Rhea, a more dependable, accurate, and efficient autonomous float, is introduced by Team Titans. The mechanical, electrical, and communication subsystems have advanced significantly despite continuous testing and improvement, and **Rhea** is in a solid position to compete and achieve the 70 points.

System of Mechanical

Additionally, **Rhea** has a more advanced Vertical Profiling System (VPS). The addition of pneumatic cylinders with stepper motors at the bottom of the buoyancy motors has further enhanced the system. Stepper motors were employed for better control and force since the DC motor, which was first used, lacked enough torque. The switch to pneumatics this year has also improved depth control, responsiveness, and fineness.

An aluminum extrusion rod that is fixedly connected to the float's upper body supports the VPS. The float's modular architecture facilitates quick iteration and on-the-spot customization by making it simple to add, delete, or swap components with little labor.

Features of the Drive System:

A 157 ml pneumatic cylinder.

Power screw for transmission of linear motion

Flexible coupling with misalignment correction for efficient torque transfer

Piston-sealed container to shield interior parts from the elements

A relief valve in the enclosure allows excess pressure to be vented, protecting the integrity of the system against overpressure.

Stability and buoyancy:

By removing the requirement for external ballast, constant volume design makes buoyancy calculations easier.

The enclosure floor's lead-acid battery serves as a stabilizing mass.

A hydrodynamic outer casing reduces drag, and all electronics are in a water-tight enclosure to exclude water flow.

Electrical System

A 12V rechargeable lead-acid battery powers the electrical system, giving all subsystems dependable power. Important aspects of performance and safety include:

To avoid overcurrent risks, a 4A fuse is positioned 5 cm from the battery's positive terminal.

A buck converter that steps down voltage from 5V to 3V for the microcontroller ESP32, a module for the Real-Time Clock (RTC), converter of logic levels. 3.3V regulator that provides electricity to: A linear potentiometer, A pressure sensor with a Bar30 rating. There is a logic level shifter included to guarantee that components are functioning at varied voltage levels. A TMC stepper motor driver is used to regulate motion, resulting in high-resolution movement. While the linear potentiometer allows for exact tracking and adjustment of float position within the prescribed depth range, the RTC module guarantees perfect scheduling and time-based activities.

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

Table 1 Power calculation

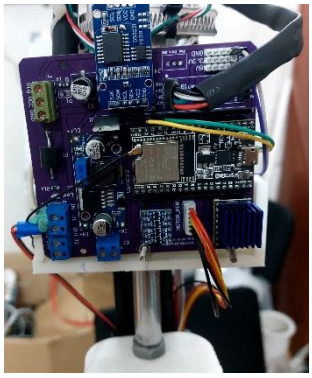


Figure 1 nFLoat PCB

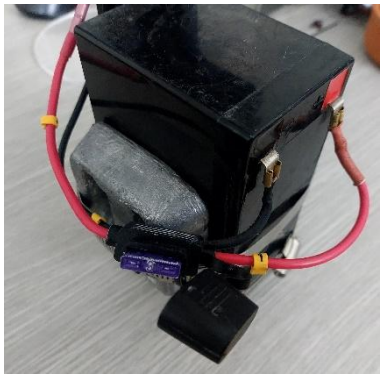


Figure 2 float Battery

Communication System

To achieve seamless communication between the float and the station, we're using two ESP32 modules—one onboard the float and the other at the mission station. They communicate wirelessly using the ESP-NOW protocol, a low-power, low-latency, and secure communication method ideal for real-time data transmission. ESP-NOW enables direct peer-to-peer communication without requiring an internet connection, ensuring a fast and stable data exchange in challenging environments with potential interference. The ESP32 is responsible for collecting sensor data, packaging it into a structured data packet, and transmitting it wirelessly.

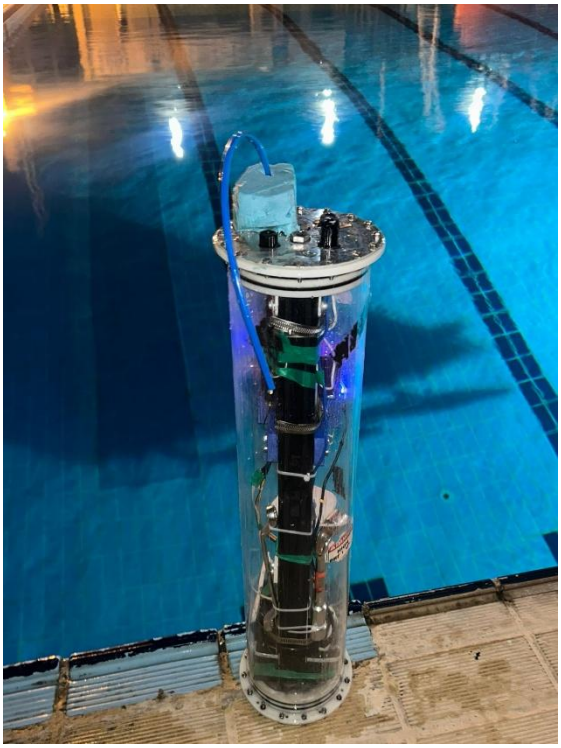
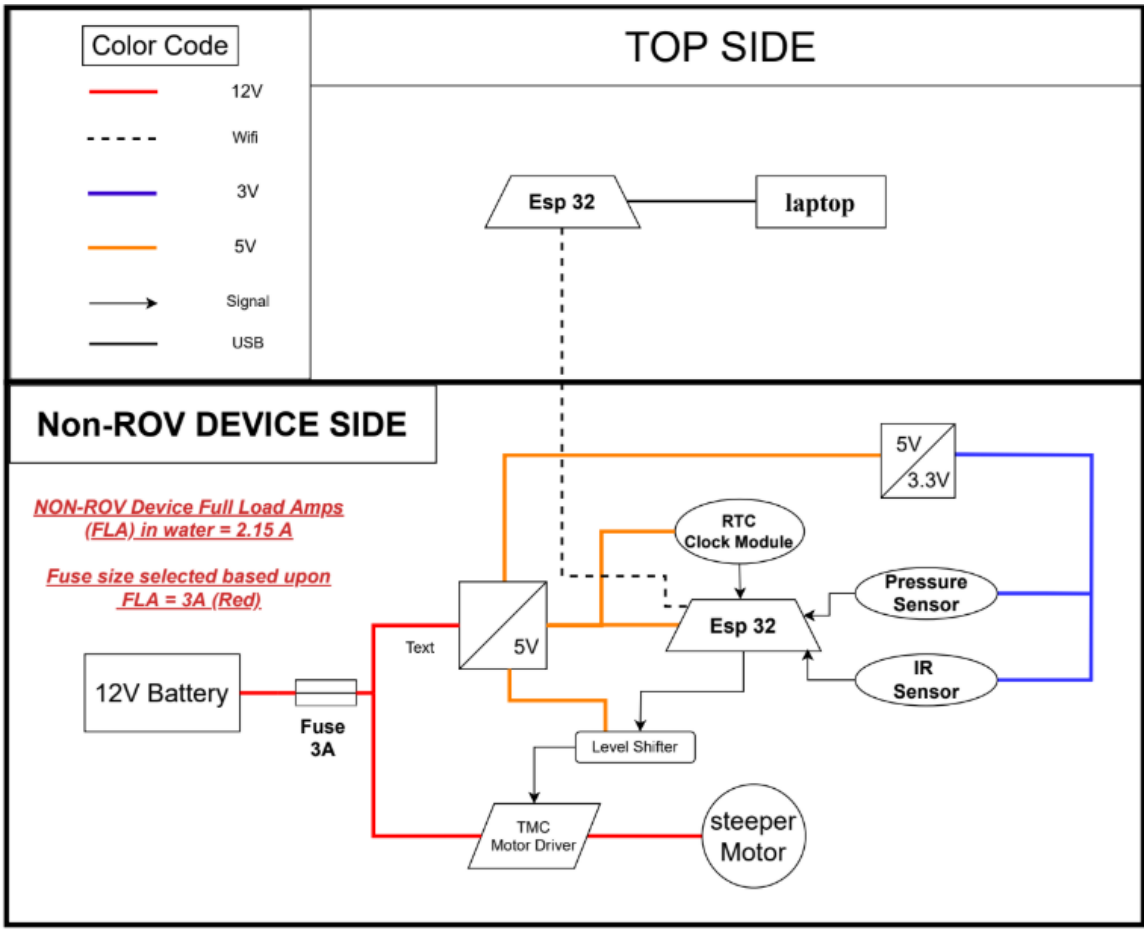


Figure 3 Rehea

Float SID


Color Code
12V
Wifi
3V
5V
Signal
USB
TOP SIDE
Esp 32
laptop
Non-ROV DEVICE SIDE
NON-ROV Device Full Load Amps (FLA) in water = 2.15 A
Fuse size selected based upon FLA = 3A (Red)
5V / 3.3V
RTC Clock Module
Pressure Sensor
Esp 32
IR Sensor
Text
5V
12V Battery
Fuse 3A
Level Shifter
TMC Motor Driver
steeper Motor