

Silent Aluminum Fishing Boat

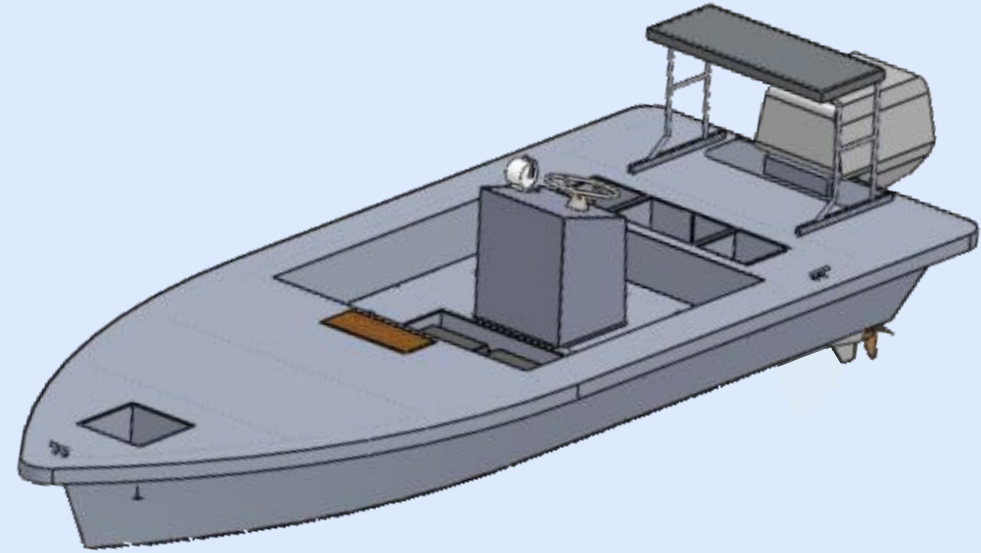
Group 5 Members:

Tyler Brown, Electrical Engineering

Carley Camarotti, Computer Engineering

Alec May, Computer Engineering

John Santiago, Electrical Engineering



Sponsors:



Background

- Flats fishing is a popular form of fishing in Central Florida
- Boating industry looking towards the future
- Room for innovation in current design of the flats boat
 - Few options for electric propulsion boats
 - Even fewer options for aluminum flats boats
 - Arrival of IoT allows integration of low-cost electronics

Motivation for ECE Team

- Marine electronics are expensive
- Limited control with entry level components
- Develop a low-cost solution for marine electronics
- Offer Internet of Things (IoT) integration with smartphone
- Collaborate with different engineering disciplines

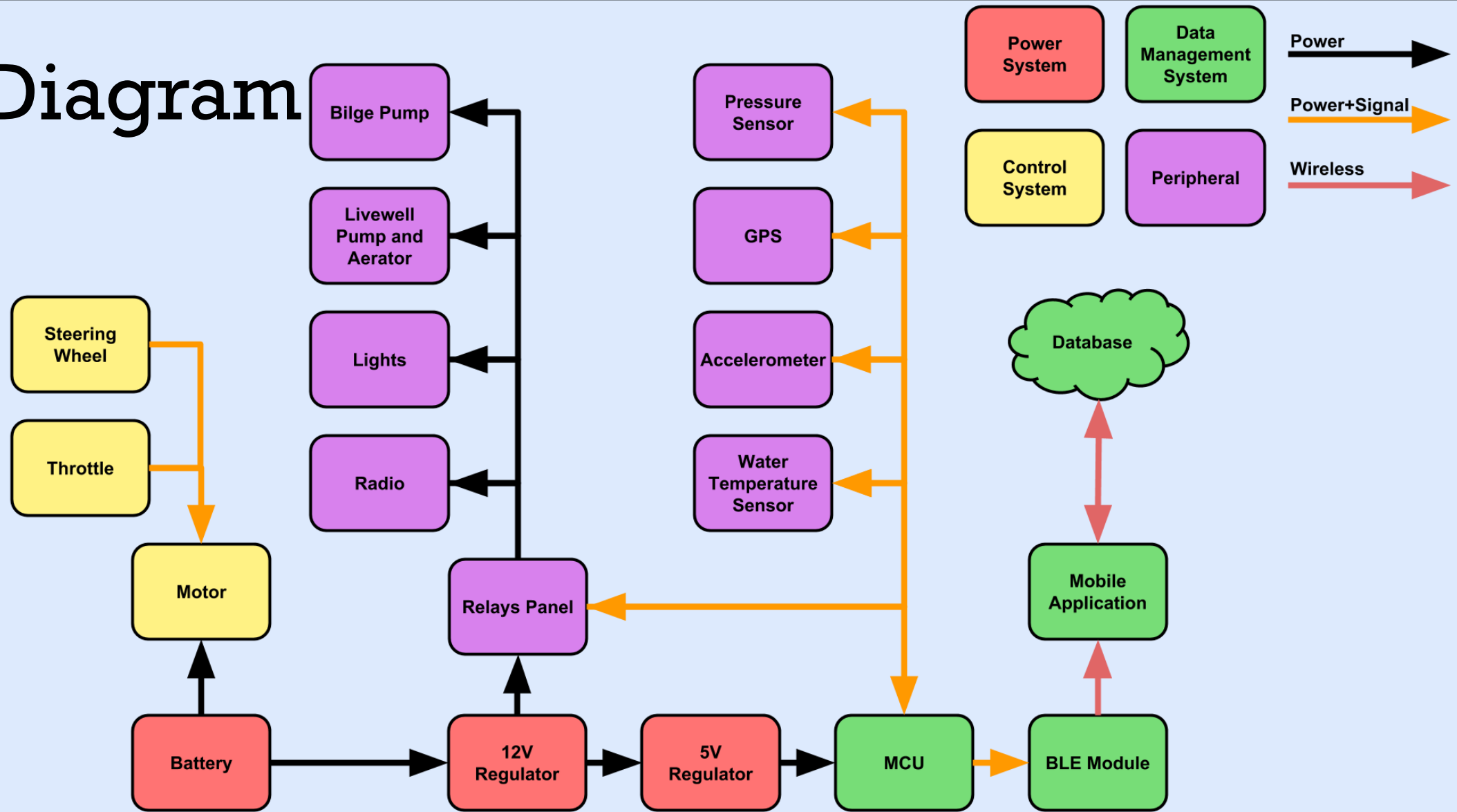
Goals and Objectives

- Numerous sensors to record water temperature, barometric pressure, speed, and orientation that will be communicated to the user via Bluetooth
- Accurate GPS and tracking capabilities to be tracked through a mobile application
- Low power consumption

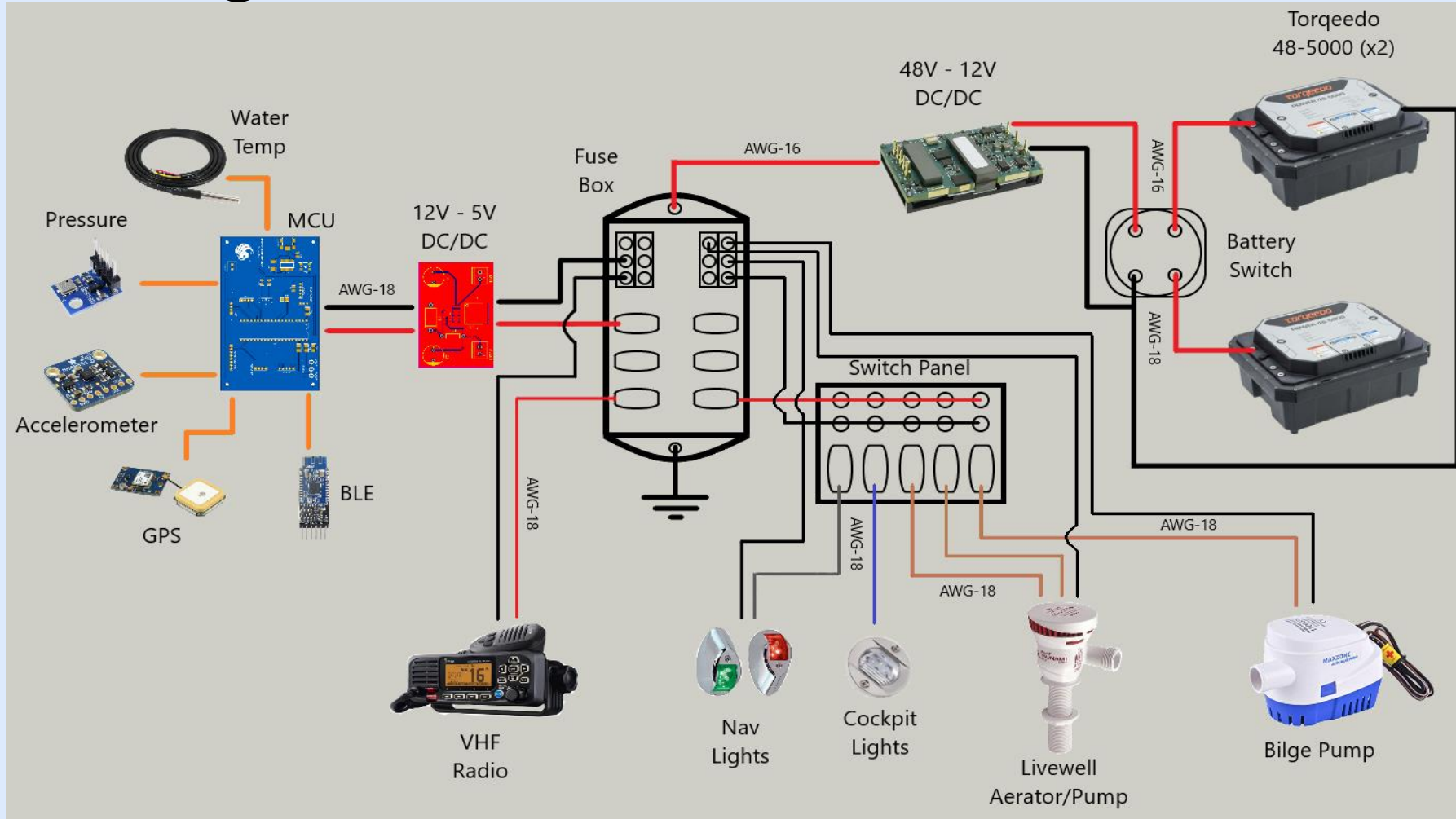
Specifications

Feature	Parameter	Design Specification
Boat	Capacity	Maximum 3 people
Boat	Length	17 to 18 feet
Boat	Weight	400 lb
Electronics Box	Permeability	Waterproof
Electronics Box	Dimensions	7" x 7" x 2"
Batteries	Weight	36.5 kg
Batteries	Output Power	10 kW

Block Diagram



Boat Wiring



Microcontroller

- ATMEGA1284P
- Serves as the brain of the project
- Will handle processing all data and sending it via BLE

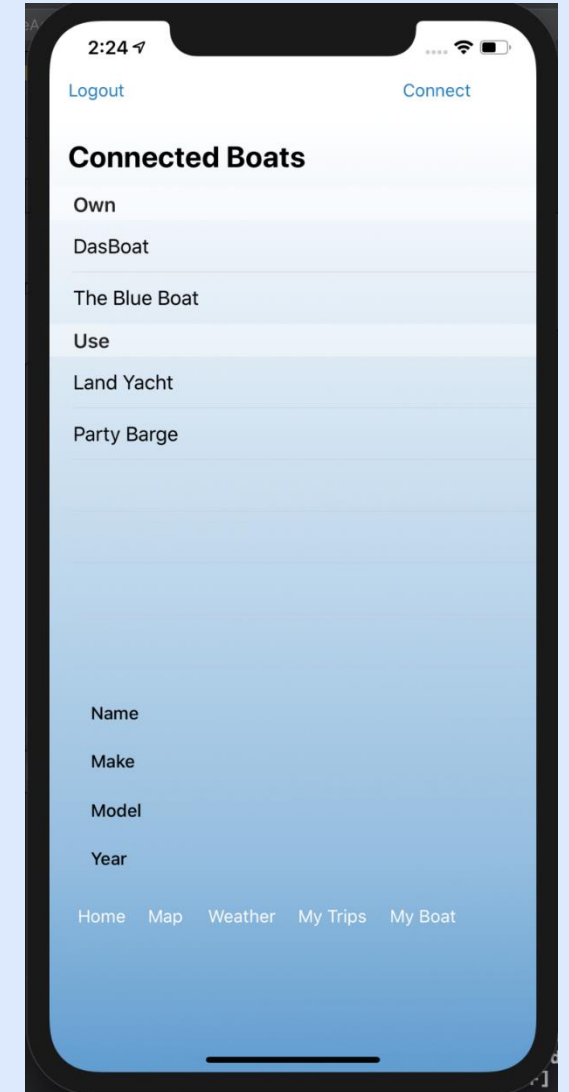
Feature	Specification
Voltage	5V
Processor Speed	16MHz
Memory	128KB



Bluetooth

- HM-10 BLE Module
- Connect to Smartphone
- Sends data from MCU to Smartphone
- Displayed on GUI

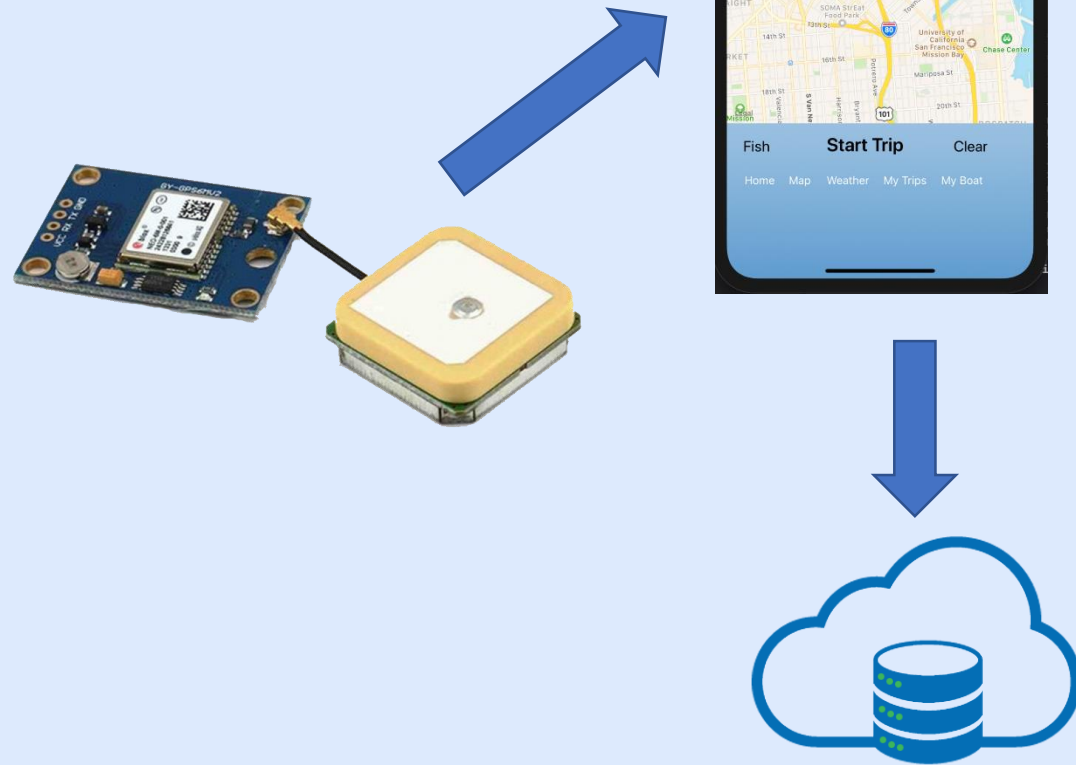
Feature	Description
I/O Lines	Vcc, Rx, Tx, GND
Required Voltage	3.3V (5V Regulator On Board)
Cost	\$9.99
Signal Range	~17ft



GPS

- NEO-6M series
- Transmits data as NMEA sentences
- Will be used to record trip data
- Transmits position as well as speed and heading

Feature	Description
I/O Lines	Vcc, Rx, Tx, GND
Required Voltage	5V
Cost	\$5.75



Water Temperature Sensor

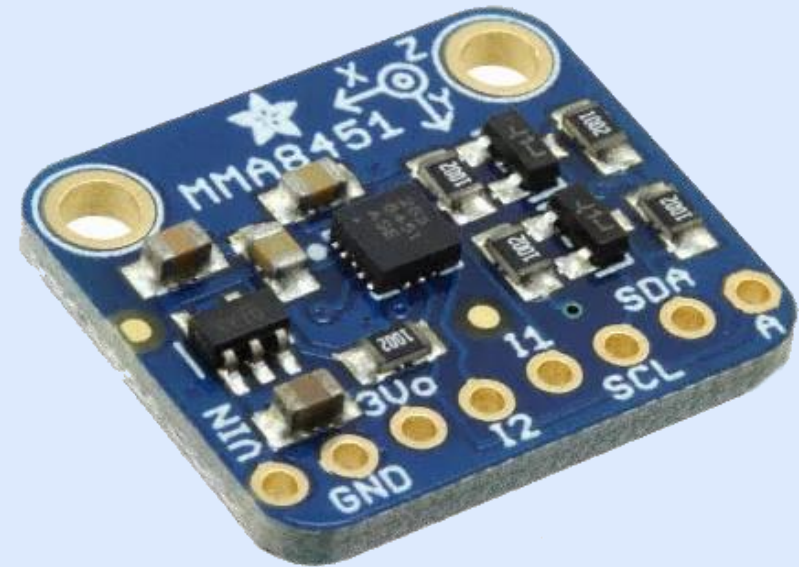
- DS18B20
- Variations of water temperature affect fish activity

Feature	Description
Connection	1-Wire
Required Voltage	5 V
Temperature Range	-55C to 257C
Cost	\$7.99



Accelerometer

- MMA8451
- Boat orientation is important for stability
- Bow angle influences planing ability

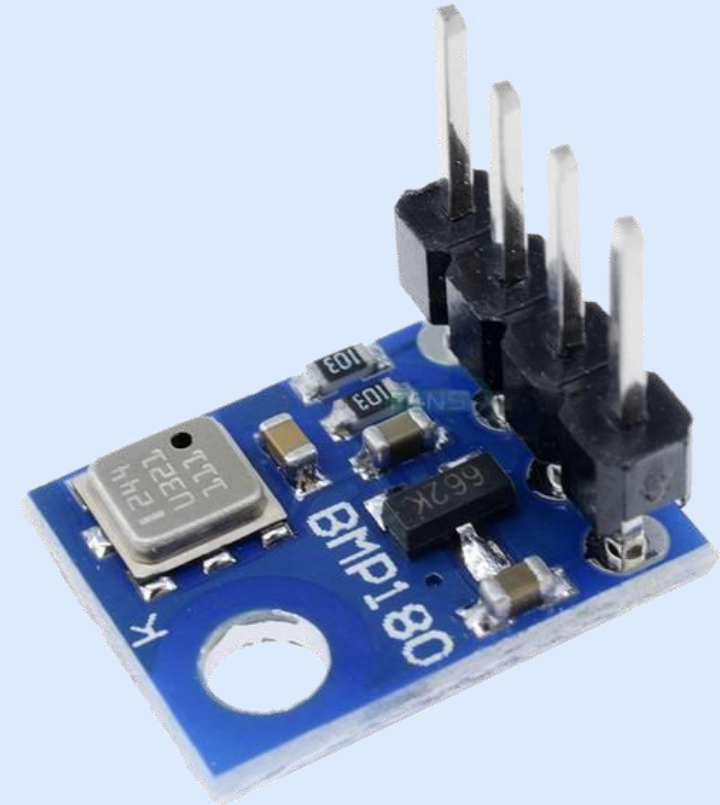


Feature	Description
Connection	I2C
Required Voltage	5 V
Range	+/-8g
Cost	\$9.89

Barometric Pressure Sensor

- BMP180
- Pressure affects fish activity
- Must be baselined to location

Feature	Description
Connection	I2C
Required Voltage	5 V
Range	300hPa to 1100hPa
Cost	\$8.99



Bilge Pump

- Rule-Mate 500 GPH Bilge Pump
- Clears nuisance water from the bilge

Feature	Description
Pump rate	500 gallons/hour
Current	2 A
Required Voltage	12 V
Cost	\$79.99



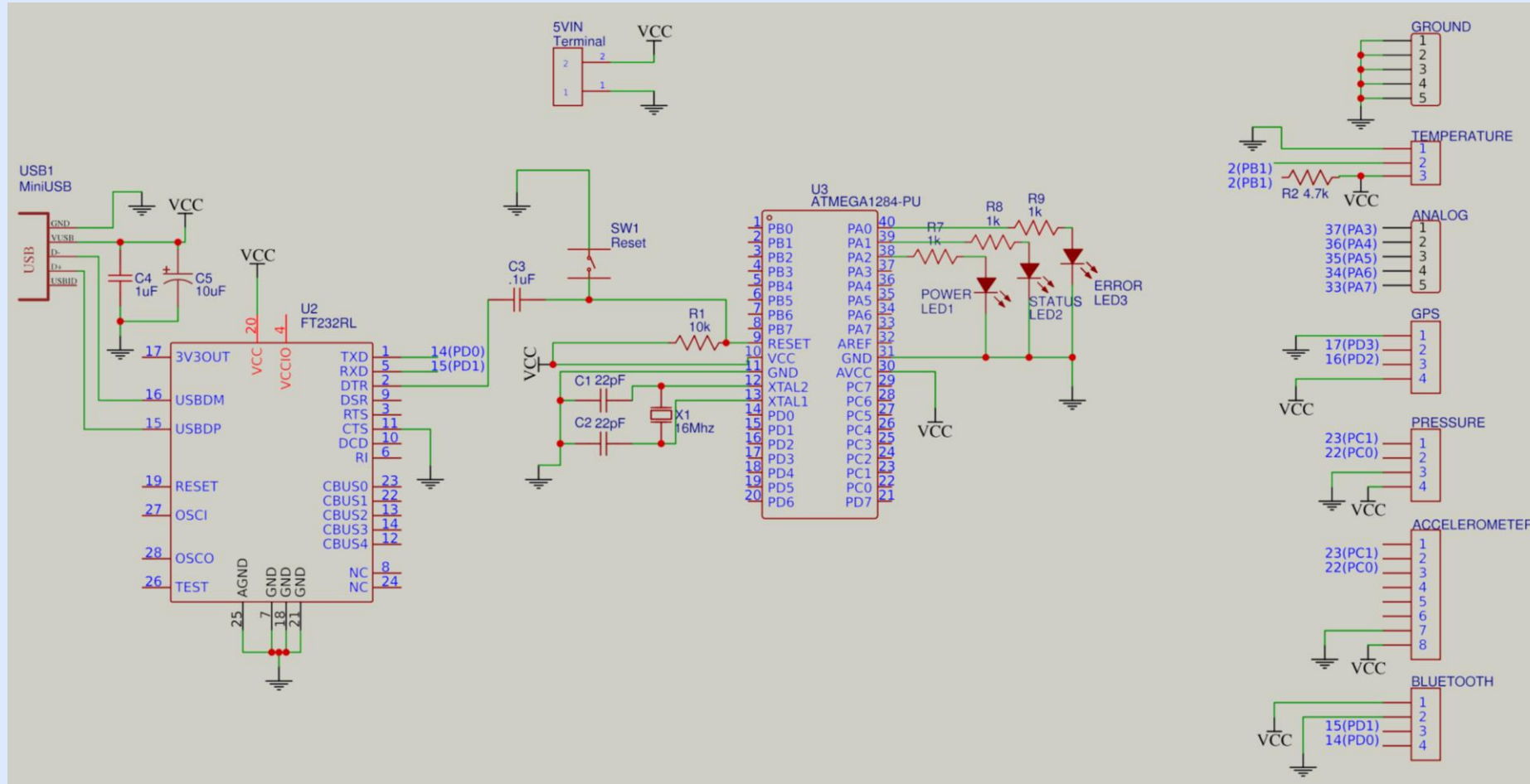
Livewell Pump and Aerator

- Johnson Pump
- Fills Livewell
- Keeps caught fish alive by oxygenating the water



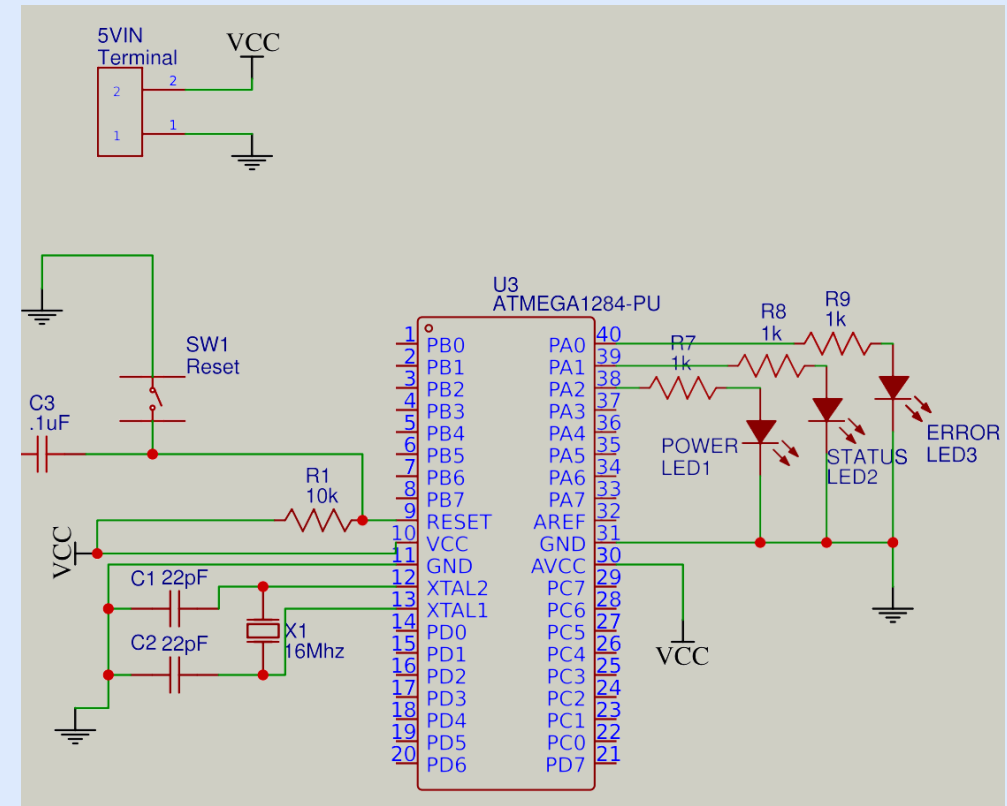
Feature	Specification
Capacity	550 Gallons/Hour
Dimensions	9.75 x 7.25 x 3.75 in
Cost	\$22.99

MCU Board Schematic Design



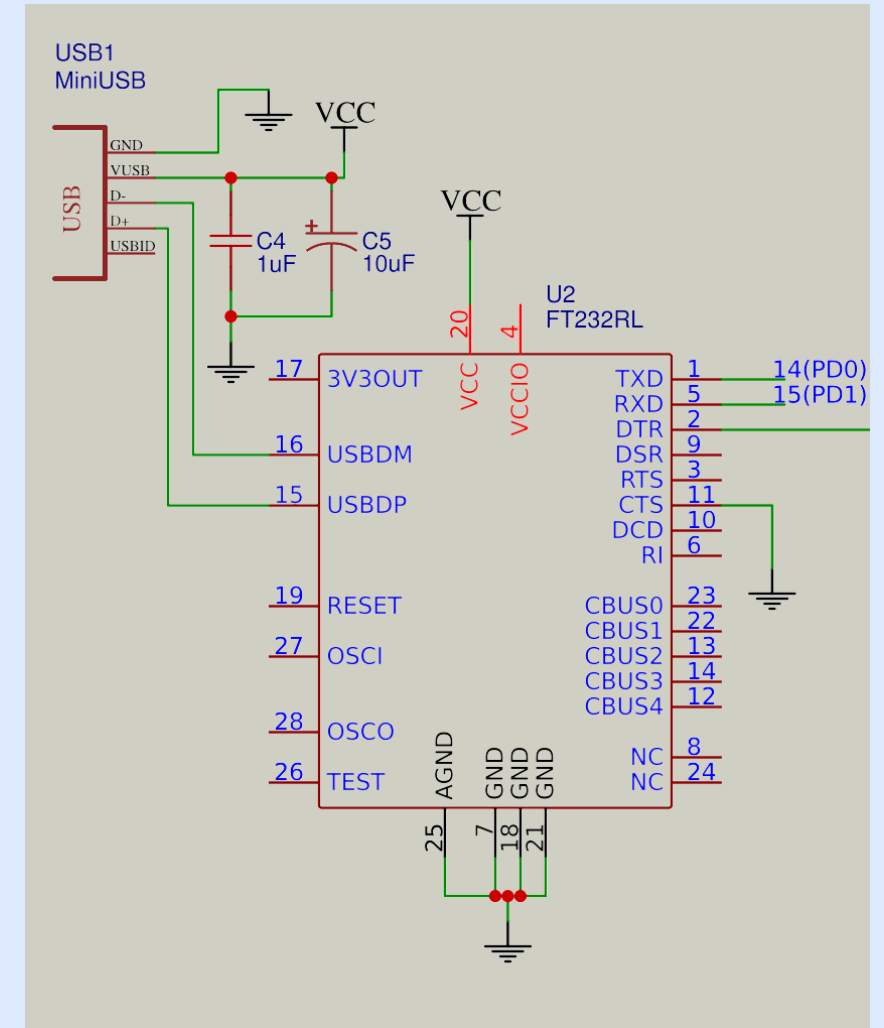
Microcontroller Unit

- All components that keep the chip running are placed around it
- Three status LEDs that can give the user feedback
- Reset button included for debugging purposes



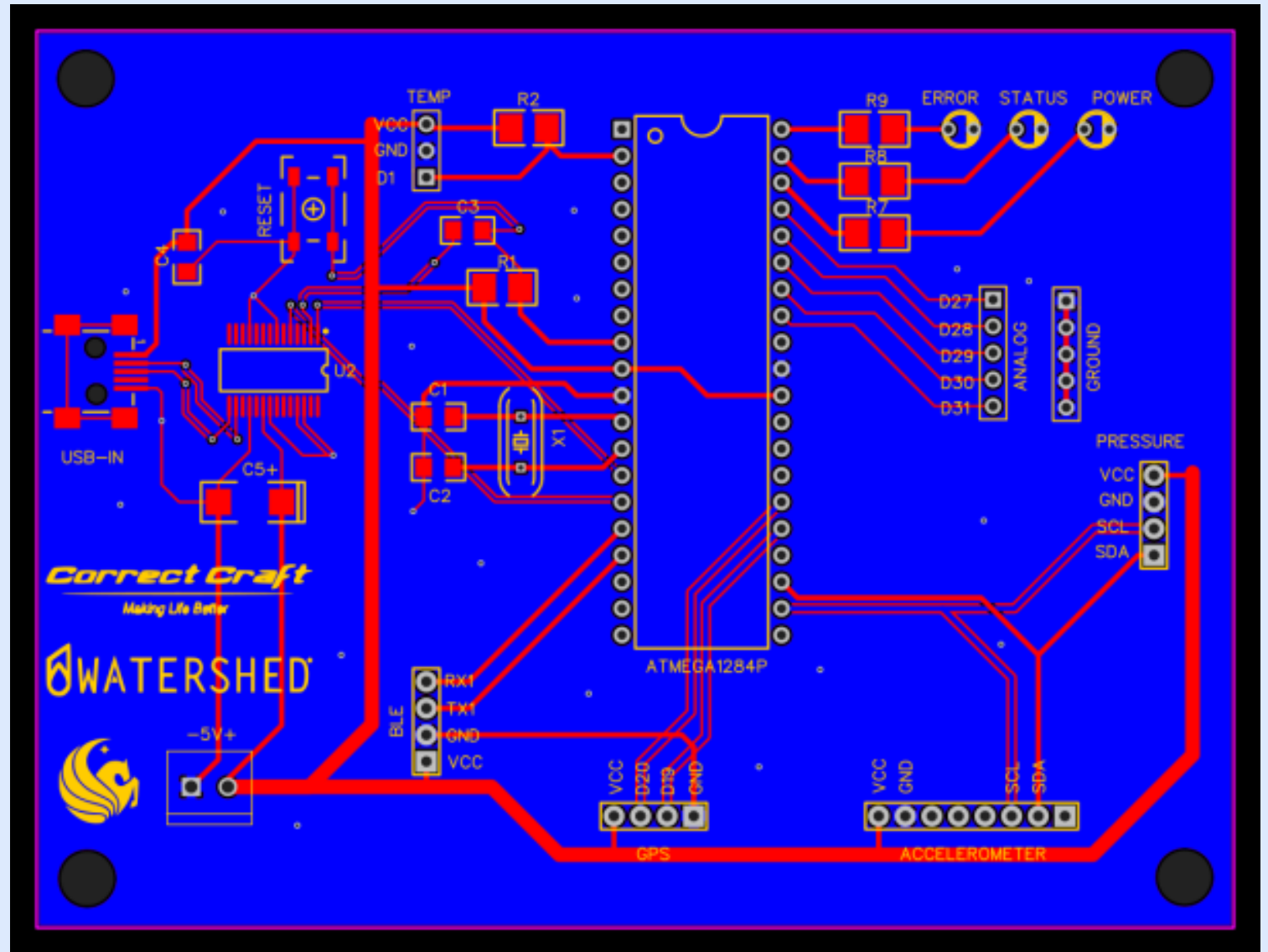
In-System Programming

- Relatively low component amount for use within our hardware
- Easier debugging and programming of chip for testing on the actual PCB
- Allows us to flash software updates via a USB from a laptop or PC



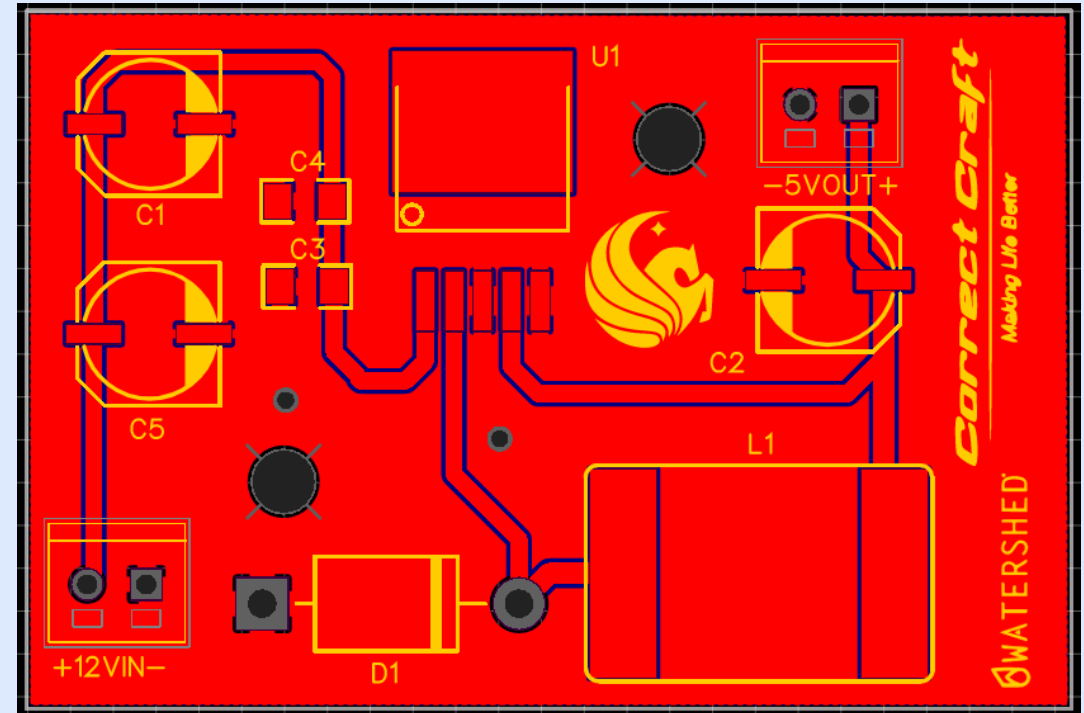
PCB Design

- 2-layer design
- 2 ounces of copper
- Most components are surfaced mounted
- Traces routed with as least harsh right angle bends as possible



PCB Design 12V to 5V StepDown

- 2 layer design
- Back Pad provides better heat dissipation during operation
- Uses enough filter capacitors to keep voltage stable and reduce ripple



Waterproof Enclosure

- Polycase SK-28
- Needs to house PCB and components
- Needs to withstand rigors of marine environment
- Punchouts for easy wire routing



Feature	Specifications
Dimensions	7.17 x 7.09 x 2.42 in
Waterproof Rating	IP66
Impact Rating	IK08
Cost	\$33.36

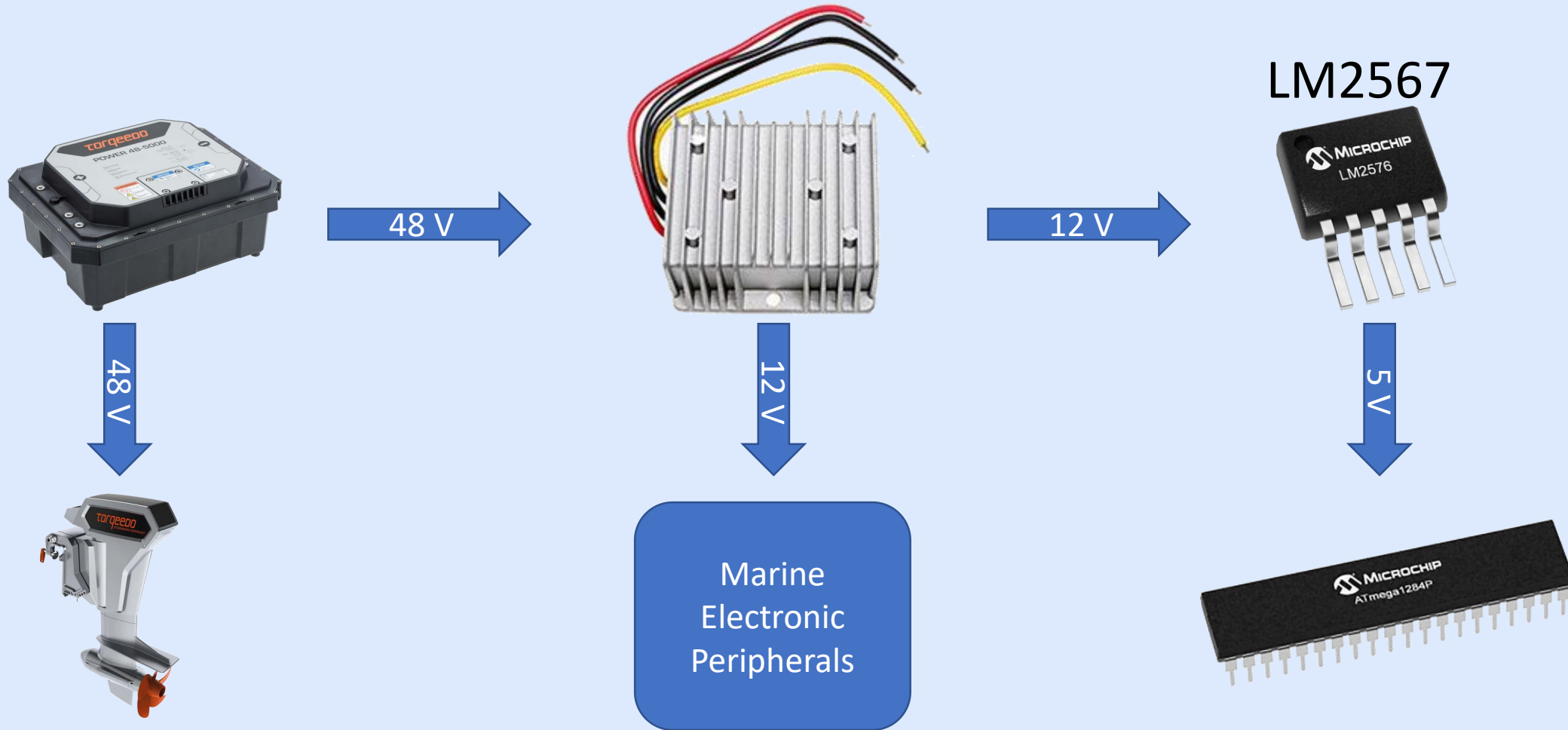
Batteries

- Two Torqeedo 48-5000
- Connected in parallel
- Included charging hardware

Feature	Description
Rated Voltage	48V
Rated Power	~5000W
Cost (Battery)	\$5,199 (Provided)
Cost (Charging)	\$899 (Provided)

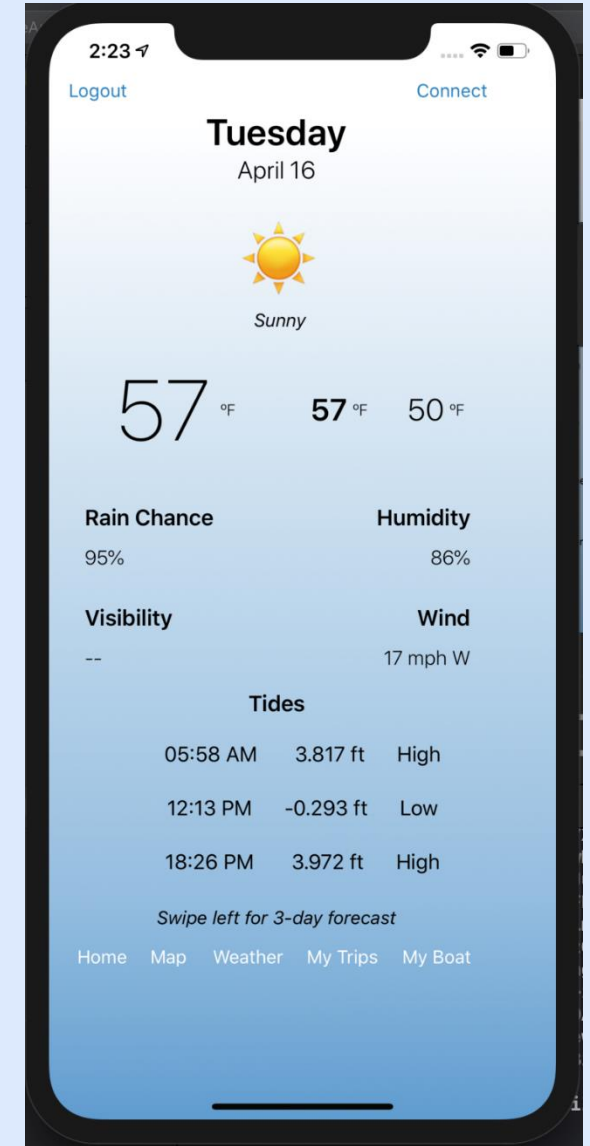


Power Management



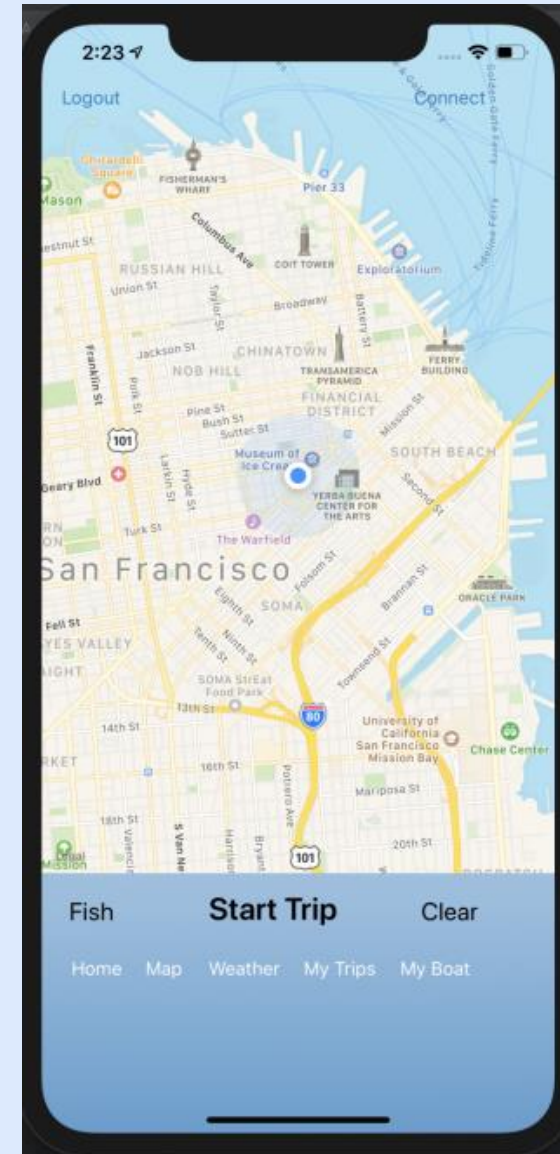
Planning Phase

- Check battery charge
- Log in to app
- Ensure weather conditions are ideal



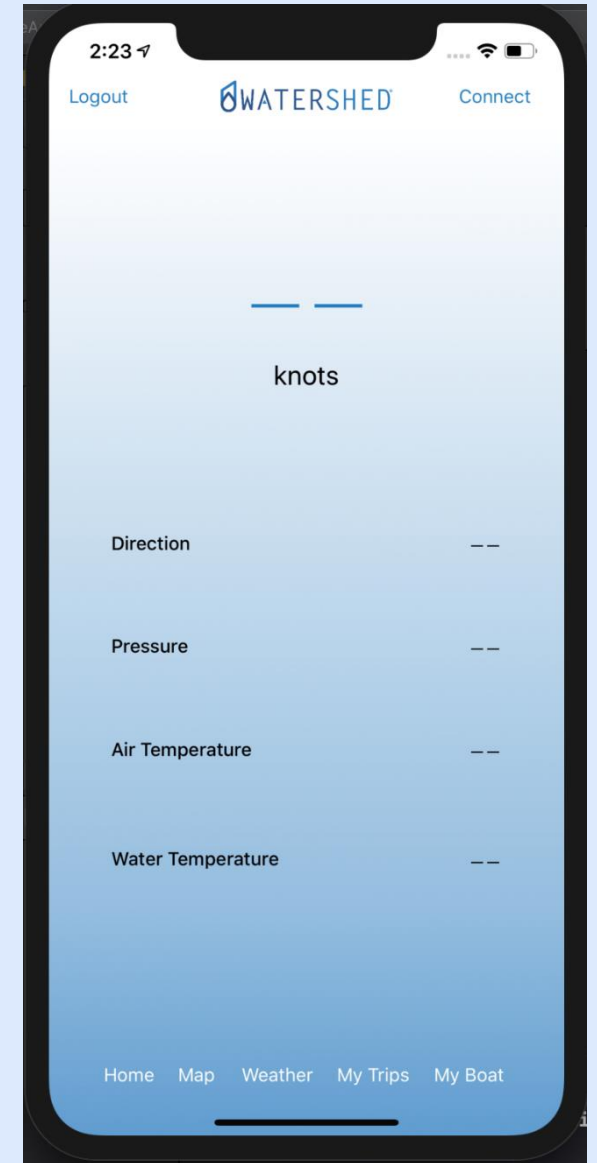
Startup Phase

- Turn on boat
- Use app to connect to boat
- Start your trip



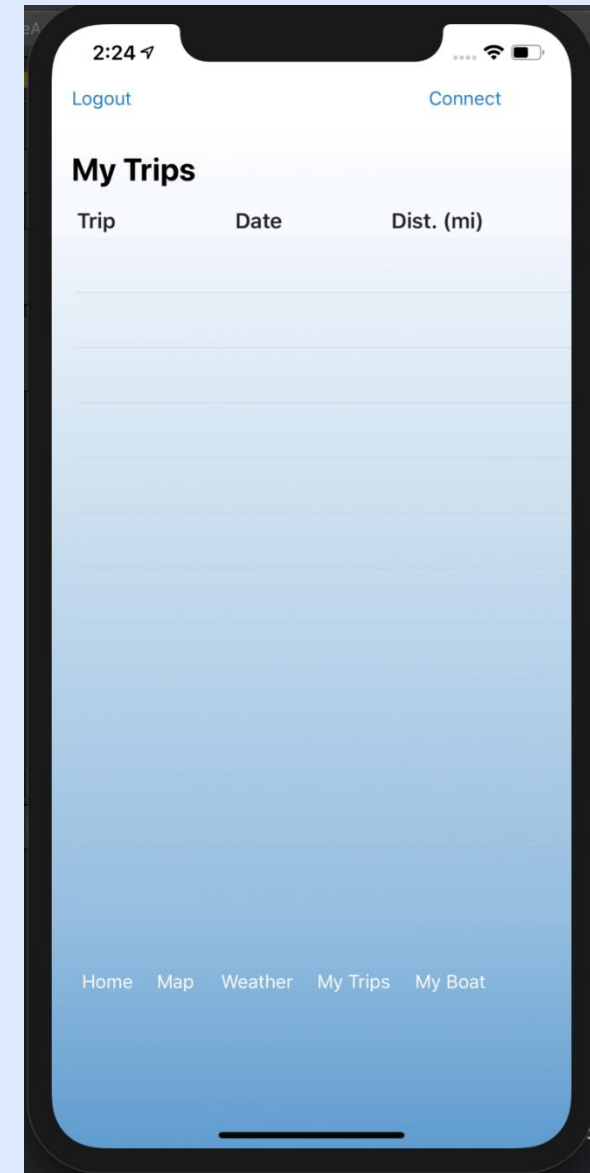
Activity Phase

- Monitor relevant data through the app's display
- Utilize GPS bread-crumbing to find your way back to the dock
- Monitor weather to know when conditions are most ideal
- Drop flags indicating which fish you caught at that location



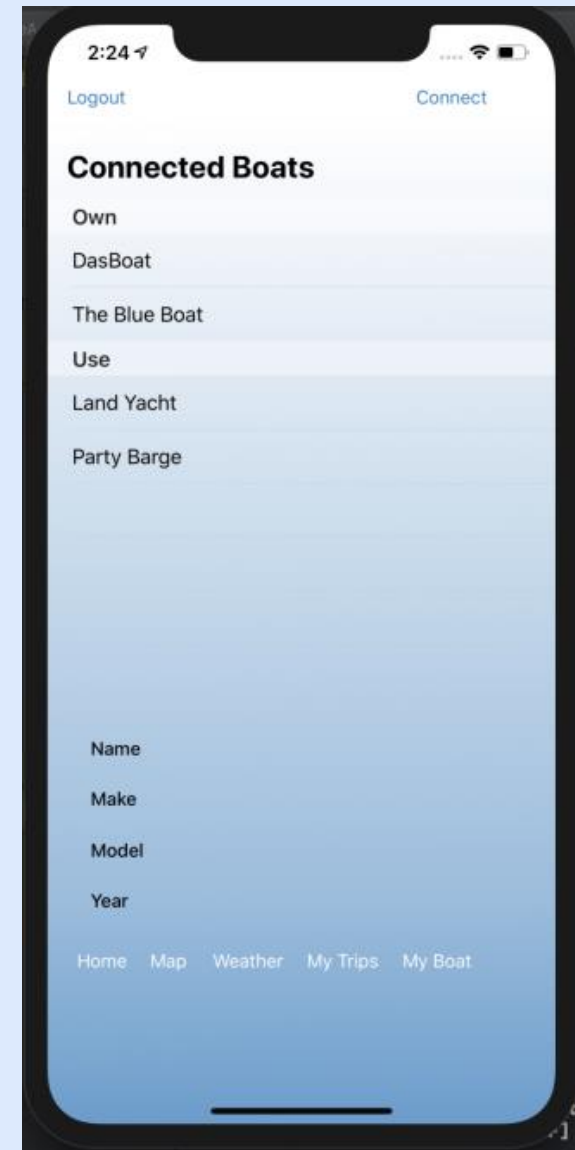
Reflection Phase

- View data from your fishing trips on the website
- Leave notes for which areas were the most successful for you
- Compare catch rates for that trip to previous ones



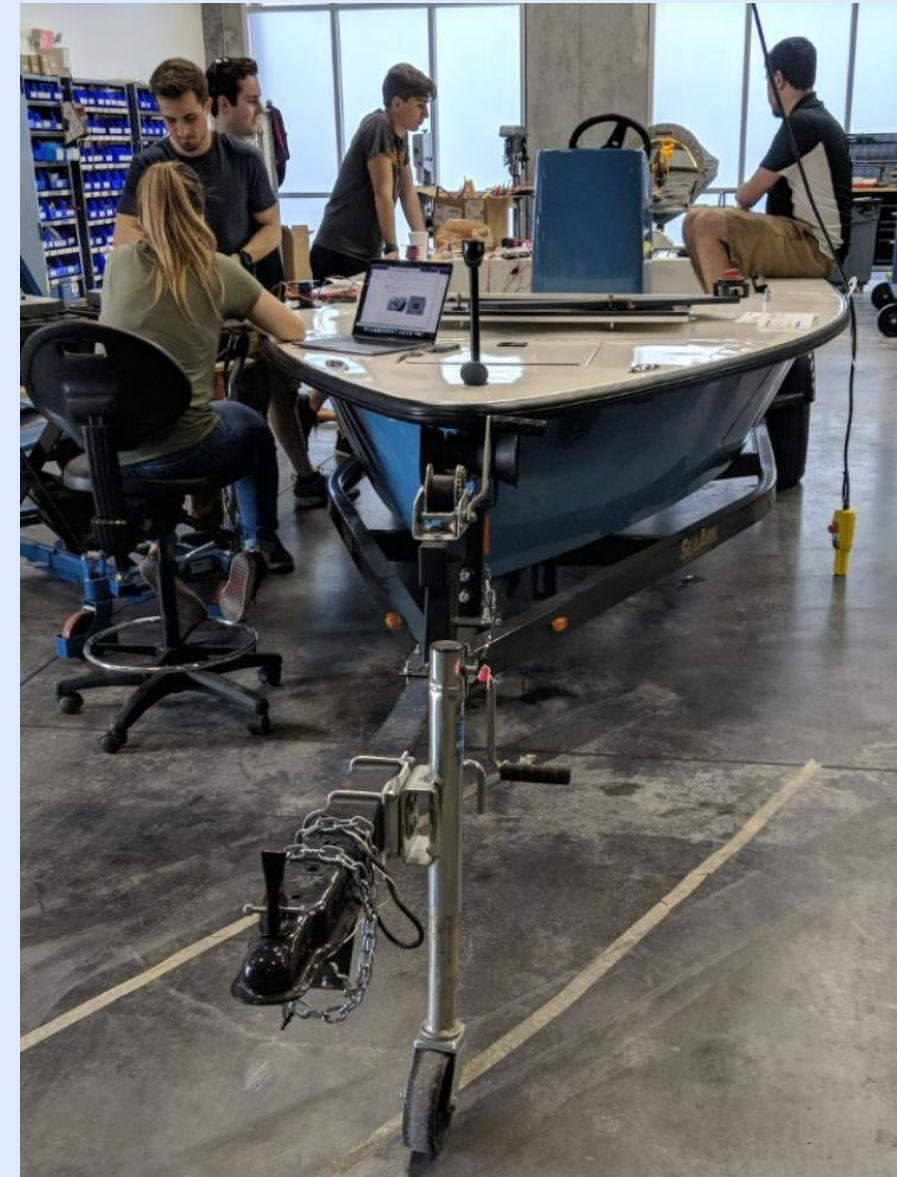
Boat Sharing

- Can grant boat access to another user
- All data from the trip is posted for both the user and the owner to see
- Owner can monitor access in realtime



Integration

- Worked with MAE Team during design phase
 - Cable tunnels
 - Central Console
- Worked with CS Team to determine formatting for BLE communications
- Worked with CorrectCraft to get all our electronics installed



Possible Future Features

- NMEA Gateway
 - Would allow us to read data from the Torqeedo motor
 - Includes battery diagnostics, motor output, telemetry, etc
- Fishing quality score in the app
- Security Features

Ethical, Environmental, and Safety Standards

- U.S. Coast Guard Lighting Standard
 - 83.22
- Coast Guard Electrical Code
 - 183.420 (Battery Standard)
 - 183.425 (Conductor/Wiring Standard)
 - 183.455 (Overcurrent Protection Standard)
- IP Code
 - Waterproofing Standard
- IEEE 802.15.1
 - BLE Standard
- IPC-1331
 - Electrical heating standard

Budget

Part	Item Count	Price per unit	Total Cost (+Tax)
Development Board	1	\$35	\$41.00
ATmega1284	3	\$5.15	\$15.45
DC-DC Converter (5V)	10	\$3.20	\$32.00
DC-DC Converter (12V) V1	1	\$88.12	\$88.12
DC-DC Converter (12V) V2	1	\$35.99	\$35.99
DC-DC Converter (12V) V3	1	\$39.99	\$39.99
Wire/Crimp/Heat Shrink	-	\$144.50	\$144.50
Electrical Components	-	\$18.49	\$18.49
8 Channel Relay	1	\$7.99	\$7.99
GPS Module NEO-6M V1	1	\$16.99	\$16.99
GPS Moudle NEO-6M V2	2	\$8.99	\$17.98
MMA8451 Accelerometer	1	\$10.58	\$10.58
BMP180 Pressure Sensor	1	\$8.99	\$8.99
Fuse Box	1	\$33.86	\$33.86

Part	Item Count	Price per unit	Total Cost (+Tax)
USB Connector	5	0.65	\$3.25
HM-10 BLE Module	4	\$9.99	\$36.96
Crystal Oscillator	1	\$9.79	\$9.79
Navigation Light	1	\$45.00	\$45.00
Waterproof Encloser	1	\$33.36	\$33.36
Torquedo 48-5000	2	\$5,199	\$0.00 (Provided)
Torquedo 10.0R	1	\$8,999	\$0.00 (Provided)
Charger for 48-5000	2	\$899	\$0.00 (Provided)
Live Well Aerator/Pump	1	\$44.99	\$0.00 (Provided)
Rule-Mate Bilge Pump	1	\$79.99	\$0.00 (Provided)
FTDI	1	\$15.95	\$15.95
PCB Version 1	5	\$13.00	\$65.00
PCB Version 2	5	\$15.00	\$75.00
Total	-	-	\$796.24



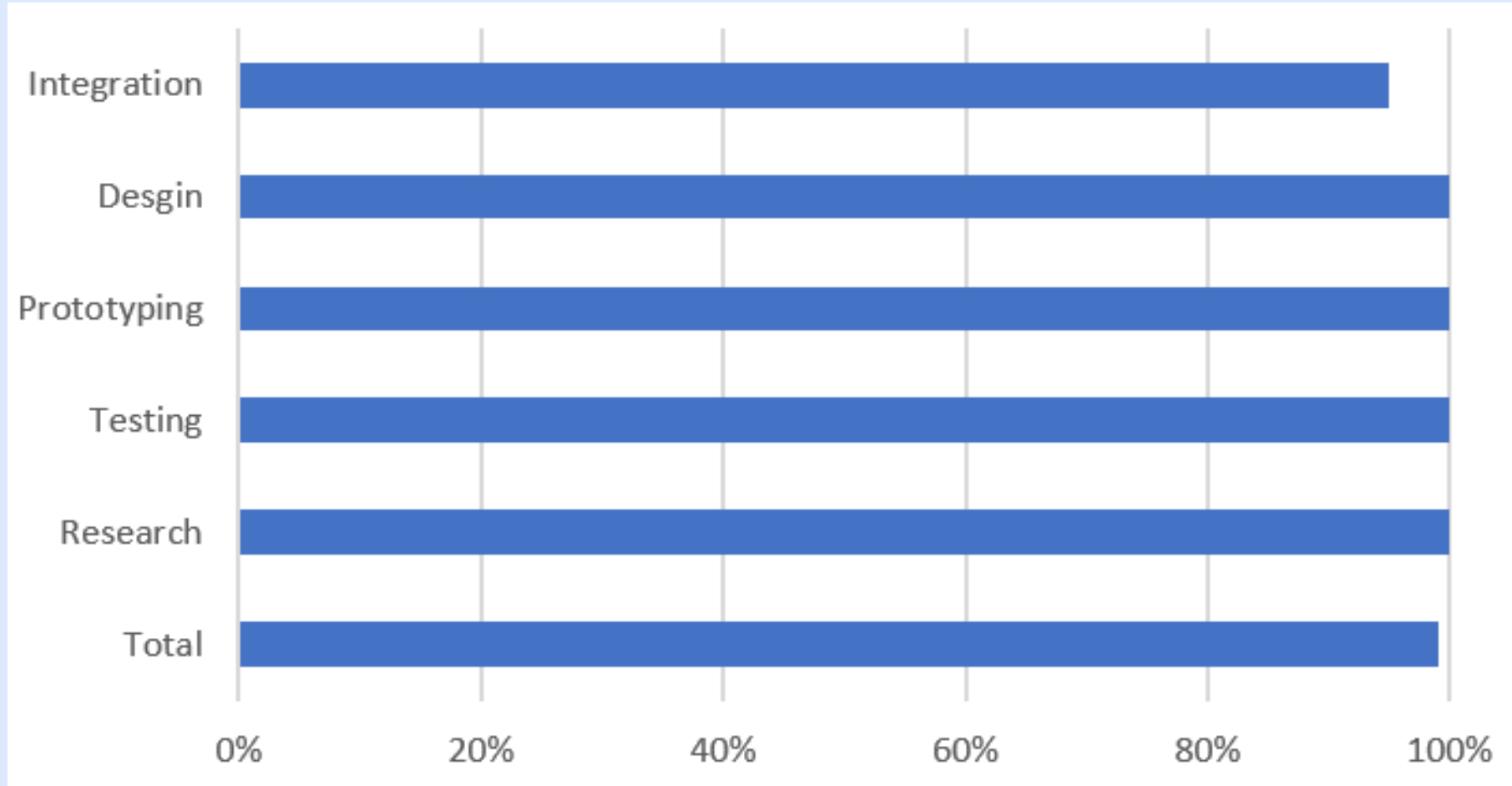
Production Cost

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Torqueedo 10.0R	1	\$8,999	\$8,999
Charger for 48-5000	2	\$899	\$1,798
Live Well Aerator/Pump	1	\$44.99	\$44.99
Rule-Mate Bilge Pump	1	\$79.99	\$79.99
FTDI	1	\$15.95	\$15.95
PCB Version 1	5	\$13.00	\$65.00
PCB Version 2	5	\$15.00	\$75.00
Total	-	-	\$22,116.22



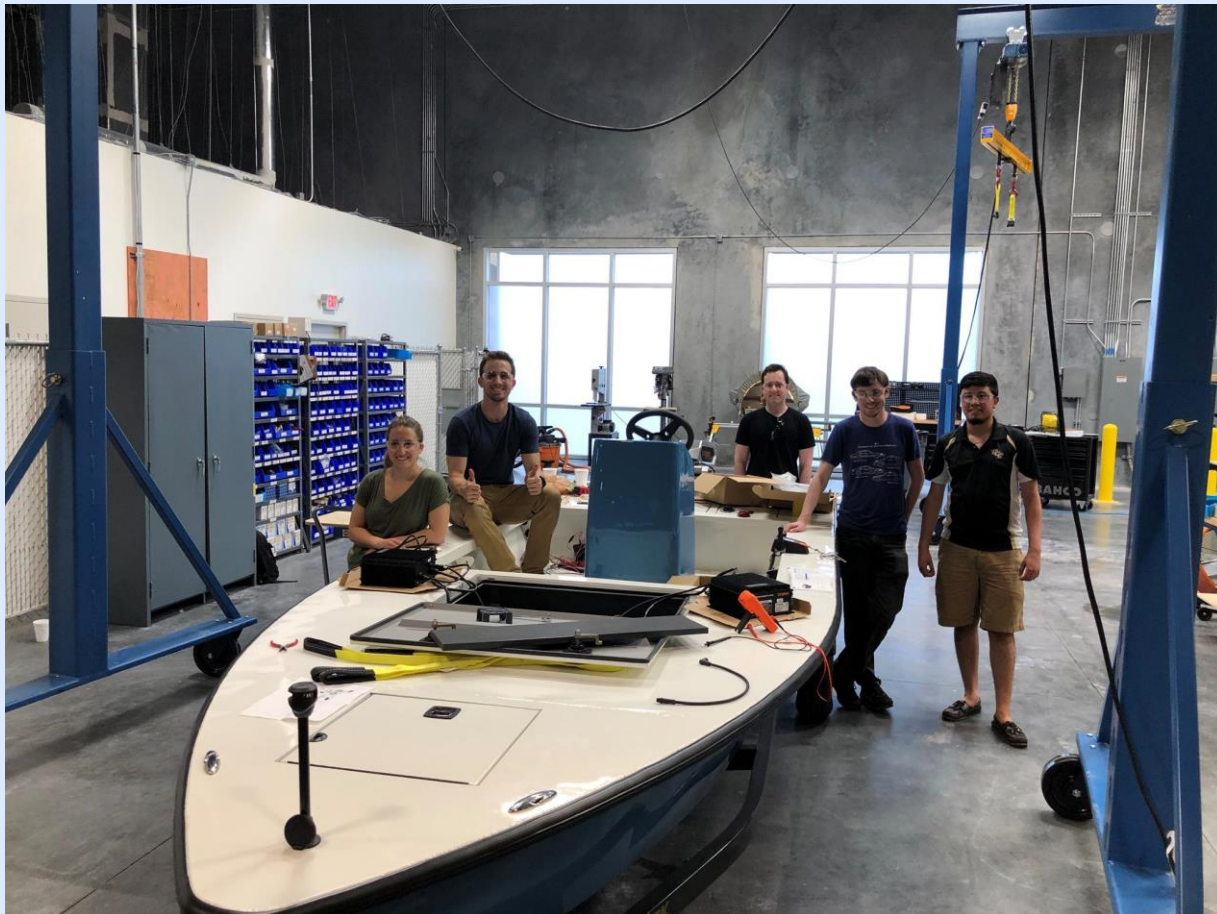
Progress



Challenges

- Final Integration with the fabricated boat
- Marine standards compliance
- Sponsor Communication
- Power distribution design
- 48-12V DC/DC Converter

Questions



Demo

- [Motor Spinning](#)
- [Kayak-App](#)
- [Kayak-Onboard](#)
- [Kayak-Combined](#)
- [Initial Wiring](#)

