PROJECT TITLE: Deep Sea Mining

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INTRODUCTION

Minerals and metals are the vital elements required in industrialisation .The rising demand of minerals has led to a resurgence of interest in exploration of mineral resources located on the seabed .This paved the path for advancements in deep sea mining .But the point of concern is deep sea is also an habitat to the fragile yet the largest ecosystem on the earth. Here comes the question of sustainability.

In order to meet the requirements we need to mine the deep sea while also protecting the vulnerable aquatic environment deep down the ocean.

Keeping the above factor as a priority we have developed a robot which can pickup polymetallic nodules on the deep sea bed causing minimal interruption to the sediments present on the deep sea as well as the deep sea habitat.

ROBOT SPECIFICATIONS

The robot is designed with most attention paid to its survivability in the harsh deep-sea conditions. It has a submarine like structure with wide base tires for movement, which will allow the robot to move Fast Without causing it to sink. The robot has an extended arm in the front, with a claw attached to the end. The arm is connected to the main body with a hinge joint, and there are three another joints in the arm, which would allow it to pick up Rock nodules and place it in the primary chamber .There are two rods extending from the middle part of the main body with propellors at end, Which would help in under water movement of the robot and also help to increase the speed of upward motion to surface and downward movement to sea bed. There are two ballast tanks for upward and downward movement of robot in the depths of the ocean.

In the middle, the robot has two chambers, the smaller one is Primary Chamber and the larger one is Secondary Chamber. Primary Chamber contains a submersible motor, which helps in drawing out water from it. The opening for primary chamber is present on the upper part of the structure and the opening for Secondary is present at the Partition of the two chambers. Slider System has been used for Movement of Door. The face part would Have a Wireless WIFI Camera Connected to a motor to

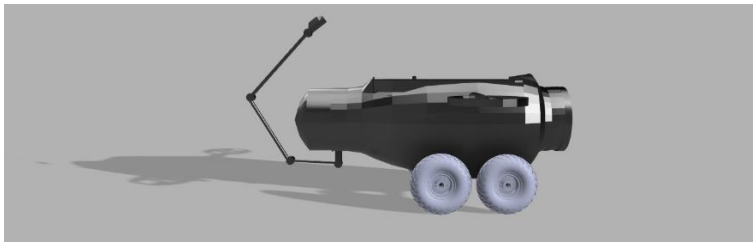
allow a near 180 degrees view for ease in operation. This would be Accompanied with a powerful flash light.
The COM is balanced by the internal components of the bot.
The back part of the robot would Have the main circuit which would be controlling all the operations. An ultrasound sensor would be present at the bottom part for measuring the depth at which the robot is present. The robot has a depth limit to which it can travel so Water pressure sensor would allow to measure the pressure.

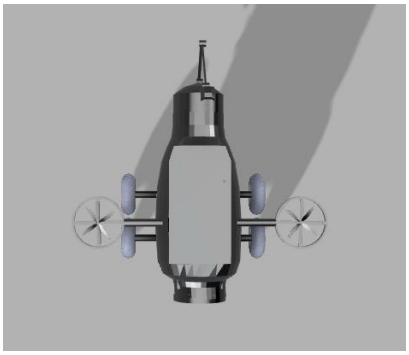
Control Strategy and Navigation

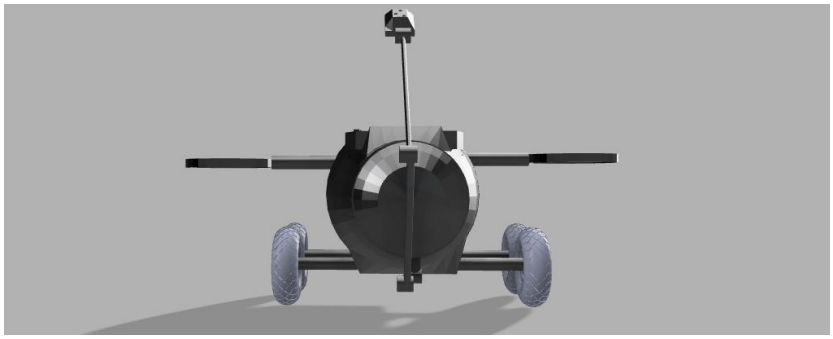
The bot works like a submarine that can go to the ocean floor with the help of ballast tanks and navigate on the seabed through the use of wide area wheels and propellors. First through camera a rock nodule would Be recognized and then through the claw the nodule would be picked up. Simultaneously, the door of primary chamber would open where the nodule would be kept by the arm. The door of primary chamber would close followed by pumping out of water which would enter with the rock. After completion of process the door of secondary chamber would open And the rock nodule would fall in the secondary chamber where it would finally be stored. Every movement would be controlled either manually or by Arduino.

Parts used in Circuit For controlling Robot:

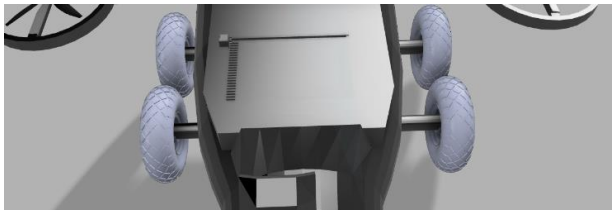
- **Arduino:** Arduino Mega 2560 has been used in our robot. It is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, a USB connection, a power jack, and a reset button. It contains everything needed to support the microcontroller.
- **HC-SR04 Ultrasonic distance sensor:** This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver, and a control circuit.
- **Sku237545 Pressure sensor:** In the net shell it converts the pressure into a small electrical signal that is transmitted and display. The pressure sensor works on the piezoelectric effect. This is when a material creates an electrical charge in responses to stress.
- **Hc05 Bluetooth module:** Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth. It is to be used for remotely controlling the bot.
- **L298N Motor Driver Module:** It is a high-power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.
  A2212 BLDC motor: Brushless DC Motors (also called as BLDC Motors) are used in drones for high performance and low power consumption as well as lightweight suitable for drone applications. This motor is bi-directional which means it can rotate in CW or CCW direction by swapping the polarity of the input supply.
- **3W High Power LED Module for Arduino:**
  Type: LED High Power Board
  long life, small size, Mainly Compatible with: Arduino
  Color temperature: Warm White 3000-3200K / white 6000-6500K
  Luminous flux: White 180-200LM (lumens)
- **Servo Motor:** A Servo Motor is a small device that has an output shaft. This shaft can be positioned to specific angular positions by sending the servo a coded signal. As long as the coded signal exists on the input line, the servo will maintain the angular position of the shaft.



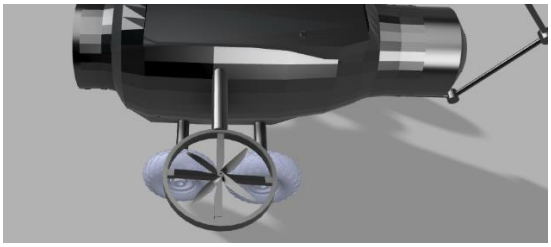




MAIN BODY



Gate for entering in primary Chamber



Propellers