

MEDICAL HISTORY APPS FOR PATIENT CONSULTATION IN THE EMERGENCY AREA OF THE MEDICAL AND HOSPITAL UNIT.

¹Ing. María Magdalena Díaz Solís, ²M. I. Alejandro Gil Vázquez, ³M.C. Violeta Martínez Ramírez

^{1,2}Instituto Tecnológico de Tláhuac
Tecnológico Nacional de México Systems
and Computing Department
Estanislao Ramírez Av. # 301 Colonia Ampliación Seleno C.P. 13430 Tláhuac CDMX
(¹)mmagui_1993@hotmail.com, (²)ing.gil@ittlahuac.edu.mx

³Instituto Tecnológico de Puebla
Tecnológico Nacional de México
Department of Systems and Computer
Science
Av. Tecnológico # 420 Col. Maravillas Puebla, Puebla. CP 72220 Mexico. violetmartinezr@gmail.com

Digital Object Identifier: <https://doi.org/10.61117/ipsumtec.v1i1.4>

Abstract-- The main objective of this research and development work is to respond to the requirements of the Information Technology Department of the Medical and Hospital Unit of the public sector in Mexico City, which is starting an ambitious project aimed at including the use of new technological tools with main purpose of initiating a digital modernization challenge in its administrative and customer service processes.

For this purpose, the first stage consists of having an Android application for mobile devices (in particular, Smartphone) in the Medical Emergency area that allows easy and quick consultation of the medical records of patients admitted to the Shock, Short Stay and Observation areas. This App displays patient data and medical history, in addition to the medical assessment and relevant notes recorded by the doctors on duty.

This area, and within any other medical unit in the country, is considered of vital importance due to the delicate health situation of the admitted patient, in which his life or death hangs in the balance. Patients are received there 24 hours a day, 365 days a year. Its care is uninterrupted, and is covered in shifts by an extraordinary group of specialists, specially selected to perform medical work under pressure.

Keywords: Mobile applications, Android operating system, RUP method.

INTRODUCTION

Information technologies have had a great advance in the field of information technology, being introduced in almost all areas of society and making their use more and more essential. This is the case of the use of mobile telephony. Its evolution has been impressively fast adding more and more functionalities that go beyond just making calls, with this evolution it has been called smart phone (Smartphone) and corresponds to the miniaturization of the computer [1].

The proposed project of Mobile Application for Patient Consultation wants to provide the patient's data regarding the medical consultation previously performed by the assessment and clinical diagnosis personnel on duty. Although this information is stored in a website installed on the PC, the mobile application through the phone would offer, due to its easy installation, an extremely fast and orderly access to the file in order to obtain timely and accurate information to any of the members of the medical group that requires it.

PROBLEMS TO SOLVE

The Emergency Department of the public hospital in Mexico City has a few computers installed in a fixed area with non-exclusive access for all its physicians, whose installed software allows searching and knowing the medical situation of the patient through the notes generated in the different emergency , causing delays in the

availability of computer equipment, which is of vital importance for the correct and timely medical care of the patient and, therefore, his or her prompt recovery.

GENERAL OBJECTIVE

To develop a mobile application based on Android Studio that efficiently displays clinical information of patients in the Emergency Department under search criteria defined by the Hospital's medical staff.

JUSTIFICATION

Nowadays, the use of mobile applications has become even more indispensable because they have facilitated access to information in a more personal way, optimizing the work of people in extraordinary times and with a certain ubiquity that makes it even more attractive [1].

The implementation of a mobile application to consult patient records in the emergency department will allow the physician to digitally visualize, from palm of his hand and at any point within the Hospital facilities, the current status of the patient and the length of stay in the emergency department, without having to stop to search from a computer at a fixed location.

For this reason, the IT area wishes to implement the use of a mobile application that significantly reduces the response time in the search for information required by the physician about the patient within the hospital.

LIMITS AND SCOPE

The application seeks to simplify the visualization of the digital record of the observations in the file that the patient generates through the different consultations that he/she may have in the emergency department, as well as the evaluation that is made within the TRIAGE. TRIAGE is a term used within the Hospital to establish a process of preliminary clinical assessment of patients, prior to diagnosis and complete therapy in the emergency department.

Emergency physicians will have access to the patient's record through their mobile devices with Android operating system within the area with access to the hospital's WIFI.

Physicians will know the current status of the patient who is admitted to the Shock, Observation or Short Stay areas.

METHODOLOGIES FOR MOBILE APPLICATION DEVELOPMENT

The following is a comparative analysis that helps to visualize in a more objective way which methodology is better adapted to the development of the proposed project.

RUP Methodology

Characteristics: Development development. Requirements . Use of component-based architecture Change control. Visual modeling of software. Software quality verification.

Advantages: Requires knowledge of the process and UML. Visible progress in early stages. Use of iterations. Risk assessment rather than discovery at final system integration. Facilitates code reuse.

Disadvantages: Due to the degree of complexity it may not be very suitable. Poorly applied in cascade style [2].

XP Methodology

Characteristics: Methodology based on trial and error. Based on Values and Practices

Expressed in the form of 12 Practices-Complete set-They support each other-They have been known for a long time. The novelty is to put them together

Advantages: Organized programming. Lower error rate. Programmer satisfaction

Disadvantages: It is advisable to employ it only in short-term projects. High commissions in case of failure [3].

PROTOTYPE Methodology

Characteristics: It belongs to the evolutionary development models, it starts with the definition of the global objectives for the software, it identifies the known requirements and the areas of the scheme where more definition is needed.

Advantages: Does not modify the life cycle, reduces the risk of building products that do not meet user needs, reduces costs.

Disadvantages: Important aspects such as quality and long-term maintenance are often neglected [3].

Thanks to the research and analysis of the methodologies mentioned above, it is concluded that XP is the best, since it avoids making big mistakes by constantly evaluating the progress, that is, by carrying out the application and verifying the satisfaction of the program.

OPERATING SYSTEMS

Mobile technology

As a particularly important fact, it should be considered that the new smartphones are devices that allow from making phone calls, sending text messages, taking pictures and videos in high definition, to playing video games, containing office automation and a host of advanced features [4].

According to statistical data from the IFT (Federal Telecommunications Institute) during the fourth quarter of 2016 at the national level, there are 91 telephone lines for every 100 inhabitants in Mexico, so a smartphone is already within reach of any person registering a total of 111.7 million lines, which represents a growth of almost 4% compared to the same period of 2015 [5].

Mobile Operating Systems

Just like a computer operating system, mobile operating systems are also a set of low-level programs that allow the abstraction of hardware functionalities to provide the necessary service in this case to the phone. However, unlike the computer phones are much simpler and are oriented to wireless connection [6].

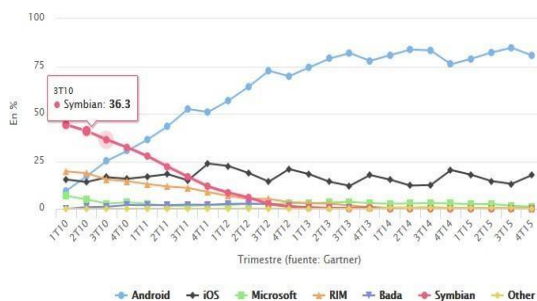


Figure 1. Evolution of mobile operating systems at a global level

As handsets grow in popularity, the operating systems they run become more important. Figure 1 shows the quarterly evolution of the market share of mobile operating systems globally:

Android Operating System.

The system allows you to program applications in a variation of Java called Dalvik. The operating system provides all the necessary interfaces to develop applications that access the phone's functions (such as GPS, calls, phonebook, etc.) in a very simple way in a well-known programming language such as Java.

This simplicity, together with the existence of free programming tools, means that one of the most important things about this operating system is the number of applications available, which extend the user experience almost without limits.

One of the best features of this operating system is that it is completely free. That is, neither to program in this system nor to include it in a phone you have to pay anything. And this makes it very popular among manufacturers and developers, since the costs to launch a phone or an application are very low.

Anyone can download the source code, inspect it, compile it and even change it. This gives security to users, since something that is open allows them to detect bugs more quickly. And also to the manufacturers, since they can better adapt the operating system to the terminals [7].

DESIGN OF THE SKETCHES OF THE SYSTEM SCREENS

One of the first steps in the development process of a mobile application is to **make a prototype or sketch of its basic functionalities**. The objective is to visualize space distribution, content prioritization, and available functionalities. Using the right tools is essential to obtain a good result. NinjaMock was used to design the screens (see Figure 2), accessible at <https://ninjamock.com/project/create>.

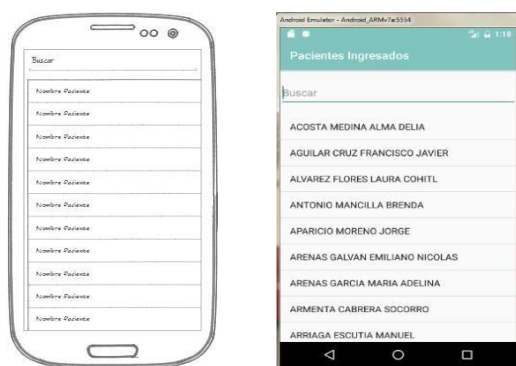


Figure 2. NinjaMock official website.

NinjaMock is a free tool for the creation of sketches for mobile devices such as iOS, Android and Windows Phone, and also for design web. Figure 3 shows the main designs of the application with its corresponding pair.



i) Prototype
ii) Display
a) Login



i) Prototype
ii) Display
b) Patient List



i) Prototype
ii) Display
c) Notes from Patient

Figure 3. Prototypes and main screens of the application

CODING PHASE

In this phase of the development, each of the pieces that give functionality to the application were implemented, among them, the following stand out:

- The class Java MainActivity (main class).
- The Java DB class (contains the connection to the PostgreSQL database).
- The Java class User (which contains the login method).
- The activity_login XML file (logging interface).
-

For the development of the application environment, the following tools were used:

- JDK
- Android Studio
- PostgreSQL

XML code snippets and Java code with the most relevant classes of the project are described and presented below.

Java MainActivity class

This class is in charge of "access" or login. The user's information is entered and sent as a parameter to the User class to validate if the data is correct, if so, it verifies if the user has the permissions to view the information (See Figure 4).

```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_login);
    etUsuario = (EditText) findViewById(R.id.editTextUsuario);
    etContraseña = (EditText) findViewById(R.id.editTextContraseña);
    btnLogin = (Button) findViewById(R.id.buttonEntrar);

    btnLogin.setOnClickListener(new View.OnClickListener() {
        @Override
        public void onClick(View v) {
            Login();
        }
    });
}

public void Login(){
    Log.d(TAG, "Login");
    if(!validacion()){
        return;
    }

    btnLogin.setEnabled(false);

    final ProgressDialog progressDialog = new ProgressDialog(MainActivity.this,
        R.style.Theme_AppCompat_Light_Dialog);

    progressDialog.setIndeterminate(true);
    progressDialog.setMessage("Autenticando...");
    progressDialog.show();

    new android.os.Handler().postDelayed(
        () -> {

            String Usuario=etUsuario.getText().toString();
            String Contraseña=etContraseña.getText().toString();

            Usuario usu=new Usuario();

            String recibirMensaje=usu.evaluar(Usuario,Contraseña);
            if(recibirMensaje.equals("correcto")){
                ExitLogin();
            }
        }, 3000);
}
```

Figure 4. Java code snippet of the MainActivity class

Java BD Class

This class contains the connection to the PostgreSQL and through it the database queries are executed (See Figure 5).

```
public class BD extends _Default implements Runnable{
    private Connection conn;
    private String host="192.168.66.184";
    private String bd="hrgis";
    private int port=5432;
    private String user="monroy";
    private String pass="monroy1";
    private String url="jdbc:postgresql://"+host+"/"+bd+"/"+user+"/"+pass;

    public BD(){
        super();
        this.url=String.format(this.url,this.host,this.port,this.bd);
        //Abrir conexion
        this.conectar();
        this.desconectar();
    }

    public void run() {
        try {
            Class.forName("org.postgresql.Driver"); //carga el Driver
            this.conn= DriverManager.getConnection(this.url,this.user,this.pass);
        } catch (Exception e){
            this._mensaje=e.getMessage();
            this._estatus=false;
        }
    }
}
```

Figure 5. Java code snippet of the BD class
activity_login XML file

Figure 6 shows some XML code that are part of the application.

```
<EditText
    android:id="@+id/editTextContraseña"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:layout_alignLeft="@+id/editTextUsuario"
    android:layout_alignStart="@+id/editTextUsuario"
    android:layout_below="@+id/editTextUsuario"
    android:layout_marginTop="15dp"
    android:ems="10"
    android:hint="Contraseña"
    android:inputType="textPassword"
    android:singleLine="true" />
```

a) EditText

```
<Button
    android:id="@+id/buttonEntrar"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:layout_alignParentBottom="true"
    android:layout_centerHorizontal="true"
    android:layout_marginTop="300dp"
    android:background="@drawable/custom_button"
    android:gravity="center"
    android:onClick="verLista"
    android:text="Entrar"
    android:textColor="#FCF5E3"
    android:textSize="16sp" />
```

b) Button

```
<ListView
    android:id="@+id/listViewPaciente"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:layout_below="@+id/etBuscar"
    android:layout_centerHorizontal="true"
    android:layout_marginTop="15dp"
    tools:layout_editor_absoluteX="17dp"
    tools:layout_editor_absoluteY="95dp" />
```

c) ListView

```
<ExpandableListView
    android:id="@+id/exp_list2"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:cacheColorHint="#00000000">
</ExpandableListView>
```

d) ExpandableListView

Figure 6. XML codes of the activity_login file

RESULTS AND DISCUSSION

Once the application is launched on the physicians' mobile devices, the following activities are carried out:

Authenticity verification. Restricted access to medical personnel to the information from their cell phone was performed in a period not longer than 5 seconds, ensuring the reliability of the clinical notes.

Efficient digital consultation. The application displays the complete patient record information based on the efficient search by simply entering the initial characters of the patient's data, which expedites the timely capture and interpretation of the diagnosis.

Updated information. The patient's observation notes recorded during the stay in the hospital's emergency department are displayed. This allows the homogenization of clinical diagnoses regardless of the physician on duty.

This can lead to a modernization of processes with the digitalization of information and mobile care that improves the quality of service provided to the population affiliated to the public health system in the country, leaving behind delays and medical negligence due to the lack of homogeneously updated records at any time the need arises.

Finally, this App can also be used on other mobile devices such as Tablets with minor changes only in the design of the XML code.

CONCLUSIONS AND RECOMMENDATIONS

The mobile application developed for the emergency area of the public hospital in Mexico City offers the following benefits when used in the care of patients in the emergency area:

It is the first mobile application used in the city's public hospital that allows immediate consultation of the health status of patients hospitalized in the emergency area.

In addition, it significantly reduces the time required to consult the information in the observation record for critically ill patients, who require urgent attention and whose lives depend on it as a priority.

, it will not matter the change of shift in medical staff, since the record of the patient's current status is consulted by the

next person in charge at the beginning of the shift and before arriving at the emergency area, from their mobile device.

The implementation of this mobile application in the health institution opens endless possibilities to continue incorporating more of them; gradually adapted to the inherent technological changes of the current era, whose trend is towards permanent use of Apps; thanks to immediate access to digitized information from any of the mobile devices (tablets and cell phones), it will facilitate timely and accurate consultation in all services provided in the medical and administrative areas of the public institution.

Workers affiliated with Mexican health systems, both public servants and private sector employees, will benefit significantly by reducing the time required for medical attention and obtaining more accurate diagnoses as a result of having homogeneous, complete and updated clinical records.

In order to obtain the best performance of the Apps, it is recommended to hire quality internet service and to have servers and WiFi signal amplifiers within the medical and hospital unit that provide a secure and stable connection assigned to the Emergency Area.

BIBLIOGRAPHY .

- [1] University of the Americas Puebla. (2011). Universidad de las Américas Puebla: The evolution of the cell phone. [Blog UDLAP]. Retrieved: <http://blog.udlap.mx/blog/2011/01/evoluciondeltelefonocelular/>
- [2] Gómez, J. (2007). Universidad Tecnológica de Pereira: Fundamentals of the RUP methodology RATIONAL UNIFIED PROCESS. Retrieved: <http://www.monografias.com/trabajos-pdf4/essay-sobrt-rup/essay-sobrt-rup.pdf>
- [3] The PostgreSQL Global Development Group (2018). The PostgreSQL Global Development Group: PostgreSQL 10.6 Documentation, Retrieved: <https://www.postgresql.org/files/documentation/pdf/10/postgresql-10-A4.pdf>
- [4] The PostgreSQL Global Development Group (2018). The PostgreSQL Global Development Group: PostgreSQL 10.6 Documentation, Retrieved: <https://www.postgresql.org/files/documentation/pdf/10/postgresql-10-A4.pdf>
- [5] Android Academy. (2014). Android Academy: Android Studio v1.0:

- features and comparison with Eclipse. [Blog Academia Android]. Retrieved:
- [6] <https://academiaandroid.com/android-studio-v1-characteristics-comparison-eclipse/>
- [7] Android Studio. (2018). Developers: Official Android Studio IDE for Android [Blog Developers]. Retrieved: <https://developer.android.com/studio/intro/?hl=en> 419
- [8] Gómez, S. (2014). SGOliver: Structure of an Android project. [SGOliver Blog]. Retrieved: <http://www.sgoliver.net/blog/estructura-de-un-proyecto-android-android-studio/>
- [9] Lancetalent (2014). Lancetalent: The Best Tools To Make The Prototype Of Your App. [Lancetalent Blog]. Retrieved: <https://www.lancetalent.com/blog/best-tools-prototype-app/>



This work is
licensed under a Creative
Commons Attribution 4.0
International License.