EMCC Desert Star Robotics Vertical Profiler Design Doc

Design Goals:

For our second year of the competition, we decided to completely overhaul last year's design with two goals in mind. First, decrease its size, and increase reliability. Our current design does that by using a smaller integrated actuator, and a Printed circuit board that consolidates most of the electronics.

System Description:

Body and caps

The float body is a 2in polycarbonate tube with resin 3d printed caps. The top cap has an enclosure vent and depth sensor installed. Bottom Cap contains the sleeve for the buoyancy engine.

Power

The Float is powered using 4xAAA Alkaline Batteries Integrated into the frame of the Profiler. Those batteries are directly connected to the fuse contained on the carrier board. This is then regulated by a voltage regulator to 5v for the Electronics.

Electronics

This Profiler is controlled by Sparkfun RP2040 Pro Micro soldered to a custom carrier board that handles signal and power distribution. For communication, the microcontroller is connected to a LoRa Radio that communicates with the base station using packetized radio system. For Depth Sensing, the profiler uses a BAR02 Sensor epoxy cast into the cap of the float. Finally for timing there is a Real Time Clock Daughter Board

Buoyancy Engine

For the buoyancy engine we decided to use a similar syringe system as last year to maintain the system's simplicity. While similar in operation, it was heavily improved using an Actuonix PQ12 High Force Micro linear actuator pushing a 3d printed plunger. This allowed for a miniaturization of the float
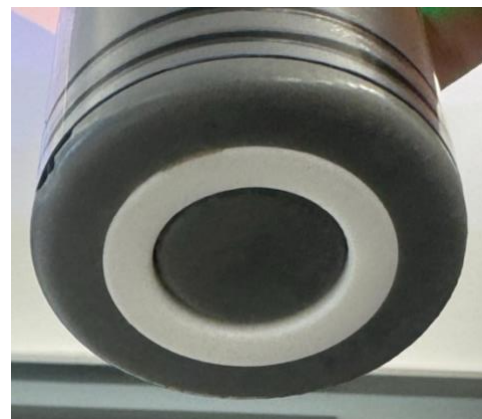
and a reduction in complexity of the control electronics. The buoyancy engine plunger runs in a PTFE sleeve bringing in and pushing out water.

Buoyancy

To reach neutral buoyancy there is provisions for the installation of tungsten weights into the float.