

3D room mapping with a hand-held ToF camera

Project Plan

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1 Client

The client for this project is Per-Erik Forssén, associate professor at the Computer Vision Laboratory at the Department of Electrical Engineering at Linköping University, in association with the company Fotonic.

2 Project Overview

The goal of this project is to develop a program that can produce a 3D model of a room from a hand-held sequence of Time-of-Flight data. The data should be collected using a Fotonic G-series 3D camera which produces depth images. The project is divided into three main parts; point-cloud logging from sensor, registration and outlier filtering of the point clouds. An overview of the system is described in further detail in Section 9.

3 Organization

The project will be organized into a team described in section 3.2 which will implement the project using a project model described in section 3.1.

3.1 Project Model and adaptations

The project workflow will be run mainly according to the agile Scrum [1] model with some minor adaptations explained in this section. Since the project is not run on full time there will not be a daily Scrum every single day but instead there will be a daily Scrum on the occasions when the whole team meets, approximately three times per week.

3.2 Team and roles

In addition to any extra role all team members will contribute fully to the product as developers. The team is described in full in the table below.

| Name | Role | Mail |
|-------------------|---------------|-------------------------|
| Fredrik Olsson | Scrum Master | freol454@student.liu.se |
| Tobias Grundström | Product Owner | tobgr602@student.liu.se |
| Anna Hjelmberg | Developer | annhj876@student.liu.se |
| Mats Nilsson | Developer | matni403@gmail.com |

4 Documents

The team intends to write all documents in the document preparation system L^AT_EX and based on the LIPS Project Model. [2]

The client requires certain documents in order to supervise the project. At the beginning of the project a *project plan* and *requirement specification* should be handed to the client, supervisor and examiner at the latest 2017-09-21. The documents should outline a plan for the project execution, the requirements of the final product and an overview of the intended system design.

After all functionalities has been implemented in the system, a test protocol, user guide, and a draft of the technical documentation should be handed to the client by 2017-12-08. The final version of the technical documentation should be handed in as soon as possible after comments has been received on the technical documentation.

5 Deliveries

Each week the team will either send an email to the supervisor or in person briefly present the current status and progress of the project.

There will be a half-time check up where the results of the project so far will be presented. A date for this occasion remains to be set.

The final product with all functionalities will be presented to the examiner at the latest 2017-12-08. The project team also intends to showcase the final product for the company supplying the camera, *Fotonic*, in another presentation.

6 Methods for development

The product will be developed in accordance with the workflow of the agile Scrum model with some adaptations, described in in section 3.1. The project will be implemented in an operating system independent programming language.

7 Education

In order to update the skills of the team members in the areas concerning the project a pilot study will be performed by the entire group. Each member of the team will be responsible for his/her own education if problems that can not be solved due to lack of knowledge appear. Primarily the knowledge of the group members will be shared in the

process and secondly external sources of education, such as experts in a certain area, can be used if available.

8 Resources

In this section the resources that are available during the project will be presented. This includes time, participants of the project team and available work spaces.

8.1 Participants

The following participants will be part of the project: a group supervisor, Felix Järemo-Lawin, the project client, Per-Erik Forssén and the development team as described in section 3.2.

8.2 Material

The material available during the project consists of science papers, literature in the university library and online, the *Fotonic* G-series sensor and data gathered using the sensor with panorama reference images. The *Fotonic*-API and an implementation of the Fast Global Registration algorithm is also available.

8.3 Work spaces

Work spaces that are available during the project consists of computer labs, project rooms and conference rooms at ISY (the Department of Electrical Engineering).

8.4 Time

Each member of the project group has 240 hours at their disposal that are to be distributed evenly during the course of the project. The supervisor is available for a total of 24 hours during the project, this includes meeting time, preparatory work and correction of documents. Thus the supervisor will be available roughly one (1) hour per week.

9 System Design Overview

Below is an overview of the system design illustrated in a flowchart. Each box in the flowchart is described in section 9.1.

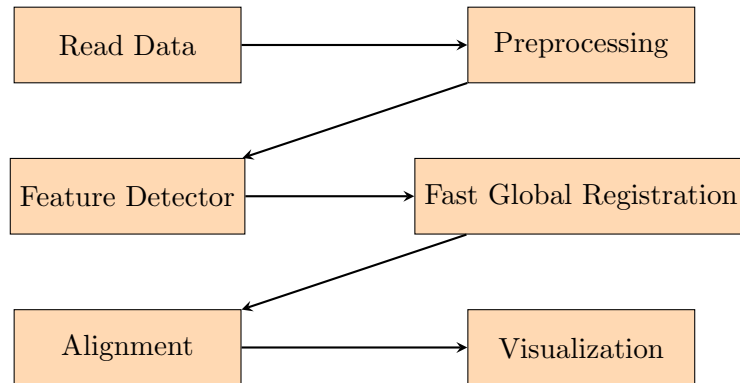


Figure 1: System overview

9.1 System Design Description

Here follows a brief description of each box in the flowchart above:

- **Read Data:** Read and organize collected data. In a later stage, in addition to reading and organizing the data, collecting data will also be a part of this step.
- **Preprocessing:** Filtering and outlier removal will be performed.
- **Feature Detector:** An algorithm for Fast-Point-Feature-Histogram (FPFH) feature extraction.
- **Fast Global Registration:** The pairwise FGR will be used to solve the registration problem. It will be extended to multiway-registration if there is a surplus of available time when pairwise registration have been implemented.
- **Alignment:** Apply transformations to each view to align the point clouds.
- **Visualization:** Visualizing the 3D model as a point cloud.

10 Time Plan

A weekly time plan with important milestones is shown in the Gantt schedule below. Each sprint period (green bars) will consist of several shorter sprints. cycles will be performed.

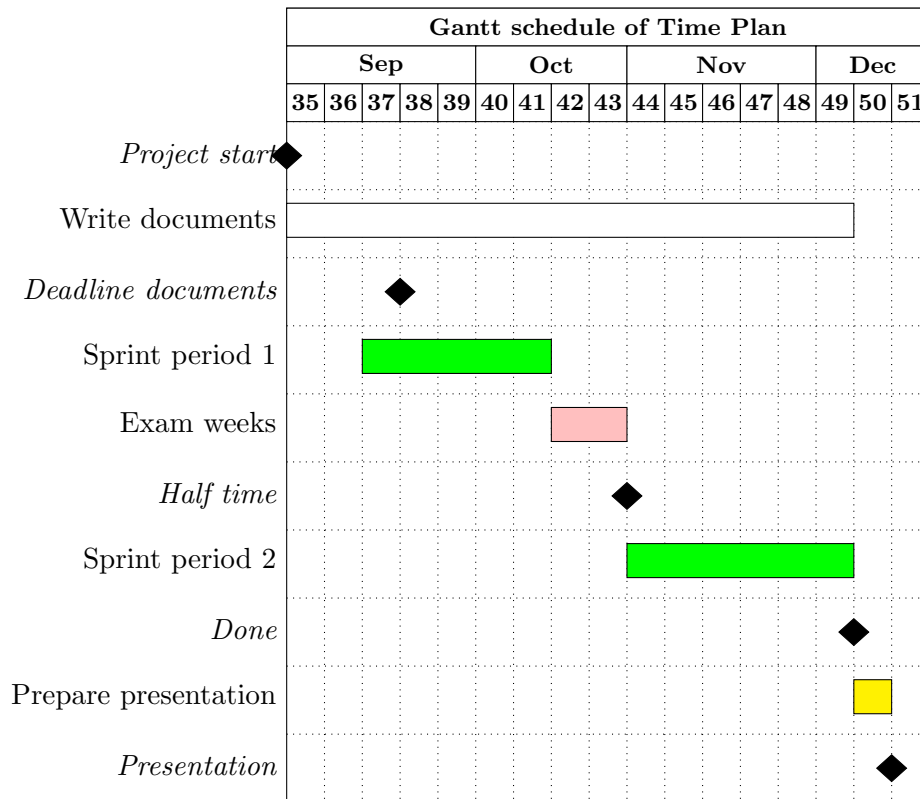


Figure 2: Gantt schedule of the project

References

- [1] Scrum.org, “What is scrum?” *Https://www.scrum.org/resources/what-is-scrum*, visited 2017-09-09.
- [2] T. Svensson and C. Krysander, “The lips project model,” *Linköping University, Sweden*, 2004.