Remorus: Autonomous Underwater Vehicle Research at UC Irvine

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REMORUS
Autonomous Underwater Vehicle Research at UC Irvine

UCI Samueli School of Engineering

Problem Overview

Problem:

Battery technology is a current limitation of AUVs

- Often requires manual battery swaps
- Limits operation time

Objective:

- Engineer an AUV that can autonomously navigate to a homing station / recharging station
- Implement the wireless recharging technology
- Maintain small scale and make AUV as small as possible

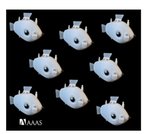
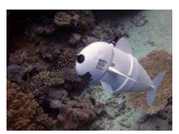
Our Solution:

- Ultra Wide Band signal detection
- Mounting mechanism to recharge

Existing Solutions

Industry AUV

- Harvard's S.O.R.S.G. BlueSwarm Robot
- MIT's Sofi
- CoCo Ro


2022 Winter Design

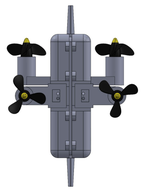
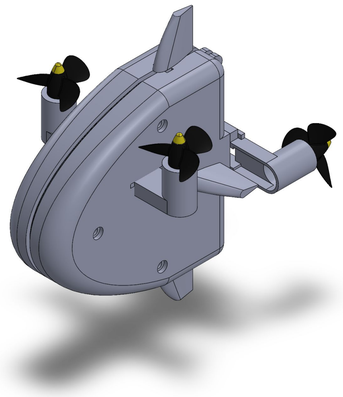
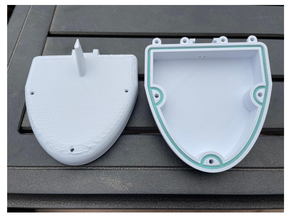
- Uses a pump to remain neutrally buoyant
- Utilizes a magnetic navigation system
- Electromagnetic homing station

Introduction

Remorus

Design Solution

Positive Buoyancy - added 2 z axis motors
UWB - Triangulation
Recharge Technology
Propulsion: DC Motor
Chassis - Waterproof, with silicon, streamline body, fins for balance

Positive Buoyancy

$F_b = \rho V g$

$ma \uparrow F_b$ (we want $F_b > mg$ by just a bit)
$\downarrow mg$

$ma = F_b - mg = \rho V g - mg$
$ma + mg = \rho V g \rightarrow m(a+g) = \rho V g$

desired $a = 0.01\ m/s^2$
$\rho_{H_2O} = 1\ kg/m^3$
$g = 9.8\ m/s^2$
V is in solidworks
m is our independent variable

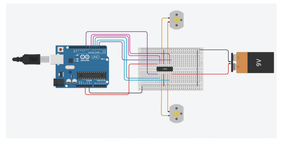
$$m = \frac{\rho V g}{a+g}$$

- Made robot positively buoyant to take out the pump in previous design
- Equation is to calculate the mass needed to obtain an acceleration of .01 m^2/s
- Use two propellers pointing up to control the negative z axis movement

Analysis

Motor Testing

- Changed inputs of the motors from liw to high to change the direction or rotation
- Uses PWM to change the speed of the motos

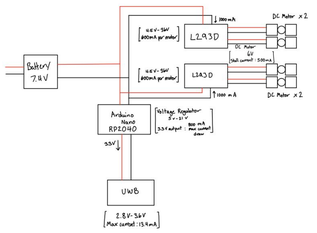


```
digitalWrite(in1, HIGH);
digitalWrite(in2, LOW);
digitalWrite(in3, HIGH);
digitalWrite(in4, LOW);

analogWrite(enA, i);
analogWrite(enB, i);
```

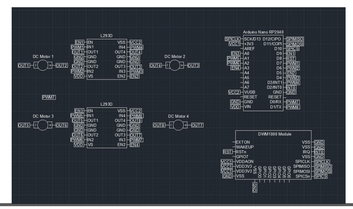
Power Distribution

Distribution of power between all components



Electrical Pinout Diagram

Pin connection between all components



Conclusions

Next Quarter Improvements:

- More anchors for better triangulation
- More robust propulsion system
- Functional wireless charging

Impact on Society

- Help advance the microrobot technology
- Possible use in microrobots for the body and non-intrusive repair

Acknowledgments

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