



PROP-PULSION

ROBOTICS

Simply Complex

Non-ROV Device Documentation

B.O.B.B.

Buoyancy Operated Buoy Bot



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Jon Kaminski	- Fabrication & Graphic Design
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BOBB Specifications

Length - 84cm
Diameter - 18cm
Weight - 7.2kg
Power - 9.6 DC (8 C NiMH batteries)
Processor - VEX EXP Cortex
Sensor - Analog to Digital Pressure
Data - Micro SD Wifi

Key Safety Features

- Master power switch
- 5A fuse within 5cm of battery pack
- Easy battery access panel
- 2.5cm pressure relief plug (Figure 2)

Key Design Features

- Syringe buoyancy control
- Custom syringe control gearbox
- Removable battery pack
- Easy access battery compartment
- Ice avoidance algorithm
- Ability to hold a predetermined depth

Performance Capabilities

1. Complete vertical profiles
2. During descent, stop and hold at 2.5m (+/- .33m)
3. During ascent, stop and hold at 0.4m (+/- .33m)
4. Uses realtime depth data to adjust buoyancy
5. Gather and store depth data every 5 seconds
6. Wirelessly transmits data once float has safely surfaced



Figure 1: B.O.B.B.

Buoyancy Control

BOBB uses three syringes to control the buoyancy of the float. The syringes move up and down in unison using a single 7.2v motor, 9 to 1 gear reduction and threaded rod system (Figure 3). The float is designed to be just slightly positively buoyant. As the syringes take in water the volume of the float decreases as the mass remains the same and the float becomes negatively buoyant and sinks. When the syringes expel the water they ingested the float becomes positively buoyant and begins to ascend.

Software

BOBB uses a customized VEX EDX Cortex as its central processor (Figure 6). Depth data is fed into the system and the code was written to set the cutoff points that signal the float to ascend and descend and how long it remains at those set depths. Even though data is only stored every 5 seconds, the Cortex gathers data constantly in order to control and fine tune its ascent and descent. After two profiles the float surfaces and begins the data transmission process.

Depth Sensor

BOBB uses a custom, proprietary, analog to digital depth sensor (Figure 4). An analog pressure sensor measures the water pressure. The pressure moves the needle on the gauge. The needle has a thin cover attached to it and as the needle moves it reveals more (or less) of a bright yellow strip. A VEX AI Vision Sensor measures the length of this yellow line and sends that number to the cortex. Through exhaustive testing we set the parameters that correlate the length of the line to the depth of the float. The cortex uses this data to control its depth on ascent and descent.

Onboard Power and Electronics

BOBB uses a battery pack consisting of 8 C Cell NiMH batteries connected in series to produce 9.6 volts of power. The battery pack is contained in its own custom battery pod (Figure 5). Voltage regulators transform this to the 7.2v and 5v levels needed for the LED lights and VEX Cortex. A detailed SID is included in Figure 7.

Wireless Data Transmission

BOBB stores all its time and depth data on a Micro SD card. This card is connected to a WiFi SD card that broadcasts its own wireless network that we tap into to collect the data from the vertical profiles. This assembly can be seen in Figure 6.



Figure 2: Pressure Relief Plug

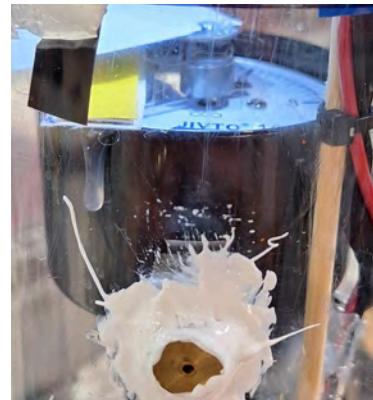


Figure 4: Custom Depth Sensor



Figure 3: Syringe Actuator

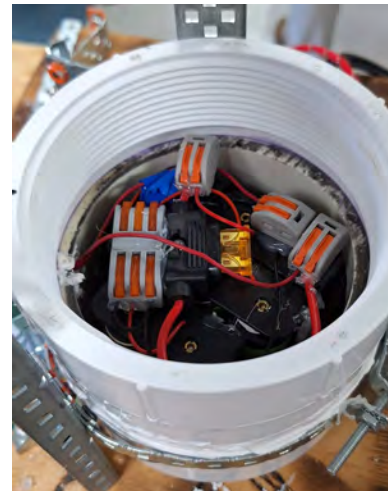


Figure 5: Battery Pod

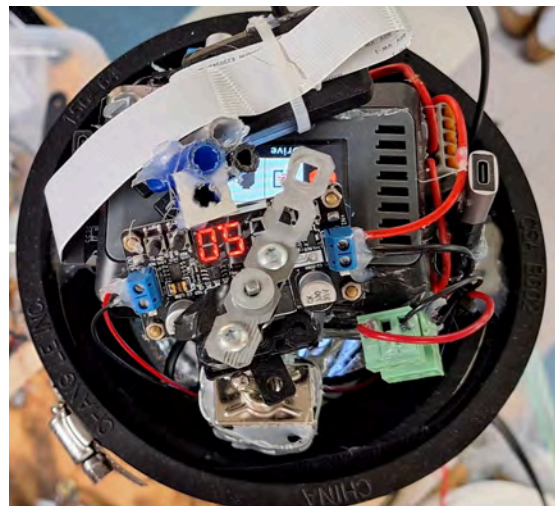


Figure 6: Customized VEX Cortex

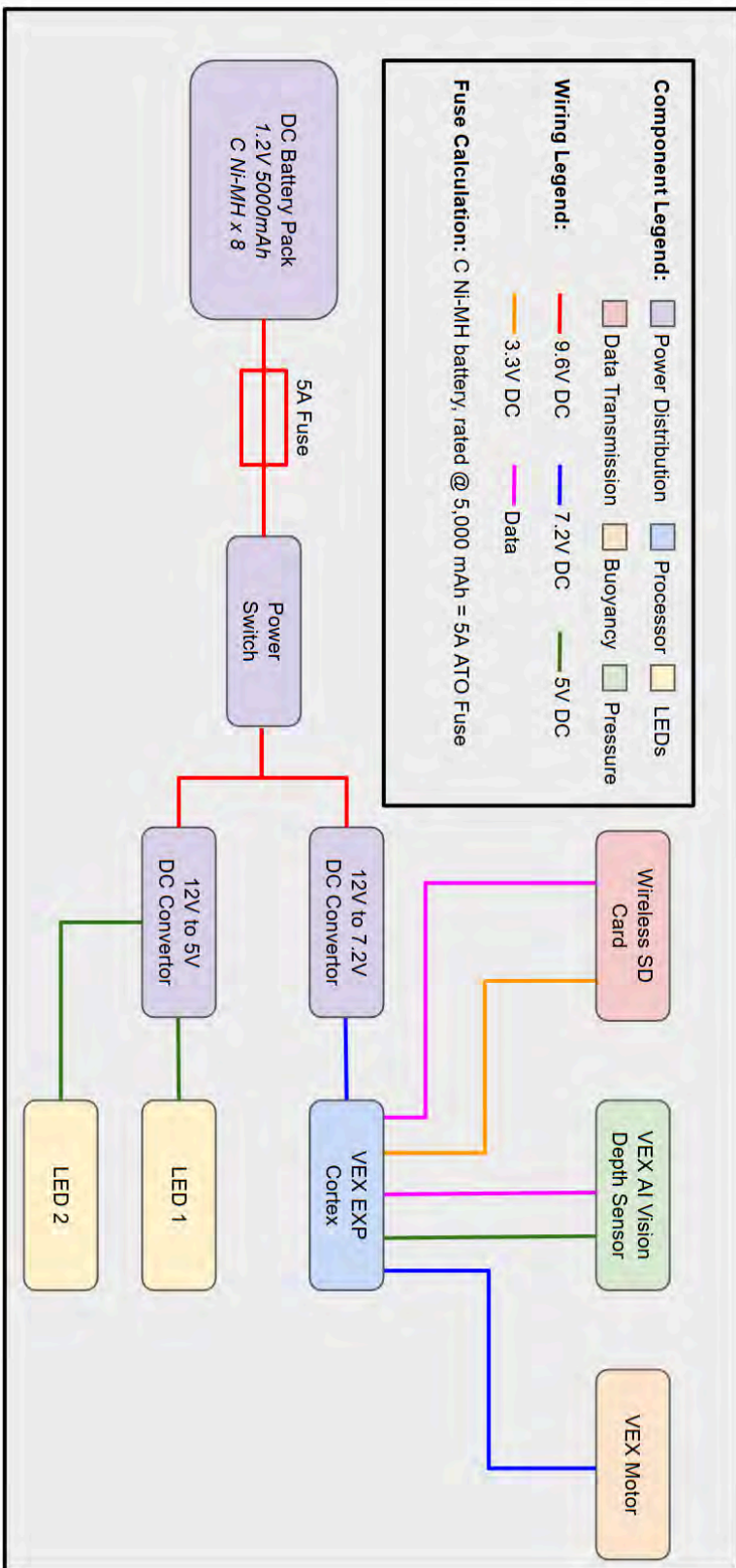


Figure 7: B.O.B.B. SID

B.O.B.B.
SID