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TrackMe

**Requirement Analysis and Specification Document
(RASD)**

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Chapter 1

Introduction

1.1 Purpose

This document will provide an analysis of requirements and specifications of three new services the *TrackMe* company is willing to launch.
TrackMe is a company that wants to develop a software-based service allowing Third-parties to monitor the location and health status of individuals. Said services are described below.

1.1.1 Data4Help

Data4Help allows *TrackMe* to gather data from Users and to provide them to Third-parties upon request. In particular, it has the following goals:

[G1.1] Third-parties have to be able to monitor the location and health status of Individuals.

[G1.2] Third-parties have to be able to request data of an Individual through his/her fiscal code.

[G1.3] Third-parties have to be able to request data of groups of Individuals.

[G1.4] Third-parties have to be able to subscribe to user data, specifying the frequency of updates and the desired granularity of data.

[G1.5] Individuals have to be able to decide whether to share their not anonymised data (gathered through smart devices) or not and to see what they are sharing to whom.

1.1.2 AutomatedSOS

AutomatedSOS lets Third-parties provide assistance to Elderly people in case of sudden illness by sending them an ambulance. Hence, its goals are:

[G2.1] Elderly people's health status has to be constantly monitored.

[G2.2] An ambulance has to arrive to Elderly people's location when their vital signs go below a certain threshold.

1.1.3 Track4Run

Track4Run allows the organisation of runs, the subscription to them and the tracking of runners through *Data4Help* gathered location. These are the objective the service aims to achieve:

[G3.1] Organisers have to be able to define the details of runs.

[G3.2] Runners have to be able to enrol to runs.

[G3.3] Visitors have to be able to track Participants' position on a map.

1.2 Scope

Nowadays being able to retrieve users data is very important for many companies operating in several fields (think about insurance, health, fitness...), since it allows them to provide assistance, tailor their services to the user, and so on. With the rising amount of smart devices capable of gathering data from the wearer, this necessity could easily be satisfied: smart-watches and fitness bands are being refined and they are also becoming more affordable.

On the other hand, there is the need to ask permission to the users to be allowed to exploit their data and they have to be informed about what is being gathered and who is requesting it, especially with the recent the introduction of GDPR (General Data Protection Regulation) in Europe.

TrackMe is willing to satisfy these necessities through **Data4Help**, a service capable of balancing users' privacy with companies' need of data. This will be done allowing both Individuals and Third-parties to register to the service, so that the latter can perform requests over the former, which can accept or refuse them. Moreover, *TrackMe* wants to launch two more services exploiting **Data4Help**'s framework:

- **AutomatedSOS**, a software dedicated to Elderly people that will call an ambulance whenever the health signs of the person (gathered through **Data4Help**) are below a critical threshold;

- **Track4Run**, a software for runs organisation, where spectators can follow the participants thanks to the localisation provided by **Data4Help**.

1.3 Definitions, Acronyms and Abbreviations

In this section the definitions, the acronyms and the abbreviations used throughout the document are explained in detail.

1.3.1 Definitions

- **Application, Software, System**: these terms refer to *Data4Help*, *AutomatedSOS* or *Track4Run*, depending on which of them is being described, in their entirety (design and implementation alike).

- **Health status:** this expression refers to the status of the Individual inferred from the health signals gathered through smart devices.

- **Maps, Map service:** these terms refer to Google's map service, Google Maps.

- **Query, group search:** these terms refer to the data requested by Third-parties through *Data4Help* involving a group of Individuals.

- **Smart devices:** the ones taken into consideration are smart-watches and fitness-bands.

- **Subscription:** this term refers to the request of continuously updated data performed by a Third-party. Such data can belong to an Individual or may refer to a group search.

- **User:** this term refers to all possible customers of *TrackMe*, such as Individuals, Third-parties, Elderly people, Organisers, Runners, Visitors (see section 2.3 for further details).

1.3.2 Acronyms

- **R.A.S.D.:** Requirement Analysis and Specification Document.

- **A.P.I.:** Application Programming Interface.

1.3.3 Abbreviations

- **D4H:** *Data4Help*.

- **ASOS:** *AutomatedSOS*.

- **T4R:** *Track4Run*.

- **[D.1.k]:** *Data4Help*'s k-th domain assumption.

- **[D.2.k]:** *AutomatedSOS*' k-th domain assumption.

- **[D.3.k]:** *Track4Run*'s k-th domain assumption.

- **[D.2-3.k]:** *AutomatedSOS*' and *Track4Run*'s k-th domain assumption.

- **[G.1.k]:** *Data4Help*'s k-th goal.

- **[G.2.k]:** *AutomatedSOS*' k-th goal.

- **[G.3.k]:** *Track4Run*'s k-th goal.

- **[R.1.k]:** *Data4Help*'s k-th requirement.

- **[R.2.k]:** *AutomatedSOS*' k-th requirement.

- **[R.3.k]:** *Track4Run*'s k-th requirement.

1.4   Revision History

Version	Comments
1.0	First delivery of RASD

Table 1.1: Revision history table

1.5   Reference Documents

1. Specification document: *Mandatory Project Assignment A.Y. 2018-2019. pdf*

2. Software Engineering 2 course slides

3. Previous mandatory project examples:

   3.1. Specification document: *Mandatory Project Assignment A.Y. 2017-2018.pdf*

   3.2. *RASD to be analyzed.pdf*

4. 29148-2011 - ISO/IEC/IEEE International Standard - Systems and software engineering – Life cycle processes –Requirements engineering

1.6   Document Structure

The structure of this RASD documents follows IEEE standard for the most part, therefore it is divided into six chapters:

1. Introduction

2. Overall description

3. Specific Requirements

4. Formal Analysis using Alloy

5. Effort Spent

6. References

The overall aim of this document is to state what are the requirements of the software *TrackMe* wants to develop.

In the first chapter a general overview of the purpose of the software-to-be has been provided, together with the description of the context in which it is going to operate. Being an introductory chapter, all the terminology that will be used in the rest of the document has been clearly defined.

In the second chapter a broader description of the software is provided. Here, a class diagram that specifies the relations of the software-to-be with the world can be found, together with the detailed definition of the the assumptions made, the users of the software and its functions.

The third chapter delves into the details of the specification, talking about the various interfaces offered by the software-to-be, defining both its functional requirements through use cases, sequence and activity diagrams, and its non-functional requirements, along with the constraints it has to respect. In this part, differently from the IEEE standard, the description about Performance Requirements is included with the other System Attributes, in order to make the document more homogeneous.

The fourth chapter presents the formal analysis of the most critical parts of the software-to-be using an Alloy model, also showing a world obtained by running such model.

The fifth chapter contains the effort spent by each member of the group in order to realise the RASD.

In the sixth and last chapter all the sources of information exploited to write the present document are listed.

Chapter 2

Overall description

2.1 Product perspective

The application will offer some services based on data gathered from individuals. In particular, the three services are the following:

- The *Data4Help* service has as the main goal of providing user data to Third-parties, allowing them to know their position and health status. To do that, the Individuals have to collect their data through smartwatches and allow the system to store them. Upon successful requests, the system provides Third-parties with the already collected data and will send the new data according to the frequency of updates and granularity specified during the request compilation, if a subscription is performed. At any time, Third-parties can unsubscribe, in this way they won't receive updates but but they can still access already gathered data, relative to past requests.

- The *AutomatedSOS* service has as the main goal of offering an SOS service to Elderly people. To do that, the system accepts Elderly people subscriptions in order to collect and analyses data gathered by their *Data4Help* account. In case of critical health values, the system sends the exact position to the ambulance service, in order to send an ambulance to the rescue.

- The *Track4Run* service has as the main goal of organising runs. The system allows organisers to define all details of a run: path, starting date and time, maximum number of participants. After the creation of a run, people registered to *Data4Help* service can enrol to the race simply through their D4H account. In order to not exceed the maximum participants number, the software keeps track of the number of runners already enrolled. During the competition, everyone (an account is not needed) can monitor on a map the exact position of all runners; at the end of the race,

the system stores the rankings to make it available in the future to both participants and organisers.
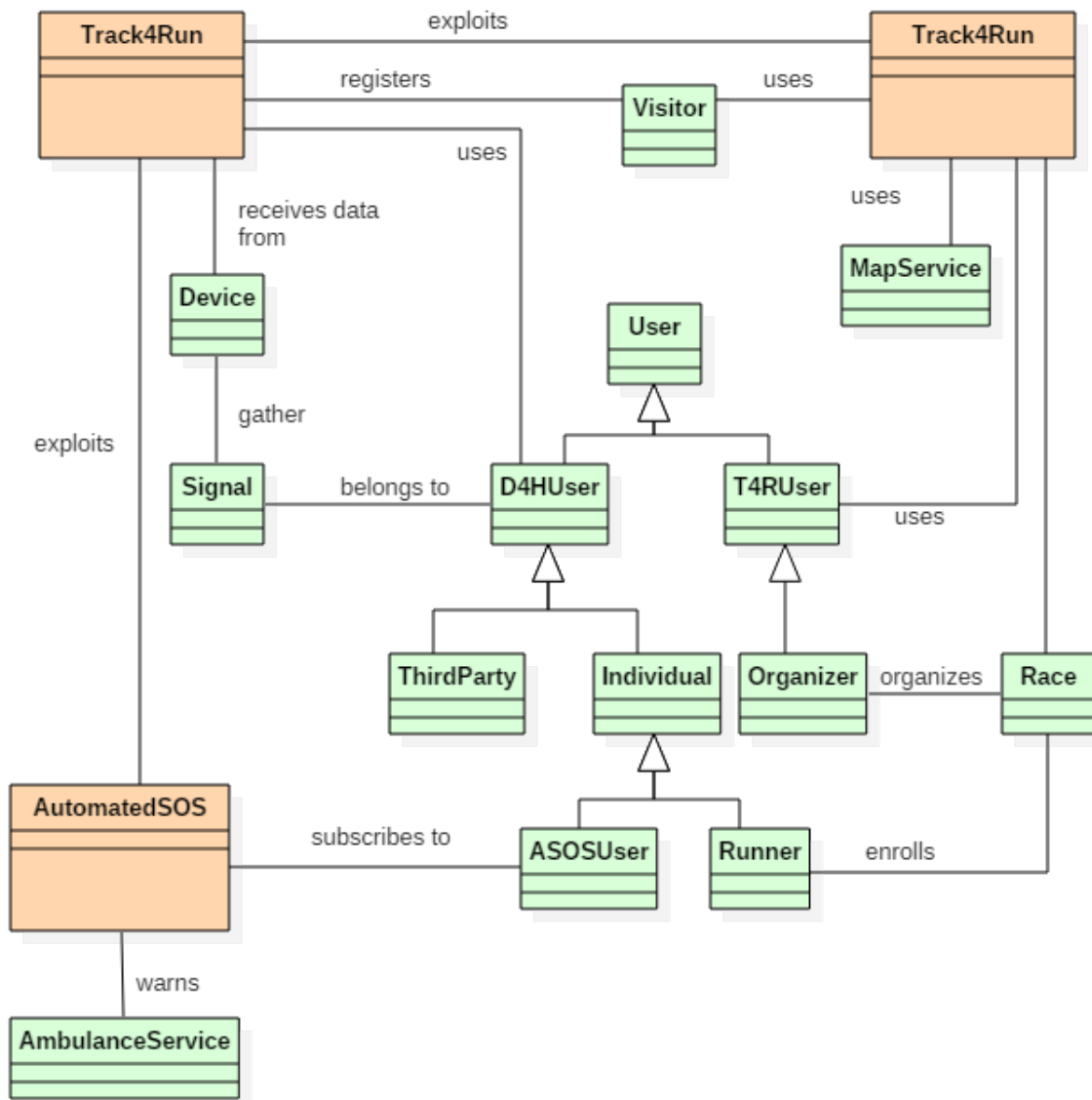

Figure 2.1: Class diagram of the entire system

2.2 Product functions

In this section there is an analysis of functional requirements (grouped by three main services) that the application needs to reach the main goals.

2.2.1 Data4Help

[R1.1] The system allows Individuals to register, requiring name, surname, fiscal code, password and email in order to create a new Individual account.

[R1.2] The system allows Third-parties to register, requiring the company name, VAT number, email and password in order to create a new Third-party account.

[R1.3] The application retrieves from smart-watches the following data, associating them to the user:

- beats per minute (bpm);
- number of steps;
- location;
- time-stamp of the measurement.

[R1.4] The frequency is 30sec

[R1.5] The system allows Third-parties to request data of Individuals and the latter to accept or refuse them.

[R1.5.1] If the Individual accepts, the system sends to the Third-party all the data gathered from the specified user.

[R1.5.2] If the Individual refuses or he/she is not registered, the system sends to the Third-party an error message.

[R1.6] Upon Third-parties request, the system can perform parametric searches based on geographical areas, age, genre, time of the day. The result of the query is then stored and evaluated for approval.

[R1.6.1] If the request is approved, the saved data is provided to the Third-party.

[R1.6.2] If the request is not approved, an error message is sent to the Third-party.

[R1.6.3] In order to anonimize data, the application only sends information related to the health status of individuals (e.g. bpm, step).

[R1.7] The application allows Third-parties to subscribe to certain data.

[R1.7.1] The application, if the Third-party subscribed to some data (belonging to Individuals or group searches), sends updates to the Third-party aggregating the data with the specified granularity and frequency.

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[R1.8] The application allows Individuals withdrawals of consent for accessing their data and Third-party unsubscriptions.

    [R1.8.1] If the Individual withdraws consent for the access of his data, a message is sent to the subscribed Third-party and data is no longer provided.

    [R1.8.2] If the Third-party no longer wishes to collect data from an Individual, a message is sent to him/her and his/her data is no longer sent.

[R1.9] The system allows Third-parties to access to their request history and results.

[R1.10] The system allows Individuals to check gathered data.

2.2.2 AutomatedSOS

[R2.1] The system has to analyse user data and sends the location of the user to the ambulance service in case of emergency, when health values goes under the threshold.

[R2.2] The system gives the possibility to subscribe to the service upon request, only after checking the user age from his/her fiscal code.

2.2.3 Track4Run

[R3.1] The system allows Participants to log into the application through their Data4Help account and, after they are logged in, to enrol the the runs available.

[R3.2] The system allows the enrolling of runners only if they are not enrolled in a race at the same time.

[R3.3] The system allows Visitors to access the application as host-users, without registration, by giving them only the possibility to track the runners.

[R3.4] The system store the ranks of old races so that both Participants and Organisers can access to the race history.

[R3.5] The system should allow the registration of Organisers without requiring also Data4Help registration.

[R3.6] In order to organise a run, the application requires track, data, time and the maximum number of participants.

[R3.7] The system needs to update subscriptions to the runs, decreasing the number of allowed participants. It should not allow further subscriptions if there are no leftover places.

[R3.8] The system shouldn't allow that two or more runs are organised either at the same place or at the same time.

2.3 User characteristics

The main actors who interact with the application will be presented under this section.

- *Visitors*: They are not registered users, the system allows them to register through a sign up service either to Data4Help, becoming individuals or third-parties, or to Track4Run, becoming organisers. The application lets them also to be spectators of a run organised with Track4Run service.

- *Individuals*: They are single users registered to Data4Help service. It means that the system lets them sign in, accept or refuse Third-parties requests and monitor data acquired from them.

- *Third-parties*: They are companies that are registered to Data4Help. Also in this case, the application provides a sign in service, so as to let companies interact and perform single and groups requests.

- *Ambulance service*: The software has to interact with the ambulance service to provide a non–intrusive SOS service to Elderly people, in case of illness. The application sends the exact position where the ambulance has to go.

- *Elderly people*: They are Individuals, the software allows them to subscribe to an SOS service provided by AutomatedSOS, through their Data4Help account (they must have one). They are assumed to be over 65 years old.

- *Map service*: The application needs to interact with the map service, *Google Maps*, in order to let visitors and users see on a map the position of all runners during the run.

- *Organisers*: They are companies that are registered to Track4Run service. The system provides them a sign in interface and, after log in, lets them organise runs. They don't need to be registered to Data4Help.

- *Runners*: They are Individuals, the application allows to enrol in a race through their Data4Help account (they must have one).

2.4 Assumptions, dependencies and constraints

In this section all the domain assumptions made in order for the software-to-be to work are listed, together with the dependecies and the constraints it has to respect.

2.4.1 Domain assumptions

It is assumed that the following properties hold in the world.

Data4Help

[D1.1] Acquired data is precise enough.

[D1.2] Each Individual can be identified unambiguously through his/her fiscal code.

[D1.3] One anonymized, data cannot be associated to specific Individuals.

[D1.4] Every interaction gets correctly encoded.

[D1.5] Third-partied group queries are accepted only if the number of results is greater than 1000.

[D1.6] Third-parties are assumed to be companies that want to gather data, therefore they have a VAT code.

[D1.7] Third-parties know the fiscal code of the Individual they are looking for.

AutomatedSOS

[D2.1] An ambulance service capable of handling requests exists.

[D2.2] The thresholds beyond which a person is considered to be in need of help are under 40 bpm and above 130 bpm.

[D2.3] Elderly people are over 65 years old.

[D2.4] The service is offered in Italy (118 is the emergency number for the ambulance service).

Track4Run

[D3.1] Maps and tracking services are accurate enough.

[D3.2] The defined path exists.

2.4.2 Dependencies

It has to be noted that both *AutomatedSOS* and *Track4Run* need *Data4Help* in order to work. In particular, from the point of view of the two applications, these assumptions have to hold:

[D2-3.1] Customers (only Participants for *Track4Run*) have to be registered to *Data4Help*.

[D2-3.2] User data is gathered through *Data4Help*.

[D2-3.3] Data gathered through *Data4Help* is valid.

Moreover, the services refer to Google Maps for the provision of maps.

2.4.3   Constraints

A smart-watch or a fitness-band are needed in order to use the software and the health data provided is limited to what can be gathered from these devices and to what can be directly calculated from their measuring.

Chapter 3

Specific Requirements

3.1 External Interface Requirements

3.2 Functional Requirements

3.2.1 Data4Help

Individual registration/log in

Every user who wants to use *D4H* should be registered to the application System. After registration the user has to sign in, in order to collect data.

Actors	• Visitor • Individual
Goals	
Entry Condition	The user who want to register must have a smart-watch or fitness-band
Events Flow	1. The visitor accesses the application log in page. 2. The visitor fills all the mandatory information (name, surname, fiscal code, password and email) in order to create an Individual account. 3. The D4H System registers the user and sends back a confirmation email. 4. The user has to associate his smart-watch or fitness-band to the account. 5. The visitor becomes an Individual, inserting its email and password in the log in page.
Exit Condition	Now the user has his personal account.
Exception	The Registered user is not able to sign in the System because the ID (fiscal code for individual) or password are wrong or if he did not confirmed his email. In this situations, the system will show the user an error message.

Third-party registration/log in

In order to have access to the functionalities of the application, Visitors have to register to the service as Third-parties. After that, they will be able to log into the application using their email and password and to perform their researches.

| Actors	
	• Visitor • Third-party
Goals	G1.1, G1.2, G1.3, G1.4
Entry Condition	There is no entry condition.
Events Flow	1. The Visitor accesses the registration page. 2. The Visitor fills in all the necessary information useful to be recognised as Third-party (company name, VAT code, email and password). 3. *Data4Help* creates a new account and sends a confirmation email to the just registered Third-party. 4. The newly registered Third-party can now log into the application using the email and password previously provided, so to have access to the available features.
Exit Condition	The Third-party is registered and able to log into *Data4Help*.
Exception	The Visitor is not able to registered because the email is already in use. A registered Third-Party is not able to log in because the email or password inserted are wrong or the email has not been confirmed. These exceptions will be handled by the system sending an error message.
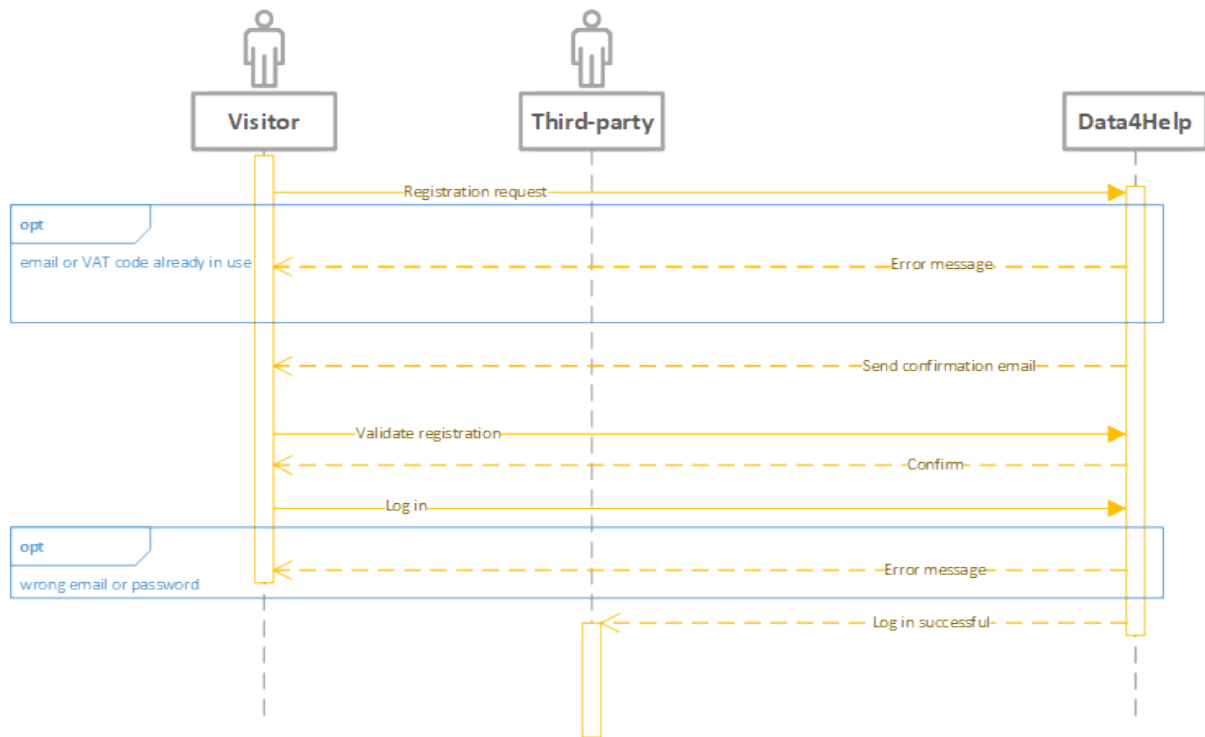
Figure 3.1: Sequence diagram representing the registration/log in phase of a Third-party

Single user data request and subscription

Single User data unsubscription

After a successful subscription request, both Third-party or Individual can make a request in order to break the subscription to the specified data.

Actors	
	• Third-party • Individual
Goals	
Entry Condition	Third-party is logged in and has previously subscribed to the Individual's data.
Events Flow	1. The Third-Party or Individual access to the subscription page and select the subscription to be cancelled. 2. The Third-party or the Individual presses "*Unsubscribe*" button. 3. The system deletes the Third-party subscription and sends an email to both Third-party and Individual.
Exit Condition	The Third-party is not subscribed anymore, but it has access to the previously received data.
Exception	There are no exceptions.

Aggregated user data request and subscription

Third-parties can perform group queries, asking for data coming from several Individuals that are within certain parameters specified by them (geographical areas, age, genre, time of the day). These requests are evaluated directly by D4H, that sends back the requested data only if the number of Individuals involved in the research is greater than 1000. If this is not the case, D4H sends an error message to the Third-party.

Actors	
	• Third-party
Goals	
Entry Condition	The Third-party is logged in.
Events Flow	1. The Third-party clicks on the "*Aggregated data research*" button. 2. The Third-party inserts the parameters of interest. 3. The Third-party decides whether it wants to subscribe to this particular research by checking the specific box or not, then clicks on the "*Search*" button to have D4H perform the query. 4. *Data4Help* does the research and evaluates the results. 5. D4H sends back the result to the Third-party.
Exit Condition	The Third-party receives the requested information.
Exception	The number of Individuals involved in the query is lower than 1000, therefore D4H sends an error message back to the Third-party.

Aggregated user data unsubscription

After a successful subscription to a group search, a Third-party can cancel it at any time if it does not wish to receive any further update. He will, however, still have access to the data collected until that point.

Actors	
	• Third-party
Goals	
Entry Condition	The Third-party is logged in and has previously subscribed to a group search.
Events Flow	1. The Third-Party accesses to the subscription page and selects the subscription to be cancelled. 2. The Third-party presses the "*Unsubscribe*" button. 3. The system deletes the Third-party subscription and sends an email to it for confirmation.
Exit Condition	The Third-party is not subscribed anymore, but it has access to the previously received data.
Exception	There are no exceptions.

Data Collection

Upon registration, Individuals allows the D4H system to collect their data and store them. To gather data, it's mandatory to have a device (smart-watch or fitness-band).

Actors	
	• Individual
Goals	
Entry Condition	The user is correctly registered and logged into the D4H system.
Events Flow	1. Smart-watches or fitness-band samples specific data. 2. This device sends acquired data to D4H system. 3. The system stores data and makes them visible to the owner Individual.
Exit Condition	The individual has personal data storage in his D4H account.
Exception	If the associate device (smart-watch or fitness-bend) doesn't work or does not send data anymore an exception will be handled by the system ... come?

3.2.2   Automated SOS

Subscription Request

Every Individual, user registered to D4H, can ask for subscription to Automated SOS service, but only Elderly people will be allowed to use it.

Actors	
	• Individual
Goals	
Entry Condition	The user has a D4H account.
Events Flow	1. The user logs into his D4H personal account.
	2. The Individual presses on *"AutomatedSOS service"*, in order to make a new subscription request.
	3. The ASOS System checks if the petitioner is at least 65 years old.
	4. If verified, the user is now subscribed.
Exit Condition	The Individual is now subscribed to Automated SOS service.
Exception	If the petitioner is less then 65 years old, the system handle the exception, sending him an error message.

3.2.3 Track4Run

Run organisation

The T4R system allows registered organisers to organise a run. They have to specify the time and the place, but it is not possible to add if there is another, already stored, race in the same place and at the same time. Different runs at the same time but different place are allowed.

Actors	
	• Organiser
Goals	
Entry Condition	Organiser must have an organiser account in T4R system.
Events Flow	1. The organiser logs into his/her personal account. 2. He presses on "*New Run*" button. 3. The organiser specifies date, time, place and the maximum number of participants. 4. The system creates this new run, stores it and sends a notification email to the organiser.
Exit Condition	A new race has been created.
Exception	If there is another stored race with the same data, time and place, the system handles the exception, showing an error message to the organiser.

Participant tracking

Every Visitor, registered or not, is able to track participants on a map during the race and, if there is more then one run at the same time, they can choose which run to watch. To provide this service, the system interacts with Google Maps.

Actors	
	• Visitor • Map service
Goals	
Entry Condition	There is no entry condition
Events Flow	1. The visitor launches the application. 2. They press on the "*Track runners*" button. 3. The system shows the list of current runs. 4. The visitor selects the run of interest. 5. The system asks for map and runners positions to the map service. 6. The map service sends to the system map and runners location. 7. The system shows the map with all runners current position.
Exit Condition	Visitors are now able to see runners on a map.
Exception	If there are no runs in that moment, the system handles the exception, showing a notification message.

Chapter 4

Formal analysis using alloy

Chapter 5

Effort Spent

5.1   Alessia Buccoliero

DATE	Number of hours	TOPIC
15/10/2018	2	Work Organisation
16/10/2018	3	General discussion and introduction writing
21/10/2018	3,5	Goals and domain assumptions sketch
23/10/2018	4,5	Goals and domain assumptions revision and requirements analysis discussion
24/10/2018	1,5	Goals, domain assumptions and requirements review
26/10/2018	3,5	Class diagram and use cases definition
27/10/2018	3	Chapter 2: Overall description
28/10/2018	1,5	Chapter 2: Overall description

Table 5.1: Alessia Buccoliero's working hours

5.2   Emilio Corvino

DATE	Number of hours	TOPIC
15/10/2018	2	Work Organisation
16/10/2018	3	General discussion and introduction writing
21/10/2018	3,5	Goals and domain assumptions sketch
23/10/2018	4,5	Goals and domain assumptions revision and requirements analysis discussion
24/10/2018	1,5	Goals, domain assumptions and requirements review
26/10/2018	3,5	Class diagram and use cases definition
27/10/2018	1,5	Chapter 1: Introduction (Purpose)
28/10/2018	1,5	Chapter 1: Introduction (Scope)
29/10/2018	2,5	Chapter 1: Introduction
30/10/2018	1	Chapter 1: Introduction, finalisation and refinement
31/10/2018	0,5	Chapter 2: Assumptions, dependencies and constraints
02/11/2018	1,5	Chapter 2 revision and Chapter 3 use cases writing
03/11/2018	2	Chapter 3 use cases writing

Table 5.2: Emilio Corvino's working hours

5.3   Gianluca Drappo

DATE	Number of hours	TOPIC
15/10/2018	2	Work Organisation
16/10/2018	3	General discussion and introduction writing
21/10/2018	3,5	Goals and domain assumption sketch
23/10/2018	4,5	Goals and domain assumptions revision and requirement analysis discussion
24/10/2018	1,5	Goals, domain assumptions and requirements review
26/10/2018	3,5	Class diagram and use cases definition
28/10/2018	2	D4H Alloy design
29/10/2018	1,5	Use case relative to G1.2 definition and D4H Alloy design
30/10/2018	4	D4H Alloy design and implementation
02/11/2018	5	D4H Alloy modelling
03/11/2018	4	D4H Alloy debugging

Table 5.3: Gianluca Drappo's working hours