Universidad
Carlos III de Madrid

UC3M Emergencies: Health Center Search, First Aid, Defibrillators, Emergency Exits, Last Warnings and Torch (iOS platform)

Degree in Computer Engineering

Final Project

Year 2012-2013

Author:

María Martín Civiac

Tutor:

Dr. Javier García Guzmán

Leganés 24/06/2013

Tittle: UC3M Emergencies: Health Center Search, First Aid, Defibrillators, Emergency Exits, Last Warnings and Torch (iOS platform)
Author: María Martin Civiac
Tutor: Dr. Javier García Guzmán

THE TRIBUNAL

President: _____

Vocal: _____

Secretary: _____

Performed the presentation and after reading the bachelor thesis on the day xx of July of 2013 in Leganés, in the School of Engineering of Universidad Carlos III Madrid, agrees to grant the qualification of:

VOCAL

SECRETARY   PRESIDENT

Acknowledgements

Five years ago, an engineering degree looked like an impossible goal to achieve. Now, after five years and millions of hours in front of a computer, I am happy to say I managed to get it thanks to many people who supported me and believed in me on the way. I would like to thank them chronologically as follows:

Firstly, I would like to thank the origin. Thank you mom and dad for your love, education and patience. Without you, anything of this would have been possible. Thank you for helping me to dream about this uncertain but amazing future that comes ahead. I feel very lucky of my all family, the support of my family has been crutial but more precisely I would like to mention my grandmother and sister. I have grown up with my grandmother and I am the person I am today, thanks to her dedication. She led by example and she taught me many aspects in life, which I am very grateful to have learnt on time. In addition, my little sister came three years later than me but has been a great support during these 19 years together. Especially this year, we have shared everything together and it has been just amazing, her daily smile, help, lunchs and trust on me really helped me to success academically this year. But she did not only help me to finish my degree, she made me happy and made me feel safe, relaxed and loved. She is my second soul.

I would like to have some words for my highschool in Monzón, the good basics I learnt there and the good teachers I had really helped me and motivated me in my degree. Also the good friends that I still have despite the distance are great and have always encouraged me during these years.

In my two first years of University in Huesca I met many good professionals and wonderful people starting from my residence girls, Chuso girl and of course, my university collegues. Huesqueta was good fun thank to you guys.

Universidad San Jorge gave me the opportunity to spend a year in lovely Salzburg which was the best decision I could have ever made. I met awesome friends there who I loved from the very beginning and who were my family for a year. These people deserve the best, they have always supported and helped me with anything I asked them for, I am so blessed to still have them around me.

These two years in Universidad Carlos III in Madrid have been really productive in all senses. I would like to first thank my classmates, we knew we were going through the same problems and always helped each other, without that support and Madrid Madriz it would not have been possible.My flatmates have been a great push to this success, they always had ready a smile in my worst days and I really appreciate their endearment and interst in my success.

Besides, this last year I have worked in the Computing Service of the University where I have developed my iphone application. I would like to thank all the team, including Ernesto, but the person more directly related to my aaplication success has been David Santín, he helped me from the very first day and has been always willing to help me. His support during these months really made a difference in my application, thank you David. I wil never be grateful enough for all your help. I would also like to thank my tutor, Javier Guzmán, who helped me write this document.

Finally, I would like to mention the best work experience I have had so far. Last summer I worked in the Olympics for three months and the overall experience gave me a boost of optimism and inspired me concerning my future career. It helped me realize how important was to finish the degree as soon as possible in order to jump in the sport events world in a very short future. All the people I met there were absolutely incredible, great workers and people. I learnt loads of the experience in general, but my manager Richard was a great inspiration and taught me the best attitude to face any situation at work. These were happy times.

In conclusion, thank you to all the people I mentioned, thank you to my friends from Benasque and thank you for all these people around the world that somehow influenced on this academic success. Thank you, muchas gracias, efgaristw poli, grazie mile, dank u wel, Vielen Dank!

"Dont put a limit on anything.
The more you dream, the further you get"

Abstract

This document contains Maria Martin's bachelor thesis. The issues that this project wants to solve are emergencies-related: health centersand emergency exits location,emergency call, first aid instructions and information and latest emergency alerts at Carlos III University. It has been detected that members of Carlos III University currently have difficulties to find health centers, emergency exits and first aid information. Furthermore, the University itself did not have any mechanism to publish the latest alerts apart from email notifications.

The application can be divided into Health Care and Emergency functionalities. On the one hand, the application classifies health centers in three different sections: inside the university, outside university and according to the community group, as there are many different roles and insurances. The application also gives information, scheme and video of usagefor defibrillators and a manual with the main diseases and symptoms.

On the other hand, concerning Emergency functionalities, it provides help with emergency exits and alerts. Depending on the device properties, the application will either show the emergency exits via Augmented Reality or will show them in a map.Moreover, the application shows all university alerts, giving the possibility to the user to share them via email, Twitter or Facebook in order to spread the word. And it has torch functionality in case there is a light outage as well.

The main motivation to develop this project was to provide an emergency service to the people who want to learn about first aid or need some specific information in case of an emergency. In order to have a 24/7 service, it was decided to develop the app formobile platforms, more precisely for iOS. The development of the project was carried out for the author in the Computing and Communication Service of Carlos III University. The objectives established for the project were the development of a web service in order to post alerts and the development of an iOS application to provide all the other information above mentioned.

The results have been successful as all the objectives were fully developed, thanks to the collaboration of multidisciplinary teams of the Carlos III University. The application was finally published in AppStore.

The development of this project has been a challenge, which was completed with complete knowledge of emergencies in the university and mobile applications development. At the same time, the author gained experience working on a real research environment while cooperating with different services within the university, finallyachieving an added value to this bachelor thesis.

x

Resumen

Este documento contiene el proyecto fin de grado de Maria Martin Civiac. Los temas que el presente proyecto quiere resolver son varios problemas relacionados con las emergencias: ubicación de centros de salud y salidas de emergencia, llamada de emergencias, instrucciones e información de primeros auxilios y avisos de emergencia en la Universidad Carlos III. Se ha detectado que los miembros de la Universidad Carlos III actualmente tienen dificultades para encontrar centros de salud, salidas de emergencia e información de primeros auxilios. Por otra parte, la propia Universidad no tiene ningún mecanismo para publicar los últimos avisos aparte de a través de notificaciones por correo electrónico.

La aplicación se puede dividir en funcionalidades de emergencia y atención médica. Por un lado, la aplicación clasifica los centros de salud en tres secciones diferentes: dentro de la Universidad, fuera de la universidad y según su colectivo, ya que hay muchos roles y seguros diferentes. La aplicación también ofrece información, un esquema y vídeo de uso de desfibriladores y un manual con las principales enfermedades, sus síntomas y tratamientos.

Por otra parte, en relación con las funciones de emergencia, proporciona ayuda con las salidas de emergencia y avisos. Dependiendo de las propiedades del dispositivo, la aplicación o bien muestra las salidas de emergencia a través de Realidad Aumentada o las mostrará en un mapa. Por otra parte, la aplicación muestra todas los avisos de la universidad, dando la posibilidad al usuario de compartirlos por correo electrónico, Twitter o Facebook con el fin de difundirlos. Y tiene la posibilidad de linterna en caso de que haya un corte de luz.

La motivación principal para desarrollar este proyecto era proporcionar un servicio de emergencia a las personas que quieran aprender sobre primeros auxilios o necesita alguna información específica en caso de emergencia. A fin de tener un servicio 24/7, se decidió desarrollar la aplicación para plataformas móviles, más precisamente para iOS. El desarrollo del proyecto se llevó a cabo por la autora en el Servicio de Informática y Comunicaciones de la Universidad Carlos III. Los objetivos establecidos para el proyecto fueron el desarrollo de un servicio web con el fin de publicar avisos y el desarrollo de una aplicación iOS para facilitarle toda la información mencionada anteriormente.

Los resultados han sido un éxito ya que todos los objetivos han sido completamente desarrollados, gracias a la colaboración de equipos multidisciplinares de la Universidad Carlos III. La aplicación fue finalmente publicada en AppStore.

El desarrollo de este proyecto ha sido un reto, que se completó con el conocimiento completo de las emergencias en la universidad y el desarrollo de aplicaciones móviles. Al mismo tiempo, la autora adquirió experiencia trabajando en un entorno de investigación real, que junto con la cooperación con diferentes servicios dentro de la universidad, finalmente, obtuvieron un valor añadido a este proyecto fin de grado.

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

1. INTRODUCTION

In this chapter, the project problem is expained along with its motivation, objectives and the resolution method followed to develop the app. Besides, there are two extra sections which facilitates reading and understanding the overall document where the terminology used is defined and the document contents are detailed.

1.1. PROBLEM

The problems detected that the author wanted to solve with this project are the difficultyfinding emergency exits and health centers, spreading last-minute alerts and distributing first aid information inside Carlos III University.

This problem affects to the following groups within the Carlos III community:

- All the students and employees who do not know which insurance match their role inside the university. These groups are classified into PAS/PDI, students, scholars, foundation and people that are not sure about it. This classification is later broke down into different categories.UC3M community who need to be instantly notified in case an alert is reported in order to act accordingly.

- All the UC3M community and visitors that do not know how to reach a health center outside the university and/or inside the university. They may need some defibrillators information such as their location inside the Carlos III University. They also may need to quickly locate the emergency exits in any university building. And, if an emergency occurs inside the University, the user may be able to call the emergency service number easily.

- Anyone who may need a light source, torch, in case of a light outage. Anyone who may need a first aid manual to identifyinjuries and/or require some defibrillator schema of use or informative video.

In order to perform any task that is focused on UC3M community people only, will require the person to know some specific data. So, in order to obtain the health center according to the group, the user will need to know the exact role that he/she belongs to.

Likewise, when a user wants to locate a health center outside the university, they must know exactly which insurance group they are looking for, they are classified into: Fremap, public insurance hospitals and/or public insurance and student insurance centers. All the centers or hospitals that belong to the same insurance group will appear centered as annotations in the same map along with the user location. In this way, the user will be able to get a sense of the closest center from her/his current location and will be able to later calculate the rout from the actual point until the chosen health center.

1.2. PROJECT MOTIVATION

The main motivations that led to the development of this project are:

- **Help** all the members of the UC3M community and all the occasional visitors in case of an emergency; locating health centers, sending broadcast alerts, dialing an emergency call, locating defibrillators and switching on the torch.

- **Educate** all the community members and any potential user to use defibrillators via video player and a schema. Furthermore, the user may also get to know and classify all the posible deseases through a first aid manual.

Another important motivation is the huge and exponential increase of smartphone sales and its importance in everybody's daily routine. Thesetechnologies allow users to access information in an instant and comfortable way with mobility, no matter where the user is located. These properties totally fit the requirements of the emergencies app, as the user will be able to access the app and its information anytime and anywhere.

Finally, there is an interest of the Computing and Communication Service of UC3M and another UC3M Services like the Occupational Risks Service, for developing applications that facilitate the university life to all the community members. At the same time, any punctual visitor could enhance their visit and experience in the different university Campuses. Both visitors and community membersare important to Carlos III University and their experience is another outstanding motivation to develop a solution that covers the problem in this bachelor thesis.

IOS development requires Apple hardware and software in order to test and develop iOS applications. Having the chance to get a physical space inside the Computing and Communication Service together with the above-mentioned requirements was an incentive to opt for this project.

The project purpose, linked to the motivations outlined, consist of the development of the following utilities:

- A mobile iOS application that covers the functionality of the project motivations, providing emergency information and emergency location.

- An external and internal database where all the emergency alert are stored, together with their priority, published date and ID. The alerts will be listed in the app sorted in order of arrival (published date) and priority.

- A web service and HTML form page that allows registered users to post alerts, that will be later send broadcasted to all the users that have the app installed.

- A repository that stores the entire emergency exits in the different buildings and Campuses together with their longitude and latitude.

1.3. OBJECTIVES

The main objective of this project is to develop integrated services that will provide users **emergency information and location in any Carlos III University Campuses and buildings**.

From the main objective we can conclude with the following objectives that are essential to achieve the total functionality of the application:

- **Development of a web service for alerts**: It will allow registered users to post alerts in real-time and save them in an external database located in a server. The website will show a table with the latest alert sorted by priority and published date. The application will get a document with all the alerts in order when requested

- **Development of an internal database**:An internal mobile database will be needed in order to be able to read the alerts even if the mobile device does not have data connection at that moment. Using the database, only the new alerts will be printed in the table. Also, the different UIDs registered will be stored in a different table, inside the same database.

- **Emergency exits digitalization:** Every floor in every building in every Campus will be analysed, all the emergency exists will be reviewed and all their latitudes and longitudes will be written down. Once this information is collected and properly digitalized, the application will be able to localize the closest emergency exit via Augmented Reality.

- **Development of Apple Push Notification Service:** In order to receive push notifications in every user device, communication with APNs will be deployed. In this way, if an application is not running and a new alert is registered, the device will alert the user that a new alert has been launched and therefore, is available.

- **iOS development:** The services specified in the objectives will be developed and used in a iOS app. This will allow users to:

  - Look for health centres, defibrillators and emergency exists inside UC3M
  - Educate themselves in first aid with defibrillators and a diseases manual
  - Receive the latest alerts
  - Dial emergency calls
  - Use a torch.

1.4. RESOLUTION METHOD

The method carried out to solve this problem has been iterative, as not all the requirements were fixed from the very beginning and their definition has been progressed through the development of the project.

The initial requirements were defined with the collaboration of multidisciplinary teams of the Carlos III University:

- The Communication Service defined and designed all the icons and layouts of the different views of the application. They created the application mock-up.

- The Occupational Risks service facilitated all the information concerning first aid (defibrillators and first aid manual) and emergency exits. They also made a scheme to classify all the different roles inside the university and their corresponding health centres. They were the responsible to draw the first draft.

- SEL-UC3M also collaborated with the location of defibrillators in the UC3M Maps application.

- The Computing and Communication Service was the department responsible of developing the application with all the information above mentioned.

Initially, the author together with the Computing Service responsible had several meetings with both the Communication and Occupational Risks Services in order to set up the basic functionalities and the final mock-up. And shortly after, all the information needed was handed in to the author.As the development progressed, some extra information was requested when needed and some additional meetings with these departments were required as well.

As the project was developed inside the Computing and Communication Service in Carlos III University, the author had the support and help of her colleges anytime. Specially the iOS development responsible, Mister Santin, has always been willing to help and find an effective solution in case any issue was reported.

The author and the iOS development responsible were having meetings weekly as the project progressed; reviewing previous lines of code and raising new future functionalities. In order to follow up with the different tasks, *Reminders*was used. It is an app built into Mountain Lion, that quickly schedules a to-do list and the user can also review the tasks already completed.

1.5.   TERMINOLOGY

1.5.1. GLOSSARY

Term	Definition
iOS	Mobile operating system developed and distributed by Apple Inc.
Map annotation	Little pins that show up in a map, identifying the place location. It may include some extra information in the annotation.
Web service	Communication method between two devices over the World Wide Web
Digitalization	Diverse forms of physical information, like text, sound, or image, are converted into a digital form.
Database	Organized collection of data
Smartphone	Mobile phone built on a mobile OS
Mock-up	Prototype used when a product is new designed.
Framework	Directory that contains a dynamic shared library and the resources needed to support that library.

Table 0.1– Glossary

1.5.2. ABREVIATIONS

Term	Stands for
UC3M	Carlos III University.
App	Application, piece of software that runs on the Internet, on your computer or mobile device.
GPS	Global Positioning System that provides location information anywhere on Earth.
24/7	Twenty-four hours a day, seven days a week.
PAS	Personal de Administración y Servicios, means Administration and Services University Staff.
PDI	Personal Docente e Investigador, means Teaching and Research Staff.
OS	Operative System
PFG	Proyecto Fin de Grado, which means bachelor thesis
IDE	Integrated Development Environment is a software application that allows programmers create new software easily.
AR	Augmented Reality
UID	Device's Unique ID
APNs	Apple Push Notification service
MVC	Model View Controller Pattern
QR	Quick Response Code is a type of matrix barcode used for mobile devices.

Table 0.2– Abreviations

1.6.   THESIS CONTENTS

In this section, the contents of each of the chapters are briefly explained and introduced.

In the first Chapter, Introduction, the problem that will be solved with the PFG is introduced, its motivation and objectives are classified and the resolution method is described. Here all the technical terms and all the varied abreviations are defined and finally, a document overview is explained.

In the second Chapter, State of the Art, an analysis is performed in order to check the different mobile applications that are related to the objectives stablished in the first Chapter. At the same time, the development environment is reviewed including the current state of the mobile environment and iOS operative system along with its IDE. Lastly, the methodology followed for the development of the project is explained.

In the third Chapter, Application Analysis, an application description is made in its context in order to later perform the functional and non-functional requirements definition. In the description, you can find the product perspective, its functionalities and the classification of the user types that will be using the app.

In the fouth Chapter, Application Design, the first and last mock-ups used to model the layout of the app are described together with the design alternatives. The component diagrams are obtained from the app and the requirements. Moreover, the classes and sequence diagrams are explained and drawn. Also, the database design is included with few emergency exits maps letting the user know about the majority of the system design.

In the fifth Chapter, Testing, the tests performed in order to assure its quality are described. Unit, integration and system testing were included, with their succesful results.

In the sixth and last Chapter, Conclusions and Future Lines, the author conclusions are exposed once the app has been developed. Finally, future lines are explained that be carried out in order to improve the application, offering new functionalities while improving university life.

2. STATE OF THE ART

Before developing a project where time and resources will be invested, it is necessary to review and analise the current state of the problem in already existing applications which offer a similar solution. Following this process, a general overview is obtained and the necessity of the application and its development will be decided.

The reason of the study of the existing applications is the support and improvement of these applications in order to adopt them to our problema. Advantages and disadvantages will be taken into a count and disadvantages will be improved. Therefore, the solution proposed will be adjusted to the problem we are trying to solve.

Concerning the contents of the chapter, the information obtained when researching about the development of this project will be exposed. For that, firstly an application mobile analysis and web are performed related to the stablished objectives. After that, the mobile development environment chosen will be explained together with its main properties. And finally, the methodology chosen will be exposed.

2.1.   APPLICATION ANALYSIS

In order to define the analysis that will be performed in the already existing, it is important to refresh the objectives first, established in Chapter 1.3. From these objectives, the following two are the most important ones:

- **Emergency exits digitalization:** Every floor in every building in every Campus will be analysed, all the emergency exists will be reviewed and all their latitudes and longitudes will be written down. Once this information is collected and properly digitalized, the application will be able to localize the closest emergency exit via Augmented Reality.

- **iOS development:** The services specified in the objectives will be developed and used in a iOS app. This will allow users to:

  - Look for health centres, defibrillators and emergency exists inside UC3M
  - Educate themselves in first aid with defibrillators and a diseases manual
  - Receive the latest alerts
  - Dial emergency calls
  - Use a torch.

- **Server development:** The development of a server to communicate with the APNs will be needed in order to get push notifications, and also another one to receive the alerts from the notification website.

Taking into a count these objectives, the analysis has been focused in two points. Firstly, the Article written by Alonso, García and Amescua [2] is reviewed and secondly, the research on applications and possible solutions from Google and Apple App Store.

In the referred article, a research based on mobile learning and learning through applications developed for Spanish Universities. It explains that only the 17,94% of the Spanish universities have become involved into the mobile development field. It highlights that the analyzed app more stable are the ones developed for iOS facing the Android apps. The Android app are the most vulnerable to failure, fact that is directly related to the poor security control that Google performs when a developer uploads an app to the Google Play store. The article concludes that the university applications found are informative and not complex and besides, they do not explore the facility to improve university life.

Research was made in Google search engine and AppStore, available in iOS devices. The criteria for the research have been different for both search engines and the search have been performed in English and Spanish, in order to gather information in Spain as well.

On one hand, in AppStore the research have been oriented to find university applications along with generic emergencies app. The search terms were:

- *Emergencias*: Madrid Emergency Maps, Primeros Auxilios por Cruz Roja España, SafetyGPS V3.
- *Emergencies university*: Saint Louis University Hospital, RRAPID, Card Safety
- *University mobile*: iWestminster, MIT Mobile, iStanford

When analyzing other university applications, it can be deduced that they only offer an alert service and some emergency numbers. The most well known ones were chosen for a deeper analyse. Some other medical universities do offer specific information regarding emergencies and first aid, so the most complete ones were selected as well. And finally, *SafetyGPS* was chosen because it offers defibrillator information, *Madrid Emergency Maps* because it offers simple and organized emergency points and *Cruz Roja* because of its complete first manual.

On the other hand, when searching in Google, the search was oriented to get different app solutions that were difficult to find through AppStore. The search terms were:

- *Emergencies app iphone*: iTriage
- *Augmented Reality iphone*: Layar
- *Accidente laboral iphone app*: Asepeyo

From this search, the *iTriage*and *Asepeyo*appsofferwide and complete information concerning first aid information and doctor location compared to other apps found which did not have enough useful information. Besides, *Layar* was one of the best AR apps found.

The first search was carried out at the beginning of the project, in January 2013 and the last one was performed in middle May in order to double-check the latest emergency apps. As a result of the searches for both search engines and the applications found in the research article, an app list was obtained from them.

In the following sections, the most interesting and educative apps are described along with their main functionalities. They are divided into Alert Notifications, First Aid and Emergency Location and finally Augmented Reality. In this way, applications will be analysed and grouped with other apps that offer similar functionalities.

2.1.1. ALERT NOTIFICATIONS

These applications represent the most important universities in the world. Compared to the application that will be developed for this project, they do only solve the emergency alerts functionality. Whenever an alert is published, they launch a push notification with the alert.

2.1.1.1.   MIT Mobile

This application [3] allows the user to check if there is any alert at the moment, but the user is not able to check the previous alerts. It also provides some emergency telephones in MIT University case of an emergency.
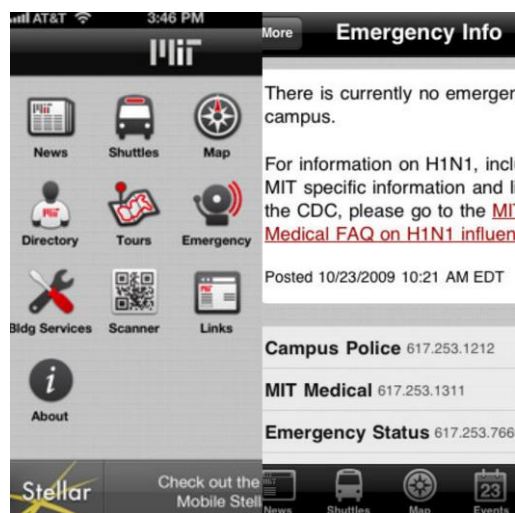
Figure 2.1 - MIT Mobile

2.1.1.2. iStanford

In the iStanford [4] application the user can acccess important numbers and information when you need them, report an emergency, get information from the Stanford University Emergency Information Hotline. But it only provides the telephone numbers, there is no other extra functionality.

Figure 2.2 - iStanford

2.1.1.3. Harvard Mobile

Also Harvard University provides an alert service in Harvard Mobile[5] where emergency numbers are available for everyone. If a user wants to get all the emergency alerts, first it is necessary to sign up in MessageMe [6] , and it is only possible to sign up with a Harvard ID.

Figure 2.3 - Harvard Mobile

María Martín Civiac

2.1.1.4.   iWestminster

Also Westminster University provides a iWestminster app [7] where the user can check if there is any alert on Campus at the moment.

Figure 2.4– iWestminster

2.1.2. FIRST AID AND EMERGENCY LOCATION

These applications offer either first aid information or any kind of emergency location, or either both together.

2.1.2.1.   iTriage

iTriage was developed for Healthagen [8] , which is one of the leaders in health care innovation. There was a need of accionable halthcase information for patients, so the app was developed. The first version of iTriage appeared on 20th of October 2010, and the last update was made on the 13th May 2013 [9] .

This application offers a friendly user interface along with a large list of different symptoms and the user can even locate symptoms in a body. It also allows the user to look for doctors and facilities close to the user location, classifying them according to the specialities. It offers very detailed and profesional healthcare information but does not have any alert broadcast service or emergency exits location as it is not based for a specific place like a university. It is also possible to share the app via email or text.
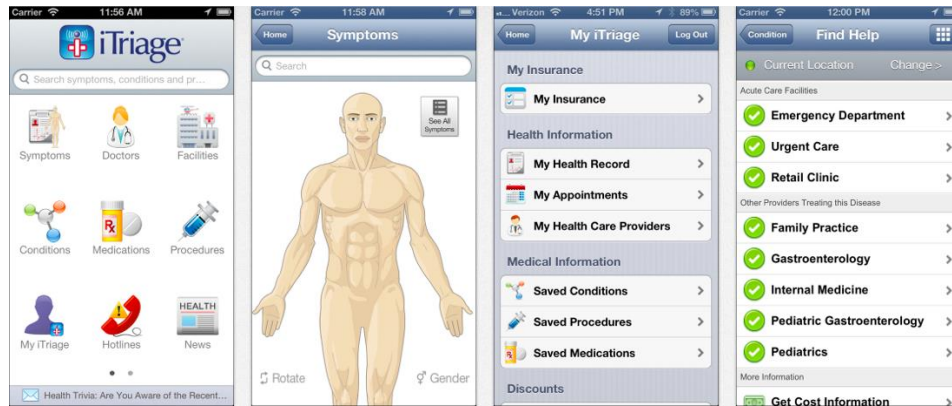
Figure 2.5 - iTriage

2.1.2.2.   Asepeyo

The Asepeyo app [10] offers telephone assistance to users covered by Asepeyo mutual insurance company. Also guides the user to the nearest center, it offers basic health and first aid advice, and a very friendly user interface. It also offers a torch functionality.
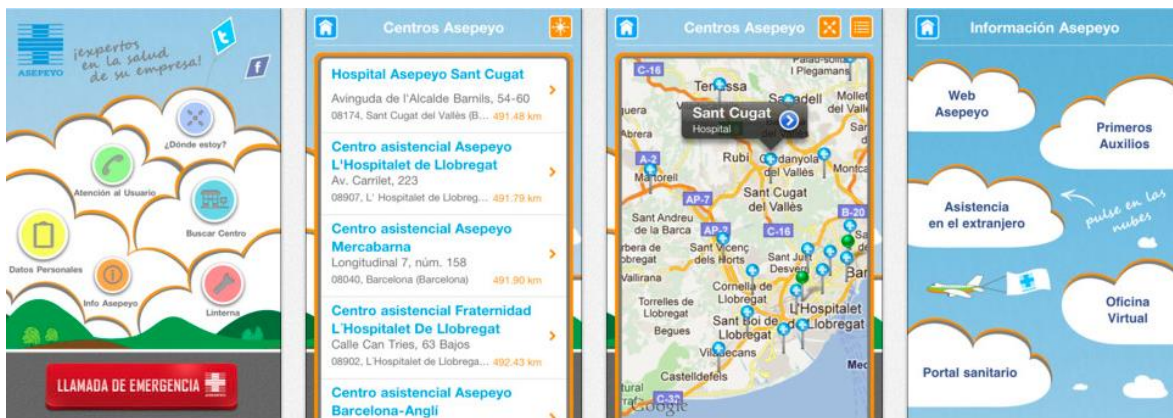
Figure 2.6– Asepeyo

2.1.2.3.   Primeros Auxilios por Cruz Roja Española

The Emergencias app [11] allows the user to dial emergency numbers. It also provides full interactive manual basic first aid, with major accidents and emergency maneuvers; it is easy to use, has a interactive interface and explanatory videos. It has a map with health centers but only in Galicia, indicating address, telephone and with direct telephone dialing and route planning how to get to each one from our location.

The first aid interface is very intuitive and original, providing many different injuries cases with specific and concrete information.

María Martín Civiac
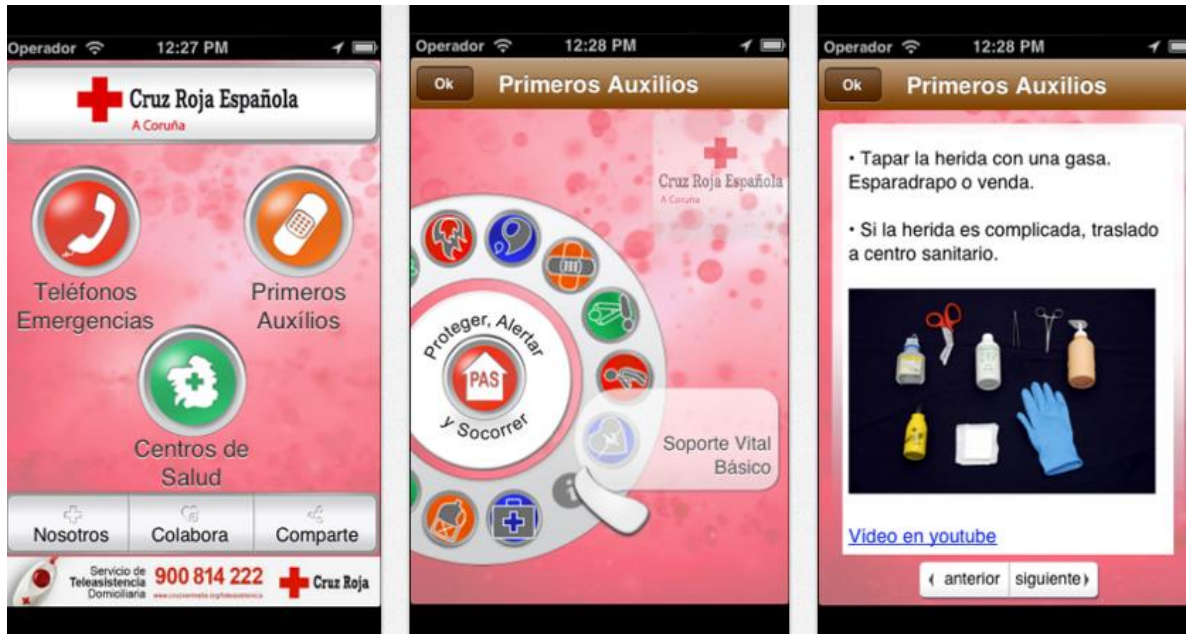
Figure 2.7–Primeros Auxilios por Cruz Roja

2.1.2.4. Madrid Emergency Maps

Madrid Emergency Maps [12] offers offline maps with hospitals, pharmacies, embassies and police stations. It also offers offline routing in case of an emergency to the interest point and new emergency places can be added thanks to Openstreetmap.

Figure 2.8 - Emergency Maps

2.1.2.5. Saint Louis University Hospital

The Saint Louis University Hospital app [13] gives hospital information such as Emergency Room waiting time, finding physicians, guidance to the hospital, health and first aid references, and storing of important personal medical data. It has a Map showing hospital location and a guide Me from your current location.It provides First Aid manual such as infant choking, poison, animal bites, bleeding, burns, etc. The user also can save Emergency Contacts and Insurance Numbers as a handy reference.
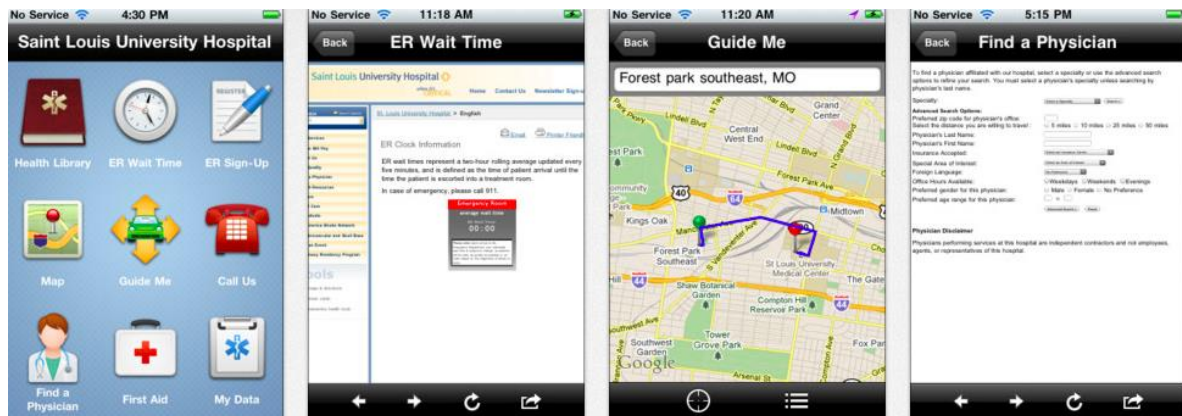
Figure 2.9 - Saint Louis University Hospital

2.1.2.6. SafetyGPS V3

SafetyGPS [14] is specialized in alerts of emergencies and it is bidirectional between entities and habitants. It allows the user to send alerts of emergencies to public administrations and at the same time, receive alerts fro public administrations such as evacuations zones, closed steets, weather alerts. It is the only application found that has defibrillator information.

Figure 2.10 – SafetyGPS V3

María Martín Civiac

2.1.2.7.   Card Safety - University of Louisville

The Card Safety app [15] belongs to University of Louisville and it provides information on what to do in various emergency situations, how to prevent crime and what to do when crimes occur, and links to important University of Louisville websites. It also provides interactive maps with university campuses and buildings information. Finally, an emergency dialer is included for quick access to emergency personnel.
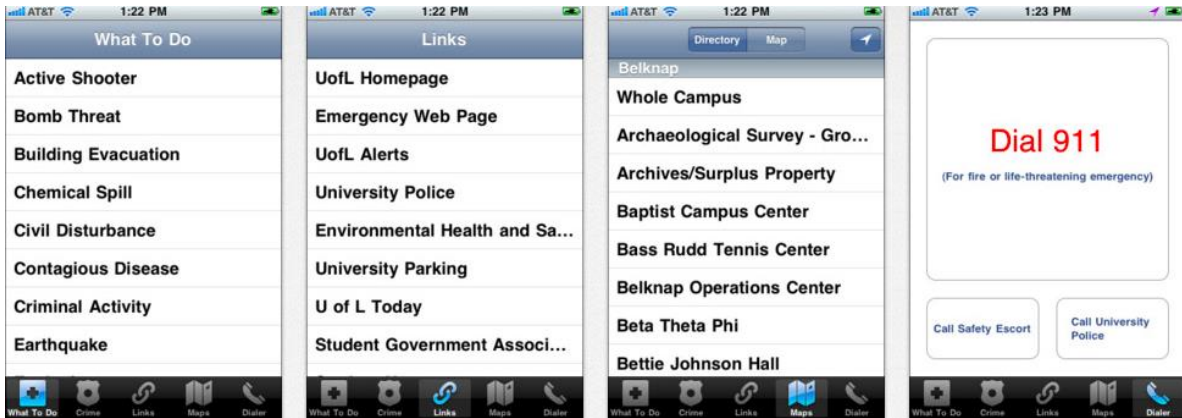
Figure 2.11 - Card Safety

2.1.2.8.   RRAPID - University of Leeds

The RRAPID (Recognising and Responding to Acute Patient Illness and Deterioration) app [16] was developed by the University of Leeds. Their objective is having an early recognition and rapid response to the acutely ill patient and to equip medical trainees with the appropriate skills to manage these patients.
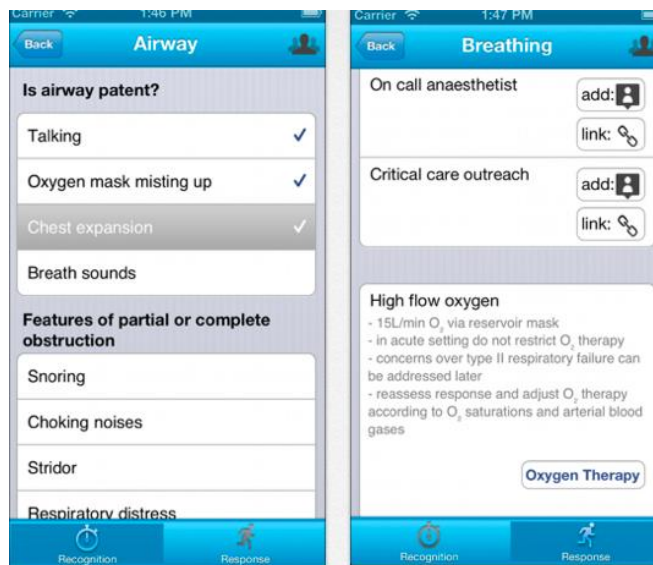
Figure 2.12– RRAPID

2.1.3. AUGMENTED REALITY

2.1.3.1.   Layar

Layar app [17] is the app number one in AR and interactive print app. Scaning the Layaer logo you can watch extra digital content, allowing interaction as well. It is translated into many languages like Spanish and it allows the user to browse and view thousands of Geo-Layers for location-based content like ATMs, restaurants, etc.

Though it does not have any emergency exits information, but it is a very handy application with a friendly user interface. For instance, a Spanish user would be able to check the nearest tube stations close to her/his current location.
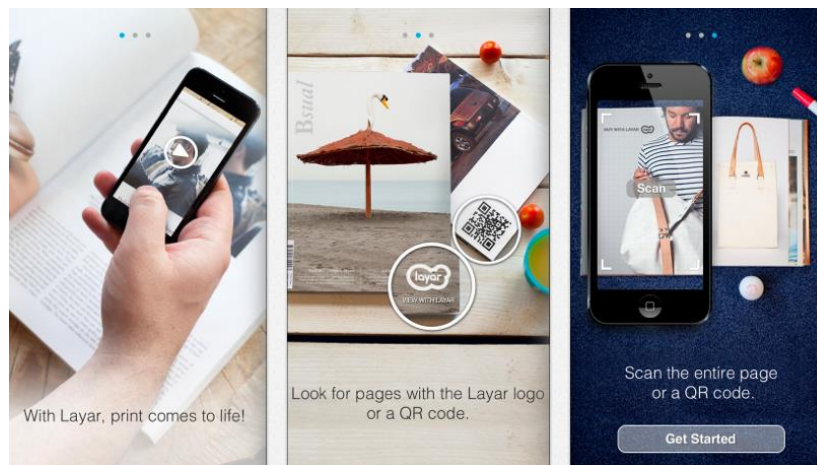
Figure 2.13 - Layar

After analysing all the apps found, a comparative analysis is performed, taking into an account the most important features of each app. The results of the analysis can be checked intoTable 2.1.

María Martín Civiac

	University Apps				Health care Apps								AR app
	MIT Mobile	iStanford	Harvard Mobile	iWestminster	Saint Louis University Hospital	iTriage	Asepeyo	Emergencias	Madrid Emergency Maps	SafetyGPS	Card Safety	RRAPID	Layar
Push Alerts	X		X	X									
Emergency call	X	X	X				X	X	X	X	X		
First aid Manual					X		X	X			X	X	
Health centre location					X	X	X	X	X				
Doctor location					X	X							
Torch							X						
Share app						X		X					
Offline maps									X				
Pharmacies, embassies, police station location									X				
Emergency contacts					X								
Bidirectional emergency										X			
Defibrillator location										X			
Crime manual												X	
AR location													X
QR scan													X

Table 2.1 - Apps Comparison

In this table we can easily distinguish the different functionalities of each of the analysed apps. The functionalities that were not included in the app from the beggining, will be taken into an account.

The most common functionality among all the applications is the Emergency call one. It is very important and necessary to keep handy the emergency numbers in case of an emergency and it is, at the same time, very easy to implement.

Also, many university applications provide an alert notification service. Thanks to that service, any person belonging to the university community would be able to receive alerts in real-time. It is an informative service and alerts are easily broadcasted to all the users. In the UC3M Emergency app, it will offer the push notifications service and, simultaneously, the user will be able to share through Facebook, Twitter and email the last alert. There is no other app that currently offers this possibility, and it helps users to spread the word easily.

Most of the University corporative app do not offer a first aid manual, only the medical app that are only focused on that. The author considered very important to inform users about first aid synthoms and treatment in order to educate and help them in case of an emergency. Non of the above University apps considered this functionality apart from the Saint Louis University Hospital, which is actually a hospital and not a university.

From the apps that are health-care related, they provide a health centre location. One of them, Madrid Emergency Maps, offers offline routing and all the rest need data connection to be fully functional. The author also considered this functionality very important as there is no much clear information about it in UC3M. As there are many different colectives and many different insurances according to these groups, this application will distinguish between health centres outside and inside university and also they will be classified according to their rol inside university.

There is only one of the apps analysed that offer a torch functionality, Asepeyo one. The author believed it is an important feature in case of an light outage.

Furthermore, only two of out fourteen allow sharing the app with other users. It is believed that social media is one of the most effective ways of spreading information nowadays, so it is as well an important feature. This Emergency UC3M app will go further and let the user share the last alert so more people get to know about it in a shorter period of time.

Considering the apps that are health-care related again, it is found that only one of them, SafetyGPS has some information related to defibrillators and it's only its location. The Emergency UC3M app will provide location information, a video of usage and an schema of usage, so they can be used by any user with medical knowledge.

And finally, Layar is the most important app concerning AR. It has a Geo-Layers feature similar to the emergency exits functionality. In Layar you chose what kind of information are you interested in and then you can get to know which are the closest points via camera.

María Martín Civiac

After studying the different functionalities obtained for each of the apps and their use, it was considered advisable to add the following ones to this project app:

- **Push Alert**: among with sharing options via Twitter, Facebook and email.
- **Emergency Call**
- **First Aid Manual**
- **Health centre location**: classified in centres inside, outside and according to role.
- **Torch**
- **Defibrillator location**: together with video and schema of usage.
- **AR Location**

The other features will be considered desirable and among them it can be highlighted the emergency contacts and the offline maps one.

2.2. MOBILE DEVELOPMENT ENVIRONMENT

This section first discusses the state of the different mobile environments, then gives an overview of the iOS operating system, its evolution and explains the internal structure of the system. Finally, it introduces what is the Integrated Development Environment used and the reason for its choice.

2.2.1. MOBILE OPERATIVE SYSTEMS

The most important mobile OS in Spain and worldwide are Android, iOS, Symbian, WindowsPhone and BlackBerry among others. According to Canalys Q1 2013 [18] total smart mobile devices hit 300M units as Figure 2.14 shows. Android had 60% of the general share while Apple had the 20%. But concerning tablets, Apple continues to lead with 47% of share. Canalys affirms that Apple had the lowest annual growth since 2007, but despite its slowing growth, Apple shipped over 37 million iPhones.

OS vendor	Q1 2013 shipments (millions)	% share
Total	308.7	100.0%
OHA (Android)	183.7	59.5%
Apple	59.6	19.3%
Microsoft	55.9	18.1%
Others	9.6	3.1%

Source: Canalys estimates, © Canalys 2013

Figure 2.14 - Mobile devices market shares

But despite the slow growth of mobile devices, and according to App Annie Market Report Q1 2013 [19] , Apple and iOS keep increasing in app downloads and their revenues.iOS has both more revenue and downloads compared to Google Play. And it is also noted that educational apps like Emergencies UC3M increased in iOS revenue, becoming the fourth largest worldwide. The comparison can be shown in Figure 2.15.
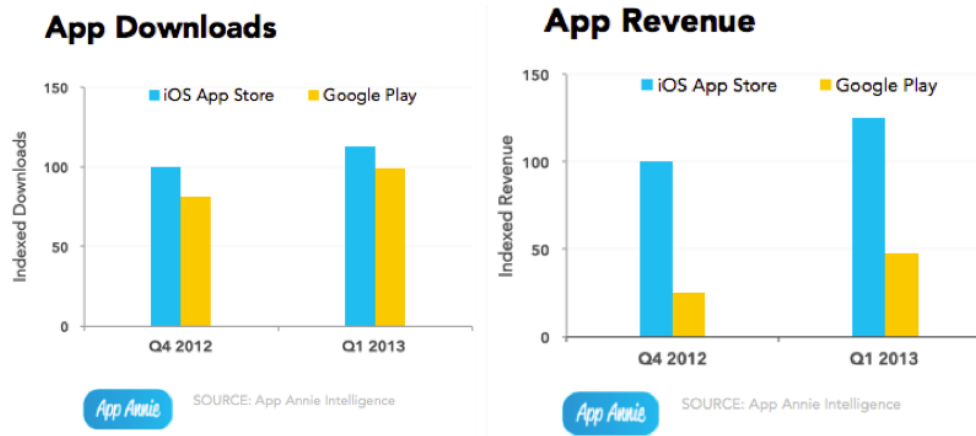
Figure 2.15 - App downloads and revenue

And finally, it is also very important to take into an account the security of the app and the security of their corresponding marketplaces which is directly related to the app security. According to McAfee 4Q 2012 report [20] , Android represents 97% of the total mobile malware. Furthermore, in the graph represented in Figure 2.16 we can note the exponential increase of Android Malware and it is predicted to keep increasing. Despite the security measures and vetting process taken at application store level, it is predicted that more malicious applications will find their way to the marketplaces and therefore, malware will keep being produced and expanded. Despite the fact that AppStore has a more secure vetting process than Android Market, making iOS app more secure, it is still vulnerable.
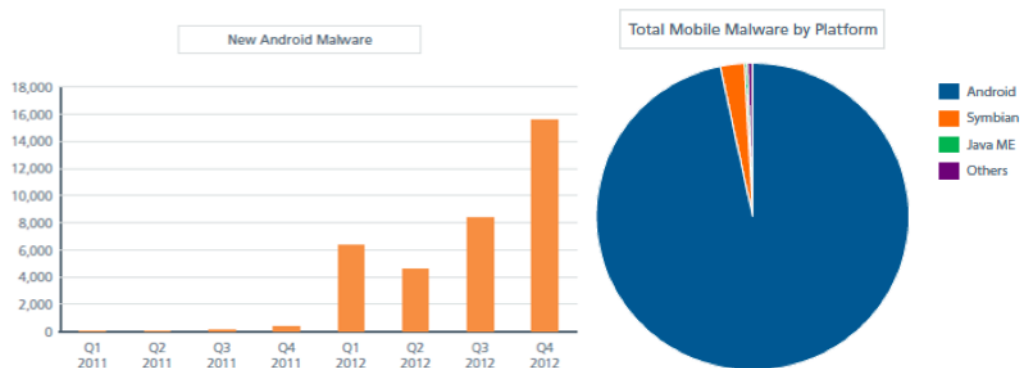
Figure 2.16 - Android Malware

María Martín Civiac

Therefore, the main reasons that led to chose an iOS platform versus Android were:

- **Popularity** of iOS apps worldwide, given the number of downloads of apps that have been recorded for each platform.
- The ability to get **revenues**from the app. Although the app developedcan be downloaded for free, it is useful for future lines that the author could get benefits from it.
- The **security** that AppStore offers against Android Market, leds more people to get Apple devices and to download iOS apps.
- Additionally, the existence of the parallel development of the same project for the **Android** platform.

2.2.2. iOS OVERVIEW

The appearance of the iOS operating system came in 2007 with the iPhone launch. The first iPhone generation iPhone incorporated iOS version 1.0 as an operative system. Apple iOS has been progressively incorporatingiOS into different mobile terminals, such as iPod Touch devices in the 2007 and iPad in 2010, debuting with versions of iOS 1.1 and 3.2 respectively.

IOS versions have standard numeration, the left number is the version number and the following, separated by periods, correspond to revision number. Each of the versions has a distinctive name as with the Android operating system does, but they are known by iOSX, where X represents the version number.

To review the operating system evolution [21], Table 2.2lists the most important versions specifying the devices it supports, the new features included and its release date.

Version	Devices	Features	Release Date
1.0	iPhone 2G	Core iOS UI, Multitouch gestures, Mobile Safari, iPod, Visual Voicemail, Maps, iTunes Sync	06/2007
1.1	iPhone 2G, 1st Gen iPod touch	iTunes Wi-Fi Music Store, iPod Touch compatiblity	09/2007
2.0	iPhone 3G,iPhone 2G,iPod Touch 1st Gen	Native 3rd-party apps, App Store, Microsoft Exchange support, MobileMe, Contact Search	07/2008
2.2	iPhone 3G,iPhone 2G,iPod Touch 2nd Gen,iPod Touch 1st Gen	Google street view, Podcast downloads	11/2008
3.0	iPhone 3GS,iPhone 3G,iPhone 2G,iPod Touch 2nd Gen,iPod Touch 1st Gen	Cut, copy, paste, Voice Control, MMS, Spotlight search, Push notifications, USB & Bluetooth tethering, Landscape keyboard, Find my iPhone	06 / 2009

3.2	iPad	Support for iPad resolution, New app views for iPad, Location based on Apple data, Bluetooth keyboard support, iBooks	04 / 2010
4.0	iPhone 4,iPhone 3GS, iPhone 3G,iPod Touch 3rd Gen,iPod Touch 2nd Gen	Multitasking, Home screen folders, FaceTime video chat, Unified email inbox, Threaded email messages, Retina Display support, iAd support	06/2010
4.3	iPhone 4 (GSM), iPhone 3GS,iPad,iPad 2, iPod Touch 4th Gen,iPod Touch 3rd Gen	Personal Hotspot (GSM), AirPlay for 3rd-party apps, iTunes Home Sharing	03 / 2011
5.0	iPhone 4S, iPhone 4,iPhone 3GS,iPad,iPad 2, iPod Touch 4th Gen,iPod Touch 3rd Gen	Siri, Notification Center, PC-free, iTunes Wi-Fi Sync, iMessage, iCloud	10/2011
6.0	iPhone 4,iPhone 3GS,iPod Touch 4th Gen	Homegrown Maps and turn-by-turn navigation, Siri enhancements, Facebook integration, Passbook, iCloud Tabs, Mail enhancements, FaceTime over cellular	09/2012
6.1.3	iPhone 3GS, iPhone 4, iPhone 4S, iPod Touch (4th & 5th Gen), iPad 2, iPad 3rd Gen, iPad 4th Gen, iPad Mini	Bug fixes: Maps improvements, security fixes, fixes Facebook App, Patches EvasiOn Jailbreak, not possible to bypass the passcode and Access the Phone app	03/2013
6.1.4	iPhone 5	Bug fixed: update audio profile for speakerphone	05/2013

Table 2.2 - iOS versions

Apart from using iOS in mobile devices, from the second Apple TV [22]generation onwards, Apple started to use iOS as an operative system. The iOS oustanding updates for Apple TV have been the ones shown in Table 2.3.

Version	Release Date
4.1	09/2010
4.3	09/2011
5.0	10/2011
5.1.1	05/2012
6.0	09/2012
6.1.2	03/2013

Table 2.3 - Apple TV versions

María Martín Civiac

Analysing Table 2.2 and Table 2.3, we can conclude that iOS is deployed in a wide variety of devices, such as smartphones, touchscreen music players and tablets for which it is possible to develop compatible apps.

Each of the updates highlighted have contributed to innovation improvements that allow to get the most of the devices properties. They do also allow developers to make use of a wide development possibilities, turning into great potential apps for the context they are developed.

2.2.3. iOS ARCHITECTURE

The iOS Developer Library explains how the iOS architecture is distributed [23] and every layer shown in Figure 2.17is explained. The implementation of iOS technologies can be distributed as a set of layers, so every layer is referred and their functionalities inside the operative system are explained. The fundamental services and technologies on which all apps rely are at the lower layers, whereas sophisticated services and technologies belong to higher-level layers.

iOS operative system behaves as an intermediary between the apps that appear on the screen and the underlying hardware. The apps do not communicate to the underlying hardware directly but instead, they communicate with the hardware through system interfaces which protect the app from hardware changes. This abstraction makes it easier to write apps that work on different devices with different hardware capabilities.
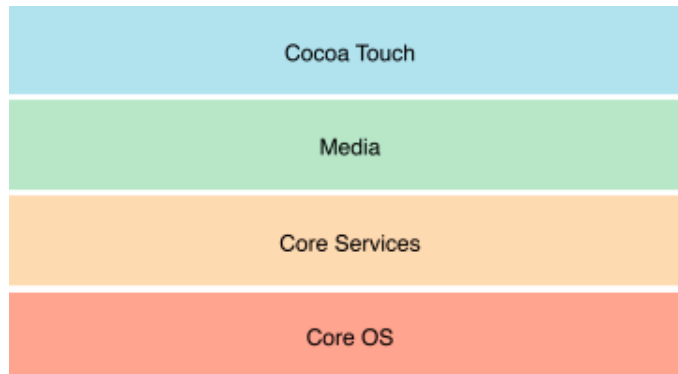
Figure 2.17 - Layers of iOS

- **COCOA TOUCH**: It is located in the highest layer and it contains the key frameworks for building iOS applications. It supports key technologies such as touch-based input, multitasking, many high-level system services and push notifications. The basic application infrastructure is defined here, so when designing applications, the developer should investigate the technologies in this layer to check if they meet the needs.

- **MEDIA**: This layer is composed by the frameworks that providethe graphics, audio, and video technologies in order to create the best multimedia mobile experience. The technologies in this layer were created and designed to make it easy for developers to build applications that sound and look great.

- **CORE SERVICES**:This layer has the frameworks which allow acces to the low level services in the operative system which are the fundamental system services that all application use. Some of them are not used directly but many system parts are built on top of them. For example, the Social Framework belongs to it and allows access to the user's social media accounts. And also Core Data, iOS database, and iCloud are one of the high-level features on this layer.

- **CORE OS**: This layer is composed of the frameworks that provides access to the lowest-level services inside the operative system, like cryptography and complex maths. The use of these functionalities are not needed for the development of general-purpose apps but they are likely to be used by other frameworks. They are also used sometimes when you need special security or communication with an external accessory.

The most used frameworks among apps are *UIKit* from Cocoa Touch, *CoreGraphics* from Media layer and *Foundation* from Core Services as they have most of the functionalities that a developer would use in apps.

It has to be taken into an account that for iOS development, Apple first developed Cocoa Touch layer, which gives this layer an extra maturity. Cocoa was first created on 1980 in NeXSTEP platform and in 1996, Apple bought NeXT Computer company. Some years later, Cocoa started to be used as standard for the Macintosh app development.

There are two advantages of adapting Cocoa for iOS: its maturity offered against another mobile operative systems and the facility for Macintosh developers to start developing for iOS as well. Both platforms iOS and Macintosh use very similar development patterns.

2.2.4. iOS DEVELOPER TOOLS

According to the iOS developer library [23], in order to develop iOS applications, the developer needs an Intel-based Macintosh computer and the Xcode tools. Xcode itself is the Integrated Development Environment chosen which provides the basic source-code development environment. Xcode is the center of Apple's suite of development tools that have support for source-code repository management, building executables, source-level debugging, project

managemenet and performance tuning among others. The key applications used to develop software for iOS are Xcode IDE together with instruments and the developer library.

This project has been developed in Xcode version 4.6.2 and its iOS development target has been iOS 6.0. Its base SDK has been the latest iOS at the moment, 6.1.

- **Xcode IDE**: It provides all the necessary tools needed to manage and create iOS source files and projects, build code into an executable, assemble the user interface and debug and run the code either in iOS Simulator or on a device. Some of the most important features are:
  - o Integrated editor for creating storyboard and nib files.
  - o LLVM, Clang and GCC Compilers supporting Objective-C.
  - o Support for managing iOS devices.
  - o iOS simulator in order to test apps, though it has some limitations like the camera. It allows the user to chose its device model and iOS version.
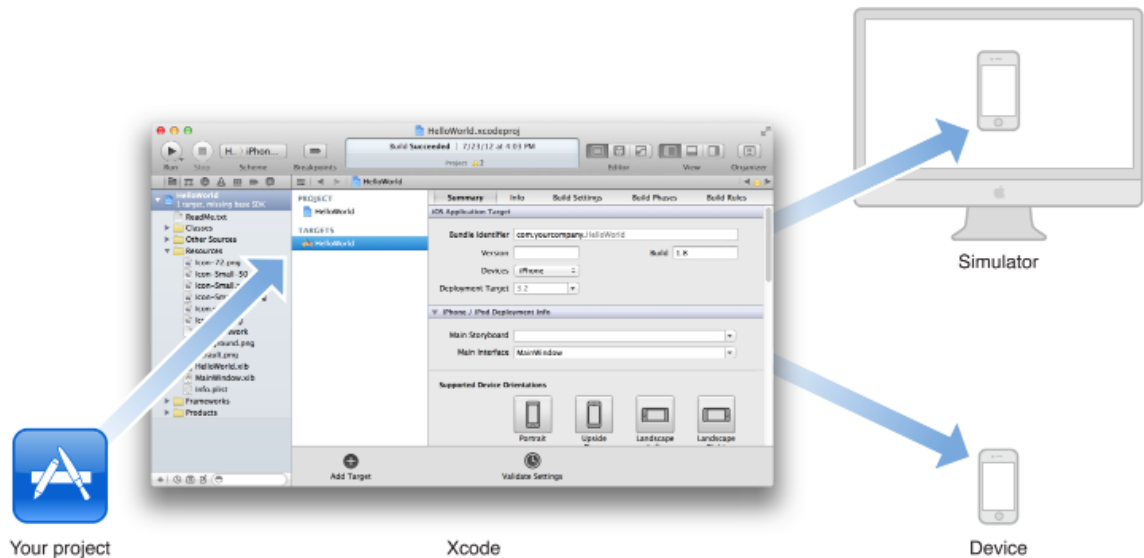
Figure 2.18 - Xcode Project

- **INSTRUMENTS:** It allows the user analyze the iOS app performance while its running either in iOS Simulator or on a device. It analyzes data from the running app and presents it the limeline view which is a graphical display. The information displayed is about memory usage, network activity, disk activity and graphics performance. All tyes of information can be displayed side by side, so the user can correlate the overall behavior of the app.
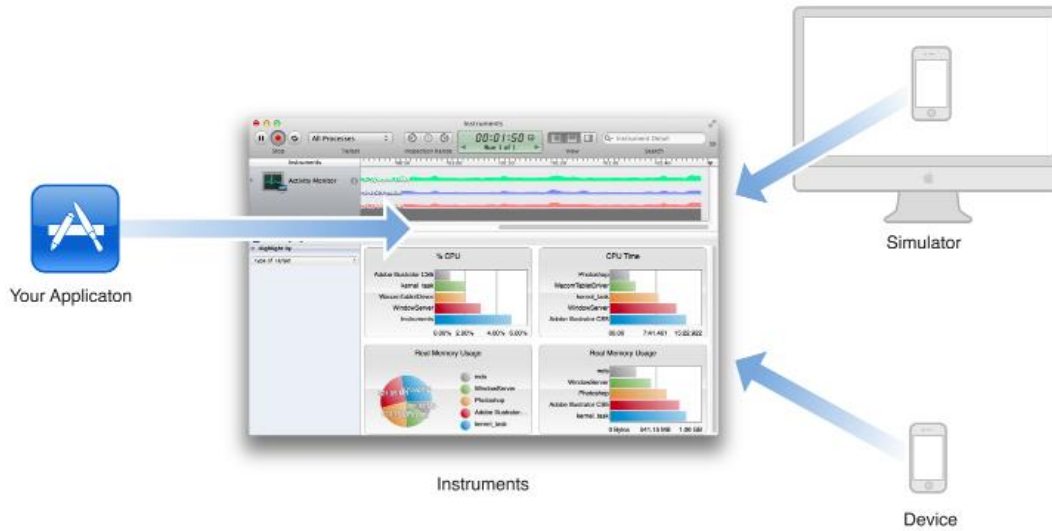
Figure 2.19 - iOS Instruments

- **DEVELOPER LIBRARY:** It contains simple code, documentation, tutorials and any information needed to develop iOS apps. It organizes its contents in an easy way for the developer to find from getting started documents to low-level API reference docs. It can be accessed from the Apple Developer website or directly from Xcode.
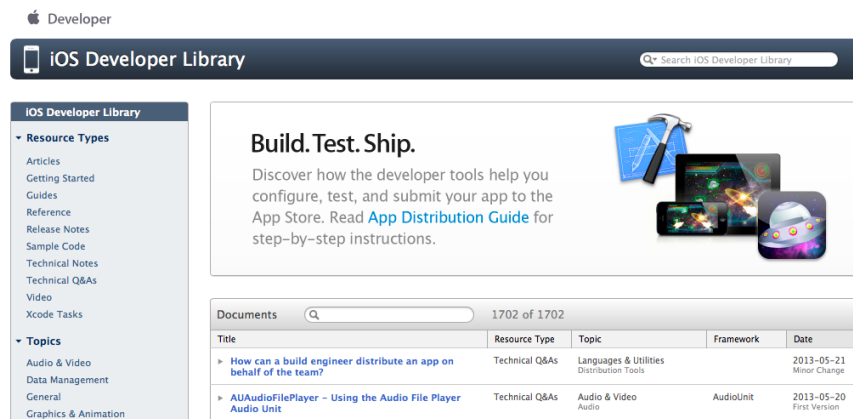
Figure 2.20 - iOS Developer Library

María Martín Civiac

2.2.5. OBJECTIVE-C

Objective-C [24] is the programming language used for OS X and iOS development. It is classified as a object-oriented language with dynamic runtime and it is mixed with of C programming language. It was initially a C programming language extension and it is based on Smalltalk, one of the first object-oriented languages.

This language inherits the main properties of C like its syntax, primitive types and flow control statements and at the same time, adding sysntax for defining classes and methods. We can distinguish two different types of files: the interface ones with .h extension and the implementation ones with .m extension. In the first ones you can find the definition of attributes and methods whereas in the second ones, methods are implemented and the defined attributes are used.

Before Storyboard was created in the latest versions of Xcode, NIB files were used in order to build the user interface. So many files were needed in order to build the interface, as every class was related to a NIB file. In the current version of Xcode, in a single file called Storyboard every interface is definied there and linked to their corresponding classes. So Storyboard allows the user to use the interface builder to layout, create and customize boards, including views and views controllers) while the user i sable to manage transitions between the boards. It makes much clear the whole user interface final appearance and its traceability.

On the the most distinctive feature is that this language is descriptive, which means that methods definitions try to describe their main purpose. Using this feature, the code is easier t oread and understand.

2.3.   PROJECT MANAGEMENT

In order to plan, organize and control the development of this project, the traditional approach has been carried out. The primary challenge is to achieve the project goals previously described in Section1.3.

The main reasons why this methodology has been chosen an not an agile methodology are the following ones:

- This project has a fixed agreement, as many university departments agreed on its necessity and goals.
- The different University departments, clients, interact with the author via meetings.
- The clients are a big group and do not work in the same office as the author.
- There are many different roles inside the project.

As stated in Section 1.4, some requirements were fixed from the beggining as they were essential and had a high priority in the development of the application. But some others, as the Augmented Reality were added later on as they were not required from the first draft. So the requirements definition have been progessed through the development of the application, divided in two main phases: initial requirements and new value-added functionalities.

The initial requirements were defined with the collaboration of multidisciplinary teams of the Carlos III University:

	Rol
Communication Service	They defined and designed all the icons and layouts of the different views of the application. They created the application mock-up.
Occupational Risks Service	They facilitated all the information concerning first aid (defibrillators location, schema and first aid manual) and emergency exits in the three Campuses. They also made a scheme to classify all the different roles inside the university and their corresponding health centres. They were the responsible to draw the first draft.
SEL-UC3M	They collaborated with the location of defibrillators in the UC3M Maps application.
Computing and Communication Service	It was the department responsible of developing the application with all the information above mentioned.

Table 2.4 - Services Roles

2.3.1. DEVELOPMENTAL COMPONENTS

Initially, the author together with the Computing Service responsible had several meetings with both the Communication and Occupational Risks Services in order to set up the basic functionalities and the final mock-up. And shortly after, all the information needed was handed in to the author. As the development progressed, some extra information was requested when needed and some additional meetings with these departments were required as well.

As the project was developed inside the Computing and Communication Service in Carlos III University, the author had the support and help of her colleges anytime. Specially the iOS development responsible, Mister Santin, has always been willing to help and find an effective solution in case any issue was reported.

The author and the iOS development responsible were having meetings weekly as the project progressed; reviewing previous lines of code and raising improved functionalities. In order to follow up with the different tasks, *Reminders* was used. It is an app built into Mountain Lion, that quickly schedules a to-do list and the user can also review the tasks already completed.

2.4. ANALYSIS CONCLUSIONS

After analysing different applications that offer similar functionalities, the main ones that will be developed in the application are:

- **Alert Service**: among with sharing options via Twitter, Facebook and email.
- **Emergency Call and Torch**
- **First Aid Manual and Defibrillator location:** together with video and schema of usage.
- **Location of Health centre location and Emergency exits**: The Health Centers are classified in centres inside, outside and according to role and the Emergency exits are shown via AR.

The other functionalities highlighted in Section **¡Error! No se encuentra el origen de la referencia.** and considered desirable, like emergency contacts and the offline maps, will be considered out of the scope of the project. In order to get alerts even when the application is not running, the APN service will be implemented, as many other Universities already do.

There are some other functionalities like the emergency exits locations that are not implemented in any of the applications, and therefore they do not include AR localization. As this project, includes different and wide functionalities related to the emergencies fields, it offers a very complete application that any other app offers yet.

The development of the project has been carried out via the traditional approach and not via agile methodologies. The main reason is because there are different University services involved and therefore different roles and different locations. Weekly meetings were carried out with the iOS development responsible and other meetings with the other services have been arraged when needed. The initial requirements have been fully developed and added-value ones have been.

3. APPLICATION ANALYSIS

3.1.   INTRODUCTION

In this chapter a system description is included along with the specific requirements. The requirements are written according to the Estándar 830 as set by the IEEE [25].

The general description gives an overview wider than the provided one introduced in the first chapter. Furthermore, it helps to start with the specification of software requirements.

Once we set up the main features of the system, the system functionalities and how they are going to be performed are specified, the functional and non-functional requirements are collected and written down.

3.2.   GENERAL SYSTEM DESCRIPTION

Getting the reference of IEEE 830 Standard, in this section all the factors that affect the system and its requirements are described. The intended goal is not to describe the requirements but their context, leaving a detailed description for the Section 3.3.

3.2.1. OBJECTIVE

The app was thought to offer a solution for the problem above mentioned, when Universidad Carlos III decided to offer some institutional mobile applications oriented to improve university life.

The apps catalogue that was thought to make available for the university community is broken down below. All of them have been developed for both Android and iOS operative system, intended to embrace a wide public because as it was analysed in section 2.2.1, these two are the most popular mobile OS.

- **UC3M News:** It offers a list with the latest news inside UC3M. The user can read the complete new and share them via social networks. It allows to zoom in the text so it is accessible for users with impared vision.

- **UC3M People:** It offers students, PDI and PAS search inside the UC3M directory. It also gives relevant information about the person searched in the UC3M scope, like contact details. Besides, it allows the user to add the person searched to the user contact lists.

- **UC3M Multimedia:** It is a service for watching videos related to news or events in the UC3M scope. It classifies the videos according to its importance or topid and they are ordered by temporal or alphabetical. It also offers a video search. Shortly, a streaming video functionality will be added that classifies the videos in progress, the ones that will be streamed today and in the following week. For the videos that are not being stream in the moment, the user will be able to set a local notification so the user gets an alert when it starts. The author of this project has developed the streaming functionality.

- **UC3M Studies:** It is a catalogue with the degree information and postgraduate programs that can be coursed in UC3M.

- **UC3M Directions:** It offers directions to get to the three Campuses that UC3M has, depending on the means of transportation.

- **UC3M Agenda:** It is a service that offers the UC3M events classified into different types. It offers two displays: one list orders the events according to the date of publishment and the other is a calendar that shows the day that the event will be hold. It has a detailed view for each event and allows them to be shared in social networks. Also text can be adapted for users with impared vision.

- **UC3M Maps:** It offers a geolocated search in places inside the university like rooms or offices. It shows the Campus, building and floor of the result of the search. The layouts of each floor are accessible and identify with different colors doors and stairs. It also has a detailed view with the person or place looked up. It has been used to embed into the Emergencies application to offer localization of defibrillators and health center inside the university.

- **UC3M Marks:** It is a service that allows the user to show the qualifications obtained in their academic life inside the university.

- **UC3M Emergencies:** This is the app developed as a proposed solution for this project. It has a Health Center search inside the university, outside the university and according to the rol inside the university. It also has a first aid manual where measures, action and defibrillators information can be found as an educative purpose. The application locates emergency exits depending on the Campus, building and floor where the user is located, giving accurate information concerning the distance between the user and the exit via Augmented Reality. It has an alert system where a user can post a warning in a website and that alert is sent broadcasted to all the users that have downloaded the application as a push notification thanks to the Apple Push Notification service. And it also has a torch functionality in case of a light outage.

Following the lead of other Spanish and international universities that provide services to the university community using mobile devices, a container app has been developed to put together the applications considered of general interest, distinguishing self-contained and installable applications. The installables applications can be downloaded from the container app called UC3M and its installation remains at the discretion of the user according to their necessities.

Another classification criteria beneath which the applications can be disaggregated is the targeted audience. The possibilities are: university community, external public, UC3M students, UC3M staff, incoming students, new staff and UC3M services. In **¡Error! No se encuentra el origen de la referencia.** all the UC3M applications are classified under the criteria established.

Having a look at **¡Error! No se encuentra el origen de la referencia.**, it can be derived that most of the institutional applications are self-contained and are targeted to the university community and external visitors. More precisely, UC3M Emergencies is a self-contained application and its targeted audiences are both internal and external people. It has information like the health center search according to the role inside the university that is focoused for internal people but most of its contents are usable for anyone.

Once the ecosystem where the application will be integrated is known, it is the moment to expose what value will be added and to the users that will make use of the application. As it has been previously defined in the introduction chapter, the main goal of this project is to develop a set of integrated services that will ease the emergencies inside any of the Universidad Carlos III Campuses. On this basis, it can be deduced that the principal values provided to the users are information regarding alerts, health centers and first aid together with emergency exits location.

Regarding the value added to the users, it is increased for two reasons: localization of emergency places and educative contents. The application will be able to localize health centers, defibrillators and emergency exits inside the three campuses of Universidad Carlos III. Furthermore, it also provides the users some informative contents like the first aid manual in order to educate them in case of an emergency. The binding of these two properties results in a base to provide the user a complete emergencies application in order to act before and after an emergency occurs.

Regarding the value added to other applications of the ecosystem, the Emergencies app will not allow other apps to make use of it directly. But for instance, it uses UC3M Maps in order to locate defibrillators and health centers inside the university.

In addition to add a value to the university community and the users that will make use of the app, the app also brings value to the UC3M as from now on the university has a data base with all the emergency exits registered so far. It is built in a way that in a future, new necessities can be added easily.

	Distribution		Targeted audience						
	Self-contained	Installable	University Community	External Public	UC3M Students	Incoming Students	UC3M Staff	New Staff UC3M	UC3M Services
UC3M News	x		X	X					
UC3M People	X		X	X					
UC3M Multimedia	X		X	X					
UC3M Studies	X			X	X				
UC3M Directions	X		x			X		X	
UC3M Agenda		X	X	X					
UC3M Maps		X	X	X		X		X	X
UC3M Marks		X			X				
UC3M Emergencies	**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**

Table 3.1 - UC3M Apps Classification

3.2.2. SOFTWARE SCOPE

So far the necessities have been analysed and the main goals have been set for the development of this project. After needs and objectives are progressed, the main functionalities of the system can be defined:

- **Search for Health Center**: The user will be able to localize health center through three different classifications: inside the university, outside the university and according to their university group

- **Search for Defibrillators:** Thanks to UC3M Maps, the app is able to localize defibrillators in the three campuses. But, if UC3M Maps is not installed, it gives written information of where to find them.

- **First Aid Information:** The application contains an schema and video of usage for defibrillators. It also provides an action schema of how to react in case of an emergency and the general principles. And in addition, it includes some standards information, their definition, symptoms and treatment.

- **Emergency Exits Search:** The user is able to localize emergency exits in the three Campuses, in every building and in every floor. If the device has gyroscope, the exits are shown via camera, using Augmented Reality and stating the distance from the user's location. Otherwise they are shown in a map with their distance as well.

- **Alerts Notification:** Allowed community members will be able to post new alerts that all the users that have downloaded the app will receive as a broadcast message. If the application is not currently running, a push notification will be sent to all the devices using the Apple Push Notification services. These alerts will be able to be shared via email, Twitter and Facebook so the alerts can be easily spread.

- **Torch light:** The user will be able to use a torch in case of a light outage, depending on the device properties the app will show the flash light or a white page.

- **Emergency Calls:** The user will be able to directly call the Emergency service of the UC3M.

From these functionalities the functional and non-functional requirements are extracted. As already mentioned in section 1.4 where the resolution method was explained, the requirements have been set from the beggining but some extra functionalities have been added while the app has been developed.

3.2.3. USERS

The definition of the user profile that will use the app belongs to the targeted audience presented in section 3.2.1. As an essential requirement, all the users that want to use the app wil need an iOS device.

The first targeted audience and most important one is the **university community**, no matter if it is an academic or laboral relationship. Many people inside the university do not know which insurance they have due to their relation with the university. Also, they will be able to localize the defibrillators and emergency exits in different buildings and campuses. And finally, they will be able to receive and spread university alerts in real time.

Apart from the usual community members, there will be **external people** visiting the university or **incoming students** that will be able to make use of the localization services or the alert notification in case an emergency occurs while they are inside the university.

There are some functionalities like the first aid manual, torch and the health center localization outside the university that can be used for the **general public** no matter if they are directly related with the university or not.

Apart from the users, there are some university services, specially the **ocuppational risk service**, that have got an important benefit from the development of this application. This service is responsible for the university emergencies and has feed with all the required information such as health centers, first aid and emergency exits localization. The development of this application is very possitive for them as now these information will reach a wider audience and the university community will be more aware of everything related to the emergencies in the UC3M.

3.2.4. OPERATIONAL ENVIRONMENT

The application interacts with several system that can be classified into different groups:

- Localization and support services
- Internal commmunication
- External communication.

According to the localization and support services, there are several systems that facilitate the health centers, defibrillators and emergency exits localization, which are:

- **Cartographic maps service**: It is neccessary for the localization of health centers and defibrillators or emergency exits when the device doesn't have gyroscope or UC3M Maps installed. In iOS the mapping service is performed through the MapKit framework. Before iOS6 the requests were made to Google Maps, but from iOS6 on, request will be performed to Maps, developed by Apple.

- **UC3M Maps**: It is an application developed by the university that allows external communication, so any app can request localization inside the university through it. The Emergencies app make use of it when locating defibrillators or health centers inside the university. The request will be able to be progressed only if UC3M Maps was previously installed in the user's device.

- **Augmented Reality library**: Apple provides a library called pARK [26] that uses Core Motion's true north-referenced attitude API. It uses AVFoundation to provide a live camera feed and Core Location to determine the user's location and where the user is facing. The app projects the emergency exits onto the user's screen using the attitude provided by Core Motion.

- **Emergencies web service**: From the web service developed all the registered users will be able to publish new alerts. These alerts will be stored in both the device database and the server database and inmediately sent to all the devices that have downloaded the application in a Push Notification message.

- **Apple Push Notification services**:The Apns provider [27] has been used to interact with the Apple Push Notification service for the iphone. Using the alert message and the device ID, the Emergencies web service sends a push message to the APNs and Apple is in charge of delivering the push alert to all the devices registered for the application.

It is important to take into an account that when using external services, the availability of the service cannot be controlled and as a consequence, some app functionalities could stop working. It could happen that the access to the service would not possible like the map service.

The internal communications allow the application to communicate with other applications previously installed in the device. These communications are performed through different frameworks allowing users to dial an emergency call, sending an email or interact with Facebook and Twitter when sharing the latest alert.

3.2.5. GENERAL RESTRICTIONS AND CONSTRAINTS

To set the scope of the system and implicitly record all the aspects of it that do not fit in other sections we defined the following restrictions:

- The graphical interface of the application shall comply with the design guidelines [28] and development guidelines [29]stablished by Apple.

- The application must be compatible with iOS devices the version is equal or greater than 5.0.

- The programming language that must be used to develop the app is Objective-C.

- Alert communications with UC3M servers will be made through a web service that returns the requested data in XML format and sends push notifications via APNs. The app will process this data to display the results of queries in the warning section.

- The criticality of the system is the response time of queries concerning the alert functionality, as all the other required information will be stored locally in the application.

- First-time usersshould not have any difficulty getting familiar with the app and further use should notcause any difficulties either.

3.2.6. ASSUMPTIONS AND DEPENDENCIES

As described in section 3.2.4, the app interacts with other systems in order to get support and provision for location and alert services. This interaction creates a strong dependency on the system as part of their core functionality is lost if connection is longer available.

The main dependencies of the app are:

- **Emergencies Web Service**: In case the web service provided by the Computing group is not available, the application could not publish any alert and therefore, it would not be able to sent any push notification.

- **Apple Push Notification Service:** In case the Apple service is not properly running, the application would not be able to receive push notifications in real-time.

- **Mapping Service**: In case the iOS mapping service is not available, the application could not offer any type of search because all the localization functionalities and UC3M Maps use it.

3.3. SPECIFIC REQUIREMENTS

The requirements defined in this section have the necessary detail for designers to design a system that meets these requirements and allows the team to test, plan and conduct tests to check whether the system meets the requirements. The defined requirements describe the external behavior of the system perceivable by users, operators and other systems. And, in order to define them Table 3.2 will be used.

ID		Source	
Dependencies		Name	
Description			

Table 3.2 - Requirement Format

In section 3.3.1the functional requirements are defined, they establish the functionality provided by the application and define what the application does.

In section 3.3.2the definition of external interface requirements is included. In external interfaces there are different points considered, such as the interactive views of the application and utilities that connect the application to external services.

Section 3.3.3 includes the definition of the requirements that affect application performance.

Section 3.3.4 includes design constraints that limit certain points in the application.

The fields and their contents of the table used to define the requirements are:

- **ID**: Each requirement shall include an identifier, to facilitate tracing through subsequent phases.
  - o **Value**: CODXX (Requirement code plus number). We will group them in different categories, so XX will identify the requirement number. The COD will be specified as follows: Functional requirements will be FR COD, the external interface is IR, performance ones PR and the design constraints is DR.

- **Name**: The name of the requirement. It is desirable that the name summarizes the requirement and that includes who does the action and its supplements.

- **Dependencies**: identifier of the requirements on which implementation depends on.

- **Description**: Explanation of the requirement to allow any programmer to implement it without extra information required.

Although the standard used is IEEE 830, priority and necessity were not included because once the application has been developed is not necessary to know their value.

3.3.1. FUNCTIONAL REQUIREMENTS

ID	FR-01	Source	Communication Service
Dependencies		Name	The user selects the desired functionality to be performed.
Description	The application will allow the user to select from the main view the different functionalities available. The user will be able to select from Health Center Search, First Aid, Emergency Exits location, Latest Alerts and Torch.		

Table 3.3 - Main View Selection

ID	FR-02	Source	Communication Service
Dependencies		Name	The user directly calls the Emergencies service.
Description	The application will allow the user to directly call the Emergencies service number from the main view.		

Table 3.4 - Emergencies Service Call

ID	FR-03	Source	Communication Service
Dependencies	FR-01	Name	The user looks for Health Centers.
Description	The application will allow the user to select an specific Health Centers search, and depending on this selection, a different Health Centers search will be performed. The user will be able to choose from Health Centers inside the university, outside the university and depending on the user's group inside the University.		

Table 3.5 - Health Center Selection

ID	FR-04	Source	Communication Service
Dependencies	FR-03	Name	The user looks for Health Centers inside the University.
Description	The application will show the university's health center timetable and the user will be able to call the center or see the center on the map.		

Table 3.6 - Health Center inside the University

ID	FR-05	Source	Communication Service
Dependencies	FR-03	Name	The user looks for Health Centers outside the University.
Description	The application will show the health centers close by the three University Campuses. The application will allow the user to locate them in a map, giving some contact information in annotations and the user will be able to call or get		

	directions to the center chosen.		

Table 3.7 - Health Center outside

ID	FR-06	Source	Occupational Risk Service
Dependencies	FR-03	Name	The user looks for health centers according to his/her group inside the university.
Description	The application will allow users to select a health center according to the group they belong to. The application will ask three different questions to the user in order to perform the search: role inside the university, who is the user and insurance selection.		

Table 3.8 - Group Health Center

ID	FR-07	Source	Occupational Risk Service
Dependencies	FR-05, FR-04, FR-06	Name	The user contacts the health center via telephone call.
Description	The application will open the iOS telephone app in order to call a Health Center searched.		

Table 3.9 - Health Center Call

ID	FR-08	Source	Computing and Communication Service
Dependencies	FR-05, FR-04, FR-06	Name	The user localizates the health center in a map.
Description	The application will open the iOS maps app in order to get the location of a Health Center searched and to get directions to that point from the user's location.		

Table 3.10- Health Center Map

ID	FR-09	Source	Communication Service
Dependencies	FR-01, IR - 23	Name	The user locates defibrillators inside the university.
Description	The application will allow the user to locate defibrillators inside the University. This action will be performed via UC3M Maps if installed; otherwise the defibrillators location will be described.		

Table 3.11 - Defibrillators Location

ID	FR-10	Source	Communication Service
Dependencies	FR-01	Name	The user watches an instructional video for defibrillators.
Description	The application will present an instructional video for the usage of defibrillators. The user will be able to pause the video at any time.		

Table 3.12 - Defibrillators Video

María Martín Civiac

ID	FR-11	Source	Occupational Risks Service
Dependencies	FR-01	Name	The user looks for the action principles of First Aid.
Description			The application will allow the user to look for the First Aid action principles. These principles will be classified into Activation, Primary Assesment and Secondary Assesment and the actions will be presented in order of performance.

Table 3.13 - Defibrillator Usage Scheme

ID	FR-12	Source	Occupational Risks Service
Dependencies	FR-01	Name	The user looks for the general principles of First Aid.
Description			The application will allow the user to look for the ten most important principles concerning First Aid.

Table 3.14 - General Principles Information

ID	FR-13	Source	Occupational Risks Service
Dependencies	FR-01	Name	The user looks for different injuries, their treatment and symtoms.
Description			The application will allow the user to look for the most important injuries in case of an emergency. The injuries will be described, together with their symtoms and treatment.

Table 3.15 - First Aid Injuries

ID	FR-14	Source	Computing and Communication Service
Dependencies	FR-01	Name	The user looks for different injuries, their treatment and symtoms.
Description			The application will allow the user to locate emergency exits depending on his/her location. There will be two different options depending on the device properties, either showing the exits via Augmented Reality or in iOS maps application:

The application will allow the user to locate emergency exits depending on his/her location. There will be two different options depending on the device properties, either showing the exits via Augmented Reality or in iOS maps application:

- If the device has a gyroscope, the application will present the exits in the camera via Augmented Reality. The application will include the distance from the user's location to the exit as a distance reference.

- If the device doesn't have a gyroscope, the application will present the exits in the iOS map app. The application will indicate the distance to the different exits in annotations

Table 3.16 - Emergency Exits

ID	FR-15	Source	Computing and Communication Service
Dependencies		Name	The user receives the latest alerts in real time.
Description	The application will notify the user whenever a new alert is received with a Push Notification.		

Table 3.17 - Alerts

ID	FR-16	Source	Computing and Communication Service
Dependencies	IR - 24	Name	The user receives the latest alerts in real time.
Description	The application will notify the user whenever a new alert is received with a Push Notification.		

Table 3.18 - Latest Alerts

ID	FR-17	Source	Computing and Communication Service
Dependencies	FR-15	Name	The user shares the last alert.
Description	The application will allow the user to share the last alert received in the social networks, Twitter and Facebook, and via email.		

Table 3.19 - Social Networks

ID	FR-18	Source	Computing and Communication Service
Dependencies	FR-15	Name	The user refreshes the alerts' list.
Description	The application will allow the user to manually refresh the alerts, pulling down the table list.		

Table 3.20 - Refresh Alert

ID	FR-19	Source	Computing and Communication Service
Dependencies	FR-01	Name	The user switches on the torch light.
Description	The application will allow the user to switch on and off the torchlight. If the device does not have the torch functionality, a blank view will be presented.		

Table 3.21 - Torchlight

3.3.2. EXTERNAL INTERFACES

Should be recalled that according to the IEEE 830 standard, the interface requirements are the ones related to the services to other applications with the views of the application with which the user can directly interact and the utilities needed to connect the application to external services.Making use of Storyboard, one of the newest features of Xcode, all these views will be presented and connected in the same file, as it will be explained later on.

ID	IR-01	Source	Computing and Communication Service
Dependencies		Name	The application shows the user interfaces in Spanish and English.
Description	The application will support English and Spanish as a language. The language will depend on the device settings. Data received from the services will directly be presented in the language that was written.		

Table 3.22 - Languages available

ID	IR-02	Source	Communication Service
Dependencies		Name	A main view will be provided by the application.
Description	The application will provide a main view from which the user will have access to all the possible functionalities of the application. It will be presented as a table view and will have a row for each of the services: Health Center Search, First Aid, Emergency Exits, Alerts and Torch. Furthermore, it will allow the user to place a call to the Emergencies service of Universidad Carlos III through a button.		

Table 3.23- Main View

ID	IR-03	Source	Computing and Communication Service
Dependencies	IR-02	Name	The application will provide a view where the different health search engines will be presented.
Description	The application will offer a view where the user will be able to select which kind of health center he/she would like to know. These options will be presented in a table and the three rows inserted will be: University Health Centers, Health Centers outside the University and Health Centers according to my group.		

Table 3.24 - Health Search Options

ID	IR-04	Source	Communication Service
Dependencies	IR - 23	Name	The application will provide detailed view for University Health Centers.
Description			The application will offer a view where the University Health Centers are specified. The view will contain the timetable and localization information. Furthermore, it will provide two buttons with the option of calling to the center or seeing the center on the map. If the user has installed UC3M Maps, the center will be shown there, otherwise it will be presented in a simple map.

Table 3.25 - University Health Center

ID	IR-05	Source	Communication Service
Dependencies	IR-04	Name	The application will provide detailed view for Health Centers outside the university.
Description			The application will offer a view where all Health Centers outside the university are specified. The view will contain a map that will present the different centers. There will be a label where the four different categories which will be insterted together with their logos: Fremap, Hospitals Public Insurance, Public Insurance and Student Insurance. Initially, the user location will be presented. After the user selects the desired Health Center category, all the centers related to this category will be presented in the map. In order to avoid large distances, the user location will be centered with the furthest centre so everything is visible in the view. Every center will have an annotation with its city and address, and will offer the possibility of going to a detailed view concerning that specific center.

Table 3.26 - Health Centers outside the University

ID	IR-06	Source	Communication and Computing Service
Dependencies		Name	The application will provide a detailed view for every Health Center outside the university selected.
Description			The application will offer a detailed view for each Health Center outside the university when the detail disclosure button is selected. The view provides the name of the center, its address and telephone number. The view also will allow the user to directly call the center or see the center on the map.

Table 3.27- Detailed view for Health Center outside the University

ID	IR-07	Source	Communication and Computing Service
Dependencies		Name	The application will provide views for Health Centers according to the user's group.
Description			The application will present two different views in order to find out the Health Center according to the user's group. The views will ask for the role inside the university and for the insurance, all the different possibilities are presented in the - Insurances Classification.

Table 3.28 - Health Centers according to the user's group

María Martín Civiac

ID	IR-08	Source	Communication and Computing Service
Dependencies	IR-05	Name	The application will provide a detailed view for Health Centers according to the user's group.
Description			The application will present a detailed view that will present the different insurances that the user has access to. The different insurances will be divided in two sections that can be: work accident and illness or public and private centers. Depending on the information known about these insurances, the user will be able to directly call the center or see on the map. If the user selects the option of center localization, the application will make use of the previously described Health Centers outside the university view to show their location.

Table 3.29 - Detailed view for Health Centers according to the user's group

ID	IR-09	Source	Communication Service
Dependencies	IR-02	Name	The application will provide a view where First Aid options will be presented.
Description			The application will present a table with the two First Aid options: Defibrillators and Manual.

Table 3.30 - First Aid Options

ID	IR-10	Source	Communication Service
Dependencies	IR-09	Name	The application will provide a detailed view for Defibrillators.
Description			The application will present a table with three information options concerning Defibrillators: Location, Instructional Video and Usage Schema

Table 3.31 - Defibrillators Options

ID	IR-11	Source	Communication Service
Dependencies	IR-10	Name	The application will provide a detailed view for the Campus where the Defibrillator is.
Description			The application will present the user the places where there are defibrillators inside the university: Leganés, Colmenarejo, Getafe, Parque Científico, so the defibrillators can be located precisely.

Table 3.32 - Defibrillators Location Campus

ID	IR-12	Source	Communication Service
Dependencies	IR-11, IR - 23	Name	The application will present the Defibrillator location.
Description			The application will present the defibrillators available depending on the Campus where the user is. If UC3M Maps is installed, it will be opened and the defibrillators available will be presented. Otherwise, there will be a detailed view where the defibrillators location will be written along with a map of the Campus.

Table 3.33 - Defibrillators Location

ID	IR-13	Source	Communication Service
Dependencies	IR-10	Name	The application will present the Defibrillator instructional video.
Description			The application will present an instructional video that explains the main characteristics of defibrillators. The media player will contain a pause/play button along with a return one.

Table 3.34 - Defibrillators Video

ID	IR-14	Source	Communication Service
Dependencies	IR-10	Name	The application will present the Defibrillator schema of usage.
Description			The application will present a schema of usage where the main steps to use a defibrillator will be explained step by step.

Table 3.35 - Defibrillators Schema

ID	IR-15	Source	Communication and Computing Service
Dependencies	IR-09	Name	The application will present the detailed view for the Manual.
Description			The application will have two sections concerning the First Aid Manual: action and measures. Inside the measures section, general principles and the ten most important standards will be included.

Table 3.36 - First Aid Manual Options

ID	IR-16	Source	Communication and Computing Service
Dependencies	IR-15	Name	The application will present the detailed view for the specific Manual section.
Description			The application will present a detailed view for either actions or measures. If the Action section is selected, there will be information concerning activation and primary and secondary assessment. If the General Principles are selected, the ten most important will be presented. Or if the standards are selected, the ten most important will be presented together with their definition, treatment and symptoms.

Table 3.37 - First Aid Manual Detail

ID	IR-17	Source	Communication and Computing Service
Dependencies	IR-02	Name	The application will locate the user's location in order to find the emergency exits.
Description			The application will find the user's complete location through several views regarding city, campus and building. If the device has GPS, the application will directly get the city location from it. Otherwise, there will be a view that will ask the user for the city where he/she currently is. After the city is known, and depending on it, the different buildings will be presented ordered by the distance from the user's location to them. In that way, if the user doesn't know the building name or number, he/she will be able to guess which is the building. Once the city and building are known, the application will present the last view needed to get to know the exact location. Depending on the building, the app will present a different number of floors that the user will select.

Table 3.38 - User's Location for Emergency Exits

ID	IR-18	Source	Communication and Computing Service
Dependencies	IR-02	Name	The application will be able to locate the emergency exits through Augmented Reality.
Description			The application will make use of Augmented Reality to locate the Emergency exits. After the city, building and floor are known, all the emergency exits will be loaded into the user's camera with the distance from the user to the different exits and the emergency exits logo.

Table 3.39 - Augmented Reality in Emergency Exits

ID	IR-19	Source	Communication and Computing Service
Dependencies	IR-17	Name	The application will be able to locate the emergency exits in a map view.
Description			The application will be able to locate the emergency exits in a map in case the device does not have a gyroscope. The view will make use of the MKMap Framework to localize the different exits depending on the city, building and floor.

Table 3.40 - Map Localization in Emergency Exits

ID	IR-20	Source	Communication and Computing Service
Dependencies	IR-02, IR - 24, IR - 22	Name	The application will offer a view with the latest alerts.
Description			The application will have a detailed view where the last university alerts will be presented. There will be a maximum number of 10 alerts shown and the RefreshControl class can refresh them when the user pulls down the table. The user will be able to share the last alert via Facebook, Twitter or email. There will be a label presented where the numbers of new alerts if there is any or simply saying there are no new alerts on Campus. The application will gather the information from the Emergencies web service that will response with an XML including the information required. At the same time, the APNs will be able to send push notifications to the device whenever a new alert is logged in the web service, so if a notification is received, the application will directly show this view.

Table 3.41 - Alerts View

ID	IR-21	Source	Communication and Computing Service
Dependencies	IR-02	Name	The application will offer a view where the user can enable the torch.
Description			The application will present a view with a switch that enables or disables the torch. By default, the torch will be switched off. If the device has flash, it wil be switched on when the user enables the switch. Otherwise, the switch will be hidden so the user can get some light from the blank view.

Table 3.42 - Torch View

ID	IR - 22	Source	Communication and Computing Service
Dependencies		Name	The application will interact with the Emergencies web service.
Description			The application will communicate with the web service for two different purposes: POST UIDs and GET the latest alerts. In order to save all the registered devices, once the user accepts to receive push notifications, the user's device is saved through an INSERT query in the Emergencies database. On the other hand, in order to get the latest alerts, the application will request them and the web service will send an XML with the alerts. These alerts will be ordered by publication date and priority.

Table 3.43 - Emergencies Web Service

ID	IR - 23	Source	Communication and Computing Service
Dependencies		Name	The application will interact with UC3M Maps.
Description	The application will send specific parameters to UC3M Maps using a protocol known as URL-Schema. The UC3M Maps parameters will indicate the search engine to use: place or person plus the campus and the search term to find. UC3M Maps will be used to locate defibrillators and health centers inside the university.		

Table 3.44 - UC3M Maps Interaction

ID	IR - 24	Source	Communication and Computing Service
Dependencies		Name	The application will interact with the Apple Push Notification services.
Description	The application will send specific parameters to UC3M Maps using a protocol known as URL-Schema. The UC3M Maps parameters will indicate the search engine to use: place or person plus the campus and the search term to find. UC3M Maps will be used to locate defibrillators and health centers inside the university.		

Table 3.45 - Apple Push Notification Services Interaction

3.3.3. PERFORMANCE REQUIREMENTS

ID	PR-01	Source	Computing and Communication Service
Dependencies		Name	The application shows a limited number of alerts.
Description	The application will show a maximum number of 10 alerts. These alerts will be ordered by priority and publication date.		

Table 3.46 – Alerts Limit

ID	PR-02	Source	Computing and Communication Service
Dependencies		Name	The application shows a limited number of emergency exits.
Description	The application will only show the emergency exits that are placed in the user's location, which means the exits in the Campus localized and the building and floor selected.		

Table 3.47 - Emergency Exits Limit

3.3.4. DESIGN RESTRICTIONS

ID	DR-01	Source	Computing and Communication Service
Dependencies		Name	The author shall develop an application supported by a specific iOS version.
Description	The application must be compatible with mobile devices using iOS greater or equal than 5.0 version.		

<div align="center">**Table 3.48 - iOS Version**</div>

3.3.5. SYSTEM ATTRIBUTES

The application should be reliable. All possible errors must be taken into account and the error's information must be shown in alerts so the user can try to fix them in case he/she can.

The application must be able to be maintained without any difficulty by another developer using the available documentation and code.

The application won't be portable since in this case the app is specific to the iOS operating system. But, it should be portable inside iOS, as it should be compatible with as many iOS versions as possible.

The application must be prepared to respond to attacks. In this case, the security layer is integrated into the server, so that the mobile application is not necessary to implement security aspects.

4. APPLICATION DESIGN

Firstly in this chapter the different papers prototypes are presented, which interface has been progressively changed until the final version was achieved. The paper prototypes or application mockups are very useful to graphically describe the requirements previously set for the application in Section 3.3. They allow the user to get to know the user interface of an application and offer the user interaction on it. The discussions performed until the final version was achieved allowed the author to include new requirements and improve the ones already defined.

After the paper prototypes are presented, the design alternatives will be explained, incluying advantages and disadvantages on each of them and the reasons of why the final alternative was chosen.

Once the system design is elected, the components diagram will be shown in order to get a panoramic view of the design performed. In the following section, the classes diagram will be detailed in order to facilitate the future implementation for the programmer. Also, the final Storyboard appearance will be presented in this section in order to clarify the relationships before the different views of the application.

Once the classes diagrams are drawn, the sequence diagrams are presented in order to set the iterations for the objects of the system. Using these diagrams, any programmer would be able to develop the system.

Apart from the functionality diagrams, there is also a persistance diagram where the different data bases and their tables are presented. Also the data base in the Emergencies webservice is detailed through a diagram.

Finally, the design elected for the emergency exits repository is specified and also the process performed to digitalize the exits from the maps into digital information, obtaining latitude and longitude for each emergency exit. The emerngecy exits will be classified depending on the Campus, building and floor where they are located.

4.1. PAPER PROTOTYPE

In this section the paper prototype of the application is presented. Paper prototypes are a mockups of the user interfaces and can be edited manually or using a graphics software. They do have two clear advantages: they are easy to develop and low-cost to perform, in addittion they also offer a general overview of the aspect and interaction of the application to the client. They are also very useful for programmers and designers in order to define the application views.

During the application development, the initial paper prototype for Emergencies UC3M has evolved. The first version was released at the beggining of the Project and new interface elements have been added and deleted in order to improve the user experience.

4.1.1. FIRST VERSION

The first prototype covers both Figure 4.1 and Figure 4.2. It was performed by the Ocupattional Risks Service of the University on middle October in 2012 and it was based in some of the applications analysed in Section 2.1. For example, it offers a similar interface and similar functionalities than Asepeyo. In Figure 4.1 appears the different main views proposed, the main functionalities were looking for health center, torch, emergency exits, defibrillators, where to go, first aid and work health center.

Figure 4.1 - Main View First Version

In Figure 4.2 an example of two different detail views is presented. More precisely they are the Emergency exits and the Emergency calls views. The user will be able to select from different emergency telephones and will be able to check the emergency views directlty in the map.
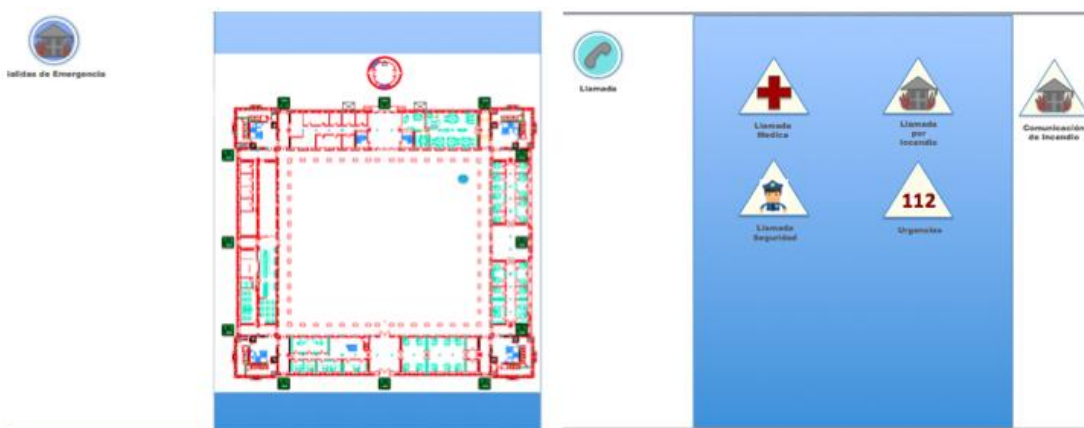

Figure 4.2 - View Appearance First Version

This prototype was just a first draft where the different functionalities were analsysed and proposed from the Occupational Risks Service. The design offered from this draft was not very user friendly so more prototypes were presented.

4.1.2. SECOND VERSION

The second version was presented on the 28th of November, 2012 by the Communications Service of the University. This prototype presentes significant modifications regarding the previous one presented above in section 4.1.1, specially in the design point of view.

In Figure 4.3 appears the new version of the main view. Instead of using a container view with the different functionalities like described for Figure 4.1, the Communications service decided to present them in a table to stablish a clear difference between them. Also the emergency call will be carried out by a green button at the end of the table, to make it more apparent to the user. In Figure 4.3 the different emergency exits are presented, as the Emergencies University telephone number 9999 was not yet created in November.

Figure 4.3 - Main View and Emergency Call Second Version

In Figure 4.4 a new view for the Health Centers outside the University is presented. It will allow the user to check for the four different types in the same map view, making use of a side bar with the centers options. Furthermore, in Figure 4.4 the latest alerts view is presented. This view offers two different sections in a table; the first one shows the actual alert ongoing on Campus and the other one offers the history of the different alerts registered so far. This functionality was extracted from the MIT Mobile App which shows the alerts on Campus, sending push notifications to the registered devices when a new alert is raised.

Figure 4.4–Health Centersand Latest Alerts Version 2

4.1.3. LAST VERSION

The last version was presented on the 30th of January, 2013 by the Communication Service of the University. It offers similar design as the previous version, but with slightly different details concerning views. There are some functionalities that were added in new requirements and are not specified in these views, like the Augmented Reality, Push Notifications and Social Networks connection.

In Figure 4.5 the final version for the main view is presented. As compared to Figure 4.3, some of the functionalities are finally grouped into the same section, like for example defibrillators are now included inside the First Aid section. The previous table offered a usability problem when chosing the first functionality, as the table was longer than the device's screen and all the functionalities were not visible at first appearance. Then it was decided that all the health centers will be grouped into the same section as shown in Figure 4.5, finally getting a total of five different initial sections. In this final version, the emerngecy call button is presented in red, as it shows a better emergency reality than the green one. The health centers will be then classified into those inside the University, outside the University and they will be specified according to the user's group inside the University.

Figure 4.5 - Main View and Health Centers Classification

Also there are slight changes in the view for health centers outside the university. In the final version, as shown in Figure 4.6, the side bar is finally set in the top part of the view. Although the view is changed, the health center elements remind the same. In addittion, the defibrillators location was defined regarding the Campus where the user is at that moment. The author together with the SEL-UC3M group decided to add the different defibrillators in the UC3M Maps, so if the user has UC3M Maps installed, it will help the users to locate them. Otherwise a deailed view information is presented to the user.

Figure 4.6 - Health Center Search and Defibrillators Location Version 3

In Figure 4.7 appears the final version for the alerts. Instead of using a two section table as proposed in Figure 4.4, there will be only one table where all the alerts will be displayed ordered by data published and priority. The label at the bottom of the view will inform the user of how many new alerts there are, if there is any. The author together with the Computing Service decided to add a sharing button in this view, where the last alert can be shared through Twitter, Facebook and via email.

In the same figure, the emergency exits solution is presented. The Communication Service proposed UC3M Maps to find the exits, but since this application does not cover emergency exits yet, another alternative was suggested from the Computing Service. The author together with the Computing service finally decided to use Augmented Reality to localize them, making use of the GPS signal. This view has not been designed but it consits of the camera view, superimposing as many emergency exits symbols as exits are, together with the distance from the user to the different exits. These distances will be updated every 2 seconds in order to make possible a guidance from the current possition to the final destination, the emergency exit more convenient.

The complete set of views can be shown in the GETTING STARTED AND BASICS section of the Appendix C.

Figure 4.7 - Alerts and Emergency Exits Version 3

4.2. DESIGN ALTERNATIVES

This section briefly discusses the various alternatives that have been considered during the design phase of the application and which one has been chosen for the final design.

In the design alternatives different elements of the system are integrated which also have different design options. Firstly the elements of the system will be discussed and then the different alternatives in order to combine them to build the entire system. The alternatives are created using an online diagram tool called Gliffy Online Diagrams [30], version: Online-2067.

4.2.1. SYSTEM ELEMENTS

Web services: At the beginning of the project the author had to decide what language to use to return data provided by the Web service Emergencies-UC3M. The alternatives were XML and JSON. The first has the advantage that it is very understandable and there are many tools that allow the customer to obtain the encoded information. XML has a complex structure where child elements can be added any time so it has been used to get alerts from the webservice data base.As in JSON it is difficult to extend properties but it has a high speed of responses and a light structure, it has been used to sabe the UID of the registered devices that generates a very simple answer indicating success or error.

Data Source: When logging in the notifications website, the Emergencies UC3M retrieve information directly from LDAP directory UC3M in order to validate a user. It was decided to communicate the Web service Emergencies UC3M with a Web service offered by UC3M, so the app does not access the directory of people directly.

Format of the returned data: The application retreives information from the webservice twice. Once the webservice data base is accessed in order to get the alerts via *printXML* function, which returned format is presented in XML. It presents a list of Warnings with their specific properties. These properties are the published date, the text of the alert and the ID in order to distinguish the different alerts.

```
<?xml version='1.0' encoding='UTF-8' standalone='no' ?>
<rss version='2.0' xmlns:g='http://base.google.com/ns/1.0' xmlns:emergencias='http://arca.uc3m.es/'>
<list>
    <warning>
            <date>2013-05-21 19:26:20</date>
            <text>Cierre del Campus de Getafe por fuertes lluvias</text>
        <id>15</id>
    </warning>
    <warning>
            <date>2013-05-21 17:59:20</date>
            <text>Cierre del Campus de Colmenarejo por nevada</text>
        <id>14</id>
    </warning>
  </list>
</rss>
```

Figure 4.8 - PrintXml Return Data

The other time when the application connects with the web service is when the user accepts to receive push notifications the first time the app is used. The web service will be in charge of storing the device ID into the corresponding data base and it will give a JSON reply indicating if it was successfully stored or an error happened. So the information returned in *saveID* could be either:

$$\{ \quad \text{"result":} \quad \text{"Error"} \quad \}$$
$$\{ \quad \text{"result":} \quad \text{"ok"} \quad \}$$

4.2.2. FIRST DESIGN ALTERNATIVE

The first alternative consists in the first and most simple design approach. Here the Web service Emergecies UC3M directly contains all the requested information from the app.

In this alternative the application performs the necessary queries to the Web service SEL-UC3M and this returns the information in JSON and XML format.

In Figure 4.9 appears the designed diagram proposed in this alternative.

The advantages of this approach are speed and an easy design but it does not contribute with enough functionality to the system:

1. It did not contain any LDAP information for users registration.
2. It did not contain any push notification service in order to notify users when a new alert is raised and the application is not currently running.
3. As the emergency exits are classified in Campus, building and floor it was a complex structure to organise in Data Base tables.

Figure 4.9- First Design Alternative

4.2.3. SECOND DESIGN ALTERNATIVE

The second alternative of the system already includes a complete functionality, considering all the requirements previously stated.

In order to validate users when logging alerts, the system will include a People Data Base where the administrator users will be included. These users will be the only people allowed to publish alerts. The system will also make use of LDAP UC3M Data Base in order to double check the user's validation inside the UC3M system.

As the emergency Data Base was complex to perform, a local repository was created inside the application in order to ease the process. The different emergency exits will be distributed in folders according to their Campus, building and floors. In this way it will be easier to get the different coordinates of the exits and in a quicker way. The application will also include an internal Data Base called Core Data in iOS where all the alerts will be stored. Making use of this internal data base, the application will be able to compare if there are any new alerts logged, comparing the last stored ID alert and the last obtained ID alert from the web service.

In the previous alternative the user did not get any notification if a new alert raised and the user was not using the application at the moment. In this alternative, the system would include a Notification Web Service developed by the SEL-UC3M team. This web service would be shared by the iOS developing team and the Android one in order to get the same performance and the same results. This web service would be then in charge of connecting with the Apple Push Notification Service everytime a new alert is logged. The Notification web service would need to send the APNS the list obtained from the UID Data Base with all the registered devices IDs.
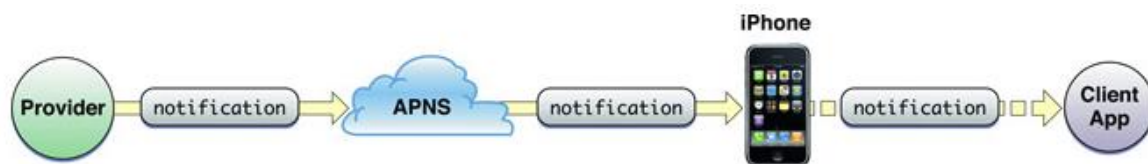

Figure 4.10 - Apple Push Notification path

In Figure 4.11, the new design alternative is presented with the added functionalities and services.

Figure 4.11 - Second Design Alternative

4.2.4. THIRD DESIGN ALTERNATIVE

The third design alternative offers the same functionality as the second design alternative, but there was not enough time in the scope of this project to develop a Notification Web Service so a third-party software component was used instead. This software was obtained from the APNS-PHP library [27] and was included in the Emergencies UC3M. In a short future the Notifications Web Service will be implemented by the SEL-UC3M group so the Second Design Alternative specified in section 4.2.3 will be implemented.

In Figure 4.12 the final design alternative is presented and is the one implemented in this project.

Figure 4.12 - Third Design Alternative

4.3.   COMPONENT AND CLASS DIAGRAM

Once the design alternative is chosen, see Figure 4.12, the application is modeled using UML diagrams in Visual Paradigm [31], version 10.1.

The diagrams used in this section are the component diagram and class diagrams. The component diagram models the application software architecture, grouping different parts of the application and showing the relationship supplier - consumer service between components. The class diagram shows the composition of the classes and the relationships between them.

Figure 4.13 shows the diagram of application components. We can distinguish the following components:

- **Controller:** It is a package which includes five components that include application logic implementation. It offers the UI_Sender port and through it the user interfaces send their current state to the different components. From Data, the Alerts component will be able to load the last alerts from the requested information in the Data Base.

    o **Support:**It is included in the controller package. It includes the operating system frameworks and libraries developed by third parties that support the implementation of the application functionality. This component provides Utilities port in order to provide the needed services.

    o **Health Centers, First Aid, Torch, Alerts, Exits**: They are included in the controller package. They include classes that give direct support and control to the core functionality of the application. It communicates with the following components:

        o **Support** to use the resources of third-party libraries and frameworks that enable to implement the core functionality.

        o **User Interface**, to send and receive control information on the user interfaces for the application.

        o **Server**, to retrieve information from alerts and save the devices IDs.

- **User Interface**: It includes classes that implement user interfaces. It communicates with the Controller components to send and receive control information on the current status of the interfaces. It has the UI_Receiver port for the controller package components to send them control commands to update or retrieve the current status of the interfaces.

- **Apple Push Notification Services:** It connects with the Server package which sends requests to the Apple Push Notification server. This component will directly send notifications to the user device whenever a new alert is logged in the Server package.

- **Server**: It is a package that brings together the components including the database tables and the APN service.Its port offers Requests for the controller package components.

    o **Database**: It is included in the Server package. It includes web resources that the application accesses for information on alerts and device ID of UC3M. It communicates with the controller package components to provide the information requested by their package.
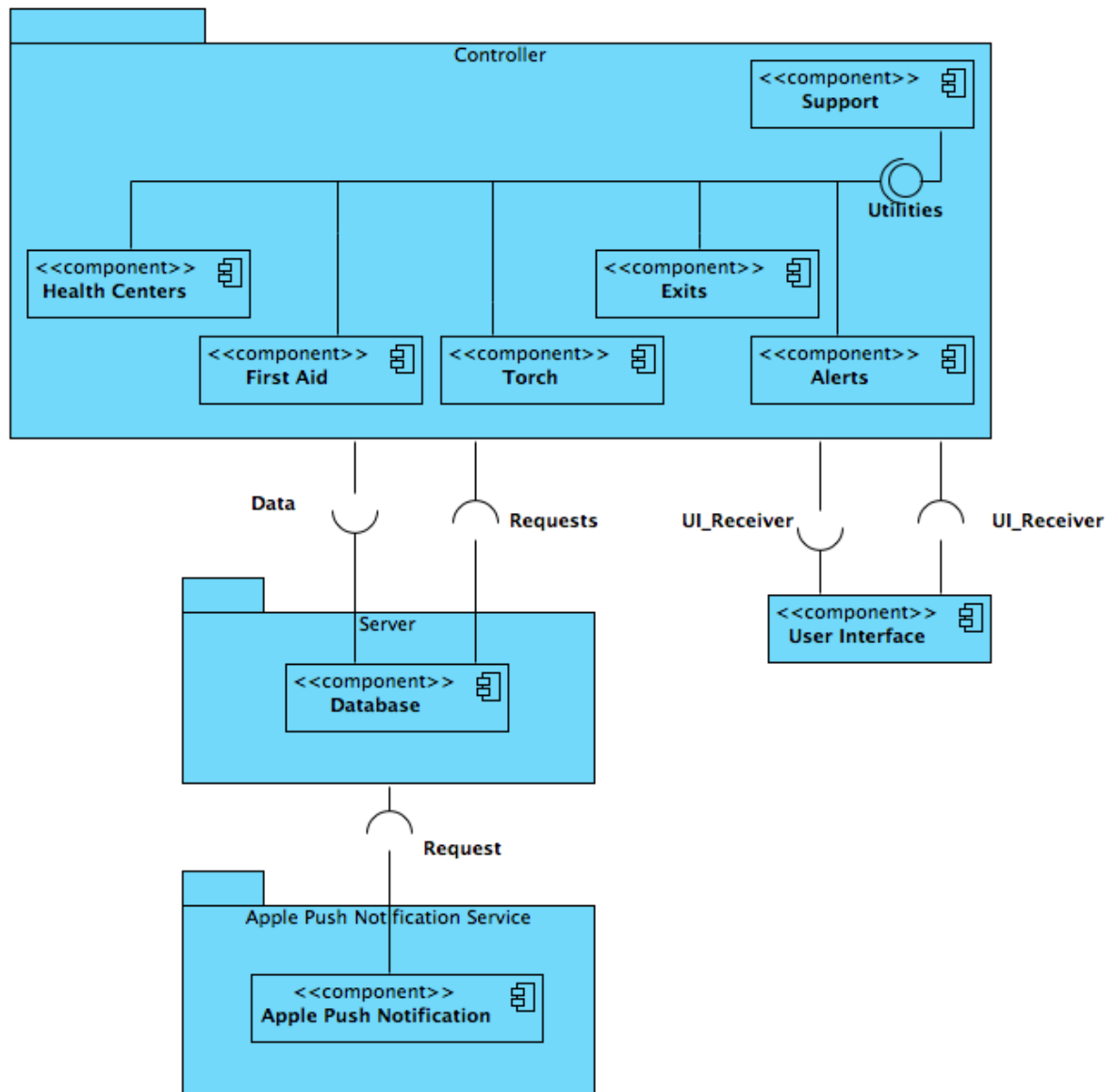
Figure 4.13 - Component Diagram

After the component diagram, it can be deduced that the application has been designed following the design pattern Model-View-Controller. This pattern suggests a controller responsible for collecting user interactions in the sights and update views in terms of the actions that trigger. The controller also interacts with the model which provides you the information and data necessary to carry out actions.

Once the components diagram is drawn, the application classes extracted from the components will be detailed in Figure 4.14.
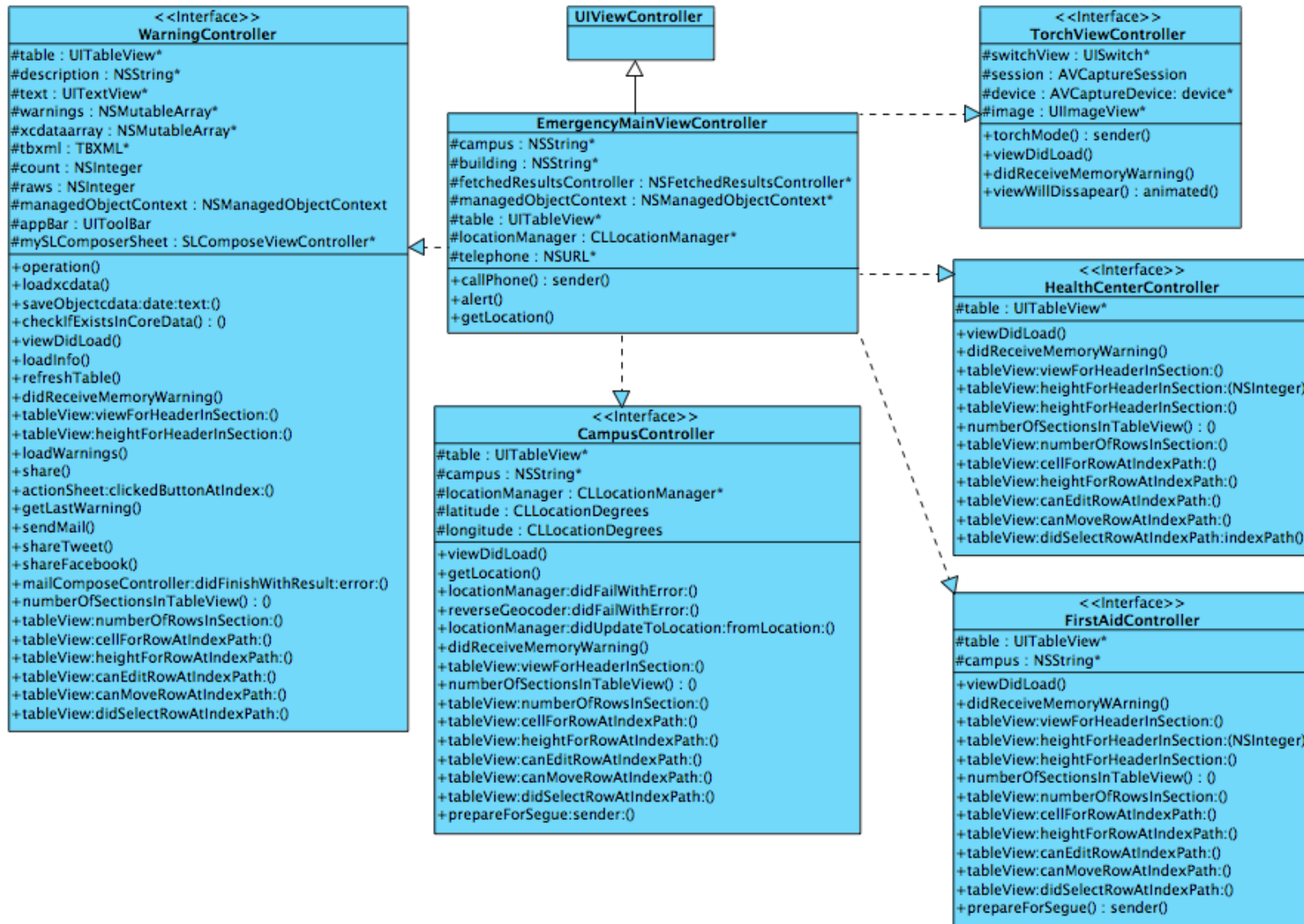
Figure 4.14 - Class Diagram

In order to show the relationships between the main application classes they have been included in the diagram above. The class diagram only includes the classes contained in the Controller package because they are those that implement the functionality of the iOS app. Also part from the app's classes, the Support and User Interface components havenot been includedin the diagram. The reason was because the first classes that implement user interfaces are actually files written in XML markup language and for the second, the classes have been implemented by another as they are frameworks and libraries.

There are fourty eigth classes in total inside First Aid, Torch, Health Centers, Emergency Exits and Alerts. Only the main controllers have been included in the diagram, as there would not been space for all of them and the main functionalities would not be clear enough, it was decided to include only the main controllers of the application.

The *EmergencyMainViewController* class implements handles the main view of the interface and provides the functionality selection and the emergency call. As attributes, it be in charge of getting the user's current location, so it will send to the other controllers the Campus where the user is. The methods implemented allow three different functionalities; firstly to call the Emergencies service when the button is pressed, then to go directly to the Alerts view when a notification is received and then to get the specific user Campus.

HealthCenterController, *FirstAidController* and *CampusController* provide a table view where several options are presented in order to go to the final controller where the different functionalities are. On the other hand, *TorchViewController* is the controller in charge of the torch so it captures the switch state from the view in order to switch on and off the torch while changing the switch and background image.

Finally, *WarningController* performs the alert management, providing features to manage information obtained from Web service regarding alerts. The methods are oriented to present and store the XML information obtained; it is parsed, presented in a table and stored in Core Data. Also, there are sharing options implemented, either via Twitter, Facebook or email.

4.3.1. APPLICATION VIEW DESIGN

Making use of Storyboard, one of the newest features of Xcode, all the views previosuly described in Section 3.3.2 will be presented in the same file. From there it is possible to control every setting and how the different views connect to each other through segues. Furthermore, every view will be monitored and related to a Controller, having a Model-View-Controller model as described in Section 2.2.3. Depending on the type of frameworks selected in each view, different elements and functionalities will be presented. This file will complete the classes information provided in section 4.3, as it has all the clases of the system. The final storyboard obtained in the Emergencies UC3M is presented below in the Figure 4.15.
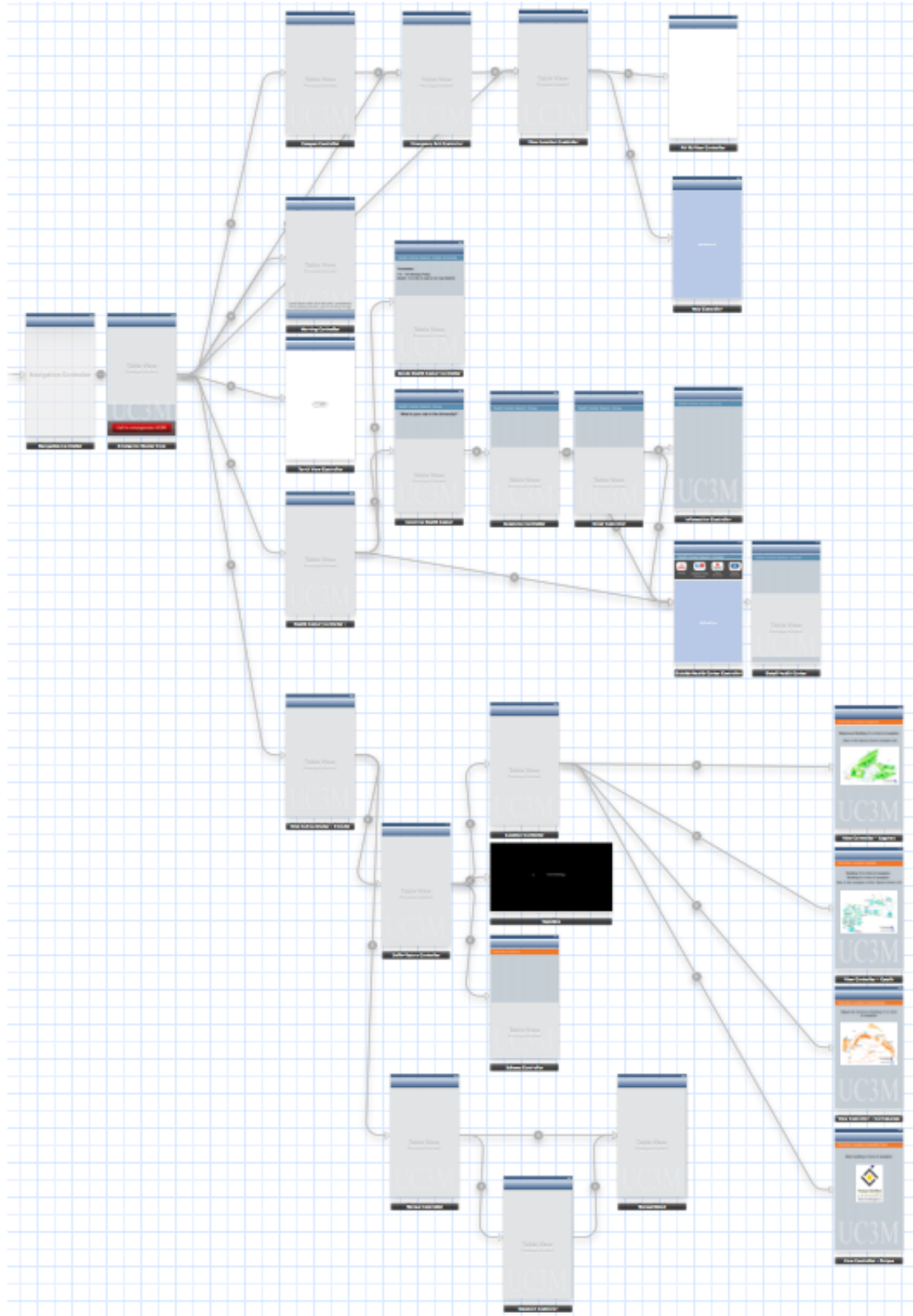
Figure 4.15 - Emergencies Storyboard

4.4. SEQUENCE DIAGRAMS

Once the relationships among the classes of each of the system's components are defined, thesequence diagrams willserve the developer as a model for developing the object interactions inside the application.

The first is depicted in Figure 4.16 and shows the method that run when the device starts UC3M Emergencies application. Firstly, the method calls viewDidLoad method and from there, the getLocation, alert and callTelephone methods will be called when neccessary.
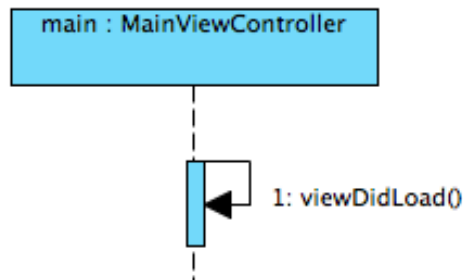

Figure 4.16 - Init Sequence Diagram

When the user pushes the emergency call button in the main view, the application will directly dial the Emergencies service number as shown in the following diagram:
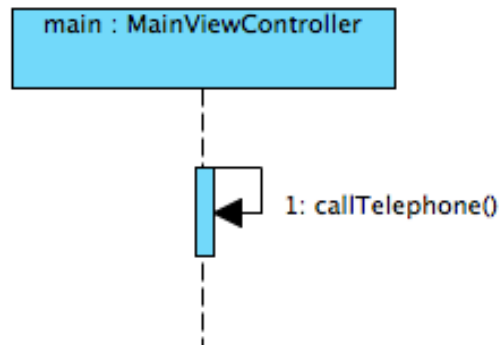

Figure 4.17 - Call Emergencies Diagram

The same sequence diagram will represent the *HealthCenterController*, *FirstAidController* and *ExitsController*, as they represent a table view and depending on the selection, will send the user to one view or another. In the diagram this transition is represented as a lost message in order to indicate the sequence of the message, but it won't be lost, it would have been sent to the next controller.
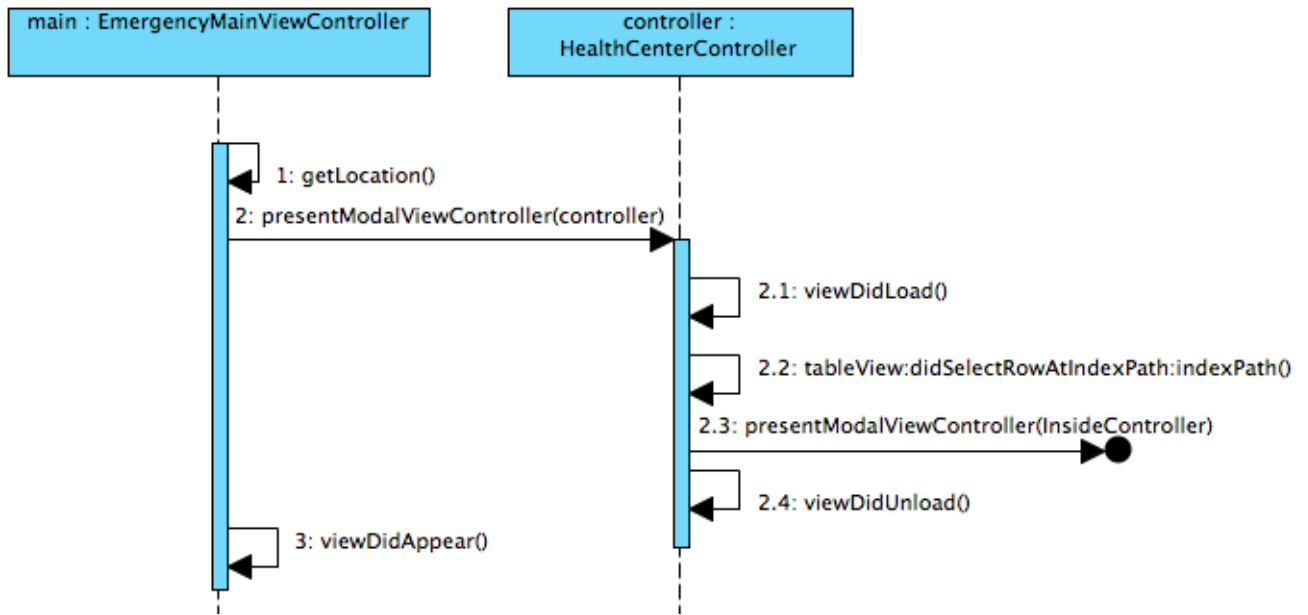
Figure 4.18 - Health Center Diagram

The *WarningController* will init the connection with the web service in order to get the alerts. Once the data is received, it is loaded and they are shown in the table. Then the user can also refresh and share.
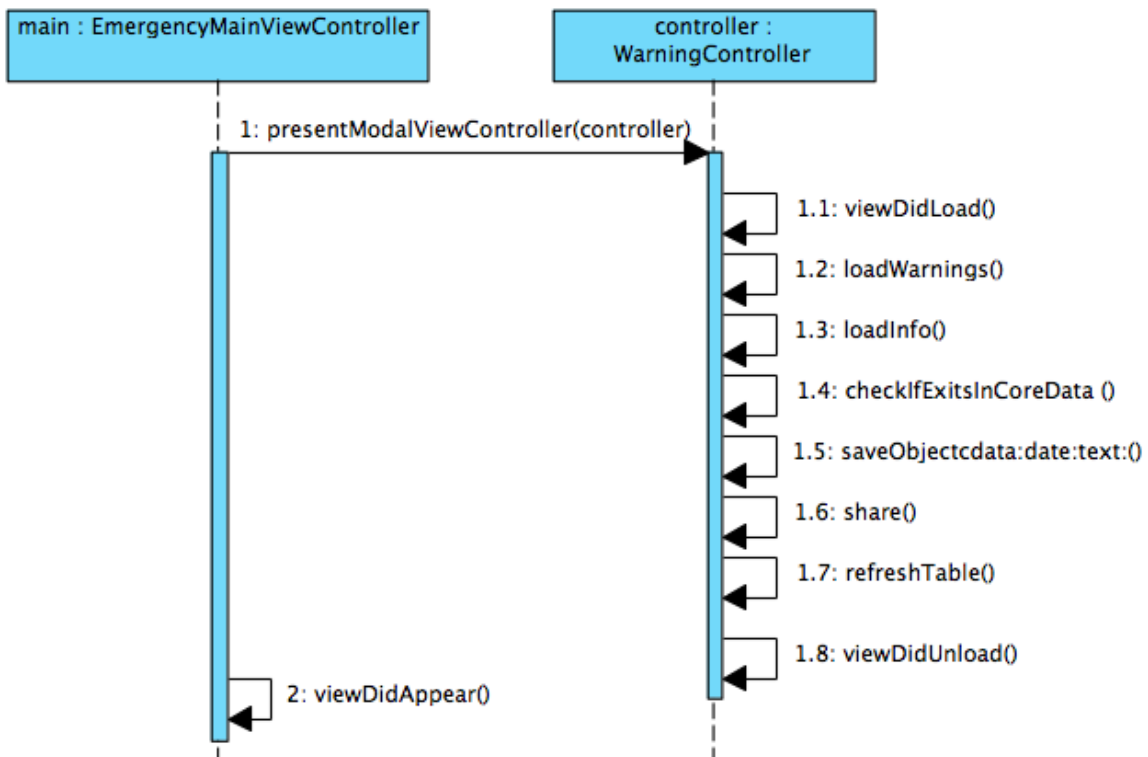

Figure 4.19 - Warning Controller Diagram

And finally, the *TorchViewController* will load the view, wait for the user to press the switch button and if so, perform the torch. When the user leaves the view, the torch will be turned off anyway using the viewWillDissapear method in the class.
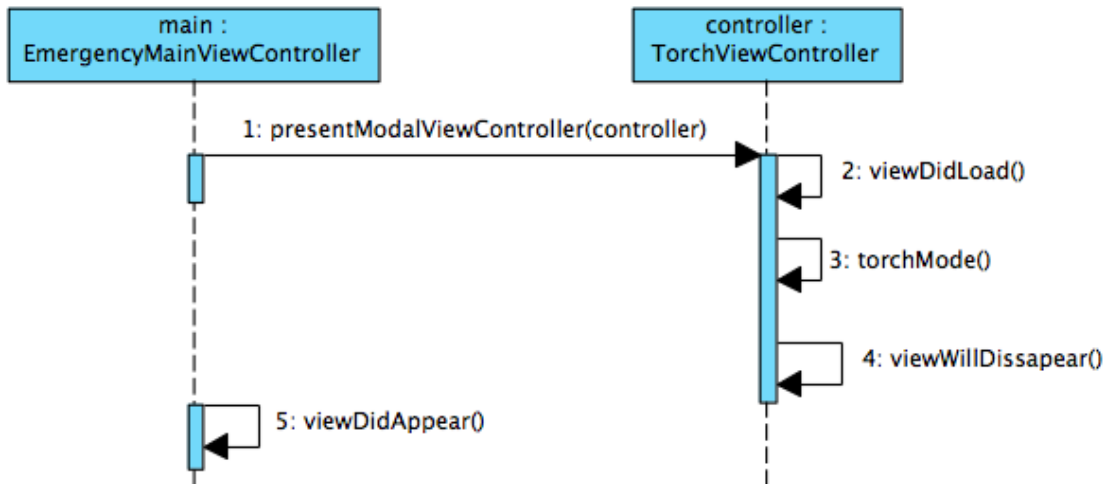

Figure 4.20– TorchViewController Diagram

4.5.   PERSISTENCE DIAGRAMS

The previous sections explained how the app makes requests to a web service about alerts, registered people and registered UID. Apart from the data bases inside the web service, it has been explained that the application itself also has an internal data base where alerts are stored. It has been considered to include the design of the database in order to provide the reader with greater vision of the system and to make it easier to understand the overall storage process. Both databases are implemented in the Database component diagram of the system components.

In this persistence system there is no Entity-Relationship diagram as any of the data bases are related among them. The different entities inside the Emergencies Data Base have been designed in Figure 4.21 with Visual Paradigm [31], version 10.1.
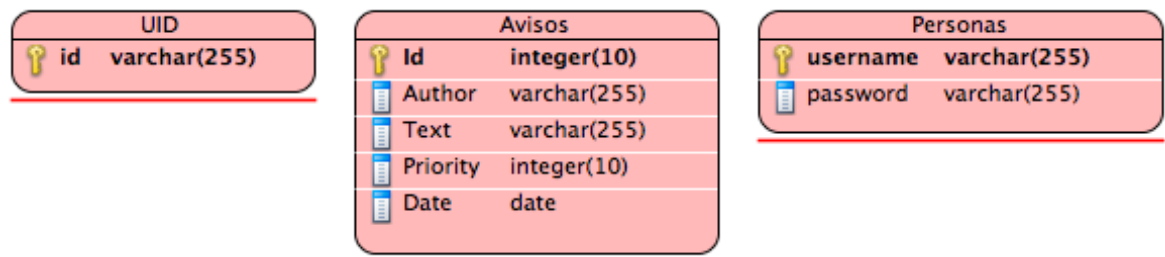

Figure 4.21 - Emergencies Data Base Model

María Martín Civiac

The UID table represents the id of all the registered devices. The only colum in this entity is the id of the device which will be the primary key, therefore every id will be unique for every device.

The Avisos table represents all the alerts logged in the system. Every alert will have a unique identifier that are automatically increased and inserted when an alert is logged. Another identifiers of the alerts are the Author, the Priority of the alert (will vary from 0 to 5, being 0 the minium and 5 the maximum), the Date of the alert and of course, the Text.

In order to track and monitor the administrator users that are able to log alerts, the Personas entity was created where the user names and passwords are stored in plain text. It would be convenient to store these passwords encrypted as described in section 6.2.4.

In the internal data base stored in the application, Core Data, only one entity was defined and used which is called Alert. Every Alert object will have three different attributes: date, idwarning and text, these objects will not be related to any other entity and will be monitored by a controller.
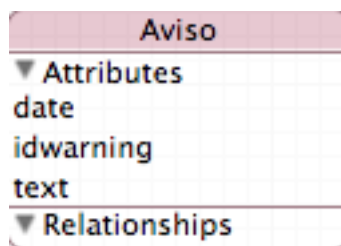
Figure 4.22 - Core Data Model

4.6. EMERGENCY EXITS REPOSITORY DESIGN

The emergency exits have been stored locally in the application instead of designing the a data base structure. The data base design would make web service requests take longer to implements as it would need to consult on multiple tables. To increase the speed of requests, the author decided to store them in plain text in the application using folders to distribute the .txt files.

Overall, the repository stores information about the campuses that the UC3M has, buildings that are located on campus andfloors that each building. The information stored for every exit in the repository are the coordinates.

During the development of the application the creation of the repository that stores emergency exits has been included. The repository is included in the component maps Repository diagram of system components. Specifically, the author has worked on the digitalising process of the maps.

The Occupational Risks service facilitated to the author the UC3M architectural drawings of floors of all buildings UC3M in digital.

The complete steps to take to achieve the final result obtained in were:

1. Obtained the coordinates, longitude and latitude, from every building.

2. Obtained the coordinates, longitude and latitude, from each emergency exit in every floor, building and Campus using Google Maps.

3. Created the folder structure organising Campuses, buildings and fllors.

4. Created a file for every floor and added the coordinates on it.
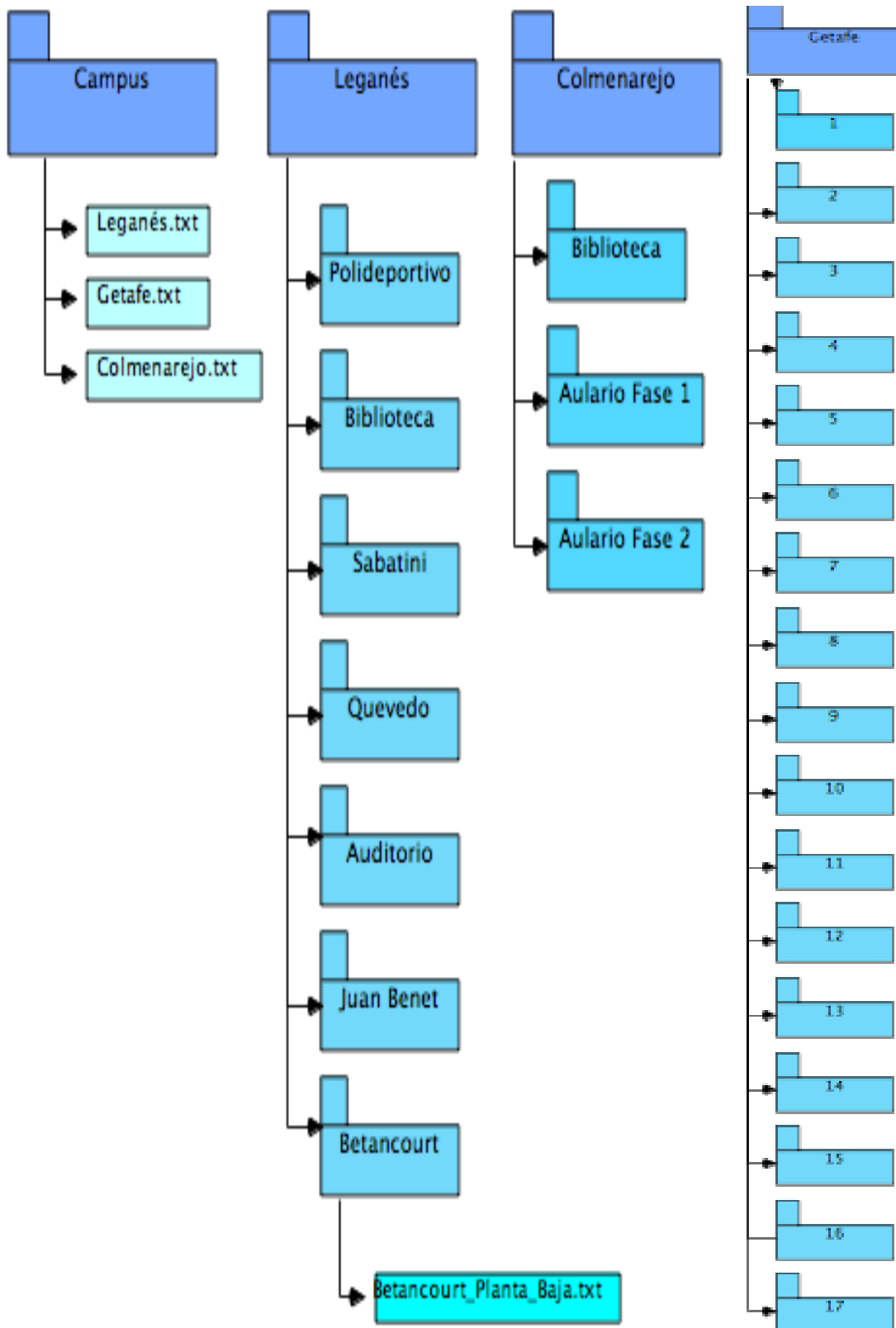
Figure 4.23 - Folders Structure

As we can see from Figure 4.23 , there are four main folders: Campuses, Leganés, Colmenarejo and Getafe.

In the Campus folder, there is a file for each Campus. In this file the different buildings presented in each Campus appear with their ID number, name and coordinates.

In Leganés, Getafe and Colmenarejo folders the different buildings inside them are included in one folder each. Then inside the buildings folder, there will be one file for each floor inside it. The structure that these files follows is:

Campus/Building/<Building>_<Floor>.txt

For example, in Leganés/Betancourt there is a specific file for the ground floor of this building and the file is called Betancourt_Planta_Baja.txt.

5. APPLICATION TESTING

In this chapter unit and integration testing are defined, which are used to verify the correct operation of the application.

Software testing is a series of software evaluation process which aims to provide independent and objective information about the quality of the product to the customer.

5.1. UNIT CASES

To test the correct operation of the application some unit test have been designed to test the functionality of the components that incorporate the application. In the XCode project created to implement the application a new module with unit tests was added. The author have followed the steps for setting up and creating unit tests provided by Apple [32]. The approach followed to define the corresponding unit tests was to test if the user interaction is completed.

The unit cases will be distributed into the different main functionalities groups: Health Centers, First Aid, Emergency Exits, Alerts and Emergencies Call. The torch functionality and the Augmented Reality won't be possible to test as the iOS simulator does not provide with a camera service.

Inside these groups it will be possible to find two different techniques: Logic or Application tests. The Logic tests will check the correct functionality of a unit of code by itself, not in the Emergencies app. And the Application tests will check units of code in the context of the Emergencies Application.

5.1.1. HEALTH CENTERS

The Health Centers tests will be divided into Inside Health Center, Outside HC and User's Group.

5.1.1.1.   Inside Health Center

The first series of tests are designed for *InsideHealthCenterController* class that is responsible for managing the health centers inside the University, providing telephone number, location and timetable.

It has been proved that the class stores correctly the internal data regarding telephone and location, the timetable and then the information is retrieved correctly. The tests conducted have been:

- Test **testInsideHCIsCorrectLocated**: It is considered correct if the application retreives properly the center coordinate.
- Test **testInsideHCCorrectCall:** It is considered correct if the application retreives properly the center telephone.

- Test **testInsideHCTimetableLoaded**: It is considered correct if the application loads properly the timetable text view.

The result of the test battery has been satisfactory, properly storing and retrieving data from the *InsideHealthCenterController* class configuration. In Figure 5.1the result of the test run with real data is shown.
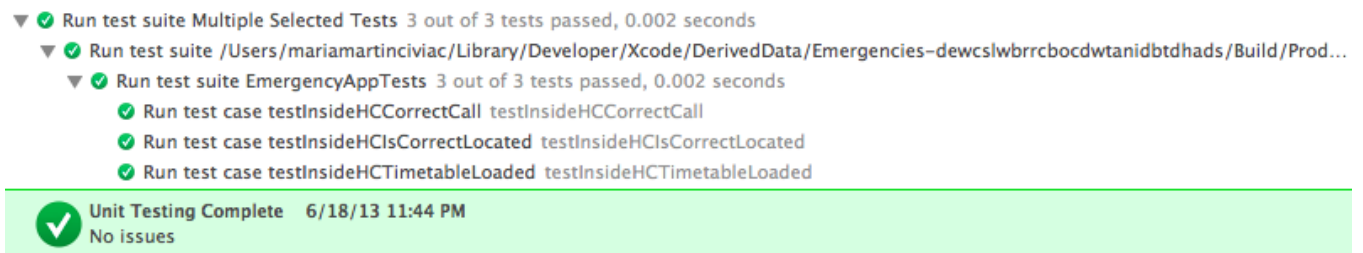
Figure 5.1 - Inside Health Center Test

5.1.1.2.   *Outside Health Centers*

In order to test the *OutsideHealthCenterController* class, it has been proven that some of the coorindate locations are right and also that the map and the top bar are loaded correctly. The tests conducted have been:

- Test **testOutsideHCIsCorrectLocated**: It is considered correct if the location, address, telephone and names are the same as the ones loaded for the Fremap Hospital.

- Test **testBarLoaded**: It is considered correct if the top bar where the buttons are included is correctly loaded.

- Test **testMapLoaded**: It is considered correct if the view loads correctly the map view.

- Test **testButtonsLoaded:** It is considered correct if the buttons are loaded correctly inside the label in the view.

The result of the test battery has been satisfactory, properly storing and retrieving data from the *OutsideHealthCenterController* class configuration. In Figure 5.2the result of the test run with real data is shown.

Figure 5.2 - Outside Health Centers Test

5.1.1.3.   User's Group

In order to test the *ColectiveHealthCenterController* class, it has been proven that the table and the text views are loaded correctly. The tests conducted have been:

- Test **testTableLoaded**: It is considered correct if the table is loaded correctly in the view.

- Test **testTextLoaded**: It is considered correct if the text view is correctly loaded.

The result of the test battery has been satisfactory, properly storing and retrieving data from the *ColectiveHealthCenterController* class configuration. In Figure 5.3the result of the test run with real data is shown.
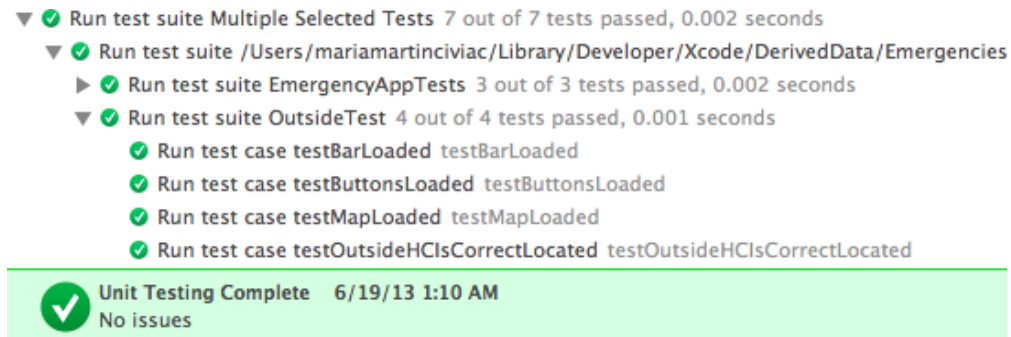

Figure 5.3 - User Group Health Center Test

5.1.2. FIRST AID

The First Aid tests will be divided into Defibrillators and Manual.

5.1.2.1.   Defibrillators:

In order to test the *DefibrillatorController* class, it has been proven that the video and the schema views are loaded correctly. The tests conducted have been:

- Test **testMPMoviePlayerControllerLoaded**: It is considered correct if the player is loaded correctly in the view.

- Test **testVideoStored**: It is considered correct if the video file is correctly stored in the application.

The results of the test battery have been satisfactory, properly storing and retrieving data from the *repvideo* class configuration. InFigure 5.4and Figure 5.5the results of the tests run with real data are shown.
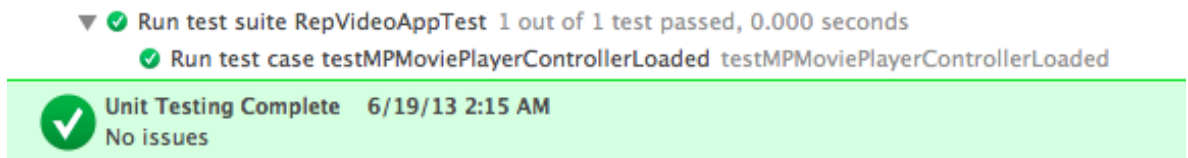
Figure 5.4 - Movie Player Test
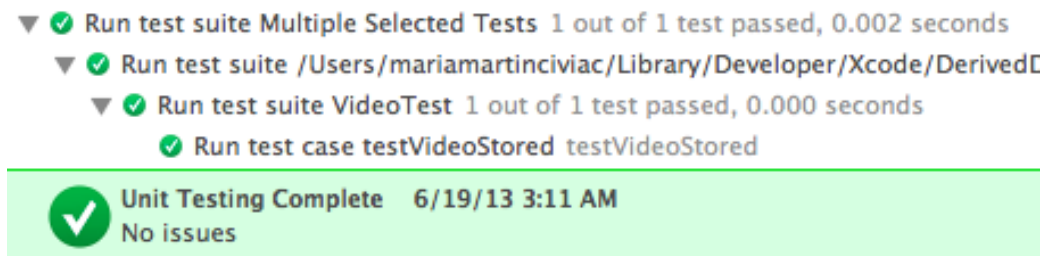
Figure 5.5 - Video Storage Test

5.1.2.2. Manual:

In order to test the *ManualController* class, it has been proven that the table is loaded correctly. The test conducted has been:

- Test **testTableLoaded**: It is considered correct if the table is loaded correctly in the view.

The result of the test battery has been satisfactory, properly storing and retrieving data from the *ManualController* class configuration. In Figure 5.6the result of the test run with real data is shown.
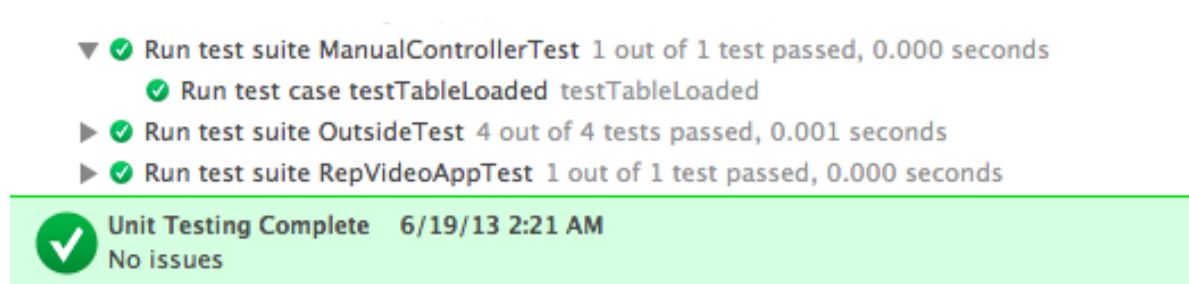
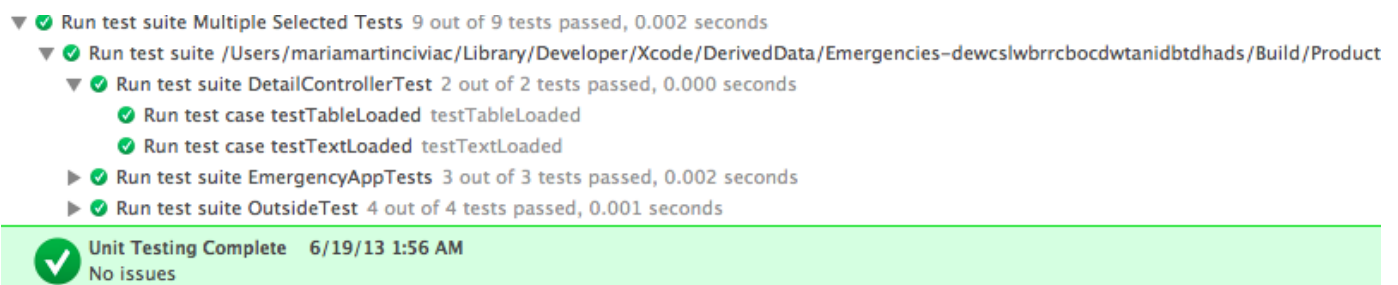**Figure 5.6 - Manual Controller Test**

5.1.3. EMERGENCY EXITS

As the Augmented Reality cannot be tested in the iOS simulator, the coordinates data will be checked instead. In order to test the emergency exits repository the test conducted have been:

- Test **testEmergencyExitsInfoIsSaved**:It is considered correct if the data structure responsible for storing the emergency exit of the place is not empty.

The result of the test battery has been satisfactory, properly storing and retrieving data from the repository. In Figure 5.7the result of the test run with real data is shown.
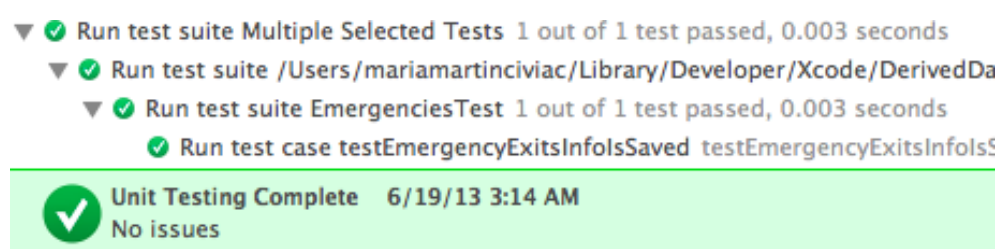
Figure 5.7 - Emergency Repository Test

5.1.4. ALERTS

Both Logic and Application tests will be performed in this section. Firstly, it will be checked that the table view loads correctly so the information can be stored there, also the tool bar and text. Finally it will be checked that the connection with the web service is successful and if the information received is not nil. The tests conducted have been:

- Test **testTableLoaded:**It is considered correct if the table is loaded correctly in the view.

- Test **testToolBarLoaded:**It is considered correct if the tool bar is loaded correctly in the view.

- Test **testTextLoaded:**It is considered correct if the text is loaded correctly in the view.

- Test **testGetAlertParametersReception:** It is considered correct if response from the server when alerts requested, result of the request is not null.

- Test **testExternalParametersCorrectRequestDone:** Is considered correct if the app has been able to correctly interpret the request parameters. As we have an alert request, the application will obtain results concerning alerts and the application should be able to classify this information. In this test it will be checked that every alert has at least an ID, text and date.

The result of the test battery has been satisfactory, properly storing and retrieving data from the web service. In Figure 5.8 and Figure 5.9the results of the tests run with real data is shown.
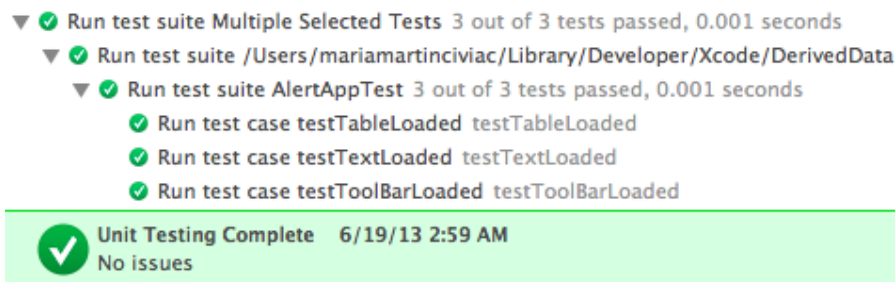

Figure 5.8 - Alerts Application Test
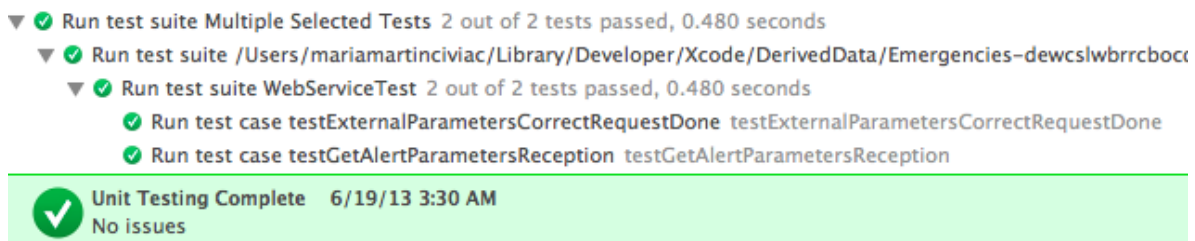
Figure 5.9 - Alerts Logic Test

5.1.5. EMERGENCY CALL

The user is able to directly log a call from the main view to the Emergencies UC3M service, this test will check if the telephone number is correctly stored and retreived. The test performed has been:

- Test **testEmergencyNumberCorrect:** The application tests if the main view stores correctly the Emergencies service telephone number.

The result of the test battery has been satisfactory, properly storing and retrieving data from the *EmergenciesMasterViewController* class. In Figure 5.10the result of the test run with real data is shown.

▼ ⊘ Run test suite Multiple Selected Tests 1 out of 1 test passed, 0.002 seconds
   ▼ ⊘ Run test suite /Users/mariamartinciviac/Library/Developer/Xcode/DerivedData/Emergencies–dewcslwbrrc
      ▼ ⊘ Run test suite EmergencyNumberTest 1 out of 1 test passed, 0.000 seconds
          ⊘ Run test case testEmergencyNumberCorrect testEmergencyNumberCorrect

✓ **Unit Testing Complete**   6/19/13 2:51 AM
No issues
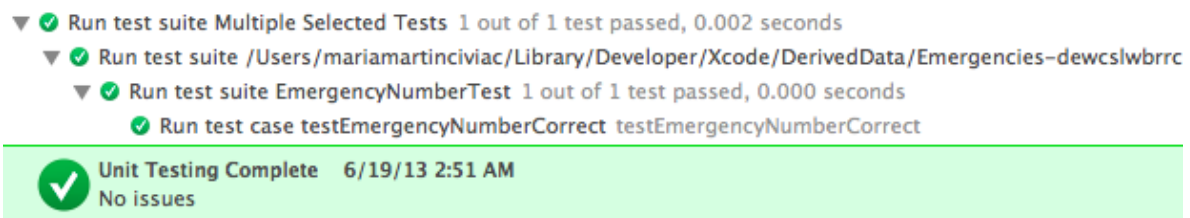
Figure 5.10 - Emergency Call Test

5.2. INTEGRITY CASES

UC3M Emergency application communicates with an external server which is in charge of performing the query request about alerts, with operating system frameworks and third-party libraries that support the functionality of the app.

From the beginning of the app development the integration between different components was performed so integration tests have not considered at the end of development.

6. CONCLUSIONS AND FUTURE LINES

This chapter includes the conclusions obtained during the development of the project which are about the project environment and the author's experiences in its development. It also indicates some future lines which include new features that can be incorporated into the application for its improvement.

6.1. CONCLUSIONS

Nowadays humans feel the need to know information about the environment around them andother external environments, in order to process it into knowledge that accrues the improvement of daily life. Inside this information need, we can distinguish many different ways of information, where we can include all kind of emergencies data. There is a lack of this specific type of information, totally needed in many situations where life can be saved thank you some first aid knowledge or localising emergency exits among others.

The bachelor thesis is part of a research line recently opened at the University Carlos III of Madrid: developing apps for the improvement of university life. It has been promoted by the Software Engineering Research Group, Department of Computer Lab and has the collaboration of the Computing and Communications, Corporate Communications Service, the Vice President of Infrastructure and Environment and the Department for Culture and Communication. The cooperation of the people involved in each group has been instrumental in making available to the university community at UC3M the first version of an application ecosystem to improve and facilitate daily life in college.

The developed application, Emergencies UC3M, is part of the research done for improvement of university life and risks inside the University. It is intended to cover recurrent needs of the members of the university community as to the location of emergency exits and health centers as well as first aid knowledge and alerts broadcasting. This is a common need in all environments with human beings on it, as an emergency can occur anytime. Thanks to the work done to develop a repository that stores a correspondence between the UC3M and geographic coordinate, bound to work to adapt the emergency exits of the University, has taken a big first step to provide this exits location service.

The author obtained all the needed information from the different University services and classified them accordingly. In the case of the first aid information and health centers, the information was previously classified and then the author designed the different views needed for each data entry. According the emergency exits, they were obtained manually one by one from the maps provided by UC3M and stored in a repository. Also a webservice was created to perform the log of alerts in an efficient way and present them in the device so the user is aware whenever it happens.

The possibilities of the technology used have been well used since the development of the application is not limited and includes a wide variety of emergency information that is actually not included in any application, not even in a University scope. Emergencies UC3M is in fact, the first University application that includes extra emergency information apart from the alert service provided for most of the University application. All the first aid, health center and exits information add value to the application, turning the application into a complete emergency app.

With the knowledge provided to users with the combination of educative and action emergency information, they can quickly locate the important emergency places, identify them thanks to the alert service and act accordingly thanks to the educative first aid information. By providing both types of information in the same application, the UC3M assures that in case of any emergency raises, the app could improve the situation in case the user decides to use it.

The difficulties carried out in the project could be classified into those inherent in the technology used or in the actual development process. The first broken barrier has been learning to use the development environment, XCode and learn and understand the programming language, Objective-C and the iOS development philosophy. XCode environment is fairly intuitive to use, finding the biggest problems when adding and configuring development and distribution certificates required to program, testing and sending the app to the AppStore for distribution.

The Apple development philosophy can be summerized in developong simple applications based on development guides provided to developers. It is important to follow the main guidelines as Apple may not approve an application as happened to the app container for UC3M iOS in iPhone and iPod Touch. Developers should also take care of the internal design of the application and try to use design patterns as much as possible, like in most application developments. iOS application development is meant for designing them using the design pattern Model View Controller, making use of the new feature Storyboard. MVC is now fairly widespread pattern and fits well with mobile application development but how to apply the pattern in iOS, coupled with design features of Objective-C language, raises some challenges to be overcome to apps where your design does not apply to the MVC pattern. The author luckily had previously worked with C and Java, so had object-oriented concepts together with structures and memory management.

Concerning the difficulties encountured while developing the application two different issues raised. Firstly, it was very difficult to get accurate information about the emergency exits from a physical map. The author needed to digitalize all that information, trying to achieve the most accurate possition possible in Google Maps. The UC3M Maps obtained were last edited in 2007, and as some Campus has grown or have been modified since then, either the maps should be renewed or the exits carefully reviewed. Also the design of the alerts service was complex to perform, in order to achieve the best and most usable service to the user. But at the same time, it was important to order and classify all the emergencies information in order to get a user-friendly application.

The author's experience during the development of the project has been very positive as well as educative. She has been able to develop the project into a real work environment and the help and support received from teammates and supervisors has definitely been rewarding. In addition to this experience, the motivation of learning new technologies is always challenging and also the application on real human beings needs. Furthermore, the motivation is intensified by the spirit pursued on the research team at the Computing and Communication service and the use of emerging technologies used to solve the problem, like Augmented Reality. Mobile technologies have experienced a quick expansion very important from the past five years and a continual exponential increase is expected for a short future. Mobile devices are changing the way information is processed and they will set a milestone in the history of the knowledge era.

6.2. FUTURE LINES

After the conclusions reached by the author while developingthe project, some future directions are proposed for the work to bring more functionality and accuracy to the app developed.

6.2.1. EMERGENCY EXITS LOCATION IMPROVEMENT

The Improvement of locations inside the University, or indoor location, is a problem institutions inside the University are currently working on.

The most precise location technology used is the satellite system provided by GPS service. The error found while indicating the position of an emergency exit is quite small if you are outside of a building, but big enough if you are inside one, which will be the case of an emergency. In some tests conducted, sometimes the application places the user outside the building even if they were inside.

In the application, the user's location is obtained by GPS satellites. There are some alternatives that the application could make use of in order to improve the user's location:

- **Georeferencing network routers wifi UC3M**: This solution suffers the wifi signal distortion when going through walls. The aim would be triangular wifi signals closer to the user to get the exact point. Also, using the wifi routers the application would be able to localize the exact location of a user for emergency exits, without needing the user to indicate building and floor.

- **Using RFID devices**: It can be considered to deploy beacons containing RFID's chips in strategic locations on campus. There are already mobile devices that incorporate RFID readers, so each time the user passes through one, the application will warn of where you are and where is the closest emergency exit. The disadvantage of this alternative is the investment to be made in the deployment of the beacons.

- **Using QR codes**: It is based on the same principle as the use of RFID's, but with the disadvantage that the location is not performed automatically. It would be possible to give a precise location because doing QR codes is cheap compared to RFID beacons and they could be placed in many places of UC3M. The user would read the QR code app and the app would show in a plane their location and their closest emergency exit form there.

- **Google localization**: There is actually a project ongoing in the University according to Google's localization. The University will facilitate Google all the rooms identifiers so a user can localizate places inside the University making use of Google Maps.

- **UC3M Maps**: Whenever a device does not support Augmented Reality, the application shows a map with the emergency exits on that floor. If UC3M Maps would include all the emergency exits on the three Campuses, the application would be able to present these exits with UC3M Maps instead of Apple Maps, giving a better interface and more accurate location.

It would be convenient to assess the advantages and disadvantages of each alternative depending on the user needs and the budget available to implement it.

6.2.2. REPOSITORY MANTAINMENTAND STORAGE

There are some reforms currently on going in the University and it is going through an expansion progress. For the new reforms and new buildings like Puerta de Toledo, it would be necessary to include to the emergency exits repository and modify the code accordingly. Also, after the users have reported some localization errors or suggestions, it would be necessary to update some emergency exits coordinates.

The ideal alternative is an homogeneous communication web service with the location of emergency exits in a repository that is updated regularly. The repository could be included in the geolocation UC3M database so the application does not need to be updated whenever a modification is required.

6.2.3. PUSH NOTIFICATIONS SERVICE

As explained in Section 3.2.4 regarding the Operational Environment of the application, Emergencies UC3M currently makes use of a third-party software component called APNS-PHP [27]. This library connects the application with the Apple Push Notification service so the device can receive a push notification whenever a new alert is logged. The problem with an external component is that you cannot guarantee if an alert was received. In addittion, the Android team would make use of another library as this one is focused just on iOS and APNS.

The Software Engineering Lab from the Computing Department are currently developing a common web service for Android and iOS that would give homogeneity to the system and to that specific functionality.

6.2.4. SENSITIVE INFORMATION ENCRYPTION

In the Emergencies web service data base there is a Personas table where the user names and passwords are stored. This table main goal is to check the administrator users of the systems, this people will able to log new alerts in the system through the emergencies website. The action form will be proteceted with a session variable that will indicate if the user has been previously logged in and validated or not, avoiding a direct access to an alert publishment.

The only sensitive information found so far in the system are the user passwords, which are stored in plain text in the data base and they could be accessed by malicious user using a specific attack. It would be convenient to store the password encrypted in order to make it personal and secret.

6.2.5. DEFIBRILLATORS ALTERNATIVES

Currently the application gives defibrillators location via UC3M Maps when the user selects the defibrillator location. And, in case the user does not have UC3M Maps installed, a detailled view appears with instructions on where to find the different defibrillators depending on the Campus.

iOS Maps could not be used as an alternative as it was complex to get the precise coordinates of the defibrillators. In a short future, UC3M will include places of interest in Google Maps so it would be a good idea to give defibrilators' locations via Google in case UC3M Maps is not installed.

BIBLIOGRAPHY

[1] *Test Flight.* Available: https://testflightapp.com. Last accessed 15[th]May 2013.

[2] ALONSO, Juan Carlos; GARCÍA, Javier; AMESCUA, Antonio. "The use of mobile applications in Spanish Universities, current status and future challenges". Available: Actas de la International Conference of Education, Research and Innovation (ICERI), (Madrid, Spain 14th-16th November 2011).

[3] MIT University (2012). MIT Mobile (version 3.3.4) [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/us/app/mit-mobile/id353590319?mt=8

[4] Stanford University (2013). iStanford (version 5.6) [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/us/app/istanford/id292922029?mt=8

[5] Hardvard University (2013). Hardvard Mobile (version 2.1) [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/us/app/harvard-mobile/id389199460?mt=8

[6] Harvard University (2010). MessageME. Available: https://messageme.harvard.edu. Last accessed: 18th May 2013.

[7] Westminster University (2012). iWestminster (version 5.0) [iOs mobile application] Retrieved from AppStore: https://itunes.apple.com/es/app/iwestminster-university-westminster/id410340418?mt=8

[8] *Healthagen.* Available: http://www.healthagen.com. Last accessed 16th May 2013.

[9] Healthagen (2010). iTriage (version 4.8) [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/es/app/itriage-health-doctor-symptoms/id304696939?mt=8

[10] Mutua Asepeyo (2013). Asepeyo (version 1.3). [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/es/app/asepeyo/id474437296?mt=8

[11] Cruz Roja Española (2012). Emergencias (version 1.0) [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/es/app/primeros-auxilios-por-cruz/id568379347?mt=8

[12] Ignacio Zunino (2011). Madrid Emergency Maps (version 1.0) [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/us/app/madrid-true-emergency-maps/id461390778?mt=8

[13] Tenet HealthSystem SL (2013). Saint Louis University Hospital (version 1.5) [iOS mobile application] Retrieved from Appstore: https://itunes.apple.com/es/app/saint-louis-university-hospital/id439653856?mt=8

[14] Eugenio Herrero (2013). SafetyGPS (version 3.0.2) [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/es/app/safetygps-v3/id474822425?mt=8

[15] University of Louisville (2011). Card Safety (version 1.0) [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/es/app/card-safety/id428942873?mt=8

[16] University of Leeds (2013). RRAPID (version 1.1) [iOS mobile application] Retrieved from AppStore: https://itunes.apple.com/gb/app/rrapid/id574407225?mt=8

[17] Layar B.V. (2013). Layar (version 7.2.2) [iOS mobile application]Retrieved from AppStore: https://itunes.apple.com/es/app/layar-augmented-reality/id334404207?mt=8

[18] Canalys. "Smart mobile device shipment exceeded 300 million in Q1 2013". [online document]. Available: http://www.canalys.com/static/press_release/2013/canalys-press-release-090513-smart-mobile-device-shipments-exceed-300-million-q1-2013_0.pdf

[19] App Annie. (2013). App Annie Index: Market Report Q1 2013. [online document] Available: http://blog.appannie.com/app-annie-index-market-q1-2013/. Last accessed 19th May 2013.

[20] McAfee. "McAfee Threats Report: Fourth Quarter 2012". [online document] Avaiable: http://www.mcafee.com/us/resources/reports/rp-quarterly-threat-q4-2012.pdf

[21] Dieter Bohn (2011). "iOS: A visual history." [online document] Available: http://www.theverge.com/2011/12/13/2612736/ios-history-iphone-ipad. Last accessed 22th May 2013.

[22] "iOS version history". Available: http://en.wikipedia.org/wiki/IOS_version_history. Last accessed 22th May 2013.

[23] "iOS technology overview". Available: http://developer.apple.com/library/ios/#documentation/Miscellaneous/Conceptual/iPhoneOSTechOverview/Introduction/Introduction.html . Last accesed 22th May 2013.

[24] "Programming with Objective-C" Available: http://developer.apple.com/library/mac/#documentation/Cocoa/Conceptual/ProgrammingWithObjectiveC/Introduction/Introduction.html#//apple_ref/doc/uid/TP40011210-CH1-SW1 . Last accessed 23th May 2013.

[25] Institute of Electronic and Electrical Engineers Press. "IEEE std 830-1993, recommended practice for software requirements specifications". December 1993.

[26]Apple Inc. (2012). pARK Library. Available: http://developer.apple.com/library/ios/#samplecode/pARk/Introduction/Intro.html#//apple_ref/doc/uid/DTS40011083-Intro-DontLinkElementID_2 Last accessed 8th June 2013.

[27]ApnsPHP: Apple Push Notifications Provider. Available:http://code.google.com/p/apns-php/. Last accessed 9th June 2013.

[28] Apple Developer. "iOS Human Interface Guidelines". [Online document]. Available in: http://developer.apple.com/library/ios/#DOCUMENTATION/UserExperience/Conceptual/MobileHIG/Introduction/Introduction.html . Last update 19/09/2012.

[29] Apple Developer. "App Review Guidelines". [Online document]. Available in: https://developer.apple.com/appstore/guidelines.html

[30]*Gliffy Onlie Diagrams*. Available: https://www.gliffy.com . Last accessed 18th June 2013.

[31]*Visual Paradigm for UML*. Available: http://www.visual-paradigm.com . Last accessed 18th June 2013.

[32]Apple Developers. "XCode Unit Testing Guide". [Online document], Last update 09/01/2012. Available in:
https://developer.apple.com/library/mac/#documentation/DeveloperTools/Conceptual/UnitTesting/00-About_Unit_Testing/about.html. Last accessed 19th June 2013.

APPENDICES

APPENDIX A
INSURANCES CLASSIFICATION

APPENDIX A   INSURANCES CLASSIFICATION

PAS/PDI		
MUFACE	**SEGURIDAD SOCIAL** (ver direcciones de Centros de Salud)	
	ENTIDADES PRIVADAS **SANITAS**: 902 102 400 **ADESLAS**: 902 200 200 **ASISA**: 902 010 010 **DKV SEGUROS**: 902 499 600 **IGUALITARIO MÉDICO QUIRÚRGICO COLEGIAL DE SANTANDER**: 942 229 600	
TRABAJADORES SEGURIDAD SOCIAL	**CENTROS ASISTENCIALES DE LA MUTUA: FREMAP** (ver direcciones de Centros Asistenciales)	
PERSONAL INVESTIGADOR EN FORMACIÓN (PIF)	**GETAFE** 91 696 8413 **LEGANÉS** 91 686 5389 **VILLALBA** 91 849 7430 **URGENCIAS 24 HORAS**: 900 61 00 61	
CATEDRAS DE EXCELENCIA	**GENERALI SEGUROS**: 902 400 300	
ALUMNOS		
1º Y 2º CICLO Y ALUMNOS DE GRADO	**CENTROS SEGURO ESCOLAR**. El alumno tendrá que pasar por la Oficina de Alumnos.	**SEGURIDAD SOCIAL** (ver direcciones de Centros de Salud)
MÁSTER OFICIAL Y DOCTORADO <u>MENORES</u> DE 28 AÑOS.		Centro más próximos concertado: **MADRID** Clínica Virgen del Camino (Pº de las Delicias, 150) Tfno: 91 468 28 61
MÁSTER PROPIO, MÁSTER OFICIAL <u>MAYORES</u> DE 28 AÑOS Y DOCTORADO <u>MAYORES</u> DE 28 AÑOS	**SEGURO DE REEMBOLSO (PRIVADO)**, se recomienda acudir a la <u>seguridad social</u> puesto que la cobertura es mayor.	En el caso de acudir a un <u>centro privado</u>, deberá abonar y solicitar factura médica a dicho centro para que luego el seguro a través de CEAES reembolse.
UNIVERSIDAD DE MAYORES		En el caso de acudir a un <u>centro privado</u>, deberá abonar y solicitar factura médica a dicho centro ya que tiene una póliza de reembolso.
ESTUDIOS HISPÁNICOS	**SEGURO PRIVADO** contratado por el propio alumno.	
ERASMUS Y MOVILIDAD NO EUROPEA	Con **TARJETA sanitaria europea**, acudir a cualquier centro de la **SEGURIDAD SOCIAL**. Si tuviera **SEGURO PRIVADO** donde él determine.	
BECARIOS		
BECARIOS PRÁCTICAS COMPLEMENTARIAS (Practicas extracurriculares)	**CENTROSSEGURO ESCOLAR**. El alumno tendrá que pasar por la Oficina de Alumnos.	**SEGURIDAD SOCIAL** (ver direcciones de Centros de Salud)
		Centro más próximos concertado: **MADRID** Clínica Virgen del Camino (Pº de las Delicias, 150) Tfno: 91 468 28 61
BECARIOS DE AYUDAS A MASTER (IMAS)	**CENTROS ASISTENCIALES DE LA MUTUA: FREMAP** (ver direcciones de Centros Asistenciales) **GETAFE** 91 696 8413 **LEGANÉS** 91 686 5389 **VILLALBA** 91 849 7430 **URGENCIAS 24 HORAS**: 900 61 00 61	
BECARIOS COLABORACION DE LA OTRI (IOTCOLAB)		
BECARIOS DE COFINANCIADAS (BACACOF)		
FUNDACIÓN		
TRABAJADORES	**CENTROS ASISTENCIALES DE LA MUTUA: FREMAP** (ver direcciones de Centros Asistenciales) **GETAFE** 91 696 8413 **LEGANÉS** 91 686 5389 **VILLALBA** 91 849 7430 **URGENCIAS 24 HORAS**: 900 61 00 61	
BECARIOS		
NO PREVISTAS EN LOS APARTADOS ANTERIORES	**SEGURIDAD SOCIAL** (ver direcciones de Centros de Salud)	

Table 0.1- Insurances Classification

APPENDIX B
PROJECT BUDGET

APPENDIX B   PROJECT BUDGET

Once the effort required to implement the Project is known, its cost is detailed in this section. First the costs associated with personnel responsible for conducting the application are calculated. The salary of the developers varies depending on the position which they hold.

In the staff related to the projectMaria Martin Civiac was included as the main developer of the application. Javier García Guzmán also because it is the tutor of the project and the meeting hours must be computed as well. And also David Santín was included as a Senior developer, because he has provided all necessary assistance to the author to get through the project. The staff cost has been as follows:

Staff	Category	Men/hour cost	Dedication	Cost
Martín Civiac, María	Junior Engineer	20	550	€11,000.00
García Guzmán, Javier	Senior Engineer	36	50	€1,800.00
Santín, David	Senior Engineer	36	10	€360.00
	Total			€13,160.00

Table 0.1 - Staff Cost

It should also be taken into account as expenses the cost associated with the project depreciation. In this case the amortization can be applicable to the desktop computer used for the project, the developer license and the mobile terminal used.

Is considered a useful lifetime for computers for 4 years, while for the mobile device 3 years life. The developer license is renewed annually.

The attributable cost was calculated using the following data:

- A = number of months from the invoice date on which the equipment is used
- B = deprecation period (48 or 36 months depending on the type of device)
- C = cost of equipment (excluding VAT)
- D =% use dedicated to the project

Given the above data, the chargeable cost is calculated by the following calculation formula amortization: A / B * C * D

The total cost associated with the depreciation is € 554.83 as the following table indicates:

Product	Months	Amortization Period	Price	Project Dedication	Costs
Mac Mini	7	48	649	100%	€94.65
iOS developer license	7	12	80	100%	€46.67
iPhone 3G	7	18	150	100%	€58.33
iPhone 4S	7	18	699	10%	€27.18
Total					**€226.83**

Table 0.2 - Amortization Costs

The final cost of application development score is the sum of the cost of personnel and depreciation costs. The total amount is € 13,386.83 (thirteen thousand three hundred and eighty six euros and eighty-three cents).

Budget	Cost
Staff Cost	€13,160.00
Amortization Cost	€226.83
Total	**€13,386.83**

Table 0.3 - Total Cost

María Martín Civiac

APPENDIX C
USER MANUAL

APPENDIX C   USER MANUAL

The purpose of this manual is to serve as a quick guide to start using the application Emergencies UC3M version for iOS devices.

1. WHAT IS EMERGENCIES UC3M?

Emergencies UC3M is an application designed and aimed to provide with emergency information in order to educate the university community, but at the same time, it provides useful location information in case of an emergency. The application will always be available in App Store for any iOS device.

Its main porpouse is to provide with action information in the three Campuses inside Universidad Carlos III. There are some specific information, like emergency exits and alerts that are specially oriented for the university community. But the first aid information, together with torch and health center location can be applied outside the University scope.

2. GETTING STARTED AND BASICS

Firstly, you must download the application by entering in the App Store, installed by default on the device, the name of the app: UC3M Emergencies. It is also possible to access the link to download the app via QR code made to that effect. The QR leads to a link that detects the operating system of the device and redirects to the appropriate app store.

2.1. MAIN VIEW

When you first open the app you will see the main application view. The user will need to first accept the push notifications alert view and the localization one, in order to properly locate the user in some of the functionalities of the system and also to send push notifications in case of an emergency.

The main view is composed by five different sections that will lead to different services inside the app: Health Centers Search, First Aid, Emergency Exits, Last Alerts and Torch.

María Martín Civiac

It will also be possible to directly make a call to the Emergencies service which is 91 624 99 99 and will be available all day long, every day of the year.

| 1 – Service Selection |
| 2 – Emergency call button |

Figure 0.1 - Main View Manual

2.2. HEALTH CENTERS

If the user selects the Health Center search, the application will provide with three different options: Health Centers Inside the University, Health Centers Outside the University or Health Centers according to the user's group.

In case the user needs information about **Health Centers Inside** the University, the first option will be selected and the Campus information will be presented in a new view as shown in the picture below. Once in the detailed view, the user will be able to call the center or see on the map. If the user has installed UC3M Maps, the center will be shown there. Otherwise, iOS Maps will be opened instead.

Figure 0.2 - Health Centers Inside the University Manual

In case the user needs information about **Health Centers Outside** the University, the following view will be presented. It has four different possibilities: Fremap, Hospitals Public Insurance, Public Insurance and Student Insurance. Every possibility has one or more centers that the user can check in the map. The user's position will be represented by the blue circle and the centers location will be represented with the red annotations. Once the user clicks an annotation, the name of the center and its address will appear on it. The user will also have the option to select the annotation in order to go to a detailed view with the telephone number and location.

Figure 0.3 - Health Centers Outside the University Manual

In case the user needs health center information regarding his **group** inside the University, the third selection will be chosen. Here, three different questions will be asked in order to get the right health center as shown in the picture below.

Figure 0.4 - Health Center According to the User's Group Manual

2.3. FIRST AID

In case the user selects the **First Aid** option, there will be information available for defibrillators and there will also be a First Aid Manual available for educational purposes.

If the **Defibrillators**section is selected, the user will have access to three specific information regarding their location, instructional video and some steps to follow.

Figure 0.5 - First Aid Defibrillators Index

The **location** of defibrillators inside the University will be opened in Maps UC3M. Otherwise, if the **video** is selected, an instructional video with subtitules will be presented.

Figure 0.6 - Instructional Video

Or, if the user wants to be guided through the **steps to follow** in order to use a defibrillator, these steps will be presented step by step in several views, like the one presented in the image below. The user will be able to go back to the previous step or go further to the following step at any time.

Figure 0.7 - Steps to Follow Manual

With an educational purpose or in case it is needed during an emergency in order to identify injuries or the action principles, a First Aid Manual is provided to the user. All the information available can be divided into Action and Measures. All the injuries are presented with definition, treatment and symtoms.

Figure 0.8 - Manual Options

2.4. EMERGENCY EXITS

If the user grants access to his/her location to the application, it wil be able to automatically locate the user's Campus, otherwise the user will need to manually indicate the Campus. Then the buildings are ordered by approximation, in order to help users that are not familiar with the building nomenclature. Also, the user will need to indicate the floor.

When the application already has an exact location of the user, it presentes a camera view with Augmented Reality where the emergency exits in that floor are presented together with the distances from the user's location to the exits. This distance will be updated every 2 seconds so the user is able to move towards the exits, getting updated information in real-time.

Figure 0.9 - Emergency Exits Views

María Martín Civiac

2.5. Last Alerts

If the user grants the application permission to receive Push Notifications, every time a new alert is logged, the user will get it through a notification if the app is not running. The user can manually update the alerts pulling down the table as show in the picture. The application lets the user see the alerts logged and the user can share the last one via Facebook, Twitter or by email.

Figure 0.10 - Last Alerts Options

2.6. Torch

The user will be able to turn off and on the torch light at any time using a switch button. Devices without flash will simply present the following view. In case the device has flash, it will activated once the user selects the status in ON.

Figure 0.11 - Flash View Manual

3. What to do in case of an Emergency?

In case of an emergency the emergency exits can be located depeding on the building where the user is and the floor. Also the health centers that are closer to the University Campuses can be located and shown in Health Centers Outside The University. At the same time, the user could make use of the torch functionality in case of a light outage or check the first aid manual in case there are injuries.

In order to log alerts in case of an emergency in the University, the user will need to contact the Emergencies service via telephone in order to report it. The Occupational Risks service or the Computing and Communication service will be in charge of logging the alert, and this alert will be spread out via push notifications sent to all the registered devices.

4. Contact Emergencies UC3M Service Desk

The Computing and Communications team wish you enjoy the app and get the most of it. For any questions or suggestions, please contact us at the email address sugerencias_apps@uc3m.es.Happy Emergencies!