

# Project plan

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## Status

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## DOCUMENT HISTORY

<b>Version</b>	<b>Date</b>	<b>Changes made</b>	<b>Sign</b>	<b>Reviewer</b>
0.1	2022-09-16	First draft.	All	GH
0.2	2022-09-21	Second draft.	All	GH
0.3	2022-09-27	Third draft	All	GH
1.0	2022-09-29	First version.	All	GH

# 1 OVERVIEW OF THE PROJECT

The hardware used in the system is Tobii Pro Glasses 2 (G2), for this project new hardware, Tobii Pro Glasses 3 (G3), must be implemented such that it can work for the current modules. The G2 glasses consist of a pair of spectacle frames with a forward-oriented cameras, and two eye-tracking cameras per eye, a microphone, and an IMU. The G3 consists of the same hardware as the G2 but also has a magnetometer and overall better sensors.

The wide angle scene forward-oriented camera is used to identify whether surrounding people are speaking or not in order for the hearing aid to focus on such person. The camera and IMU is also used with statistical localization methods such as EKF and SLAM to estimate the the users position, head orientation and position of surrounding people. New localization methods such as JPDA, IMM and MHT will be implemented in hope of improved results.

The simulation environment from previous year will be improved and extended with new modules such as a simplified GUI and sound physics.

The system as a whole can currently approximate other people's orientation relative to the user and identify whether people are speaking within the camera frame. Using all this information about the system it can be seen that there is potential to further develop the system such that all the information mentioned above can be used to detect when the user is speaking to or focusing on one or more people at each time instant. If it would be made possible for the system to detect if the user is focusing on one or more people at each time instant, that information could be used to amplify the sounds only from the people the user is interested in hearing.

## 1.1 Definition of terms

The table below contains the meaning of abbreviations used in throughout the time plan.

**Table 1:** Definition of terms

Terms	Meaning
sim-env	The simulation environment is a combination of Gazebo with ROS, where instructions from ROS controls the Gazebo environment.
GUI	Graphical user interface, in which the user can interact with the program.
SLAM	Simultaneous localization and mapping.
IMU	Inertial measurement unit.
ISY	The department of electrical engineering at Linköping University.
DP	Decision point.
LIPS	Project model, containing rules, instructions and templates to conduct a project.
User	Refers to the person using the Tobii Pro Glasses.
Speakers	Refers to people talking in the environment of the user.

## 1.2 Aim and goals

The aim of this project is to improve and further develop the already existing features as well as implement them on the new hardware. The system will be able to orient the user, detect and track potential speakers relative to the user as well as determine if people are speaking or not. The system will be able to detect and analyze eye movements. Improvements of the simulation environment will be conducted to be able to provide realistic data and to integrate the new hardware.

- Make the software work for G3.
- Improve modules and calibration using eye-tracking.
- Improve the simulation environment to generate realistic data for the new hardware.
- Make the program easy to use both for people developing new features but also for the user of the Tobii Glasses.

### 1.3 Deliveries

The deliveries and their respective priority are shown below.

**Table 2:** Deliveries to customers

Version	Description	Date
1.0	A status report including a time report should be delivered to the orderer at the end of each week.	-
1.0	DP2: Delivery of the requirement specification, project plan, time plan and a first draft of the design specification.	2022-09-21
1.0	DP3: Delivery of the design specification and testing plan.	2022-10-03
1.0	DP4: All functionality in subsystems, modules and the simulation environment should be complete.	-
1.0	DP5: The entire system should be functional. Delivery of test protocols and user guide including a presentation showing that the requirements from the requirement specification have been fulfilled.	2022-12-07
1.0	Delivery of project to the customer and after study.	2022-12-12
1.0	Delivery of poster to the customer.	2022-12-13
1.0	Delivery of website with overview of the project and documents.	2022-12-15
1.0	DP6: Delivery of the technical report, a poster presentation, the project web page and project movie.	2022-12-19

### 1.4 Limitations

There are only 240 hours per person to spend on the project, which enumerates a total of 1440 working hours. The real time software that has been developed will have a high time complexity which demands powerful computers that can run the software real time. The off-line software will not have as high demands on the computer running the software.

## 2 ORGANISATION

### 2.1 Overview

The project is organized according to Figure 1.

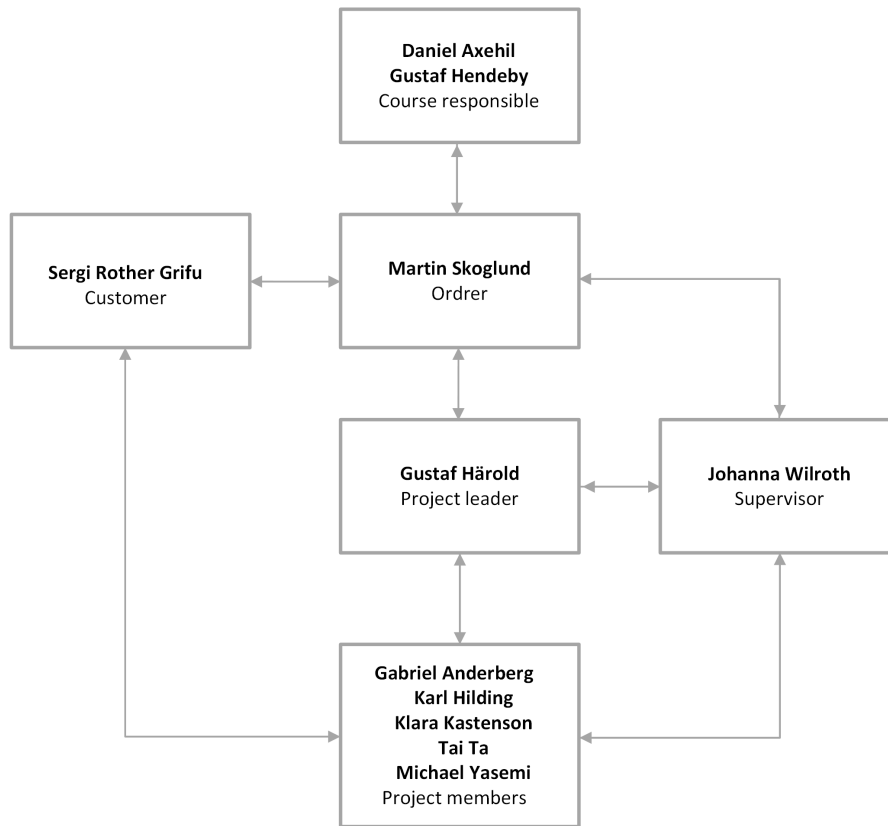


Figure 1: An overview of the project organization.

## 2.2 Responsibilities within the project group

The roles in the project group and their responsibilities are presented in Table 3 below.

## 2.3 Terms for cooperation within the project group

Each group member should spend at least 240 hours on the project and is responsible for making sure that this requirement is fulfilled. Each member should also participate at the project meeting each Monday unless a notice of absence is given to the rest of the group at least 24 hours in advance. A shorter notice may be approved by the group if the reason is seemed significant enough.

It is every group members own responsibility to make sure that they follow the time plan to the best of their ability and not fall behind or ahead by a significant amount. If there is a possibility that this may happen it should be reported to the project leader as soon as possible so that a redistribution of time may be performed.

**Table 3:** Description of group roles

Role	Description	Name
Project leader	Leads the project and is responsible for planning the work and making sure the goals are reached	Gustaf Härold
Responsible for the Documentation	Makes sure that necessary documents are completed in time and of a high quality	Tai Ta
Responsible for the Design	Responsible for the system design and compatibility between modules	Klara Kastensson
Responsible for the Testing	Responsible for all tests and makes sure that tests are synchronized and relevant.	Karl Hilding
Responsible for the Hardware	Responsible for the safety and use of the hardware	Michael Yasemi
Responsible for the Software	Responsible for making sure that all code is well documented, integrated and version controlled	Gabriel Anderberg

### 3 DOCUMENT PLAN

Table 4 lists all documents that shall be produced in the project

**Table 4:** Documents to be produced.

Document	Language	Aim	Target	Date
Project plan	English	Describes how the project should be conducted and group responsibilities	Project members, Orderer, course responsible	2022-09-21
Time plan	English	Describes how the time should be spent in the project. Includes a time report.	Project members, Orderer	2022-09-21
Requirement specification	English	Determination of the project and products requirements	Project members, Orderer	2022-09-21
Design specification	English	Describes how the system should be designed to meet the requirements	Project members, Orderer	2022-10-03
Test plan	English	Describes how the requirements are to be tested.	Project members, Orderer	2022-10-03
Test protocols	English	Description of each test and their results.	Project members, Orderer	2022-12-07
User Guide	English	A guide on how to use and operate the system.	Customer, Orderer	2022-12-07
Technical documentation	English	A collection of all the conducted tests.	Project members	2022-12-07
Project report	English	A report summarizing the project and its outcome.	Project members, Orderer, course administrators	2022-12-12
After study	English	A reflection of the project as a whole.	Course administrators	2022-12-12
Status report	English	A short summary of the work done each week.	Orderer, Customer	Every Friday



## 4 DEVELOPMENT METHODOLOGY

The project group will be divided into 3 subgroups responsible for different modules and subsystems. These groups will be:

- Updating and improving the simulation environment regarding the GUI, implementation and verification of existing/new modules and possibility to test unfeasible scenarios.
- Improve existing modules and calibration using eye-tracking. Implement new modules using eye-tracking.
- Making the Tobii Pro 3 glasses work with existing software as well as new software.

The groups will work together to ensure that their work is compatible with the rest of the systems and that everything runs smoothly.

## 5 EDUCATION PLAN

In order to work effectively in the project, each project member must educate themselves in areas relevant to the project. This includes the programming languages used (mainly Python) and areas relevant to each subgroup. There will also be a short education in Git held by an experienced user for the rest of the group to minimize merging errors and other issues that may arise.

## 6 REPORT PLAN

Each project member shall give a small status report to the project leader no later than the end of each week. This report should include the activities worked on during the week, how much time they took and if any problems occurred. The project leader will then combine these reports and send a full status report to the orderer and customer.

## 7 MEETING PLAN

- The previous weeks progress and any issues that may have arisen.
- Any upcoming design choices that may affect multiple modules or subgroups.
- The plan for the coming week and each project members top priority.
- A review of the time plan including any eventual necessary modifications.

## 8 RESOURCE PLAN

The resources available for the project are listed below.

## 8.1 Personnel

The project consists of 6 students from Linköping university taking the course TSRT10 (Automatic Control - Project Course). Additionally, the order Martin Skoglund, customer Sergi Rotger Griful, supervisor Johanna Wilroth and course responsible Daniel Axehill and Gustaf Hendeby are part of the project to answer questions and helping the group.

## 8.2 Material

The material available are:

- Tobii Pro Glasses 2.
- Tobii Pro Glasses 3.
- A hearing aid device with integrated accelerometer.
- A computer capable of running the necessary programs and code.
- A GitLab repository with code and files from previous associated projects.

## 8.3 Premises

The premises available are:

- A project room in the B-building at Campus Valla, Linköping.
- An ability to book the testing room Visionen in the B-building at Campus Valla, Linköping.

## 8.4 Economy

The economy and time requirements are:

- Each member should spend at least 240 hours on the project. This means that the project group in should spend 1440 hours in total.
- The group should receive up to 40 hours of guidance from ISY and Eriksholm Research Centre.

# 9 MILESTONES AND DECISION POINTS

The project milestones and decision points are defined below. The decision points are part of the LIPS-model and are important steps toward completing the project. The milestones are set by the group and are based on the requirement specification.

## 9.1 Milestones

Table 5 contains the project milestones.

**Table 5:** Milestones

#	Description	Date
1	The first draft of the requirement specification, time plan and project plan	2022-09-16
2	Have existing code configured	2022-09-28
3	Design specification finished	2022-09-30
4	Delivery of project	2022-12-12
5	After study finished	2022-12-14
6	Poster finished	2022-12-14

## 9.2 Decision points

Table 6 contains the decision points in the project.

**Table 6:** Decision points

#	Decision point	Date
DP2	Delivery of the requirement specification, project plan, time plan and a first draft of the design specification.	2022-09-21
DP3	Delivery of the design specification and testing plan.	2022-10-03
DP4	All functionality in subsystems, modules and the simulation environment should be complete.	2022-11-13
DP5	The entire system should be functional. Delivery of test protocols and user guide including a presentation showing that the requirements from the requirement specification have been fulfilled	2022-12-07
DP6	Delivery of the technical report, an after study, a poster presentation, the project web page and project movie.	2022-12-19

# 10 ACTIVITIES

The activities in the project are presented below.

#	Activity	Dependency	Requirement	Time
1	Group contract	-	58	6
2	Requirement specification	-	64	60
3	Time plan	-	64	22
<i>cont. on next page</i>				

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#	Activity	Dependency	Requirement	Time
4	Project plan	3,1	64	17
5	Design specification	2,3,4	64,65	8
6	Test plan	-	65,67	70
7	Simulation environment	-	16-37	120
8	Eye tracking modules	-	38-48	120
9	Target localization	-	49-52	110
10	G3 implementation	8,9	2-8, 13-15, 50	110
11	Hearing Aid modules	8,9,10	12	30
12	Testing	6	61-62, 67	70
13	User Manual	-	54-55, 67	50
14	Presentation	-	68	30
15	Final Report	-	68,70	40
16	Technical Documentation	6,12	70	45
17	After study	All	68	12
18	Web page	-	68	12
19	Poster	-	68	30
20	Project movie	-	68	24
21	Status reports	-	63	32
22	Order/Project Meetings	-	-	192
23	Research	-	-	42
24	Buffer	-	-	138

## 11 TIME PLAN

The time plan can be found in a separate Excel spreadsheet. The plan states how many hours are allocated to each task and when they are to be carried out. As conditions can change during the project the plan is a living document that is subject to change.

## 12 PRIORITIES

The project will follow the priorities listed in the requirement specification. In case the project is delayed a decision of which subsystems to focus on will be made. As subsystems are developed at the same time the one closest to completion will be the highest priority.

## 13 COMPLETION OF PROJECT

The project is considered completed after the project conference 2022-12-19 assuming that all high-priority requirements are fulfilled. The decision to end the project is done at DP6.