

TRACK UP

Capturing user profile in a mobile platform – Final Year Project Thesis



Author: Sergi Aguilar Roquet

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Supervisor: Muthu Ramachandran

Supervisor Department: School of Computing,
Creative Technologies and Engineering

Bachelor Degree in Informatics Engineering

Specialization: Software Engineering

University: Leeds Metropolitan University

ABSTRACT – CATALAN

Avui en dia, amb l'augment de l'ús dels smartphones, serveis d'internet i la tecnologia en general, la vida de milions de persones ha canviat de manera substancial. Actualment, molta gent fa servir el mòbil cada dia, i aquests poden guardar informació personal dels usuaris. Per tant, els smartphones poden guardar informació personal i perillosa de l'usuari com poden ser hàbits, interessos i relacions socials. Aquesta informació és utilitzada per aplicacions i serveis per millorar la experiència d'usuari, ja que saber informació de l'usuari permet als dispositius anticipar-se a les seves accions. Tot i així, és sabut que aquesta informació no és només utilitzada per millorar l'experiència, sinó que també la fan servir empreses i governs per treure'n un profit, ja sigui econòmic o per altres motius. Aquest procés d'obtenir informació de l'usuari i guardar-la és anomenat "user profiling". Per tant, veient que "user profiling" té coses bones i dolentes arribem al dilema sobre si preferim personalització o privacitat ja que normalment una cosa va en detriment de l'altra.

L'objectiu del projecte consisteix en desenvolupar una aplicació android ensenyant a l'usuari quin tipus de informació personal són les aplicacions capaces d'obtenir. Per tant, l'aplicació espia l'usuari durant tot el dia i guarda valuosa informació a la base de dades. Finalment, l'usuari pot comprovar quina informació ha estat obtinguda durant els últims dies. Si ens fixem en el resultat final, l'aplicació desenvolupada s'està executant fins i tot quan l'aplicació està tancada i obté informació com la localització de l'usuari, les hores que l'usuari es lleva, els usos del telèfon, amics, l'historial de cerca, informació personal, etc.

El projecte inclou la planificació, recerca sobre el tema i la situació del moment, l'estudi dels requisits i del disseny del software, el desenvolupament de l'aplicació, la presentació del projecte i l'informe d'avaluació.

El desenvolupament va precedir per l'informe de recerca. La recerca consisteix en analitzar com "user profiling" funciona avui en dia i quina informació és important. D'altra banda, el document també analitza com el terme de "big data" ha canviat el món i com això pot ser perillós contrastant la opinió de diferents experts. A més a més, diverses maneres d'obtenir informació valuosa en dispositius android és estudiada a la recerca i utilitzada en el desenvolupament.

Finalment, l'informe d'avaluació inclou l'avaluació de cada part del projecte. Aquest informe analitza extensament la metodologia usada i la planificació del projecte, comparant les dates previstes a l'inici amb la seva modificació durant tot el procés. Per altra banda, la usabilitat de l'aplicació també és analitzada en aquest apartat, fent servir l'experiència i l'opinió d'alguns usuaris.

ABSTRACT – SPANISH

En estos días donde el uso de los smartphones, servicios de internet y la tecnología en general ha crecido rápidamente, la vida de millones de personas ha cambiado de forma sustancial. Actualmente, mucha gente utiliza el móvil cada día, ofreciéndoles la oportunidad de obtener información personal. Por lo tanto, los smartphones pueden saber información personal y peligrosa del usuario como hábitos, intereses y relaciones sociales. Esta información es utilizada por aplicaciones y servicios para mejorar la experiencia de usuario, ya que conociendo información del usuario los dispositivos se pueden anticipar a sus acciones. Aun así, es sabido que esta información no es solo utilizada para mejorar la experiencia sino que también la usan empresas y gobiernos para sacar un provecho, ya sea económico o de otro tipo. Este proceso de obtener información del usuario y guardarla es conocido como “user profiling”. Por lo tanto, viendo que “user profiling” tiene ventajas e inconvenientes para los usuarios, llegamos a la discusión sobre si preferimos personalización o privacidad, ya que normalmente una cosa va en detrimento de la otra.

El objetivo del proyecto consiste en desarrollar una aplicación Android que muestre a los usuarios que tipo de información suya son las aplicaciones capaces de obtener. Por lo tanto, la aplicación espía el usuario durante todo el día y guarda valiosa información en la base de datos. Finalmente, el usuario puede comprobar qué información ha sido obtenida durante los últimos días. Si nos fijamos en el resultado final, la aplicación desarrollada se está ejecutando incluso cuando la aplicación está cerrada y obtiene información como la localización del usuario, las horas que se despierta, los usos del teléfono, amigos, el historial de búsqueda, información personal, etc.

El proyecto incluye la planificación, el estudio sobre el tema y la situación actual, el estudio de requisitos y diseño del software, el desarrollo de la aplicación, la presentación del proyecto y la información de evaluación.

El desarrollo va precedido por el informe de investigación. La investigación consiste en analizar como “user profiling” funciona hoy en día y que información es importante. Por otro lado, el documento también analiza como el término “big data” ha cambiado el mundo y como eso puede ser peligroso, contrastando con la opinión de expertos. Además, también se estudian varias formas de obtener información en dispositivos Android que después se utilizan en el desarrollo.

Finalmente, el informe de evaluación incluye la evaluación de cada parte del proyecto. Este informe analiza extensamente la metodología usada y la planificación del proyecto,

comparando las fechas previstas en el inicio con su modificación durante todo el proceso. Por otra parte, la usabilidad de la aplicación también es analizada en este apartado, usando la experiencia y opinión de algunos usuarios.

ABSTRACT – ENGLISH

Nowadays, with the rise of the smartphones, internet services and technology in general, the life of millions of people has changed drastically. Specifically, people use smartphones every day and those store personal and important information about their lives. Therefore, smartphones may know some personal and dangerous user information such as habits, interests and relations. That information has been used by applications and services to improve the experience between the user and the device, because knowing user information allow the devices to anticipate the user's actions. However, it's known that that information is not only used to improve the experience, but is also used by companies and governments to take own advantage of the users information. The process to obtain user information is called user profiling. So, proved that user profiling has good and bad things, it creates the dilemma about personalization vs privacy.

My project's aim is to build an android application showing which kind of information the applications are capable to obtain from the user life. Therefore, the application tracks the user during the whole day and stores some powerful information at the database. Finally, the user can check which information has been obtained during the last days. Looking at the final result, the application developed is running even when the application is closed, obtaining information such as the whole day location, user wake up times, phone usages, friends, browse history, personal information, etc.

Therefore, the project includes planning and management, research about the topic and the moment situation, the study of requirements and software design, the application developing, the project viva and the evaluation report

The developing process is preceded by a research report. The research consists in analysing how user profiling works nowadays and which information is important in user profiling. The research also studies how the term big data has changed our world and how it may be dangerous, contrasting that some experts' opinions. In addition, different ways to obtain valuable information in android devices is studied in the research and used later in the developing process.

Finally, the evaluation report includes an evaluation of every part executed during the project. This report analyses extensively the methodology used and the project planning and management, comparing the dates planned at the beginning and modified during the project. Finally, the report also evaluates the application's usability to find problems, using the experience of some users and their opinion.

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1. Project Contract

FINAL PROJECT INDIVIDUAL AIM & OBJECTIVES

Title of my Project: Capturing user profile in a mobile platform

Aim of my Final Project: *[Type the Aim of the **individual** piece of work you will do (this may be your individual contribution to a team project). The Aim should be one or two sentences giving a high level outline of the project you will present at your Product Demonstration and Viva].*

To develop an Android application showing to the users what an application can know about them, their profile and their behaviour, combining data obtained from the phone and from cloud services.

Objectives of my Final Project: *[Type the Objectives of the **individual** piece of work you will do from initial research to final evaluation of your product including the assignment submissions (this may be your contribution to a team project). An Objective is an outcome you can complete in a set period of time. You should distinguish between project activities and assignment submissions. By meeting all your Objectives, you will achieve your Aim. It is suggested that you have between 8 and 12 Objectives – use bullet points to show each of the Objectives you intend to meet. When creating your detailed Project Plan, you are likely to sub-divide most Objectives into smaller tasks].*

- To research into user profile, augmented reality and other approaches
- To research how the field is at this moment
- To learn new technologies for user profiling
- To draft the Planning Documents, such as Project Charter, Project Scope, WBS, Gant Chart, Backup Plan, Communication Plan and Documents Standards
- To draft user requirements and use cases for user profiling app
- To draft the conceptual model and data model with UML
- To complete and submit the research report
- To implement and submit the prototype of an user profiling app
- To implement and submit the final user profiling app
- To write and submit the final report with the conclusions and problems of the app
- To prepare and show the presentation of the project

Specification of my Final Product: *[A Product Specification in as much detail as you can provide, also indicating the source of the specification and any uncertainty or options which are not yet decided].*

Develop an Android application using the Android Eclipse SDK. The application will obtain all the possible data about the user from the phone, such as location, friends, notes or contacts, and from the cloud services, such as Facebook or Google. Finally, the application will show to the user the amount of data obtained using an interactive way, probably a facial composite. Advising if the user has to have more care about his data, probably, simulating the percentage of discovered.

Rationale: *[Explaining your choice of Project and its background (suggested length 100 words)].*

Nowadays, the raise of the smartphones, internet services and the technology in general have changed the live of the millions of people in the world. Today, a lot of people around the world, almost everyone in the rich countries, have smartphones, use them every day and keep in their memory and services a lot of information about them.

How it is known, the smartphones and their applications try to know the user and know his behaviour to improve the interaction with them. Obviously, it makes the things easier and more comfortable for the user. However, the knowledge that the smartphones have about the user is not always an advantage for the user, the main problem is that the users don't know what the smartphone and his applications know about them and what they do with this knowledge. This brings the users to make an effort to trust the applications and believe that their data is sure. But, who knows?

I'm really interest about this topic, at the same time as worried. My aim is to learn how the smartphones obtain this information and behaviour from the user and demonstrate the users that the smartphones are really useful and knowing about the user helps, but this is also dangerous and requires care about it.

RESEARCH

Title of my Research Report: *[this is the title of the Research Report you will submit on or before 8 December 2013 – see Modules Guide, Assessment, Part 2 – your research should be directly related to the aim of your Final Project – it may help you if you formulate a question that your research will answer].*

Critical review of user profiling techniques.

Outline of my Research: *[type an outline of the individual Research you will do during Semester 1 – include both your planned literature review (with references) and any practical research you will complete].*

Mainly, the research will be centred in user profiling, investigating which information can be obtained from the user and how is this information usually treated in order to give more personalization to the user. In addition, the research will include the dangers and benefits for the user and the obvious dilemma about personalization against privacy.

User profiling make the interaction between the applications and the users more comfortable and easy, and turns into better results. We can see it in the real life, for example, if we go to buy a glasses, if they have knowledge about us, such as our optical problem and how we want the glasses, the action of purchase will be easier and faster. The same thing happens with the mobile applications and online services.

This knowledge is also used for the advertising companies. Nowadays, the mobiles and applications are an easy and fast way to advertise products and services to the user. The information about the user is really important and valuable to provide the user more personalized ads.

All of the above makes us ask questions to ourselves. Is it dangerous for us? Obviously, everyone want their life more comfortable, but is this the price we have to pay? Probably now it is not a big problem, but can it be a problem in the future and affect to our freedom? The only clear thing is that it brings a lot of benefits to all, but we have to be careful.

In addition, the research will include the necessary information about how to access to some hardware devices in android language, such as camera or GPS position, how to access information stored in the mobile and how to access some services using their API.

Finally, the research will include the plan of the implementation and the specification of the product, including the requirements, use cases and the conceptual and data model.

EMPLOYABILITY SKILLS ANALYSIS

Review the skills you believe necessary to complete your Project and a range of job advertisements to ascertain the skills sought after by employers in the industry you plan to enter after graduation. Rate each of the skills identified against skills you possess at the start of the Project. Identify methods to develop those skills in which you are weak – you should include these as a skills development plan within your overall project plan. At the end of the Project reflect on your progress in developing these skills.

Use the following to rate your skills: [5 – skill fully developed to a professional level (rarely achieved until you have worked for a few years); 4- skill well developed and used with confidence; 3 – skill developed but used with limited confidence; 2 – skill partially developed so used with little confidence; 1 – weak in this area and in need of significant development; 0 – don't know what this means]

Employment area: *Enter the industry area you currently plan to enter after graduation*

Identified Skills <small>(examples are given to start you off – delete any which do not apply and enter your own)</small>	Rating [0 – 5]	Development method
<ul style="list-style-type: none"> Expression in English 	2	Studying English by myself and in a course
<ul style="list-style-type: none"> Data collection and dissemination 	4	Working hard in the research

• Analyse and report on a topic	4	Searching a lot of information about the topic
• Report writing	2	Improving my level of English
• Ability to work as part of a team or independently	4	Dividing the tasks in smaller tasks and concentrating to each one of these
• Knowledge about android	3	Researching about the language
• Memory of past modules	3	Looking back and clarifying ideas from internet and notes

RESOURCE REQUIREMENTS

The hardware and software I require to complete my Project

successfully: *[List, in detail, the hardware and software you require to complete your Project – it is important that you have access to the necessary resources – indicate against each item whether you intend to use resources supplied by the **Faculty**, by you as an **individual** or by some **other organisation**].*

Item (Hardware or Software)	Source (Faculty, own or specified other organisation)
• Computer	Own
• Android smartphone	Own
• Eclipse and plugins	Other organisation (Eclipse, Free)

2. Project Scope

2.1. Introduction

This project will be developed in an individual way. The project will be supervised by a tutor. After each task of the project, this task will be discussed and analyzed between the member and the supervisor.

The tool used to develop the android application will be eclipse. The language used will be android 4.3.

Because of this is an individual project, the way to develop and plan the project will be easier. The developer does not have to alert to anybody if he changes the code. So, this means that any kind of tool to share code can be avoided.

There will not be a limit about different kinds of data the application can obtain. Therefore, it will depends on the research and the project status.

There will not be any specific cost in the project. The only cost will be the time needed by the member.

The deadline of the final project cannot be changed. If some task has not finished in the time specified by the grant chart, pending tasks have to be executed faster. In addition, if some change on the product has to be applied for any reason, another quick iteration can be added. Therefore, this means that if another iteration is added, pending tasks have to be executed faster.

2.2. Methodology Plan

- The development of the project will be iteratively. There will be two iterations:
 - The first iteration will consist in developing the product prototype. The product prototype will be able to get some knowledge(less than the final product) about the user and show it.
 - The second iteration will show the information in a better way for the user and also more information than the first iteration.
- Which knowledge will be covered by the first and second iteration is not determined yet. That will also depend on the research.

2.3. Members

- Sergi Aguilar: Architect, Analyst and Developer of the project.
- Muthu Ramachandran: Supervisor.

2.4. Deliverables

- Research Report: Sunday 20/10/2013
- Product Prototype: Thursday 07/11/2013
- Final Product: Sunday 24/11/2013
- Evaluation Report: 10/12/2013

Final Presentation: 10/12/2013

3. PROJECT CHARTER

3.1. Mission

- Show to the society and users which kind of information can be obtained from their mobiles phones and tablets, talking about their profiles and lives.

3.2. Mainly Stakeholders

- User: Person who uses the application in his mobile.

3.3. Secondary Stakeholders

- Companies that use “user profiling”: Companies that obtain information about the users and want to obtain the maximum information possible.
- Society: Indirectly, the way to use the applications and services and the care of the society and their citizens about their data could be affected.

3.4. Objectives

Stakeholders	Objectives
User	To learn which information the applications can obtain about him in less than a month.
Society	Make that more than 100 users have more care about their privacy in mobile phones in less than a year.

3.5. Deliverables

- Research report about “user profiling” in mobile platforms
- Product prototype: first sample of the product
- Final product
- Evaluation report

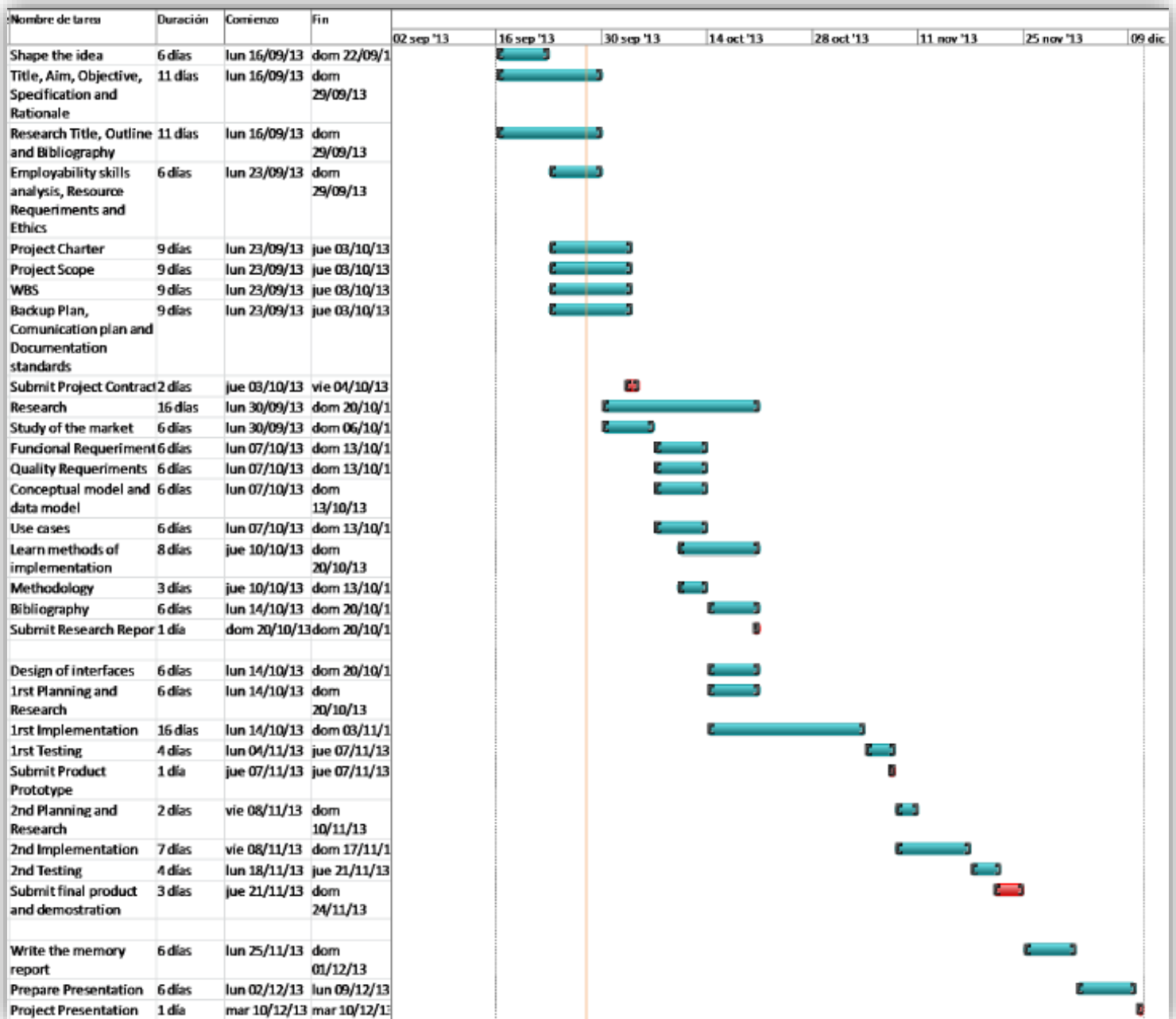
3.6. Communication Plan

- Meeting on Tuesday every week or every two weeks with the supervisor of the project. We can meet others days occasionally if it is necessary.

3.7. Backup plan

- This project just have one developer, so it is not necessary to make a complex backup plan. Each change will be saved on the personal computer and every new version will be saved in an external memory.

4. Gant Chart



5. Research Report

Abstract: This research focuses on user profiling in mobile phones, analysing the information that is looked for and the methods to obtain this information. User Profiling in mobile phones is a way to obtain information, with various useful fields. That information can be obtained in mobile phones using offline data, sensors and online services. In addition, a lot of information is stored and kept by companies and governments, defining the term big data and making it a big potential and threatening our privacy. All above described brings us to the doubt about what we prefer, personalization or privacy.

5.1. Introduction

During the last few years, our life has changed completely, mainly because of the technology. Smartphones, tablets and other electronic devices have been introduced quickly in our lives. Nowadays, these devices help us to solve little daily problems day after day. Most of us bring our mobile phones with us 24 hours every day and wherever we go. In addition, people store a lot of information in these devices or even in cloud services. For all this, I would even say that if we destroyed all the electronic devices instantly, a lot of people would suffer a crisis.

This need for the technology described above open plenty of chances to the companies talking about offering personalized services to the users and obtaining information of them. The large amounts of information stored by the companies or organizations about their users and how they use this information is called big data. A lot of applications and cloud services have raised the last few years, helping our lives and making them easier. These applications and services have begun to know about us, knowing our preferences, behaviour and actions in order to offer us a more comfortable service. The process of knowing about the user to offer a better service is known as “user profiling”.

“User profiling” is really useful as it can offer us a better service. We can see it in the real life, for example when we go to buy glasses, if they have information about us, such as our optical problem or how we want the glasses, the purchase will be easier and faster. In the optical shop they have a personal file with the customer’s details. “User profiling” uses the same principle.

However, not everything about “user profiling” is an advantage, sometimes applications and services obtain the user’s information by tracking or spying them. Therefore, some information is being stored for the applications whilst the user thinks that the information has not been obtained. Finally, the user doesn’t know what apps and companies do with this information. Is it only used in order to proportionate a better service to the user? Do the companies sell this information or it is just treated by machines and deleted when it is not necessary anymore? Some of these questions and doubts open the discussion about personalisation against privacy.

5.2. Big Data

Big data is a term that references to the systems who manipulate a big amount of information and how they use it. Big data also references how the information is collected, analysed and interpreted. How Nunan and Di Domenico pointed, during the last years, the price of storing information has reduced drastically at the same time data volumes have increased (Nunan, D. and Di Domenico, M., 2013). That brings an opportunity to online companies to keep the data. This amazing amount of data stored in the web and services around the world stores information of all internet users and even information about non internet users. Furthermore, with the growing of the social networks, the information left by us involuntarily when we use the web seems not to be enough for us, as we share things of our lives voluntarily making the job easier. However, big data also have benefits, having the chance to offer a better services to the users using that information.

On its dark side, big data is known for giving companies the chance to profit with their costumers' information. Nowadays, this information is very valuable, possibly being sold to other companies such as advertising companies or even governments. Even those companies that do not currently sell access to their data stores could themselves be potentially sold in the future, and policies for the use of data changed (Nunan, D. and Di Domenico, M., 2013). However, Alessandro thinks that we can have the benefits of big data by protecting privacy, as there are examples and technologies such as PGP or TOR, but these technologies imply a shifting of cost and revenues between data holders and data subjects, which is why, perhaps, we do not hear more about them (Acquisti A., 2013).

For example, how Malte Spitz assured in 2006, the EU tabled a directive that says that each phone service in Europe has to store a wide range of information about the users, such as who calls whom or where you are, for 6 months (Spitz, M, 2012). If you have access to all this information, you can see what your society is doing and control your society (Spitz, M, 2012). Few would argue that this information has to be collected to control the terrorism, such as Richard Kemp, who opined that we cannot ignore the unknown terrorists, and in collecting information, the intelligence services have no choice but to collect material that has nothing to do with terrorism (Kemp, R., 2013). However, this information could be used for the governments not just to control the terrorism, but also to control each citizen and the possible social actions, such as rebellions and demonstrations. But actually, the truth is that we are tracked and controlled without even been asked before, and this affects our freedom and privacy. Although we could ensure that the only aim is controlling the terrorism, is this the price we have to pay?

Summarizing, big data is a powerful tool for the governments and companies and sometimes for the users, but can be dangerous. Our data can be obtained from anywhere and nowadays the smartphones are a useful tool. With the raise of the smartphones, the data to be obtained from the users has raised drastically. In addition, in android applications, when an ad library embedded in a mobile application on the user's device requests an advertisement, it sends information about the device and user to the ad server (Stevens, R. et al., 2012). Moreover, we also have to be careful about the information we share in social networks like Facebook or Twitter and web services like Google's services. How Alessandro assured, with the actual facial

recogniser techniques, we can start from an anonymous face and using social media data we can find out the name and other important information (Acquisti A., 2013). In addition, an experiment demonstrated that the information in social networks like Facebook is used to choose the candidates for a job interview, discriminating through social media for equally skilled candidates (Acquisti A., 2013).

5.3. Useful for user profiling

There are many tools that help developers to obtain a good and useful user profile. The more technologies we have, more tools are possible to explore. We can find even more ways to obtain information in mobile phones than other places, because mobile phones are with us all day and store really important information about our days and lives. With the raise of the smartphones, really powerful ways to track the user and obtain information have raised too.

Talking mainly about mobile platforms, a lot of information can be obtained and used to make a better experience for the user. This information consulted to build a good user profile is obtained from different ways and places. The information needed to build a user profile is mainly composed by interests and preferences, user behaviour, individual information, goals, user's knowledge and user ambient. In a lot of cases, artificial intelligence techniques are used in order to obtain data from difficult sources, such as messages. Furthermore, artificial intelligence techniques are also used to treat the information obtained, such as making recommendations. From now, the ways to obtain this information in mobile platforms and specifically android will be studied.

5.3.1. Interests

The interests of the user are a really important part for "user profiling". Applications and services can adapt better with the users if their interests are analysed.

Sometimes, obtain information about the interests of the user can be difficult and artificial intelligence techniques are often required. However, there are multiple ways to obtain these interests, some of them really complex and some easier. See bellow some of these ways.

- Forms filled by the users are one of the easiest ways to know about them, although sometimes can be incomplete or false.
- Ratings and comments of some online products are also one of the easiest ways to obtain interests. If the user gives a good rate or comments a product, it generally means that that user likes the product.
- Messages can be treated in order to obtain keywords used by the user. If the user uses a lot the same word, the interest of the user in that word can be supposed. This way requires artificial intelligence techniques and can also be applied in messages in the cloud such as Facebook, Twitter or Gmail.
- Social networks such as Facebook or Twitter are a good chance to capture the user's interests. On Facebook, users can even put "like" to messages, topics, facts or companies and on Twitter, users follow what they like to know about.

- User searches for example in web browsers make a clear map about what they are interested about. The history of visited web pages can also be a powerful tool to know the interests.
- Finally, the tracking location can even be a tool to know the user's interests. For example, a user going a lots of times to the cinema usually means that he is interested in cinema and films. This is possible to know using the mobile phone location.

The interests of the user are not always used to help the user, sometimes are used for corporate benefits and to make more profits. Advertising companies also use the interests to showcase advertisements that the users are interested in, being a powerful way to improve the success of the advertisements.

Often, a topic ontology is used as the reference to construct a user interest profile (Silvia Shiaffino and Analía Amandi, 2009). An ontology is a conceptualization of a domain into a human-understandable, but machine-readable format consisting of entities, attributes, relations and axioms (Guarinino and Giarretta, 1995).

5.3.2. User's knowledge and skills

The knowledge that the user has is really important in terms of providing the user a communication adapted to that knowledge. If the information proportioned to the user is too basic or too advanced, the user experience will not be as good as it could be.

Usually, this information is stored giving a quantitative or qualitative mark to each user characteristic. The method to obtain this information can be really difficult in applications or services where the user has not been voluntarily registered. That information can be obtained from a test or previous information (e.g. a student from the university who is using the service).

5.3.3. User behaviour

The behaviour of the user is really important in mobile platforms. The users usually use the smartphones to do similar actions and even they do these actions in the same way. This fact opens an opportunity to adapt to the user and make the actions easier, faster and friendlier. The smartphone can observe those actions and, if some of them is repeated a lot of times, can even be skipped. For example, if a user almost always wakes up at 8:00 am, the first option shown at the alarm configuration should be 8:00 am.

Artificial intelligence techniques are used in order to find patterns in the user's behaviour. To obtain the user behaviour, the answers of the users to queries and the actions of the users are tracked. Those answers or actions are controlled having in mind the actions and answers in the past and even other facts such as the user's context. Once the information is obtained, one way to store this information about the user's behaviour can be using Bayesian networks, storing the probability of each answer and action in function with the others.

5.3.4. Personal Information

Personal information about the user can be useful for “user profiling”. Personal information includes information such as age, status, friends and even the usual path to go to work. Every potentially useful information about the user can be used in the user profile. For example, information such as demography or age can be used to give the user more personalized advertisements.

However, that is possibly the most delicate information that the user may give, although it can proportionate a great experience. For example, Google Now uses this information to know the meetings of the user and the place where the meeting is and it is able to inform the user when to leave in order to arrive at time according to the traffic.

That information can be obtained in different ways, as the group includes a really big range of options. The information can be obtained from the mobile device and online. Any online service used by the user can store this kind of information. From an android smartphone, personal information can be obtained from the phone such as contacts, calendar or messages or cloud services such as Twitter, Facebook, Google, Amazon, etc.

5.3.5. Goals

User goals are a valuable information but really difficult to obtain for sure. The topic consists on predicting what the user is going to do in the service or the application being based on different facts. Other information about the user described above can be really useful to discover the goals of the user. Complex algorithms of artificial intelligence are used to obtain them, making it a very difficult process.

5.3.6. User ambient

User ambient represents any information that can be obtained about the user’s environment and the user state in that moment. This group includes information such as if the user is alone, stressed, walking, waiting for something or his environment such as the weather, the amount of people and the place. All that information is useful to know what the user needs and improve the experience.

In addition, user’s context is a very powerful tool for user profiling. Actually, is a new way to improve the experience and sometimes can be associated with the future. Nowadays, smartphones can obtain user’s context information such as time, location, direction, temperature or brightness. Other kind of user’s context has appeared, such as eye tracking, knowing where the user is looking and anticipating his actions.

5.4. Data collection ways in android devices

5.4.1. Data sources offline

Android makes an easy access to offline resources, being a potential information to discover the user’s conduct and extracting useful and delicate information. Applications can read or

modify data information such as contacts or call log using Content Providers. Content Providers is the method that android uses to get and provide information between applications. Android exposes several native Content Providers, which can be accessed directly (Meier, R., 2012). Some examples of native content providers are shown next:

- Media Store: Is the way to manage audio, video and image files in your device.
- Browser: Manage the browser search history.
- Contacts: Read or modify the contact details and profiles.
- Calendar: Create, modify or delete existing events or reminders.
- Call Log: Consult all the calls history and details.

As can be content providers from any application, other information than the described above can be obtained using offline data sources. For example, the application Gmail has a content provider and other applications can access to the specific accounts and messages.

5.4.2. Sensors

With the raise of smartphones, sensors have been an important tool to collect information about the user and the ambient, improving the experience between the user and the device. Sensors are a way to connect software with the real world. However, sensors can be used with bad intentions and interfere the user's privacy. Some sensors used in smartphones and specifically in android will be analysed next:

- Accelerometers: Accelerometers are a tool to measure the acceleration produced in any of the three axis. It has been successfully verified in many studies that a single accelerometer attached to the user body is enough to detect the majority of daily life activities with the accuracy required for these applications (Amir, S. et al., 2013). The acceleration generated during human movement varies across the body and depends upon the activity being performed, making possible to know where the user keeps the phone and what activity he is doing (Amir, S. et al., 2013).
- Gyroscopes: Gyroscope in android device provides the rotation of the device compared with the three axis of reference. Therefore, information such as the device position (and user) are possible to find out using the gyroscope.
- GPS: GPS is a satellite navigation system that provides the position of the device on earth. Nowadays, that satellite can also be used for commercial applications. Android provides the way to obtain the location of the device. Well GPS designed receivers can achieve horizontal accuracy of 3 meters or better and vertical accuracy of 5 meters or better 95% of the time (U.S. government, 2008). Therefore, that is a powerful tool to track the users whatever the intention is.
- WiFi: WiFi is a technology that provides connection to devices inside a wireless local area network. The logging of the MAC address of access points or the SSID (service set identifier) of the network with a known location can be used for locating the scanning device (Amir, S. et al., 2013).
- Camera: Camera is a tool that can be used for applications to see the environment of the user. Therefore, plenty of information can be obtained with the camera. As Amir, S. et al. pointed, since the pictures are not taken under user direction, the data acquisition technique must be able to ensure, with reasonable confidence, that the taken picture contains the proper data about the user's surroundings (e.g., the phone is

not in the user's pocket) (Amir, S. et al., 2013). Other information can be extracted and some utilities such as eye-tracking have appeared using the camera. Eye-tracking is a technology that tracks the user's eyes, trying to know what the user wants to do looking his eyes.

- **Microphone:** How everyone knows, microphone is a sensor used to record audio. Using that audio, information about the user and the environment can be obtained. Usually, the exact words recorded from the microphone are not used. However, as Amir, S. et al. assured, nonverbal vocal cues, such as the pattern of silent moments, pitch, or tempo of the speech, have been used in sociometer badges, to give feedback about the user's social behaviour on his mobile phone (Amir, S. et al., 2013). Anyway, that information and the use of the microphone to record the user can be an intrusion to the user's privacy.
- **Temperature:** In Android 4.0, there is an API to obtain the ambient temperature using a thermometer.
- **Ambient light sensor:** The sensor return a single value describing the ambient illumination, commonly used to control the screen brightness (Meier, R., 2012).
- **Proximity:** Indicates the distance between the device and the target object. The selection of the target object depends on the hardware implementation (Meier, R., 2012).

In Android devices, the applications can keep getting information and controlling the sensors even when they are turned off, making it dangerous for the user's privacy.

5.4.3. Online services

Online services have raised in the last few years. Companies such as Facebook and Twitter have provided an API to permit applications use their information. If a user gives permission to an application to access some of this services, the application can obtain plenty of information using the API.

- **Facebook:** Facebook provides an API for android developers and information such as friends, news and photos can be obtained.
- **Google Play Services:** Google also provides an API for android developers to access to services such as Maps or Google Plus.

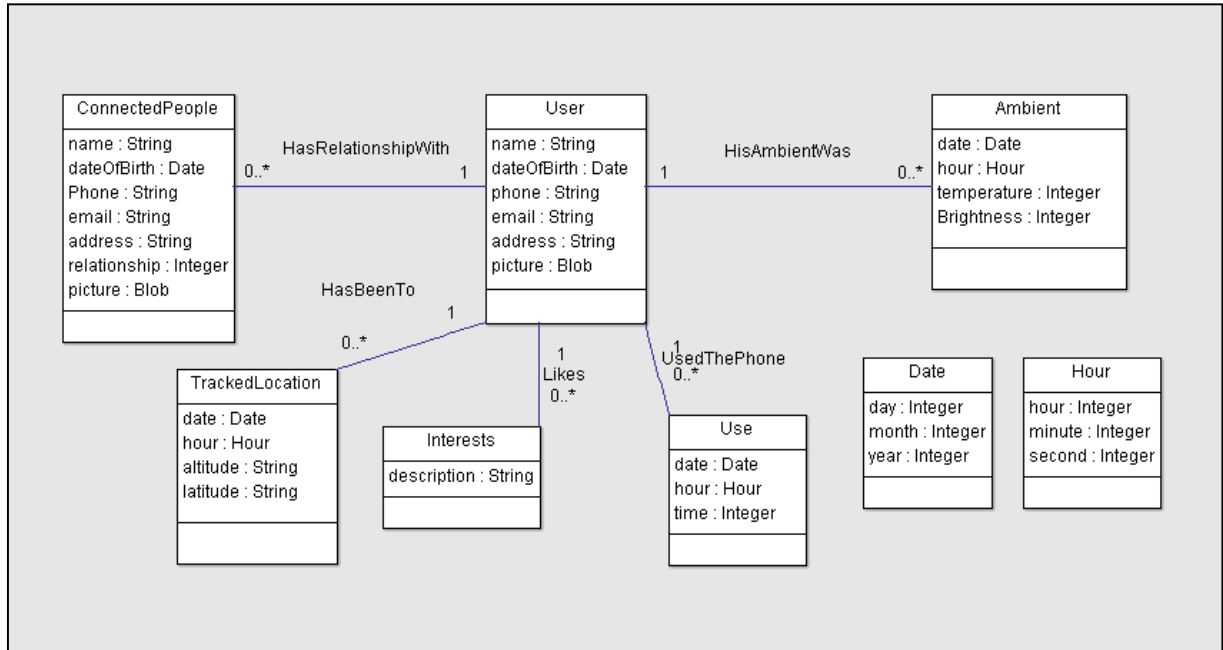
5.5. Summary

As the name implies, a smartphone is a smart phone. Smartphones are devices designed to be brought most of the day and to be our way to be contacted. Therefore, most of us have our smartphone with us almost twenty-four hours every day. Nowadays, smartphones can store a lot of information about what we do with them and about the environment and the ambient even when we are not using them. And if that was not enough, Big Data helps the smartphones to be even more powerful with the information stored online about us. Obviously, that information permits a better experience and opportunities between the user and the phone, but unfortunately, we cannot control what the applications do with the information. Consequently, as users we should be careful about the applications we have, having only those we trust, providing only the information that we don't mind to share in those cases that it can be controlled.

6. Implementation Design

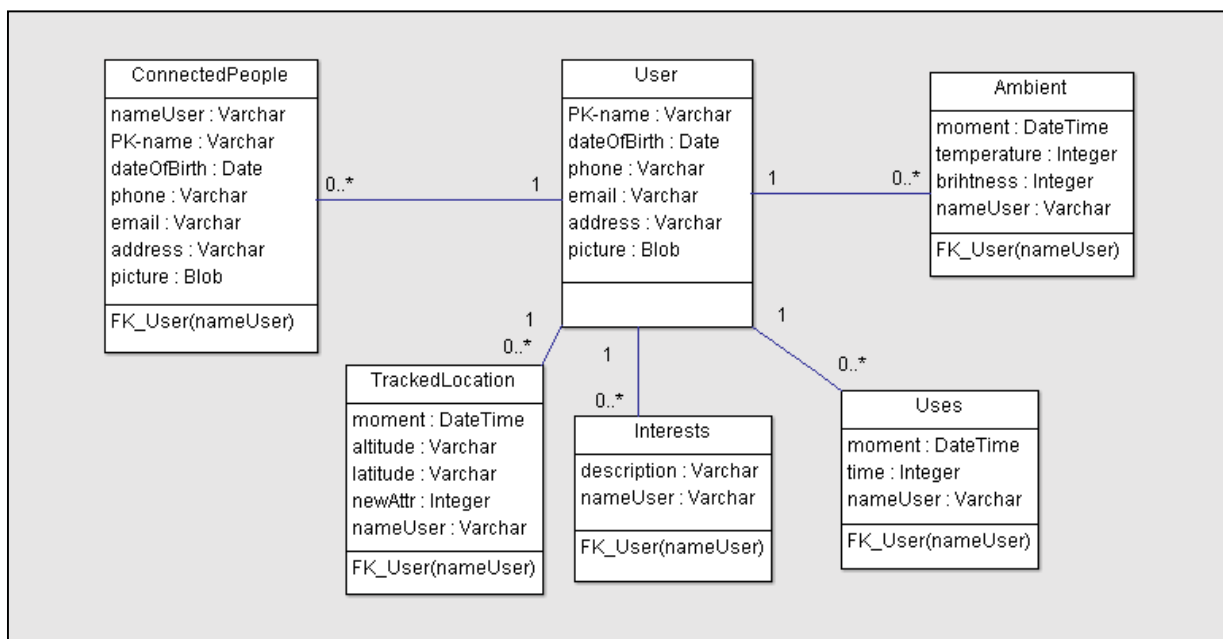
6.1. Conceptual Model

The following diagram represents the objects existing in the application and the relation between them. Basically, in this case, the objects represented are the user, his ambient, his friends and family, his tracked locations, his interests and his phone usages.



6.2. Data Model

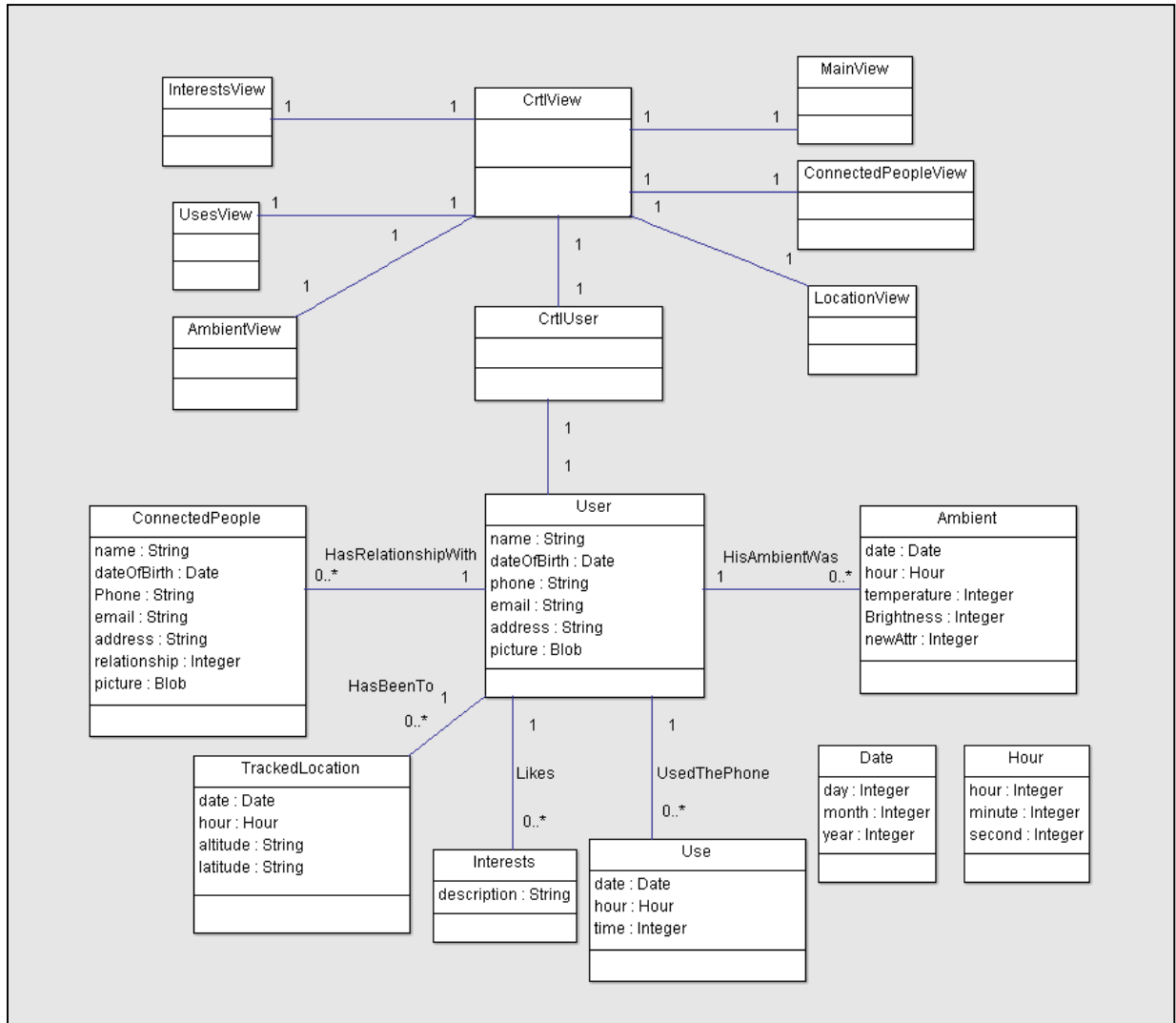
Data model represents how the data will be stored in the database.



6.3. Design Model

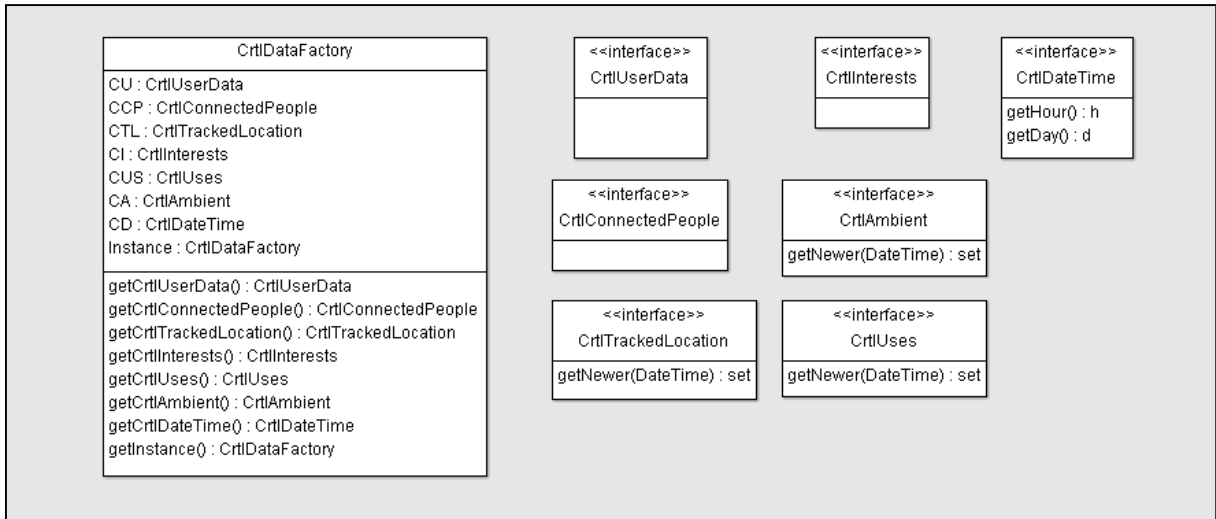
This section shows the planned classes to be developed in the implementation process. Including the domain layer, view layer and database layer.

Class Domain and view:



Class Data Interface:

In the data layer, one class for each table in the database is implemented to have a good control of gets and sets.



6.4. Quality Requirements

Name: Data protection

Priority: High

Difficulty: Low

Description: The user's personal information will be just stored on the phone and will not be used for any other purpose than for the application.

Name: Battery use

Priority: Medium

Difficulty: High

Description: The battery used tracking the user in background should be viable and not too much.

Name: Friendly interface

Priority: Medium

Difficulty: High

Description: The application's interface should be friendly for the user's view, being modern and simple.

Name: Easy use

Priority: Medium

Difficulty: Medium

Description: The application should be easy to use and dominate, because none manual will be shown.

Name: Availability

Priority: High

Difficulty: Low

Description: The application has to be possible to use in android devices with version 4 or higher.

Name: Adaptability

Priority: Medium

Difficulty: Medium

Description: The interface and the screens have to be adaptable in any kind of android smartphones devices, having in mind the screen's weight and height.

Name: Performance

Priority: Medium

Difficulty: Medium

Description: The application should response to any user actions in less than 3 seconds approximately. In case that was not possible for some action, a progress bar should be shown.

6.5. Use Cases

Name: Login Facebook

Description: The user logs in Facebook allowing the application to access Facebook.

Primary actor: User

Pre-Conditions: -

Triggers: The user's indication

Main Success Scenario:

1. The user indicates he wants to log in Facebook.
2. The system ask for the Facebook email and password.
3. The user provides the Facebook email and password.
4. The system informs that the login has been successful.

Alternatives:

- 3a. The Facebook email and password provided by the user are incorrect.
 - 3a.1. Go back to the step 2 informing that the data provided is incorrect.

Name: View own picture

Description: When the user starts the application, in the main screen, a user's face's picture is shown in the middle of the screen, obtained from the front camera or Facebook.

Primary actor: User

Pre-Conditions: -

Triggers: The user starts the application

Main Success Scenario:

1. The system validates if there is a front camera.
2. The system takes pictures with the front camera until a face can be detected.
3. The system shows the face's picture centred in the middle of the screen.

Alternatives:

- 1a. There isn't a front camera in the device.
 - 1a.1. The system checks if can access to the user's Facebook.
 - 1a.2. The system goes to the user's Facebook and gets the profile picture.
 - 1a.2. Go back to the step 3.
- 1aa. The system can't access to the user's Facebook.
 - 1aa.1. The system shows a prototype face.

Name: View user's details

Description: When the user starts the application, in the main screen, the user's details such as name or age are shown in the bottom of the screen, obtained from Facebook or others sources.

Primary actor: User

Pre-Conditions: -

Triggers: The user starts the application

Main Success Scenario:

1. The system tries to discover some details of the user.
2. The system shows the user's details obtained in the bottom of the screen.

Alternatives:

- 1a. No user details can be obtained
- 1a.1. The system doesn't show any detail.



Prototype of main screen where there are the user's picture and the user's data.

Name: Get the ambient recorded

Description: The application shows to the user the ambient (such as light or temperature) data recorded of the device.

Primary actor: User

Pre-Conditions: -

Triggers: The user's indication

Main Success Scenario:

1. The user indicates he wants to see the ambient tracking.
2. The system shows the days it has stored in memory and the general option.
3. The user indicates the day he want to see.
4. The system shows the day's ambient statistics.

Alternatives: -

Name: Get location during the last few days

Description: The application shows to the user the places obtained by tracking the user.

Primary actor: User

Pre-Conditions: -

Triggers: The user's indication

Main Success Scenario:

1. The user indicates he wants to see the location tracking.
2. The system shows the days it has stored in memory.
3. The user indicates the day he want to see.
4. The system shows the day's path done by the user in a map.

Alternatives:

- 2a. The application is not allowed to track the location.
 - 2a.1. The system informs that it is not allowed to track the location.



Example of view where the tracked location for a day can be checked.

Name: Get the user's interests

Description: The application shows to user his interests.

Primary actor: User

Pre-Conditions: -

Triggers: The user's indication

Main Success Scenario:

1. The user indicates he wants to see the interests.
2. The system obtains the browser history to get the interests.
3. The system shows the user's interests.

Alternatives: -

Name: Get friends and family

Description: The application shows the user's closest persons.

Primary actor: User

Pre-Conditions: The system has access to Facebook.

Triggers: The user's indication

Main Success Scenario:

1. The user indicates he wants to see his closest persons in his life.
2. The system checks if can access to the user's Facebook.
3. The system shows the user's closest persons.

Alternatives: -

Name: Get the approximate user's sleep's times and phone usages

Description: The application shows the approximate user's sleep's times and phone usages.

Primary actor: User

Pre-Conditions: -

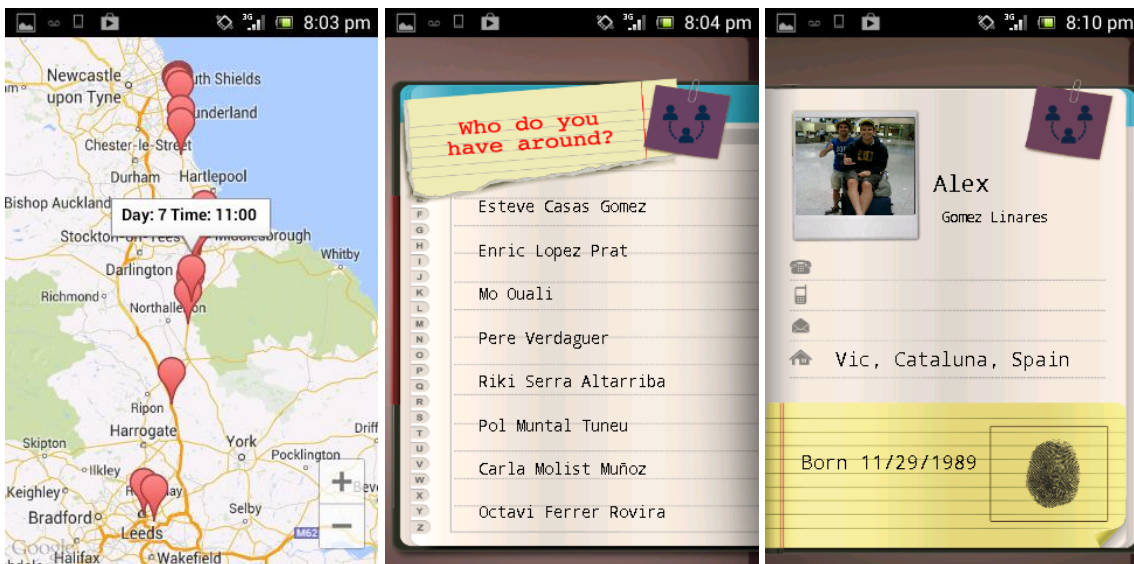
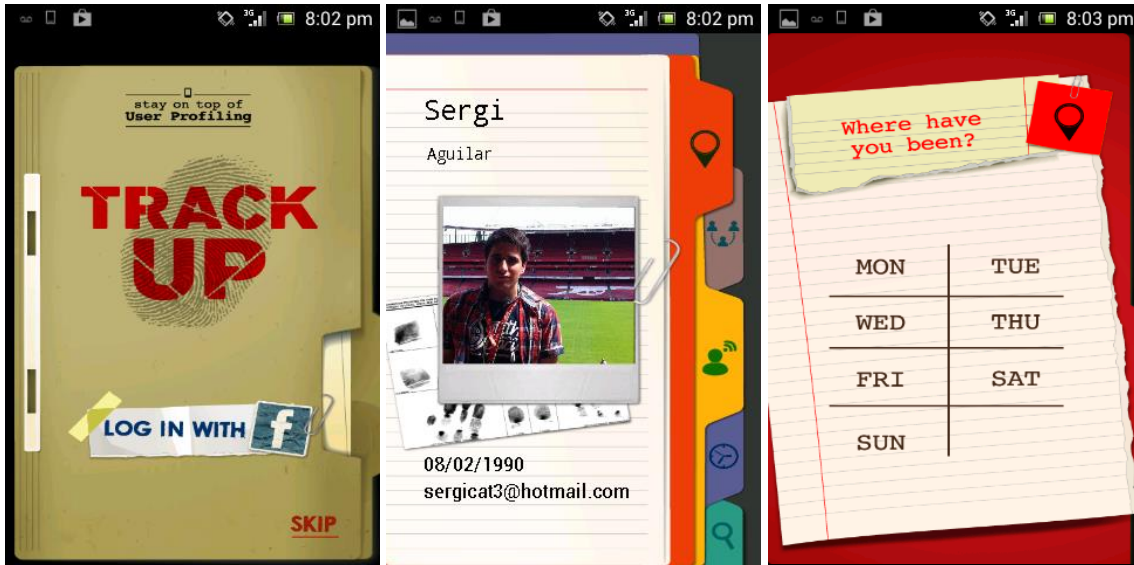
Triggers: The user's indication

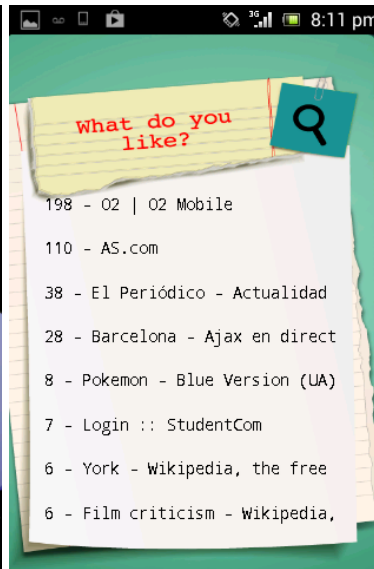
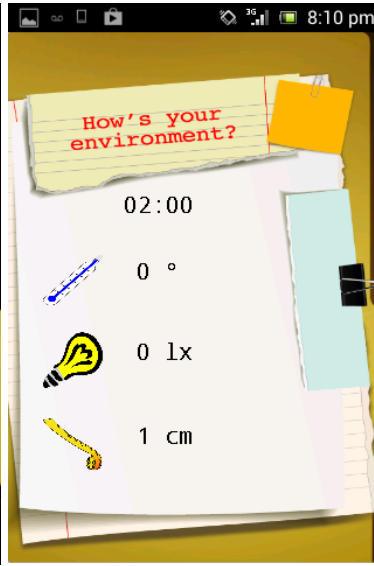
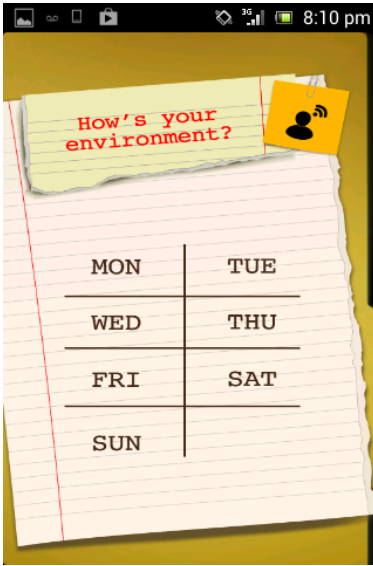
Main Success Scenario:

1. The user indicates he wants to see his sleep's times.
2. The system shows the days it has stored in memory and the general option.
3. The user indicates the day he want to see or the general case.
4. The system shows the approximate user's sleep's times and phone usages for the day selected or in general if it's the case.

Alternatives: -

6.6. Final Result Screens





7. Evaluation Report

Abstract: This report analyses the problems occurred during the project and the solutions applied. It also explores the methods and techniques used to develop the product, from little android language things to the planning and methodology of the whole product. The report also evaluates the final application result and suggests ways to make the app better and improve the user experience.

7.1. Introduction

Basically, the project topic is user profiling and the process of obtaining information from users. Focusing on the smartphones, the project contains a research about the ways and reasons to obtain user's informations and the developing of an android application. Mainly, the application consists in obtaining information from the users and showing them what has been obtained.

Nowadays, it is known that user's information is obtained, stored and used from some technological sources. The amount of information obtained from users is increasing more and more, worrying some people. That's the reason of the application, because users don't use to know which information is obtained and which information is dangerous to give to applications. Therefore, the application can be useful for some people who want to know which kind of information is obtained and if they should be worried about.

Focusing on the application developed for this project, the final result is explained next. Basically, the first screen allows the user login Facebook for better results or skip it to the main screen. The main screen shows user's details and a picture obtained from Facebook or the camera. This screen permits the user to choose one of five options. The first option shows to the user his locations recorded every 30 minutes since the last week. The second options allows the user to see a profile of each friend. The user can see the smartphone's ambient recorded every hour since the last week. The forth option allows the user to see his phone usages and the wake up time guessed by the software recorded since the last week. Finally, in the last option, the user can see their interests, obtained from the browser history.

Talking a bit about the technology used, the application has three processes running background, obtaining and storing the location (obtained from GPS), ambient (obtained from sensors) and phone usages information. Other information is obtained from Facebook, such as user's details and friends. Finally, information such as interests are obtained from other applications, the browser in this case.

Obviously, plenty of more information can be obtained from the smartphones. However, the information obtained in the developed application is just a small portion. The reason of the information obtained and showed is because represents almost all the different ways to obtain information from the smartphones. Therefore, information is obtained using the following ways: GPS, an online service, sensors, system and other applications.

Summarizing, all the information planned before developing has been achieved. However, in the project contract, more information was mentioned to be potentially obtained but it was impossible because of the time. Anyway, relevant information is gotten even if the application is not working making the application a useful and interesting tool.

7.2. Research

My research was oriented in exploring the ways and methods to obtain information in smartphones. In addition, it also explained the uses of that information nowadays and benefits and problems of user profiling. In terms of developing, the important data for user profiling and different ways to obtain that data was studied.

During the developing, some of the information explored in the research report was used and implemented. For example, the information about how to obtain data in Android phones was implemented following the research report structure. In addition, the important data for user profiling studied in the research was followed in the developing stage.

Additionally, the research report was also used to organize the developing process and to know the difficulty of some actions and processes in the implementation. Therefore, in other words, the application was developed in acceptable dates because of the good guessing of tasks duration.

Looking at the research report, some strengths and shortcomings can be found if we have the implementation in mind. On the one hand, the introduction, user profiling explanation and the big data section were useful to contextualize the rest of research and the application, because the project wouldn't have been possible without the basic knowledge on the topic. Still talking about strengths, the ways to obtain information described in the research were really useful in the developing process. On the other hand, the section "Useful for user profiling" has become a little useless since any information can be helpful in user profiling and more information about how to obtain that information would have been better. In addition, there is a lack of information in terms of processing the information obtained, because some gotten data is useless in itself and can become useful after a processing.

Looking at the skills, developing skills and basic android language knowledge in the beginning was assimilated. However, advanced android knowledge had to be learned to develop the chosen application. That advanced knowledge was assimilated using research and resolving the problems consulting internet sources. In addition, another important things in design and developing necessities to develop the project were already assimilated but refreshed during the implementation part.

Summarizing, the research was useful in the moment of developing. In addition, the contents were appropriate and a helpful tool. However, a lot more of information was required to research while developing.

7.3. Methodology

Followed, the developing methods and techniques and the problems occurred will be explained task by task. Basically, the applications is classified in 7 big tasks: login Facebook, view the user's data and picture, view the phone's locations recorded in the last 7 days, view the friends information, view the phone's ambient recorded the last 7 days, view the phone usages and the wake up time recorded the last 7 days and view the user's interests.

Focusing on the action login Facebook, some problems occurred and some decisions were made to fix those problems. One problem is that Facebook gives an extensive and hard API to the developers to make queries and procedures to the social network from an Android App. However, the Facebook information required for the app was just user's data and user's friends' data, so use the Facebook API would have been a long time of understanding and developing for a basic usage. Finally, the app uses an open source library found on internet called "Simple Facebook" which allows the developers use the Facebook API in an easier way. Another problem occurred in this task was that after the login process, the phone takes a long time to get the information from Facebook, actualize the software state and store it in the database. Therefore, a screen is displayed to inform the user than the application is working in it. Nevertheless, a bar progress is always better to let the user know the task state.

Looking at the view user's data and picture task, basically one problem occurred. The first idea was take a picture of the user using the front camera but hidden from the user. However, Android doesn't allow the apps using the camera without a view of the camera vision. Therefore, the first idea was declined and finally the picture is either obtained from Facebook or a photo reclaimed to be taken at that moment. The user's data is simply obtained from Facebook.

Centring on the location, there is a process running background recording the user's location using GPS every 30 minutes. In Android, there is a method to run background processes called services that are working even if the application is closed. In this case, the service has an alarm triggered every 30 minutes, and it collects and stores the location after that. This task allows to the user to view the locations in the last 7 days, showing a menu with the week days. When a day is pressed, the last week day selected locations are obtained and showed in a map, allowing the user to interact with the map and to view the time of the locations. So, the user knows where he has been and at what time he was there. Google maps API v2.0 is used to show the map and to allow the interaction. The ambient and phone usages tasks use the same menu to select the day. (See Appendix E E.2. Location task)

Focusing on the friend's task, the information is obtained from Facebook. The user's friends list and their information is obtained from Facebook during the "login Facebook" task and stored in the database. So, if the user logins Facebook once, the information will be already stored in the database. To avoid using a big space in the database, the friends' pictures are stored using a URL and the picture is obtained from internet when the user indicates it. (See Appendix E E.3. Friends task)

In the ambient task, sensors are used to obtain the temperature, brightness and proximity every hour. Basically, the way used is the same that in the location task, running a background service with an alarm every hour. Therefore, the app obtains the room temperature, brightness and the closest object distance from the sensor every hour. However, a problem occurs in old

devices, because some of them may not have the proximity or brightness sensor and only a few have the temperature sensor. (See Appendix E E.4. Ambient task)

Looking at the phone usages task, the phone usages and their duration are recorded during all the day. Basically, the app records when the screen is turned on and turned off, so when the user uses the phone and the duration can be known. The Android system has like a trigger notifying the app when the screen state changes. Therefore, the application has another service running background and waiting for changes in the screen, storing the time of the usage and the duration of the screen turned on. The task also guess the user's wake up time. To do that, the application controls the phone usages during the night and assumes that a big difference between two phone usages is because the user is sleeping. Obviously, the user wake up time can be wrong and it's only an assumption. (See Appendix E E.5. Phone usages task)

In the last task, the user's interests are obtained from the phone's browser. Android has a method to obtain information from another applications and share information to them. That method is content providers. Using content providers, an application can make its information public and get others applications' public information. In the task, the history is obtained from the browser content provider and showed to the user, showing also how many times a page has been visited. (See Appendix E E.6. Interests task)

In addition, before arriving in the main screen, there is a process that consists in getting all the data from the database and actualize the software. Using that way, there shouldn't be delays and long waits after the main screen. The database used in Android is SQLite Database, used in the application to store all the information needed.

Moreover, in the designing part, Android was in mind and caused some changes in the view diagram class. On the one hand, the thing is that Android doesn't allow to transfer classes between activities (view classes in Android). Therefore, the result was a singleton class (ctrlViews) that is communicated to the activities to provide them the information needed (See Appendix F, F.1. Domain and View layers - class diagram). In addition, this singleton class is an application class (specifically in Android) that is executed every time the application is started. On the other hand, another singleton is used for the database, to provide the data classes. Actually, there is one class for each table in the database (See Appendix F, F.2. Data layer – class diagram).

The method used to draw into the screens and to interact with the user is using SurfaceView in the whole application. SurfaceView is an Android library which allows the developer to control the screen like it was a coordinate system. Therefore, the developer can control the images and the interaction with the user in any moment. The library also controls the events provided by the user. The images needed to draw on the screens have been designed by Silvia Aguilar, as she is a designer and could be helpful in order to make the interaction more comfortable.

Summarizing, the application uses ways and methods provided by the Android language and external services to obtain and show information. The aim was to obtain information from different sources and explore almost every possible way to obtain it. So, the application is a mix of different techniques and methods to get user's personal information.

7.4. Project Management & Employability

The project plan and strategies specified in the beginning to distribute the project tasks and processes has been really useful but, as normal, some parts had to be changed because of the problems occurred.

The project communication plan (See appendix C, C.1) planned in the beginning has been followed and the meetings with the supervisor have been usual as was specified. The state of the project, the pending work and the work already done were discussed in the meetings with the supervisor (see appendix B), being helpful to clarify the plan and the project steps. There was another meeting with the designer to inform which images were needed (see appendix B, B.7).

Moreover, the backup plan was followed and no problems occurred in this section. The developing code was saved as a new version every week in an external memory, being sure that a problem with the computer would not be a big problem. As this is an individual project with only one developer, the backup plan was easier than in a group project.

Focusing on the project dates planned and on the Gantt chart, the project have been delayed for almost two weeks. If we look at the first Gantt chart (see appendix D, D.1), the final date to finish everything was 10 of December and finally, the final date is 20 of December. Basically, the reason was a bad research report planning. The research in the project topic was harder than expected and some other tasks outside the project were not considered. Looking at the second Gantt chart (see appendix D, D.2), the viva was just three days delayed, however, the project evaluation was almost two weeks delayed and there was less time for the product development.

Looking at table below, the skills before and after the project are compared. The expression in English has been obviously improved because of living in an English native place. Moreover, other skills that were good in the beginning (such as data collection and dissemination, analyse and report and ability to work independently) have been improved but just for a little (not enough to be reflected on the table). In addition, report writing has obviously been improved, the knowledge about android has been improved a lot because of all the research, development and problems solved and the memory of the past modules also because of all the work in similar things.

Skills	Before	After
Expression in English	2	3
Data collection and dissemination	4	4
Analyse and report on a topic	4	4
Report writing	2	3
Ability to work as part of a team or independently	4	4
Knowledge about android	3	5
Memory of past modules	3	4

Skills comparison table before the project and at the end of it

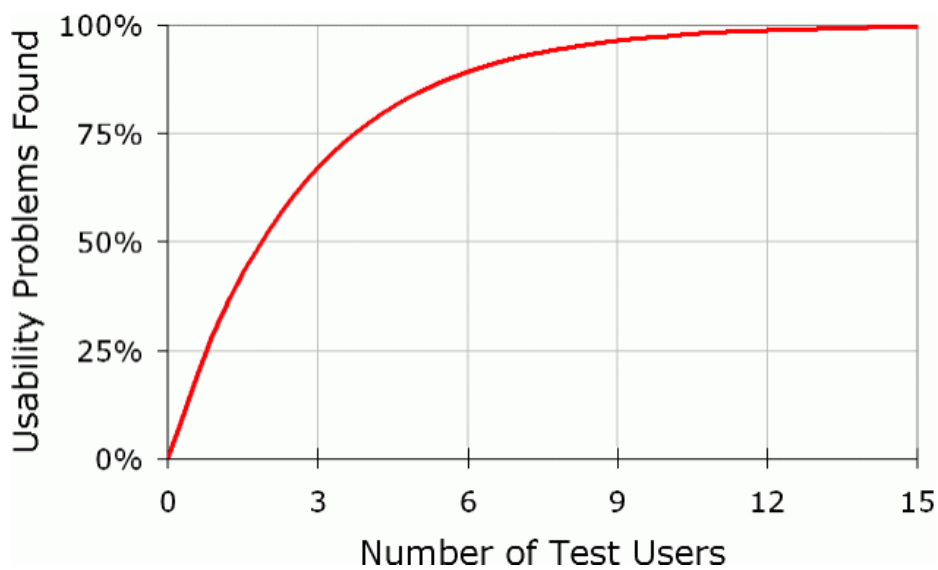
Therefore, beside the little delay in the planning and dates, the planning and management has been successful. The communication and backup plan have worked without any problem and

the skills have improved as expected. The only problem was with the Gantt chart, but it was adapted at the new schedule and fortunately, there was a marge on the university schedule.

7.5. Product Evaluation

In this section, the product will be evaluated in terms of quality, difficulty, originality, usefulness and target audience. As it is an android application, the application usability and content will also be evaluated having in mind the user's opinion.

As Jacob Nielsen pointed, elaborate usability tests are a waste of resources, the best results come from testing no more than 5 users and running as many small tests as you can afford (Nielsen, J., 2000). Therefore, as can be seen in the graphic bellow, 3 users find the 70% of the problems. In the project, three usability tests have been done by the users (see appendix A).



Graphic representing the problems solved depending on the test users (Nielsen, J., 2000)

If we look at the tests done by the users, some conclusion can be taken. In the location task is almost everything fine, except for one user who reclaims a title in the map to make it clearer. In the friends task, the interaction is not enough clear and it is difficult to figure out that friends' profiles are available. Focusing on the ambient task, the task should be clearer for the users. In the phone usages task, it should be clearer for the users. Finally, in the interests' task, the interests should be in a different way, with hobbies and others. Therefore, the main problem is that some interactions should be clearer, because may be difficult to figure out how they work.

Checking the application results with the quality requirements, almost every requirement has been achieved (see appendix F, F.4). Data protection is obviously controlled, the battery used is very little (see appendix F, F.3, after 19 hours using the app), the app is available for android 4 or higher, it is adaptable to all kind of screens and the tasks response times are 3 seconds or less. The things that could be discussed are the friendly interface and the easy use, because some interactions can be difficult to figure out.

Focusing in originality, it is hard to find a similar application. Looking at Google Play, few applications track the user but with other aims such as control another person or healthy and

diet things. However, something else may be needed to seduce the target audience. The target audience in the app is people interested in the topic, so transform the app to a game or another interesting form could help the success of the project.

Therefore, the basic aims of the product such as requirements (see appendix F, F.4 and F.5) have been achieved. However, other aspects such as usability and usefulness could be improved and make the application better and more successful. Anyway, the final result is working, original and may seduce plenty of users.

7.6. Project Conclusion

Summarizing the project, the research and the implementation were useful and interesting, informing about a lot of controversial things probably unknown for most part of the society. The research report was harder than expected because of the unknown problems occurred and being a topic not explored until few years ago. That was the reason that produced a delay in the research report and all the project in general. In the developing process, some problems occurred as usual but the process followed the plan successfully.

Basically, looking back at the project, it could have been designed in a different way and different form. For example, more interesting information from other applications could have been obtained, as that is quite easy. Information from the call log would be interesting and easy to obtain. In addition, some information could have been treated and made it more comfortable for the user. Moreover, some scroll bars should have been added. Finally, convert the fact of obtaining user information to a game would have been made the application more interesting and funny.

From now, there are a lot of ways to improve the experience of the application and make it better. To begin, all the usability and content issues could be solved and that would benefit the interaction with the user. In addition, more contents could be added and more information could be obtained. Finally, the project could be extended to IOS and even to a web services, although the last one would probably be less interesting.

This project has explored ways to obtain information from smartphones, what can be dangerous nowadays and in the future and value information for companies and governments among others. Therefore, all kind of information about privacy and personalization of user profiling have been studied, particularly in android devices. Android language has been fully explored to find the ways to implement techniques and methods to obtain that information. In addition, software design techniques and android language views have also been studied to make the project possible and improve the user experience.

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9. Appendices

9.1. Appendix Research Report

Technique	Information
Media Store	Manage audio, video and image files
Browser	Browser search history
Contacts	Contact details
Calendar	Existing events
Call log	Call history
Accelerometer	Activities, movements, phone position...
Gyroscope	User and device position
GPS	User location
WiFi	User location
Camera	Eye-tracking and user surroundings
Microphone	Environment and user's behaviour
Temperature	Ambient temperature
Ambient light sensor	Ambient illumination
Proximity	Distance between device and target object
Facebook	Friends, news, photos...
Google services	Mails, social user information...

1.1. Table summarising ways to obtain information.

9.2. Appendix Evaluation Report

9.2.1. Appendix A

A.1. 1st usability test:

Choose three tasks and describe them (i.e. show the location in a determined time):

1st Task: Where I have been in a determined day

2nd Task: What time do I wake up in one day

3rd Task: Show one friend's information

1st Task (Possible answers: Yes, No, N/A)

Is the interaction method appropriately chosen? Yes

Are response times appropriate to the task? Yes

Are you familiar with the icon set/menu labels/visual cues related to this task? Yes

Does the task provide adequate visual feedback upon completion? Yes

Is the visual feedback adequate? Yes

Does the interaction behave as expected? Yes

Is the task content appropriate? Yes

What would you change about the task? (Explanation)

On the map showing where you have been during that day, there should be a title next to it.

2st Task (Possible answers: Yes, No, N/A)

Is the interaction method appropriately chosen? Yes

Are response times appropriate to the task? Yes

Are you familiar with the icon set/menu labels/visual cues related to this task? Yes

Does the task provide adequate visual feedback upon completion? Yes

Is the visual feedback adequate? Yes

Does the interaction behave as expected? No

Is the task content appropriate? Yes

What would you change about the task? (Explanation)

The layout needs to be clearer to show the information provided.

3st Task (Possible answers: Yes, No, N/A)

Is the interaction method appropriately chosen? Yes

Are response times appropriate to the task? Yes

Are you familiar with the icon set/menu labels/visual cues related to this task? No

Does the task provide adequate visual feedback upon completion? Yes

Is the visual feedback adequate? Yes

Does the interaction behave as expected? No

Is the task content appropriate? Yes

What would you change about the task? (Explanation)

It needs to be alphabetically structured with each letter representing their names.

Application:

Is there a consistent icon design scheme and stylistic treatment across the system? (Yes, No, N/A) **Yes**

Which interaction or UI element would you change? (Explanation)

The one in the third task.

Do you think the contents shown by the application are appropriate? (Yes, No, N/A) **Yes**

Which contents shown would you change, add or delete? (Explanation)

I think there should be information on achievements or awards you have achieved.

A.2. 2st usability test:

Choose three tasks and describe them (i.e. show the location in a determined time):

1st Task: Show where I have been in a determined day

2nd Task: Show the environment in a determined day and one hour

3rd Task: What I'm interested in

1st Task (Possible answers: Yes, No, N/A)

Is the interaction method appropriately chosen? **Yes**

Are response times appropriate to the task? **Yes**

Are you familiar with the icon set/menu labels/visual cues related to this task? **Yes**

Does the task provide adequate visual feedback upon completion? **Yes**

Is the visual feedback adequate? **No**

Does the interaction behave as expected? **Yes**

Is the task content appropriate? **Yes**

What would you change about the task? (Explanation)

It's fine.

2st Task (Possible answers: Yes, No, N/A)

Is the interaction method appropriately chosen? **Yes**

Are response times appropriate to the task? **Yes**

Are you familiar with the icon set/menu labels/visual cues related to this task? **Yes**

Does the task provide adequate visual feedback upon completion? **No**

Is the visual feedback adequate? No

Does the interaction behave as expected? No

Is the task content appropriate? Yes

What would you change about the task? (Explanation)

Make the task clearer.

3st Task (Possible answers: Yes, No, N/A)

Is the interaction method appropriately chosen? Yes

Are response times appropriate to the task? Yes

Are you familiar with the icon set/menu labels/visual cues related to this task? Yes

Does the task provide adequate visual feedback upon completion? Yes

Is the visual feedback adequate? Yes

Does the interaction behave as expected? Yes

Is the task content appropriate? Yes

What would you change about the task? (Explanation)

It's fine.

Application:

Is there a consistent icon design scheme and stylistic treatment across the system? (Yes, No, N/A) Yes

Which interaction or UI element would you change? (Explanation)

For task 2 to make the results more clear. It's preferable to do a scientific table.

Do you think the contents shown by the application are appropriate? (Yes, No, N/A) Yes

Which contents shown would you change, add or delete? (Explanation)

Add: Hobbies/Interests – put on sport, music...

A.3. 3rd usability test:

Choose three tasks and describe them (i.e. show the location in a determined time):

1st Task: View the user's friends

2nd Task: View the user's ambient

3rd Task: View the user's phone usages

1st Task (Possible answers: Yes, No, N/A)

Is the interaction method appropriately chosen? **Yes**

Are response times appropriate to the task? **Yes**

Are you familiar with the icon set/menu labels/visual cues related to this task? **Yes**

Does the task provide adequate visual feedback upon completion? **Yes**

Is the visual feedback adequate? **Yes**

Does the interaction behave as expected? **No**

Is the task content appropriate? **Yes**

What would you change about the task? (Explanation)

Scrolling and choosing one friend's profile are not enough clear.

2st Task (Possible answers: Yes, No, N/A)

Is the interaction method appropriately chosen? **Yes**

Are response times appropriate to the task? **Yes**

Are you familiar with the icon set/menu labels/visual cues related to this task? **Yes**

Does the task provide adequate visual feedback upon completion? **No**

Is the visual feedback adequate? **Yes**

Does the interaction behave as expected? **No**

Is the task content appropriate? **Yes**

What would you change about the task? (Explanation)

The interaction could be clearer.

3st Task (Possible answers: Yes, No, N/A)

Is the interaction method appropriately chosen? **Yes**

Are response times appropriate to the task? **Yes**

Are you familiar with the icon set/menu labels/visual cues related to this task? **Yes**

Does the task provide adequate visual feedback upon completion? **Yes**

Is the visual feedback adequate? **Yes**

Does the interaction behave as expected? **Yes**

Is the task content appropriate? **Yes**

What would you change about the task? (Explanation)

It's fine.

Application:

Is there a consistent icon design scheme and stylistic treatment across the system? (Yes, No, N/A) Yes

Which interaction or UI element would you change? (Explanation)

Some scrolling interactions are not clear enough.

Do you think the contents shown by the application are appropriate? (Yes, No, N/A) Yes

Which contents shown would you change, add or delete? (Explanation)

The interests part should be clearer and the friends part should have more information than only Facebook friends, such as calls and messages relations, etc.

9.2.2. Appendix B

Field	Explanation
Meeting with	Muthu Ramachandran (Supervisor)
Date & time	13 September 2013 – 30 minutes
Topics	Meetings plan and project definition

B.1. Meeting 1

Field	Explanation
Meeting with	Muthu Ramachandran (Supervisor)
Date & time	17 September 2013 – 20 minutes
Topics	Project plan, Project Contract fields and project topic

B.2. Meeting 2

Field	Explanation
Meeting with	Muthu Ramachandran (Supervisor)
Date & time	15 October 2013 – 20 minutes
Topics	Research report topics and information explained and studied

B.3. Meeting 3

Field	Explanation
Meeting with	Muthu Ramachandran (Supervisor)
Date & time	29 October 2013 – 20 minutes
Topics	Research report final details and implementation plan

B.4. Meeting 4

Field	Explanation
Meeting with	Muthu Ramachandran (Supervisor)
Date & time	12 November 2013 – 20 minutes
Topics	Research report submission and implementation and design details

B.5. Meeting 5

Field	Explanation
Meeting with	Muthu Ramachandran (Supervisor)
Date & time	3 December 2013 – 20 minutes
Topics	Postpone presentation and dates and presentation and evaluation details

B.6. Meeting 6

Field	Explanation
Meeting with	Sílvia Aguilar (Designer)
Date & time	16 November 2013 – 2 hours
Topics	UI theme, screens design and images needed

B.7. Meeting 7

9.2.3. Appendix C

C.1. Communication Plan:

Communication Plan

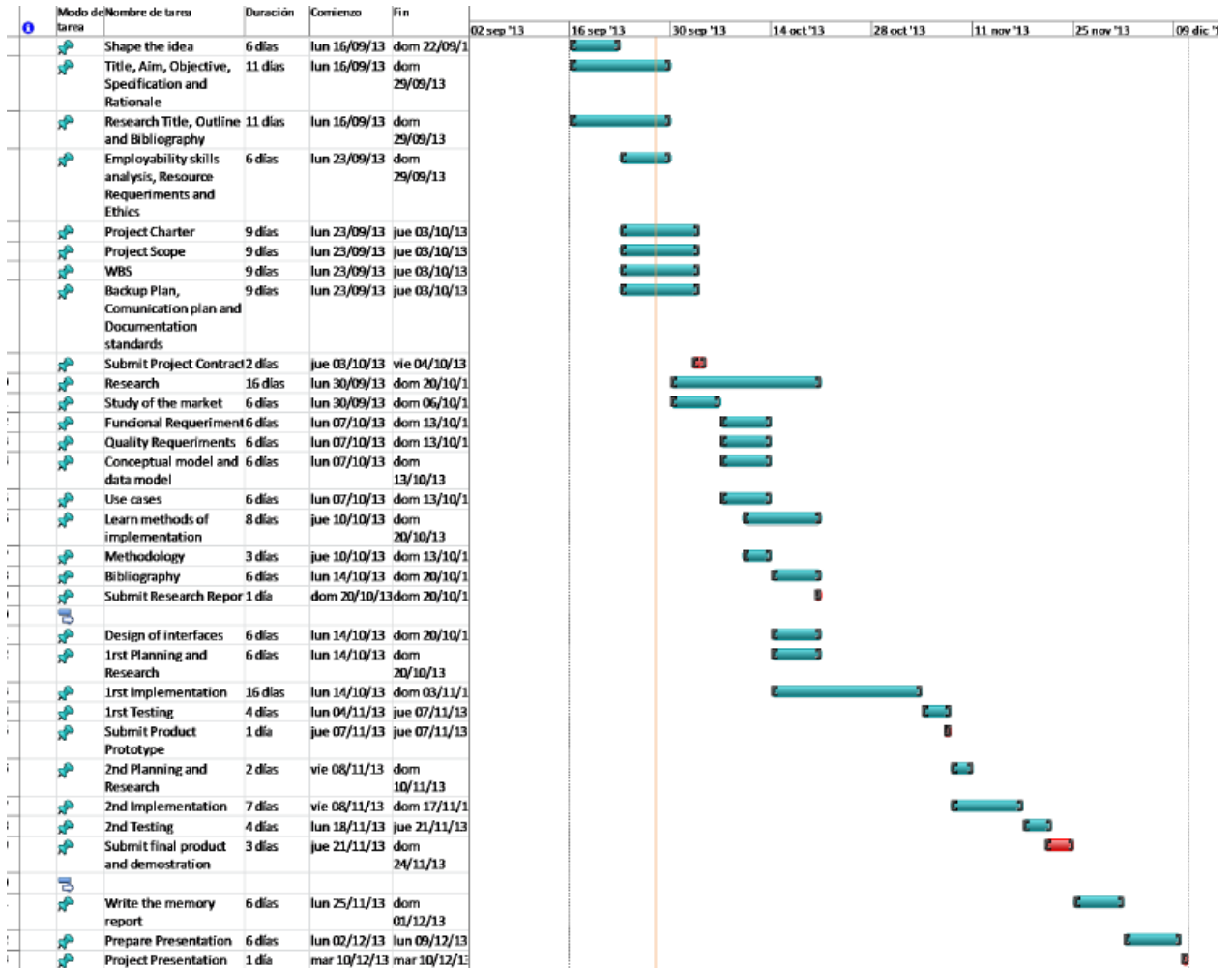
Meeting on Tuesday every week or every two weeks with the supervisor of the project. We can meet others days occasionally if it is necessary.

C.2. Backup Plan:

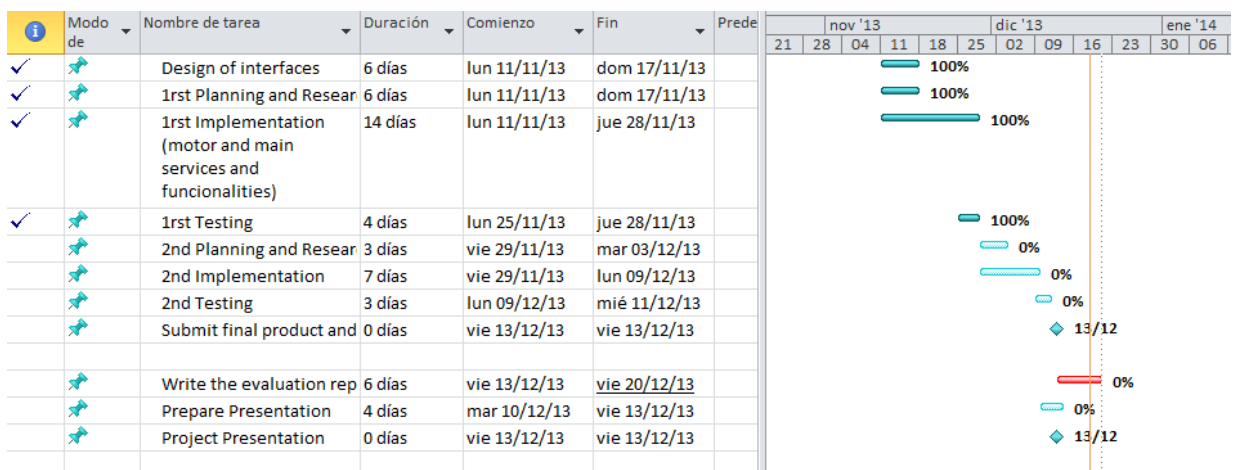
Backup plan

This project just have one developer, so it is not necessary to make a complex backup plan. Each change will be saved on the personal computer and every new version will be saved in an external memory. A new version will be considered a successful part in a task.

9.2.4. Appendix D



D.1. 1st Gantt chart

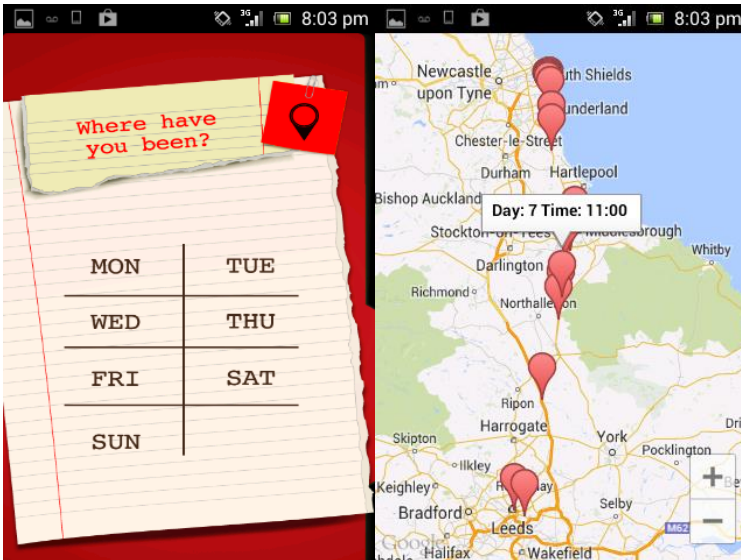


D.2. 2nd Gantt chart

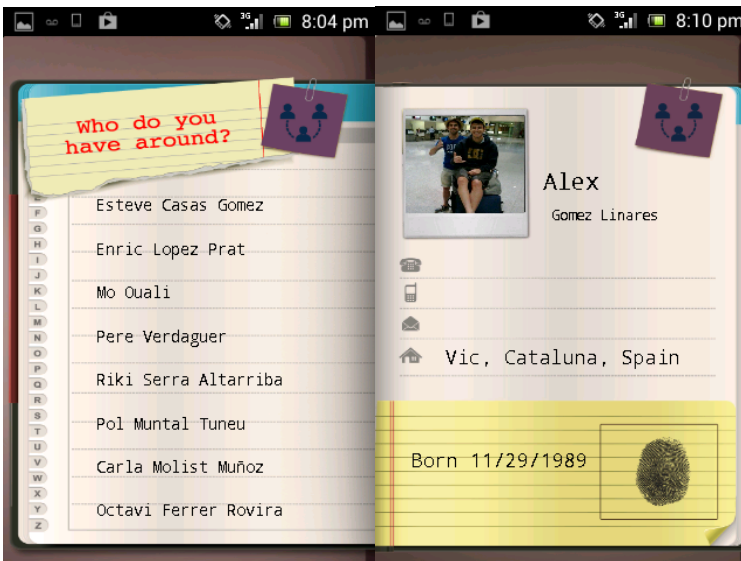
9.2.5. Appendix E



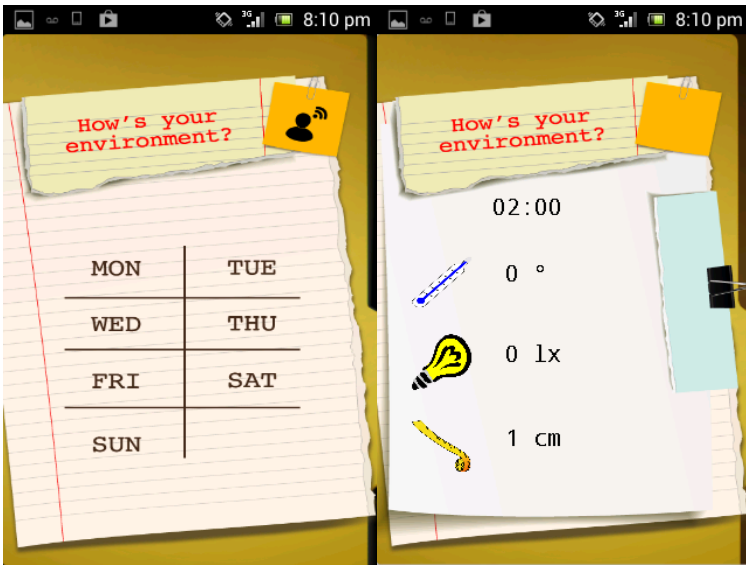
E.1. Main screens



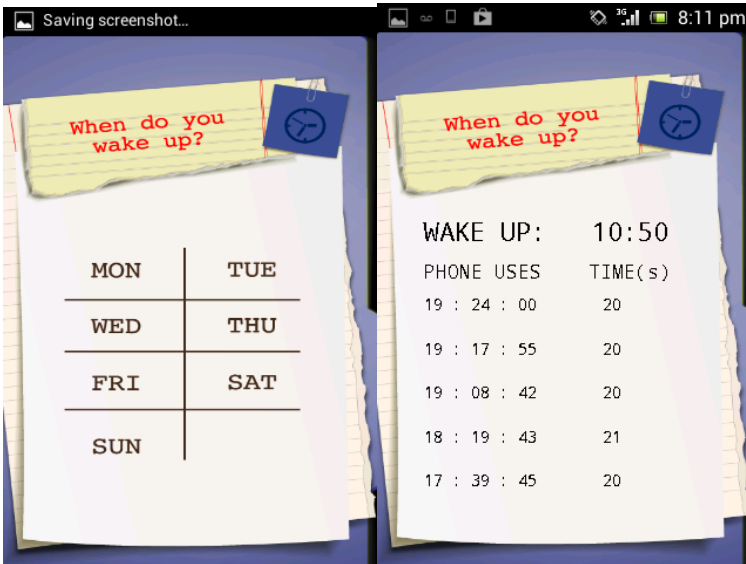
E.2. Location task



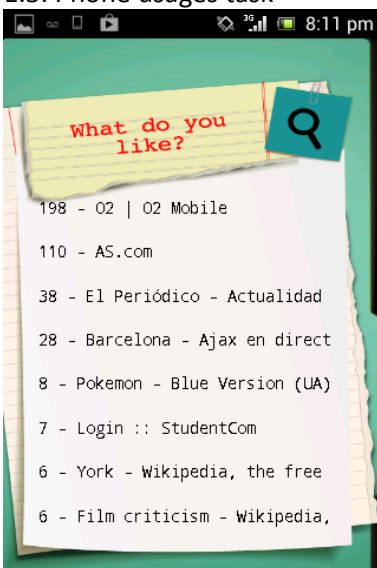
E.3. Friends task



E.4. Ambient task

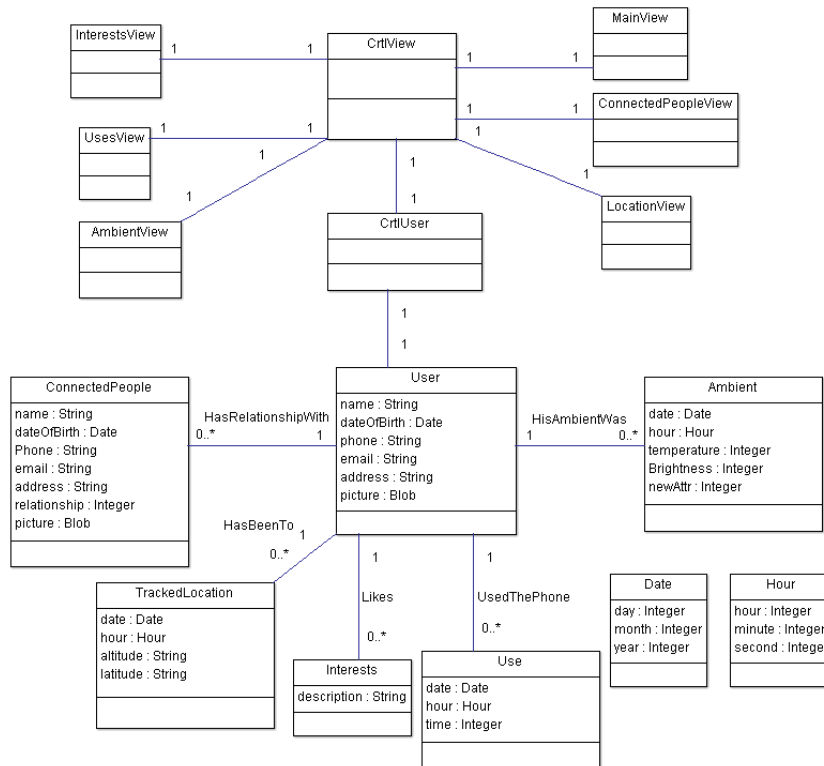


E.5. Phone usages task

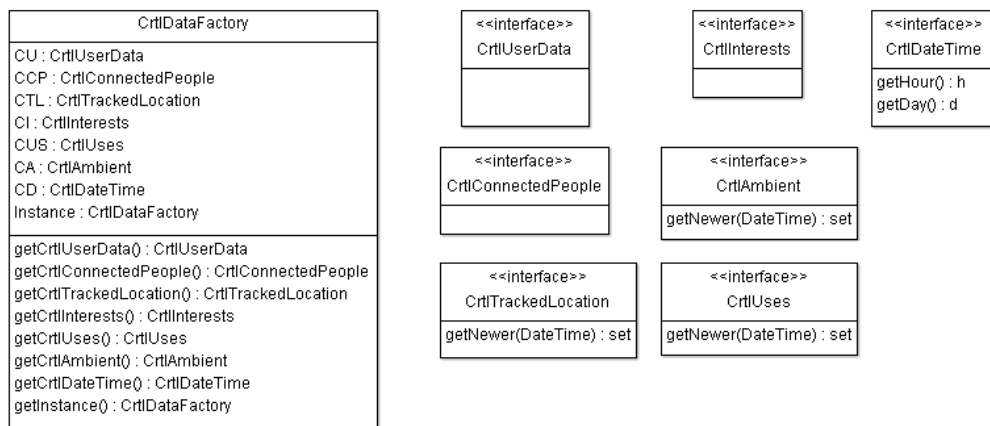


E.6. Interests tasks

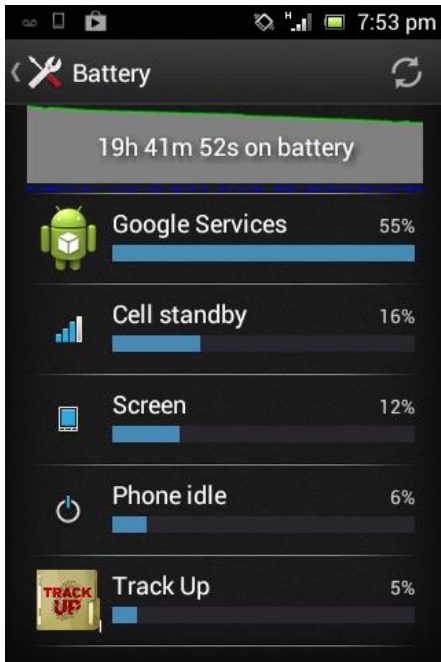
9.2.6. Appendix F



F.1. Domain and view layers – class diagram



F.2. Data layer – class diagram



F.3. Battery screen

F.4. Quality Requirements:

Name: Data protection

Priority: High

Difficulty: Low

Description: The user's personal information will be just stored on the phone and will not be used for any other purpose than for the application.

Name: Battery use

Priority: Medium

Difficulty: High

Description: The battery used tracking the user in background should be viable and not too much.

Name: Friendly interface

Priority: Medium

Difficulty: High

Description: The application's interface should be friendly for the user's view, being modern and simple.

Name: Easy use

Priority: Medium

Difficulty: Medium

Description: The application should be easy to use and dominate, because none manual will be shown.

Name: Availability

Priority: High

Difficulty: Low

Description: The application has to be possible to use in android devices with version 4 or higher.

Name: Adaptability

Priority: Medium

Difficulty: Medium

Description: The interface and the screens have to be adaptable in any kind of android smartphones devices, having in mind the screen's weight and height.

Name: Performance

Priority: Medium

Difficulty: Medium

Description: The application should response to any user actions in less than 3 seconds approximately. In case that was not possible for some action, a progress bar should be shown.

F.5. Use Cases:

Name: Login Facebook

Description: The user logs in Facebook allowing the application to access Facebook.

Primary actor: User

Pre-Conditions: -

Triggers: The user's indication

Main Success Scenario:

5. The user indicates he wants to log in Facebook.
6. The system ask for the Facebook email and password.
7. The user provides the Facebook email and password.
8. The system informs that the login has been successful.

Alternatives:

- 3a. The Facebook email and password provided by the user are incorrect.
 - 3a.1. Go back to the step 2 informing that the data provided is incorrect.

Name: View own picture

Description: When the user starts the application, in the main screen, a user's face's picture is shown in the middle of the screen, obtained from the front camera or Facebook.

Primary actor: User

Pre-Conditions: -

Triggers: The user starts the application

Main Success Scenario:

4. The system validates if there is a front camera.
5. The system takes pictures with the front camera until a face can be detected.
6. The system shows the face's picture centred in the middle of the screen.

Alternatives:

- 1a. There isn't a front camera in the device.
 - 1a.1. The system checks if can access to the user's Facebook.
 - 1a.2. The system goes to the user's Facebook and gets the profile picture.
 - 1a.2. Go back to the step 3.
- 1aa. The system can't access to the user's Facebook.
 - 1aa.1. The system shows a prototype face.

Name: View user's details

Description: When the user starts the application, in the main screen, the user's details such as name or age are shown in the bottom of the screen, obtained from Facebook or others sources.

Primary actor: User

Pre-Conditions: -

Triggers: The user starts the application

Main Success Scenario:

3. The system tries to discover some details of the user.
4. The system shows the user's details obtained in the bottom of the screen.

Alternatives:

- 1a. No user details can be obtained
- 1a.1. The system doesn't show any detail.

Name: Get the ambient recorded

Description: The application shows to the user the ambient (such as light or temperature) data recorded of the device.

Primary actor: User

Pre-Conditions: -

Triggers: The user's indication

Main Success Scenario:

5. The user indicates he wants to see the ambient tracking.
6. The system shows the days it has stored in memory and the general option.
7. The user indicates the day he want to see.
8. The system shows the day's ambient statistics.

Alternatives: -

Name: Get location during the last few days

Description: The application shows to the user the places obtained by tracking the user.

Primary actor: User

Pre-Conditions: -

Triggers: The user's indication

Main Success Scenario:

5. The user indicates he wants to see the location tracking.
6. The system shows the days it has stored in memory.
7. The user indicates the day he want to see.
8. The system shows the day's path done by the user in a map.

Alternatives:

- 2a. The application is not allowed to track the location.
- 2a.1. The system informs that it is not allowed to track the location.

Name: Get the user's interests

Description: The application shows to user his interests.

Primary actor: User

Pre-Conditions: -

Triggers: The user's indication

Main Success Scenario:

4. The user indicates he wants to see the interests.
5. The system obtains the browser history to get the interests.
6. The system shows the user's interests.

Alternatives: -

Name: Get friends and family

Description: The application shows the user's closest persons.

Primary actor: User

Pre-Conditions: The system has access to Facebook.

Triggers: The user's indication

Main Success Scenario:

4. The user indicates he wants to see his closest persons in his life.
5. The system checks if can access to the user's Facebook.
6. The system shows the user's closest persons.

Alternatives: -

Name: Get the approximate user's sleep's times and phone usages

Description: The application shows the approximate user's sleep's times and phone usages.

Primary actor: User

Pre-Conditions: -

Triggers: The user's indication

Main Success Scenario:

5. The user indicates he wants to see his sleep's times.
6. The system shows the days it has stored in memory and the general option.
7. The user indicates the day he want to see or the general case.
8. The system shows the approximate user's sleep's times and phone usages for the day selected or in general if it's the case.

Alternatives: -