

NAUTIX PIONEERS



Float Documentation

Vortex Academy
Alexandria, egypt



Introduction

After three years of accumulated experience in underwater robotics competitions, we proudly introduce **Flautix**, an advanced autonomous float developed to improve upon previous designs in terms of efficiency, reliability, and precision.

Through iterative design, testing, and optimization, our team enhanced the mechanical, electrical, and communication systems to ensure consistent and high-performance operation within the competition environment.

Mechanical System

Flautix operates using a vertical profiling mechanism based on a pneumatic cylinder, forming an accurate and efficient buoyancy control system. A stepper motor drives a lead screw, which in turn actuates a piston inside a sealed chamber. This motion allows controlled displacement of up to 153.66 mL of fluid, enabling precise buoyancy adjustments.

This mechanism allows the float to achieve and maintain neutral buoyancy, ensuring stability at specific depths while minimizing energy consumption.

The system is supported by an aluminum extrusion structure, providing both strength and modularity for easy integration and maintenance. A flexible coupling connects the stepper motor to the lead screw, ensuring smooth torque transmission even in the presence of slight misalignments.

To ensure durability and safety:

- The enclosure is piston-sealed to prevent water ingress
- A pressure relief mechanism is integrated to handle overpressure scenarios

The float maintains a constant external volume, simplifying buoyancy calculations. Additionally, the internal lead-acid battery acts as ballast, lowering the center of gravity and improving overall stability. The streamlined hydrodynamic design reduces drag, allowing smooth and stable vertical movement during operation.



FIGURE 1: flautix

Electrical System

The system is powered by a 12V AGM lead-acid battery, selected for its high current capability, durability, and sealed maintenance-free design. For safety, a 3A fuse is installed close to the positive terminal to protect against overcurrent conditions.

Power distribution is managed as follows:

- A 5V, 3A buck converter supplies the ESP32 microcontroller, RTC module, and logic level converter
- A 3.3V regulator powers the IR and pressure sensors

A TMC stepper motor driver is used to control the motor with high precision and efficiency, ensuring accurate piston movement.

The RTC (Real-Time Clock) module enables precise timing and scheduling of operations, while the IR sensor assists in maintaining correct positioning within the desired depth range.

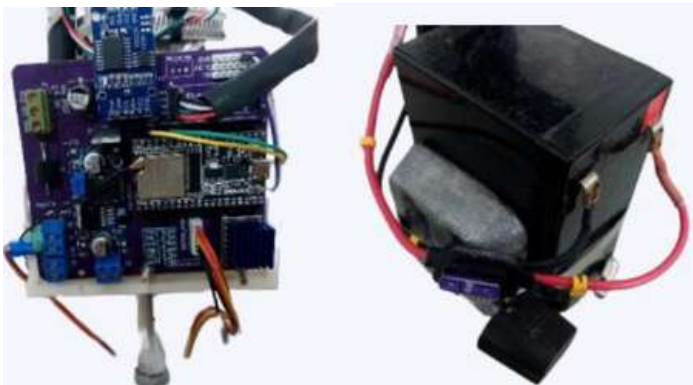


FIGURE 2(A) : PCB on board

FIGURE 2(B):fuse and battery

Communication System

Flautix utilizes two ESP32 modules to establish communication between the float and the base station. The system relies on the ESP-NOW protocol, a low-latency, peer-to-peer wireless communication method that does not require an internet connection.

The onboard ESP32 is responsible for:

- Collecting sensor data
- Processing system feedback
- Transmitting real-time data to the base station

This ensures fast, stable, and reliable communication, enabling continuous monitoring and efficient control during operation.

power calculations

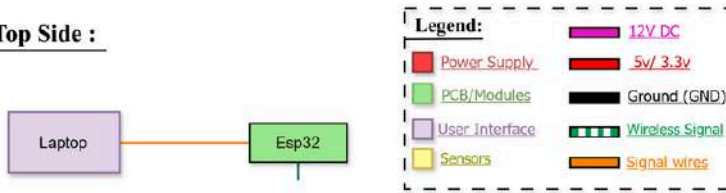
Component	Voltage (V)	Current(A)	Power(W)
Stepper	12	1.5	18
ESP32	5	0.25	1.25
TMC	12	0.1	1.2
Buck	12	0.3	3.6
Total	—	2.15	24.05

TABLE 1 :power calculations

Load Amps in water = 2.15A
Therefore, the Chosen fuse rating is 3A to ensure overcurrent protection.

SID

Top Side :



Float Side :

Float FLA in Water = 2.15 Amps
Fuse Value Chosen : 3 Amps

