SONAR-BASED 3D RECONSTRUCTION

OVERVIEW
We propose to use the HC-SR04 Ultrasonic Distance Sensor Module in addition to servo motors and servo mounts to recreate the local environment using the 3D point cloud data acquired by the sonar sensor. The mounts will be configured to allow for dual-panning and the software will command the two motors to sweep 180 degrees horizontally and 90 degrees vertically. The measured distance will be documented with the corresponding configuration of the two motors at every new configuration. After the full sweep, the data will be processed to follow a specific format. The formatted data will then be fed into an openGL-based visualizer.

PERIPHERALS
HC-SR04 Ultrasonic Distance Sensor
SG90 Micro Servo or MG996R Servo Motors

SOFTWARE DESIGN
Data Collection
```
For tick1 = 0 -> 180
      For tick2 = 0 -> 90
            Motor1.setAngle(tick1);            (via PWM)
            Motor2.setAngle(tick2);            (via PWM)
            D = SonarSensor.readDistance();    (via I2C)
            LogData(D,tick1,tick2);            (via UART)
      end
End
```

Data Processing
- Construct the transformation matrices (following Denavit-Hartenberg Convention) that convert from the sensor reference frame to the global reference frame whose origin will be defined to be the center of the output gear of the base motor

Data Visualization
- An openGL cloud viewer will accept a file containing the pose of each point in global coordinates and will plot them accordingly

GOALS
- The goal of this project is to test the accuracy of the distance sensor in its 3D reconstruction.