POLITECNICO
MILANO 1863

Computer Science and Engineering
Software Engineering 2 Project

Requirement Analysis and Specification Document

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Contents

Chapter 1

Introduction

1.1 Purpose

TrackMe wants to offer a service named "Data4Help" on top of which will be built two services named "AutomatedSOS" and "Track4Run".

Data4Help: the basic idea behind Data4Help is to acquire the location and health data of *Users* through *Smart wearables* connected to a smartphone. Moreover, data can be directly sent to *Third Party* customers who pay for the service. In order to analyze *Users data*, these need to obtain *User* authorization. Furthermore, they can request anonymized data of a group of *Users*.

AutomatedSOS: a service offered only to subscribed customers that constantly monitors their health status. Its purpose is to identify when a *User* is in need of immediate assistance and send an ambulance to their location.

Track4Run: a service used to track runners participating in running competitions. *Organizers* will be able to define a path for the run, *Participants* will share their position and health data and *Spectators* may watch the competition on their smart devices.

1.2 Scope

TrackMe offers its services in a world where technology and health are taking huge strides forward every day and innovation is commonplace.
Nowadays, people use smart devices such as smartphones and smart wearables more than any other object that they own. This means that any activity they perform already is or can be integrated with these devices.
TrackMe, with the introduction of Data4Help, offers the possibility to monitor users' location and health data and allows third parties to register in the system

to acquire these data.

When it comes to personal data acquisition, privacy is a fundamental issue that TrackMe needs to consider. Privacy is, in fact, regulated by several laws: there are many restrictions on how user's data is acquired and stored. Therefore, TrackMe is concerned with users' consent to transferring data to TrackMe itself and to third parties for individual specific analysis. Moreover, TrackMe guarantees that anonymized data of groups of individuals are properly anonymized by checking specific constraints.

Over the course of their daily routine, users perform several actions during which their data can be analyzed to provide them with insights. For instance, they might want to monitor their heart rate while sleeping or to keep track of the distance they have walked during their day and the places they have been to.

People with a potential need for immediate assistance have always been a huge concern for their relatives and for technology makers. These may include old people with limited movement and a high chance to need urgent assistance, anyone who has a specific disease, but also a healthy individual who can suffer from a sudden heart failure. Until now, the only practical way to receive help has been to call for help, either by using a cell phone or by pushing an SOS button on a dedicated device. TrackMe proposes to automatize the step of calling for help through AutomatedSOS. In fact, when determined health values will no more be considered as normal, the system will automatically send a request for help.

Furthermore, nowadays when it comes to sports and working out, having the possibility of collecting and sharing athletes' data is a disruptive innovation. In fact, giving anybody the possibility of having on their smartphone an accurate analysis of their health while performing a work out session is a breakthrough. A sport that is practiced and loved by many is running. Organizing a run requires several steps to be taken such as defining a path, getting athletes to participate and spectators to watch it. TrackMe proposes to simplify the organization of a run, by introducing Track4Run. This service will allow the definition of a path, easy enrollment for participants and a real-time tracking of each runner's position on a map.

1.2.1 Analysis of shared phenomena

TO DO LIST OF SHARED PHENOMENA

1. user move
2. user can have health problems
3. sensor collects data

4. sensor communicate
5. sensor breaks
6. third party collects data from the system
7. third party register to Data4Help
8. user grants direct usage of personal data
9. user adds a new service
10. organizers of run define path
11. participants of run enroll to it
12. run spectators see on a map the position of runners

1.3 Goals

Data4Help

G_1 Collect *User Data* through *Smart Wearables*.

G_2 Send specific *User Data* to *Third Parties* only if *User* consent was given after *Third Party* access request.

G_3 Send anonimyzed requested *Group Data* to *Third Parties* if the group it refers to is made up of 1000 or more *Users*.

G_4 Send *Users Data* and *Group Data* to subscribed authorized *Third Parties* as soon as they are produced.

G_5 Allow *Users* to manage their subscription to *Services*.

AutomatedSOS

G_6 Analyze *User data* to check whether or not a *User* is a *User in need*.

G_7 Send an ambulance to the last position of a *User in need*.

Track4Run

G_8 Allow *Organizers* to create a *Run*, defining a path.

G_9 Allow *Users* to enroll in a *Run* as *Participants*.

G_{10} Allow *Spectators* to watch a *Run*.

1.4 Definitions, Acronyms, Abbreviations

1.4.1 Definitions

User : registered individual of Data4Help who agreed on the acquisition and processing of their data (see add reference to user data below).

User Data : *User*'s health data and location acquired by Data4Help

Third party : a company that is willing to access *User data* stored in TrackMe's database.

Service : application available for some Data4Help *Users*, generally offered by a Third party.

Group Data : set of *Users data* acquired by Data4Help. The set of *Users* is determined by specific characteristics and constraints defined by the *Third Party* requesting the data. When sent to the *Third Party*, this data is anonymized.

Smart wearable : smart devices that can be worn on the body as accessories. These devices are required to have specific sensors for data acquisition, to be compatible with the system to be (see add reference to requirements for smart wearables). The adjective 'smart' refers to the possibility of connecting them to an external device, such as a smartphone, and to the ability of operating autonomously even if not connected.

Anomalous data : health data that is outside certain intervals, which identify a *User* normal health condition. define better

User in need : registered user of AutomatedSOS in need of assistance since their health data is *amomalous*.

Run : running competition registered on Track4Run.

Organizer : company or private person organizing a *Run*.

Spectator : person participating as spectator of a *Run*.

Participant : *User* subscribed to Track4Run participating in a *Run*.

Username : *User*'s email address.

1.4.2 Acronyms

GPS : Global Positioning Service

1.4.3 Abbreviations

G_n : n^{th} goal

D_n : n^{th} domain assumption

R_n : n^{th} requirement

S_n : n^{th} scenario

1.5 Revision history

1. v. 1.0

1.6 Reference Documents

TO DO DURING THE WRITING OF THIS DOCUMENT

1.7 Document Structure

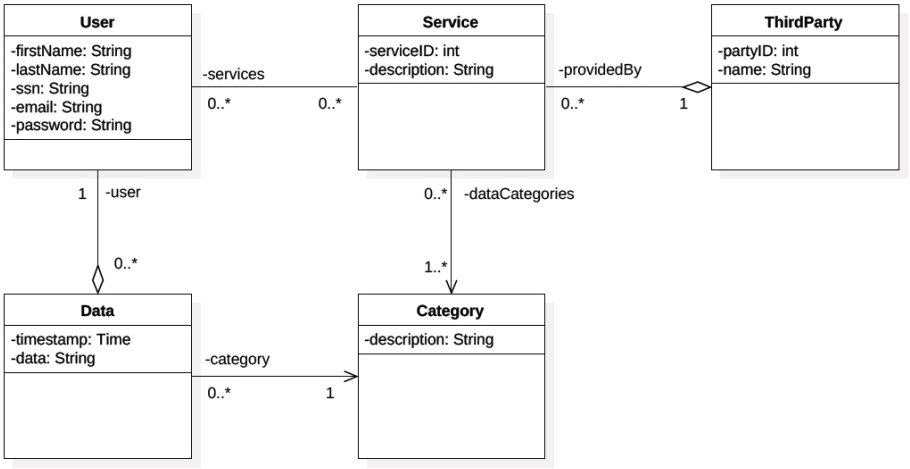
WORK IN PROGRESS

Chapter 2

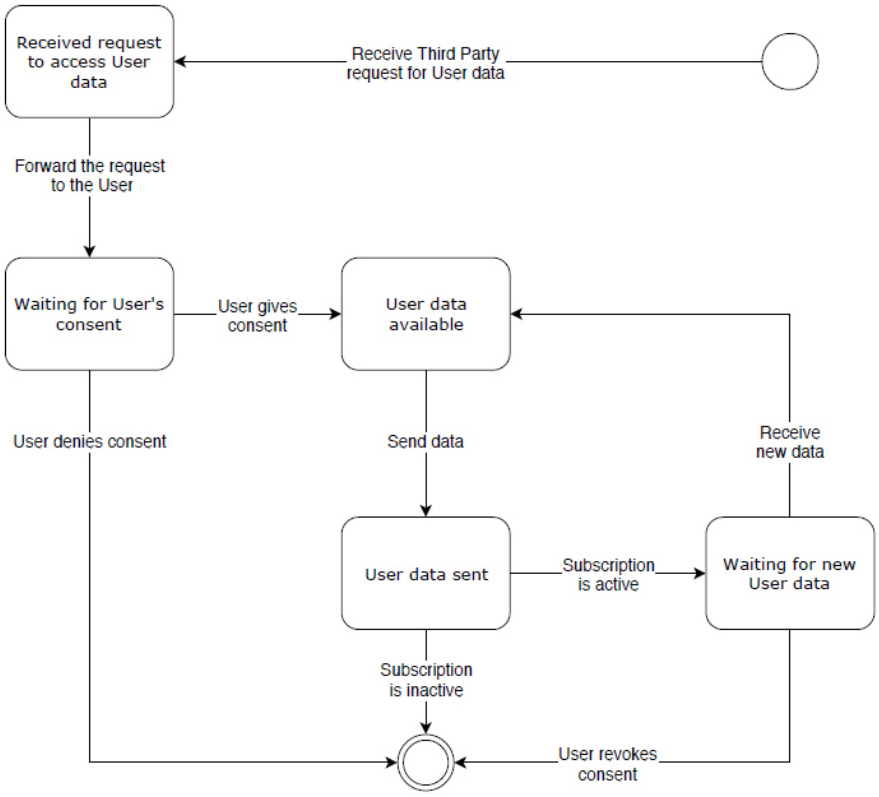
Overall Description

2.1 Product perspective

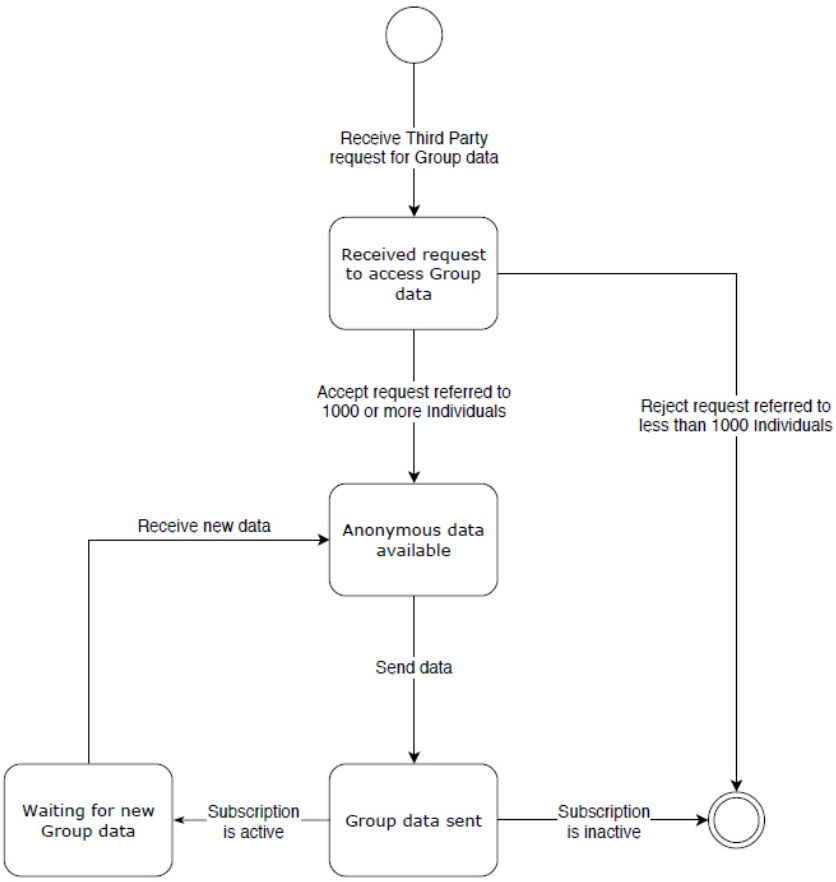
Data4Help



Data4Help class diagram



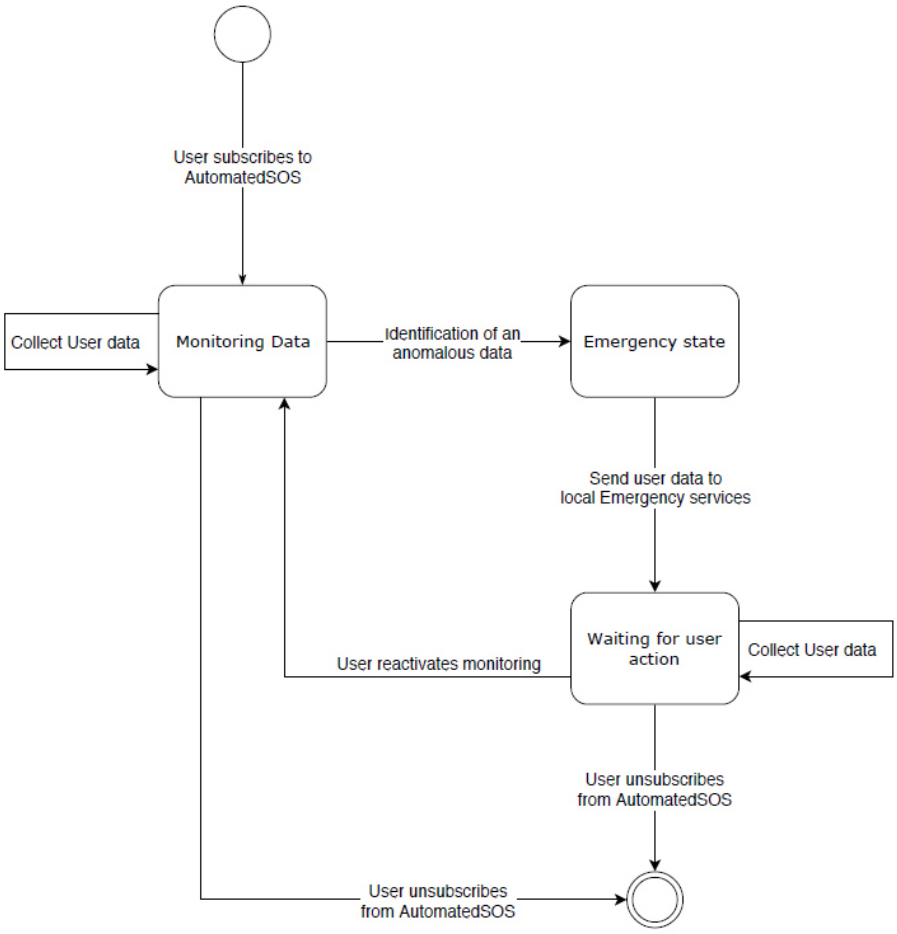
Data4Help state chart referred to *User Data* request



Data4Help state chart referred to *Group Data* request

- *User* subscribes to Data4Help
- *User* log in to Data4Help account on the app
- *User* adds a new service on personal Data4Help account granting to it the direct access of data
- *User* unsubscribes from Data4Help
- *Smart wearables* send data to Data4Help system

AutomatedSOS

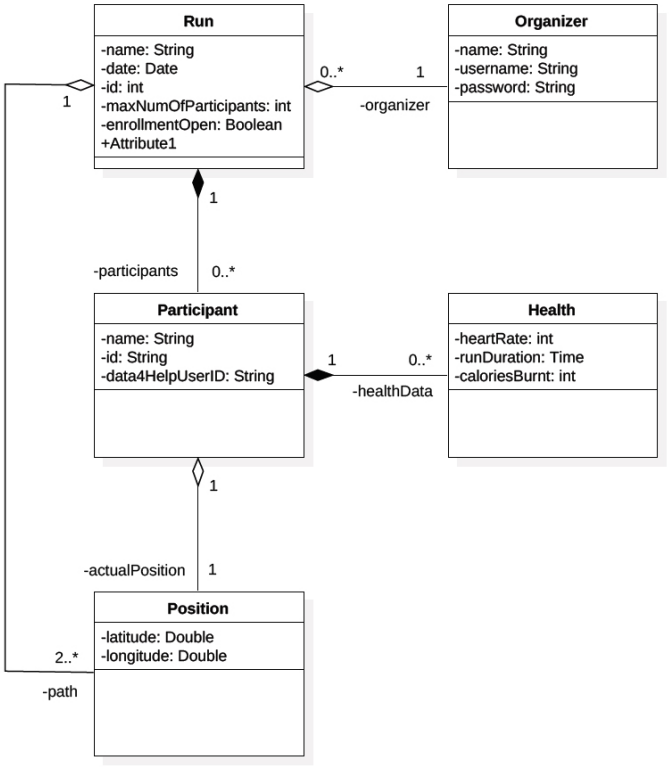


AutomatedSOS state chart

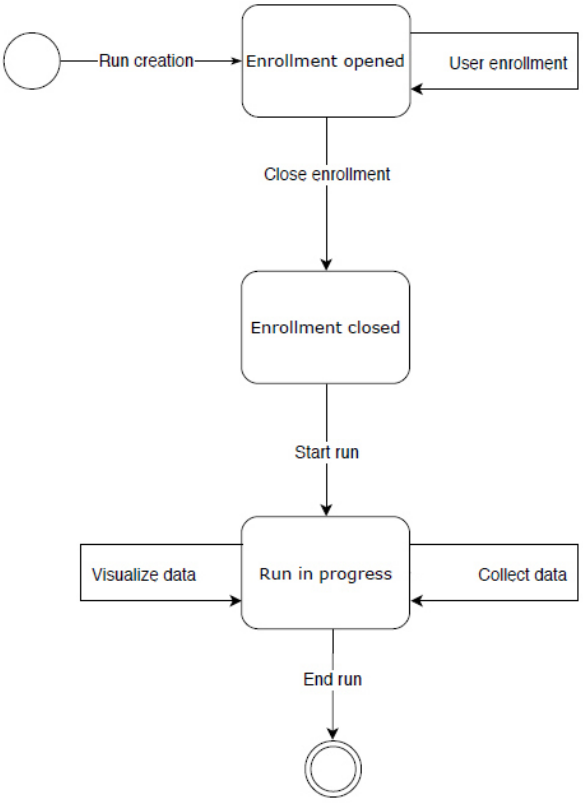
The product, because it is built on top of Data4Help, inherites from it the same shared phenomena.

- *User* becomes a *User in need*
- The system calls an ambulance

Track4Run



Track4Run class diagram



Track4Run state chart

The product, because it is built on top of Data4Help, inherites from it the same shared phenomena.

- *Organizer* sets a path for a running competition
- *User* enrolls to a running competition
- *Spectators* watches the participants' tracking map

2.2 Product functions

2.2.1 Data4Help

User Registration

Data4Help will allow individuals to register. These will register by entering all the required information (see [R_X] add reference to Requirements where we

specify User info for registration). When registering to Data4Help, an individual will first declare to have read the privacy statement and secondly they will have to accept the terms and conditions, which specifically include their consent to the acquisition and processing of their data, including sensitive ones, by TrackMe.
The *User* registration process will be carried out on the Data4Help application (see add reference to where we are going to specify the user interface and add reference to User Sign Up use case.

Third Party Registration

A *Third Party* may register to Data4Help through the *Third Party* dedicated website (seereference), including all required information (see [R_X] add reference to Requirements where we specify *Third Party* info for registration). Once terms and conditions have been accepted by the *Third Party*, it will be successfully registered to the service.

User Data Acquisition

Data4Help will acquire *User data* through *Smart Wearables*.
Users must give consent to the acquisition of their data when registering to Data4Help.
Data acquisition frequency can be changed according to *Users* or *Third Parties* needs. For instance, if a *User* wants to save their *Smart wearable* battery, frequency can be reduced. On the other hand, if a *Third Party* would like to track more accurately the position of a *User*, a higher location acquisition frequency can be requested.

Third Party Data Request

Once a *Third Party* is registered to Data4Help, it can request access to *Users data* acquired through Data4Help and stored by TrackMe. *Third Parties* may request data that refers either to a specific individual - *User data* - or to a group of *Users* identified by common characteristics - *Group data*.
Consent to individual data access is left to the specific *User*, who can either give or deny it to a *Third Party* request.
Group data will be shared with *Third Parties* as long as TrackMe will be able to anonymize it properly (see R_X include reference to requirement about anonymized data).

Data Management and Privacy

All data acquired through Data4Help will be stored on a database accessible only by TrackMe. Each piece of *Users data* will have a list of *Third Parties* to whom access was granted. At any time, a *User* will be able to revoke the

previously given consent to any *Third Party* or to TrackMe. Moreover, a *User* may exercise their right to data portability, which means that TrackMe will have to provide them with all the collected data regarding them. Finally, *Users* may ask the deletion of all their data stored by TrackMe. might want to list the requirements that relate to this
By guaranteeing these functions, Data4Help will respect existing general regulations on privacy (e.g. EU GDPR).

2.2.2 AutomatedSOS

User Subscription

All Data4Help *Users* may subscribe to AutomatedSOS through Data4Help application(see add reference).

Health Status Monitoring

The service will constantly monitor *User*'s health data to verify if it is *Anomalous*. While data acquisition frequency can be tweaked only by Data4Help, AutomatedSOS may request a different value according to user needs. check this: When the service is not receiving data, it may try to contact the *User*. Otherwise, it may send an alert to a close friend of the *User* for them to check in.

Calling an Ambulance

check this title In case the health status of a subscribed *User* is considered not to be good, AutomatedSOS will make a call to local emergency services within 5 seconds and send an ambulance to the last registered location of the *User*.

2.2.3 Track4Run

User Registration

Track4Run will be a service used by three different kinds of *Users*: *Organizers*, runners and *Spectators*.*Organizers* will register to Track4Run by filling in all required information in the organizers registration form (see include ref to requirements for organizers registration). *Participants* will enroll in the run using their Data4Help credentials through the Data4Help application. *Spectators* will just need to know the *Run identifier* and entering when requested where??.

Run Creation and Path Definition

Organizers have the ability of creating a run. They will be able to give the run a name, set a date and time the run is going to be held on and define a path for it.

Display Runners on Map

Track4Run will display a map with the real time position of all the *Participants* during a *Run*. *Spectators* may watch a *Run* by inserting its identifier.

2.3 User characteristics

2.3.1 Data4Help

Users: People having at least a device with a sensor connected to internet, willing to share their data (add reference to User data) with TrackMe to use the services built on top of Data4Help.

Third Parties: Companies or private persons willing to collect bulk data. This data is maily used for building *services* on top of Data4Help; for many of these *services* it is very important that data is transferred real time. Otherwise data may be used for statistics analysis. In both cases, *Third Parties* need that collected data is correct and accurate.

2.3.2 AutomatedSOS

Users: People with a high probablity of needing immediate assistance. AutomatedSOS users are willing to monitor their health parameters and GPS location to prevent finding themselves alone when in need. These are mainly elderly people, especially those living by themselves. However, all categories of people may want to use AutomatedSOS, specifically those who suffer from a disease that may strike any moment.

2.3.3 Track4Run

Participants: People participating in a *Run*. They need to have a small device with no required interaction during the *Run* so as to avoid distractions.

Organizers: Companies or private persons organizing *Runs* willing to better engage the *Spectators* giving them the possibility to track in real-time the position of all participants. They need to provide this *Service* easily in order to ensure *Spectators* and *Participants* are not prevented from using it.

Spectators: People participating as spectators of *Runs*. They are willing to enjoy the event by tracking *Participants* during all the *Run*. Watching a *Run* must be easy: no need of particular devices or installed applications.

2.4 Assumptions, Dependencies and Constraints

2.4.1 Domain Assumptions

D_1 Personal data inserted by the *User* at sign up corresponds to their real data.

D_2 *User data* collected at a certain instant corresponds to the actual status (GPS position and health data) of the *User* at that precise moment.

D_3 The maps in use accurately represent the world.

D_4 A *Third Party* can receive consent to *User data* access only through a service it offers and can use the data only for that specific service.

D_5 AutomatedSOS and Track4Run are *Services* developed by TrackMe.

D_6 AutomatedSOS and Track4Run are subscribed to new data.

D_7 When AutomatedSOS needs to send an ambulance to a *User in need* it forwards the request to local emergency services, which eventually dispatch an ambulance.

D_8 *Smart Wearables* are correctly worn by *Users*.

D_9 Data4Help and all *Services*, including AutomatedSOS and Track4Run, are always online.

D_{10} *Users* own a working smartphone which is always connected to the Internet.

D_{11} *Users* own a working *Smart Wearable* which is always connected to the *User*'s smartphone.

2.4.2 Dependencies

DA FARE

2.4.3 Constraints

Track4Help

- Smartphone must have a working internet connection.
- Smartphone or *smart wearable* must have GPS activated.
- Smartphone must be able to communicate somehow (e.g. bluetooth) with the *smart wearables*.
- Smartphone must have enough space for downloading and installing the Data4Help application.

AutomatedSOS Definire se lasciare vuoto o meno questa parte

Track4Run

- *Organizers* and *Spectators* must have a modern browser on a device connected to internet in order to access respectively the organizers admin panel and the spectators map.

Chapter 3

Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

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3.1.2 Hardware Interfaces

Data4Help is a service based on native applications for smartphones and on a centralized backend handling the retrieval of data from users and their storage. Data4Help acts only as an intermediary between the sources of data and the parties that want to get access to those. Due to this, Data4Help has no hardware interfaces.
Obviously also the services built on top of it, being pure software adds-on working on top of basic API's of Data4Help, don't have hardware interfaces.

3.1.3 Software Interfaces

All the following requests contain a parameter named *serviceID* that is the ID of the service that is performing the action. In case of requests of data, the data retrieved is relative to the service corresponding to the given serviceID. Moreover, each request contains the authentication digest (add reference to HMAC standard in 3.5.3 security).

- GET - */user?username=...&serviceID=...*
  Retrieves all records available for the given *username*
- GET - */user?username=...&quantity=...&serviceID=...*
  Retrieves last n records for the given *username*. The quantity parameter must be an integer.

- GET - */group?filter...&serviceID=...*
  Retrieves all records available for all people using the given service filtered according to ....
  Decidere quali sono i modi possibili di filtrare i dati collettivi
- PUT - */user?username=...&serviceID=...*
  Request the specified user authorization for subscribing to data updates.
- DELETE - */user?username=...&serviceID=...*
  Unsubscribes the service from the data updates of the given user.

3.1.4 Communication Interfaces

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3.2 Functional Requirements

Data4Help

R_1 Unregistered individuals and companies must not be able to use Data4Help.

R_2 At sign up, *User* must provide: first name, last name, SSN, email and password.

R_3 At sign up, *Third Party* must provide a company name.

R_4 At sign up, *User* must accept terms and conditions, including the privacy statement.

R_5 At sign up, *Third Party* must accept terms and conditions.

R_6 Identify a *User* by their identifier.

R_7 Query the database for a *User* by their identifier.

R_8 Receive *User Data*.

R_9 Validate *User Data*.

R_{10} Authenticate *User Data*.

R_{11} Store collected *User Data* in a database.

R_{12} Retrieve specific *User Data* by database querying based on *User* identification.

R_{13} Receive *Third Party* data access request.

R_{14} Validate *Third Party* data access request.

R_{15} Authenticate *Third Party* data access request.

R_{16} Forward *User Data* access request to the specific *User*.

R_{17} Receive *User* consent approval or denial.

R_{18} Check if a specific *User* gave consent to a specific *Service*.

R_{19} Send specific *User Data* to the requesting *Third Party*.

R_{20} Not send specific *User Data* to the requesting *Third Party* if the specific *User* denied consent.

R_{21} *Third Party* must be able to set specific constraints to define a group of *Users*.

R_{22} Check how many *Users* requested *Group Data* refers to.

R_{23} Properly anonymize *Group Data*.

R_{24} Send *Group Data* to the requesting *Third Party*.

R_{25} Not send *Group Data* if the group it refers to is made up of less than 1000 *Users*.

R_{26} Receive *Third Party* subscription request.

R_{27} Validate *Third Party* subscription request.

R_{28} Authenticate *Third Party* subscription request.

R_{29} Automatically send new data to subscribed authorized *Third Parties* as soon as they are produced.

R_{30} Allow *Users* to subscribe to *Services*.

R_{31} Allow *Users* to unsubscribe from *Services*.

R_{32} Send a specific *User* all their data stored, if requested by them.

R_{33} Delete a *User* specific data, if requested by them.

R_{34} Allow *Users* to request all their data stored by TrackMe at any time.

R_{35} Allow *Users* to request the deletion of all their data stored by TrackMe at any time.

AutomatedSOS

R_{36} Compare *User Data* against certain thresholds.

R_{37} Call local emergency services providing necessary *User Data* of *User in need*.

R_{38} *User* must be able to reactivate AutomatedSOS monitoring.

Track4Run

R_{39} Allow *Organizers* to create a *Run*, defining: name, path, date and the maximum number of *Participants*.

R_{40} Provide *Users* enrollment for an existing *Run*.

R_{41} Prevent a *User* from enrolling in a *Run* if the maximum number of *Participants* was already reached.

R_{42} Prevent a *User* from enrolling in a *Run* if it already started or finished.

R_{43} Prevent a *User* from enrolling in a *Run* if enrollment is closed.

R_{44} Show a *Run* by displaying the position of *Participants* on a map.

R_{45} Identify a *Run* by its identifier.

R_{46} Query the database for a *Run* given its identifier.

3.2.1 Satisfying Goals

Data4Help

G_1 Collect *User Data* through *Smart Wearables*.

- R_4 At sign up, *User* must accept terms and conditions, including the privacy statement.
- R_6 Identify a *User* by their identifier.
- R_8 Receive *User Data*.
- R_9 Validate *User Data*.
- R_{10} Authenticate *User Data*.
- R_{11} Store collected *User Data* in a database.

- D_2 *User data* collected at a certain instant corresponds to the actual status (GPS position and health data) of the *User* at that precise moment.
- D_3 The maps in use accurately represent the world.
- D_8 *Smart Wearables* are correctly worn by *Users*.
- D_9 Data4Help and all *Services*, including AutomatedSOS and Track4Run, are always online.
- D_{10} *Users* own a working smartphone which is always connected to the Internet.
- D_{11} *Users* own a working *Smart Wearable* which is always connected to the *User*'s smartphone.

U_1 *User Sign Up*

U_3 *User Log In*

G_2 Send specific *User Data* to *Third Parties* only if *User* consent was given after *Third Party* access request.

R_1 Unregistered individuals and companies must not be able to use Data4Help.

R_6 Identify a *User* by their identifier.

R_7 Query the database for a *User* by their identifier.

R_{11} Store collected *User Data* in a database.

R_{12} Retrieve specific *User Data* by database querying based on *User* identification.

R_{13} Receive *Third Party* data access request.

R_{14} Validate *Third Party* data access request.

R_{15} Authenticate *Third Party* data access request.

R_{16} Forward *User Data* access request to the specific *User*.

R_{17} Receive *User* consent approval or denial.

R_{18} Check if a specific *User* gave consent to a specific *Service*.

R_{19} Send specific *User Data* to the requesting *Third Party*.

R_{20} Not send specific *User Data* to the requesting *Third Party* if the specific *User* denied consent.

U_2 *Third Party Sign Up*

U_4 *Third Party Log In*

U_5 *Third Party requests User Data*

U_{10} *User revokes consent to a Service*

G_3 Send anonymized requested *Group Data* to *Third Parties* if the group it refers to is made up of 1000 or more *Users*.

R_{11} Store collected *User Data* in a database.

R_{12} Retrieve specific *User Data* by database querying based on *User* identification.

R_{13} Receive *Third Party* data access request.

R_{14} Validate *Third Party* data access request.

R_{15} Authenticate *Third Party* data access request.

R_{21} *Third Party* must be able to set specific constraints to define a group of *Users*.

R_{22} Check how many *Users* requested *Group Data* refers to.

R_{23} Properly anonymize *Group Data*.

R_{24} Send *Group Data* to the requesting *Third Party*.

R_{25} Not send *Group Data* if the group it refers to is made up of less than 1000 *Users*.

U_2 *Third Party Sign Up*

U_4 *Third Party Log In*

U_6 *Third Party requests Group Data*

G_4 Send *Users Data* and *Group Data* to subscribed authorized *Third Parties* as soon as they are produced.

R_7 Query the database for a *User* by their identifier.

R_8 Receive *User Data*.

R_9 Validate *User Data*.

R_{10} Authenticate *User Data*.

R_{18} Check if a specific *User* gave consent to a specific *Service*.

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R_{26} Receive *Third Party* subscription request.

R_{27} Validate *Third Party* subscription request.

R_{28} Authenticate *Third Party* subscription request.

R_{29} Automatically send new data to subscribed authorized *Third Parties* as soon as they are produced.

D_9 Data4Help and all *Services*, including AutomatedSOS and Track4Run, are always online.

D_{10} *Users* own a working smartphone which is always connected to the Internet.

D_{11} *Users* own a working *Smart Wearable* which is always connected to the *User*'s smartphone.

U_7 *Third Party subscribes to New User Data*

U_8 *Third Party subscribes to New Group Data*

U_{10} *User revokes consent to a Service*

G_5 Allow *Users* to manage their subscription to *Services* and to Data4Help.

R_4 At sign up, *User* must accept terms and conditions, including the privacy statement.

R_6 Identify a *User* by their identifier.

R_7 Query the database for a *User* by their identifier.

R_{12} Retrieve specific *User Data* by database querying based on *User* identification.

R_{30} Allow *Users* to subscribe to *Services*.

R_{31} Allow *Users* to unsubscribe from *Services*.

R_{32} Send a specific *User* all their data stored, if requested by them.

R_{33} Delete a *User* specific data, if requested by them.

R_{34} Allow *Users* to request all their data stored by TrackMe at any time.

R_{35} Allow *Users* to request the deletion of all their data stored by TrackMe at any time.

U_9 *User subscribes to a Service*

U_{10} *User revokes consent to a Service*

AutomatedSOS

G_6 Analyze *User data* to check whether or not a *User* is a *User in need*.

R_6 Identify a *User* by their identifier.

R_7 Query the database for a *User* by their identifier.

R_8 Receive *User Data*.

R_9 Validate *User Data*.

R_{10} Authenticate *User Data*.

R_{29} Automatically send new data to subscribed authorized *Third Parties* as soon as they are produced.

R_{36} Compare *User Data* against certain thresholds.

R_{38} *User* must be able to reactivate AutomatedSOS monitoring.

D_2 *User data* collected at a certain instant corresponds to the actual status (GPS position and health data) of the *User* at that precise moment.

D_6 AutomatedSOS and Track4Run are subscribed to new data.

D_9 Data4Help and all *Services*, including AutomatedSOS and Track4Run, are always online.

D_{10} *Users* own a working smartphone which is always connected to the Internet.

D_{11} *Users* own a working *Smart Wearable* which is always connected to the *User*'s smartphone.

U_{11} User in need assisted by AutomatedSOS

G_7 Send an ambulance to the last position of a *User in need*.

R_6 Identify a *User* by their identifier.

R_7 Query the database for a *User* by their identifier.

R_{11} Store collected *User Data* in a database.

R_{12} Retrieve specific *User Data* by database querying based on *User* identification.

R_{37} Call local emergency services providing necessary *User Data* of *User in need*.

D_3 The maps in use accurately represent the world.

D_6 AutomatedSOS and Track4Run are subscribed to new data.

D_7 When AutomatedSOS needs to send an ambulance to a *User in need* it forwards the request to local emergency services, which eventually dispatch an ambulance.

U_{11} User in need assisted by AutomatedSOS

Track4Run

G_8 Allow *Organizers* to create a *Run*, defining a path.

R_{39} Allow *Organizers* to create a *Run*, defining: name, path, date and the maximum number of *Participants*.

U_{12} Organizer Sign Up

U_{13} Organizer creates a Run

G_9 Allow *Users* to enroll in a *Run* as *Participants*.

R_{40} Provide *Users* enrollment for an existing *Run*.

R_{41} Prevent a *User* from enrolling in a *Run* if the maximum number of *Participants* was already reached.

R_{42} Prevent a *User* from enrolling in a *Run* if it already started or finished.

R_{43} Prevent a *User* from enrolling in a *Run* if enrollment is closed.

R_{45} Identify a *Run* by its identifier.

R_{46} Query the database for a *Run* given its identifier.

U_{14} User enrolls in a Run

G_{10} Allow *Spectators* to watch a *Run*.

R_{44} Show a *Run* by displaying the position of *Participants* on a map.

R_{45} Identify a *Run* by its identifier.

R_{46} Query the database for a *Run* given its identifier.

D_3 The maps in use accurately represent the world.

D_6 AutomatedSOS and Track4Run are subscribed to new data.

D_8 *Smart Wearables* are correctly worn by *Users*.

D_9 Data4Help and all *Services*, including AutomatedSOS and Track4Run, are always online.

D_{10} *Users* own a working smartphone which is always connected to the Internet.

D_{11} *Users* own a working *Smart Wearable* which is always connected to the *User*'s smartphone.

U_{15} Spectator watches a Run

3.2.2 Scenarios

Data4Help

S_1 Dante is an individual who would like to keep track of his GPS position and health data. For this purpose he decides to use Data4Help. He downloads the Data4Help application on his smartphone and proceeds to sign up. He inserts all required information, which include his name, his social security number and date of birth. He is asked to insert an email that will later be his username and a password. Dante inserts his name as his password and the system tells him that the inserted password is shorter than 8 characters, so he tries again with a new one. Eventually he inserts a valid password, accepts the terms and conditions and taps on "Create an Account". He is successfully signed up, after receiving a confirmation email by TrackMe. He tries to log into the application by inserting the newly created username and password. The system accepts the credentials and Dante is in.

S_2 YourHealth is a company that analyzes individuals' health data to provide users with insights on their well-being. It decides to offer its *Service* also on Data4Help so as to have a greater pool of users. The person in charge navigates to the *Third Party* dedicated website and clicks on "Sign Up". They fill in all required information about their company, insert an email that will be used as username and a valid password. They then accept the terms and conditions by clicking the specific checkbox, and finally click on "Create an Account". YourHealth receives an email confirming the account creation: now YourHealth *Services* are available to all Data4Help *Users*.

S_3 Dante, a Data4Help *User*, needs to monitor his heart rate through the day. He navigates to the "Discover" page inside of his Data4Help application and scrolls through the available *Services*. He finds MyHeart, a *Service* developed by YourHealth, a *Third Party* registered to Data4Help. The description of the service seems to suit his need, so he adds MyHeart to his *Services*. In order to finalize the subscription, Dante will have to accept that his data will be sent to YourHealth for analysis. He does so. After a while, in the specific MyHeart *Service* page, the "Analyze" button appears. Dante taps on it and promptly he sees a personalized graph showing his heart rate levels throughout the day, starting from the first day he registered to Data4Help.

S_4 LocalStats is a company that performs intensive statistics on individuals' positions in some cities of Switzerland. It decides to acquire individuals GPS locations data from Data4Help to enlarge its database. LocalStats registers as a Data4Help *Third Party*. Once registration is complete, the first request it makes to Data4Help refers to all female *Users* between 30 and 35 years old living in Lausanne. Unfortunately, the number of *Users* with the requested characteristics is less than 1000, which does not guarantee proper data anonymization. Therefore, Data4Help rejects the *Group Data* request. LocalStats tries again changing the interval of interest to 25-35 years old. This time the request refers to more than 1000 *Users* and finally Data4Help can send the requested *Group Data* to LocalStats.

S_5 Dante, from scenario S_3, would like to keep MyHeart active day by day. To do so, he taps on "Analyze Daily", which is a function offered by MyHeart. YourHealth, which developed and manages MyHeart, requests subscription to Dante's new data. Data4Help registers that anytime Dante's *User data* is collected, it needs to send it to YourHealth for analysis. Starting from the following day, Dante does not need anymore to tap on "Analyze" every day: new analysis is provided to him as soon as it is available from MyHeart.

S_6 Dante, who subscribed to Data4Help and used its *Third Party Services* for a while, decides that he does not want to use one of them, TrackKer,

anymore. Therefore, he navigates to the "My Services" page and taps on TrackKer. The *Service* page shows up and he taps on the "Revoke Consent" button at the bottom of the page. From now on, Data4Help will stop sending Dante's data to the *Third Party* managing TrackKer.

AutomatedSOS

S_7 GianVito is a 57 years old man subscribed to AutomatedSOS. After getting very angry at work, he drives home, but as soon as he gets there he feels dizzy and falls on the ground. He is alone and cannot call for help. Fortunately, AutomatedSOS notices that his heart rate is below a certain threshold and identifies him as *User in need*. AutomatedSOS calls the local emergency services and sends them GianVito's position and health data. When the local emergency services dispatch an ambulance and GianVito is being taken care of, AutomatedSOS waits for GianVito's action, still collecting his data, without possibly identifying it as *Anomalous*. Finally, GianVito opens up Data4Help application and taps on "Reactivate Monitoring". AutomatedSOS has fulfilled his need for immediate assistance and starts monitoring his health data again.

Track4Run

S_8 Charity4All is a Swedish charity association that organizes a running competition every year to raise money for their causes. The person in charge decides to use Track4Run to manage the run. They navigate to the *Run* dedicated website and sign up as an *Organizer*, inserting an email and a password for registration. Once sign up is complete, they click on "Create Run" and the *Run* creation page shows up. They give the *Run* a name - Run4Char - they define a path around Gothenburg and set the date and time the competition will take place on. They do not want to limit the number of participants, so they click on "Create Run" and obtain a *Run* identifier back from Track4Run. They will distribute this identifier to all viewers who wish to enjoy the *Run* on their devices.

S_9 Hannah lives in Gothenburg and she loves running. In fact, she is subscribed to Track4Run. While browsing the available *Runs* in her city, she finds Run4Char from S_8 add ref. She enrolls in the run right away and Track4Me records her registration. Hannah is now a *Participant* of the *Run*.

S_{10} George enjoys sports a lot, however he is very old now and cannot participate in competitions anymore. He still likes watching sports event, especially when it comes to running. Since he is also into helping others, he is subscribed to Charity4All (from S_8 add ref) newsletter. He reads that they are organizing a *Run* and writes down the *Run* identifier. On the day of the *Run*, he navigates to the *Spectators* dedicated website and inserts the *Run* identifier. As soon as the *Run* starts, he enjoys it by

watching the position of the *Participants* on the map right on his device, comfortably in his house.

3.2.3 Use Cases

Data4Help

U_1

Name	User Sign Up
Actors	*User*, Data4Help
Entry Conditions	*User* successfully installed Data4Help application on their smartphone.
Events Flow	1. *User* taps on "Sign Up" button. 2. *User* fills in all required fields for *User* registration, including username and password. 3. *User* checks the "Accept terms and conditions" checkbox. 4. *User* taps on "Create an Account" button. 5. Data4Help saves *User* information.
Exit Condition	*User* successfully registered by Data4Help.
Exceptions	1. Inserted email already registered for another *User*. 2. Inserted password is not valid. 3. Not all required fields are filled in. 4. "Accept terms and conditions" checkbox not checked. 5. *User* already signed up. *User* is invited to try again signing up, reporting which error(s) they have committed.

U_2

Name	Third Party Sign Up
Actors	*Third Party*, Data4Help

Entry Conditions	*Third Party* is connected to the *Third Party* dedicated website (see add reference).
Events Flow	1. *Third Party* clicks on "Sign Up" button. 2. *Third Party* fills in all required fields for *Third Party* registration, including username and password. 3. *Third Party* checks the "Accept terms and conditions" checkbox. 4. *Third Party* clicks on "Create an Account" button. 5. Data4Help saves *Third Party* information.
Exit Condition	*Third Party* successfully registered by Data4Help.
Exceptions	1. Inserted email already registered for another *Third Party*. 2. Inserted password is not valid. 3. Not all required fields are filled in. 4. "Accept terms and conditions" checkbox not checked. 5. *Third Party* already signed up. *Third Party* is invited to try again signing up, reporting which error(s) it has committed.

U_3

Name	User Log In
Actors	*User*, Data4Help
Entry Conditions	*User* successfully registered to Data4Help and installed Data4Help application on their smartphone.

Events Flow	1. *User* enters username. 2. *User* enters password. 3. *User* taps on "Log In" button. 4. Data4Help checks *User* credentials.
Exit Condition	*User* is successfully logged in.
Exceptions	1. Inserted username is not valid. 2. Inserted password is not correct. *User* is invited to try again logging in.

U_4

Name	Third Party Log In
Actors	*Third Party*, Data4Help
Entry Conditions	*Third Party* successfully registered to Data4Help and is connected to the *Third Party* dedicated website (see add reference).
Events Flow	1. *Third Party* enters username. 2. *Third Party* enters password. 3. *Third Party* clicks on "Log In" button. 4. Data4Help checks *Third Party* credentials.
Exit Condition	*Third Party* is successfully logged in.
Exceptions	1. Inserted username is not valid. 2. Inserted password is not correct. *Third Party* is invited to try again logging in .

U_5

Name	Third Party requests User Data
Actors	*Third Party*, Data4Help, *User*

Entry Conditions	*Third Party* and *User* successfully registered to Data4Help.
Events Flow	1. *Third Party* requests access to specific *User data*. 2. Data4Help forwards the request to the specific *User* unless the consent was already given. 3. *User* gives consent to the requesting *Third Party* to access their data.
Exit Condition	Data4Help sends *User data* to the *Third Party*.
Exceptions	1. *User* denies consent to their data access by the requesting *Third Party*.

U_6

Name	Third Party requests Group Data
Actors	*Third Party*, Data4Help
Entry Conditions	*Third Party* successfully registered to Data4Help.
Events Flow	1. *Third Party* requests access to *Group data*. 2. Data4Help checks if the requested data refers to minimum 1000 *Users*.
Exit Condition	Data4Help sends *Group data* to the *Third Party*.
Exceptions	1. *Group data* refers to less than 1000 *Users*. Data4Help denies *Group data* access to the *Third Party*.

U_7

Name	Third Party subscribes to New User Data
Actors	*Third Party*, Data4Help
Entry Conditions	*Third Party* successfully registered to Data4Help and obtained access to *User data*.

Events Flow	1. *Third Party* requests subscription to *User data*. 2. *User* gives consent.
Exit Condition	Data4Help registers the *Third Party* subscription to new data. Each time new data is produced, it is sent to the *Third Party*.
Exceptions	No Exceptions

U_8

Name	Third Party subscribes to New Group Data
Actors	*Third Party*, Data4Help
Entry Conditions	*Third Party* successfully registered to Data4Help and obtained access to *Group data*.
Events Flow	1. *Third Party* requests subscription to *Group data*.
Exit Condition	Data4Help registers the *Third Party* subscription to new data. Each time new data is produced, it is sent to the *Third Party*.
Exceptions	No exceptions

U_9

Name	User subscribes to a Service
Actors	*Third Party*, *User*, Data4Help
Entry Conditions	*User* is successfully registered to Data4Help and installed Data4Help application on their smartphone.
Events Flow	1. *User* navigates to "Discover" page. 2. *User* chooses which *Service* they would like to subscribe to. 3. *User* taps on "Add" button. 4. *User* gives consent to sharing their data with the specific *Third Party*.
Exit Condition	Data4Help registers the new *Service* for the *User*

Exceptions	1. *User* does not give consent to sharing their data. The *Service* is not added and the *User* is invited to try again adding it.

U_{10}

Name	User revokes consent to a Service
Actors	*Third Party*, *User*, Data4Help
Entry Conditions	*User* gave consent to sharing their data with a *Third Party*.
Events Flow	1. *User* navigates to "My Services" page. 2. *User* chooses which service they would like to revoke consent. 3. *User* navigates to the *Service* dedicated page by tapping on its name. 4. *User* taps on "Revoke consent" button.
Exit Condition	Data4Help stops sharing the data of the *User* with the specific *Third Party*.
Exceptions	1. ??? ???

? ? ? Collect data –¿ probably it is not a use case, but regular product function ? ? ? User manages data (gdpr)

AutomatedSOS

U_{11}

Name	User in need assisted by AutomatedSOS
Actors	*User*, AutomatedSOS, Local emergency services
Entry Conditions	*User* is subscribed to AutomatedSOS and installed Data4Help application on their smartphone.

Events Flow	1. AutomatedSOS identifies User data as *anomalous data*. 2. *User* is identified as *User in need*. 3. AutomatedSOS calls local emergency services requesting an ambulance. 4. AutomatedSOS sends *User data* including GPS location and health data to local emergency services. 5. Local emergency services send an ambulance to the location of the *User in need*.
Exit Condition	*User in need* taps on "Reactivate Monitoring" button.
Exceptions	1. Local emergency services don't answer the call. 2. The call to local emergency services is answered but the communication fails before giving all the necessary details. AutomatedSOS repeats the call.

Track4Run

U_{12}

Name	Organizer Sign Up
Actors	*Organizer*, Track4Run
Entry Conditions	*Organizer* is connected to the Track4Run website dedicated to organizers.

Events Flow	1. *Organizer* taps on "Sign Up" button. 2. *Organizer* fills in all required fields for *Organizer* registration, including username and password. 3. *Organizer* checks the "Accept terms and conditions" checkbox. 4. *Organizer* taps on "Create an Account" button. 5. Track4Run saves *Organizer* information.
Exit Condition	*Organizer* successfully registered by Track4Run.
Exceptions	1. Inserted email already registered for another *Organizer*. 2. Inserted password is not valid. 3. Not all required fields are filled in. 4. "Accept terms and conditions" checkbox not checked. 5. *Organizer* already signed up. *Organizer* is invited to try again signing up, reporting which error(s) they have committed.

U_{13}

Name	Organizer creates a Run
Actors	*Organizer*, Track4Run
Entry Conditions	*Organizer* is connected to the *Run* dedicated website (see add reference).
Events Flow	1. *Organizer* clicks on "Create Run" button. 2. *Organizer* fills in all required fields for *Run* creation. 3. *Organizer* clicks on "Confirm" button.

Exit Condition	Track4Run creates the *Run* defined by the *Organizer*.
Exceptions	1. Not all required fields are filled in. *Organizer* is invited to try again creating the *Run*.

U_{14}

Name	User enrolls in a Run
Actors	*User*, Track4Run
Entry Conditions	*User* is subscribed to Track4Run and installed Data4Help application on their smartphone.
Events Flow	1. *User* navigates to "My Services" page. 2. *User* taps on Track4Run. 3. *User* taps on the *Run* they wish to enroll in or inserts the run identifier. 4. *User* taps on "Enroll" button.
Exit Condition	Track4Run registers the *User* as a *Participant* of the *Run*.
Exceptions	1. No *Runs* are listed. 2. The selected *Run* reached the maximum number of participants. 3. The selected *Run* is closed to enrollment. 4. There are no *Runs* associated to the inserted run identifier *Participant* is invited to try again later enrolling in a *Run*.

U_{15}

Name	Spectator watches a Run
Actors	Individual

Entry Conditions	Individual is connected to the *Spectators* dedicated website (see add reference).
Events Flow	1. *Individual* clicks on the *Run* they would like to watch or inserts the run identifier. 2. *Individual* watches the *Run* as a *Spectator*.
Exit Condition	The *Run* is over.
Exceptions	1. No *Runs* are listed. 2. There is no *Run* associated to the inserted run identifier 3. The *Spectator* disconnects from the *Spectators* dedicated website. Concerning Exception 1 (add reference), *Spectator* is invited to try again later watching a *Run*. For Exception 2 (add reference), no action is taken.

??? participant runs in a run ???

3.3 Performance Requirements

WORK IN PROGRESS

3.4 Design Constraints

3.4.1 Standards compliance

WORK IN PROGRESS

3.4.2 Hardware limitations

WORK IN PROGRESS

3.4.3 Any other constraint

WORK IN PROGRESS

3.5 Software System Attributes

3.5.1 Reliability

WORK IN PROGRESS

3.5.2 Availability

The software must offer the maximum availability, granting its service 24/7. The lack of service must be minimal.

AutomatedSOS AutomatedSOS must be active 24/7. The lack of service is acceptable only if it is due to maintenance. AutomatedSOS users must have received a warning fourty-eight hours before, and they must be noticed again one hour before the service disabling.
Even in this case, the lack of service must be kept to a minimum.

3.5.3 Security

WORK IN PROGRESS

3.5.4 Maintainability

WORK IN PROGRESS

3.5.5 Portability

Portability of *User data* from a device to another is possible by entering personal login data, also for devices with different operating systems. Personal data and settings are stored in a database and they are downloaded when a new device is connected.

Chapter 4

Formal Analysis using Alloy

WORK IN PROGRESS

Chapter 5

Effort Spent

WORK IN PROGRESS

Chapter 6

References

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