University of Burgundy

Software Engineering Project

3D Scanner

Report 1

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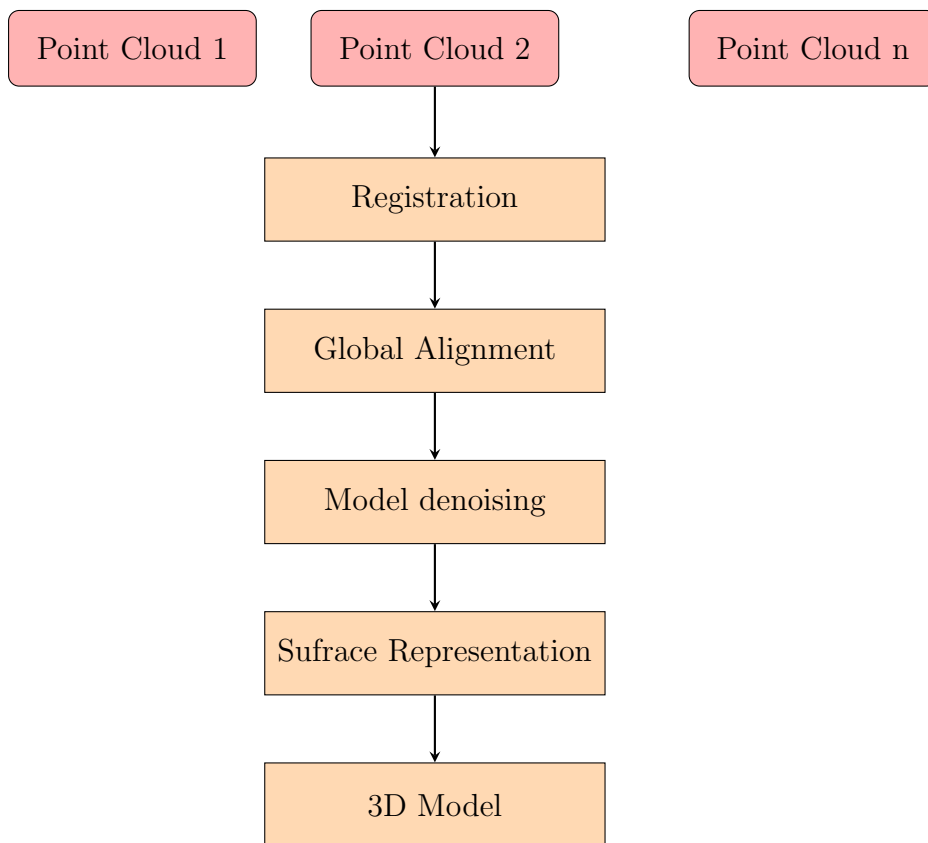*Supervisor:*
Prof. Yohan Fougerolle

1   Introduction

As the first week -started in the 1st of October- We start to put the blueprint of the project and the main points to organize the work. In this report, we will present these points.

2   Proposed Software Architecture

We will use Kinect V.2 to scan the object, as it can deliver real-time good accuracy and dense 3d scenes at economical cost. However, the depth map is noisy and may contain holes due to surface property and conclusion, so we will need a denoising step.

After that, we start the processes to acquire 3D modeling of the captured images. the next flow-chart shows the first draft of our project's structure, explaining the different stages of the project.

```
┌─────────────┐   ┌─────────────┐          ┌─────────────┐
│ Point Cloud 1│  │ Point Cloud 2│         │ Point Cloud n│
└─────────────┘   └──────┬──────┘          └─────────────┘
                         │
                         ▼
                  ┌─────────────┐
                  │ Registration │
                  └──────┬──────┘
                         │
                         ▼
                  ┌──────────────┐
                  │Global Alignment│
                  └──────┬───────┘
                         │
                         ▼
                  ┌──────────────┐
                  │Model denoising│
                  └──────┬───────┘
                         │
                         ▼
              ┌──────────────────┐
              │Sufrace Representation│
              └────────┬─────────┘
                       │
                       ▼
                ┌──────────────┐
                │   3D Model    │
                └──────────────┘
```

The steps of the project can be summarized as follows:

1. In this framework, first the synchronized RGB, and depth images of the object are captured with Kinect.

2. Object segmentation from background, then represented as 3D point cloud.

3. To avoid overlapping from neighbouring views, initial registration using RANSAC and then ICP for fine registration.

4. Global alignment, to minimize misalignment due to error propagation.

5. Combined 3D model point denoising.

6. Transforming to 3D representation.

7. Meshing using delaunay triangulation.

3 Tasks for next week

1. Familiarize with key techniques/development phases (for instance, meshing,registration...etc.) that will be used to create 3D model from Kinect.

2. Familiarize with basics of relevant algorithms and libraries, e.g., ICP, RANSAC, and PCL

3. Set up platform to proceed with the actual project (install OpenCV and PCL, and ensure they can work with QT)

4 Future Work

Divide ourselves into multiple subgroups to work on different parts of the project; everyone should research on techniques/stages and try to find the part that is more suited to ones interest.