Development of a tool based on mobile services in a WiFi network as support of tutorial activity

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Abstract

This paper describes the design and development of an application based on mobile services using a WiFi network as support of tutorial activity. One of the main objectives was to design a tool with bidirectional communication between tutors and students to support the comprehensive training of universitary students considering tutoring as a process of support in their academic life. The mobile application was developed natively for the Android platform because of the advantages offered by this technology such as access to platform resources in a straightforward manner and coupled with the benefits provided by current complementary tools such as Apache server, PHP, JSON and MySQL. To develop this application a methodology named D-mobile was used, which is an agile development methodology that we consider appropriate to our context, given the requirements and resources of our development team.

Keywords: Android app, M-Service, Mobile service, Tutorial session.

1. Introduction

Wireless and mobile communication networks have had tremendous success in today's communication market both in general or professional usage. In fact, obtaining communication services anytime, anywhere and on the move has been an essential need expressed by connected people. This becomes true thanks to the evolution of communication technologies from wired to wireless and mobile technologies, but also the miniaturization of terminals. Offering services to users on the move has significantly improved productivity for professionals and flexibility for general users [1].

So , wireless technologies such as WiFi are considered vanguard by introducing advanced technologies and Internet connectivity to rural areas because they provide enormous benefits to local users by connect them to a service provider [2] .

In [3] a mobile service (m -service) is defined as an application that is accessible from mobile clients over wireless networks. These services promise several benefits compared to their counterparts that use cables. First of all , mobile services fall into the category of access to services "anytime, anywhere" . Users do not need to sit in front of their desktops to manage their activities.

With regard to development technologies, the use of Android has increased considerably since the beginning of its exploitation between the academic community because of the large amount of mobile devices that they cover. The Android platform is open -source and the process to develop applications is friendlier than competing platforms. Additionally, the applications distribution is more flexible in the development and access to device resources [4].

Regarding to development methodologies, D -mobile is included as an agile development methodology to mobile applications [5]. This methodology was conceived in a period of intense growth in the field of mobile applications and it is based on other well known and consolidated solutions such as eXtreme Programming (XP), Crystal methodology and Rational Unified Process (RUP) [6].

On the other hand in [7] tutorship is defined as a process of personal and academic support throughout the training process to improve academic performance of the student, solve his/her troubleshoots, develop study habits, work, reflection and social interaction. In order to succeed as a tutorship program, it requires a shared and permanent commitment, without it, it is not possible to achieve the objectives of the programs each institution intends to design and implement. It is a commitment between two parts: the tutor and tutoring, in an institutional context, which should create the conditions for the fruitful relationship between both parties [8].

This paper describes the design and development of a mobile application as a service to support tutorship program at the Autonomous University of Yucatan, Mexico, Tizimín Multidisciplinary Unit. One of our main objectives is to describe how to make a tutorial session for supporting the academic life of students at our institution, and how it is intended to implement it using the advantages that smartphones and wireless networks provide.

The work is divided as follows: after this introductory

section there is a section with the description of the architecture and design considerations. Below we have a section describing the development of the mobile service, the core of this work. Then the results and implementation considerations are described. Finally, we describe the tasks in progress and future works considered.

2. Architecture and design considerations

An application based on mobile services does not store data on the mobile device. Therefore, when the user requires access to the application and data, a network connection is required. In our case the network connection is wireless (WiFi) whereby all data are transmitted to user request.

With respect to methodologies to development of mobile services, we considered D-mobile [5] and additionally we used a participatory approach, i.e. involving different end-users working with the team at different stages.

With respect to users, the application has modules to serve three types of users: tutors, students, and administrator. Each of them has different needs and different characteristics. Because of this, we decided to include in the system three different actors to manage these users: Tutor, Student and Administrator.

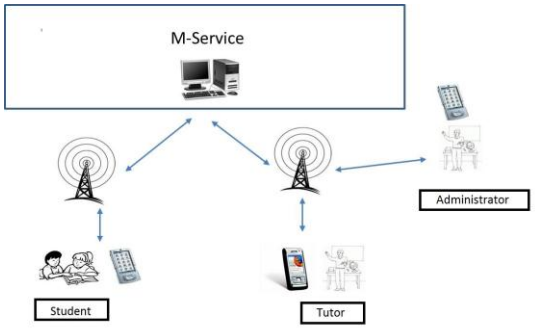

Figure 1. General Application Architecture

The need for accessing to information at any time and place within the institution triggered the design of these actors to be used on smartphones. For a tutor is important to be able to manage information about their tutorial sessions in an orderly, and efficiently way and above all have temporal continuity to offer their services without interruption. Also, due to management requirements, we decided to introduce another actor that manages all the session information of the tutors: Administrator. This actor is responsible for maintaining the availability of the application on the network and controls the access to data. Thus the application has three actors: Tutor, Tutoring, and Administrator.

These three actors interact with the mobile service, emphasizing communication between tutor and student. If the user (Tutor or Student) is located at any point within the institution, using the WiFi network can use the tutorial application, sending requests to the mobile service, and the appropriate response to the actor applicant as well.

3. Mobile Service development

The following describes the design and implementation of the service considering the types of users and processes to develop.

3.1 Service modules considered

Part of the functional requirements was to define the services that the tool would provide. Among the main modules offered by the mobile service are the following:

• Sig in or update the profile of tutor or student (users accessing: Tutor/Student). In this module, the registration process (or modification of data) is done with access control.

• Viewing data concerning to the Tutor and Tutoring (Tutor / Student). This module shows the necessary data to each of the actors, providing confidentiality of the information displayed.

• Send notifications (Tutor/Student). This module provides a communication channel between tutor and tutorship. The tutor can display different notifications from their tutees, while each tutee can only see its own.

• Appointment Request (Tutor/Student). Once the student queries possible schedules, it must select one and thus establish a reservation at a specific time for the tutorial session.

• Session tutorial (Tutor). This is the core of the mobile service, it will be generated according to the matters considered at the meeting. It was designed with the following sub-modules:

- General data for the current session
- Theme developed in the session
- Difficulties submitted (or detected in the session).
- information requested by tutee
- tasks agreed
- Commitments set
- Next appointment tutoring

• Generate a Tutorial Report (Tutor). This report will be generated by the tutor at the end of the tutorial session by mutual agreement with the student.

• Requesting next appointment (Tutor/Student). This module may be made an appointment request in person, by both the tutor and the student.

Each of the three types of users considered in the tool have their respective access control, due to the three different levels at which the mobile service has: student level, tutor level and administrator level. While the tutor will have access to most of the modules such as tutorial session, appointment calendar, task management, and administration of commitments, the student may only view their own data and specific data of his/her tutor, request appointments and edit his/her profile. Meanwhile, the administrator will be responsible for managing users, creating backups, restoring backups and providing technical support to mobile users. Figure 2 displays the use cases to the actors: administrator, tutor and student.

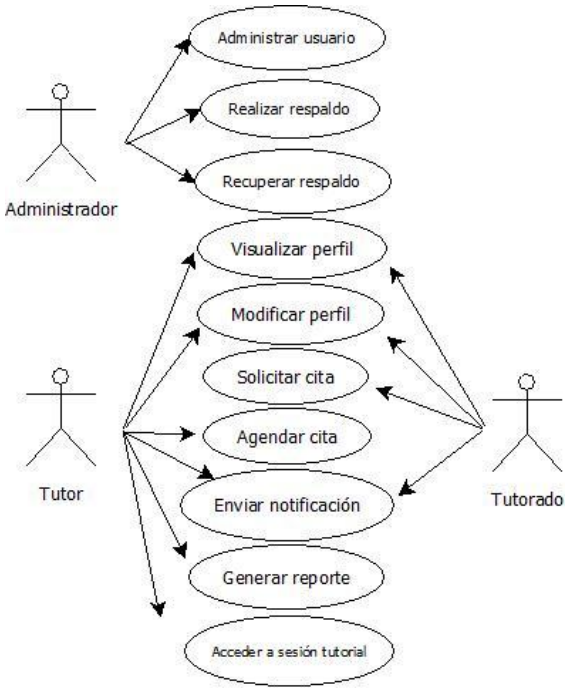

Figure 2. UML Diagram of use cases of the app

3.2 Implementation of mobile service

The development was divided into two parts, which are detailed below:

• Server part (PHP applications with MySQL interaction)

• Client part (Android interfaces and native operation)

Server part. The server application processes were developed in PHP using JSON and interacting with the MySQL DBMS. JSON means JavaScript Object Notation, which is a simple format, easy to read and write for a wide range of scripting languages and may represent a structured nested data [9].

A considerable part in the development involved using the JSON structure with PHP instructions. For example, the following PHP code (a script called Consulta.php) uses JSON format to return the name and identifier of a tutor (to provide such information to a tutee):

```
<?php
require_once __DIR__ . '/Coneccion.php';
$db = new DB_CONNECT();
$consulta=mysql_query("SELECT Nombre,idTutor FROM
datos_tutor");
$nombres= array();
$ids=array();
if (mysql_num_rows($consulta) > 0) {

 while($Resultado=mysql_fetch_assoc($consulta)){
          $nombres[]=$Resultado["Nombre"];
          $ids[]=$Resultado["idTutor"];
 }

 $Ouput["Nombre"]=$nombres;
 $Ouput["idTutor"]=$ids;
 echo json_encode($Ouput);
}
else {
    echo 0;
}
?>
```

The database was created with the MySQL DBMS due to the ease of interaction with PHP, which allows proper management of data in conjunction with other tools.

This database considers the relational tables shown in Table 1 to provide the necessary services to users.

Table 1. Relational tables for the database of the mobile service

Relacional table	Description
Cita	Relationship between datos_tutor and datos_tutorado tables
Compromise	Relationship between the student and the session to arrange a task
datos_tutor	Table of Tutor Data
datos_tutorado	Table of Student Data
dificultades_catalogo	Tableof predefined difficulties
horario_asesoria_tutor	Table of Tutor advisory schedules
informacion_catalogo	Table of complementary information
Notificacion	Table of notifications between tutor and student
Session	Table of data of the tutorial session

sesion_dificultades	Table with data of the difficulties identified in the session
sesion_dificultades_adicionales	Table with data of the additional difficulties identified in the session
sesion_informacion	Table with general information of the session
sesion_informacion_adicionales	Table with additional general information of the session
sesion_tematica	Table with data of the subject treated in the session
sesion_tematic_adicionales	Table with additional thematic data discussed in the session
tareas	Table of tasks assigned to student
tematica_catalogo	Table of predefined topics
tutorado_beca	Table with scholarships data
usuario	Table with data from service users

Tematica is the name of a relational table that stores some tutorial session data. The scheme and relational table information is shown in Figure 3. These themes are stored in order to produce statistics and determine the status of each of the students.

idTematica	descripcion
1	Expectativas hacia la carrera
2	Situación escolar actual
3	Elección de materias
4	Estrategias de estudio
5	(Situación personal) Problemas económicos
6	(Situación personal) Estudiar y estar casado(a)
7	(Situación personal) Trabajar y estudiar
8	(Situación personal) Estudiar y tener hijos
9	(Situación personal) Problemas de salud
10	(Situación personal) Problemas familiares
11	(Situación personal) Problemas sentimentales
12	(Situación personal) Autoestima
13	(Situación personal) Otro
14	Falta de cumplimiento de tareas
15	Inasistencia a clases
16	Comunicación interpersonal
17	Insatisfacción de la carrera elegida
18	(Apoyo académico) Proyecto
19	(Apoyo académico) Bibliografía
20	(Apoyo académico) Tareas
21	(Apoyo académico) Asesoría
22	(Apoyo académico) Gestión para diversos apoyos
23	(Apoyo académico) Canalización para solicitud de a...
24	(Apoyo académico) Otro
25	Reprobación
26	Otra temática

Figure 3. Relational Schema: Tematica

Another of primary relational tables which is stored in the server is the table called *Dificultades* (Figure 4). Data represent predefined difficulties that can be detected in a tutorial session. Identifying student's difficulties is a fundamental part in a tutorial session because a possible solution can be determined in a confidential and secure way and/or send to the student to educational guidance department for treatment.

idDificultades	descripcion
1	Ninguna
2	En su relación con algún profesor
3	En sus relaciones con compañeros
4	De adaptación a la escuela o grupo
5	En la administración del tiempo
6	Para trabajar en equipo
7	Para relacionarse
8	En su relación de pareja
9	Con alguna asignatura
10	Otra dificultad

Figure 4. Relational Schema: Dificultades

Client part. In this part application interfaces were developed. They were developed with the Android development kit that includes the use of XML [10] . The Eclipse IDE was used [12], due to the excellent management of resources to mobile programming. Connexion from Android was necessary to give internet access permissions to the file android.manifest of the project:

```
<uses-permission
    android:name="android.permission.INTERNET" />
```

The interface in Figure 5 (activity_alta_tutorado.xml) shows the required data for the administrator to register students in the app.

Figure 5. Interface of Sign-in of students

Below the Android method *onCreate* ( ) of the *AltaTutorado* class is showed, which is in charge of invoking the service Consultas.php to link each student with his/her tutor and to add the student to the users in the MySQL database [11] of the mobile service .

```
protected void onCreate(Bundle savedInstanceState) {
   super.onCreate(savedInstanceState);
   setContentView(R.layout.activity_alta_tutorado);
   Matricula = (EditText)
findViewById(R.id.editMatriculaTutorado);
   ClaveTutor= (EditText)
findViewById(R.id.editClaveTutorParaTutorado);


   ClaveTutor.setOnClickListener(new
View.OnClickListener() {
```

```
     public void onClick(View v) {
      ArrayList<NameValuePair> postValores= new
ArrayList<NameValuePair>();
      postValores.add(new BasicNameValuePair("clave",
"1"));
      try {
           respuesta =
HttpWithJson.executeHttpPost("Consultas.php",
postValores);
           JSONArray jArray =
respuesta.getJSONArray("Nombre");
           int Tam=jArray.length();
           listaNombres=new String[Tam];
           for(int i=0;i<Tam;i++){
             listaNombres[i]=jArray.get(i).toString();
           }
           crearDialogoSeleccion().show();
           } catch (Exception e) {
            e.printStackTrace();
           }
      }
     });


   Aceptar   = (Button)
findViewById(R.id.BtnAceptarRegistroTutorado);
   Aceptar.setOnClickListener(new View.OnClickListener(){
    public void onClick(View v) {
      MatriculaE=Matricula.getText().toString();
      ClaveE=ClaveTutor.getText().toString();
      crearDialogoAlerta().show();
    }
   });
}
```

Figure 6 shows the interface of the first part of the tutorial session which covers the topics addressed in the session.

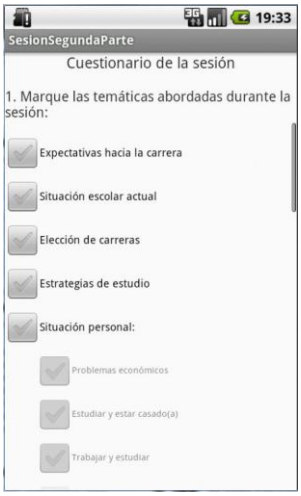

Figure 6. Interface about topics of the session

Figure 7 shows the interface of the difficulties section presented in the tutorial session, which can be from one, up to a certain number of them that were informed by the student or detected by the tutor.

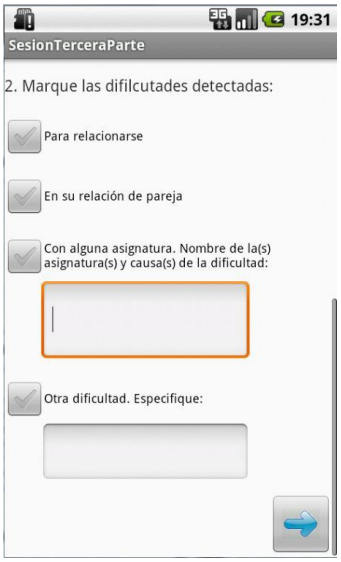

Figure 7. Interface about presented difficulties

The development was successfully completed in a timely manner due to the team's ability to work and collaborative approach applied properly. The implementation had an initial delay due to problems with data management formats on the network but this was solved using JSON, which offers an easy way of structuring and transporting data between PHP and Android apps.

4. Results and additional considerations

Different qualitative assessments were made throughout the development process based on direct interaction with various representatives of a significant population sample of end users (6 of 11 tutors and 4 of 67 students). We believe that the application has the features to be successfully implemented. The evaluation was conducted and documented in various stages of development process according to the methodology used. However, considering that the mobile is in final testing stage, it will be necessary to make a quantitative assessment of satisfaction and usefulness of the application.

Among the advantages that we consider will provide the application are the following:

• Encourage two-way communication between tutors and students in a confidential and secure way.

• Collecting qualitative information in a timely tutoring, and providing information such as personal data, academic issues, data about tutorial sessions, tasks and commitments, etc.

• To make teachers aware about the benefits of mobile technology to help develop tutorials tasks more effectively and efficiently. In [13] is considered that teachers have a certain fear of being outdated unless they learn to use these

applications, as they have no doubt that the use of technological resources is a great professional help.

• Regarding technical aspects, a major advantage is the native integration of the application with the mobile device resources in which it is installed, i.e., the application can access to all device resources (GPS notifications, camera, contact list, accelerometer, calendar, etc.).

Among the possible considered are the following:

- Initial disinterest by teachers in the use of mobile technologies.
- Refusal to perform activities of a constructivist tutor, such as planning, encouraging cooperative learning and teaching students about the autonomy to decide their own learning strategies [14].
- Dependence of the application to the platform. Platform changes would significantly affect the application, in addition to having to adapt to the policies and restrictions imposed by it.
- High expectations regarding the availability of data. Logically, the user expects to have wireless network coverage, so however the application could not be always available if the connection is unstable and the use of the application can be frustrating.

Finally, we consider some principles for successful implementation of the mobile service in our institution:

• Feedback. The tutor must be able to respond in a short period of time and effectively provide assessment and guidance to the student's performance in wireless usage. The answer of the tutor must be enough timely to modify the coaching process that is being applied to tutoring.

• Ability to self-criticism and drawing conclusions from the use of the mobile service. This could become a very useful tool to detect mistakes in their use. If it is used incorrectly could cause disinterest to the users.

• Friendliness. The tutor must be always cordial, even in a non-face, so that student feels comfortable and can freely express their concerns, interests or suggestions regarding the mobile environment.

• Confidence. The tutor must create a climate of trust with students, highlighting their achievements and progress in tutoring using the mobile service, avoiding criticize in a non constructive form and motivating them to achieve the commitments agreed in tutoring.

5. Conclusions and future work

In this paper we presented the design and development of a mobile service as support of tutorial activity using Android technology with PHP, JSON and MySQL on a WiFi network.

The main contribution of this paper is in the supporting part students will receive in a medium term, because this tool will analyze trends in students, regarding the problems that occur throughout his/her college career. This tool is not intended to replace face tutorship, but to complement the development of tutorship to both parties: tutor and student.

As part of further work is a security analysis ongoing considering elements such as the network that serves the application, server security and safety in the same application. As future work, it is clear that a plan for monitoring and continuous improvement is necessary for this mobile service because it does not suffice to describe how it works, but at one point the why is serving or is useful or not.

Moreover, we consider the range of possibilities offered by a native application like ours is huge and we can do just about anything we design. Our app is really an application that can be extensible, also having native access to resources. Based on this fact, another future work will leverage the popularity and efficiency of web applications, and develop modules for using the same tools of native applications (such as camera, calendar, and notices in our case).

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