Point Cloud Generation

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FISAT

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Abstract

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This project aims at building a robot that visualizes its surroundings by using Arduino to control the hardware and PCL for visualizing the data.

Objective

- The objective of the project is to retrive data from surroundings and to create and visualize a Point Cloud.

Introduction

Robotic Arm

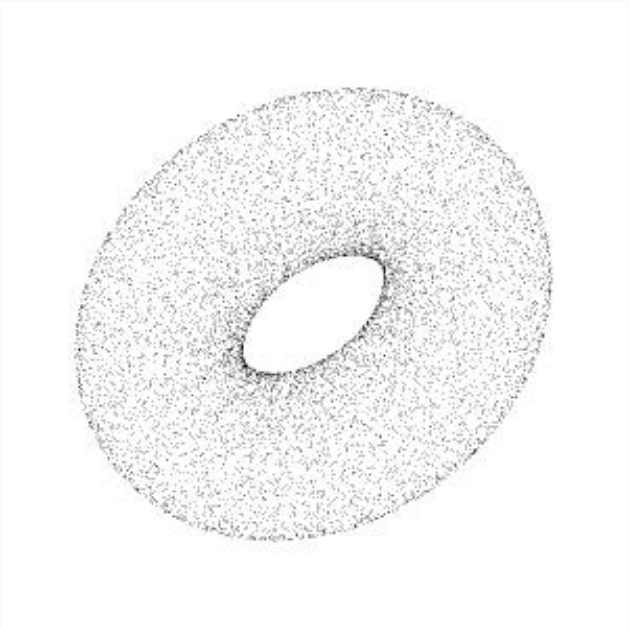
- Mechanical Arm, which is programmable
- Similar functions to a human arm
- Links connected by joints allowing either rotational motion or translational displacement
- End of the manipulator called End Effector

uArm

- Open Source robotic arm that can be assembled and controlled
- Manufactured by UFACTORY

Point Cloud

- Huge number of tiny data points existing in three dimensions
- Used to represent a 3-D shape or feature



LIDAR

- Stands for LIght Detection And Ranging.
- Remote Sensing Method.
- Uses light in the form of a pulsed laser to measure ranges.
- These light pulses along with other data generate precise 3-D information about the shape of the earth and it's surface characteristics.

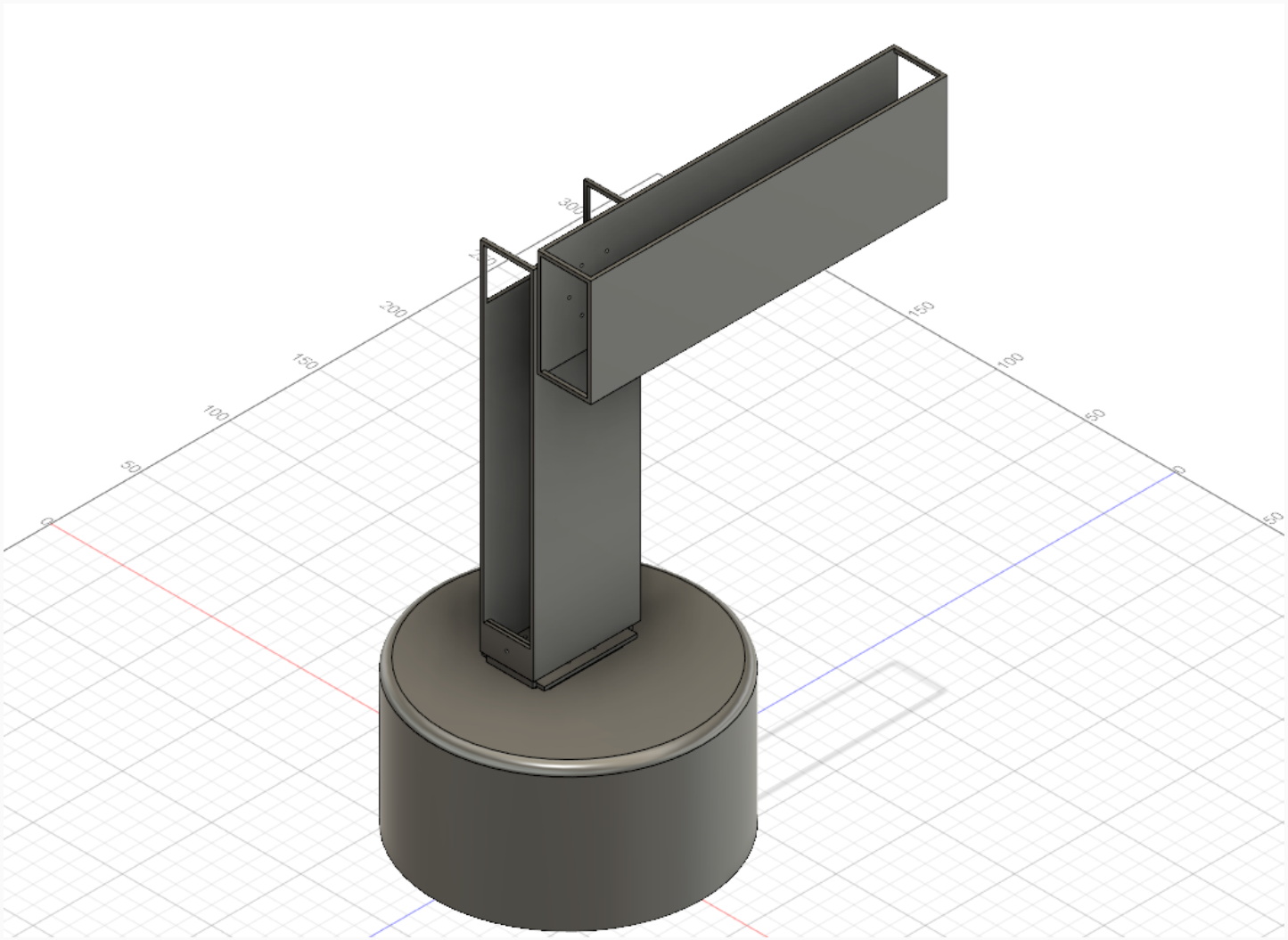
Proposed Work

Proposed Work

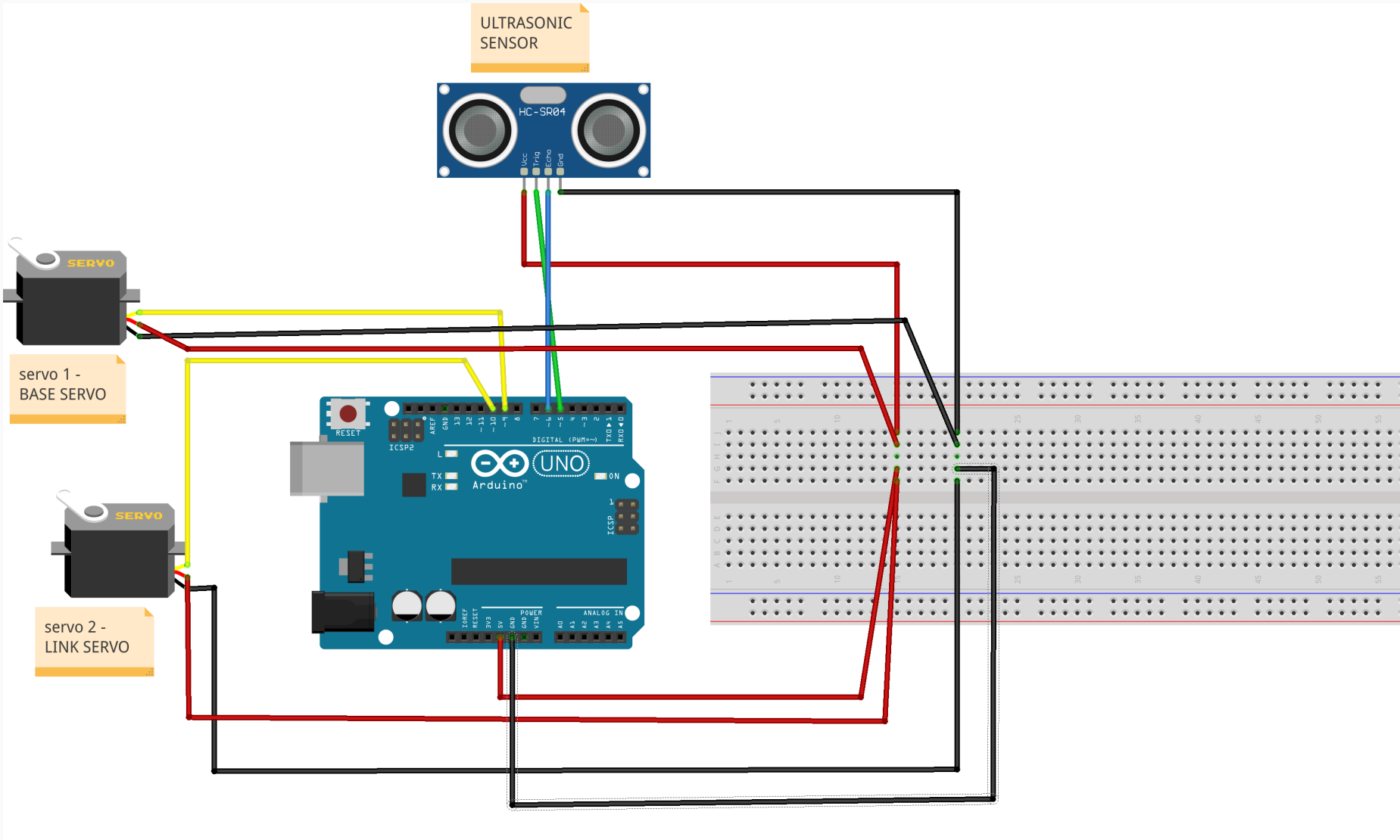
- The proposed work is to create a robot which can detect nearby objects and create a digital image of the same.
- The robot scans it's surroundings using HC-SR04 sensor, the distance is calculated.
- A python script parses this data and finds the values of x, y and z.
- This is then stored in a point cloud data file. We expect to plot these points and visualize it.

Design

Design



Circuit Design



Completed Tasks

Completed tasks

Task 1: To learn basics of robotic arm manipulation

- Familiarised with the parts of the arm.
- Learnt basic foward and inverse kinematics.
- Graphical and Jacobian methods were introspected.

Completed tasks

Task 2: Given end effector co-ordinates, to find joint angles

- Given a two-joint robotic arm, with base rotation of 360° and other joint of 180°.
- Find the relation between end effector co-ordinates and joint angles.
- The equation was found using graphical analysis method.

Completed tasks

Task 3:Implementation of Robotic arm

- Designed a two-joint robotic arm using Fusion-360.
- Fabricated and assembled the arm.
- Given the end-effector co-ordinates, the arm moved to the target position.

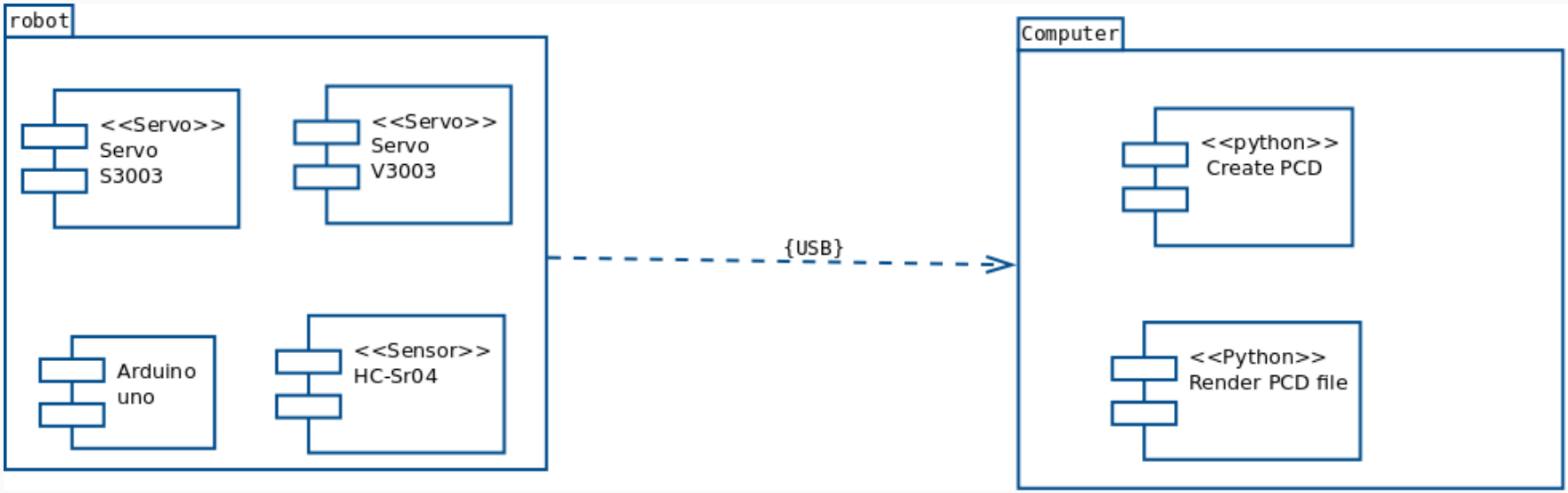
Completed tasks

Task 4 : To detect the distance of obstacles present

- An ultrasonic sensor HC-SR04 was attached to the end effector position of the arm.
- The arm swept 360° in both clockwise and anti-clockwise direction.
- The sensor detected the distance to the obstacles around it.

Deployment Diagram

Deployment Diagram



Conclusion

Conclusion

- Our project is to implement a two joint robot with an ultrasonic sensor that visualizes its surroundings.
- During the progress of the project we were learnt a lot of concepts.
- These concepts mainly comes under hardware and software sections

Conclusion

- Hardware part
  1) 3-D design and modelling
  2) Controlling of servo
  3) Operations using the arduino

Conclusion

- Software part
  1) Concept of point cloud and mapping the surroundings
  2) Generating the pcd file for visualization