

Project Plan

Indoor mapping with autonomous vehicle

Version 1.0

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Project group:	MARCO	Document responsible:	Martin Åbom
Course code:	TSRT10	Author's E-mail:	marab256@student.liu.se
Project:	MARCO	Document name:	ProjectPlanV10.pdf

Project Identity

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Document History

Version	Date	Changes made	Sign	Reviewer
0.1	2012-09-19	First draft.	All	All
0.2	2012-09-20	Second draft.	All	All
0.3	2012-09-21	Third draft.	All	All
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1 Orderer and Customer

The orderer of the project is André Carvalho Bittencourt, Linköping University. The customer for the project is Joakim Rydell at the sensor informatics division, FOI.

2 General Description of the Project

This section contains information about the aim of the project, the documents it contains and the restrictions it has.

2.1 Purpose and Objectives

The main objective of the project is to equip a wheel based robot with autonomous mapping capabilities. The hardware for the project will be supplied by the costumer (FOI), who has also developed a 3D-mapping software which will be available for implementation with the system. Design of the control system for the autonomous robot will include Simultaneous localization and mapping (SLAM) hardware (SICK laser range sensor and an Inertial measurement unit (IMU)). The robot should be able to plan it's trajectory to complete mapping of the entire enclosed area.

To fulfill the main objective the system should be able to localize its position and orientation in an enclosed area with certain restrictions (see Requirement Specification) and from that point plan a trajectory to position itself in such a way that it can see a new area of interest. The trajectory should be updated in intervals until the whole area is mapped. The objectives also include designing an interface to set necessary parameters for the control system and documentation to make usage of the system easier.

2.2 Deliveries

For the respective decision points (DP) the following content will be delivered. Dates are preliminary.

Delivery	Decision Point	Date	Type of delivery
Requirement specification	DP2	2012-09-21	Electronic
System description	DP2	2012-09-21	Electronic
Project Plan	DP2	2012-09-21	Electronic
Time Plan	DP2	2012-09-21	Electronic
Design Specification	DP3	2012-10-05	Electronic
Test plan	DP3	2012-10-05	Electronic
Required functionality	DP5	2012-11-22	Electronic
Test protocols	DP5	2012-11-22	Electronic
User Manual	DP5	2012-11-22	Electronic
Presentation	DP5	2012-11-22	Oral presentation
Technical Documentation	DP6	2012-12-06	Electronic
After Study	DP6	2012-12-06	Electronic
Webpage	DP6	2012-12-06	Electronic
Poster	DP6	2012-12-06	Electronic
Movie	DP6	2012-12-06	Electronic

Status report and time plan shall be delivered to the orderer once a week.

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2.3 Restrictions

All hardware will only be available at the facilities at FOI, and will also only be tested there.

3 Phase Plan

The project consists of three phases; before, during and after.

3.1 Before Project

The planning process is initiated and information about the project is obtained. All resources regarding time, staff, hardware and facilities are organized. All documents for decision point two (see above) will be created. Weekly project meetings will occur.

3.2 During Project

All documents for decision point three are created, and should be regarded as a ground to work on for the coming weeks. Each person is reporting time and status to the project manager, these documents will be merged and then reported to the orderer. A test plan is developed and will be followed so that the security and progress of the project can be guaranteed. The product is being developed as well as the documentation for the last two decision points.

3.3 After Project

The project is being presented for the orderer and customer. All documents are finalized and published on the web page. A movie and a poster are created and shown to the world. The project is finished.

4 Organization for the Project

In this section the organizational parts of the project and all communications between them are described. Figure 1 below shows the structure of the organization.

4.1 Definition of Work Contents and Responsibilities

Here are the responsibilities of each project role specified.

4.1.1 Project Manager

The project manager has the responsibility that the project objectives are fulfilled. The project manager is responsible for the group meetings, that everything goes according to the schedule and to make sure everyone works towards a common goal.

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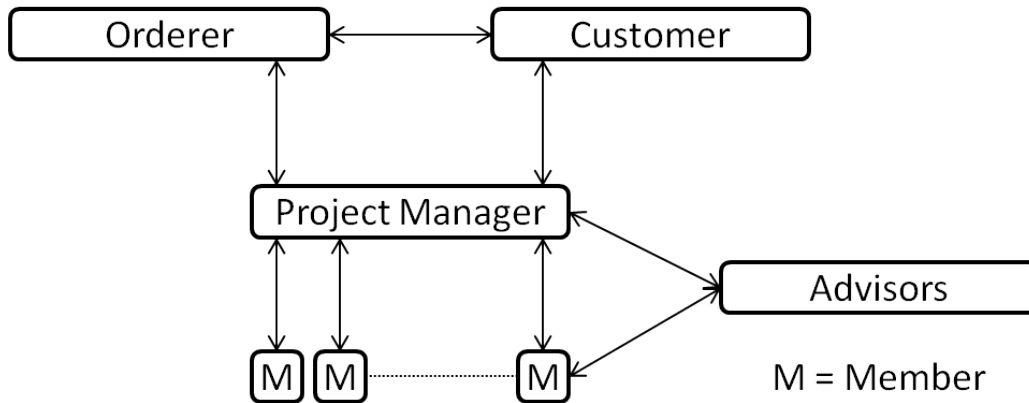


Figure 1: Project organization

4.1.2 Documents

The document manager is responsible for all the documents, to create templates for different documents and how they are written in \LaTeX . The document manager will also manage the SVN server.

4.1.3 Design

The design manager is responsible for developing a common design language and for the use of correct tools and principles during development. The design manager is also responsible for all the information concerning the project and will manage the web page and is responsible for the video clip, poster and the presentation.

4.1.4 Tests

The test manager will write the test plan, appoint times for the tests and must make sure the required hardware are present when the testing is supposed to occur. The test manager has the responsibility that all requirements are tested.

4.1.5 Mapping

The mapping manager is responsible for developing a subsystem that generates a map over the enclosed area that meets the requirements (see Requirement Specification).

4.1.6 Localization

The localization manager is responsible for developing a subsystem that gives the location and orientation of the robot according to the requirements (see Requirement Specification).

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4.1.7 Path following

The path following manager is responsible for developing a subsystem that controls the robot according to the planned trajectory that meets the requirements (see Requirement Specification).

4.1.8 Trajectory planning

The trajectory planning manager is responsible for developing a subsystem that generates a trajectory that evolves such that the whole area is explored according to the requirements (see Requirement Specification).

5 Documentation

All documents will be written in English and \LaTeX . All completed documents will be stored on a common dropbox and the documents in progress will be stored at a SVN server. All documents will have a specific version number except the meeting schedules. The convention is to use 0.x for all drafts and when the document is approved it's upgraded to version 1.0. The documentation for the project is listed below.

Document	Purpose	Format
Requirement Specifications	Specifies the requirements of the project.	PDF
System Description	Interprets the Requirements Specification. Includes ideas of how specific problems can be solved.	PDF
Project Plan	Describes how the project will be realized.	PDF
Time Plan	Describes how the time is divided between the different activities.	PDF
Design Specification	Describes in more detail how the specific parts of the system shall be constructed.	PDF
Test Plan	Describes what and how testing will be done.	PDF
Test Protocol	Protocol of all tests.	PDF
Technical Documentation	Describes in detail what is implemented in the final product. It also describes how this was done.	PDF
User Manual	Describes how to use the product.	PDF
Poster	A poster which briefly describes the product.	PDF
Webpage	A webpage of the product.	HTML
Video	A video which demonstrates the products functionality.	YouTube
Project Evaluation	An evaluation of the projects results and its execution.	PDF

6 Development Methodology

The documents will be written according to the LIPS guidelines. To make the work efficient it will be divided into smaller activities and in small groups. The groups should be able to develop and test these parts independently.

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7 Reporting Plan

During the project all meetings will follow a meeting agenda and will result in a protocol to keep track of the progress. Every week a time report should be sent to the project manager by each member of the group. The project manager will then revise the time table and send it to the orderer.

8 Meeting Schedule

A meeting will be held every Monday during lunch to discuss the progress and possible issues. The meeting protocol will be written by the project manager and approved by one of the other group member.

9 Resources

In this section the available resources will be described.

9.1 Staff

There are seven students who will work on the project, each person is required to take part in the project. The group has also advisors to ask during the course.

9.2 Material

Computers are handed out by ISY at Linköpings University. Hardware and software for the robot are handed out by FOI.

9.3 Facilities

The group has a room available provided by ISY. FOI also provides access to parts of their facilities for hardware development and testing.

9.4 Economy

During the project the group has 1680 hours to spend on the different activities which should be divided equally among the members. The group also has 40 hours of guidance from ISY.

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10 Milestones and Decision Points

This section describes the milestones and decision points.

10.1 Milestones

The following milestones have been set:

Number	Description	Date
1	Design specification and test plan approved	2012-10-05
2	Follow a specified trajectory	2012-11-01
3	Safety function	2012-11-01
4	Positioning and orientation	2012-11-12
5	Plan a trajectory	2012-11-12
6	A complete mapping functionality	2012-11-12
7	Graphical User Interface	2012-11-12
8	Product ready for delivery	2012-11-21

10.2 Decision Points

The following decision points exist in the project:

DP	Description	Date
DP2	Requirement specification, system overview, project plan and time plan	2012-09-21
DP3	Design specification, test plan	2012-10-05
DP5	Required functionality, test protocols, user manual and presentation	2012-11-22
DP6	Technical documentation, after study, webpage, poster and movie	2012-12-06

11 Activities

The project has been divided into activities and responsibilities have been issued, for better management of the project. Some activities can be done parallel, while others need certain activities to be finished or partially finished in order to be started. Foremost it is the "Mapping" and "Trajectory planning" activities that need the function output contexture from the "Localization" functions, in order to really get started.

For a complete look at all the activities, see the time plan.

12 Changes

If the project for some reason is delayed so that all requirements cannot be met, the project manager has to negotiate new requirements with the customer.

If a project member wants to change or add something to the project, this has to be discussed and decided on a meeting.



13 Quality Plan

This section describes how the documents and codes will be audited and what tests should be done.

13.1 Audits

The code will be audited continuously to ensure that the correct convention is used. The documents are reviewed by the document manager.

13.2 Test Plan

The test manager will write a test plan for all the tests that are conducted. The test plans will contain a short description of what the test should evaluate.

14 Risk analysis

The apparent risks with the project are the following:

Malfunction of hardware. This includes the devices supplied by FOI and computers supplied by Linköping University. In case of malfunction, the project leader will contact the supplier, client and orderer to make an assessment if the project can continue with new hardware or if the project should be changed or canceled.

Insufficient performance from supplied hardware. This includes the SICK laser range sensor or the IMU is unable to supply sufficiently accurate data to be able to meet the requirements. In case of lacking performance, the project leader, the client and the orderer will renegotiate the requirements.

A project member fails to fulfill its duties as set by the time plan. In case of member fall through, the orderer, the project leader and/or members of the project group will decide if the member is to be removed from the project.

15 Priorities

The decision points will have the highest priority. If one activity takes more time than expected the deadline for that specific activity can be pushed in order to achieve a better result. All the code must be well commented since this project possibly will be continued after the group dissolves.

16 Project Closure

The project ends when the after study is approved. The project closes with a project conference where the poster is presented. All keys and computers should be returned as soon as possible after the end of the project.

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