1 Mechanical Design

Our non-ROV device's housing is constructed from High Density Polyethylene (HDPE), known for its excellent durability and water resistance. The device's diving mechanism employs a buoyancy engine, which consists of a linear actuator (a motor coupled to a power screw), which opens and closes three 50 mL syringes arranged in parallel. The device descends by retracting the actuator, sucking water into the syringes to increase density, while it ascends by extending the actuator, expelling the water to decrease density.

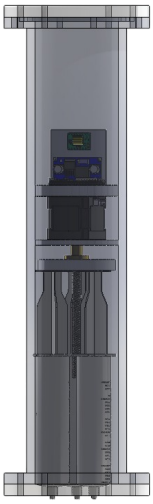

Figure 1: Non-ROV Device Design

2 Electrical Design

The float's electrical system is centered around the ESP32 microcontroller, which manages sensor data, motor control, and communication.

A critical component of the system is the BMP280 pressure sensor, which is mounted externally on the float to measure water pressure directly, allowing the system to determine the float's depth.

The ESP32 is connected to the BMP280 via I2C protocol and periodically reads pressure values, it also uses its internal Real-Time Clock (RTC) to timestamp each measurement. These readings are saved locally during the float's dive. When the float surfaces and the ESP32 regains connectivity, it transmits the collected data wirelessly to the station using HTTP requests.

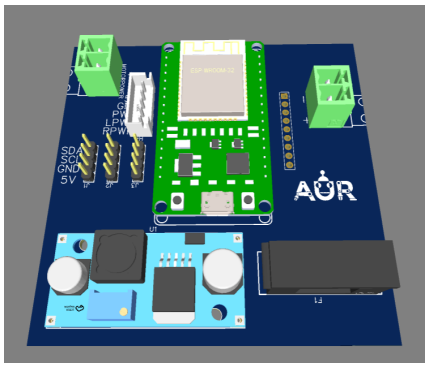

Figure 2: PCB Design

All components, including the fuse holder and power input, are mounted on a tiny printed circuit board (PCB). The system is powered from a 3S 18650 battery pack (nominal 12V), which directly supplies the motor for the buoyancy engine. An onboard buck regulator converts the 12V to 5V to power the ESP32 and the BMP280.

Power Calculations

The device has a maximum power consumption of **40W** (Table 1), drawing around **3.33A** from the **12V** power supply. Taking in a safety factor of 1.5x for inrush currents, the system is protected by a **5A** fuse.

Table 1: Power Consumption Summary

Component	Power
Motor	36W (12V×3A)
BMP280	1W (5V×0.2A)
ESP32	3W (5V×0.6A)
Total	**40W**

Current Calculation (12V Supply):

- **Base Current**: $\frac{40\,\mathrm{W}}{12\,\mathrm{V}} = 3.33\,\mathrm{A}$
- **With Safety Factor (1.5×)**: 5 A
- **Fuse Installed**: **5A**

System Interface Diagram

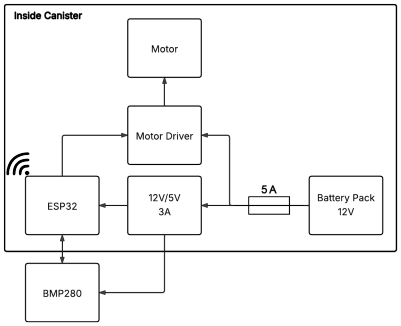

Figure 3: System Interface Diagram (SID).