NON-ROV DEVICE

Vertical Profiling Float

ETERNAL

I. Mechanical Design

Cosmo -**fig(1)** was designed to flawlessly complete several vertical profiles. After reviewing numerous ideas and tests, the final design was created. The float consists of one enclosure made of PMMA that houses the float's brain and water storage volume that stores the water in it to increase the weight and change the buoyancy. Four syringes are activated by a nut that travels on a spinning threaded rod that functions as a power screw to suck the water in or out by a DC motor driving. The PMMA enclosure is sealed from both ends with HDPE caps and O-rings with a PMMA face. Pneumatic cables are used to help the water flow inside the float. The water tank is designed and positioned in such a way that the float remains stable while operating, allowing for successful vertical profiles with a low center of mass. Two sets of four 4 mm diameter stainless steel rods hold and support the shelves of the electrical components.

Figure 1: Vertical float engine design

II. Electrical Design

Our float engine is powered mainly from 16 AA batteries (1.5V each). Eight batteries in series to be able to supply 12V. there is 2 sets of the eight batteries connected in parallel to be able to supply the demanded current. An Arduino Nano is mounted on the PCB with a 7805 regulator to supply 5V to power the Arduino. There are 4 male pin headers soldered on the PCB to connect the power and signal cables to the DC motor.

III. Software Design

The HC-12 was used to allow two Arduinos to communicate wirelessly. The first, known as the Transmitter, will be situated inside the floating engine, while the second, known as the Receiver, will be connected to the station laptop via USB. We chose the HC-12 module since it has 100 channels that can be switched between, each channel has its own frequency, and its range is 433.4 - 473.0 MHz; so, we may switch between them to minimize interference if required. However, HC-12 can communicate over a long distance (approximately 1 km). On the other hand, we control the movement of the float using a DC motor and L298N - Dual Full Bridge Driver.

a. Transmitter:

To be able to send data serially, we needed to use a battery powered RTC module with the code DS3231 on the floating engine Arduino, which provides us with the UTC time, but we need to configure it before we can send the UTC time alongside the company number to the topside Arduino.

b. Receiver:

It is made up of an HC-12 and an Arduino Uno. To receive the data being transmitted from the floating engine, the HC-12 module must be on the same channel as the transmitter. To easily visualize the data received from the floating engine, we used the threading concept to launch a thread that accepts serial data from the topside Arduino and displays it on the GUI.

The main reason for selecting the HC-12 module over the HC-05 Bluetooth module is that the HC-05 has a short-medium range and failed to transmit or receive across barriers during testing, but the HC-12 module proved otherwise.

We used a stepper motor with A4988 but it couldn't tolerate high pressure, so we had to replace it with DC motor.

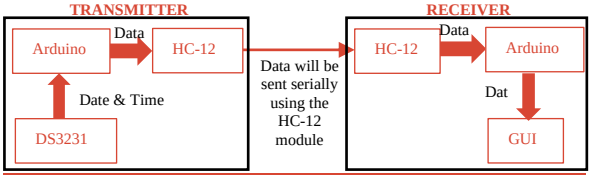

Figure 2: Float communication diagram