Final Presentation

Hackaday Prize 2020 - Conservation X Labs

September 18, 2020

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SUPPLYFRAME
DESIGNLAB
HACKADAY PRIZE 2020

CONSERVATION X LABS

Why Choose Eja?

Our Mission:

Develop a prototype ropeless gear system that can be made at low cost and deployed globally

Now:

- Accessible, low-cost design
- Location data

Potential capabilities:

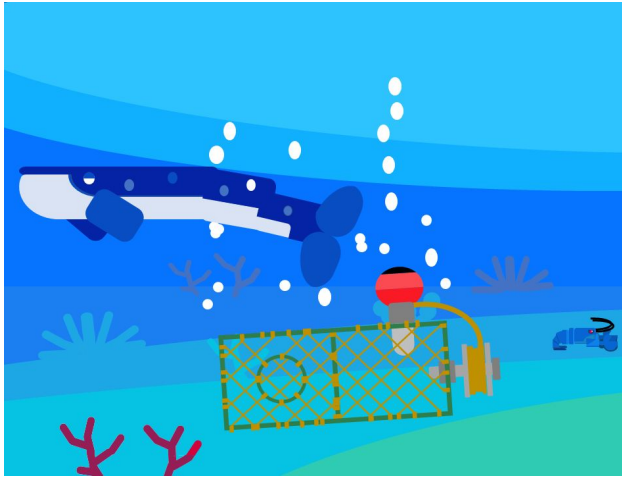
- Gathering data to release the buoy
- Network of buoys (redundancy)

- 10% of identified Ghost Gear were ropes from traps and pots *(Stelfox et al. 2016)*
- Traps and Pots have a higher ghost fishing efficiency
- Trap placement location is lacking data *(based on interviews with fishers)*

Stelfox, Martin & Hudgins, Jillian & Sweet, Michael. (2016). A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs. Marine Pollution Bulletin. 111. 10.1016/j.marpolbul.2016.06.034.

Key Focus, Goals and Constraints

- Help fishers be more data-driven in their work with an intelligent buoy
- Reduce gear loss by being able to locate it
- $250 per system
- Battery powered (72 hours)
- To be deployed globally
- Working prototype by end of Hackaday Prize

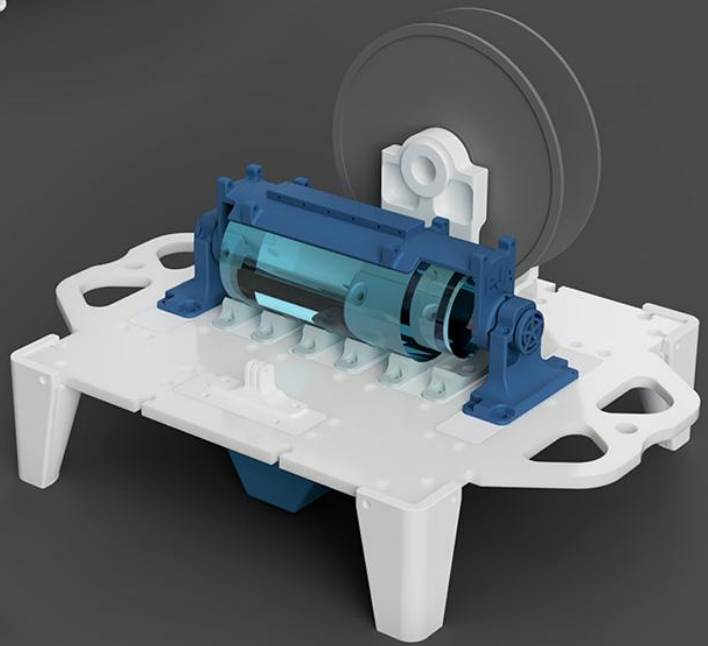


Mechanical Design

Eja: Ropeless Gear System

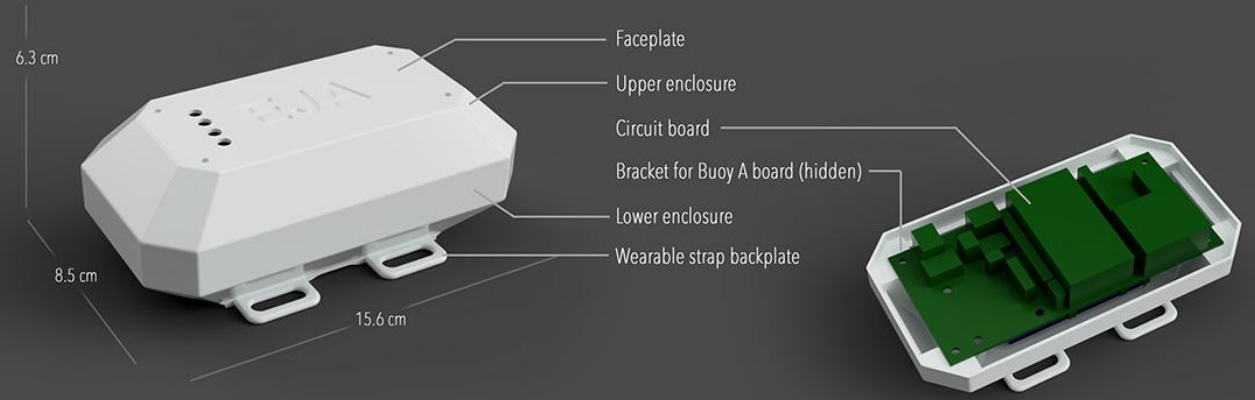
Onboard Gateway

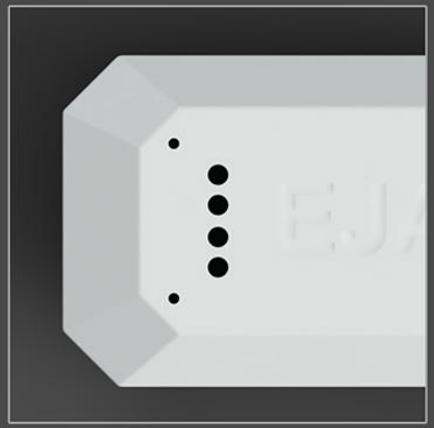
Intelligent Buoy



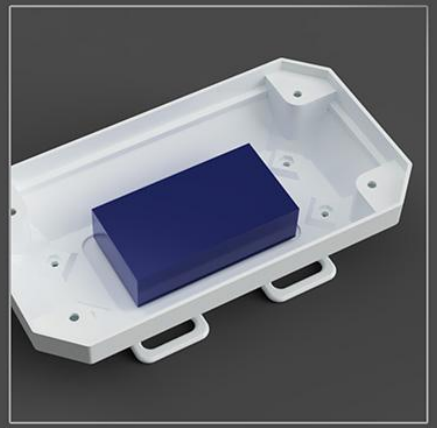
Release Mechanism

Eja: Onboard Gateway

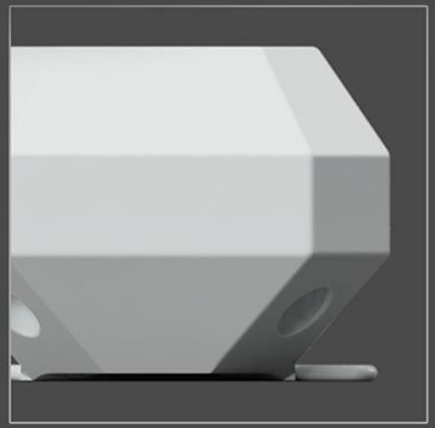




Interchangeable faceplates

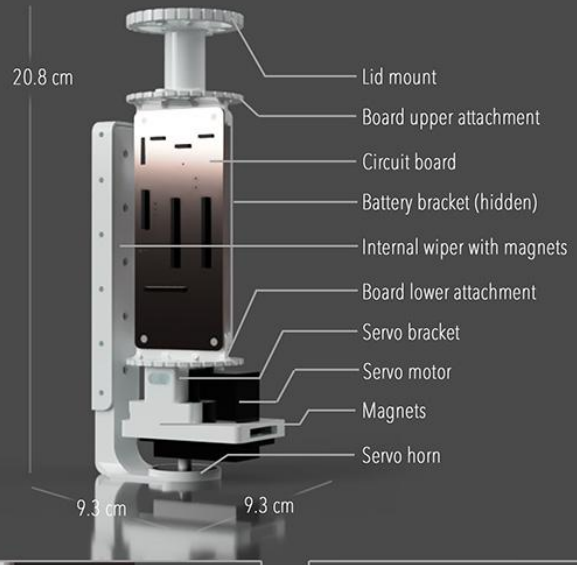


Battery below circuit board



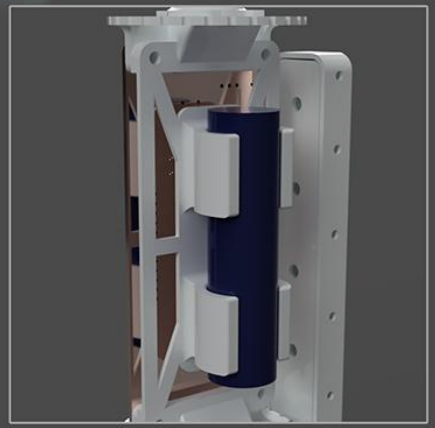
Delightful exterior design

Eja: Intelligent Buoy



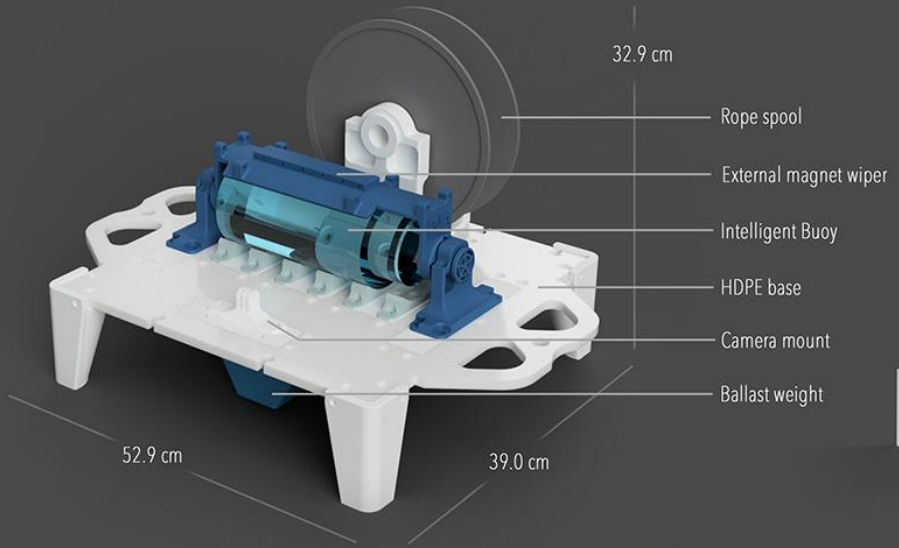
Magnetically coupled servo bracket

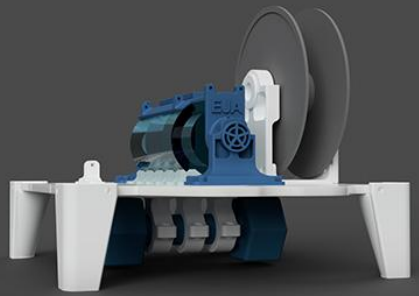
Adheres to inner lid of enclosure

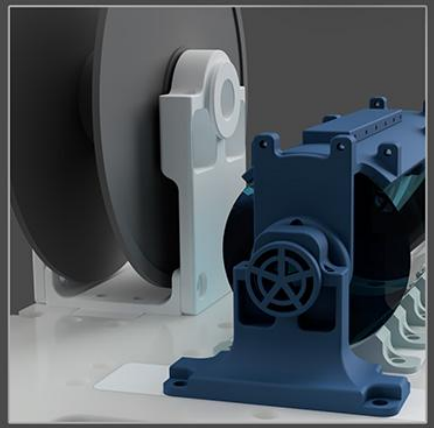


Battery bracket clearance for internal wiper

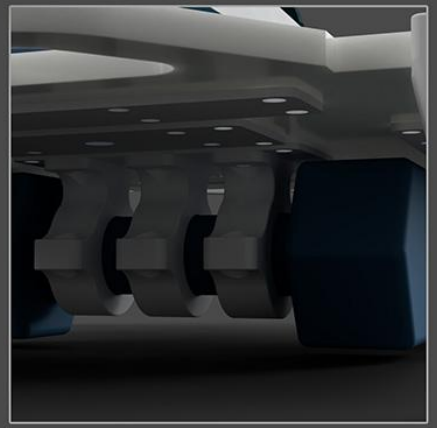
Eja: Release Mechanism



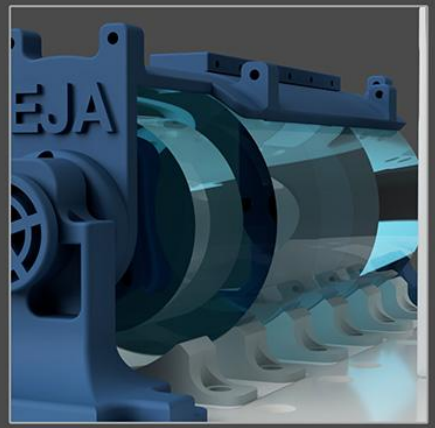




Spool for rope and 3D printed sleeve bearing

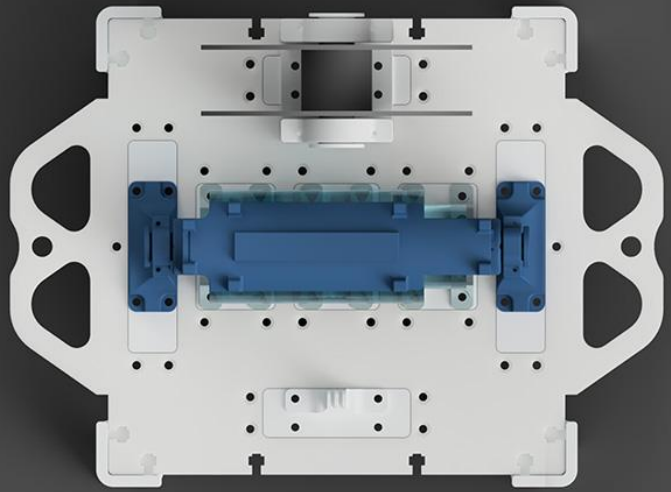


Ballast brackets underneath

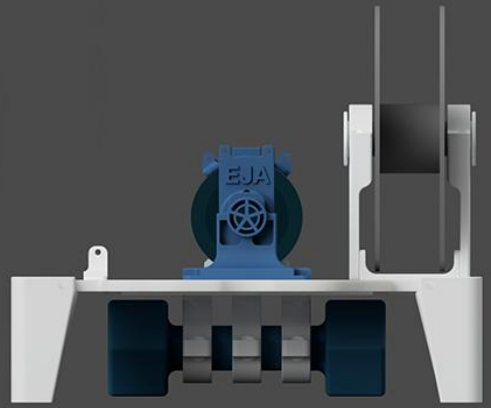


External magnet wiper holding enclosure in place

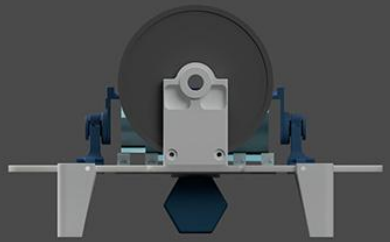
Eja: Release Mechanism



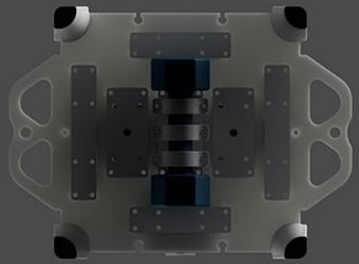
Top View



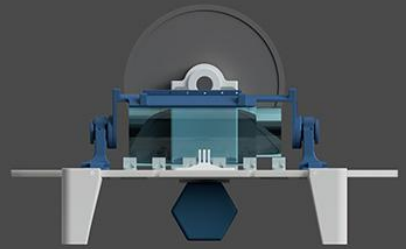
Side View



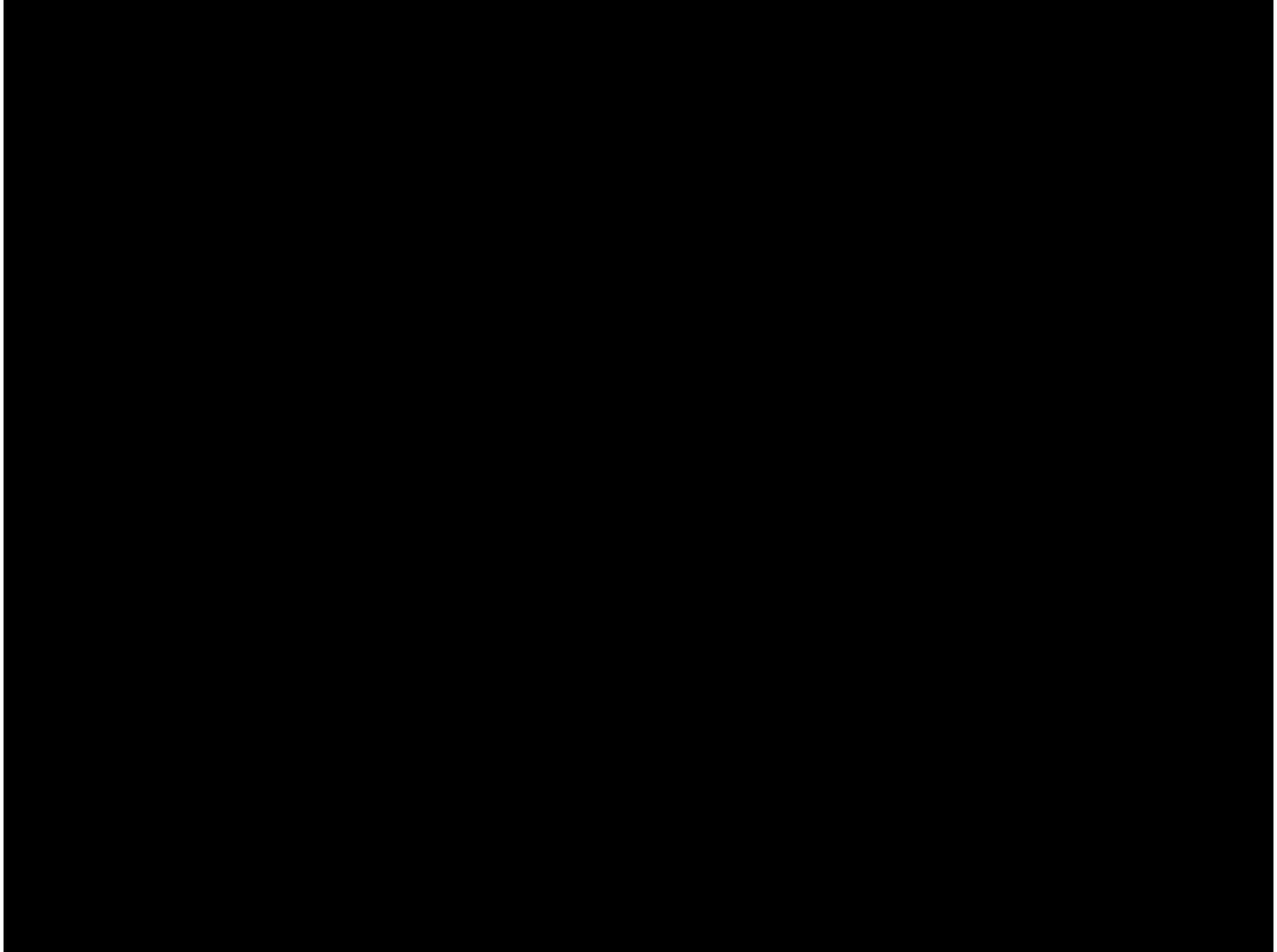
Back View

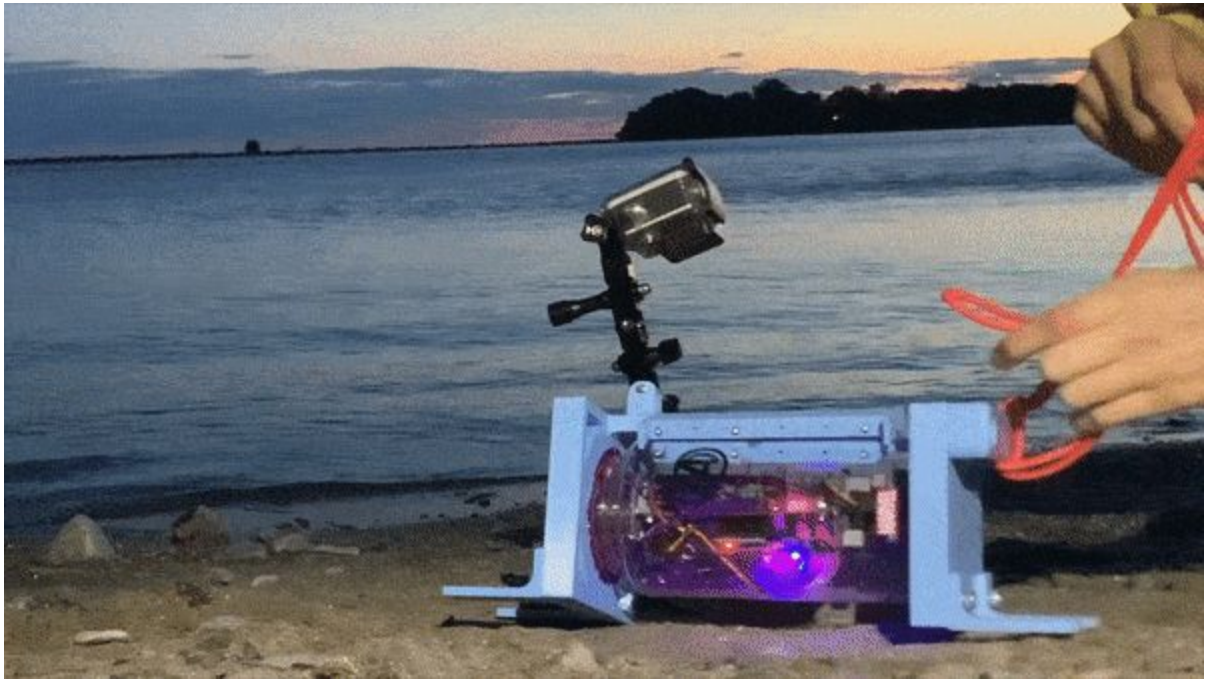


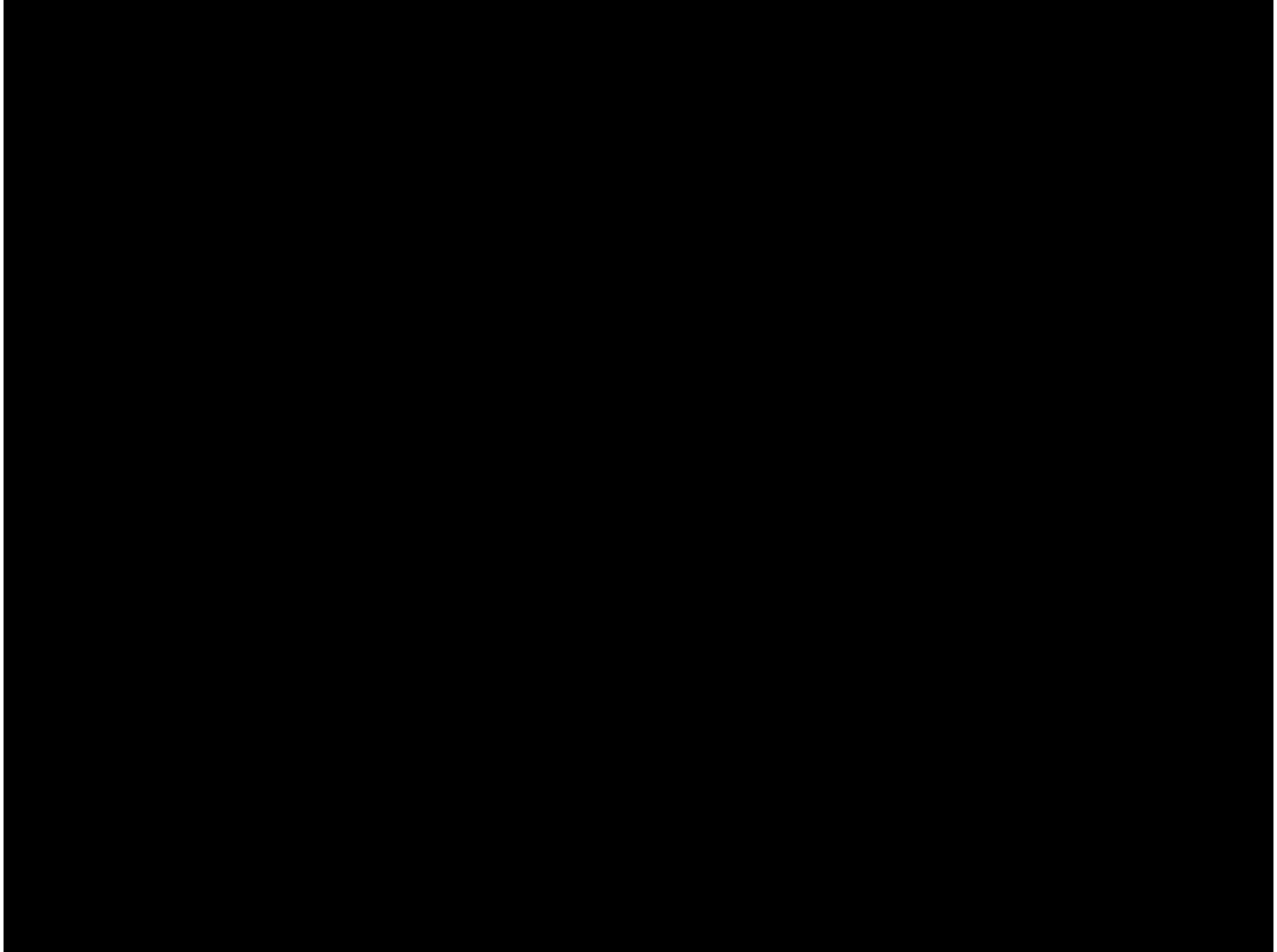
Underneath View



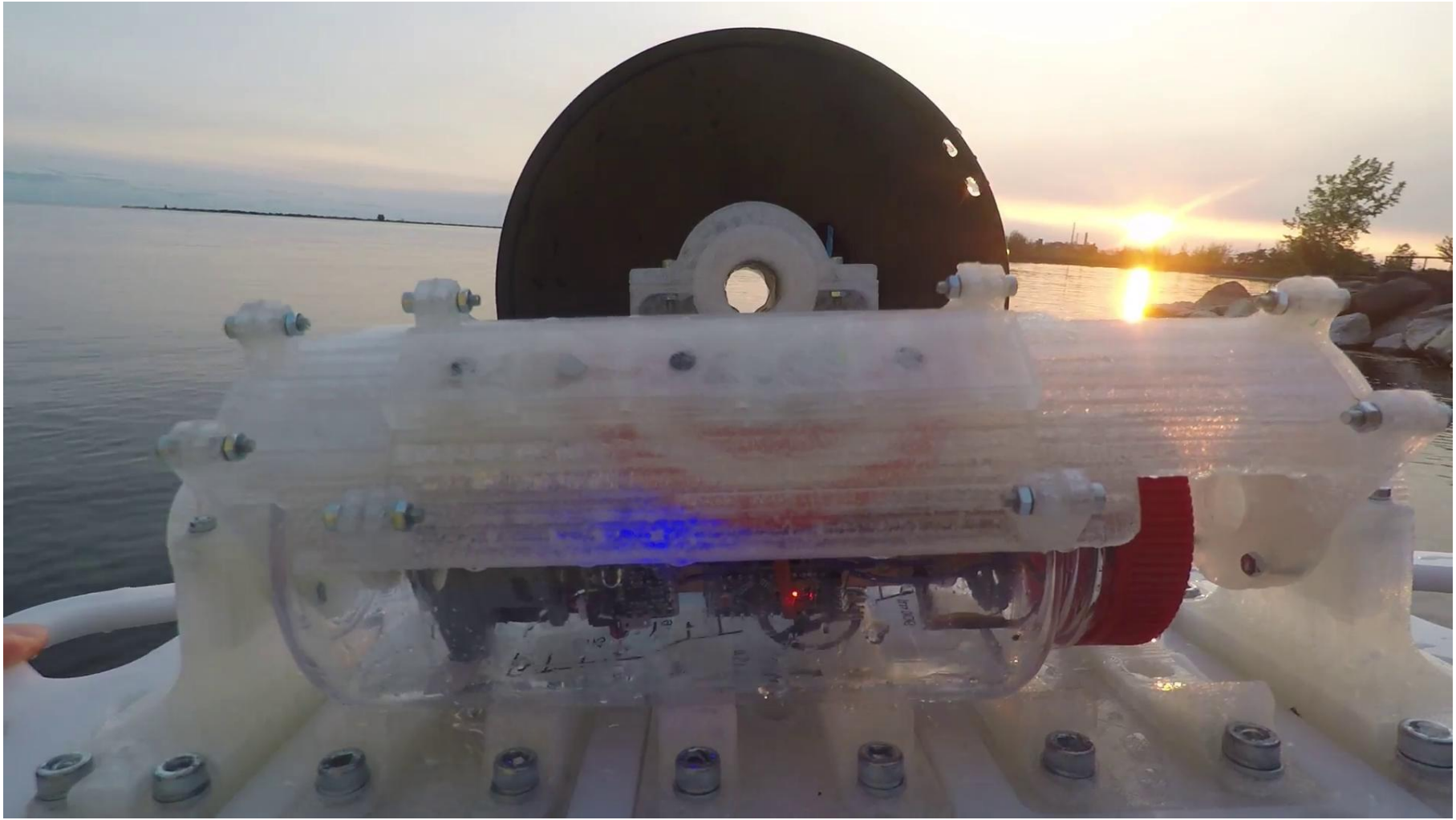
Front View

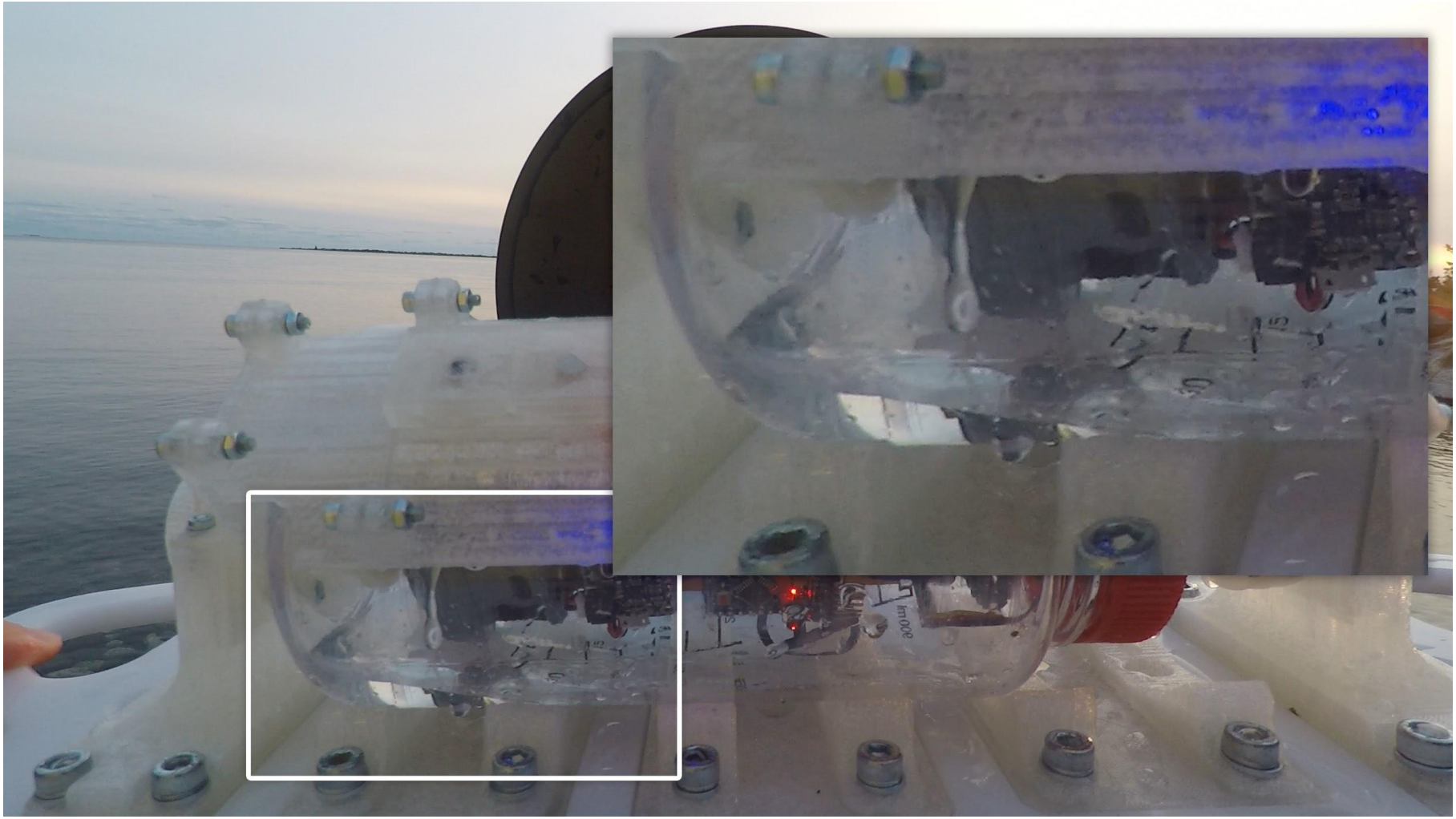






… Then a Curious Happening Occured





… It still worked!

To Be Continued :)

Intelligent Buoy

- Nalgene enclosure
  - ‘Tritan’ = Polycarbonate
- Depth limited by strength of lid (we have ideas on how to improve that!)
  - Nalgene brand:
    - 240 psi limit (source)
    - 169.24 m freshwater / 164.85 m saltwater (source)
  - Off brand:
    - 45 psi limit (source)
    - 31.73 m freshwater / 30.91 m saltwater (source)
- Further testing to verify actual limits would be necessary

Future Work

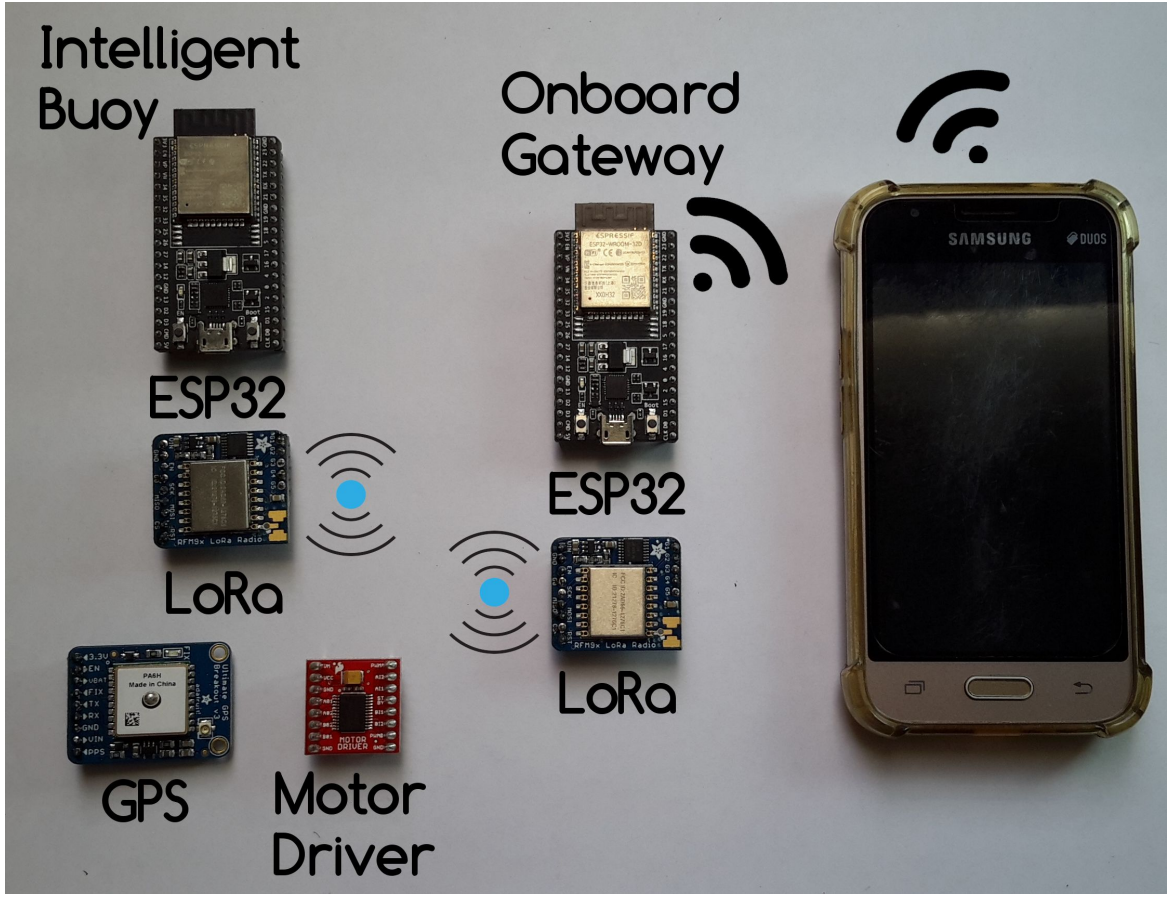
- User testing!!! It’s really important!
- Intelligent Buoy
  - Lid experimentation and improvements
  - Camera distortion and view testing
- Ropeless System
  - Loading of buoy with magnetic placement and end stops
  - Distribution of ballast weight
  - Stronger external wiper magnets
- Benchmarking

Additional Information

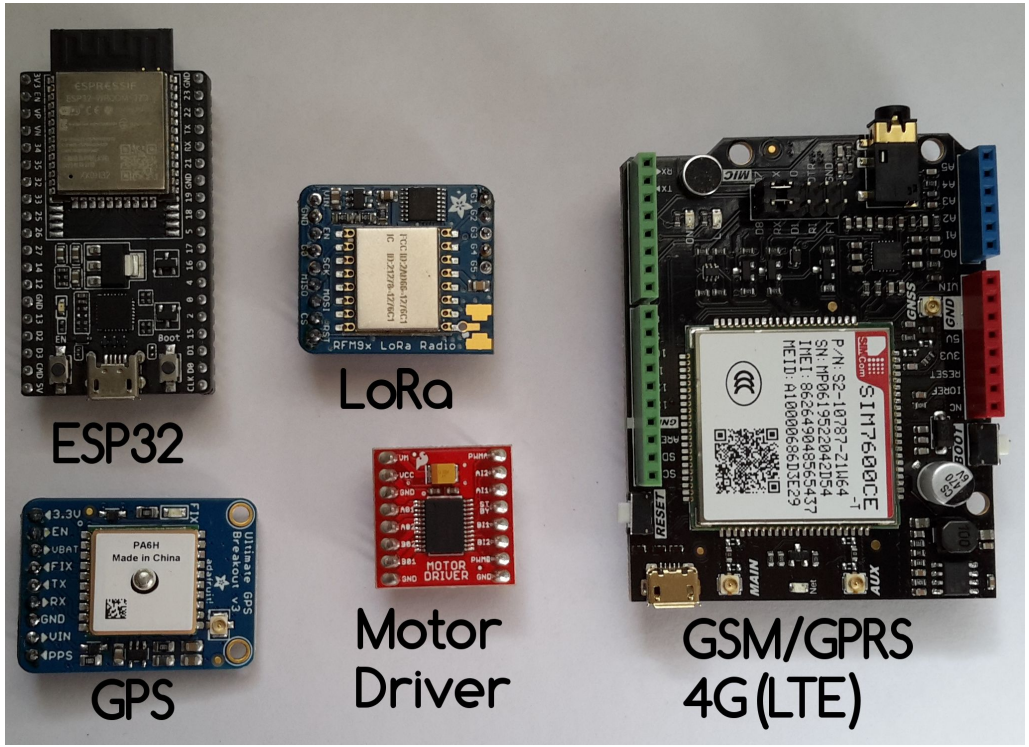
- Mechanical Specifications:
  - https://cdn.hackaday.io/files/1734577421184288/Mechanical%20Design%20Specifications.pdf
- Release Mechanism
  - 3D Viewer: https://a360.co/3msDSha
  - Github: https://github.com/RobotGrrl/Hackaday-CXL/tree/master/Design/release_mechanism
  - Cost: $237.20
- Intelligent Buoy
  - 3D Viewer: https://a360.co/3hJjc0R
  - Github: https://github.com/RobotGrrl/Hackaday-CXL/tree/master/Design/intelligent_buoy
  - Cost: $47.99
- Onboard Gateway
  - 3D Viewer: https://a360.co/32DGUHE
  - Github: https://github.com/RobotGrrl/Hackaday-CXL/tree/master/Design/onboard_gateway
  - Cost: $35.15
- *Costs are approximate and include mechanical components, materials, machine time, and assembly time*

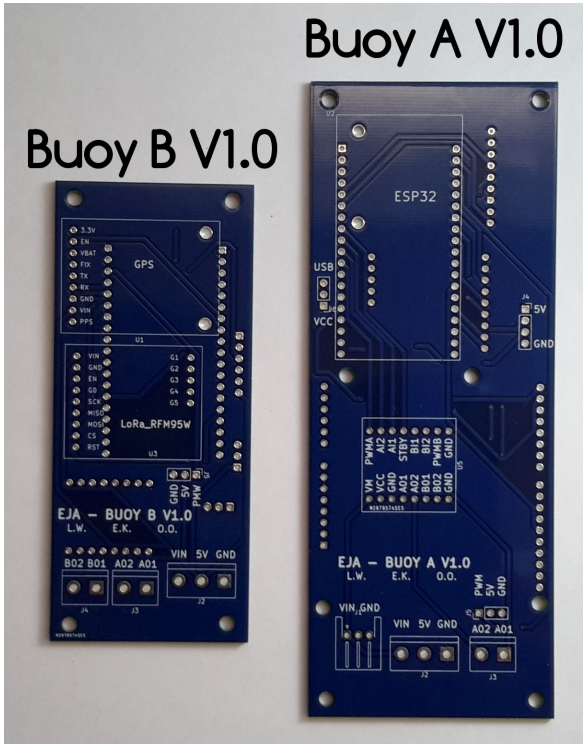
Electronics

Concept

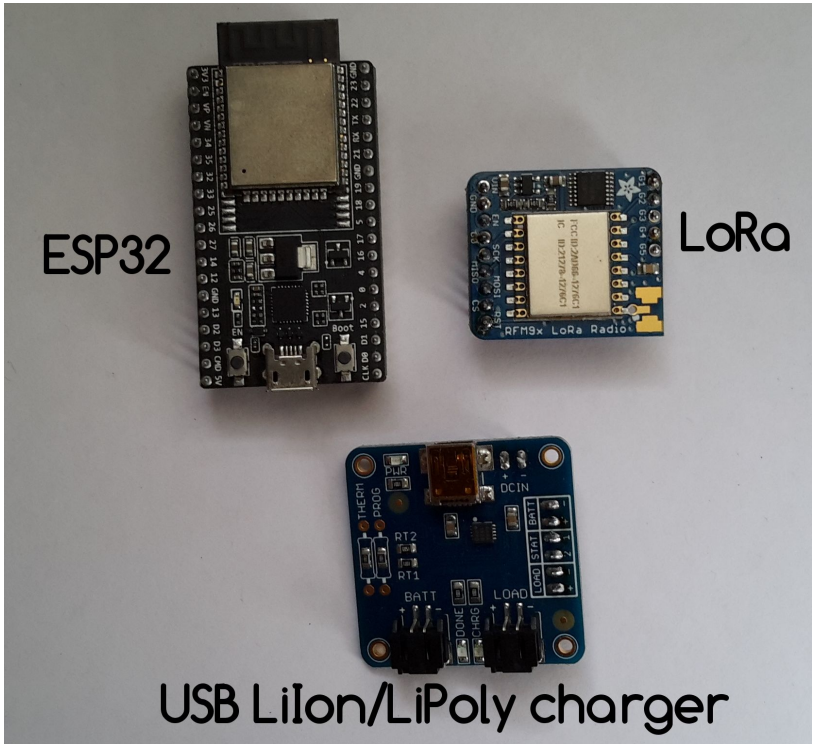

Intelligent
Buoy
ESP32
LoRa
GPS
Motor
Driver
Onboard
Gateway
ESP32
LoRa
SAMSUNG
DUOS

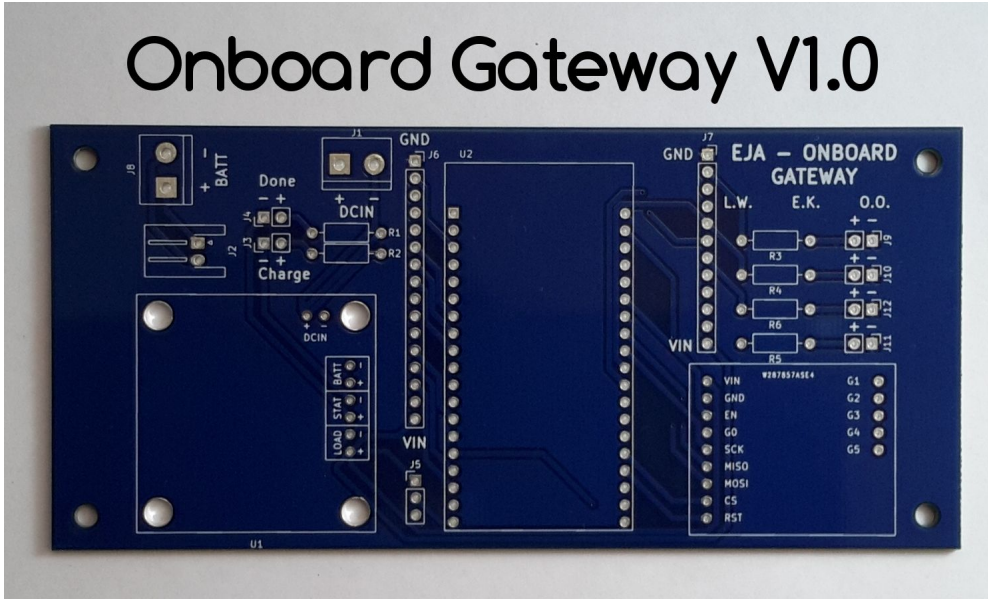
PCB Design and Manufacture



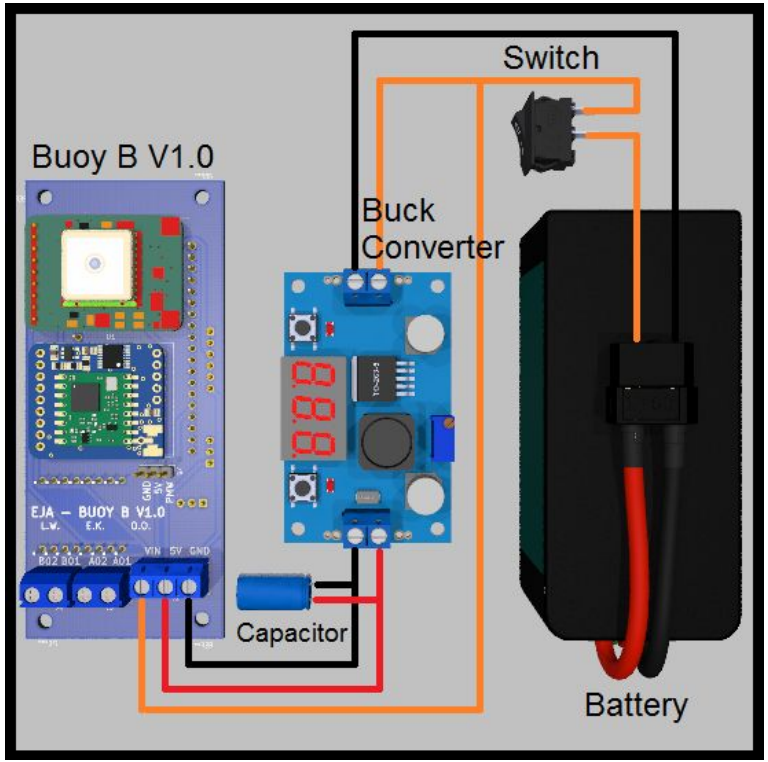


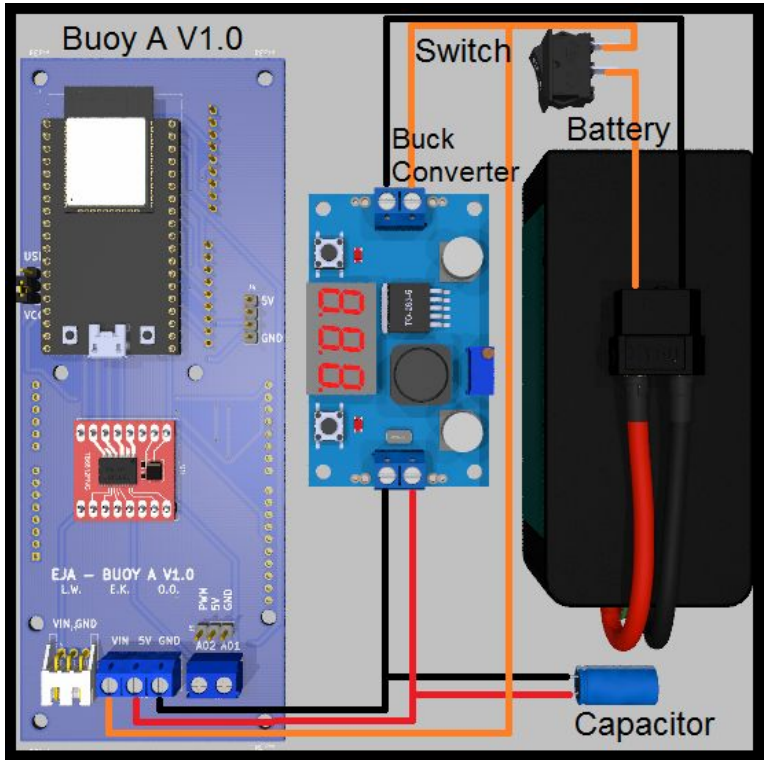
PCB Design and Manufacture





Design - Wiring Diagrams





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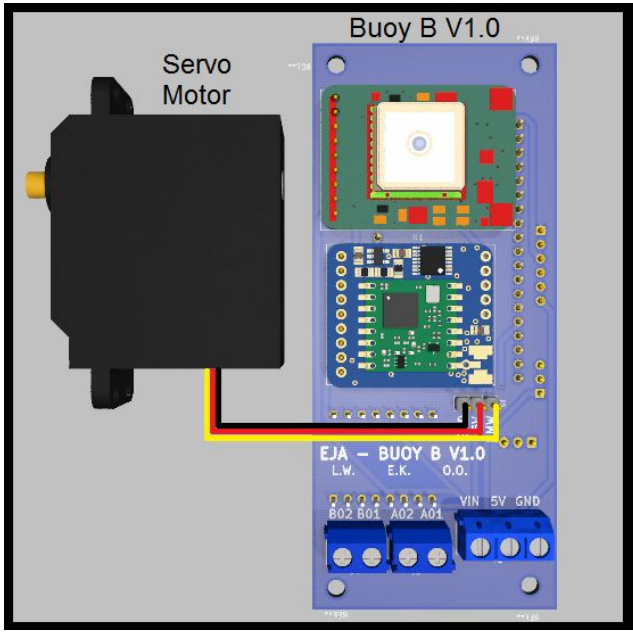
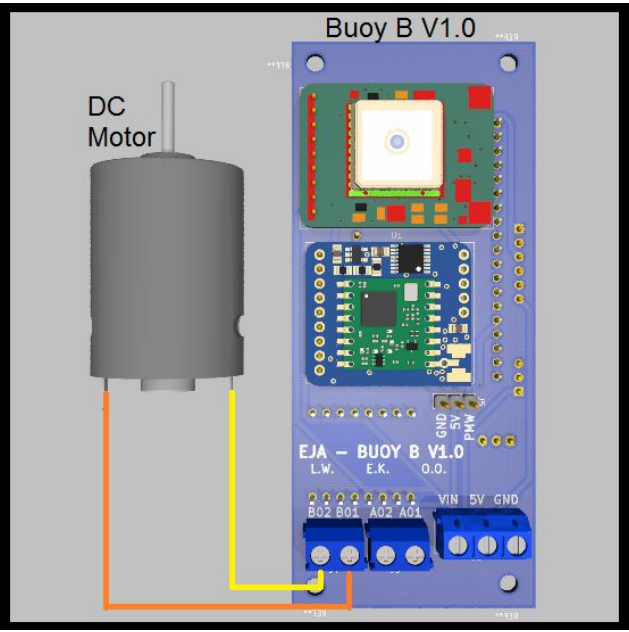
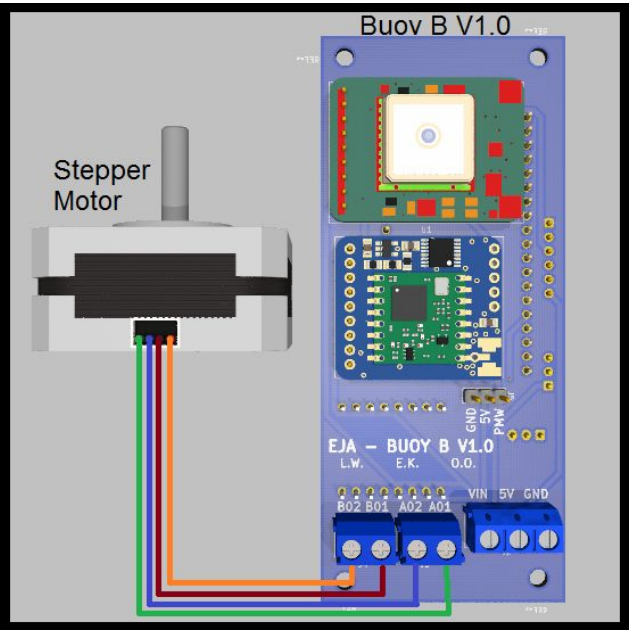
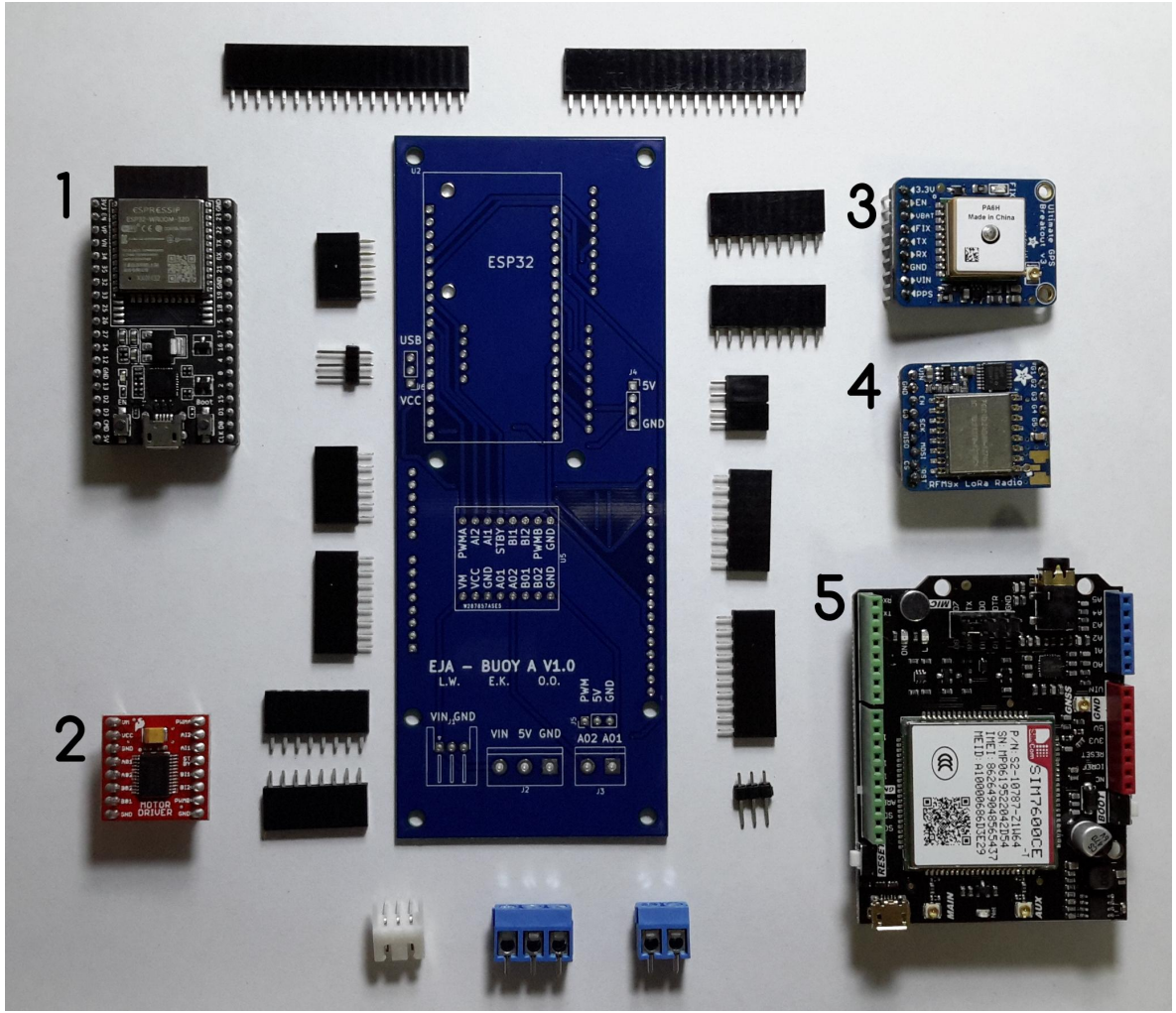






Assembly
Buoy A V1.0

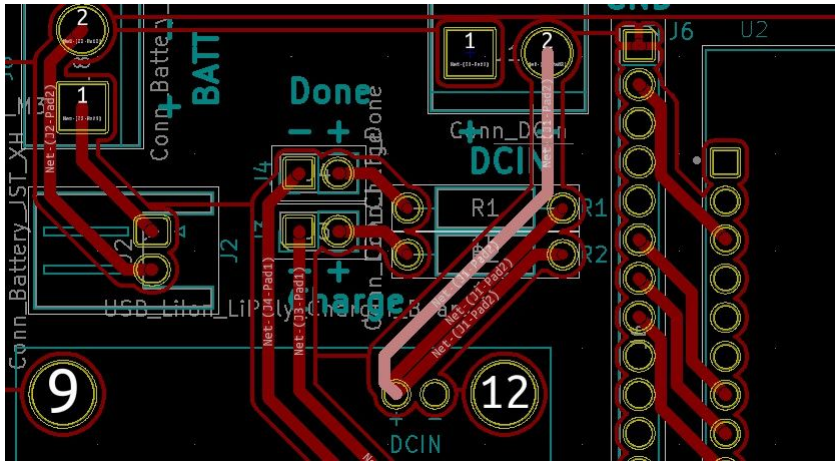
1. ESP32
2. Motor Driver (TB6612FNG)
3. GPS
4. LoRa Radio Transceiver
5. GSM/GPRS 4G (LTE)



Proof of concept

Future Improvements

- Fixing PCB text indications
- Fixing screw holes
- Fixing J5 power jumper



- https://hackaday.io/project/173457-2020-hdp-dream-team-conservation-x-labs/log/183807-future-improvements-pcb-design

Software & Network Design

Software &
Network Design

- The choice for Arduino platform
- LoRa network interface, GPS and GPRS interface
- SIM card choice
- Motor driver (TB6612FNG)

Scalability

- Nalgene off-brand < $1.00 USD / qty 1000 on Alibaba
- DFM for CNC milling of HDPE pieces
- Custom board

PCB Components

Name	Price per unit	Price per 1000 units
PCB	$0.50	$767.00
TERM BLK 2P SIDE ENT 5.08MM PCB	$0.80	$205.20
CONN HEADER R/A 2POS 2.5MM	$0.18	$80.68
CONN HEADER VERT 40POS 2.54MM	$2.29	$1,272.00
CONN HDR 6POS 0.1 TIN PCB	$0.52	$265.82
USB Lilon/LiPoly charger	$12.50	$10,000.00
RES 249 OHM 1/4W 1% AXIAL	$0.10	$11.00
RES 249 OHM 1/4W 1% AXIAL	$0.10	$11.00
TERM BLK 2P SIDE ENT 5.08MM PCB	$0.80	$205.20
CONN HDR 2POS 0.1 GOLD PCB	$0.33	$157.50
CONN JUMPER SHORTING .100" GOLD	$0.10	$26.46
CONN HDR 19POS 0.1 TIN PCB	$1.17	$643.68
ESP32-DEVKITC-32D	$10.00	$10,000.00
CONN HDR 19POS 0.1 TIN PCB	$1.17	$643.68
CONN HDR 16POS 0.1 TIN PCB	$0.98	$541.44
CONN HDR 12POS 0.1 TIN PCB	$0.78	$432.00
CONN HDR 9POS 0.1 GOLD PCB	$0.67	$368.64
RES 100 OHM 3W 5% AXIAL	$0.71	$264.44
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RES 100 OHM 3W 5% AXIAL	$0.71	$264.44
CONN HDR 5POS 0.1 GOLD PCB	$0.47	$243.54
RFM95W LoRa Radio	$19.95	$19,950.00

External Components

Name	Price per unit	Price per 1000 units
Lithium Ion Battery - 3.7v 2000mAh	$12.50	$11,250.00
Micro USB Board	$2.50	$2,500.00
LED ASSORTED RESISTOR 5MM 20PK	$9.69	$9,690.00
DP OFF-ON TABS M12X0.75 DC	$3.40	$2,270.00

Overall Price

Price per unit	Price per 1000 units
$84.34	$72,592.60

Thank you Hackaday and Conservation X Labs!