

NON-ROV DEVICE (VERTICAL PROFILING FLOAT)

Buoyancy engine

The buoyancy engine features a unique mechanism that integrates a DC motor and planetary gears connected to a ball screw. This ball screw mechanism enables vertical movement through rotational motion. The syringes manipulated by the ball screw regulate water volume, thereby altering the engine's weight for controlled vertical motion. The engine itself consists of a tube with an inner diameter of 100 mm, an outer diameter of 110mm, and a height of 600mm. The majority of electronic components are housed in the upper section, while the lower section accommodates the pressure sensor and 4 × 60 mL syringes.

The operation of the buoyancy engine begins upon receiving a signal from the ground station. The motor gradually pulls the syringe by rotating the ball screw, causing water to be driven into the syringes and increasing the overall weight of the engine. The two pressure sensor send feedback water depth data to MCU and output corresponding PWM through the Algorithm of PID. Once the engine over the target depth, the mechanism reverses, pushing the syringe to withdraw water and reduce weight, allowing the engine to ascend.

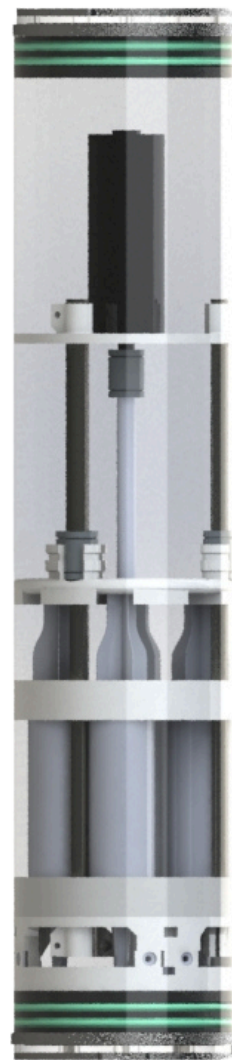


Fig. 2: Rendered buoyancy engine



Fig. 3: Real-life Buoyancy engine

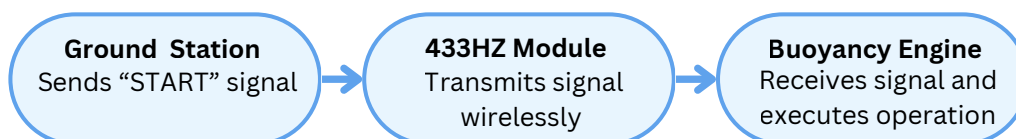
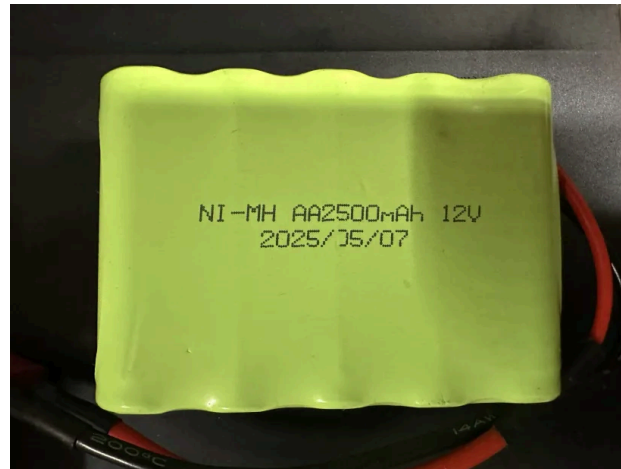


Fig. 1: Communication illustration between the buoyancy engine and ground station



The battery pack of the buoyancy engine is securely fixed and placed inside the tube using 12V NI-MH batteries for power supply.



According to Fuse calculation, the full load voltage of the device is no more than 2A. Also, the fuse is located near the battery pack less than 5cm. Therefore, 12V NI-MH batteries can safely meet the operation of the buoyancy engine.



Full load current Calculation of buoyancy engine

2 ms5837 pressure sensor = $100 \times 2 = 200$ mA

DC motor and PWM Control board = 1000 mA

UNO R4 WIFI = 125 mA

Light Dependent Resistor = 100 mA

WE2812 LED = 200mA

VL53L0X-V2 TOF laser-ranging sensor = 100 mA

AS32-D33 communication module = 150 mA

JY901 IMU = 20 mA

Full load current = 1.895A

Fuse Selection = 2A



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