DragonLeapRov

SHENZHEN TECHNOLOGY UNIVERSITY

CHINA GUANGDONG SHENZHEN

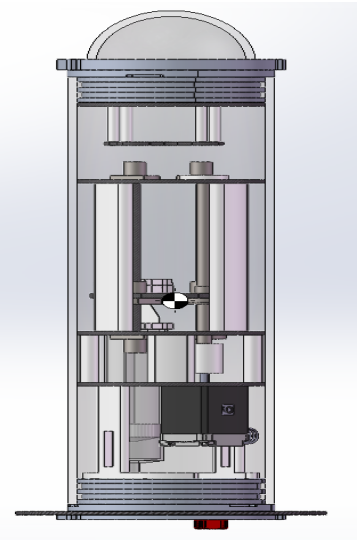
2025 Non-ROV Device Design

FLOAT DOCUMENTATION

FUTURE TECHNOLOGY SCHOOL 未来技术学院

深圳技术大学 SHENZHEN TECHNOLOGY UNIVERSITY

The float developed by our float team, is the non-remotely operated vehicle (Non-ROV) device specifically engineered for Task 4, which involves conducting vertical profiling underwater. We did not use independent sensors, so we power our float by the batteries inside.



Height:386mm

Diameter:110mm

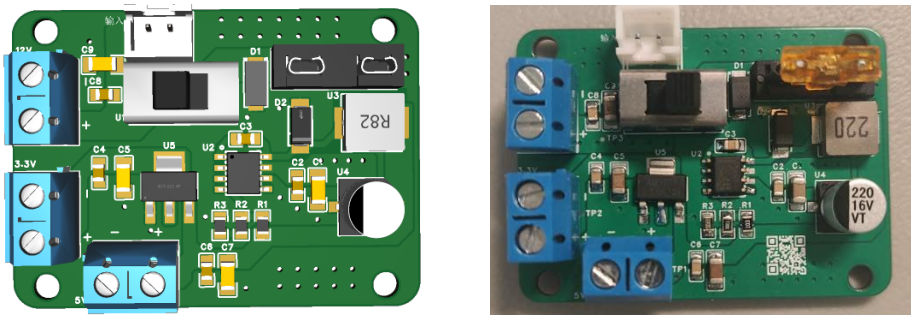
Mechanical Design

The underwater float adopts a cylindrical structure, with an optimized overall design to ensure efficient, stable, and safe operation. The exterior of the float is cylindrical, which minimizes resistance during vertical movement and reduces the impact of water flow. The internal structure secures the main control unit and battery in an upper position, away from potential water ingress areas, thereby enhancing waterproof performance. The overall center of gravity is low, ensuring the stability of the float during ascent and descent.

The power source is a stepper motor, which provides sufficient torque within a limited volume. By driving the lead screw to move the syringe piston, it achieves the drawing in or expelling of water, thereby controlling the rise and fall of the float. This design not only improves the operational efficiency of the float but also enhances its stability and safety in complex underwater environments.

Electrical Design

The step-down power module integrates the TPS5430DDAR and AMS117 chips, combining the advantages of high-efficiency step-down conversion and linear voltage regulation. The TPS5430DDAR achieves a wide input range and high output current with a conversion efficiency of up to 95%, while the AMS117 provides low dropout characteristics, ensuring stable and reliable multi-channel output voltages.



The step-down power module

Additionally, the power module is equipped with a 5A replaceable fuse. When the current exceeds this value, the fuse automatically blows, cutting off the circuit to protect it from overcurrent damage. This fuse is a one-time, fast-acting type, offering rapid response to ensure timely protection of the circuit's safety.To ensure the tightness of its structure and the sealing rubber ring is coated with silicone grease to prevent water leakage, while the wiring is all sealed, and the fuse is installed in place.

The power module

The power module utilizes a series connection of 10 nickel-metal hydride (NiMH) batteries to supply power to the main control board, motor, and a series of sensors. A fuse is installed 3 centimeters from the positive terminal of the battery, providing rapid response to promptly protect the circuit from potential hazards.

Additionally, the power supply is controlled by a master switch, which allows for immediate circuit interruption during debugging or in the event of safety concerns, ensuring the safety of the float's electrical system.

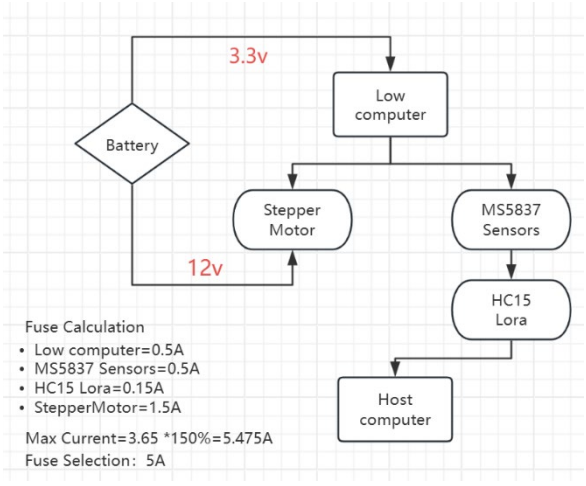
Software Design

Lower-level System

The buoy's automatic control system is composed of the STM32F103C8T6 microcontroller. This microcontroller communicates with the upper-level system via the HC15 wireless LoRa module. It transmits environmental pressure and depth data collected by the MS5837 sensor to the upper-level system, which then plots time-depth-pressure graphs. Additionally, the microcontroller employs a PID algorithm to control the stepper motor, which drives the lead screw to move the syringe piston, thereby drawing in or expelling water to submerge or ascend the buoy.

Upper-level System

The upper-level system is developed using Python and leverages the Matplotlib library for data visualization. It receives real-time data through the serial port from the wireless module and plots the data as time-series curves, providing an intuitive representation of data trends. Furthermore, the upper-level system optimizes data transmission and storage processes to ensure data security and reliability. It offers users a convenient and efficient data analysis tool, suitable for various monitoring scenarios.



Float SID