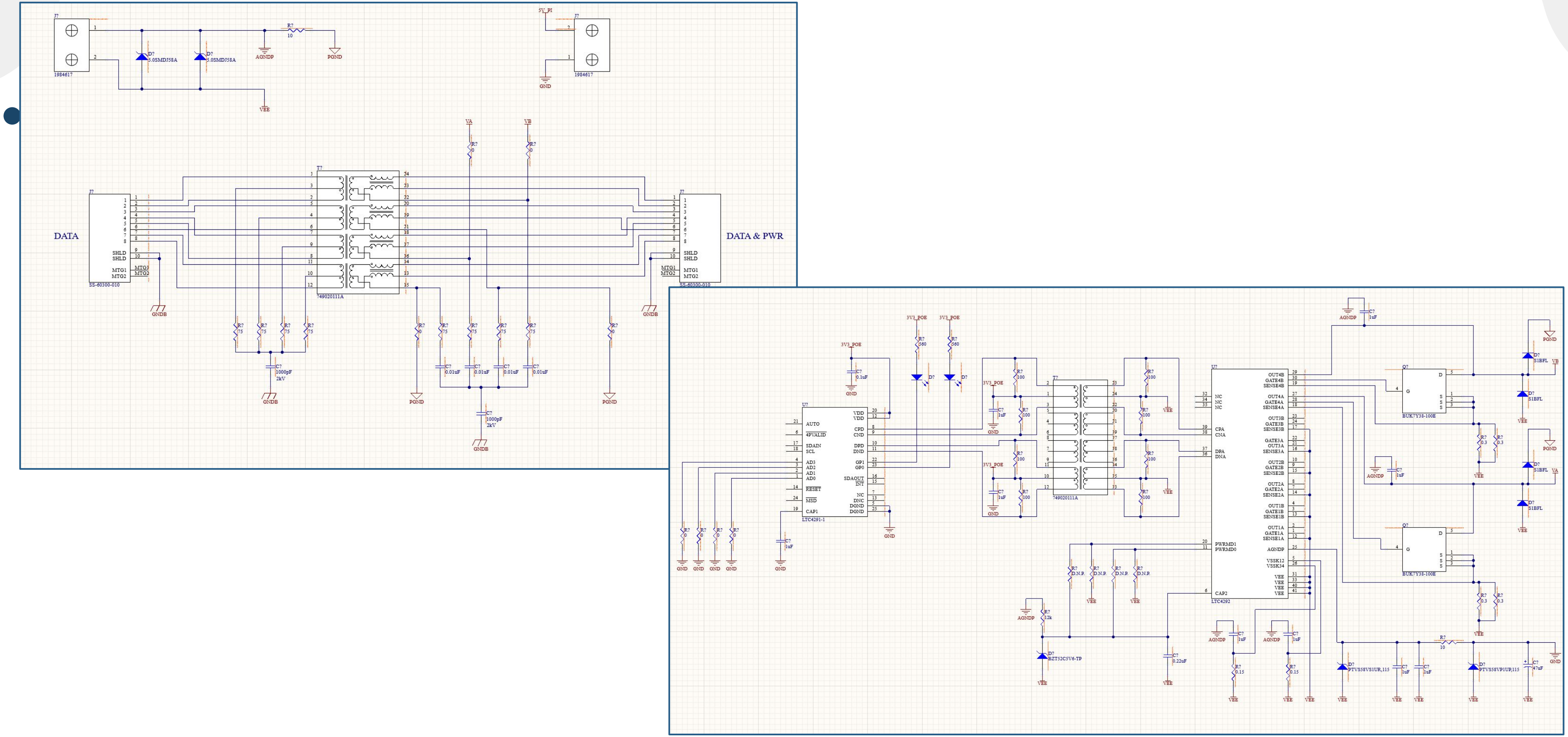
The images must be broken down into sets of packets due to the size of the images being much larger than the maximum size of data allowed in a packet - just under 64 KB. However, calculations are performed in the program to determine the maximum amount of data that can be transmitted at a time to result in a whole number of packets. Dealing with a whole number simplifies packet transmission and assembly schemes, as the final packet doesn’t have to be specially treated (if the remaining image data needed to be extracted from a significantly larger packet).

Why wired?

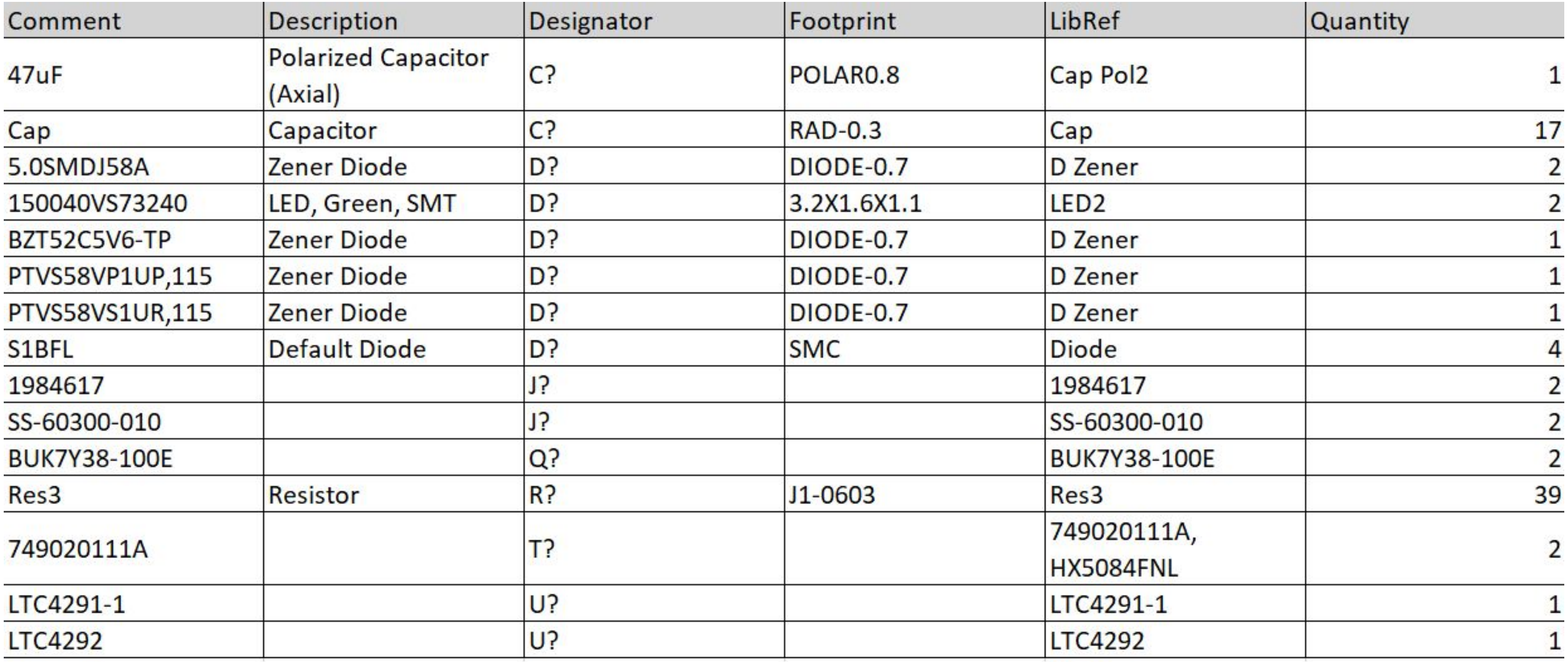
- Wifi signals can’t penetrate the water!
    - Only low frequency or very low frequency transmissions can get through, and are typically not suitable for image streaming. This is because of the poor bitrate which is on the order of hundreds of bits per second, HD pictures require at least megabytes.
    - MIT’s 2018 work on the subject was not successful past 3.5 meters underwater, and did not work well in rough waters (like the ocean).
- The submarine needed to be easily retrievable. The wire can be pulled in to shore.
- Use of a buoy out in the water to extend the range would necessitate a way to retrieve the buoy anyway.
    - Buoys out in the water can float away and become a surface level hazard to ships and swimmers.

- Having large batteries on the submarine compromises its buoyancy, so these were moved to land, as discussed on the Power over Ethernet slide.

Land PCB schematic

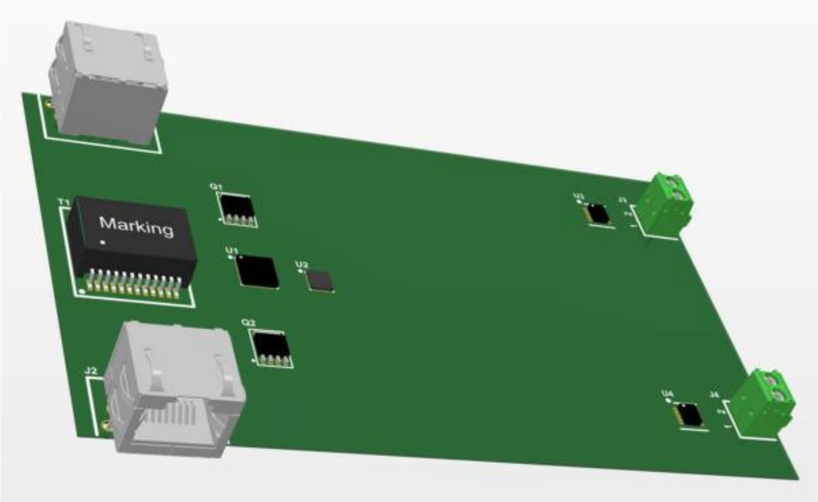


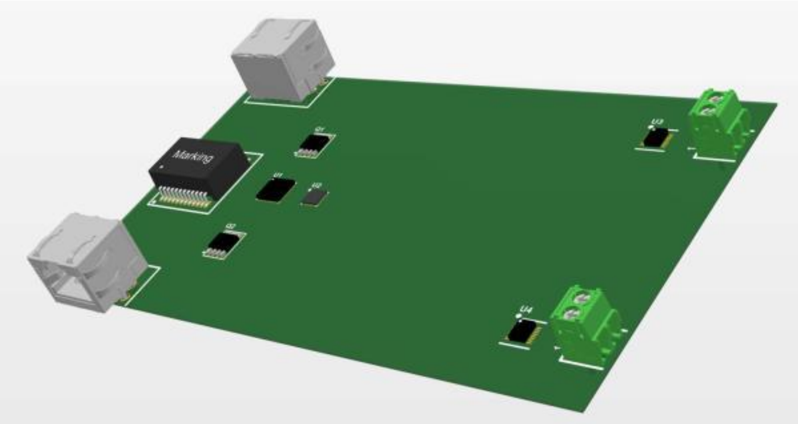
Land Board BOM



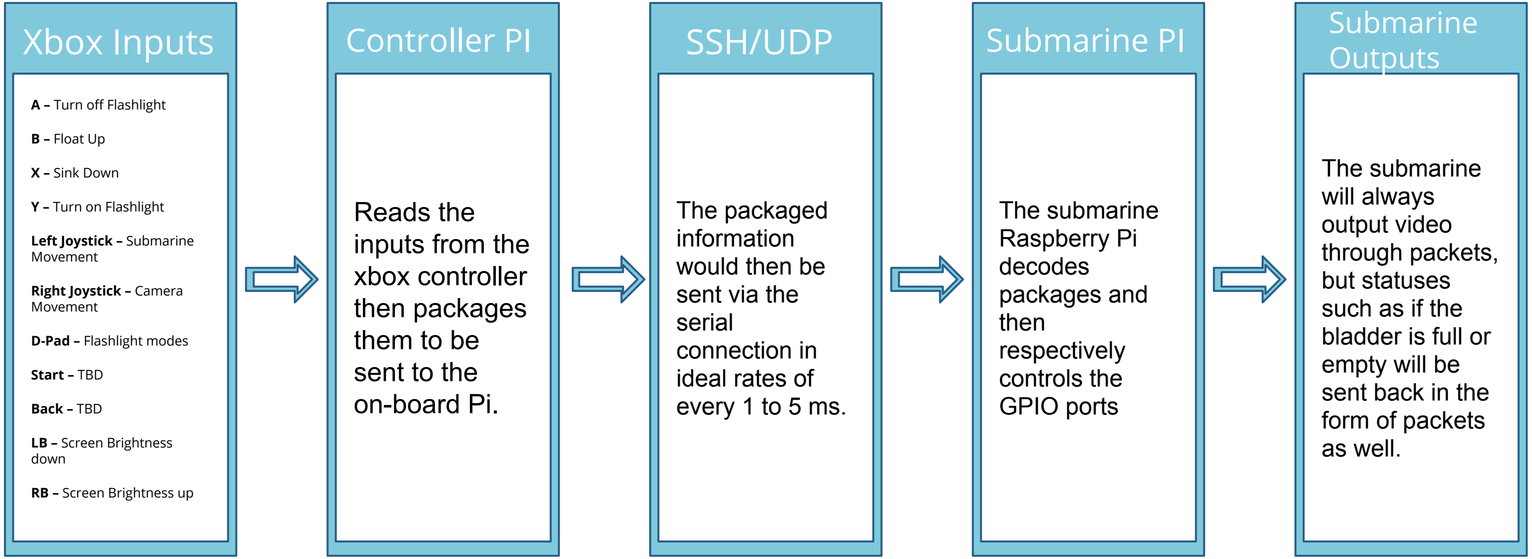
Comment	Description	Designator	Footprint	LibRef	Quantity
47uF	Polarized Capacitor (Axial)	C?	POLAR0.8	Cap Pol2	1
Cap	Capacitor	C?	RAD-0.3	Cap	17
5.0SMDJ58A	Zener Diode	D?	DIODE-0.7	D Zener	2
150040VS73240	LED, Green, SMT	D?	3.2X1.6X1.1	LED2	2
BZT52C5V6-TP	Zener Diode	D?	DIODE-0.7	D Zener	1
PTVS58VP1UP,115	Zener Diode	D?	DIODE-0.7	D Zener	1
PTVS58VS1UR,115	Zener Diode	D?	DIODE-0.7	D Zener	1
S1BFL	Default Diode	D?	SMC	Diode	4
1984617		J?		1984617	2
SS-60300-010		J?		SS-60300-010	2
BUK7Y38-100E		Q?		BUK7Y38-100E	2
Res3	Resistor	R?	J1-0603	Res3	39
749020111A		T?		749020111A, HX5084FNL	2
LTC4291-1		U?		LTC4291-1	1
LTC4292		U?		LTC4292	1

Land PCB Layout





Software Diagram (Controller)



Xbox Inputs

A – Turn off Flashlight

B – Float Up

X – Sink Down

Y – Turn on Flashlight

Left Joystick – Submarine Movement

Right Joystick – Camera Movement

D-Pad – Flashlight modes

Start – TBD

Back – TBD

LB – Screen Brightness down

RB – Screen Brightness up

Controller PI

Reads the inputs from the xbox controller then packages them to be sent to the on-board Pi.

SSH/UDP

The packaged information would then be sent via the serial connection in ideal rates of every 1 to 5 ms.

Submarine PI

The submarine Raspberry Pi decodes packages and then respectively controls the GPIO ports

Submarine Outputs

The submarine will always output video through packets, but statuses such as if the bladder is full or empty will be sent back in the form of packets as well.

Controller Design

Why Not Make Our Own Controller?

The reason for using an aftermarket controller instead of creating a new controller is because the aftermarket controller allows us to enable touch screen sensitivity on the display and add more inputs rather than limiting the Raspberry Pi I/O to only capturing touch input.

What is the significance of the touch-screen?

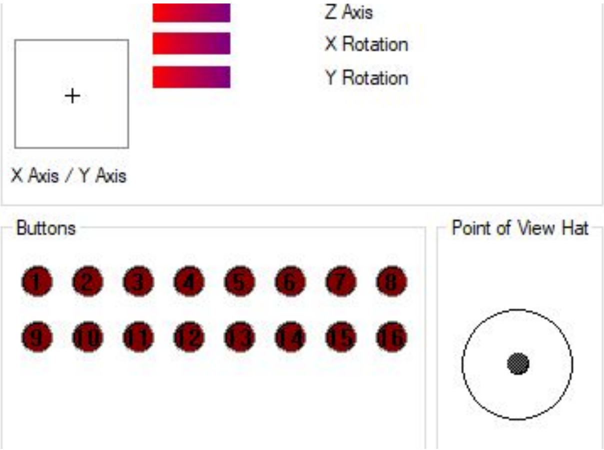
The reason the design maintains the touch screen sensitivity as a priority is because it allows for software interactions such as button inputs via the screen or dials displayed slightly transparently over the submarine imagery.

Initializing the Xbox Controller to the PI

1. Initialized the Pi to the most recent Raspbian using the commands:
   a. `sudo apt-get update`
   b. `sudo apt-get upgrade`
2. Install the driver that connects the controller and the Pi:
   a. `sudo apt-get install xboxdrv`
3. Establish the controller as the mouse of the Raspberry Pi:
   a. `sudo xboxdrv --detach-kernel-driver --silent --mouse`
4. The mouse commands become:
   a. **A –** Left click, **B –** Right-click, **X –** Middle mouse click, **Y –** Enter, **Left Joystick –** Mouse movement, **Right Joystick –** Scroll wheel, **D-Pad –** Arrow keys, **Start –** Forward, **Back –** Back, **LB –** Page up, **RB –** Page down

Controlling the Submarine Pi on Land

- Using a similar process to that of the windows software we can track the controller inputs being received and send them to the Submarine.
- The Controller input process conjoined with pigpio software allows for us to directly control the GPIO pins of the Submarine Pi from the land controller.
- This process is initialized by scripts thats run on bootup for both sides and allow the two entities to connect to each other without human initialization meaning any can power and play the device.



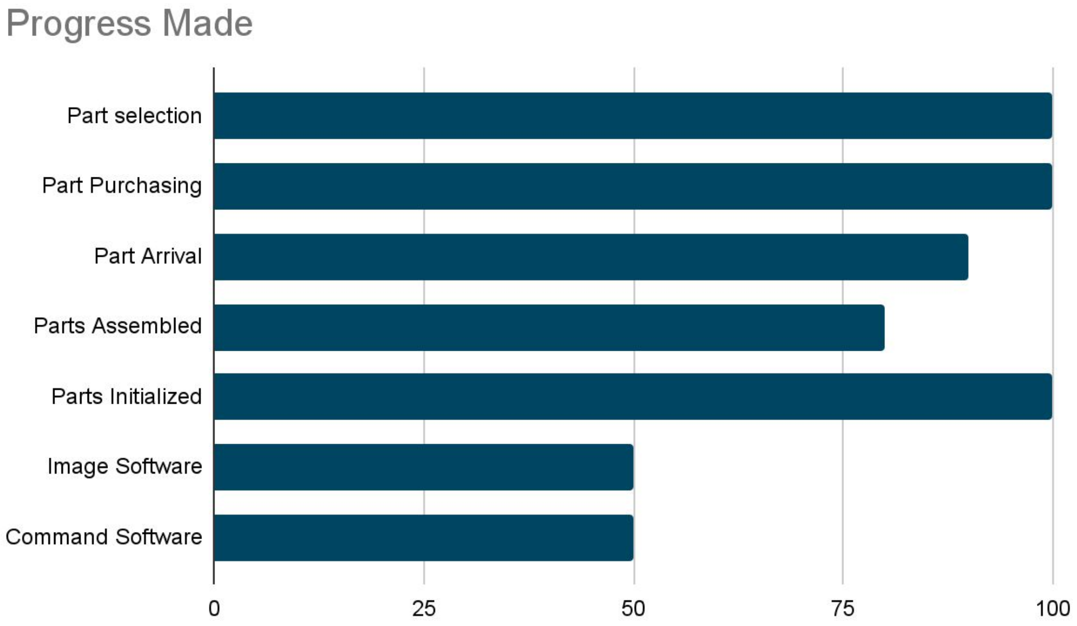
Controller Progress Chart

The Remaining steps that need to be taken with the controller are:

- Have the image software livestream from the submarine to the controller directly.
- Have the command software directly control the Submarines peripherals.

We are also waiting on the mounting bracket for the controller and the Pi in order to assemble the full controller.

Once the complete controller is finished we can then synchronize the submarine pi and the land pi and then test functions such as motor control and fine tuning.



Controller Budget Chart

Submarine Controller Components					
Item	**Purpose**	**Weight/Item**	**Price/Item**	**Count**	**Price for Parts**
Screen	controller	3.20 ounces	$39.66	1	$39.66
Raspberry Pi	controller	1.76 ounces	$75.00	1	$75.00
Controller	controller	12.28 ounces	$24.99	1	$24.99
Display Mount	controller	5 ounces	$7.99	1	$7.99
Pi and Screen casing	controller	4.5 ounces	$14.00	1	$14.00
Total:				5	$161.64
Total Allotted:					$250.00
Budget left:					$88.36

Thank you for watching!