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Requirement Analysis and Specification Document

Deliverable:	RASD
Title:	Requirement Analysis and Verification Document
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Version:	1.0
Date:	31-January-2016
Download page:	https://github.com/javferrod/CuellarFernandez
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1 Introduction

1.1 Purpose

The purpose of this document is to give a detailed specification for the TrackMe software product. Along the following pages the goals, requirements, constraints and interfaces of the project will be explained. The intention of this document is not only to be proposed to the customer but to be used as the ground for the development of the product.

This document could be used as a contractual basis for the realisation of the project.

1.2 Scope

TrackMe enhances the flowing of data from the users to the clients, enabling the companies to make right choices about their users thanks to the analysis of the data. These data may encompass location, heart rate, age and so. The data needs to be recollected in a time basis, allowing the clients to analyse their evolution trough the time.

The recollection of the data should be carried out in an automated fashion, using the sensors available in mobile devices such as mobiles (smartphones) and smart-watches.

Such automation should not undermine the privacy rights of the users. The system should provide mechanism for the users to grant or deny their approval for the recollection and treatment of their data.

The main goal of the system is to provide tools for the analysis of the recollected data. Therefore, the system should provide a dashboard and an API to the clients, allowing them to navigate and query the available data.

The goals of the system are summarised in table 1.

ID	Goal
GL1	The system should provide registration
GL2	The system should store the recollected data.
GL3	The system should recollect the data using the sensors available in the users' devices, asking the user directly the information when no sensor is available for recollecting the information (for example, weight).
GL4	The system should recollect the data from the users at time intervals.
GL5	The system should store and display the data in a time series format, allowing the client to consult the changes in the parameters along the time.
GL6	The system should allow the clients to easily query the already recollected data of the users.
GL7	The system should allow the clients to query the data of an specific user.
GL8	The system should allow the clients to subscribe to a query, providing new data as arrives.
GL9	The system should protect the privacy of the users. A data batch displayed to a client should not enable the differentiation between individuals.
GL10	The system should allow users to monitor some of their parameters, alerting the emergency system when any of these parameter gets out of a threshold.

Table 1: Goals

1.3 Definitions, acronyms and abbreviations

1.3.1 Definitions

- **Administrator**: Worker of TrackMe with access to the entire platform without restrictions.

- **Client**: Individual or company that pays TrackMe to get access to the data of the users of TrackMe.

- **User**: Individual that installs the TrackMe application and give TrackMe permission to collect and sell their personal data.

- **Data batch**: Collection of data from different users that comply with a query based on parameters made by a client.

- **Parameter**: Type of data in which the recollected data is organised. These parameters may include blood pressure, location.

- **Measure**: Data obtained by the users' devices and communicated to the server. It is classified in parameters.

- **Emergency system**:

- **Payment system**:

1.3.2 Acronyms

- **API**: Application program interface.

1.3.3 Abbreviations

- **M/F**: Male/Female.

- **bpm**: Beats per minute.

- **403 error**: Forbidden HTTP error code

1.4 Revision history

1.5 Reference Documents

1.6 Document Structure

2 Overall Description

2.1 Product perspective

The recollection of the data will be carried out by the mobile devices of the users, upon installation of the application of TrackMe. Before the recollection of data takes place, the users have to register to the system and give their approval.

To enable the analysis of the data to the clients, TrackMe provides centralised tools by means of an online dashboard and an API endpoint. The latter is intended to facilitate the integration of TrackMe platform with client's ones.

The payment of the clients for accessing the data is handle by a third party system and integrated in TrackMe. The request of ambulances is performed by a third party service, presumably an public service offered by the government.
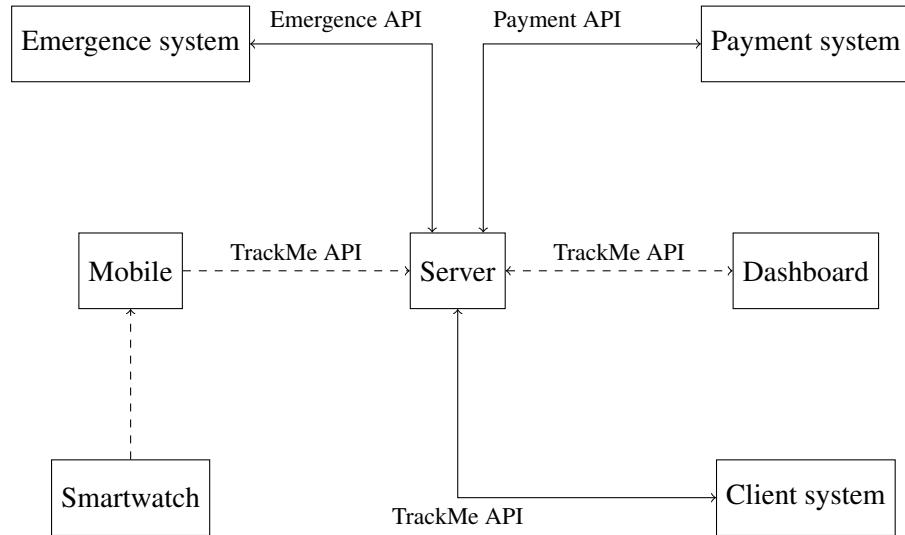
Figure 1: Overview of the system

An overview of the system is shown in figure 1. The dashed lines represents connections between elements of the TrackMe system while the solid ones corresponds to outside ones. These connections are discussed more profoundly in sections 2.4.2 and 3.1.2.

The components connected by dashed lines are internal of the system and therefore no requirements will be impose on these interfaces. However, stating the general architecture of the solution removes vagueness and allows the requirements to be specified in a more concise way.

2.2 Product functions

The main functions of the product are detailed below. The requirements stated later pursue the implementation of these functions.

2.2.1 Recollection of users' data

The related goals are GL1, GL2, GL3 and GL4.

The recollection of the users' data will be carried out by the users' devices[1] and stored by the server of TrackMe. The data will be grouped by parameters. The parameters will be defined in the technical requirements (section 2.4.3).

An important distinction has to be made between fixed parameters and temporary ones. The former includes data that not changes, like the birth of date, codice fiscale, name, residence and so on. The

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[1] i.e. smartwatch and smartphone

latter will be recollected at a fixed interval of time and stored with a time-stamp associated with them. Location and heart rate are in this group.

These temporary parameters are not limited to the information recollected by the sensors of the users' devices. Some parameters, as for example the weight, may need the manual collaboration of the user to be recollected. This may be accomplished by promping the user to introduce the information in the application by himself. These kind of parameters will be called manual parameters.

This function is the cornerstone of the entire system, as the rest of the functionalities are devoted to consuming the recollected data.

2.2.2 Querying data

The related goals are GL5, GL6, GL7, GL9 and GL9.

The data stored in the server will be available to the clients. The system should allow clients to build a query based on the available parameters. This query will return a data batch[2].

The clients will be provided with two ways of accessing the data. The first one will be by mean of an online dashboard[3] and an API.

The latter is intended to erase the interconnection between the system of the client and the TrackMe one. Because of this, the API functionalities will be limited to querying data.

No matter what way the client use, two access of the data should be distinguish:

- **Anonymous query**: Query that return a data batch with enough entries to be considered anonymous, i.e. not individuals can be distinguish.

- **Individual query**: Query by an identifier related univocally to an user. The client must elicit the permission of the user before getting the data.

This distinction is tightly related to goals GL7 and GL9. The related goal is GL10.

The charge to the clients for the access will be by means of a subscription.

2.2.3 Ambulance service (AutomatedSOS)

The related goal is GL10.

AutomatedSOS is an extra service offered to the users. The system will monitor a set of parameters further detailed in 2.4.3. When some of these parameters goes out of a threshold predefined by TrackMe, an alarm will be raised to the Emergency System, attaching the location of the user.

The aforementioned alarm will be communicated to the Emergency System by electronic means, using an API offered by the Emergency System.

2.3 User characteristics

There are three different types of actors in the system. Their definitions can be found in 1.3.1. Through these sections, each type will be analysed and an attempt of characterising them based on demographics will be made.

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[2]See data batch definition on 1.3.1

[3]i.e. a web page

2.3.1 Users

The potential users can be segmented by age:

- **Generation Z**: Born between 2000's and onwards. 95% of persons in this age interval have a smartphone. They prefer the smartphone over the laptop [1]. They are comfortable sharing personal data in order to get a more personalised experience [2].

- **Millennials**: Born between 1980 and 2000's, the so-called *digital natives* are very confident in their abilities with digital interfaces and are used to fast-paced interactions.[3]. They read less than the average user [3], which leads to a rapid acceptation of the terms of usage of any application.

- **Generation X**: Born between 1980 and 1960. According to [4], 85% of *Gen Xers* owns a smartphone, which makes this generation a good segment for TrackMe product. They are generally influenced by convenient purposes and will keep aside digital products [5] if they do not feel comfortable with them.

- **Baby boomers**: Born between 1946 and 1964. The market segment of *Boomers* is very interesting since they have a great acquisition power. However, the penetration of fitness tracking devices are very scarce in this demographic interval. In fact, *Boomers* usually found difficulties in using the health monitor devices [6].

With these segments in mind, TrackMe system will be target to the three first segments. Specially taking into account that Generation Z and Millennials are not concerned about the lack of privacy. Generation X users have a great purchase power, but will be more reticent to the acceptation of the terms of usage.

AutomatedSOS will be oriented to Baby Boomers. Since they usually found difficulties in the usage of the fitness tracking devices, the application should be simple and concise.

2.4 Assumptions, dependencies and constrains

2.4.1 Assumptions

- The location given by the user is correct at every moment.

- The user use real data.

- The user has a continuous and correct internet connection.

- The user gives permission to the app for the different services.

- The user that is using the smart-watch or the mobile phone is the user that is log in.

2.4.2 Dependencies

TrackMe system relies in two external systems to perform several tasks:

- **Stripe**: Payment system that allows TrackMe system to charge the clients a monthly fee for the access to the data. Stripe stands out over the competitors because its API, which is recognized as one of the best in the business [7].

- **Emergency system**: To offer AutomatedSOS, TrackMe system needs a programmatic way to reach the emergency institutions. Therefore, an API is needed to rise an alarm when is needed.

Tables 2 and 3 contains the format and endpoints needed for the proper functioning of TrackMe product.

ID	Method	URL	Parameters	Return	Description
SI1	POST	/ambulance	location, phone, triggered parameter	estimated time	Call when an emergency service is needed, the important data of the customer is send to the Emergency system

Table 2: Software interfaces of Emergency API

ID	Method	URL	Parameters	Return	Description
SI2	POST	/v1/tokens	Card Nº, Card expiration, CVC	Card ID	Register a card to be used in SI3. One time use.
SI3	POST	/v1/customer	Card ID, email	Customer ID	Register a client in the payment system, returns the ID that identifies the client in the payment system.
SI4	POST	/v1/subscriptions	Customer ID, Plan ID	Subscription ID	Starts charging the client the amont indicated by the Plan ID
SI5	DELETE	/v1/subscriptions	Subscription ID	Subscription ID	Register a client in the payment system, returns the ID that identifies the client in the payment system.

Table 3: Software interfaces of Payment API

2.4.3 Constraints

:

- The international and Italian regulation about the use of data by third parties.
- The user has smart-watch and phone powered by Android.

3   Specific Requirements

3.1   External Interface Requirements

3.1.1   User Interfaces
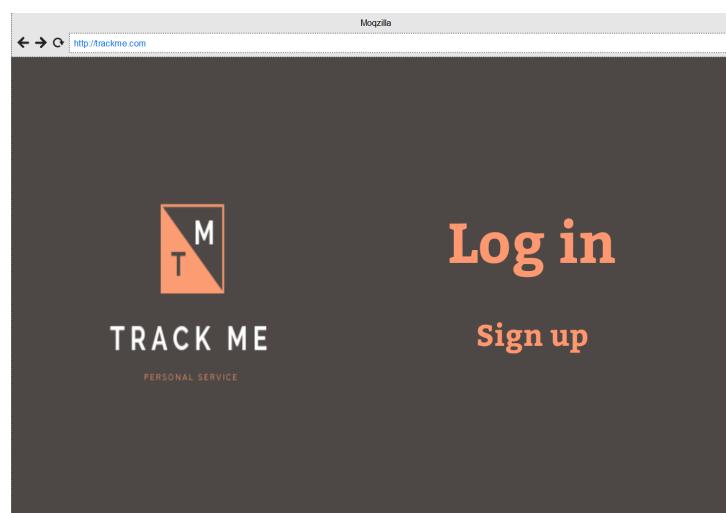
Figure 2: Log in on the Web Application
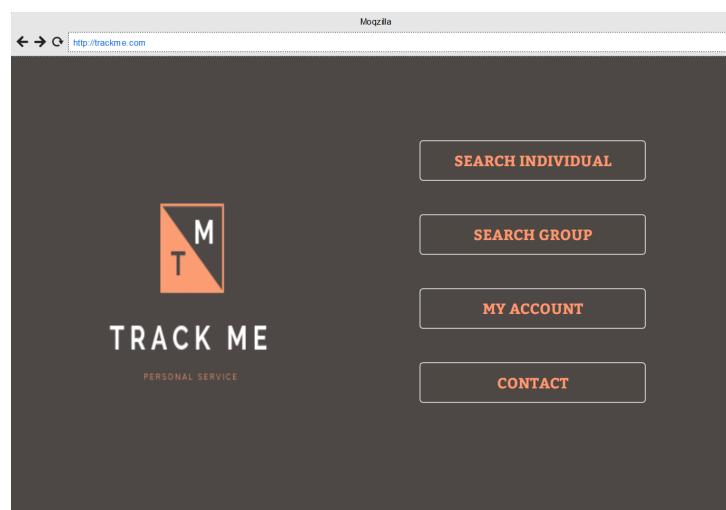
Figure 3: Principal page of the Web Application
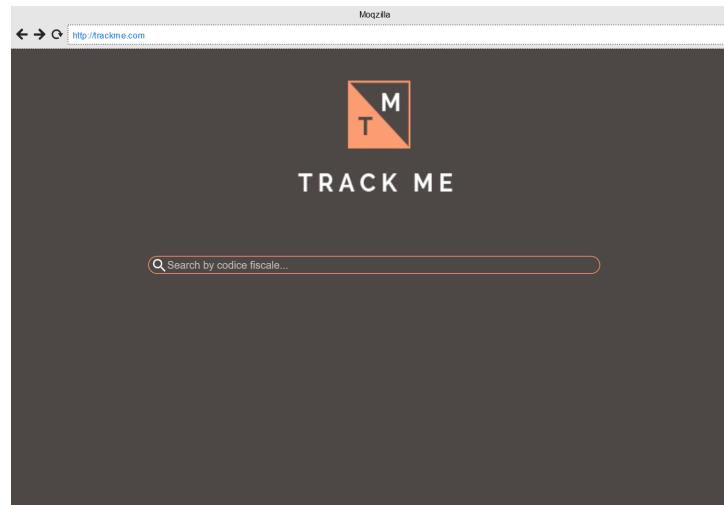
Figure 4: Search for individual data in the Web Application
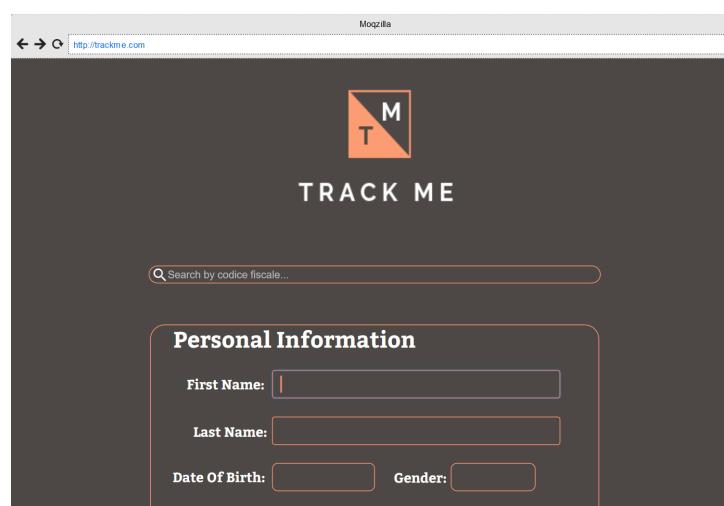
Figure 5: Results of the individual search in the Web Application (First part)
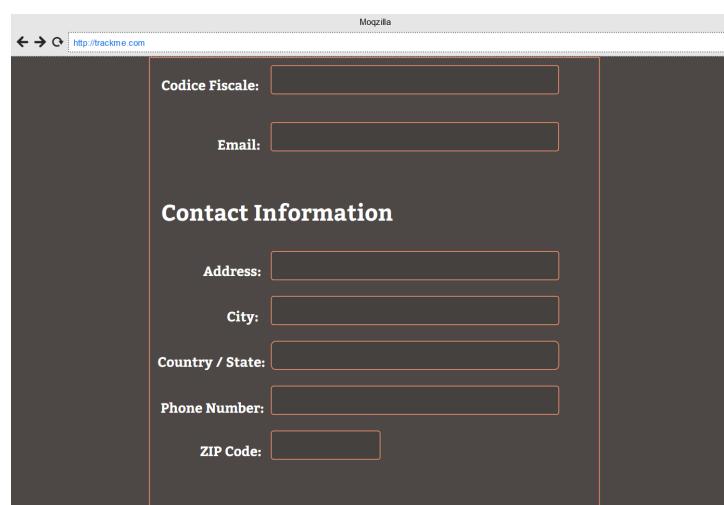
Figure 6: Results of the individual search in the Web Application (Second part)
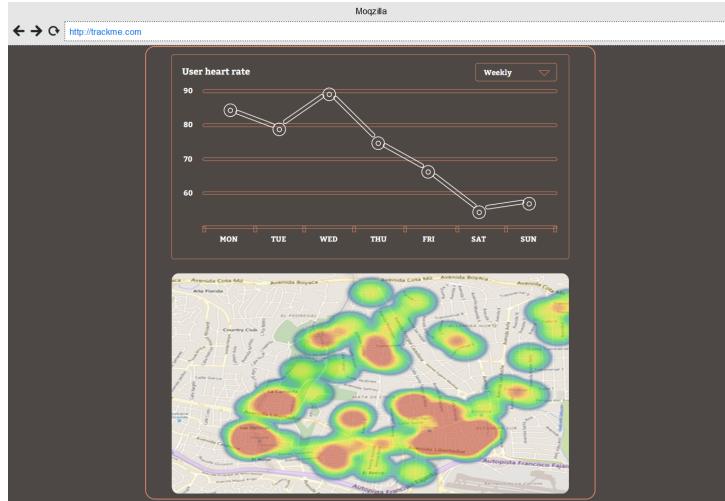
Figure 7: Results of the individual search in the Web Application (Third part)
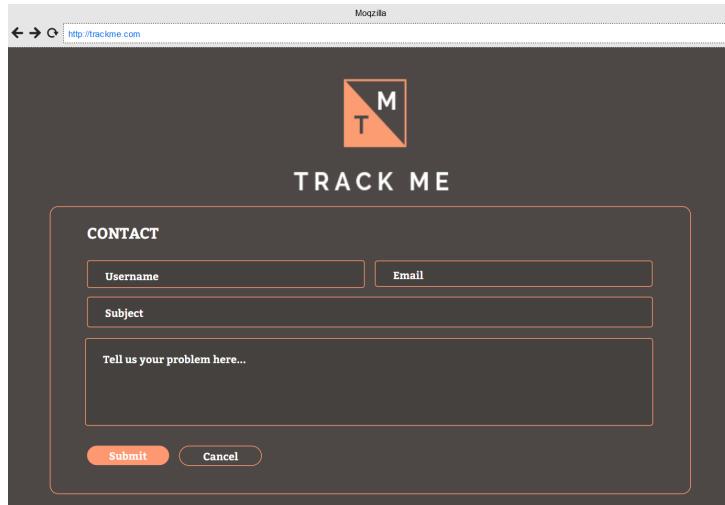
Figure 8: Contact zone of the web application

3.1.2 Software Interfaces

In this section, the API offered by TrackMe will be detailed. This API is intended to be use for the clients who seeks an integration with their own systems.

ID	Method	URL	Parameters	Return	Description
SI6	POST	/login	Username, password	Client token	Returns a token that will be use to authenticate the user in the next API calls.
SI7	POST	/query	Client token, query	Data batch	Return a data batch containing all the entries that corresponds to the query.
SI8	POST	/search-user	Client token, User ID	Data of the user	Returns the available data of the searched user if the client has permission

Table 4: Software interfaces of TrackMe API for the client

3.1.3   Hardware Interfaces

The system will run on any off-the-shelf hardware that supports Linux x64. Therefore, no special requirements and interfaces are needed. The relevant constraints for the users' devices are stated in section 2.4.3.

TrackMe is presented as a software that is based on an Android application, because of it does not require special hardware other than the one named above, this hardware is more than anything a mobile device such as a Smartphone or a Smartwach. As discussed below it is necessary that the mobile device has an Internet connection as well as Bluethoot (if Smartwatch is used) and GPS (for tracking the location).

3.2   Use cases

This section is meant to clarify the normal usage of the platform by the different actors of the system.

ID	UC1
Name	Sing up
Actor	Client
Entry conditions	The client have to be on the web application
Events flow	1. The client have to click on the button of sing up of the web application [2] 2. Fill in the necessary information requested in the form that will appear as well as a form of payment 3. After the confirmation the system will save the data and the client will be registered
Exit conditions	The client will be registered and able to work with TrackMe
Exceptions	1. The form of payment is not accepted or is incorrect 2. The client is already registered 3. The client has not filled in one of the necessary information fields or a field is not filled in correctly

Table 5: Sing up use case

ID	UC2
Name	Log in
Actor	Client
Entry conditions	1. The client have to be registered on TrackMe 2. The client have to be on the web application
Events flow	1. Press the log in button in the web application [2] 2. Complete the username and password sections of the log in window 3. After clicking on the log in button, if it is correct the username and password will access to your account and the system will redirect to the main window [3]
Exit conditions	The client will access his account
Exceptions	Username and password do not match or do not exist

Table 6: Log in use case

ID	UC3
Name	Log in
Actor	User
Entry conditions	1. The user have to be registered on TrackMe 2. The user needs to have the application installed
Events flow	1. Press the log in button in the application 2. Complete the username and password sections of the log in window 3. After clicking on the log in button, if it is correct the username and password will access to your account and the system will redirect to the main window
Exit conditions	The user will access his account
Exceptions	Username and password do not match or do not exist

Table 7: Log in use case

ID	UC4
Name	Search for an individual data
Actor	Client
Entry conditions	The client have to be registered on TrackMe and log in on the web application
Events flow	1. Click on the individual data search button [3] 2. Enter the "codice fiscale" in the search area that appears on the new page (in the area where it is requested) [4] 3. The system will redirect you to one page where you can view all that person's information (if you have the necessary permissions) or you can do another search [5, 6, 7]
Exit conditions	The client will be able to see the information of the requested user
Exceptions	1. The "codice fiscale" does not exist 2. The codice fiscale is misspelled 3. The client does not have the permissions to view that person's data

Table 8: Case of use of individual data search

ID	UC5
Name	Search for a group data
Actor	Client
Entry conditions	
Events flow	1. Click on the group data search button 2. 3.
Exit conditions	
Exceptions	1. 2. 3.

Table 9: Case of use of group data search

3.3 Functional Requirements

The functional requirements are divided in three categories. The requirements of the user application, table 10; the requirements related with clients, table 11 and 12, and finally the AutomatedSOS requirements, table 14.

ID	Goal	Description
FR1	GL1	When an user opens the application and no login had been performed, the system shall show the welcome page.
FR2	GL1	When the welcome page is shown, the system shall show two buttons. When clicked, one of them shall redirect to the login page and the other to the registration page.
FR3	GL1	When the registration page is completed, the system shall show the terms and conditions page and only users that accept the terms and conditions will successfully registered.
FR4	GL3	When the user logs in for the first time in the application, the application shall check what sensors are available an issue an Android Permission Request for each of them.
FR5	GL3	If the user declines an ▶ Android Permission Request ◀, the application shall issue again an Android Permission Request for the same sensor.
FR6	GL3 GL4	The system shall poll the available sensors in the background at fixed time intervals and store the measures in the server.
FR7	GL4	The fixed intervals at which each sensor shall be polled are stated in 16.
FR8	GL3 GL4	The system shall prompt the user to introduce the manual parameters at fixed time intervals and store the measures in the server.
FR9	GL4	The fixed intervals at which the manual parameters shall be asked to the user are stated in 16.
FR10	GL7	When a client has sent a request for access, the system shall display a notification in the user's device showing the name of the client which requires the permission and a button to accept.

Table 10: Functional requirements of user application

ID	Goal	Description
FR11	GL6	A query consists of a set of parameters with associated logical constraints. The result of the query must comply all the logical constraint in the query.
FR12	GL6	The numerical parameters' logical constraints can be equal (=), greater (>), greater or equal (=>), smaller (<) and smaller or equal (=<). The PM7 parameter do not follow this requirement.
FR13	GL6	The PM7 parameter's logical constraint is expressed as a set of points in which the searched values are geographically inside.
FR14	GL6	The system should provide specific inputs adapted to the type of data to introduce the logical constraints of the query. Table 17 states the parameters and its inputs.
FR15	GL6 GL9	When the client introduces a query from the dashboard page ► ref al mockup ◄ and the number of entries that fullfil the query are equal or more than 1000, the system shall show the data in page ► ref al mockup ◄.
FR16	GL6 GL9	When the client introduces a query from the dashboard page ► ref al mockup ◄ and the number of entries that fullfil the query are less than 1000, the system shall warn the client about the impossibility to show the results in page ► ref al mockup ◄.
FR17	GL8	When the system is showing a data batch in the dashboard that fullfils a query (► ref a mockup ◄) and new data that also fullfils the query arrives, the system shall update the view of the data without intervention of the client.
FR18	GL7	When the client introduces a codice fiscale from ► pagina de busqueda de individuos (ref) ◄, the user exists and the client have already obtained the permission of the user, the system shall return the data associated to the individual.
FR19	GL7	When the client introduces a codice fiscale from ► pagina de busqueda de individuos (ref) ◄, the user exists and the client do not have the permission of the user, the system shall prompt the client to ask permission to the user.
FR20	GL7	When the client introduces a codice fiscale from ► pagina de busqueda de individuos (ref) ◄, and the user do not exists, the system shall prompt the client to ask permission to the user[4].
FR21	GL7	When the client is requesting permission to a concrete user in page ► ref a la page ◄ and clicks on *Yes*, the system shall emit a ► Ref a la interfaz ◄ to the appropriate user application requesting their permission.
FR22	GL7	When the client is requesting permission to a concrete user in page ► ref a la page ◄ and clicks on *Yes*, the system shall emit a ► Ref a la interfaz ◄ to the appropriate user application requesting their permission.
FR23	GL7	When a user approves the request of access made by a client, the system shall store that permission.
FR24	GL7	The system shall show the client a list of all users that had give their permission of access in page ► ref a mock ◄ in descending alphabetical order.

Table 11: Functional requirements of the client dashboard

In table 12 the phrase *When a message with a correct format reach* is used often. The correct format reefers to the one stated in section 3.1.2 for each corresponding SI interface.

ID	Goal	Description
FR25	GL1	When a message with a correct format reach the interface SI6 with an existing pair of username and password, the system shall replay with a token that will identify the client in the next api calls. The token have a validity of ► 3 days ◄.
FR26	GL6, GL9	When a message with a correct format reach the interface SI7 with a well form query and the result of the query have 1000 entries or more, the system shall replay with a data batch that complies the logical constraints expressed in the query.
FR27	GL6, GL9	When a message with a correct format reach the interface SI7 with a well form query and the result of the query have less than 1000 entries, the system shall replay with a 403 error.
FR28	GL7	When a message with a correct format reach the interface SI8 with a valid codice fiscale, the user exists and the client have already obtained the permission of the user, the system shall return the data associated to the individual.

Table 12: Functional requirements of the client API

ID	Goal	Description
FR29	GL10	When a parameter sent by an user's application arrives at the server and is below a defined threshold and the user is sign up in AmbulanceSOS, the system shall rise an alarm to the Emergency System using interface SI1 within 5 seconds.

Table 13: Functional requirements of the AutomatedSOS service

3.4 Performance Requirements

ID	Description
PR1	The system shall be able to process at least 500 request per second.
PR2	The system shall be able to respond to a query made by a client within 5 seconds in an optimum internet connection between client and system scenario.
PR3	The system shall be able to store all the data gathered from the users at least during 3 months.
PR4	The system shall be able to handle at least ► 10000 active users ◄.
PR5	The system shall be able to handle at least ► 100 active clients ◄.

Table 14: Performance requirement

3.5 Design Constraints

3.5.1 Standards compliance

- The application will be installed in the internal memory of the terminal and will store all the information in it.

- The application will request and need the acceptance of some permissions for access to the terminal, if not accepted the application can not work or show a proper operation.

- The app will be kept in the background with a minimum consumption for the use of notifications if necessary.

3.5.2   Hardware limitations

There are no hardware limitations, it is only necessary for the user to present a mobile phone with the possibility of installing mobile applications (a smartphone) and if a health check is required, the user must have a Smartwatch.

In addition to what has been said for the mobile phone, it is also necessary that the user has:

- Stable Internet connection (2G, 3G, 4G)

- Bluetooth for connection to the Smartwatch if required

- GPS for user location

- Possibility of receiving calls

The Smartwatch the only requirement is to be able to measure the heart rate as well as the different parameters to perform health monitoring.

3.5.3   Any other constraint

3.6   Software System Attributes

3.6.1   Reliability

The system shall preserve the integrity of the saved data no matter what circumstances may happen.

3.6.2   Availability

The system will operate continuously and must be operational at all times, in the event of a system crash by any internal or external problem services will be redirected to secondary servers that will be present in support format for abnormal situations to perform the continuous running.

3.6.3   Security

For security, the HTTPS protocol will be used, which applies SSL/TLS cryptography that will allow the passage between the server and the different services in a secure way, not allowing attacks or loss of information from TrackMe clients and users.

3.6.4   Maintainability

The maintenance of TrackMe services will be performed by the system administrators, this maintenance will be designed to be as simple as possible using general programming formats as well as a worked documentation in which the system is explained as accurately as possible to save any doubt to the administrators about the operation of the various services.

3.6.5 Portability

The portability degree depends on each system's component. The mobile application shall be portable between Android platforms that fullfills the requirements stated in section 2.4.3. The server component shall be portable between Linux platforms that fullfills the requirements stated in section 2.4.3. The online dashboard shall work in any browser that fullfills the rules stated in section 2.4.3

4   Formal Analysis Using Alloy

Organize this section according to the rules defined in the project description.

5   Effort Spent

Provide here information about how much effort each group member spent in working at this document. We would appreciate details here.

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Appendix A   Parameters

ID	Parameter	Units	Type	Query	Individual search
PM1	Codice fiscale	String	Fixed, manual	✗	✓
PM2	Name	String	Fixed, manual	✗	✓
PM3	Surname	String	Fixed, manual	✗	✓
PM4	Birth date	dd/mm/yyyy	Fixed, manual	year	✓
PM5	Genre	M/F	Fixed, manual	✓	✓
PM6	Residence	Latitude, longitude	Fixed, manual	Searchable, not shown	✓
PM7	Location	Latitude, longitude	Temporal, automatic	✓	✓
PM8	Hearth rate	bpm	Temporal, automatic	✓	✓
PM9	Weight	Kilograms	Temporal, manual	✓	✓

Table 15: List of parameters and its type

Appendix B   Inputs and intervals associated to parameters

Parameter	Interval	Motivation
PM7	5 minutes	▶ rellenar esto ◀

Table 16: Intervals at which recollection is performed

Parameter	Input	Description of input
PM7	Map	An interactive map centred in the city of Milan. The map should allow the drawing of an area. The input will formulate a query in which all the points inside the aforementioned area are include.

Table 17: Inputs to be displayed to the clients