Solar Powered Ocean Camera Buoy Development

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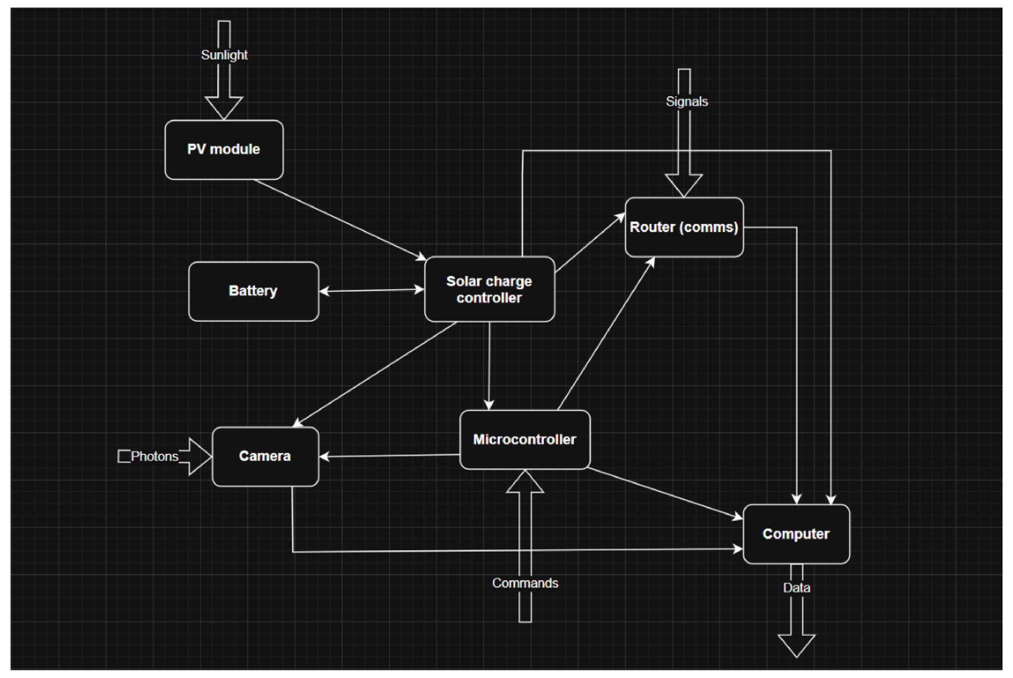
MarineSitu

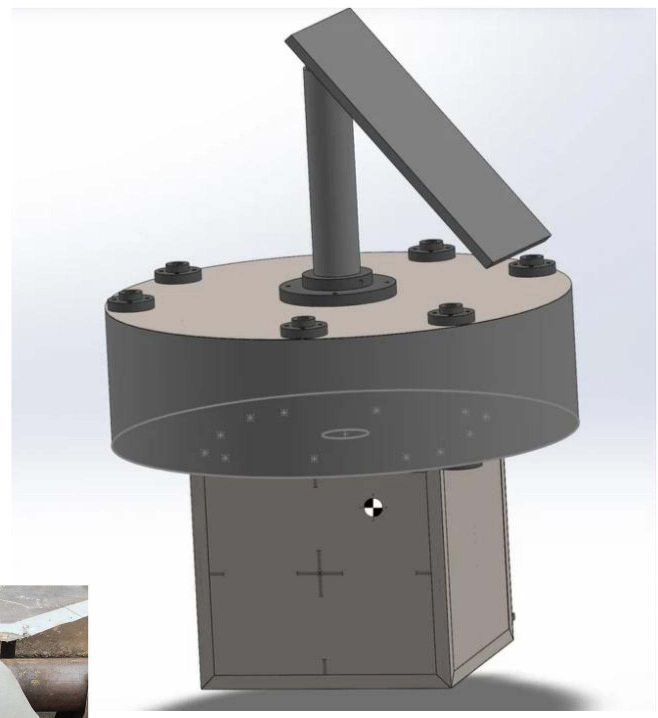
Introduction

- The solar powered ocean camera buoy is a prototype buoy that will utilize solar energy to operate an underwater camera and internal data collection and processing
- The camera is powered by a battery, which will be charged by the solar panels attached on top of the buoy
- There is a computer module that includes an Nvidia Jetson which processes the data from the camera and uploads it for the client to view
- Below is a system level diagram that looks at the inputs and the outputs for the system and also visualizes how subsystems would be connected inside the buoy



Technical Design

Feature description
Well: This is the rectangular region which holds all of the electronics
Foam: The foam is the primary source of floatation
Solar panels: sized to meet power requirements over our deployment time
The mechanical team used ProteusDS to simulate environmental conditions for the buoy



On the left there is a cardboard mold made to shape the foam and next to it is the baseplate cut out of steel
The picture on top is a CAD design of our prototype buoy

Motivation

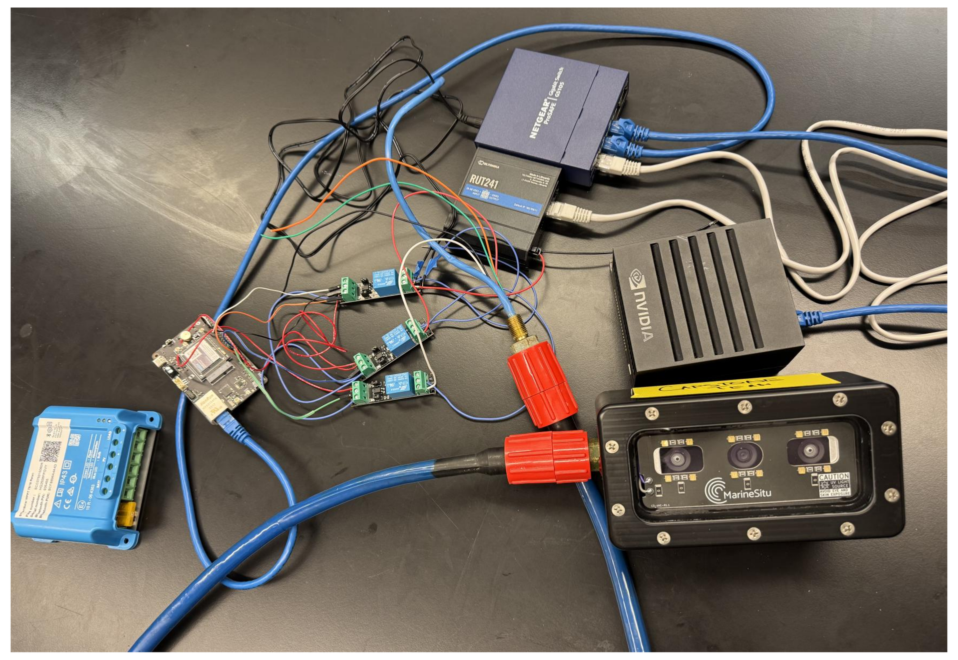
- Traditional buoys rely on large battery banks requiring frequent servicing or power cables from the shore
- Goal: Design and prototype a solar powered ocean monitoring buoy capable of running an underwater camera and transmitting data continuously for up to three months with minimal human intervention

Requirements

- For ease of deployment, the buoy has a maximum diameter of 1 meter with a weight of under 100 kg
- Operate on 262Wh per day being the estimated DC load
- Designed for a 5 day battery autonomy
- Resilient to waves, corrosion, saltwater, and biofouling
- Watertight electronics enclosure rated for marine environment
- Deployable and recoverable by 2-3 people

Required power (Wh)	Adding the power used by each of the components	262
Days of Autonomy	5 days	5
Total power (Wh)	Required power * days of autonomy	1310
Battery voltage (V)	Provided as 12 Volts	12
Battery capacity (Ah)	Total power / battery voltage	109.17
Battery losses (%)	Provided on the website (lithium ion)	0.05
Safety Margin (%)	Recommended by the second website	0.05
Final battery capacity (Ah)	Battery capacity * (1 + battery losses)	**120.08**
Peak sun hours	Specific to Seattle (from the website)	3
Solar panel size (W)	Final battery capacity / sun hours	40.03
Panel losses(%)	Provided on the website	0.15
Final solar panel size (W)	Solar panel size / (1 - panel losses)	**47.09**

The calculations on top were done to determine the size of the battery needed along with the solar panels.
The picture below is a part of the electrical assembly that goes inside a drybox. There is a camera, router, computer, and a network switch connected to each other and the microcontroller through relays

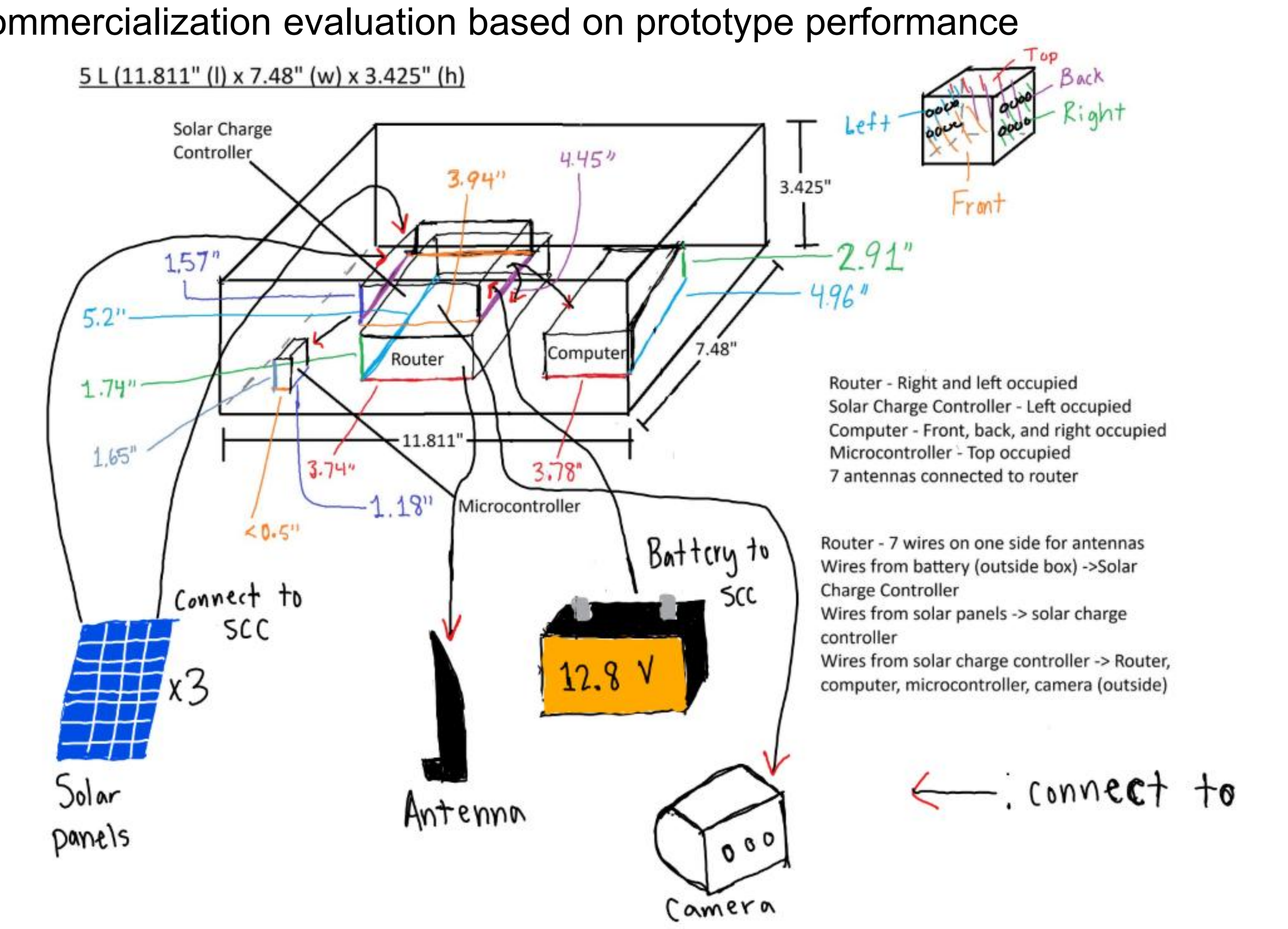


Conclusion

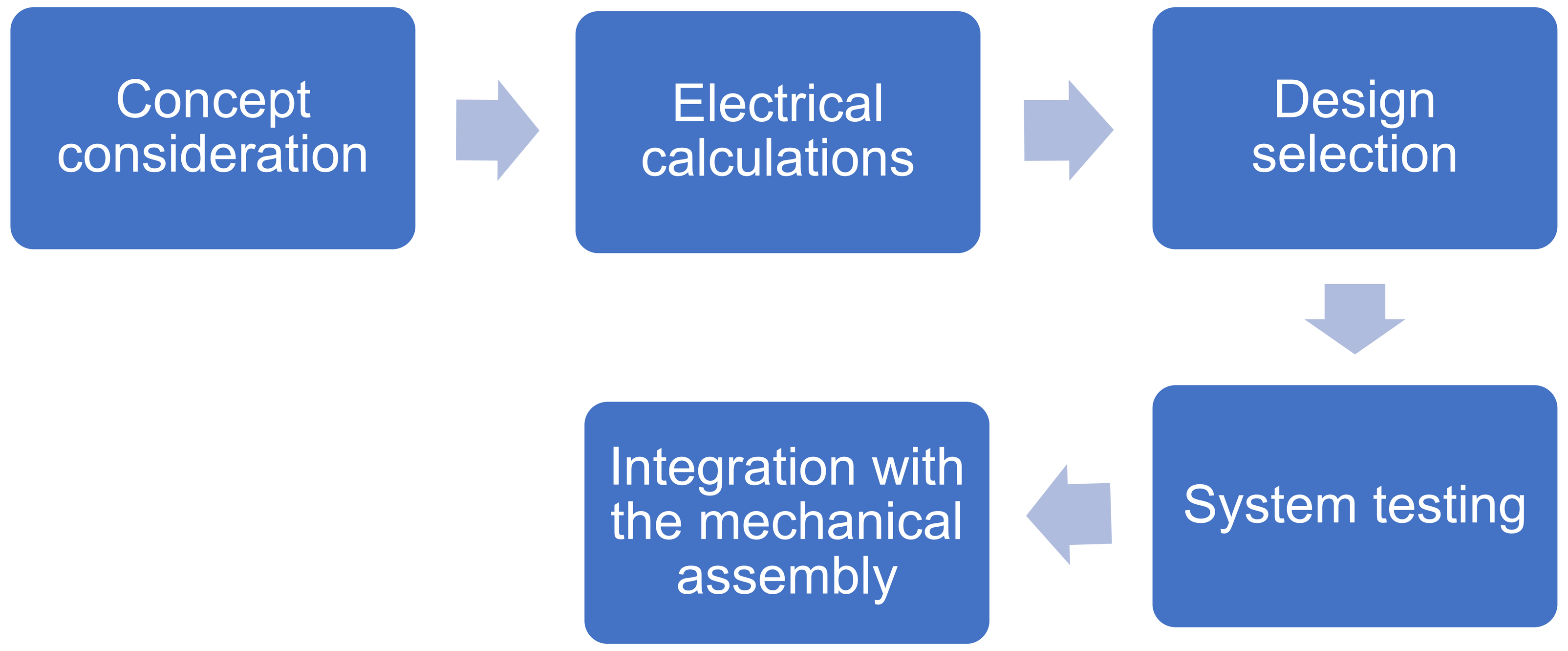
- This project integrates different devices such as cameras, solar panels, routers, and solar charge controllers
- Combines the focus of sustainability, reliability, and cost effectiveness
- One step closer to being more efficient in monitoring and protecting marine life in underwater ecosystems

Future Work

- Assess biofouling impact on solar panels and camera lens over extended deployment
- Potential system scaling for multiple buoy network
- Commercialization evaluation based on prototype performance



The diagram above includes the whole electrical system essentially and depicts how each of the components are placed inside the drybox along with their connections to the battery, solar panels, antenna, and the camera.



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