## horizontal line Image result for 3d reconstruction room

L∋DS ....Lidar 3D Scanner....



Team :

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Team Name : //fix this later

# Aim

To prototype a mechanism for registering point clouds and reconstructing 3D surfaces.

# Motivations

1. Point cloud registration and surface reconstruction.
2. Generating and storing 3D maps of scenes for assisting autonomous bots.
3. Providing 3D models for prospective projective projects like interior designing.

# Description

3D scanners find an increasing number of applications in our world. To list a few :

* Creating virtual environments motivated from real world destinations for virtual reality.
* Generating environment maps for autonomous Bots to navigate without obstruction sensors.
* Reconstructing interiors and outdoor landscapes for redesigning applications.
* Subject scanning for 3D model printing.

**Implementation**

Our approach to the problem is a non-contact-active method for data acquisition and an active method for 3D reconstruction as we process the generated point cloud.For depth data we will use a time-of-flight sensor to measure distances of the surface from our sensor.We will rotate our sensor using a stepper motor and in a perpendicular direction using a servo to get the point cloud.Our target is to register point clouds from different perspectives and overlap them for dense cloud production. Some algorithms like *Laplacian smoothing* and *Denoising algorithms* are to be used to smoothen the dense cloud. Surface generation is planned to be done using mesh generating algorithms like *Delaunay algorithm* and *Marching cubes* method. After getting a satisfactory surface we intend to texture the model using image data from a Pi camera aligned parallel to the distance sensor.

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# Milestones

## Phase 1

### Ideating the complete process for point cloud registration and processing.

We right now know the output format of the lidar sensor, next we are working on overlapping point clouds from different perspectives and then we will move to final stage which is surface construction( presumably the longest part)

### Studying required aspects of the following software :

#### MatLab (for using algorithms to overlap point clouds)

#### SolidWorks

#### MeshLab(to give 3d meshing to 2d surfaces)

#### Arduino(to program microcontroller for working on lidar sensor)

## Phase 2

### Creating Mechanical model for sensor placement.

### Designing circuit and coding the microcontroller.

### Processing generated 3D cloud for final output.

Post phase 1 work update

### Completed the circuit for our project.

### 

* Wrote the arduino Sketch for our project.   
  <https://docs.google.com/document/d/1HRDixP65lDwAiiyVD7babNbN-L9-Rr7QnFbqUSj7bxQ/edit?usp=sharing>
* Collected and documented the size specifications and began work on the mechanical mount for our project.   
  <https://docs.google.com/document/d/1FVLodBSpr3mdKphFD39PukdXDIF4QmzG4YXAPPcChFc/edit?usp=sharing>
* Studied Meshlab from Mister P’s tutorials.   
  <https://www.youtube.com/user/MrPMeshLabTutorials/videos>
* Learnt about “.xyz” file format and have decided that as final decided format. We will write a processing side sketch to write the required distances from Serial monitor to a txt file in our required format and then open it in Meshlab as xyz.
* Learnt how to Create a surface from a mesh. The link we used to learn is provided below.   
  <http://fabacademy.org/archives/2014/tutorials/pointcloudToSTL.html>

# Required parts

|  |  |
| --- | --- |
| **Item Description** | **Cost (₹)** |
| Lidar Lite V3 | 12000 |
| Stepper motor | 690 |
| Arduino board(Uno R3) | 500 |
| 9 gram Servo | 250 |
| Material for structure |  |

# Targeted output

* A 3D model of the subject environment with smooth and textured surfaces.
* Creating a repeatable algorithm that can be followed for any reconstruction.

**Extended target** (*if time permits*) : using the same setup to generate 3D models of subject objects.