Robosharks Non-ROV Device Design

Overview

This year, our float was created to emphasize simplicity above all else. Utilizing a buoyancy engine made out of a servo and a simple syringe, we're able to easily complete vertical profiles in the water. A Blue Robotics Bar 2.0 depth and temperature sensor relays data to an onboard ESP32, which then uses the depth data in a control loop to maintain a depth of 2.5 meters for 45 seconds. The data is also relayed to a surface station through an onboard wifi transmitter when the profile is completed. A 12V NiMH battery powers the float, with a 3 Amp fuse providing emergency power shutoff if necessary. Additionally, a PVC check valve relieves excess pressure inside the float if the electronics experience a catastrophic failure.
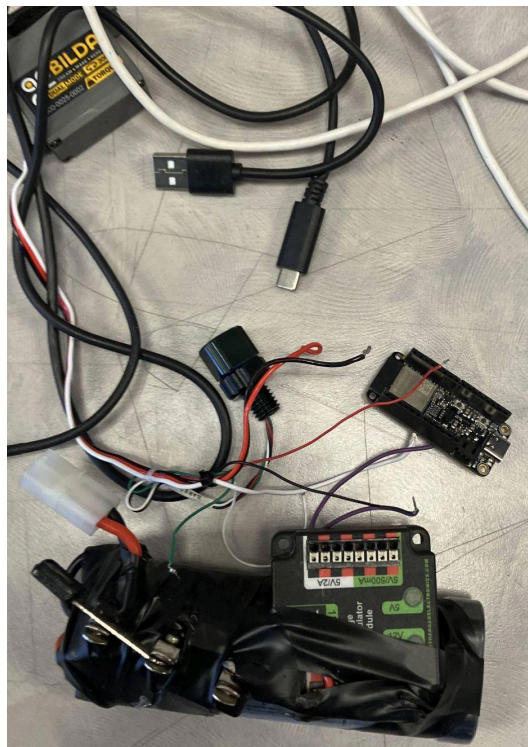

Figure 1. The electronics inside the float. The switch on the battery pack holds a 3 Amp ATO blade type fuse

Design

Our float was designed with the intent of making a simple design that had the minimal amount of complexity needed to meet its goals. To achieve this it uses a servo to move a syringe, controlled by an ESP32. The broadcasting system uses the wifi access ports on the ESP32 to interface with an antenna that communicates with the surface station.. Additionally, it is constructed inside of a commercial water bottle to seal the internal compartment while also

providing easy access to the electronics and PVC check valve provides a mechanism for internal pressure release.

Operation

Our float is fully self-contained and requires no outside input to function. Once assembled on the surface it is activated, starting a code-based delay to give time for it to be deployed before the buoyancy engine starts as well as the broadcasting. The float starts in the by retracting the syringe fully, to begin its descent. Once it approaches the target depth of 2.5m, a PID loop on the ESP32 uses the data from the depth sensor to adjust its location in the water.
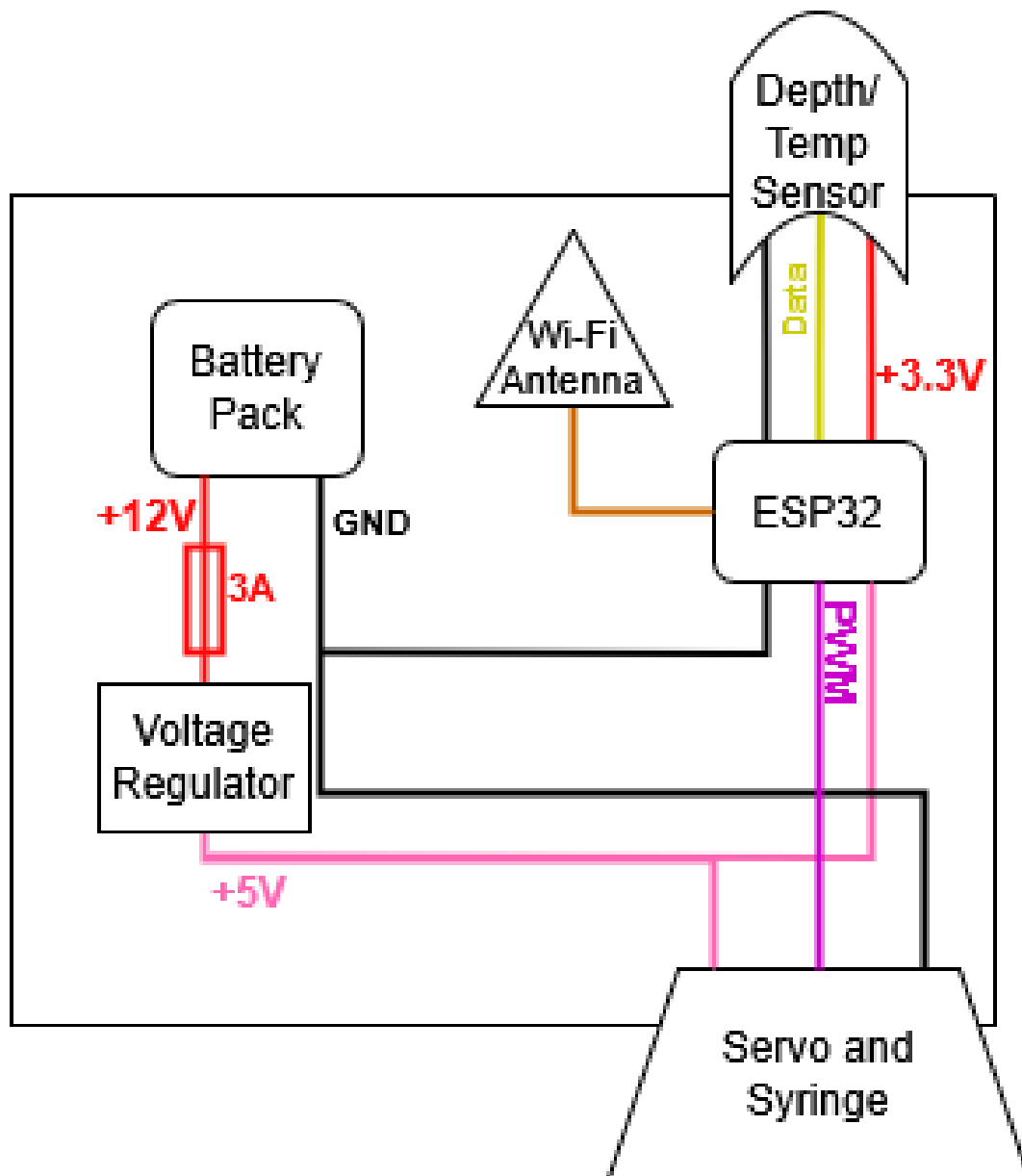
Buoyancy Engine

Our float's buoyancy engine is powered by a store-bought servo that we use to move a simple 60 ML syringe. This changes the overall volume of our float, thereby allowing us to adjust its density and move up and down in the water.

Safety

Our float was constructed in order to be as safe as possible from both an electrical and physical standpoint. We use a 12V NiMH battery securely fastened to the inside of our float, with a 3 Amp fuse positioned within 5cm of the positive terminal of the battery. It additionally has no external components such as thruster blades that could pose a hazard to personnel and wildlife.

Float SID

Depth/ Temp Sensor

Data

Wi-Fi Antenna

+3.3V

Battery Pack

+12V

GND

ESP32

3A

PWM

Voltage Regulator

+5V

Servo and Syringe

Fuse Calculations

One 2000 Series Dual Mode Servo - 2 Amps
One ESP32 - .26 Amps
One Bar 2.0 Depth/Temperature sensor: .00125 Amps

2.26125 Amps = 3 Amps fuse is used