POCKET PSY

Capstone Final Report
EGR 4402

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Student: Nabila Daya
Supervised by: Dr. Nasser Assem
POCKET PSY

Capstone Report

**Student Statement:**

“I, Nabila DAYA, have applied ethics to the design process and in the selection of the final proposed design. And I have held the safety of the public to be paramount and have addressed this in the presented design wherever may be applicable.”

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Nabila DAYA

Approved by the Supervisor

Dr. Nasser Assem
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Thank you all for being part of this journey.

Nabila Daya
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ABSTRACT

Mental health refers to the emotional and psychological wellbeing of a human been. It has serious implications on the individual’s life as it determines the way they deal with other, cope with stress, and make choices.

In the modern society, mental health problems are very common, and that is mainly due to the increasing amount of stress that we encounter in our everyday lives. However, help is available, and the earliest these problems are detected the easiest they are to treat.

The objective of this capstone project is to raise awareness regarding mental health problems and their seriousness, help detect early warning signs of mental health problems, and provide the people suffering from these problems with a platform that facilitates the ask for help.
I  INTRODUCTION

In the Moroccan society, mental health problems are considered a taboo. The inability to discuss these problems and the shame related to seeking help pushes the people to hide their suffering which makes their cases get worse and harder to treat.

Moreover, the lack of awareness about mental health in some cases makes people with mental health problems seek traditional treatment methods which are in most cases inefficient and can even lead to aggravating their cases.

Actually the consequences of neglecting mental health can be more catastrophic than what was previously stated. According to the World Health Organization, in 2012 the number of Moroccans who committed suicide raises up to 1628, these makes an average of 4.5 persons per day [1]. These scary numbers are caused by one principal factor with is the negligence of mental health.

All these reasons and gave birth to the idea of POCKET PSY: a user friendly mobile application that has for main purpose to raise awareness regarding the importance and seriousness of mental health, help detect early warning signs of mental problems and provide a platform that facilitates access to help.
II  STEEPLE ANALYSIS

1. Social:
With the invasion of smartphones to our world and their presence in every individual’s life, the easiest way to convey information became through mobile technologies. One can easily have access to information, seek help and share her/his concerns. POCKET PSY application will make patients suffering from mental problems first be able to recognize the signs of mental problems as early as possible, and then allow the ones in need of help to seek it easily. The application will not only raise awareness regarding mental health but also, hopefully, contribute in decreasing the rates of suicide.

2. Technological:
Technology a rapidly changing field, and the latest and most used trend in this field nowadays is mobile applications. Opting for implementing a mobile application allows reaching a wider range of users and thus, POCKET PSY will be easily able to have a better impact and provide the maximum help possible to people all over the country.

3. Economical
POCKET PSY is an application that provides free services. It will be available for download to all android users. The application is implemented using open source tools and software, it does not have lucrative goals, and it is aiming to rely on collaborating with associations to raise funds for covering maintenance fees.
4. Environmental:
POCKET PSY does need to take into consideration environmental factors because it does not have any impact on the environment.

5. Political:
POCKET PSY does not have any political impacts; therefore, it does not need to take into consideration the political factors.

6. Legal:
POCKET PSY is an application that respects and obeys by the laws of the Moroccan constitution.

7. Ethical:
POCKET PSY strictly follows the software engineering code of ethics and adheres to principals. It is secure and safe for its users, it insures the privacy of the users’ information by storing all their data in a secure database, it acts in the best of its users while serving the public interest, and finally both the mission and vision of the project are clearly stated in the information page of the application to insure transparency.

[2]
III FEASIBILITY STUDY

The main purpose of the feasibility study is to assess the positive and negative aspects of the project and its overall process, and determine the extent to which the project can be successful. My project consists of a mobile application with the name POCKET PSY, designed to raise awareness regarding the importance of mental health, and provide an easy access to help and guidance to people suffering from mental problems.

1. Product Feasibility
POCKET PSY is a mobile application that will be implemented to provide an easy access to help for the people suffering from mental problems. It will allow its users to be more aware about the importance of mental health, and allow them to detect the signs of mental problems at an early stage. Moreover, it will facilitate the access to help by providing a user friendly platform that allows the users in need of help to book appointments with specialists that will provide them with the needed guidance.

2. Technical and Operational Feasibility:
The language that will be used in the implementation of POCKET PSY is Java. The implementation will be done using Android Studio which is an open source tool and also the official Integrated Development Environment (IDE) for Android applications development. For the database management, I will be using Firebase, which is a product of Google that is also open source, and that can be used with both mobile and web applications, and that provides a high scalability to the application.
3. Social Feasibility:
POCKET PSY is a project which principal goal is to provide help to the Moroccan community by raising awareness regarding the importance of mental health. It targets all Android smartphone users for the purpose of facilitating the treatment of mental problems first by helping to detect these problems as early as possible, and thus treating them before they get worse. And second by facilitating the access to help.

Following the conduction of this feasibility study, I could conclude that this project is feasible in term of objectives and implementation.
IV  REQUIREMENTS SPECIFICATION

1. Functional Requirements

   a. Introduction:
   Following multiple brainstorming sessions, I settled on the following list of functional requirements for POCKE PSY application.

   b. Functional Requirements:

      Splash:

      POCKE PSY should have a splash screen containing the logo that displays when launching the application.

      Main:

      POCKE PSY should have a main activity that allows the user to choose one of the following features: Access the information page, take the diagnosis quiz, or book an appointment.

      About us:

      POCKE PSY should have an information screen containing the information about the application along with its mission and vision.

      Quiz:

      POCKE PSY should have a quiz built based on a decision tree that was trained using a data about the symptoms and signs of multiple mental health problems. The quiz will be built as a set of multiple choice questions that will allow the user to know if they have the signs of a mental health problem and in this case redirect them to another feature of the application that will allow them to book an appointment with a psychiatrist.
Register:

POCKET PSY should allow its users to create an account with which they can later login and take appointments.

Login:

POCKET PSY should have a login screen to allow registered users to authenticate and access the list of available doctors and appointments.

Search for appointments:

POCKET PSY should have a feature that allows logged in users to provide a set of search criteria in order to get available appointments.

Book Appointment:

Following the search, the user should be provided with a list of appointments that match their search criteria. The user can choose from the list and book an appointment.

Manage appointments:

POCKET PSY should allow the users that have previously booked appointments to view those appointments and delete them if they want.

2. Nonfunctional Requirements
   
   a. Introduction:
   The brain storming sessions also resulted in settling on a list of nonfunctional requirements. POCKET PSY should respect a set of operational, revision and transition requirements.

   b. Nonfunctional Requirements:
      
      Operational Requirements:

      - Performance Requirements: POCKET PSY shall use stable and efficient algorithms to insure the maximum performance to the users.
- Availability Requirements: POCKET PSY shall be always available. Notifications should be sent to the users ahead of time in case of backups.

- Usability Requirements: POCKET PSY shall be a user friendly application that is easy to use by all types of users. Moreover, the application will be available in three languages: Arabic, English and French.

- Security Requirements: POCKET PSY shall insure the following:
  o Authentication: POCKET PSY shall verify the user’s identity before allowing them to access their account
  o Accountability: POCKET PSY shall be able to detect when unauthorized changes are made
  o Confidentiality: POCKET PSY shall store users’ data in a secure database. Only the database administrator can have access this data.

Revision Requirements:

- Extensibility Requirements: POCKET PSY shall be designed and implemented in a way that allows future changes and modifications.

- Scalability Requirements: POCKET PSY shall have the ability to handle a growing amount of users and data.

- Maintainability Requirements: POCKET PSY shall allow future change and upgrades.

Transition Requirements:

- Reusability requirements: POCKET PSY shall be implemented in such a way that its components can be reused in the future by other developers.

- Installability Requirements: POCKET PSY shall be easy to install on all supported platforms.
V METHODOLOGY

Rapid Application Development (RAD) is a form of Agile software development methodology that focuses less on planning and relies more on prototyping, getting feedback and testing.

Given the deadlines imposed by the capstone design class, I opted for RAD as is the most convenient methodology to be adopted in a project that has a limited time range. Moreover, this project’s requirements kept changing and the adoption of RAD methodology made the coping with these changes very smooth and easy.

My customers were involved throughout all the stages of this project implementation, they were provided with multiple deliverables that they were able to test and give their feedback on. Their involvement during the early stages of implementation facilitated the application of the changes that they required and made the development process smoother and easier.
Figure 2 represents the use case diagram of POCKET PSY system. The system interacts with two types of users:
User:

All the application users must have access to the application’s information page, take the diagnosis quiz and create an account.

Patient:

Patients are registered users. In addition to the functionalities they inherit from the user, they can:

- Authenticate:
  
  o A patient must be able to login using the email and password they provided when creating their account.

  o A patient must be able to logout when they are done with using the application.

- Search for available appointments:
  
  o A patient must be able to search for the available appointments in the database by providing their desired city, date and time

- Book an appointment:
  
  o A patient must be able to book the most convenient appointment to their need from the list of available appointments.

- Delete an appointment:
  
  o Following booking appointments, a patient must be able to delete the appointment that they no longer want.
2. Activity Diagram

Figure 3: POCKET PSY Activity Diagram

Figure 3 represents the Activity Diagram of POCKET PSY system. It describes the flow of interaction of the user with the different functionalities of the system.

Following is the description of every Activity:
<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>About Us</td>
<td>This activity contains information about POCKET PSY, its mission, and its vision</td>
</tr>
<tr>
<td>Start Quiz</td>
<td>This Activity allows the user to answer a set of questions, and decides later whether the user has signs of a mental problem</td>
</tr>
<tr>
<td>Take appointment</td>
<td>This activity redirects a non-registered user to an activity where they can create an account, and redirects a registered one to an activity where they can login</td>
</tr>
<tr>
<td>Signup</td>
<td>This activity allows a user to create an account</td>
</tr>
<tr>
<td>Sign in</td>
<td>This activity allows a user with an existing account to login</td>
</tr>
<tr>
<td>Search for Appointment</td>
<td>This activity allows an authenticated user to search for available appointments corresponding to their search criteria: City, Date and Time</td>
</tr>
<tr>
<td>Book Appointment</td>
<td>This activity allows an authenticated user to book an appointment and add it to their appointment list</td>
</tr>
</tbody>
</table>
### Manage Appointments

This activity allows an authenticated user to view and delete appointments from their appointment list.

**Table 1: Description of POCKET PSY Activities**

### 3. Entity Relationship Diagram

![Figure 4: POCKET PSY Entity Relationship Diagram](image)

Figure 4 represents the Entity Relationship Diagram of POCKET PSY’s database.
a. **Normalization:**

The diagram in figure 4 is the result of applying the five normalization techniques on the data:

**First Normal form:**

All rows have column with only one value, and the values are atomic (data is stored separately in multiple rows).

**Second Normal form:**

There is no partial dependency in data, i.e.: no non-prime attribute depends on a subset of the primary key.

**Third Normal form:**

There is no transitive dependency, i.e.: no non-prime attribute depends on another non-prime attribute.

**Boyce-Codd Normal form:**

No prime attribute depends on a non-prime attribute.

**Fourth Normal form:**

There are no independent relationships implemented in the same bridge table.
### b. Tables and Attributes Description

<table>
<thead>
<tr>
<th>Table Name</th>
<th>Table Description</th>
<th>Attribute</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td>This table stores all the user’s information that are necessary for authentication and thus for account access and modification</td>
<td>User_id</td>
<td>INT</td>
<td>Automatically generated primary key for the User table</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Email</td>
<td>VARCHAR</td>
<td>The user’s email provided during registration and that is also used for authentication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FirstName</td>
<td>VARCHAR</td>
<td>First name of the user</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LastName</td>
<td>VARCHAR</td>
<td>Last name of the user</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phone</td>
<td>BIGINT</td>
<td>Phone number of the user</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Password</td>
<td>VARCHAR</td>
<td>Password chosen by the user during registration and</td>
</tr>
<tr>
<td>Table</td>
<td>Description</td>
<td>Column</td>
<td>Type</td>
<td>Notes</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------</td>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>PSY</td>
<td>This table stores the doctors’ information needed by the user to decide on</td>
<td>Psy_id</td>
<td>INT</td>
<td>Automatically generated primary key for the PSY table</td>
</tr>
<tr>
<td></td>
<td>the appointment to choose</td>
<td>City_id</td>
<td>INT</td>
<td>Foreign key to the City table</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Address</td>
<td>VARCHAR</td>
<td>The exact address of the doctor’s office</td>
</tr>
<tr>
<td></td>
<td>This table stores the doctors’ information needed by the user to decide on</td>
<td>Appointment_id</td>
<td>INT</td>
<td>Automatically generated primary key for the Appointment table</td>
</tr>
<tr>
<td></td>
<td>the appointment to choose</td>
<td>Psy_id</td>
<td>INT</td>
<td>Foreign key to the PSY table</td>
</tr>
<tr>
<td></td>
<td></td>
<td>StartTime</td>
<td>TIME</td>
<td>The time at which the appointment starts</td>
</tr>
</tbody>
</table>
### City
This table holds the list of cities in which there are doctors subscribed to the application.

<table>
<thead>
<tr>
<th>City_id</th>
<th>INT</th>
<th>Automatically generated primary key for the City table</th>
</tr>
</thead>
<tbody>
<tr>
<td>CityName</td>
<td>VARCHAR</td>
<td>The name of the city</td>
</tr>
</tbody>
</table>

### TakeAppointment
This is a bridge table between the Appointment and User tables. Whenever a user takes an appointment a line is inserted to this table.

<table>
<thead>
<tr>
<th>Id</th>
<th>INT</th>
<th>Automatically generated primary key for the TakeAppointment table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment_id</td>
<td>INT</td>
<td>Foreign key to the Appointment table</td>
</tr>
<tr>
<td>User_id</td>
<td>INT</td>
<td>Foreign key to the user table</td>
</tr>
</tbody>
</table>

*Table 2: POCKET PSY Database Description*
1. Decision Tree Implementation

The decision tree was implemented using WEKA. It was trained and tested on a data set of 1142 items. The tree was tested using cross validation and it has an accuracy of 87%.

![Decision Tree for Detecting Signs of Mental Problems](image)

*Figure 5: POCKET PSY Decision Tree for Detecting Signs of Mental Problems*

Figure 5 is a representation of the decision tree that results in classifying the users of POCKET PSY in two classes:

- **Need help**: When the user has signs of a mental problem
- **Need to rest**: When the symptoms of the user are those of a person with a good mental health
2. Database Implementation

POCKET PSY Database was implemented using Firebase. The choice of this option was based on the fact that it is a real time database that is cloud hosted that allows multiple users to use the application simultaneously while having access to the same updated data.

The first step was to connect the application to firebase. This was done in three steps:

- Adding the application’s SHA-1 to the firebase project in order to secure the connection

- Adding the flowing dependencies to the Android Studio application:

```java
implementation 'com.google.firebase:firebase-core:16.0.1'
implementation 'com.google.firebase:firebase-database:16.0.1'
implementation 'com.google.firebase:firebase-auth:16.0.1'
classpath 'com.google.gms:google-services:4.0.1'
```

- Adding a Google JSON file to the application package

Firebase Stores in JSON objects, and it is represented as a tree-like structure.

![Firebase Database Representation](image)

*Figure 6: POCKET PSY Database Representation on Firebase*

Figure 6 represents POCKET PSY database as it shows on Firebase console.
3. Mobile Application Implementation

POCKET PSY mobile application was implemented using Android Studio, which is java based and uses XML for frontend design.

Below are the main activities of POCKET PSY application.

Splash Activity:

![Figure 7: Splash Activity](image)

This activity contains the logo and appears for four seconds once the application is launched.

Home Activity:

![Figure 8: Home Activity](image)

This activity allows the user to choose to access one of the three options: About Us activity, Quiz Activity or Appointment Activity.
About Us Activity:

This activity contains general information about POCKET PSY and it allows the user to have a better understanding of the mission and vision of this project.

Login Activity:

This activity allows a user who is already registered to access the available appointments. In case the user is not registered yet, the “create account” button allows them to access the registration activity.
Register Activity:

![Figure 11: Register Activity](image)

This activity allows a new user to create an account.

Search Activity:

![Figure 12: Search Activity](image)

Once a user is registered, they get access to this activity that allows them to choose the city of the psychiatrist they want to meet as well as the convenient date and time.
Appointment Activity:

Following choosing the search criteria, the user is represented with a set of appointments to choose from.
## VIII TECHNOLOGY ENABLERS

| Android Studio | Standard IDE to for android development, used to implement the mobile application |
| Firebase | Used for the backend client |
| Weka | Used for building the decision tree |
| Adobe Photoshop | Used to design the logo |
| Creately | Online tool used to design the UML diagrams |

*Table 3: Technology Enablers*
 IX  Testing

1. Testing the Decision Tree
The decision tree was tested using cross validation testing, which means that it was tested using the same data set that was used for training.

The 1142 items of the data set were split into ten subsets, and the testing went through ten iterations where in each iteration nine subsets was used as the training set and the remaining one was use as a validation set.

The performance of the tree was later calculated as the average of the performances of each one of the ten iteration, and the tree showed to have an accuracy of 87%.

2. Testing the mobile application
Testing the mobile application went through multiple phases which are explained below:

   a. Unit Testing
Unit testing consists of taking every function on its own, isolating it from the rest of the code, and testing in it to make sure it works properly. [3]

   b. Integration Testing
Following the unit testing, I proceeded with integration testing. In this phase I chose to adopted the Bottom-up approach which consists of identifying the hierarchy of the components of the application, testing individually the components at the lower hierarchy and then testing the testing the components that rely on them. [3]
c. **System Testing**
This testing was performed whenever a prototype of the application was ready. I would test the application as a whole, identify the anomalies, and fix those anomalies before delivering the following prototype. After finishing the implementation of the application, I proceeded with running multiple tests on the system as a whole to make sure all its functionalities are working properly.

d. **Acceptance Testing**
In this last phase of testing, I downloaded my application on multiple devices of friends and family, and gave them the floor for testing the application and reporting any malfunctioning they encounter.
X CONCLUSION

Implementing this project was an opportunity for me to put in practice all the knowledge and skills I acquired during my undergraduate degree in computer science. I was able to apply the software development project on a real life project. I was able to conduct a feasibility study, gather requirements and prioritize them, designing and implementing the application and finally testing it.

I was also able to learn to work with new tools like Android Studio and Weka and use them as a primary tool for implementing my project.

XI FUTURE WORK

For future work, numerous features can be added to the application:

- Add an artificial intelligence Chabot that will be trained to diagnose the users of the application
- Add a review system where users of the application can rate the psychiatrists and write comments about them.
- Add more signup methods: Signup with phone number and signup using social media accounts
- Develop an iOS version and a website version of the application
- Translate the application to both Arabic and French in order to make it more appropriate to the Moroccan context.
