

# Point Cloud Generation

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FISAT

# Abstract

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This project is to generate a point cloud and visualize it .

# Objective

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A two joint robotic arm with a sensor attached sweeps  $360^\circ$  and generates a point cloud and visualizes it.

# Introduction

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- A 2 joint robot with a ultrasonic sensor as end effector sweeps  $360^{\circ}$
- The sensor detects the distance from the obstacles present and we calculate the x, y and z coordinates .
- The coordinates are compiled and stored as point cloud data ,these points are plotted and visualized using point cloud library.

# Proof of Concept

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## ARM

The robot with the sensor as end effector controlled by arduino was build in references with Uarm-ROB

## Formula to calculate coordinates of obstacles

- Since the mentioned robotic arm is of simple structure with two joints
- Assume that  $l, r$  are the lengths of the two links and  $\Theta$  and  $\phi$  are their joint angles.
- Considering the 3-dimensional space with  $x, y$  and  $z$  axes and accordingly changing the views(top view, front view), we can arrive at these relations

## Proof of concept

$$x = r \cos \Theta \cos \phi \quad (1)$$

$$y = l + r \sin \Theta \quad (2)$$

$$z = r \cos \Theta \sin \phi \quad (3)$$

- From these equations, the joint angles can be determined as

$$\Theta = \sin^{-1}((y - l)/r) \quad (4)$$

$$\phi = \tan^{-1}(z/x) \quad (5)$$

# Design

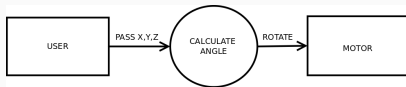
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# Data Flow Diagram

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# Level 1



## Level 2

