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SCIENTIFIC ARTICLE

TEMA

"IMPLEMENTACIÓN DE UNA APLICACIÓN MÓVIL PARA LA OBTENCIÓN DE SERVICIO SEGURO DE TAXIS MEDIANTE LA GEOLOCALIZACIÓN."

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IMPLEMENTATION OF MOBILE APPLICATION TO OBTAIN INSURANCE SERVICE TAXIS THROUGH GEOLOCATION

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Abstract. *Insecurity in Ecuador is still the largest conflict and concern among citizens. With the increase in crime, taxi service has been affected by one of the main reasons as informal taxismo. The use of these particular vehicles that do not have authorization from regulatory agencies designated by the State without a badge that represent them, puts the user in a situation of risk, where every day the number of reported cases of assaults, kidnappings, cloning radio frequency central increasing. Despite the traffic that affects many of these urban areas, potential users of the taxi service waste time trying to find a unit that takes them to their destination.*

In this sense it has developed an application for users who have a smart phone so they can access location services and basic resources of a mobile device through your SIM Card.

"Llévame" application makes use of technology that is available to us for the benefit of Ecuadorians to provide secure taxi service, in which thousands of people can interact through an only requirement, is to have a basic cell phone features, or Smartphone of the latest generation with Internet access.

With the advancement of cellular technology and building mobile applications, provide solutions to social problems generate greater security and benefit everyone in a good living.

Keywords

Delinquency, Informal Taxismo, Citizen Security, Mobile Devices, Informatic Security, Free Software

1. Introduction

1.1 Background

Android was created in beginning as operating system for mobile devices that compete with present operating systems such as IOS, Blackberry OS, Symbian with others having the advantage of being based in free and platform operating system as Linux.

This operating system facilitated the creation of applications that will use a large device features as GPS, calls, camera, calendar, removable media etc. The programming language with was developed these applications was Java.

Actually Android has 900 million of devices between Smartphone users, making in the one of the best known and trusted operating systems market, with more of 975000 applications available in their virtual stores.

Figure 1: SIM Card

1.2 Current Situation

The users that don't have intelligent phone generally cannot access the new services as entertainment applications or in this case the location and are limited to basic resources of a mobile device through your SIM Card.

Owing to increased insecurity in the taxi service that is affected is one of the higher reasons as informal taxismo; private vehicles that don't have any distinctive and don't are properly authorized put the user in a risky situation, in

which every day the number of reported cases of assaults, kidnappings, cloning radio signals are growing

In this sense without suitable regularization in the procedures of operating permits, all the people who have been left out of this process continue to work as taxi drivers at stops of formal cooperatives, which only opt to buy a vehicle, place a label and operate without care in the city.

1.3 Statement of the Problem

In the current environment, the need of use the services of one unit taxi is complicated task many times by different weather conditions, difficult traffic that attack the city, the lack of availability of time to wait a unit, the risk of hike up on vehicle informal taxismo, being a victim of assaults and express kidnappings, all these social problems require use of technology to solved.

Also these exposed problems, many times call a taxi operator may take approximately 20 minutes which carry to rapidly consume cellular balance and this time could increased if the order is made in the peak hour.

It was verified in the Ecuadorian population the increasing demand for use of telephony mobile and this is for the facilities have one device.

1.4 Objectives

1.4.1 General Objective

Implement a mobile application secure taxi service through geolocation enabling quickly identify the location of the requesting user and provide mobility to your destination.

1.4.2 Specific Objectives

- Investigate the most important aspects of the process of geolocation and location of the connection user with aerial of mobile connection for implementation of application.
- Model the request taxi service and yours distribution channels considering standards and technology of last generation.
- Develop a prototype that be able to used for users based on the application of Open Source tools and third APIs.
- Get list and reports of frequent client that request the taxi service.
- Offer safe in the storage and confidentiality of client information that is register.

1.5 Justification

The realization of this project is to build a mobile application that allows to offer a safe service taxi through geolocation of cellular telephony that allows speed the identification of the location and facilitate the mobility of people to place of destination.

This application will make use of the technology available in the actually in benefit of Ecuadorians, with which interact through of only requirement that is have a cellular telephone of basic features, or intelligent telephone of last generation with internet access.

This application couple various components of intelligent telephone getting reliability, efficiency, effectiveness, productivity and availability of information for the users that day to day require taxismo service.

Also could used by people that don't have intelligent telephone and wishing to participate in this initiative and meet your need.

The most important point of the construction of the application is treat of mitigate accidents, assaults and kidnappings when asking taxi services.
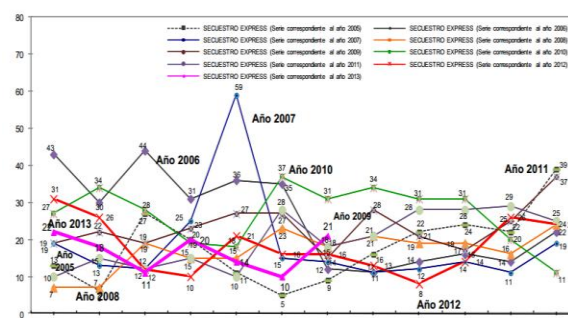

Figure 2: Kidnappings flow statistics to the Ministry of the Interior 2013

2. Theoretical Frame

2.1 History of Mobile Applications

The mobile Applications that known today are the result of more than two decades of evolution, from small applications in the first mobile equipment as for example contacts diary, alarms, games which initially surprised the first users.

Even through the applications covering the basic needs of users in the 90s, when appearing better technology in equipment and operating systems applications also evolving.

All this wave of evolution mobile had great advance with the appearance of internet surfing from the cellular, Wap and EDGE technology made that the equipment must comply with the new uses that the client needed, but this development led the equipment don't have free platforms development, and the manufacturers were the only suppliers of applications.
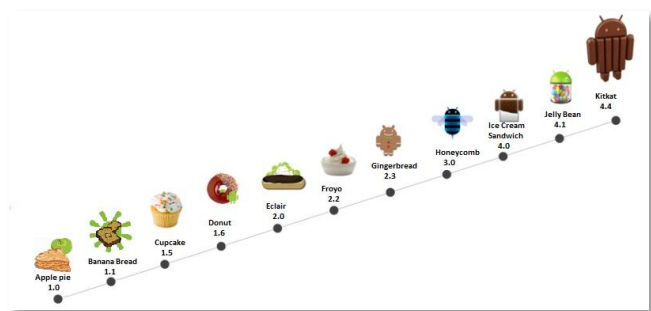

Figure 3: Evolution of Android Versions

2.2 Definition of the Reference Geolocation

To locate a point in a system reference should provide a system of coordinates, that is a set of three numerical values that allow locate a point in of given reference system.

The system of coordinate more known is the geographic coordinate system that uses two of the three coordinates of spherical coordinate system (radius, latitude (also called polar angle) and azimuth) to locate any point in the land area, the latitude and longitude. (Stern, 2003).

For the location of places and things have made important progress so technological and methodological, one of these are the Geographic Information Systems (GIS), which are a set of threads created to capture, collect, manage, manipulate, transform, analyze, model and graph the information that have referenced in space in form of drawings or maps to digital databases.

2.3 Location through GPS

The system GPS (Global Positioning System) is a radio navigation system operated by United States, based on a constellation of 24 satellites distributed in six orbital planes at 22.000 km above the land area and allows positioning points on the land area.

A GPS calculates the position of a point in any space of coordinate x, y, z, starting the calculation of distances between the point and three satellites the location known this calculation is known as triangulation.

The distance between the satellite and the GPS equipment is measured multiplying the time of flight of the signal satellite radio emitted from satellite by your spreading velocity.
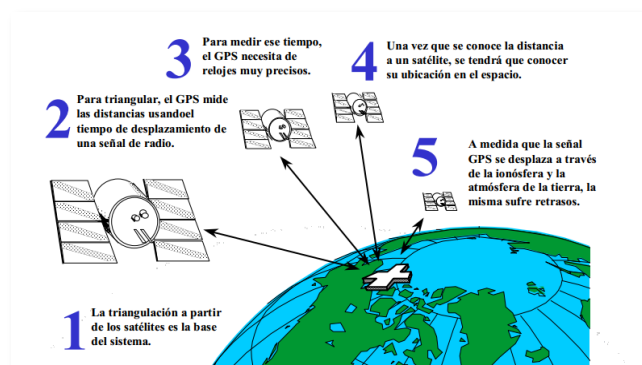

Figure 4: Principle of Operation of GPS System

2.4 Location without using GPS

Given in Ecuador the most cellular equipment don't have with an GPS integrated the service of application of taxi in Llevame can used from the SIM of terminal and for the location use the position that have registered in the cellular operator, the way of the operator obtain the user data depends on the structure of the mobile network that it is composed of:

The **MSC (Mobile Switching Center)** is the control center of cellular systems, is responsible of commute the calls to the cells, provide support, connect to telephone networks, monitor the traffic for collection purposes, perform testing and diagnostics so allow make tasks of administration allow the general network.

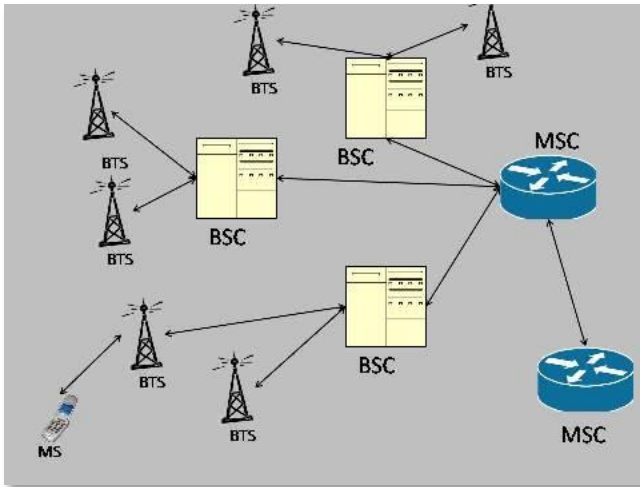**Cells:** These are the geographic areas in which divided the total area that pretend give coverage the system.

Figure 5: BTSs distribution MSC

2.5 Methods of Location

Level zero – Without location, search in all network. Only for small networks. Very simple. Risk of saturation (Flooding algorithm).

Level one - Manual location, the subscriber should located in the network to receive calls.

Level Two - Automatic location with location zone. A zone has multiple cells. The network search by zone.

2.6 Meeting of Retrospective

At the beginning of each planned Sprint should checked which and what state are the modules of the solution, so to deliver new functionality to analyze the activities to performed in this present Sprint.

To perform the task list used the information of chapter of description of the solution.

Detailed modules also Scrum Board, this Task list would recorded in a bill of meeting, in the case of project Llévame register in a general bill with dates and state.

SCRUM allows review the Task List of modules at the end of each of the iterations for this makes a "retrospective meeting" where the team should meet with the Leader and all team of development, all participants are involved in the development, that isn't required attend this meeting the final client and product leader because it is the moment where analyzed themes and internal changes of development.

2.7 Scenarios of Tests

Before of the delivery of an product or service of Software either this one delivery total or partial should performed tested to ensure that deliver to the client a solution in accordance in demand.

As principal objective of the tests is to ensure end product quality, to perform these tests should the following aspects:

- Ideal Transactions
- Failed Transactions
- Registry Transactions
- Functionality Required

3. Methodology and Software Development Technology

3.1 Agile Scrum Development Methodology

Scrum is a process that regularly applies a set of best practices for working collaboratively, in team and gets the best possible result of a project. These practices help each other and their selection have origin in a study of how to work with highly productive team.
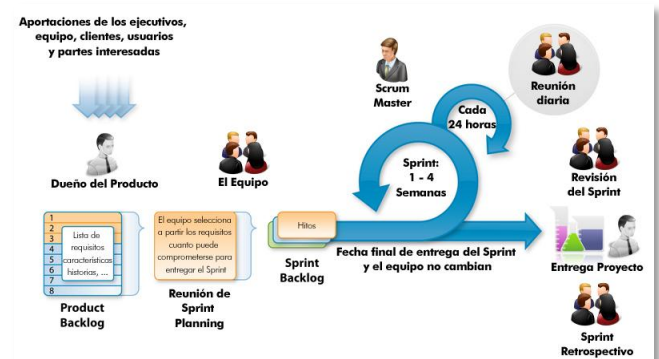

Figure 6: General Scheme Scrum

3.2 Scrum Objectives

- The main objective of Scrum is satisfy the client through delivery early and continuous of valuable software.
- Allow the client request changes in the requirements even if they are late or if they affect the modules delivered.
- Deliver the user functional modules of the project in a short period of time.
- The commercial areas or owner of the project application (product leaders) work together throughout the development process to the final delivery of the project.

- Because Scrum doesn't define tasks to the team members but it is they who choose tasks, Scrum search offer support the cognitive increase of the developers and build trust between the team.
- To avoid communication problems Scrum search maintain a person contact to person periodic, with this avoid the unknown of the project progress.
- The progress of the project is measured by the functional delivery of the solution.
- Make simple deliverables but functional to maximize the amount of work.
- Continuous improvement in delivery processes, development, processes and communication.

In Scrum perform partials and regular deliveries of the final product, prioritized by the benefit that contribute to receiver of the project.

3.3 Specifications Technology Development

Development of Android Software it does habitually with the Java programming language and development toolkit (SDK, Software Development Kit).

3.4 Android SDK

The SDK (Software Development Kit) for Android includes a set of development tools. Understand a code debugger, library, simulator of telephone based in QEMU, documentation, code samples and tutorials.

Figure 7: Android

The development platforms supported include Linux, Mac OS X 10.4.9 or later, and Windows XP or later. The integral development platform (IDE, Integrated Development Environment) officially supported is Eclipse with the ADT plug (Android Development Tools plugin), although also can used to write editor to write Java and XML files and used commands on a terminal (needed JDK, Java Development Kit and Apache Ant packages) to create and debug applications.

3.5 SIM Application Toolkit

Is a standard of GSM system that enables the module of identity of subscriber (SIM) to initiate actions that can used for various value added services.

Figure 8: SIM

The kit of tools of application SIM consists of a set of programmed commands in the SIM that define how the SIM interact directly with the outside world.

This allows that the SIM build an interactive exchange between an application of the network and the final user and access and control to network access. The SIM also gives orders to the telephone, such viewing menus and / or asking for user input.

SIM Application Toolkit (SAT) is the main technology Value Added Service (VAS) in the past, Gemalto has a clear view of services deployed, the security considerations, the new marketing tactics, design methodologies and the need to alliance with banks or information providers.

3.6 Advantages Over Conventional Systems

3.6.1 Advantages of Android about Mobile Operating Systems more Commercial

- Llévame is an Android application that can run in several versions of this operating system, for do in Android considered advantages that have Android over operating systems more commercial today IOS and Windows Mobile:

- Android can installed on any mobile device which becomes multifunctional, for example today exist tablets, intelligent television, refrigerators and cars.

- Android isn't tied to one brand, can found devices with Android operating system in popular brands as Samsung, LG, Sony, HTC and brands not very commercial as IDEOS, RKM (Android TV), Rico Magic (Mini PC Android).

- The source code of Android is free whereby allows improve and report changes improve or corrections by companies or independent developers.

- With difference of IOS that have fixed applications for different uses Android offers freedom in use and installing of applications of any source and target.

- One Android application can developed in any suite, language or tool as PHP, Eclipse (Java), Auto Android Developer Overview, the same that can run in Windows, Linux or Mac OS.

- Android isn't limited available for brand and for this reason that the prices of each device varies by yours specifications, finished, materials and brand and don't by the operating system, we can found devices with Android in low and high costs. For example to compare prices the Android devices with version KitKat 4.4 differ in cost according to their brands such as:

  Samsung Galaxy S5 cost $ 649

  Sony Xperia Z2 cost $ 569

  LG Optimus G2 $ 479

  Motorola Moto G $ 179

  This data were taken as reference in the portal of shopping online "Amazon".

- Android allow free downloads gives to the users the posibility to personalize the interfaces of equipment as menus, colors, texts and other functions.

- The integration of Google in Android is complete offering services from chat to complete backups of the equipment, going by location, storage, mail, social network, between others.

3.6.2 Advantages of SIM Technology

The advantages of perform an SIM development compared with services in common ways:

- The SIM allows easy access from any mobile terminal can high or low range, with difference that Android applications that require the use of determined equipment.

- The SIM doesn't guard browsing history in the terminal, this allows keeping the user data secure in case of suffer an unexpected loss of equipment.

- In case loss of equipment, don't loss the affiliation to the SIM services for the replacement of physical SIM Card remains registered the applications.

- To sending of campaigns of publicity or informative SIM, there several tools and institutions that allow perform the sending massive and online subscribers of a particular service, in the case of campaigns SMS can using platform of sending massive from operator making of this exclusive campaigns for the operators.

- Low operational cost and technical of migration of terminals and version of application.

3.6.3 Advantages of the Service Llevame on the Actual Services of Location

Actually there about 3 applications available to order a taxi in Ecuador, which don't marketed but after install and use found the following advantages of Llévame:

- Llévame don't only offers the service to clients with Android devices but also to clients with any type of mobile equipment.

- Llévame has a cost of $ 0 for the end client, this enables that the taxi service complies with regulation relevant with costs of racings.

- The application doesn't require of personal contacting with the taxi, is automatically through of the application to the driver.

- Llévame provides to the client an interface entirely in Spanish to ensure that use is easy and intuitive.

- The options that offered the application is in the home screen, the user can know of form quickly the benefits of the service.

- Llévame isn't only is directed to a particular taxi company but is parameterized to provide a better service to the client that request a unit.

- The precision of location in the Android applicative have a margin of error lower than actual applications uses the GPS location directly.

- Llévame isn't directed only to a city, it shows the taxis at any point near to the client, all depends of affiliated companies taxis in each city.

- The profile of Llévame is portable and don't need register when change of equipment, is necessary login or enter your telephone number when use the service from SIM.

- The users with a driver profile of an taxi don't can registered directly in the Android applicative, this prevents that other people of taxismo provide service.

- When registering the taxi in the web of service each cooperative or taxi company ensures the severity of staff that provide the transportation to the final client.

- When working directly with cooperatives or companies of taxi Llévame ensure to have units available, all the availability depends on company policies, with difference of the other applications that depending of the disposition personal of the taxi drivers.

4. Design, Implementation and System Rollout

4.1 Construction of the Solution

The construction of the solution is defined based in the needs expressed by the client, by is obtained a quality application in base to the best practices and standards of programming.

Figure 9: Llévame Logo Application

4.2 System Design (Logical Design)
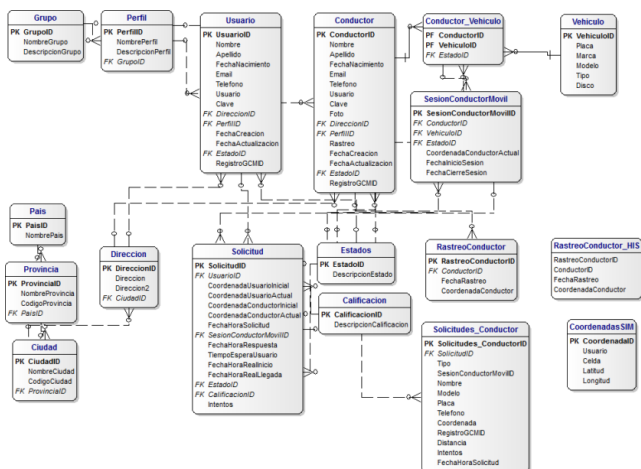
Figure 10: Database Model

4.3 Functional Architecture

4.3.1 Android Application
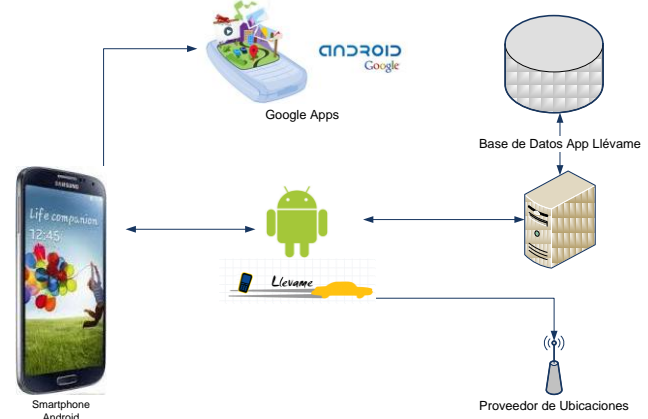
Figure 11: Functional Architecture Llévame Android
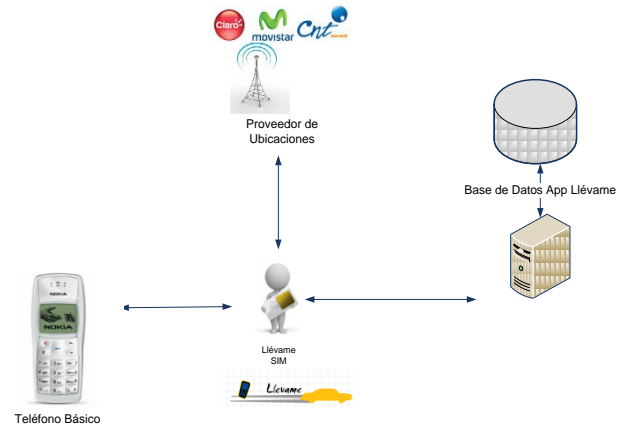
4.3.2 SIM Application

Figure 12: Functional Architecture Llévame SIM

4.4 Modules

The design of application includes the creation of the following modules.

4.4.1 Download Module Android App

In this module analyzed the procedures of validation and publishing of applications in the Android store focusing on the publication of the applicative Llévame, in that defined the following use case and your respective documentation.
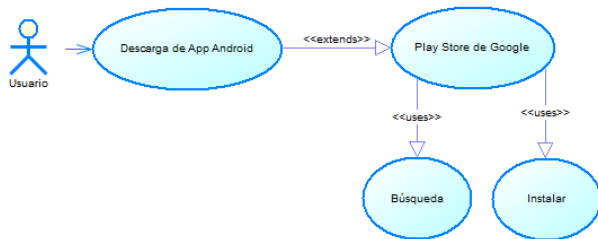
Figure 13: Use Case Diagram Download Android App

4.4.2 Module Location

This module is find shaped by:

- Android Location:
- Location from the cellular operator:

  Integration of Locations

Figure 14: Use Case Diagram Location

4.4.3 Prototype Module Android

In this module developed of prototype Llévame to end users and drivers of taxis, in defined the following use case and your respective documentation.
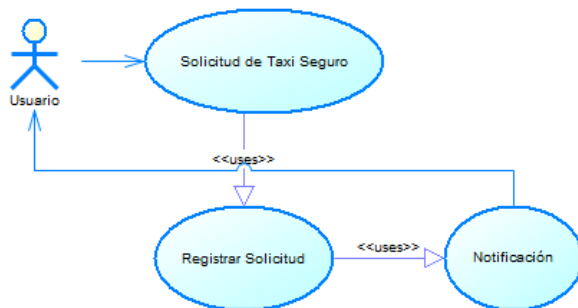

Figure 15: Use Case Diagram Solicitude of Taxi Insurance

4.4.3.1 Solicitude of Taxi Insurance

The application allows the request of taxi units will provide the required service. The user is registered according to the information of subscriber from the telephone operator or high from within application to download from your App Store.
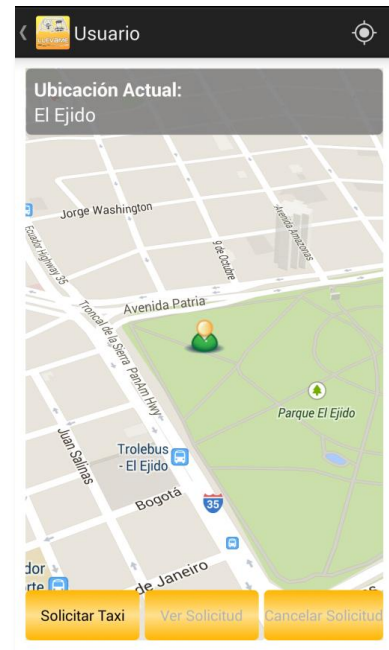

Figure 16: Taxi Insurance Interface

4.4.3.2 Allocation of Unit Taxi Insurance

Specified the characteristics of assigned vehicle to the user that requesting the service as brand, plaque, arrival time and authorization number.
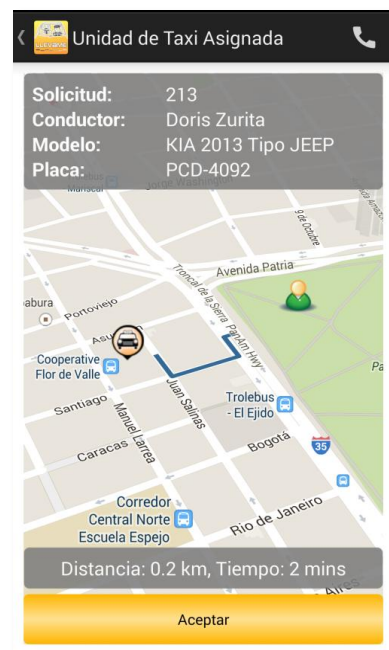

Figure 17: Taxi Assigned Interface Unit

4.4.3.3 User Registration Information

The information of user is recorded in the system follow order chronological and approval checklist maintaining the confidentiality of their location.

Figure 18: User Registration Information Interface

4.4.3.4 Location of User and Taxi Driver Insurance

The application allows visualize the user your actual location and the units of taxi nearby, in this can approve or reject your application if applicable.
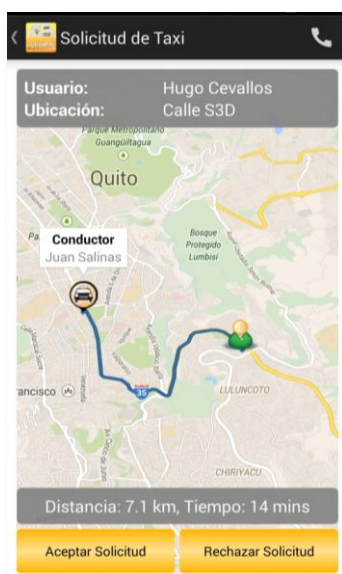

Figure 19: User Location and Driver interface

4.4.3.5 Detail Request Taxi Insurance

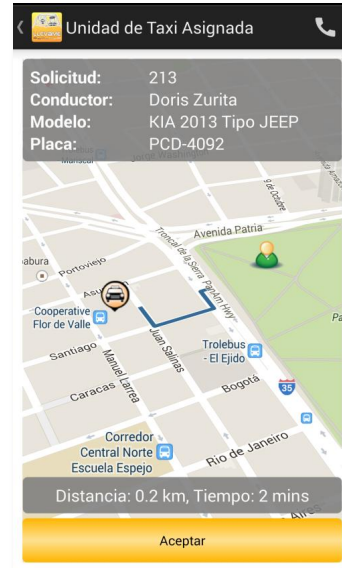The user can check the status of your request of service of taxi and waiting of time of your assigned unit.

Figure 20: Detail Request Taxi Insurance Interface

4.4.3.6 Cancel Request Taxi Insurance

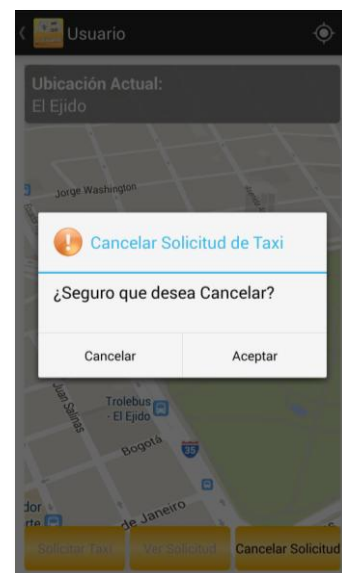The user can cancel the request of your service of taxi based in a location and response time of the nearest unit.

Figure 21: Taxi Cancellation Insurance Interface

4.4.3.7 Request Taxi Insurance Start

The service request may be canceled and started according to the requirements location of the user.
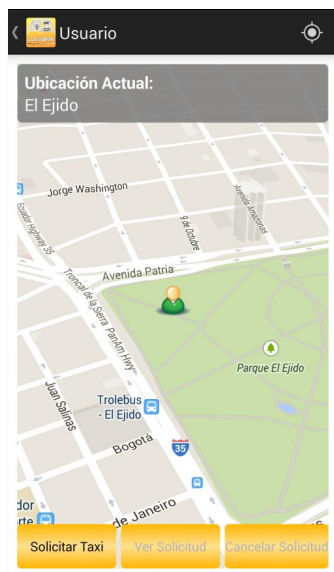
Figure 22: Request Taxi Insurance Start Interface

4.4.3.8 Report of Use and Application of Taxi Insurance

The Cooperatives of taxis that providing the service have web access to the options of Administration of users, reports and usage statistics.
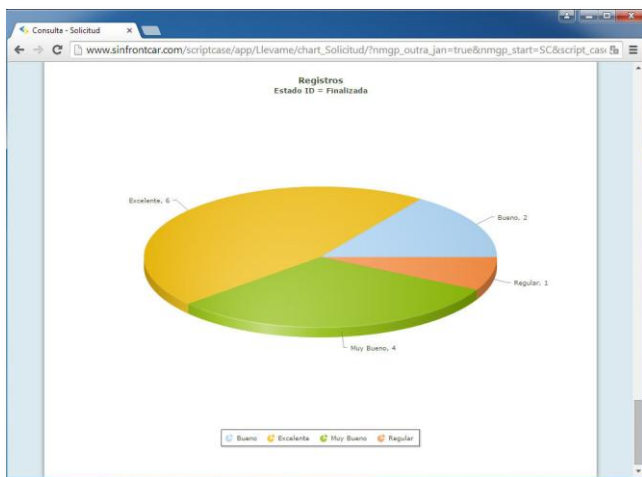

Figure 23: Report of Use and Application of Taxi Insurance Llévame App

4.4.4 SIM Module Prototype

In this module developed SIM prototype in simulator of service Llévame to end users and drivers of taxis, in defined the following use case and your respective documentation.
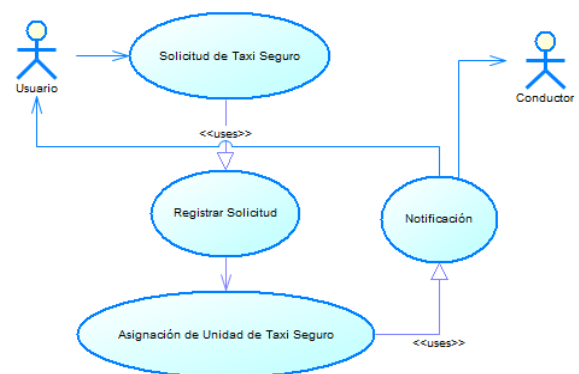

Figure 24: Use Case Diagram Solicitude of Taxi Insurance

4.4.4.1 Solicitude of Insurance Taxi

The application allows the request of taxi units will provide the required service. The user is registered according to the information of subscriber from the telephone operator or high from within application to download from your App Store.

Figure 25: Display running Llévame Service

4.4.4.2 Allocation of Unit Taxi Insurance

Specified the characteristics of assigned vehicle to the user that requesting the service as brand, plaque, arrival time and authorization number.

Figure 26: Final Run Screens Llévame Service

4.4.4.3 User Registration Information

The information of user is recorded in the system follow order chronological and approval checklist maintaining the confidentiality of their location.

Figure 27: Intermediate screens running Llévame Service

4.4.4.4 Detail Request Taxi Insurance

The user can check the status of your request of service of taxi and waiting of time of your assigned unit.

Figure 28: Final Run Screens Llévame Service

4.4.4.5 Request Taxi Insurance Start

The service request may be canceled and started according to the requirements location of the user.

Figure 29: Intermediate screens running Llévame Service

4.4.5 Racing Module

This module is responsible of request times and availability of taxis, also deliver the alerts to the end users, in defined the following use case and your respective documentation.
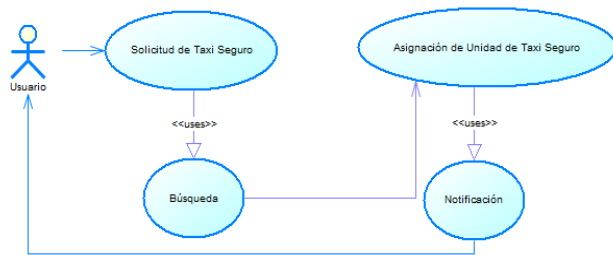
Figure 30: Use Case Diagram Assignment Taxi Insurance Unit

4.4.6 High Module Users

In this module is found the administration of new users Android and SIM of Llévame, in defined the following use case and your respective documentation.
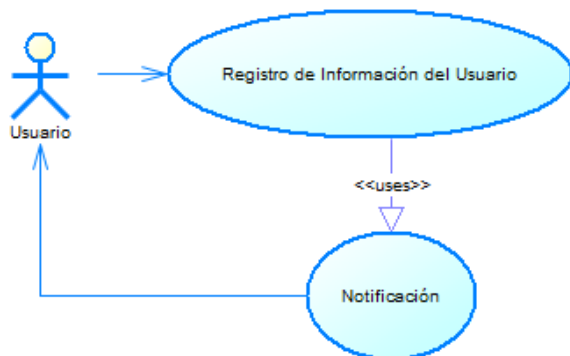

Figure 31: Use Case Diagram High Module Users

4.4.7 Security Module

This module manages the permissions in the prototypes and security in the data, in defined the following use case and your respective documentation.
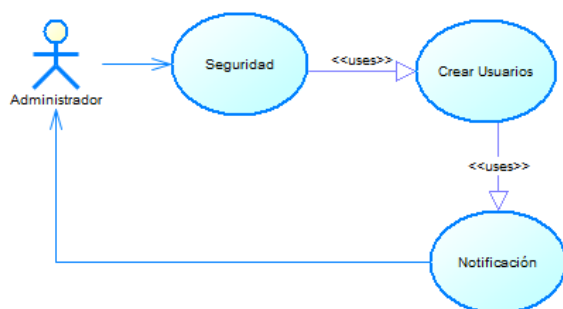

Figure 32: Use Case Diagram Security Module

4.5 Android Application Service Test Llevame

To perform tests of Llévame used the following equipment with specific characteristics of hardware and version of software:

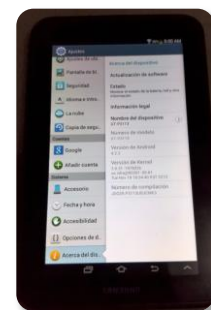|	
Samsung Galaxy Ace Operating System Android 2.2.1 Froyo	 **Figure 33: Samsung Galaxy Ace Android 2.2.1 Froyo**
Samsung Galaxy Ace Operating System Android 2.3.6 Gingerbread	 **Figure 34: Samsung Galaxy Ace Android 2.3.6 Gingerbread**
Samsung Galaxy Tab 2 de 7.0 Operating System Android 4.2.2 Jellybean	 **Figure 35: Samsung Galaxy Tab 2 de 7.0 Android 4.2.2 Jellybean**

Samsung Galaxy S3 Mini Operating System Android 4.1.2 Jellybean	 **Figure 36: Samsung Galaxy S3 Mini Android 4.1.2 Jellybean**
Samsung Galaxy S4 Operating System Android 4.4.2 KitKat	 **Figure 37: Samsung Galaxy S4 Android 4.4.2 KitKat**
Samsung Galaxy S5 Operating System Android 4.4.2 KitKat	 **Figure 38: Samsung Galaxy S5 Android 4.4.2 KitKat**

5. Conclusions and Recommendations

5.1 Conclusions

- When creating alliance with Cellular Integrators reduced costs of platform, some of them already have the necessary infrastructure to provide the operator one integral solution. Making that the application provides alerts of acceptance, arrival or cancellations of racing decrease significantly the calls between the user and the actual call center operator.

- The development in two different technologies Android and SIM is interesting and productive, you can know the potential that each one may have to provide the same service to two types of clients such as clients Smartphone and clients of Technology of Low Range.

- Developed the application "Llevame" for intelligent telephones with Android operating system, a complete tool that permit the requesting of an unit of taxi insurance to try to reduce the number of express kidnappings and assaults in a taxi that occur most frequently .

- With the experience of SIM development will could know how important is consider to users with basic equipment, they are a significant number of users that generate possible income can a good door of input to the market for mobile applications .

- Economically help to the sector of taxi to reduce the minutes to search careers, to take alternate routes to reach to the location of your client, and an improvement in the quality of your service based in the experience of each user.

- The entry secure and restricted access to data represent confidentiality and integrity required to keep regulated the sensible information. Through the use of encryption, the information can travel quietly without having that is vigilant front an external attacker.

5.2 Recommendations

- Owing to the all the SIM platform is managed by the cellular operators is recommended implement this project leaning in one of the integrators that provide direct services to Movistar, Claro and CNT.

- Llévame have a great possibility of entering in the Android market of Ecuador for the moment single exists one foreign application providing service, but is recommended analyze the market to the national level to provide the service to the principal cities in the technology mobile favors the objective.

- Taking in account all the considerations of Android platform result a very good option of profitability to develop specific applications according to the needs

that have in our environment, since being Open Source can get big input and benefits.

- The continuous training represent one of the most important roles for the mechanisms and technology implemented function correctly.
- The use of encryption through software of third decrease the possibility of an attack. If required implement an higher level of security is recommended the implementation of one solution of encryption by hardware of some service providers that would provide higher integrity to our information.
- Is recommend using this methodology Scrum in projects of any size with team of people experienced in critical modules and junior staff for less complex modules, with the frequent meetings that Scrum proposes each member would know the activities and problems of development in general and with this can learn or help to solve the problems of the project.

Bibliographic References

APACHECON. (13 de Abril de 2014). APACHE. Obtenido de http://ant.apache.org/

Chávez, M. E. (01 de Diciembre de 2012). Introducción al concepto de geolocalización e instalación del software Google Earth. Obtenido de http://escritoriodocentes.educ.ar/datos/Introduccion_geolocalizacion_google_earth.html

Chávez, M. Q. (01 de Julio de 2013). SECUESTRO EXPRESS Y SICARIATO EN ECUADOR. Obtenido de https://www.google.com.ec/url?sa=t&rct=j&q=&esrc=s&source=web&cd=10&ved=0CEUQFjAJ&url=http%3A%2F%2Fdocs.universidadecotec.edu.ec%2Ftareas%2F2013E%2FMAT230%2Falum%2F2013540263_4958_2013E_MAT230_SECUESTRO_EXPRESS_Y_SICARIATO_EN_ECUADOR.docx&ei=-8vzVNCZMomXy

Comercio, E. (01 de Julio de 2014). La ruta del secuestro exprés hasta Ecuador. Obtenido de http://www.elcomercio.com.ec/actualidad/seguridad/ruta-del-secuestro-expres-hasta.html

ECLIPSE. (11 de Marzo de 2015). Eclipse Downloads. Obtenido de http://www.eclipse.org/downloads/

Epelman, A. (28 de Mayo de 2013). Moviéndonos agilmente. Obtenido de http://blog.qualytz.com/

ESPOL. (01 de Julio de 2013). Estadísticas de Delitos. Obtenido de http://www.icm.espol.edu.ec/delitos/Archivos/reportes_mensuales/2013/Inf_Mensual_Julio2013.pdf

Franco, A. R. (11 de Septiembre de 1999). CARACTERÍSTICAS DE LAS COORDENADAS UTM Y DESCRIPCIÓN DE ESTE TIPO DE COORDENADAS. Obtenido de http://www.elgps.com/documentos/utm/coordenadas_utm.html

GEMPlus. (01 de Marzo de 2014). Guía de instalación de GemConnect. Obtenido de http://gemplus-gemconnect-on-line-sdk.software.informer.com/2.1/

Giannattasio, F. (15 de Noviembre de 2005). SIM Technology evolution and trends. Obtenido de http://www.cicomra.org.ar/cicomra2/asp/Present.%20F.%20Giannattasio%20-%20GEMALTO.pdf

GÓMEZ, P. M. (01 de Septiembre de 2005). ANÁLISIS DEL DESEMPEÑO DE LAS REDES CELULARES GSM-GPRS. Obtenido de http://profesores.fi-b.unam.mx/victor/LTesis_Patricia_Sanchez.pdf

Google. (01 de Marzo de 2014). Get the Android SDK. Obtenido de http://developer.android.com/sdk/index.html

Google. (11 de Marzo de 2014). Subir y distribuir aplicaciones. Obtenido de https://support.google.com/googleplay/android-developer/answer/113469?hl=es

GOOGLE. (11 de Marzo de 2015). ADT Plugin Release Notes. Obtenido de http://developer.android.com/tools/sdk/eclipse-adt.html

GOOGLE. (11 de Marzo de 2015). Installing the Eclipse Plugin. Obtenido de http://developer.android.com/sdk/installing/installing-adt.html

Hevia, A. (14 de Noviembre de 2011). Cómo localizar mi posición: GPS, A-GPS, WIFI y redes GSM. Obtenido de http://www.xatakaon.com/tecnologia-de-redes/como-localizar-mi-posicion-gps-a-gps-wifi-y-redes-gsm

INEC. (01 de Diciembre de 2011). Uso de tecnología en Ecuador. Obtenido de http://www.ecuadorencifras.gob.ec/documentos/web-inec/Infografias/Telecomunicaciones.pdf

INEC. (01 de Diciembre de 2012). Tecnologías de la Información y Comunicaciones (TIC´S) 2012. Obtenido de http://www.inec.gob.ec/sitio_tics2012/presentacion.pdf

Medina, R. (01 de Junio de 2013). Instalar el SDK de Android en Linux. Obtenido de http://www.mambochimbo.com/2013/06/tutorial-instalar-el-sdk-de-android-en.html

Merca2.0. (09 de Enero de 2014). Android el favorito de Latinoamérica. Obtenido de http://www.merca20.com/android-el-favorito-de-latinoamerica/

ORACLE. (11 de Marzo de 2015). Java SE Downloads. Obtenido de

http://www.oracle.com/technetwork/java/javase/downloads/index.html

ORACLE. (11 de Marzo de 2015). JDK Installation for Microsoft Windows. Obtenido de http://docs.oracle.com/javase/7/docs/webnotes/install/windows/jdk-installation-windows.html

Osorio, M. M. (30 de Marzo de 2012). SCRUM Y XP. Obtenido de http://webing-tec.blogspot.com/2012/04/scrum-y-xp.html

ROLDÁN, O. G.-A. (01 de Diciembre de 2008). ESTUDIO DE DISPONIBILIDAD DE SEÑALES DE LOCALIZACIÓN GPS/GSM. Obtenido de https://upcommons.upc.edu/pfc/bitstream/2099.1/6671/1/pfc_OscarGete.pdf

Romero, M. (01 de Diciembre de 2012). INTRODUCCIÓN A LA GEOREFERENCIACION UTILIZANDO TECNOLOGÍA GPS. Obtenido de http://www.geocities.ws/maryjromero/rvsat/p8.pdf

Stern, D. D. (12 de Septiembre de 2003). Latitud y Longitud. Obtenido de http://pwg.gsfc.nasa.gov/stargaze/Mlatlong.htm

Universo, E. (19 de Enero de 2014). Cifras del secuestro exprés se 'esconden' entre otros delitos. Obtenido de http://www.eluniverso.com/noticias/2014/01/19/nota/2049456/cifras-secuestro-expres-se-esconden-otros-delitos

Visual, I. (13 de Noviembre de 2012). DIFERENCIAS ENTRE SCRUM Y XP. Obtenido de http://www.islavisual.com/articulos/desarrollo_web/diferencias-entre-scrum-y-xp.php

Wikipedia. (09 de Mayo de 2014). Tarjeta SIM. Obtenido de http://es.wikipedia.org/wiki/Tarjeta_SIM

Ziegler, C. (12 de Febrero de 2010). Sagem Orga's SIMFi merges WiFi with SIM cards at long last, turns any phone into a hotspot. Obtenido de http://www.engadget.com/2010/02/12/sagem-orgas-simfi-merges-wifi-with-sim-cards-at-long-last-turn/