

VERTICAL PROFILING FLOAT

WARRIORTIDES

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Operation

Alongside Nautilus, WarriorTides developed the AHAVIAN is designed to adjust its buoyancy and depth autonomously using a large syringe to intake and expel water, which controls changes in buoyancy. By varying the water volume in the syringe, the AHAVIAN can complete a vertical profile and maintain a 2.5-meter depth hold, guided by a PID controller and real-time data from a depth sensor.

The AHAVIAN is powered by a Wemos D1 Mini Pro, a development board built around the ESP8266 microcontroller. Onboard electronics include a BarO2 depth sensor, an external antenna for wireless communication, a voltage converter, an H-bridge for bidirectional actuator control, and an LED status indicator. All components are mounted to a custom-designed PCB, which enhances serviceability and minimizes the risk of shorts or entanglement with moving parts. Power is supplied by eight AA batteries housed in a separate enclosure equipped with a pressure relief mechanism for added safety.

The topside station contains an identical microcontroller that communicates wirelessly using the ESP-NOW protocol, a Wi-Fi-based peer-to-peer communication method that eliminates the need for a router. This allows the crew to remotely monitor and collect data from the AHAVIAN while the float is on the surface.

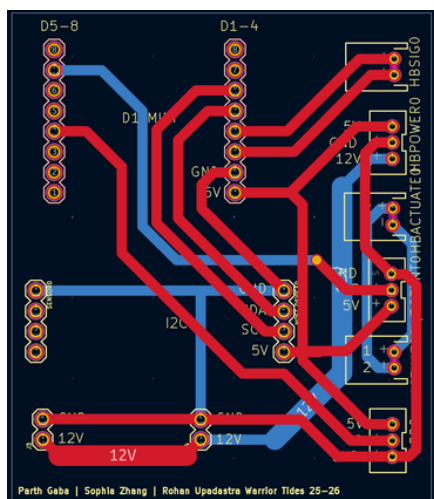


Figure 18:
The
AHAVIAN's
PCB layout
in KICAD
(By: Sophia
Zhang)



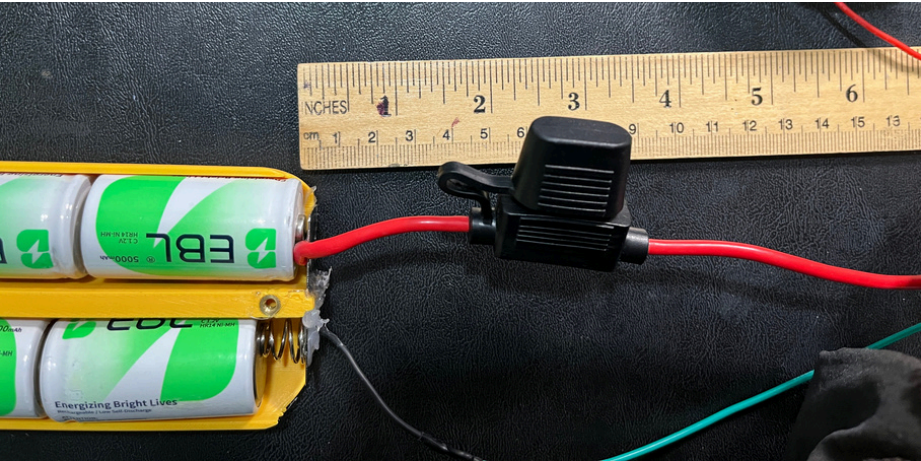
Figure 1: The AHAVIAN Vertical Profiling
Float

Taken by Sophia Zhang

Float Safety

- 5A fuse placed less than five cm from the positive terminal of the NiMH batteries, all of which are secured to the enclosure
- The syringe has been depth tested at maximum pressure to ensure that it does not burst when profiling
- The float enclosure has been leak-tested in thirty-minute increments
- All batteries are secured in a separate enclosure with an endcap that can be forced out to handle excess pressure
- A tube connects both enclosures, allowing pressure from the main enclosure to escape to the battery enclosure when the main enclosure is clamped shut

Float Safety cont.



ELEC-NRD-004
All batteries run through a single, properly sized 3A fuse. This fuse is pictured approximately 5 cm from the batteries.

Fuse Determination		
Trials	Waiting Mode	Buoyancy Change Mode
1	0.73 A	2.65 A
2	0.68 A	2.57 A
3	0.71 A	2.76 A
AVG	0.71 A	2.7 A

ELEC-NRD-005
Waiting mode FLA = 0.71 A
Buoyancy change mode FLA= 2.7 A
Fuse size selected based upon FLA = 5 A



ELEC-NRD-003 The float is powered by 10 NiMH EBL Rechargeable C Cell 1.2V Batteries. The batteries, arranged in series, reside in a 3D printed battery pack.

ELEC-NRD-006 The enclosure's external bottom endcap with a 97 mm sealing diameter can be forced out to handle excess pressure.

Fuse Selected



Pictured is a 5A ATOF blade fuse, selected based on the calculations above.

Battery Pack Safety

The AHAVIAN's battery pack is designed for quick diagnosis of the NiMH batteries enclosed inside. Following general safety guidelines, all cells within the pack are high quality, checked to be around 50% charge, and wired in series to not exceed 12V. Three screws secure the top cover (not pictured) of the custom-made battery pack, providing simple access to the batteries inside. Generous tolerance allows for easy removal for any power issues. In case of emergency, the nearby fuse cuts the batteries off from the circuit.

Float Communication

To enable reliable communication between the float and the topside station, the system utilized a Wemos D1 Mini Pro ESP8266 microcontroller, which provided both processing capability and integrated Wi-Fi connectivity. The float transmitted real-time depth data collected from the onboard sensor to the topside station using wireless communication whenever the antenna surfaced, allowing operators to monitor depth profiles and system performance live.

Onboard the float, the ESP8266 was integrated onto a custom PCB alongside the depth sensor, actuator, and antenna, forming a compact and efficient control system.

The topside station, containing a corresponding ESP microcontroller, received incoming data packets and visualized them by graphing depth over time. The float uses a PID controller to adjust buoyancy dynamically using depth sensor feedback.

By leveraging the ESP8266's wireless capabilities, the team eliminated the need for tethered communication, improving deployment flexibility while maintaining consistent and responsive data transmission between the float and the surface station.

