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TrackMe

Software Engineering II - Prof. Elisabetta Di Nitto

Requirements Analysis and Specification Document

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Section 1

Introduction

1.1 Purpose

The goal of the Requirement Analysis and Specification Document (RASD) is to give a clear description of the system that is going to be developed, its functional and non-functional requirements, its constraints and its domain. Moreover, it provides information about the relationship between the system taken into account and the external world by providing use cases and scenarios. Finally it gives a more formal specification of the most relevant features of the system to be using the Alloy language. Generally this type of document is mainly addressed to developers, programmers, testers, project managers and system analysts, but it can be useful also for final users. Track Me is a company that wants to develop three different but connected software-based services:

- **Data4Help:** a service that allows third parties to monitor the location and health status of individuals. Through this service third parties can request the access both to the data of some specific individuals, who can accept or refuse sharing their information , and to anonymized data of group of individuals, which will be given only if the number of the members of the group is higher than 1000, according to privacy rules.
- **AutomatedSOS:** a service addressed to elderly people which monitors the health status of the subscribed customers and, when such parameters are below a certain threshold (personalized for every user using the data from Data4Help), sends to the location of the customer an ambulance, guaranteeing a reaction time less than 5 second from the time the parameters are below the threshold.
- **Track4Run:** a service to track athletes participating in a run. It

allows organizers to define the path for a run, participants to enroll to a run and spectators to see on a map the position of all runners during the run. This service will exploit the features offered by Data4Help.

1.1.1 Goals

The three applications of the system have in common the following goals:

- [G.1]: Allow unregistered user to sign in to access to the application;
- [G.2]: Allow registered user to log in and access to the application;
- [G.3]: Allow registered user to manage his/her profile;

The description given above can be summarized as a list of goals, specific for each service.

Data4Help:

- [G.4]: Allow registered third parties to request data of a single individual;
- [G.5]: Allow registered third parties to request data of a group of people;

AutomatedSOS:

- [G.6]: Allow data acquisition through smart watches (or similar);
- [G.7]: Allow monitoring the health status of an individual registered user;
- [G.8]: Allow sending location of an individual registered user to an ambulance if his/her parameters are below a certain threshold;

Track4Run:

- [G.9]: Allow registered user to become organizers or athletes of a run;
- [G.10]: Allow organizers to define the date and the path for a new run;
- [G.11]: Allow registered athletes to enroll to a run;
- [G.12]: Allow unregistered user to access as spectator;
- [G.13]: Allow registered/unregistered user to see on a map the position of all runners during a run;

1.2 Scope

According to *The World and the Machine* [4] we can divide every system into two parts:

- The **machine**, which is the portion of system to be developed;
- The **world**, which is the portion of the real-world affected by the machine.

As a consequence we can classify phenomena in three different types:

- **World phenomena**: phenomena that the machine cannot observe;
- **Machine phenomena**: phenomena located entirely in the machine;
- **Shared phenomena**: phenomena that can be controlled by the world and observed by the machine or controlled by the machine and observed by the world;

Below we give an analysis of world and shared phenomena:

World phenomena

- A user turns on data connection;
- A user wears his smartwatch during a day;
- The batteries of the smartwatch of a user run out;
- A user turns on the GPS;
- An enrolled runner for a run takes part in it;
- A runner wears his smartwatch during a run.

Shared phenomena

- New user registers to Data4Help service;
- A Data4Help registered user logs into the system;
- A user receives a request to share his data;
- A user accept/decline a request to share his data;
- A third party requires data of a specific user;

- A third party requires data of a group of users;
- A user subscribes to AutomatedSOS service;
- An ambulance is called as a consequence of specific acquired data from the system;
- A Data4Help user access to Track4Run for the first time;
- A Track4Run user organizes a new run;
- A Track4Run user enrolls for a run;
- An unregistered user access as a spectator to a run.

Machine phenomena

- The machine interfaces with external software and hardware systems;
- The machine manages database queries;
- The machine manages the 3G/4G Internet connection;
- The machine manages the Bluetooth connection;
- The machine manages GPS tracking.

1.3 Definitions, Acronyms and Abbreviations

API: Application Programming Interface;

GPS: Global Positioning System;

Organizer: A registered user that organizes a run, defining date and path;

OS: Operating System;

RASD: Requirement Analysis and Specification Document;

Run: An event that is organized by one organizer, at which one or more people can participate and that can be followed by one or more spectators;

Runner: A registered user that enrolls for a run;

Spectator: Unregistered user that access to Track4Run to follow a run;

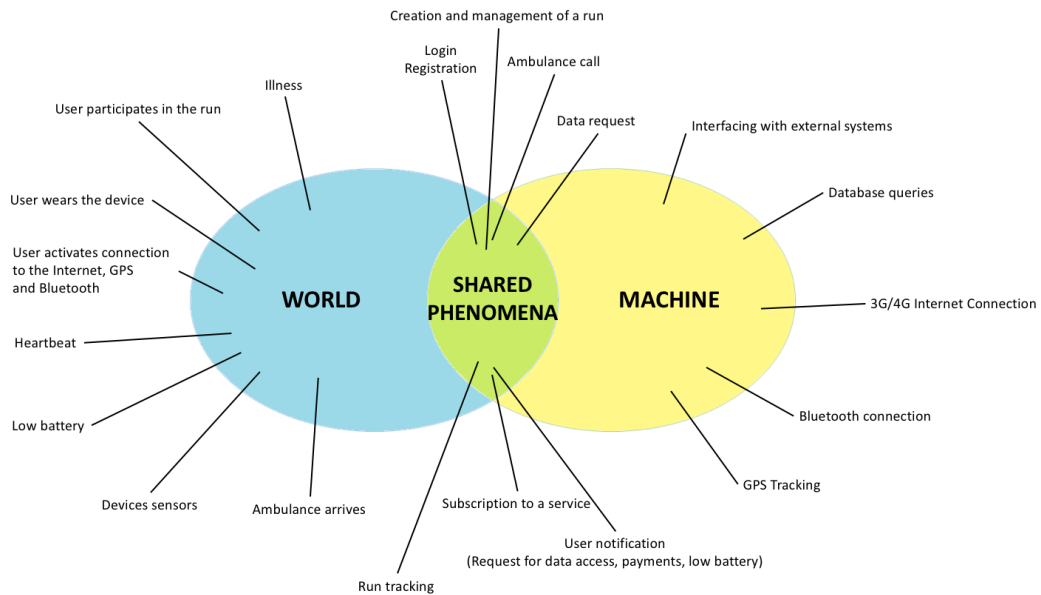


Figure 1.1: World and Machine model

System: The software system-to-be, including all of its services;

Third party: Any external organization that wants to access to data acquired by Data4Help;

UML: Unified Modeling Language;

User: Any person, registered or not, who accesses to one of the applications (for Data4Help there is a special user called *Third party*);

1.4 Reference documents

1.5 Overview

This document is structured as follows:

Section 1: Introduction. A general introduction to the goals, the phenomena and the scope of the system-to-be. It aims giving general but exhaustive information about what this document is going explain.

Section 2: Overall Description.

Section 3: Specific Requirements.

Section 4: Effort Spent. A summary of the worked time by each member of the group.

At the end there is the bibliography.

Section 2

Overall Description

2.1 Product Perspective

2.1.1 User Interfaces

Standard Users

Standard users can use two different smartphone applications: *AutomatedSOS* and *Track4Run*. Both of them should be very easy to use and should allow the user to connect the smartphone to the smartwatch or to the chosen device. *AutomatedSOS* is mainly used by elderly people so it should have large buttons and large writing and it shouldn't ask to the user to interact a lot with the device. *Track4Run* is mainly used by young people so it should be more interactive and allow the sharing of the track on social networks and other social options such as comparing race data with friends. Standard users can also access services provided by TrackMe using a web application. Using it they can manage their accounts in a more comfortable way, verify requests for accessing their data, create new route and follow a race watching players position on the map (in *Track4Run* service).

Special Users

Third parties who want to analyse data collected from *Data4Help* can access the service using a web application. The web application lets special users to insert a request for data. If the request is accepted, it allows the download of the asked data. The system should also offer an online support to help user in using the service.

2.1.2 Hardware Interfaces

- Web applications (both the one for standard users and the one for special users) must be accessible using a computer with characteristic specified in section 2.4.4.
- Smartphone on which the app must work must provide to the app an Internet connection used to send data to TrackMe servers. At least one between the smartphone and the smartwatch must have a GPS antenna built in. The wearable device must also integrate a reasonably precise heartbeat sensor.

2.1.3 Software interfaces

- Web applications (both the one for standard users and the one for special users) must be compatible with the most popular browsers such as Google Chrome, Mozilla Firefox, Microsoft Edge, Apple Safari.
- Mobile apps for standard users must be available for both iOS and Android devices and must be compatible with most of the smartwatch and other health devices available on the market regardless of the operating system used by the device (using the API made available to programmers by producers).
- Application backends store data collected in a relational DBMS.
- Web applications access and show data by accessing the relational DBMS.
- Web applications for third parties has to interface also with a payments broker in order to receive money from companies who want to get data from the system.
- Web application and Track4Run have to interface also with Maps in order to generate the path for the run and to virtually follow a run.

2.2 Product Functions

The system is composed by several applications.

AutomatedSOS

AutomatedSOS is designed for elderly people and allows you to make an automatic call for help if the application detects a dangerous state of health. To use this app, few user interactions are required. In particular the user can:

- Register to the service.
- Log-in to the service.
- Respond to requests to access to their personal data by a third party.
- Report a false alarm following an emergency call with an alert to the nearest ambulance.
- Manage personal account and send a request to delete all the acquired data.
- Connect the health device such as smartwatch, smart band, heart rate sensors with Bluetooth.
- Pause data monitoring.

The app will autonomously monitor the health status of the user and make an emergency call to the nearest ambulance in case of emergency.

Track4Run

Track4Run is designed to track athletes participating in a run. Using it the user can:

- Register to the service.
- Log-in to the service.
- Respond to requests to access to their personal data by a third party.
- Manage personal account and send a request to delete all the acquired data.
- Connect the health device such as smartwatch, smart band, heart rate sensors with Bluetooth.
- Pause data monitoring.

- Share performance data via popular social networks such as Facebook, Instagram, Twitter, etc.

The app will autonomously track the health status and the position of the athlete.

Web application for standard users

Using it they can:

- Register to the service.
- Log-in to the service.
- Respond to requests to access to their personal data by a third party.
- Manage personal account and send a request to delete all the acquired data.
- Create a path to use in *Track4Run*.
- Send an invitation to join in a run.
- Follow a competition watching the position of the athletes on the map.

Web application for special users

Using it they can:

- Register to the service.
- Log-in to the service.
- Send a request to access data of a standard user.
- Send a request to access data of a group of people.
- Manage past requests.
- Download data obtained after a request has been accepted.

———ADD SCHEMA PRODUCT FUNCTIONS———

2.3 User Characteristics

Those applications have different targets.

AutomatedSOS

This mobile app is thought for elderly people. It is not necessary the user is a “tech addicted” because a familiar can setup the system and let it work autonomously.

Track4Run

This mobile app is thought for athletes. It is most dedicated to young people who use frequently tech products.

Third party WebApp

This application is thought for companies who want to analyse data collected by the app. They could be statistics or pharmaceutical companies, hospitals, etc.

2.4 Constraints

2.4.1 Anonymous data collection

Companies who want to analyse data from a group of people without asking the permission to every single person must make a request for anonymized data of a group of at least 1000 people.

2.4.2 Privacy

Before allowing a company to access a user’s data, it is necessary to get a formal permission by the user.

2.4.3 Regulatory Policies

When a new user register to the service he must accept the privacy policy in order to use the application. He must be informed about personal and sensible data collection like his position and his health parameters. In every moment the user can ask TrackMe to delete all the collected data about him. All the collected data must be kept safe and must not be accessible

by unauthorized person. Also, third parties who access the service must guarantee the security of the data. The whole process must comply with the GDPR regulations for the protection of users' personal data.

2.4.4 Hardware limitations

In order to use the service, user's hardware should comply to these minimum requirements:

Mobile application

- Smartphone
 - iOS or Android operative system
 - UMTS/4G Internet connection with a minimum speed of 1Mb/s
 - Bluetooth antenna
 - GPS antenna
 - 300 Mb available memory
 - Dual-core processor
 - 1 Gb RAM
- Smartwatch / other health device
 - Bluetooth antenna
 - Heartbeat sensor

Web application

- Computer
 - Internet connection with a minimum speed of 1Mb/s
 - Browser application
 - 720p monitor resolution

2.4.5 Parallel operation

The system must guarantee the simultaneous use of the mobile app by at least 100,000 users and the simultaneous use of the web app by at least 10,000 users. Consequently, the DBMS must be able to process a large number of simultaneous transactions.

2.4.6 Reliability requirement

The system reliability, seen as the probability that components and performances will meet the requirement during a specified period of time, must be at least 95%, considering a period of one month.

2.4.7 Availability requirement

The system should be available 24/7 in order to guarantee the service and to manage emergency situations.

2.4.8 Criticality of the system

AutomatedSOS

An error in the system could result in an unnecessary call for an ambulance or failure to call in an emergency.

Track4Run

An error in the system could cause a non-optimal use of the service.

2.5 Assumptions and Dependencies

From now on the following assumptions are given for guaranteed:

1. Users of the app have a phone with an iOS or Android operating system.
2. Users of the app have a phone with working GPS module with an uncertain of ± 1 meter.
3. All users enjoy a stable Internet connection.
4. The user accepts or refuses the request for access to his data within 24 hours from what is forwarded. After this period the request is considered rejected.
5. Each user is identified with a unique code.
6. Once the request is accepted by the user, the system provides the applicant with the data within 24 hours.
7. Users enter the correct data during registration.

8. The user autonomously recharges the smartphone and the smartwatch when it signals that the battery is low.
9. A user cannot participate in two races at the same time.
10. Every request for access to a user's personal data by third parties must be explicitly accepted by the user.
11. When a third party accesses the personal data of a user is responsible for any unauthorized disclosure of data.

Behavioural during devices recharge time:

1. If the smartphone is charging in a fixed position near the user, the wearable device remains connected via Bluetooth to the smartphone and the *AutomatedSOS* service is not interrupted.
2. If the smartphone is charging in a fixed position, the *Track4Run* service is interrupted.
3. If the smartphone is charging using a transportable battery, all the services keep working.
4. If the wearable device is charging, the service *AutomatedSOS* is interrupted.
5. If the wearable device is charging, the service *Track4Run* keep working (available only data about position).

2.6 Future Extensions

The addition of new features will be evaluated in the future. The possible proposals are:

1. The creation of a new application with the purpose of collecting user data, without offering services such as *AutomatedSOS* and *Track4Run*. Users will be paid to use the application consistently. This operation considerably increases the number of users and also collects data from those subjects that are currently excluded (people who are not elderly and do not practice sports).
2. The possibility for the user to share their sanitary facilities for free with their doctor.

Section 3

Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

The user interfaces of *AutomatedSOS* and *Track4Run* must be intuitive and user-friendly in order to permit an easy interaction with all the services offered by the systems.
Moreover both the application and the web site must support multiple languages.

3.1.2 Hardware Interfaces

3.1.3 Software Interfaces

3.1.4 Communication Interfaces

3.2 Functional Requirements

3.2.1 Individual Sign In

Purpose

Anyone who wants to subscribe to one or both services offered by *Data4Help* must go through the registration process, which can be carried out either through *AutomatedSos* and *Track4Run* apps or through the web site. The process requires exactly the same steps regardless the platform through which it is carried out:

1. The new user is required to fill in all the fields in which she/he is asked for his name, his surname, his date of birth, his city of birth, his city of residence and a valid e-mail address;
2. The user must accept the conditions regarding his privacy, in particular the collection of his data by *Data4Help* and the sharing of them in anonymous way with third parties.

After that the system will check the correctness of the inserted data, in particular it will check that the user isn't already registered and that the inserted e-mail isn't already used by someone else. If the result of this control is positive the registration is authorized and the user will receive a confirmation e-mail to the specified e-mail address with the password she/he has to use to access to all *Data4Help* services.

Scenario 1

Sara would like to register her grandmother to *AutomatedSos* to not worry about her health status when they are not together. She opens the browser on his personal computer and search for *Data4Help* web site, then she clicks on the "*Sign In*" button, which is located in the main page. She passes through the steps of the registration process, inserting his grandmother data and accepting the required conditions. Finally, if the inserted data are accepted by the system, she receives the confirmation e-mail.

Scenario 2

Marco would like to organize an amateur run with his friends and remembers that someone told him something about a new application called *Track4Run* so he decides to try it. He downloads the app on his smartphone and turn it on. The first page that is shown to him contains the "*Sign In*" button and the "*Log In*" one, he presses on the first one and starts his registration process. He doesn't use his personal e-mail address, but an e-mail address

he has in common with his brother that they usually use to make purchase online. Unexpectedly he is informed by the system that the insert e-mail is already registered in the database and so he has to change it and this time he inserts his personal e-mail address. This time the registration is succesfull and he recives the conformation e-mail.

Use Case

The Individual Sign In is analyzed in Table 3.1.

Functional requirements

1. The system must not accept an e-mail address that is already used by an already registered user;
2. The system must not authorize the registration untill all the fields are filled up;
3. The system must not authorize the registration untill the required conditions aren't accepted;
4. The system must send the confirmation e-mail to the inserted e-mail address with the password when "*Submit*" button is clicked only if all the inserted data are acceptable and the required conditions has been accepted;
5. The system must let the **Individual user to be** leave the registration process at anytime.

Actor	Individual user to be
Goal	[G.1]
Input Condition	A person wants to subscribe to one of <i>Data4Help</i> services
Event Flow	<ol style="list-style-type: none"> 1. The Individual user to be opens the main page of <i>Data4Help</i> web site from his personal computer or of <i>AutomatedSos</i> or <i>Track4Run</i> apps from his smartphone; 2. The Individual user to be clicks on "<i>Sign in</i>" button; 3. The system shows the form the Individual user to be has to fill up; 4. The Individual user to be fills up the form with his name, his surname, his date of birth, his city of birth, his city of residence and an e-mail address; 5. The Individual user to be accepts the required conditions; 6. The Individual user to be clicks on "<i>Submit</i>" button; 7. The system checks wheter the inserted information are acceptable or not; 8. The Individual user to be recives a confirmation e-mail containing the password he has to use to access to all <i>Data4Help</i> services.
Output Condition	The system tells the Individual user to be that his registration is completed
Exceptions	<ul style="list-style-type: none"> • If functional requirements 1 or 2 are not satisfied the process goes back to step 4; • If functional requirement 3 is not satisfied the process goes back to step 5; • If the Individual user to be decides to leave the registration process this one is aborted.

Table 3.1: Individual Sign In use case

3.2.2 Third Party Sign In

Purpose

Any third party who wants to subscribe to *Data4Help* must go through the registration process, which can be carried out through *Data4Help* web site. The process requires several mandatory steps:

1. The third party which aim to become a new member is required to fill in all the fields in which it is asked for informations about the company itself like: its business name, its VAT number, its legal address, its billing address, its corporate e-mail address and the sector in which it operates;
2. The third party must also provide the data of its legal representative, in particular his name, his surname, his office address, his phone number, his e-mail address and his fiscal code;
3. The third party must accept different conditions:
 - It must assume responsibility in case of unauthorized disclosure of user data;
 - It must agree to make the payment within 60 working days after the acceptance of some of its request;
 - It must accept Milan as the place of jurisdiction in the case of a legal dispute.

After that the system will check the correctness of the insrted data, in particular it will check that the third party isn't already registered. If the result of this control is positive the registration is authorized and the third party will recive a confirmation e-mail to the specified e-mail address with the password it has to use to access to *Data4Help* services. From now we will refer to the third party that wants to become a new member as "**Special user to Be**" to distinguish it from an Individual user.

Scenario 1

PharmaAnalisi SPA wants to acquire data of a group of young people in order to do an analysis about the kind of life they conduct. It opens the browser and search for *Data4Help* web site, then it clicks on the "*Third Party Sign In*" button, which is located in the main page. It passes through the steps of the registration process, inserting all the required data but forgetting to accept one of the conditions. As a consequence the system won't permit it to conclude the registration process, so it checks again and figure out what

was missing, it accepts the condition and submit its registration. Finally, it receives the confirmation e-mail.

Use Case

The Third Party Sign In is analyzed in Table 3.2.

Functional requirements

1. The system must not accept an e-mail address that is already used by an already registered third party;
2. The system must not accept a business name that is already used by an already registered third party;
3. The system must not accept a VAT number that is already used by an already registered third party;
4. The system must not authorize the registration until all the fields are filled up;
5. The system must not authorize the registration until the required conditions aren't accepted;
6. The system must send the confirmation e-mail to the inserted e-mail address with the password when "*Submit*" button is clicked only if all the inserted data are acceptable and the required conditions have been accepted;
7. The system must let the **Special user to be** leave the registration process at anytime.

Actor	Special user to be
Goal	[G.1]
Input Condition	A third party wants to subscribe to <i>Data4Help</i> services
Event Flow	<ol style="list-style-type: none"> 1. The Special user to be opens the main page of <i>Data4Help</i> web site. 2. The Special user to be clicks on "<i>Sign in (Third party)</i>" button; 3. The system shows the form the Special user to be has to fill up; 4. The Special user to be fills up the form with its business name, its VAT number, its legal address, its billing address, its corporate e-mail address and the sector in which it operates; 5. The Special user to be accepts the required conditions; 6. The Special user to be clicks on "<i>Submit</i>" button; 7. The system checks wheter the inserted information are acceptable or not; 8. The Special user to be recives a confirmation e-mail containing the password it has to use to access to <i>Data4Help</i> services.
Output Condition	The system tells the Special user to be that its registration is completed
Exceptions	<ul style="list-style-type: none"> • If functional requirements 1,2,3 or 4 are not satisfied the process goes back to step 4; • If functional requirement 5 is not satisfied the process goes back to step 5; • If the Special user to be decides to leave the registration process this one is aborted.

Table 3.2: Third Party Sign In use case

3.2.3 Individual Log In

Purpose

The main goal of the login feature is to allow the access to one of the services of *Data4Help* to any registered user. To access to an application the user has to fill out the credential form where e-mail and password are required. Moreover, there is a *Forgot password?* section where a user could recover his/her password via e-mail. An e-mail is send to the user with a temporary password that user will change once logged in.

Scenario 1

Francesca loves running. When she has heard about *Track4Run* application she downloaded it immediately. Her friend Clara told her about a charity run for the following weekend, so Francesca opened *Track4Run*, she clicked on *Log in*. She inserted her e-mail address and password and clicked on the login button. Everything was correct, so she entered in the system and could enroll the run.

Scenario 2

One year ago Tommaso, Aldo's grandchild, installed on Aldo's phone *AutomatedSOS*. Yesterday, Aldo bought a new phone, he downloaded the app but he forgot his password so he couldn't log in the application. He clicked on *Forgot password?* he inserted his e-mail address and clicked on *Restore my password*. He received a mail with the provisional password and he became able to access to the system. After the access he was forced to change his provisional password into a new one.

Use Case

The Individual Log In is analyzed in Table 3.3.

Functional requirements

1. The **Individual User** must be already registered in the system in order to log in successfully;
2. The **Individual User** has to remember his/her e-mail address and password in order to log in successfully;
3. The password inserted by the **Individual User** must correspond with the e-mail address;

4. If the **Individual User** inserts wrong credential could not be able to access to the system;
5. If the **Individual User** clicks on *Forgot password?*, the system sends a new password to the **Individual User** e-mail address if and only if the e-mail address is valid and registered to the system;
6. After a password restoring through *Forgot password?* operations, the system must allow the access with the temporary password and then it has to force the **Individual User** to change the temporary password into a new one.

Actor	Individual user
Goal	[G.2]
Input Condition	The Individual User is already registered to the system and want to log in
Event Flow	<ol style="list-style-type: none"> 1. The Individual User open one of the applications (<i>AutomatedSOS</i> or <i>Track4Run</i>); 2. The Individual User clicks on <i>Log In</i> button; 3. The Individual User fills in the fields with his/her e-mail address and password; 4. The Individual User clicks on the login button.
Output Condition	The system allows the login of the Individual User and loads the dashboard of the Individual User .
Exceptions	<ul style="list-style-type: none"> • If the inserted e-mail address is never been registered to the system or the password doesn't correspond with the email address, the system notifies the Individual User with an error message; • If the Individual User inserts wrong credentials for three times the system notifies him/her with an e-mail.

Table 3.3: Individual Log In use case

Section 4

Effort Spent

4.1 Michele Gatti

Task	Hours
<i>Analysis of given RASD</i>	3
Purpose and Goals	1
Product Perspective and Product Functions	5
User Characteristics and Constraints	2
Assumptions and Dependencies	3
The World and the Machine	3
Team revision	1

4.2 Federica Gianotti

Task	Hours
<i>Analysis of given RASD</i>	3
Purpose and Goals	4
Scope, Definitions, Acronyms and Abbreviations	2
Team revision	1
Functional Requirements	4

4.3 Mathyas Giudici

Task	Hours
<i>Analysis of given RASD</i>	3
GitHub and LaTeX setup	2
Purpose and Goals	2
Scope, Definitions, Acronyms and Abbreviations	2
Team revision	1
Functional Requirements	4

Appendix A

Appendix

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