ORCA ROBOTICS

NON-ROV DEVICE DESIGN

OVERVIEW

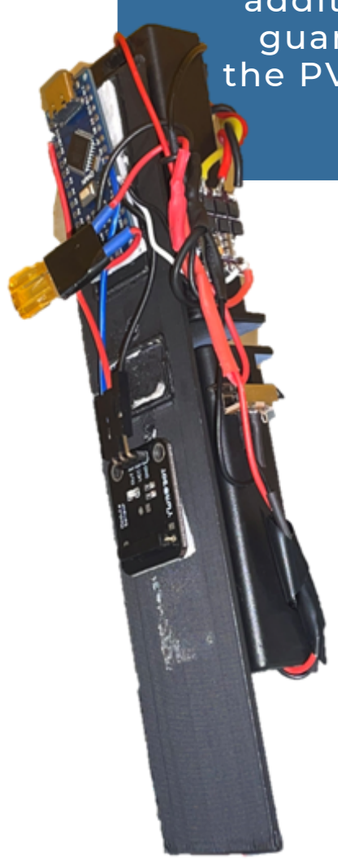
After our company qualified for the world championships, we took on the challenging task of completing the Mate Float in 6 days, and this meant ensuring that all parts had to be made in-house or purchased locally. Furthermore, we decided to opt out of using the buoyancy engine due to time constraints and higher complexity opting to use a simple thruster.

Our float is designed to be neutrally buoyant, which means that the net force acting on the float in water is zero. Therefore, firing the propellers clockwise sinks the float while spinning it in the opposite direction pushes the float up, allowing for vertical profiles to be completed.

MECHANICAL REVIEW

The float's main body is constructed using a scrap transparent PVC pipe and end caps. The thruster is attached to this body through a custom-designed 3D printed motor mount; this mount has multiple perforations to reduce its weight and improve fluid flow. The other end is sealed using a thumbscrew tightened rubber bung, which can act as a relief point for safety in the case of excess pressure buildup.

The float also positions its thruster at the bottom (heavy) to ensure the orientation of the float is always vertical; additionally, the addition of IP20 shrouds on the thruster ensures safety. The addition of 3D printed fins further guarantees that the float will always travel in a straight line. We also plan on adding a 3D printed ring around the PVC filled with steel balls to fine-tune our buoyancy, while making sure the steel balls are not in contact with the electronics.



ELECTRICAL REVIEW

The electronic is housed in a custom 3D print which effortlessly slides in and out of the tube. It consists of an Arduino Nano microcontroller, a small bidirectional Emax D-Shot ESC, 5 Amp Onboard fuse, Two 9V alkaline batteries and a reed switch. To double the floats capacity (1100 mAh) the two batteries have been connected in parallel hence our float can run up to 47 min. The current draw of the circuit is 4.4 A (4.38 from thruster and 0.019 from Arduino Nano) and a 5 amp fuse is suitable.

Furthermore, our company saved $24 by buying a reed switch ($2) over a waterproof button ($25.99). The reed switch gets activated in a magnetic field and, therefore, can be left inside the PVC pipe, reducing the need for waterproofing.

SOFTWARE REVIEW

The float is programmed using a simple timer-based Arduino program activated through a reed switch. We used the millis() function to implement a timer. To control the ESC, we used the Servo.h library, which helps output a PWM signal (1000 min, 1500 neutral, 2000 max) to the ESC. How long the thruster is fired can be changed quickly based on the depth of the pool and trial and error