TeamBuilder: Android Enquiry Application for creating project teams.

Mandela Oyeleke

Resum—En l'última dècada, hem assistit a un enorme augment de l'acceptació dels usuaris finals de les comunicacions mòbils. A través de les aplicacions mòbils, la connexió s'estableix de forma ràpida i permanent. El sistema educatiu també és part d'aquesta innovació, així, i els professors són conscients que la interacció amb els estudiants es pot fer més ràpid i d'una manera més atractiva. En el cas d'obtenir informació a través de qüestionaris, hi ha una necessitat de canviar la forma tradicional de paper de fer l'enquesta per un sistema automatitzat, que també durà a terme els processos necessaris després de la presentació de les investigacions per complir els objectius inicials de l'enquesta i TeamBuilder ajudarà cubrir aquesta necesitat. TeamBuilder va ser desenvolupat utilitzant Java i integrada en una plataforma d'Android. Aquest document recull el procés de desenvolupament i anàlisi, així com els resultats de la construcció del sistema.

Paraules clau—Android, enquesta, formació d'equips, telèfon intel · ligent.

Abstract—In the last decade, we have witnessed an enormous increase in the end-user acceptance of mobile communications. Through mobile applications, connection is established quickly and on permanent basis. The educational system is part of this innovation as well, and the professors are conscious that interaction with the students can be made faster and in a more attractive way. In the case of getting informations through questionnaires, there is a need to change the traditional paper way of making survey for an automated system which will also perform the necessary processes after submission of the enquiries to comply the initial objectives of the survey and TeamBuilder will help to meet this need. TeamBuilder was developed using Java and integrated in an Android platform. This paper covers the analysis and development process as well as the outcomes of the system construction.

Index Terms— Android, enquiry, teambuilding, smartphone.

1 Introduction

1.1 Motivation

The idea of this project was originated from a university class necessity whereby the class coordinator needed to get the students profiles, aptitude and personal behaviour in team working. To do this, the students have to answer a questionnaire and then submit them for posterior analysis. Data derived from these enquires help the coordinator to build the different teams. But the complexity of this task is directly proportional to the number of participants. Therefore, there is a need to automatize this process and this is where TeamBuilder comes in. TeamBuilder will help to create enquiry, collect enquiry responds and analyse them for grouping students in teams. The appearance of the new technologies can make this task easier. The students have access to smartphones and tablets, which can be used to simplify this task of teambuilding using an android application.

Android [1] is the first complete, open and free mobile platform. It is developed by the Open Handset Alliance, a group of more than 30 technology and mobile companies. It is supported by Google and this project uses a Google Android Mobile SDK 1.0 [5] for testing the functionality of the application. Android is an exciting platform for consumers and developers, Android tries to open up as much of the operating system as possible.

Another component of this system is a webpage where the enquiries submitted by the students will be process. Only the coordinator has access to the page; the

- *E-mail de contacte: deemandy2@yahoo.com*
- *Menció realitzada: Enginyeria del Software*
- *Treball tutoritzat per: Dr Antonio Lopez (departament)*
- *Curs 2013/14*

access will be granted by a username and password.

1.2 State of Art

The aim of my project is to develop a system for building software project teams in a computer science class using Android-based application. After research, it is observed that there is no android application doing this specific task but a lot of survey/poll apps. Examples of these applications are Quiz & Poll [2] and Quick Poll Pro [3]. These apps allow a user to set poll questions for other users to answer which is quite similar with what this project is all about; answering questions with the difference that TeamBuilder will use some criteria for posterior selection of members for software project team. The difference between these apps and the application I developed in this project is the processing done after answering the enquiry questions and the adjunct webpage that will be used to view the students' responses. The presentation of enquiry question is similar.

1.3 Scope

TeamBuilder is a tool for making well balance teams using the criteria related to human factors, such as personality and behaviour. Given that carefully selecting team members for software teams is likely to positively influence the projects in which these teams participate, so this application will be of great use to both the teacher and the students to make a successful software project.

2 Project Plan

All aspects of project management are discussed in this section: methodology, organization and costs.

2.1 Methodology of Work

We have chosen the iterative and incremental model of software development [4]. The basic idea behind this method is to develop a system through repeated cycles (iterative) and in smaller portions at a time (incremental). The procedure begins with planning and continues through iterative development cycles involving continuous user feedback and the incremental addition of features concluding with the deployment of completed software at the end of each cycle. The iteration involves the redesign and implementation of the changes made.

Features or functionality developed in each version are described below.

2.1.1 Initial Phase

During the first phase the time was spent:

- Studying Android Java-based programming. I also carried out a research on how to transfer data using HTTP get and post [6].
- Analysed how data will be stored locally and remotely.
- Functionality of Google Android Mobile SDK 1.0 [5].

2.1.2 First Cycle

Once the basic project development concepts were assimilated, the following steps were taken:

- A study of existing poll apps was made to see whether we can make use of its features.
- A first basic executable model of the app was already installed on an android smartphone that will be used mainly for testing the app functionality and I created the very structure that will be maintained during the rest of the development.

2.1.3 Second Cycle

In this version, everything related to the structure of application was completed:

- Modification of basic configuration of the app, adding all the parameters necessary for the various functions.
- Design and implementation of the database tables that will be used in the Project.

2.1.4 Third Cycle

In this third cycle, development was aimed at interactivity of the app with the Internet:

- Creation and implementation of the necessary functions for dealing with the enquiries. The functions used to submit enquiries.
- Process of loading data from remote database to display on the application.
- Storage of data locally

2.1.5 Fourth Cycle

In this last phase of the project, the webpage is created and the random function for grouping students was implemented.

2.2 Project Schedule

In this section, I am going to explain tasks organization carried out during the realization of the project and its presentation using Gantt chart. Table 1 shows the list of different phases of the project and time spent on each of them. Each phase has different tasks that will be explained below and they can be observed in the Gantt chart (See Appendix A1).

Task	Start Date	Ending Date
Project Preparation	30/09/2013	13/10/2013
Analysis and Design	14/10/2013	3/11/2013
Implementation	3/10/2013	09/02/2014
Testing	25/10/2013	10/10/2014
Documentation	14/10/201	10/02/2014

Table 1. Phases Planning scheduled

- Project Preparation: Time spent finding information about the platform to used, learning more about android, identify the users of project output etc.

- Initial Analysis: setting realistic goals and how they can be achieved.
- Getting use to the relevant tools used in the project: read manuals about android application developments and web design.

- System Analysis and Design: this phase includes the following tasks: the breaking down of the system, scope definition, define the requirements of the end-users, logical design and interface design.
  - Application Design: Identification of project classes with their properties and methods, System scenario definition, UML diagrams, Use case etc.
  - UI Design: Sketch of all the app activities [4] and webpage interface design.
  - Database: Entity-Relationship model.
- Implementation: creating classes, connection with the database, code for submitting enquiries correctly, webpage development, and user interface (UI) layout.
- Testing: Basic functionality test and errors resolution.
- Documentation: Completing the documentation that explains all the processes carried-out.

2.3 Organization

I was the only developer of the project, acting as developer and tester at the same time as the versions advanced versions. My Tutor, Dr Antonio M. Lopez, has been the one guiding me to accomplish the initial requirements of the project evaluating the reports I submitted and advising me to make appropriate changes. The hardware used for the development was my laptop and my Samsung Galaxy Advance with Android as its OS, which also served as test environment. I also made use of the following software:

- Windows as the operating system.
- Hostinger as the Server.
- MySQL as the system database management to store the necessary data.
- Android Virtual Device Manager.
- Android SDK 1.0.

2.4 Cost

No cost in hardware or software material was necessary for the realization of the Project. Regarding the hardware, only an Acer laptop with a modest processing capacity has been necessary, property of the student. All software licenses used are free and therefore have no cost.

3 System Architecture and Design

The system structure is composed of two sides; the server-side and the client-side, whereby the user interacts with the application. The system architecture shows how these two sides communicate with each other and the protocol used. The server stores PHP files that execute http requests and returns data to the application. But these data have to be converted to JSON [7] form so that the android app can interpret them properly.

3.1 Server Application

3.1.1 Hostinger Server

It was decided that the server side will be built using Hostinger Server [8], a free hosting service with PHP and MySQL [9]. An external server is chosen over any other Java servlet like Tomcat Server so that the android app and the webpage will share the same database and direct http requests to the same server. The server stores PHP files with some functions that handle the user data management.

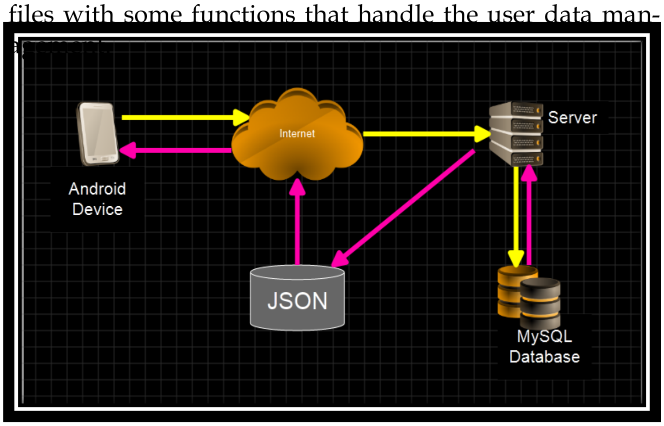


Fig. 1. Client-Server Architecture.

3.1.2 Data transfer

HTTP was the main mean of transferring data between the Android client and the server. Classes from Java's httpclient [5] package were used to prepare, send, and process POST and GET requests.

The transfer mechanism works as follows: the login data or registration data is converted into InputStream [6] and passed in a POST request, on the server side it is converted back into an object, and then inserted into the database. For the GET post, the server first convert the data retrieved from the database to JSON form before returning back to the android application. Base64_encode [2] was used in data transfer as an additional measure to ensure data security and integrity.

3.1.3 Data Storage

For the main centralized database, MySQL was chosen for the reason of being open and free, yet powerful and secure enough to guarantee the integrity of the application. Fig. 2 represents Teambuilder's database that was applied in the context of the project.

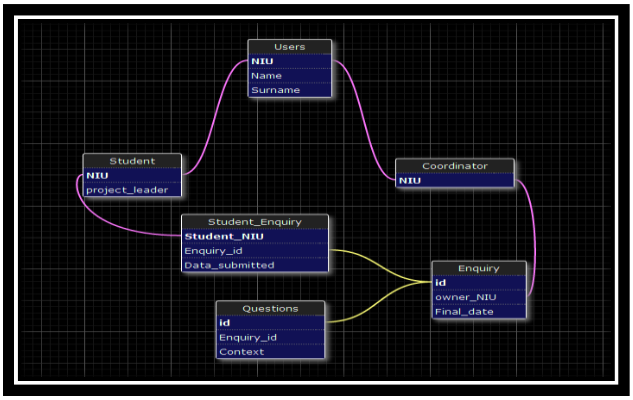


Fig. 2. Database structure used in the project.

3.2 Client-Side

3.2.1 UI design and layout

The idea of the application is to have 2 different user profiles (students and Coordinators). Depending on the type of profile, the user will have access to certain android activity [4].

3.2.2 Local data storage

Android built-in SQLite [10] database engine was used to store user session and to keep enquiries answered in android device before submitting. A content provider, the android mechanism for data storage and retrieval, was used as an extra abstraction layer to simplify and automate SQL requests.

4 System Development

4.1 System Analysis

This section covers how requirements were recollected and analysis of the application to be developed, using the UML modelling language.

4.1.1 Recollection of Requirements

The requirements were defined between me as the developer and the Project Coordinator that will be one of the future users of the application. Finally, final requirements are described in the following sections:

4.1.1.1 Functional Requirements

Functions that can be made depending on the user role:

- Students
  - Save the enquiry for further revision before submitting.
  - View the available enquiries.
  - Login to App
  - Register into app.
- Professor
  - Create a new enquiry.
  - View students' responses in the adjunct webpage.
  - View result of the grouping process.

4.1.1.2 Performance Requirements

This application will run on an android device and the data are store in a server. There may be server failure at any given time, so the application must be able to loss as less data as possible. The application must be available 98% of time. The response time after a connection loss should be less than 5 seconds.

4.2 Conceptual Model

4.2.1 Actors

This section describes the different roles played by users interacting with the system. The roles of actors can be individuals, external systems or even time (temporal events).

The Students can login to the app, answer and submit enquiries. The Professor can set enquiry questions and later view the students' responses in the webpage.

4.2.2 Use Case Diagram

In Fig. 3, we can see the use case diagram that will be explain in the following section. Each role has been considered as an actor to identify better the different functions of each of them.

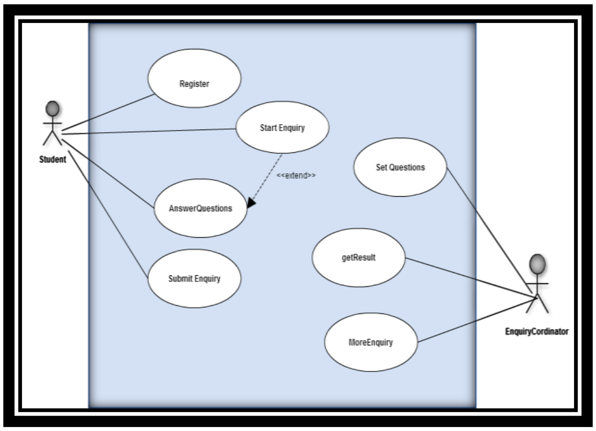


Fig. 3. User Case Diagram which shows users' interaction with the system.

4.3 Behavior Model

From previous use cases, the behaviour model was created. To do this, the system sequence diagram was created, where the operations or services were identified. Then, detailed description of the identified operations is given.

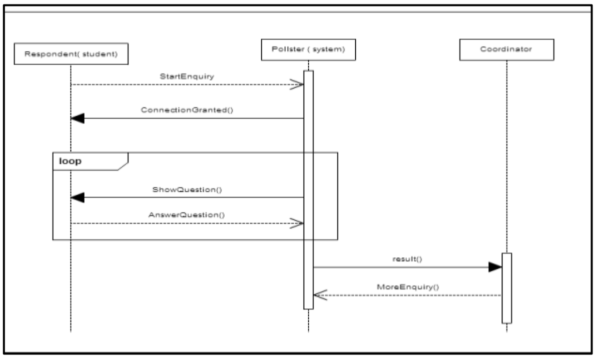


Fig. 4. Sequence diagram of the system.

4.4 User Interface Model

This section provides a prototype of a low quality of the app user interface.

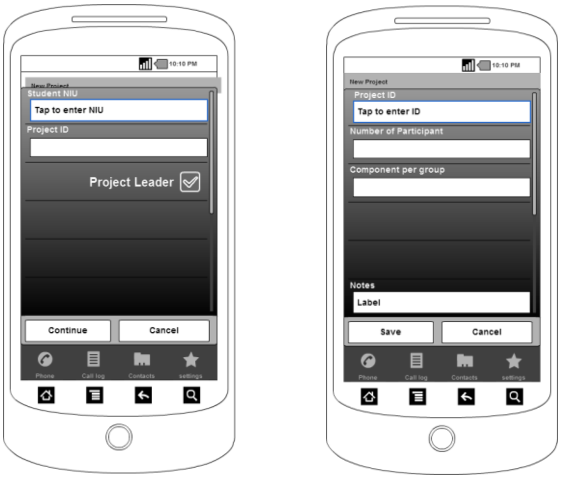


Fig. 5. Graphical Interface Prototype.

4.5 Implementation

This chapter covers all aspects related to the implementation of the system in code, using a particular technological environment.

4.5.1 Built Environment

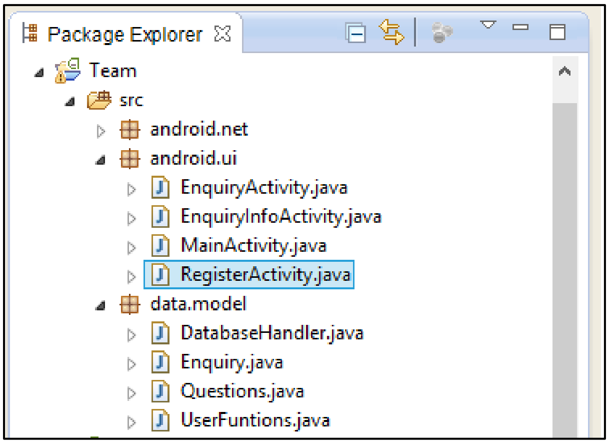
This section indicates the technology framework used to build the system: development environment (IDE), programming language, tools aid for construction and deployment, versioning, component repository, continuous integration, etc.

4.5.2 Android Application Level

Java: [11] is considered a platform-independent programming language, so that a program written can work in the same manner running under UNIX, Windows, on a Macintosh, etc.

XML: XML [12] stands for Extensible Markup Language. It is a simple, very flexible text format which was designed to carry data, not to display data. It was used to define the layout of all activities.

Code Source: The code structure and style is shown in Fig. 6. The style applied in code writing was to separate all the activity files and data files in different packages.



```
Package Explorer
Team
  src
    android.net
    android.ui
      EnquiryActivity.java
      EnquiryInfoActivity.java
      MainActivity.java
      RegisterActivity.java
    data.model
      DatabaseHandler.java
      Enquiry.java
      Questions.java
      UserFuntions.java
```

Fig. 6. Code Structure

- *EnquiryActivity.java:* contains how the questions and options will be presented on the screen and the functions for answering these questions.

- *EnquiryInfoActivity.java:* load information about an enquiry and the instruction to follow when answering questions.

- *MainActivity.java:* contains the login function, check if the user existed before granting access to enquiry page and if not, redirect to register page.

- *RegisterActivity.java:* contains the register function, one user can only register once.

- *DatabaseHandler.java:* contains functions for storing locally login information and enquiry information in case of loss of internet connection.

- *Enquiry.java:* contains enquiry class; information of enquiry.

- *Questions.java:* contains question class; information of question.

- *UserFunction.java:* contains functions that make communication with the database and server possible.

4.5.3 Webpage Level

HTML: HTML [13] stands for HyperText Markup Language. It is a markup language for developing web pages. Define a basic structure with a code for defining the content of the web pages. The W3C is the organization responsible for the standard. This markup language is then interpreted by the web browsers that implement how to display that content.

CSS: CSS [14] stands for Cascading Style Sheets. These a style sheet language used to describe the presentation semantics (the look and formatting) of a document written in markup language. It complements the HTML document shaping the content. The project contains file written in this language for styling the tables that will be displayed on the webpage.

Notepad++: [15] is a text editor and source code editor for Windows. It is a very versatile text editor, widely used by programmers and technical users. It is a very useful tool for editing code as it adapts to the language used and provides much support to the code structures through indentations and colours. It has been used to write all the code concerning the webpage development.

Algorithm 1. Random Function

```
function ramdomization($nteams){
        $list=Submit_List();
        shuffle($list);
        $newArray = array_chunk($myArray, $nteams, false);
}
```

This algorithm shows the function that is used to group the array of students randomly. The function has "nteams" which stands for the number of team that is needed. Student list is loaded with *Submit_List() and shuffle()* rearrange the order of the element in the array. Then, *array_chunk()* split the new array into different smaller arrays that will contain components of each team.

5 Result Presentation

The outcome of the system was tested periodically. The android application was tested on my android phone; a Samsung Galaxy Advance with android version 2.3.6 and the webpage on Google Chrome web browser.

Mobile Application: After installing the application on an android supported mobile phone or tablet, user can start ans. To set the question, the coordinator can either choose the predefined enquiry of the application or set different questions. For the students to be able to answer a given enquiry, they must be identified with their student identification (NIU) and name (check Appendix A2). After answering the questions, the student may choose to save it for further modification or submit them to enter the team selection process. This application has 2 types of users.

Web Application: This application will the used by the coordinator to view the enquiries submitted and for result analysis. The web page will be connected with a database where the result will be stored, on clicking on the "Group student" option (see Appendix A3 & A4), students will be grouped randomly, the coordinator can make the appropriate changes if not satisfied with the grouping.

6 CONCLUSION

In this final chapter, I am going to give details of the target achieved, the lessons learned during the development of this project and potential opportunities for improvement are identified on the software developed.

6.1 Evaluation of Objectives and Aims

Since this project was designed with clear objectives, there has been continuous redefinition of these objectives, adapting to the capabilities of the system and time. This is the description of the objectives have been able to achieve:

- Coordinator can create a new enquiry.
- User can register and login.
- Write the submitted enquiry to the remote database.
- The system can gather all submissions for one enquiry and process them.
- Give results to the coordinator about an enquiry.

6.2 Lesson Learned

This project has turned out to be challenging in many ways. Each stage has presented its own problems to be overcome.

Due to my little experience in android programming, the beginning the project was slow and there was need to study manuals and try tutorials about android programming using Java. But nevertheless I learned a lot during the process of development of the system. Some of the good procedural practices I learned were:

- Version Control.
- Documentation.
- Working in modules.

6.3 Future Work

Due to the delay in the initial stage of the project, I couldn't create an intelligent algorithm to group the students according to their aptitudes and personal profile; it will be done randomly in the present version of the application and the coordinator can make the appropriate changes. For future versions of the application, I am going to find a way to create an accurate algorithm for the team building.

ACKNOWLEDGMENT

I would like to thank my tutor, Dr. Antonio Lopez for guilding me through both the planninig and execution of the project.

BIBLIOGRAFIA

[1] Android- (Consulted on 30/09/2013) http://www.android.com/

[2] Quiz & Poll App- (Consulted on 24/10/2013) https://play.google.com/store/apps/details?id=org.quizpoll&hl=en

[3] Quick Poll Pro- (Consulted on 24/10/2013) https://play.google.com/store/apps/details?id=com.greggreno.quickpollpro20&hl=en

[4] http://www.techopedia.com/definition/25895/iterative-and-incremental-development (Consulted on 24/10/2013)

[5] Android Mobile SDK 1.0- https://developer.android.com/sdk/RELEASENOTES.html

[6] HTTP get and post http://www.w3.org/Protocols/rfc2616/rfc2616-sec9.html

[7] JSON http://www.json.org

[8] Hostinger Server http://www.hostinger.es

[9] MySQL- http://en.wikipedia.org/wiki/MySQL

[10] SQLite http://www.sqlite.org/lang_corefunc.html

[11] Java http://docs.oracle.com/javase/tutorial

[12] XML http://developer.android.com/reference/android/util/Xml.html

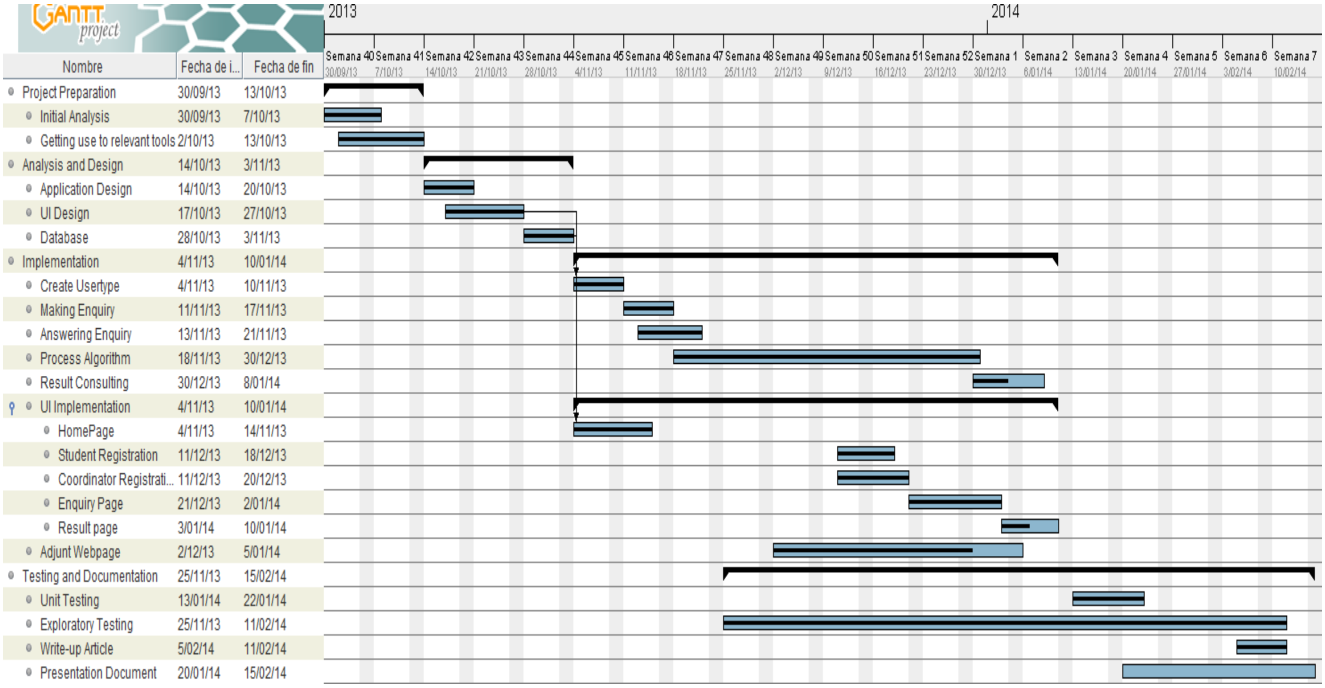
[13] HTML http://htmldog.com/guides/html/beginner/

[14] CSS http://en.wikipedia.org/wiki/Cascading_Style_Sheets

[15] Notepad++ http://en.wikipedia.org/wiki/Notepad%2B%2B

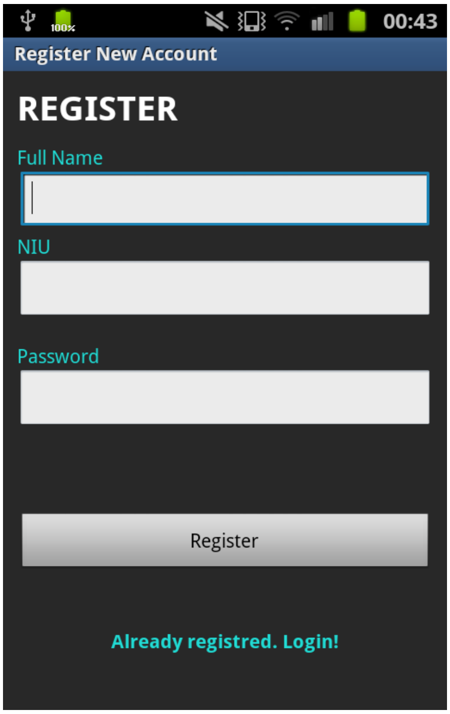
APPENDIX

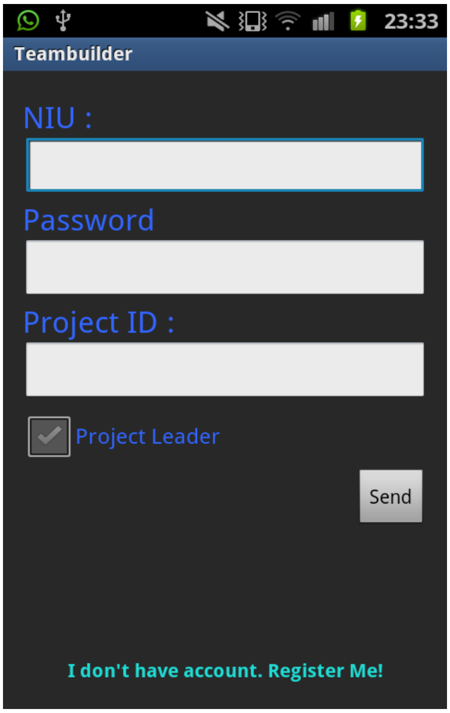
A1. Gantt Diagram

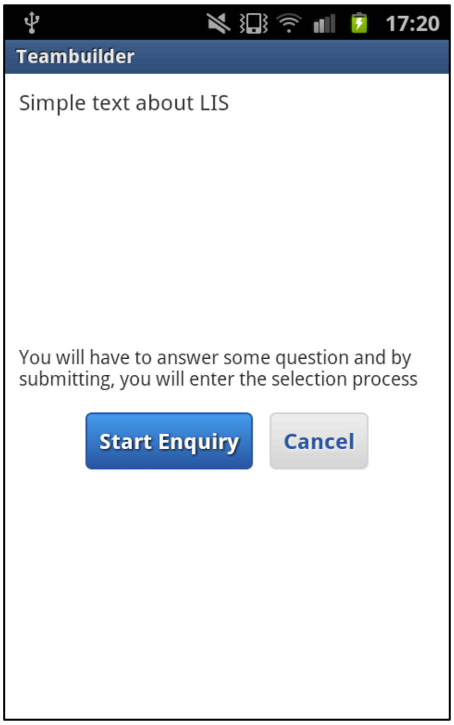


Nombre	Fecha de i...	Fecha de fin
Project Preparation	30/09/13	13/10/13
Initial Analysis	30/09/13	7/10/13
Getting use to relevant tools	2/10/13	13/10/13
Analysis and Design	14/10/13	3/11/13
Application Design	14/10/13	20/10/13
UI Design	17/10/13	27/10/13
Database	28/10/13	3/11/13
Implementation	4/11/13	10/01/14
Create Usertype	4/11/13	10/11/13
Making Enquiry	11/11/13	17/11/13
Answering Enquiry	13/11/13	21/11/13
Process Algorithm	18/11/13	30/12/13
Result Consulting	30/12/13	8/01/14
UI Implementation	4/11/13	10/01/14
HomePage	4/11/13	14/11/13
Student Registration	11/12/13	18/12/13
Coordinator Registrati...	11/12/13	20/12/13
Enquiry Page	21/12/13	2/01/14
Result page	3/01/14	10/01/14
Adjunt Webpage	2/12/13	5/01/14
Testing and Documentation	25/11/13	15/02/14
Unit Testing	13/01/14	22/01/14
Exploratory Testing	25/11/13	11/02/14
Write-up Article	5/02/14	11/02/14
Presentation Document	20/01/14	15/02/14

A2. Screen Captures of the Application

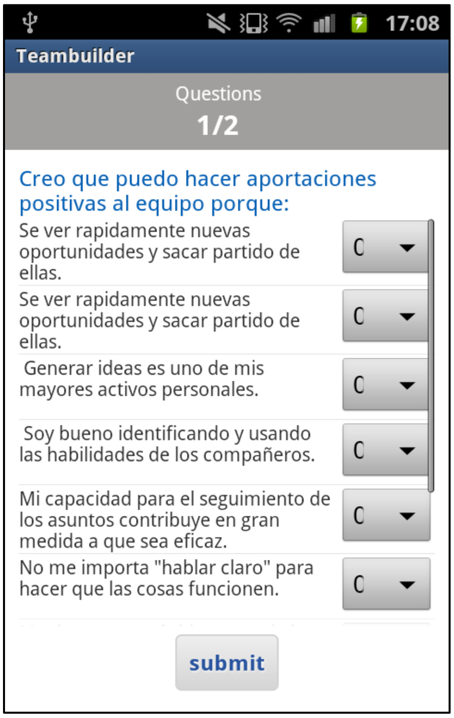






Simple text about LIS

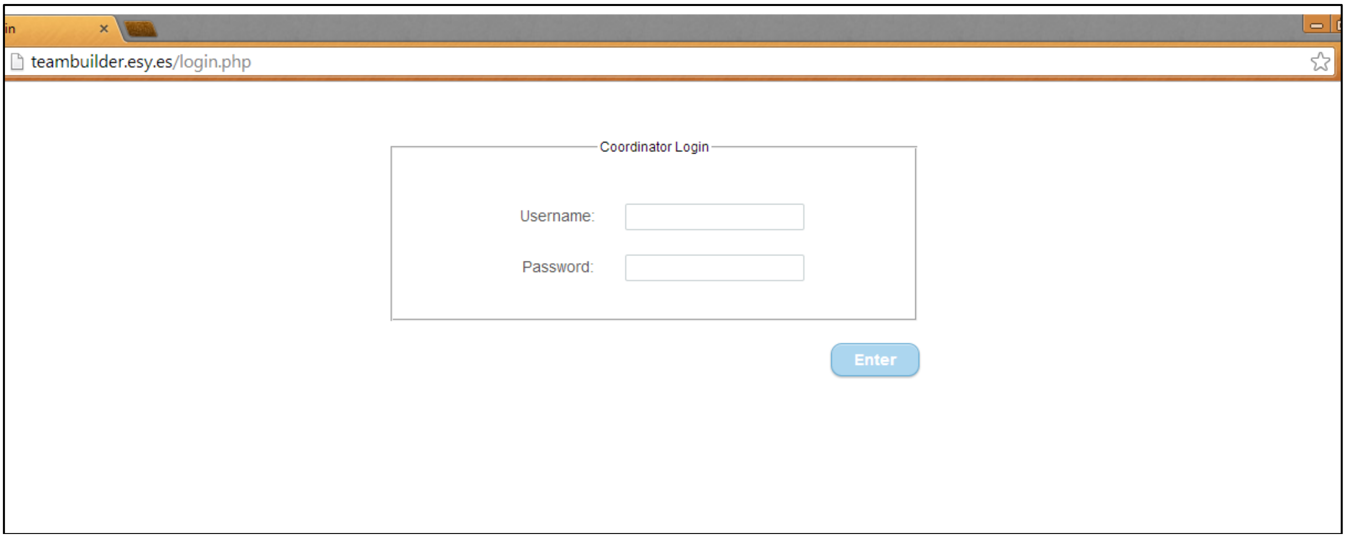
You will have to answer some question and by submitting, you will enter the selection process



Creo que puedo hacer aportaciones positivas al equipo porque:

Se ver rapidamente nuevas oportunidades y sacar partido de ellas.	0
Se ver rapidamente nuevas oportunidades y sacar partido de ellas.	0
Generar ideas es uno de mis mayores activos personales.	0
Soy bueno identificando y usando las habilidades de los compañeros.	0
Mi capacidad para el seguimiento de los asuntos contribuye en gran medida a que sea eficaz.	0
No me importa "hablar claro" para hacer que las cosas funcionen.	0

A3. Screen Capture of Coordinator Login Page

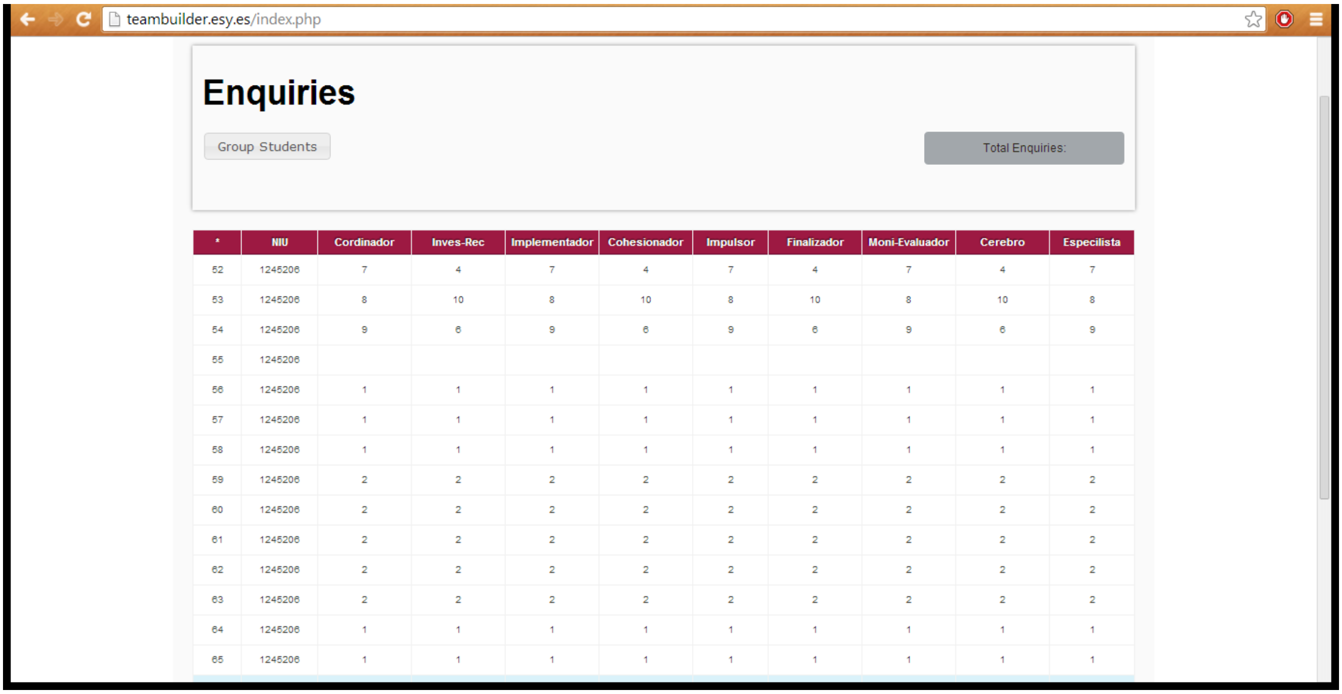


Coordinator Login

Username:

Password:

A3. Screen Capture of Enquiries submitted list



Enquiries

Total Enquiries:

*	NIU	Cordinador	Inves-Rec	Implementador	Cohesionador	Impulsor	Finalizador	Moni-Evaluador	Cerebro	Especilista
52	1245206	7	4	7	4	7	4	7	4	7
53	1245206	8	10	8	10	8	10	8	10	8
54	1245206	9	6	9	6	9	6	9	6	9
55	1245206									
56	1245206	1	1	1	1	1	1	1	1	1
57	1245206	1	1	1	1	1	1	1	1	1
58	1245206	1	1	1	1	1	1	1	1	1
59	1245206	2	2	2	2	2	2	2	2	2
60	1245206	2	2	2	2	2	2	2	2	2
61	1245206	2	2	2	2	2	2	2	2	2
62	1245206	2	2	2	2	2	2	2	2	2
63	1245206	2	2	2	2	2	2	2	2	2
64	1245206	1	1	1	1	1	1	1	1	1
65	1245206	1	1	1	1	1	1	1	1	1