وزارة التعليم العالي و البحث العلمي

جامعة الشهيد حمه لخضر -الوادي

كلية العلوم الدقيقة

قسم الإعلام الآلي

Project Graduation academic license

Theme

Design and Development of a mobile Application for geolocation of doctors in Wilaya d'El-oued

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Specialty: Information systems

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Thanks:

We thank Allah for helping us achieve this humility.
We would like to take this opportunity to express our deepest thanks and gratitude. Deep gratitude to: Our supervisor: Mr. **MEDILEH Saci** for his willingness, advice and advise Guidance and encouragement during our research.

Dedication:

We dedicate this modest part for the sake of our dear mothers and fathers, may God preserve them for us and protect them from all evil. Our dear sisters and our brothers for their encouragement and moral support, we dedicate this modest work to them in our testimony and all our friends to help them and support them morally during the development of the graduation work

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General Introduction:

No matter what place you would go to, high chances are that you would find every single person around you busy with their phones or some sort of mobile device, be it for communication with friends and family, surf the internet to interact with media, and many many other features these devices provide. That alone is proof of how deeply integrated mobile technology is in our culture and daily livelihood in this day and age.

A significant portion of the most used services by mobile device owners are related to the technology of GPS (Global Positioning System), with it one would be able to determine the position of anything, anywhere on the planet using satellites, this is more commonly known as “Geolocalization” or “Geopositioning”.

The benefits of these kinds of applications are quite immense, as they make transport and location tracking way easier and way more efficient than it has ever been before. And their main uses vary from one app to another from locating specific kinds of facilities including specific info like contact addresses, to driving route finding and optimization, and to general geolocation use with a little bit of everything, with Google Maps in particular being by far the most popular app amongst all of them.

However, there exists a certain domain that seems to lack an abundance of geolocation apps, that being the medical and healthcare world. With potentially risky diseases and ailments being on the rise in recent times, humanity would benefit a lot from having the ability to find nearby doctors and clinics, as well as being able to come into contact with to discuss appointments and other related topics. *So, what would a mobile application centered around locating medical clinics look like? And which important features would it need to implement so that it can provide its users high satisfactorily?*

It is in order to give a proper answer to this question about this projectical location of doctors and their workplaces in the Wilaya of El Oued, as well as give insights on their statuses such as open times and contact addresses. All for the sake of creating a model of a medical geolocalisation app from a specific perspective.

This report, which is split into 4 main chapters, would document the steps taken to turn this project from hypothetical to real:

1. Chapter 1 would go into details about the preliminary search section, talking about all the different topics relevant to the project.
2. Chapter 2 discusses the requirements specifications, explaining the main functions the project needs to perform, and the individuals that interact with it along with their respective roles.
3. Chapter 3 is about the conceptual design of the app, providing an abstraction of the project as a whole, describing its dynamic and static sides and the interactions between them. 4. Chapter 4 is the final chapter talks about the realization phase, the process of executing the ideas and designs of the previous chapter, listing all the tools that contributed to creating the actual project, in addition to a preview of the end result

CHAPTER 1: Theoretical Studies and Technical Choices.

1.Introduction:

This chapter consists of the preliminary study, the feasibility of the project and its objectives, and then the study of the existing: determining the geolocation location, criticism of the current system and the proposed solution.

2. Preliminary study:

The project is a mobile application to locate the state's doctors and create a route to them, (communicating with doctors and clinics, searching by departments and specializations, adding new elements) The application aims to facilitate the lives of patients and help them provide an outstanding service

Our Application Medloc is a link between patients and clinics, through which it is possible to identify the distance between it and the nearest doctor.

2.1 Study of the existing:

Wilaya El-Oued is characterized by the investment in many private doctors in the healthcare field, as many private clinics and healthcare complexes are spread throughout the state and attract many citizens from inside and outside the state for examination and treatment. One of the greatest difficulties faced by those seeking treatment from outside the state is knowing the location of doctors and health clinics, but it is also difficult to understand in some cases. Especially when people from rural areas come to urban areas for better healthcare service, they find it very difficult to know the proper way. And for this to determine the location of these doctors and health clinics, a means of assistance must be provided.

Geolocation: Geolocation is the process of positioning an object on a plane or map using its geographic coordinates. This operation is carried out using a terminal capable of being located and of publishing its geographical coordinates (latitude/longitude). The recorded positions can be stored within the terminal and be extracted later, or be transmitted in real time to a geolocation software platform; it requests the user's authorization before carrying out this operation

The location of the mobile is done using several technologies such as:

- **Internet**: The precision of the localization by IP address on the Internet network will be at the level of a country, a city or a district according to the operator (national or local). However, within an ADSL network of the same operator, the geo-location can be very precise (address or building for example) if the places of the connections are recorded in a database.
- **GPS**: It is carried out by receiving signals from several satellites in orbit. The mobile phone equipped with a GPS will transmit its position via an SMS, GPRS, Edge or UMTS network.
- **GSM**: It is based on the unique code of the SIM card. Connection to the network is authorized after identification with a cell making up the GSM network. Accuracy depends on cell extent, from 250 meters in urban area to 10 km in rural area
- **Wi-Fi**: The location is similar to the case of the GSM or IP network, by the transmitting cells, with an accuracy of less than 100 meters. A triangulation between several Wi-Fi antennas can give the position with an accuracy of about 5m by analyzing the strength of the radio signal received from the device

Google Maps: Google Maps is a free online geolocation service application created by Google. Launched in 2004 in the United States and Canada and in 2005 in Great Britain (under the name Google Local), Google Maps was launched in April 2006, simultaneously in France, Germany, Spain and Italy. This service has the privacy that it allows, from the scale of the country, to be able to enlarge the size of the street. Two types of maps are available: a classic map with the names of streets, neighborhoods and towns and a satellite image map, which now covers the entire world.

At the beginning of April 2005 Google Maps was enriched with appearance by satellite image, as well as classic cartography. Different from other services that provide static satellite imagery Google Maps allows you to navigate and locate wherever you want on the satellite map. In our app we use Google Maps to search for doctors' routes in the El-Oued state and launch GPS

2.2 Critique of existing and the proposed solution:

The mobile application market is growing exponentially, and this opens up new opportunities for mobile application developers in several areas. Nowadays, with the multiplicity of doctors and medical specialists, patients have difficulties in going to the doctor as he wants the closest or the most knowledgeable around. In addition, he needs to know the way to it, so the only way he can apply it is to seek help from more experienced people. This problem is found especially in large cities. In this work, we propose a solution to facilitate the search for patients. We are developing an application for smartphones and tablets. The application uses Google Maps to be able to see where these doctors are as well as the possibility to contact them by phone or the email justifies this work with the availability of smart devices in addition to the confirmation and speed that technology guarantees

3 Conclusion:

We extract from this chapter the most important problem facing the society to be studied for the mobile application, mentioning the solutions to it and defining the importance of the methods used to solve it.

Chapter II: Analysis and specification of needs

1.Introduction:

This chapter will be devoted to the analysis and design of our application. Describing the actors themselves, that is the participants in the application's life cycle, mentioning the main and secondary needs that it must satisfy, and a visualization of the aforementioned via a Use Case Diagram.

2. Overall analysis of the application:

The goal of this project is to work on designing and developing a mobile application that allows locating doctors and health clinics for the customer connected from his mobile phone. And in this particular section we will go into details on the needs that must be met by the app, as well as the interaction between the system and the external entities that play significant roles in its functioning.

2.1 Description of actors:

The purpose of this section is to identify the individuals that will interact with the app's system, also known as "actors", and their functionalities to which our application must respond to. We begin our analysis by identifying the actors who act on our system, namely:

- **User**: is the actor who will interact the most with our application. This person benefits from all the functions of the application, and has the rights to interact with the data the app uses.
- **Doctors and Clinics:** real life entities that are included in the app as data, from the names and specialties to their spatial coordinates and contact addresses.
- **Admins**: Those who will manipulate all the data used by the app, and tasked with authorization of using any new entries in the database.

2.2. Specification of Requirements:

The requirement specification is the starting phase of any application to be a developer in which we will identify the needs of our application. We distinguish between functional requirements that present the expected functionalities of our application, and the non-functional requirements to avoid the development of an unsatisfactory application as well as find a common agreement between specialists and users to make the project a success.

2.2.1 Specification of functional requirements:

- Provide a geographical map that allows locating and finding routes to go to any medical clinic in El-Oued.
- Provide all sorts of useful information regarding these clinics and the doctors that work in them, including their contact addresses and open times.
- The ability to add suggestions for any new doctors or clinics that aren't available in the app, or editing already existing ones

2.2.2 Specification of non-functional requirements:

➢ The app should be user-friendly in its UI and general use.
➢ Access to the database must be flexible and fast.
➢ The application must be always functional.

2.3 Use case diagram:

Use Case Diagrams are part of the UML Language and used to specify the app's architecture, and the what and how's regarding the tasks it needs to perform. Or in other words, the functionalities the app is developed for, and which users use which of these functionalities.

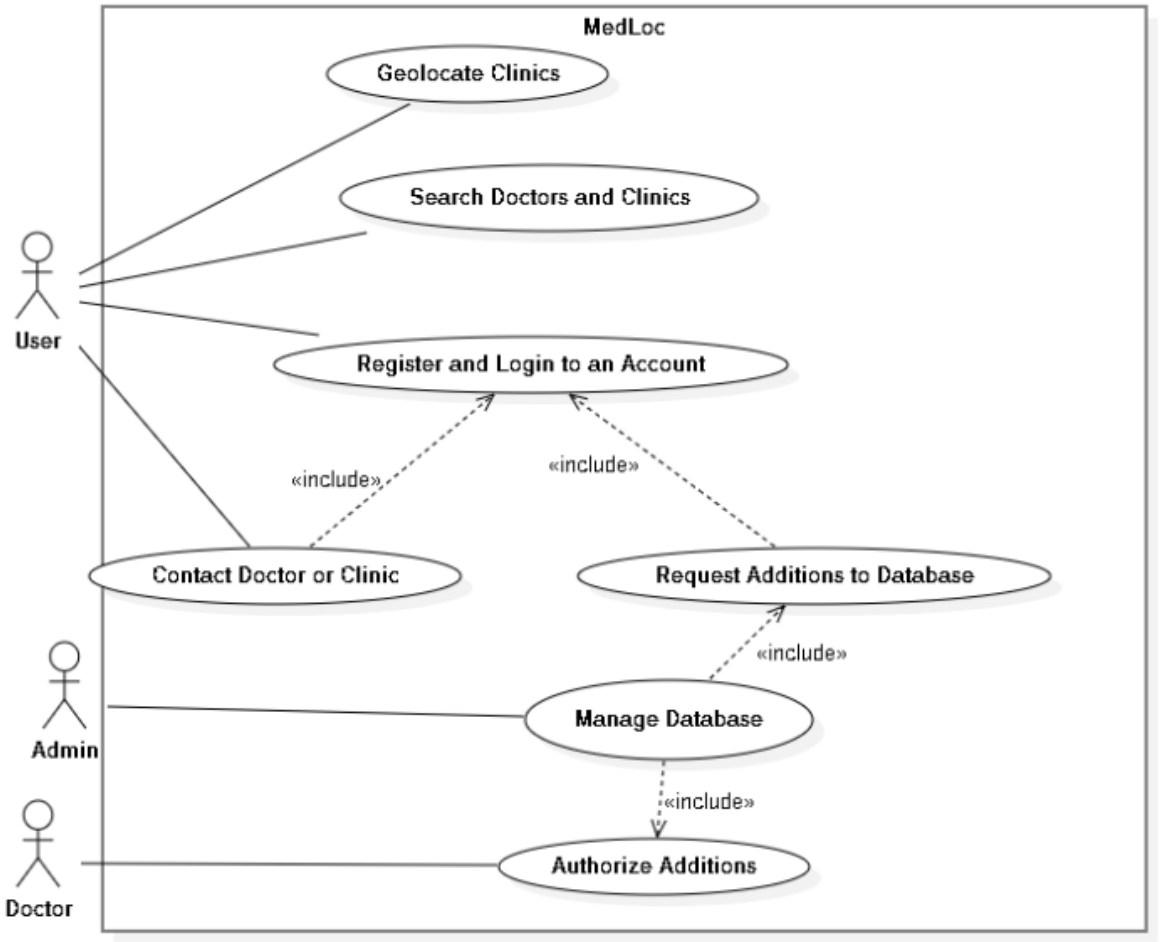


Figure 2: Use Case Diagram

CHAPTER III: Conceptual Design

1 Introduction:

In this chapter we go more into details regarding the conceptual phase of this project, where we explain the architectural side of it utilizing the Unified Modeling Language (UML for short) and its diagrams to showcase a visualization of the software's design. Firstly we explain step by step the plan behind establishing the main functions of the application, then explaining the objects that make it up and the interactions between them via UML diagrams, as well as the models of data that fill the database of the app.

2.Detailed Design:

The goal of this project is to provide users the ability to locate medicinal clinics appointed all over El-Oued along with the essential details the user needs to know about them such as the clinic's type be it a hospital or a pharmacy…etc., the days and time in which it is open, contact addresses like phone number and Email address and option to contact them; as well as displaying the list of doctors employed in these clinics with their own information, users can also contribute to the application via the option to add any nonexistent entries in the database or suggesting edits to already existing ones.

All data is stored inside a database located in an online server which is read from and written into through php code, allowing the application to receive data and store it into a local database stored within the device's memory, or send data directly into the online server. And whenever the user opens access to the local database, it will try to synchronize with the online database whenever connection to the internet and server are made, verifying any changes made to the online database and transfer them into the local one.

Once the user opens the app, they are greeted with an account authentication screen, presenting the options to log in to the app, or to register by entering the same info from a new user and store them into a table for storing user data; Another option is to use the app as a guest without an account, however the user will lose access to certain features like adding DB entires and contacting via Email. Once that is done, the user sees a map screen displaying their location along with the locations of the many clinics registered symbolized by a marker. Through it they can view all info of the clinic along with a list of doctors that work in that clinic, with the ability to contact via phone and email, the latter being exclusive only to users who are signed in. 2 additional function the app can perform are requesting additions to new doctors or clinics or edits to existing ones, and for searching certain entries depending on the user's selection, typing a name or selecting a specific type, specialty or the commune they are located in.

2.1 Class Diagram:

The Class Diagram is one of the more commonly used diagrams within the UML, a structural diagram that represents the static part of the system, that is the sum of elements that exist
independent of time, through depicting the structure of its different modules and how they connect to each other. These kinds of diagrams describe the object-oriented view of the system, therefore it serves as a way to show the different types of classes that make it up, the methods and attributes they contain, as well as the relationships between them like inheritance and aggregation represented by arrows. Class Diagrams are useful during system development as they can be utilized to represent models that makes it easier to translate them into code or vice-versa.

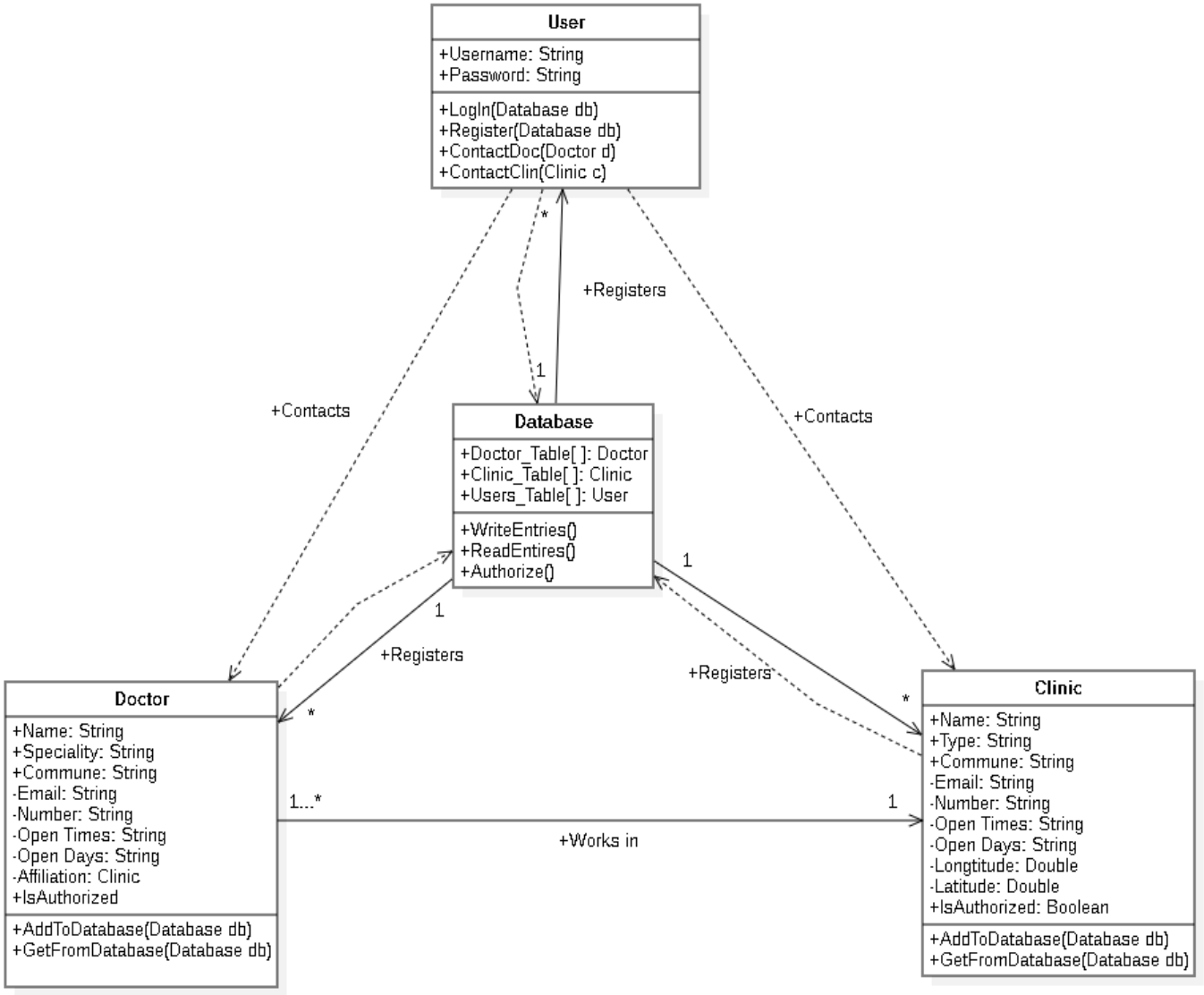


Figure 3: Class Diagram

The above diagram is the Class Diagram for this project, and it contains 4 classes, Three of which are for models for the data that we want to insert inside the databases, those being the users that register to the app, and the doctors and clinics, and the fourth one representing the general database for the app. Each of them contains the necessary information surrounding them as attributes, with the methods signifying the relationships between these classes, such as the read/write operations that involve using the database, as well as the user's ability to contact a doctor/clinic.

2.2 Application Database:

Since this project works on loads of information that needs to be sorted, it is a given to use a database to efficiently and easily store them. And in order to create a visualization of the database used in the project, we're using an Entity-Relationship Diagram (ERD) to display the entities of the model with the set of different attributes each entity contains along with any potential relationships that tie between them.

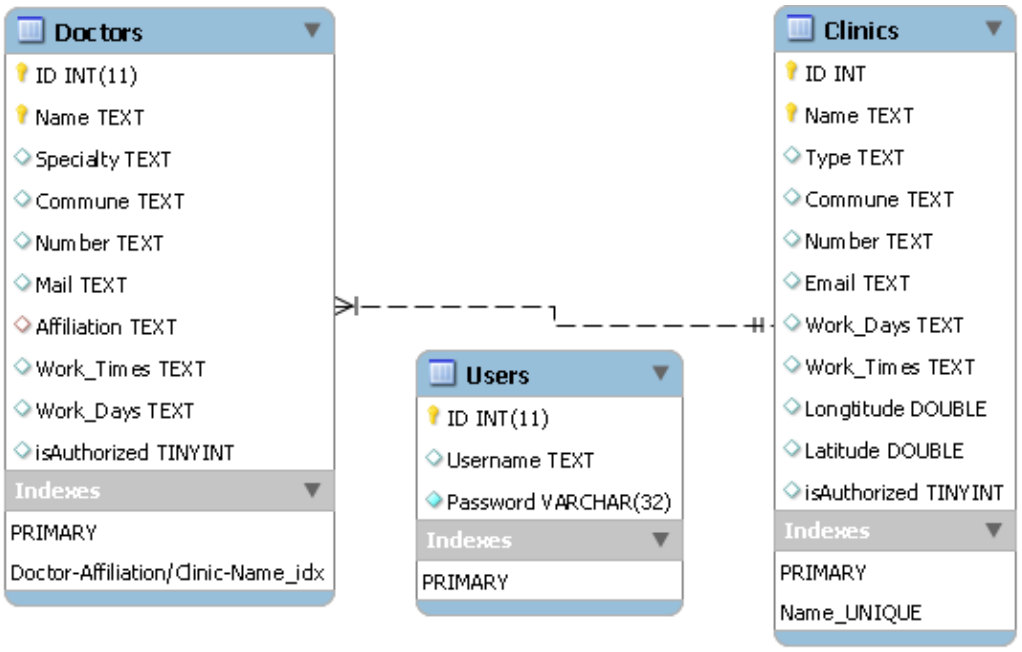
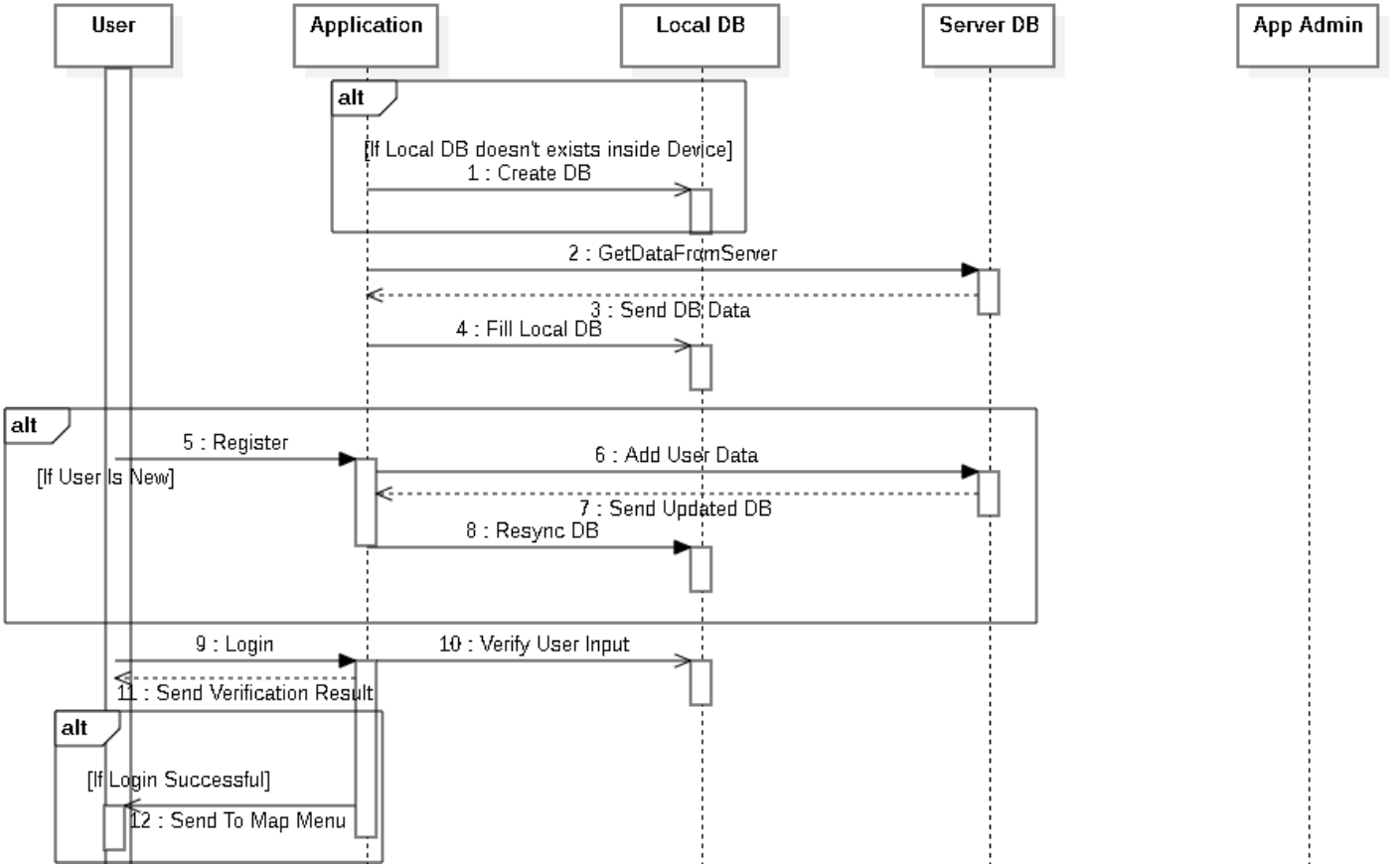


Figure 4: Relational Database Schema

As shown in the Diagram above, the database contains 3 entities. Two of them belong to the info we primarily want to use in the app: the doctors and clinics, with all their attributes that hold the necessary details for each instance, and the users' entity to record data for any user that is registered through the application. The only relationship that exists between the entities is between the doctors and clinics, to represent the idea that each doctor works under a specific clinic that needs to be stored inside the database, hence the Foreign Key assigned to the Affiliation attribute in the Doctor entity referencing the Name attribute in the Clinic Entity. Each Primary index is used to assure that there would be no duplicate instances that can cause conflict in the data. The attribute "isAuthorized" is a boolean variable that checks whether the admin approved of the addition to the database, to ensure that the data that is picked for usage is indeed legitimate.

2.3 Sequence Diagram:

Just like the Class Diagram, the Sequence Diagram is another kind of diagram within the UML Language. However, unlike the Class Diagram which is a structural diagram, it is a behavioral diagram meaning that instead of showing the different objects in the system it describes the interactions between the objects that make up the system's functionalities. And this kind of diagrams in particular is used to depict the how and the when of the interactions between the objects, in other words, the scenarios the objects are involved in and the order these interactions take place in.



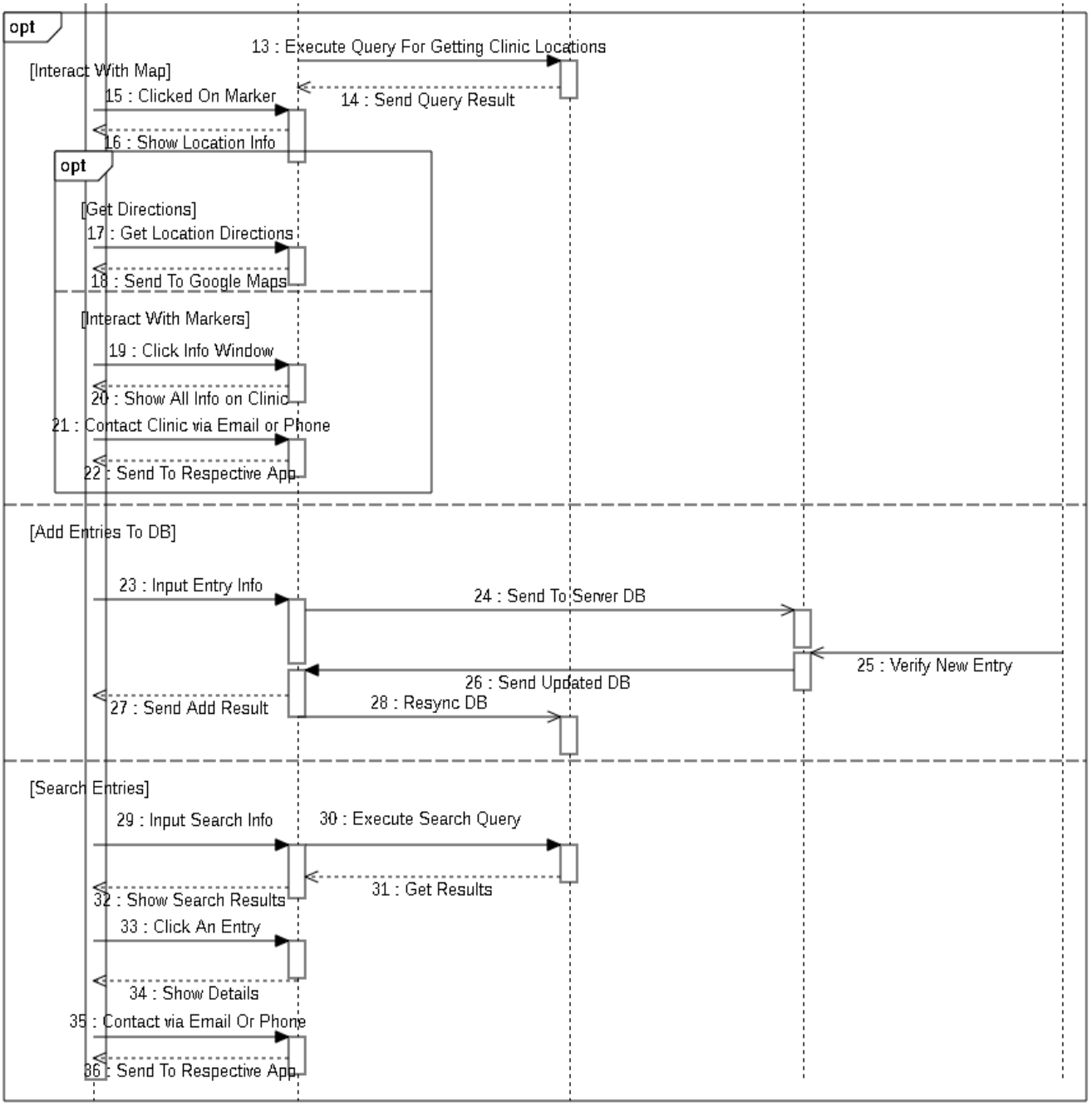


Figure 6: Activity Diagram Part 2

As seen through the diagram, the object involved in the app's functioning would be the User, the App itself and its interface, both the local and server databases to store Data and the Server Admin for monitoring the DB. The app first connects to the server and synchronizes the received Data with the user device's local DB after creating it inside the external memory, after that the user attempts to log in to the app or register if they are new, when successful they are led to the main screen which is the map screen.

There are 3 features that can be accessed from this main screen, either by interacting with the map itself through checking the markers that represent the clinics placed throughout the state and getting details about them or getting the directions to them, the option of adding any new doctor or clinic to the database which is approved of with permission from the admin, or directly searching for entries using the search engine. Upon getting the details for any entry the user can also contact the doctor/clinic by email or phone via the preferred mail client or the default phone app respectively.

3 Conclusion:

So in conclusion, this chapter covers the project's overall architecture from an abstract view with the help of UML Diagrams, from describing the application's static side like the Database's components and the objects that make it up, to the dynamic side by explaining its many functions and the ways they are utilized upon the app's functioning.

CHAPTER 4: Implementation

1 Introduction:

In this final chapter we talk about the most important part of making this project, that is the development of the application, in other words the stage of moving from the blueprints that we made for the project and described in the previous chapter, and manifest them into a real functioning software. In particular we shall discuss the Development Environment we used to build our project, that includes both the hardware and software that contributed to writing the code and allow the app to execute its functions. As well as give a preview to how the application performs in real time.

2 Development Environment:

The term “Development Environment” refers to the workspace used for developing, testing and debugging a program. And the description of this environment can be split into 2 parts, the hardware aspect of the environment which is the specifications of the devices used to work on the project and test it, and the software aspect where we talk in details about the tools that helped write the code and provide the project with the ability to perform the tasks it needed to do.

2.1 Hardware Environment:

Regarding the devices used to build the project, we used a computer with the following specifications to write the code on:

- Operating System: Windows 7 Professional 64-Bits
- CPU: Intel(R) Core (TM) i5-2520M CPU @ 2.50GHz
- RAM: 4.0 GB

In addition to using an Android device for application testing with the following specs:

- Operating System: Android Version 11
- CPU:Octa-core Max 2.96 GHz
- RAM :8.00 GB

2.2 Software Environment:

2.2.1 Development Platform:

Android Studio is an Integrated Development Environment used for Android app development built by JetBrains based on their IntelliJ IDEA IDE which they also used for other programming software like PyCharm and PHPStorm, and it primarily supports the Java and Kotlin languages. Android Studio provides certain powerful features that make it more comfortable for developers to work on including:

- Its usage of a flexible build system called Gradle in order to compile application source codes and package them into APK files that can be installed inside Android devices.Its strongest suit is in its high performance compared to other automation tools as it constantly optimizes its task execution with every run, so that it focuses only on changed tasks and therefore wasting way less time.
- Being built on IntelliJ's IDEA IDE, Android Studio inherits its smart code editing capabilities to maximize development productivity and allow more consistent coding and less bugs, from its code completion services that speed up coding by providing suggestions to complete names and keywords, to restructuring the entire code to fit whichever changes done to said code while preserving its behavior

Figure 7: Logo of Android Studio

However, developing mobile apps cannot be with Android Studio alone; it requires a development kit, a package of tools that make development truly possible, that is where Android SDK comes into play.
Like what it says on the tin, Android SDK is the development kit that enables developing applications for Android devices. It contains libraries for helpful classes and other utilities, an emulator to simulate a mobile device inside the computer system for testing and a debugger to track the behavior of operations at the time of execution.

Another SDK that is also important for developing MedLoc is the Maps SDK from Google, which allows for visualizing data from Google Maps and interacting with maps on mobile apps. In addition to downloading the SDK itself it also necessitates an API key to be integrated within the application's code in order to enable and secure map requests, which can be obtained by creating it in a project inside a Google Cloud Platform that must be connected to the application file through Android Studio.

2.2.2 Programming Languages:

- **Java:** A commonly used programming language that can be used to develop mobile apps and especially Android apps, among other things. Its main feature, object-oriented programming, allows for efficient and effective programming through code reusability, along with making data less redundant and more secure.

- **PHP:** Also Called "Hypertext PreProcessor" is a scripting language for web development that executes code on the server-side. And while it doesn't necessarily play a role in developing the Android app, it is used for writing the scripts necessary to manage the database server and its interaction with the application, as it it integrated with many databases including MySQL.

2.2.3 Web Server & Database Management System:

XAMPP is a cross-platform software package developed by Apache Friends containing the Apache HTTP Server, MariaDB database (formerly MySQL), and interpreters for the PHP and Perl scripting languages, as well as other extra modules. Which allow for testing web services on local servers as it uses identical components that actual web servers also use.

XAMPP provides certain components that make it essential for creating this project. Apache is a web server that can accept and respond to client requests, in other words it is responsible for managing the interactions that require connecting to a server through the app, and since it also supports PHP it can activate the PHP scripts that connect to the database, while MySQL is the Database Management System that we use for supervising our **Server-side database**. As the name suggests it is based on the SQL language, therefore it handles management of the database via “queries” that allow clients to read and write data on it.

The **Client-side database** on the other hand, is managed by SQLite, which is an open source database that is implemented within Android Operating Systems, like the original SQL language, it is also based on a relational database, meaning that it uses a table-based structure to store data. Thanks to it the data available inside the server can be contained locally inside the device’s memory, allowing user to interact with the data without always needing connection to the network

Figure 10:Logo of XAMPP

3.Application interfaces:

This section is for showcasing the final project, from the interfaces to the functions it can perform.

❖ Signing Up/Logging In:

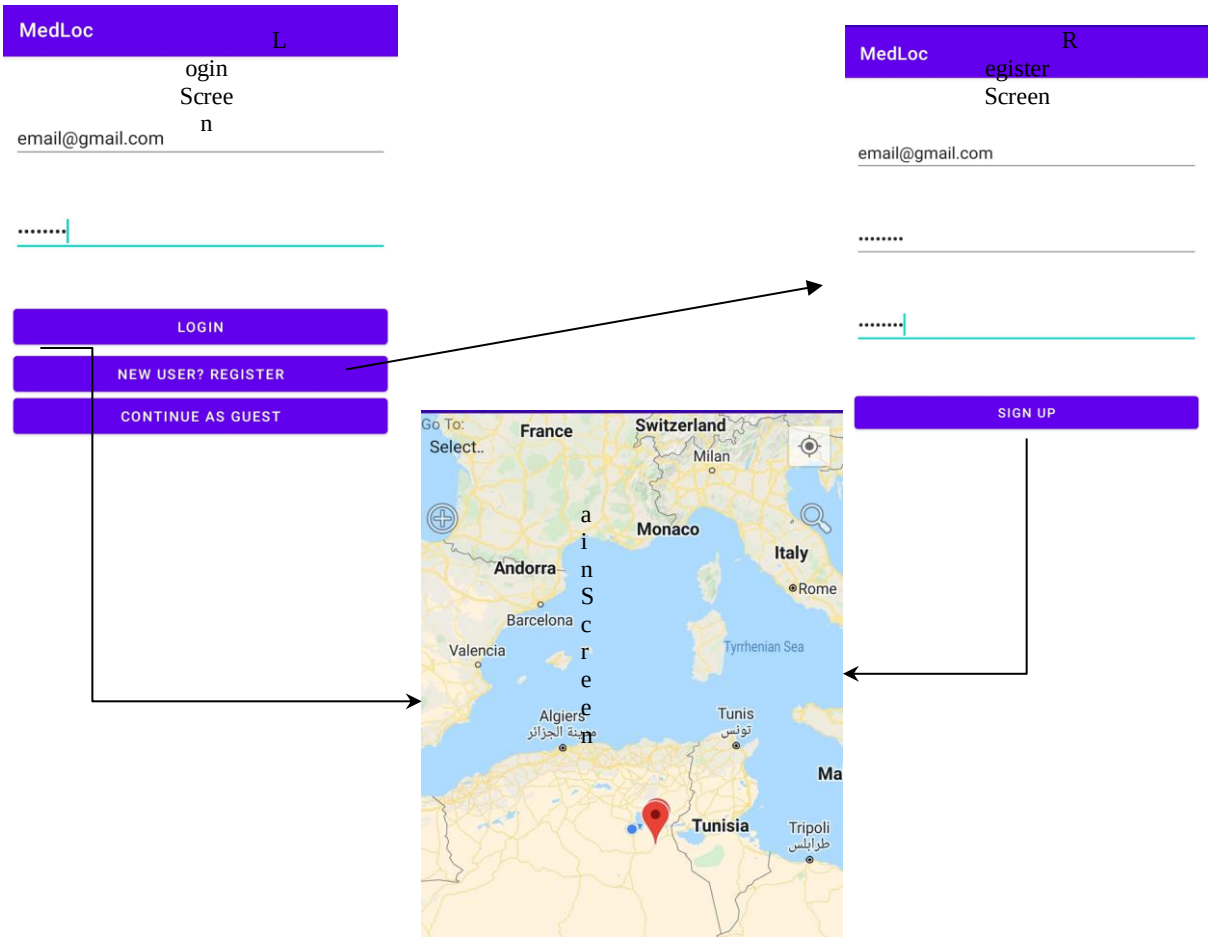


Figure 11:Login And Register Operations

❖ Interaction with Main Screen:

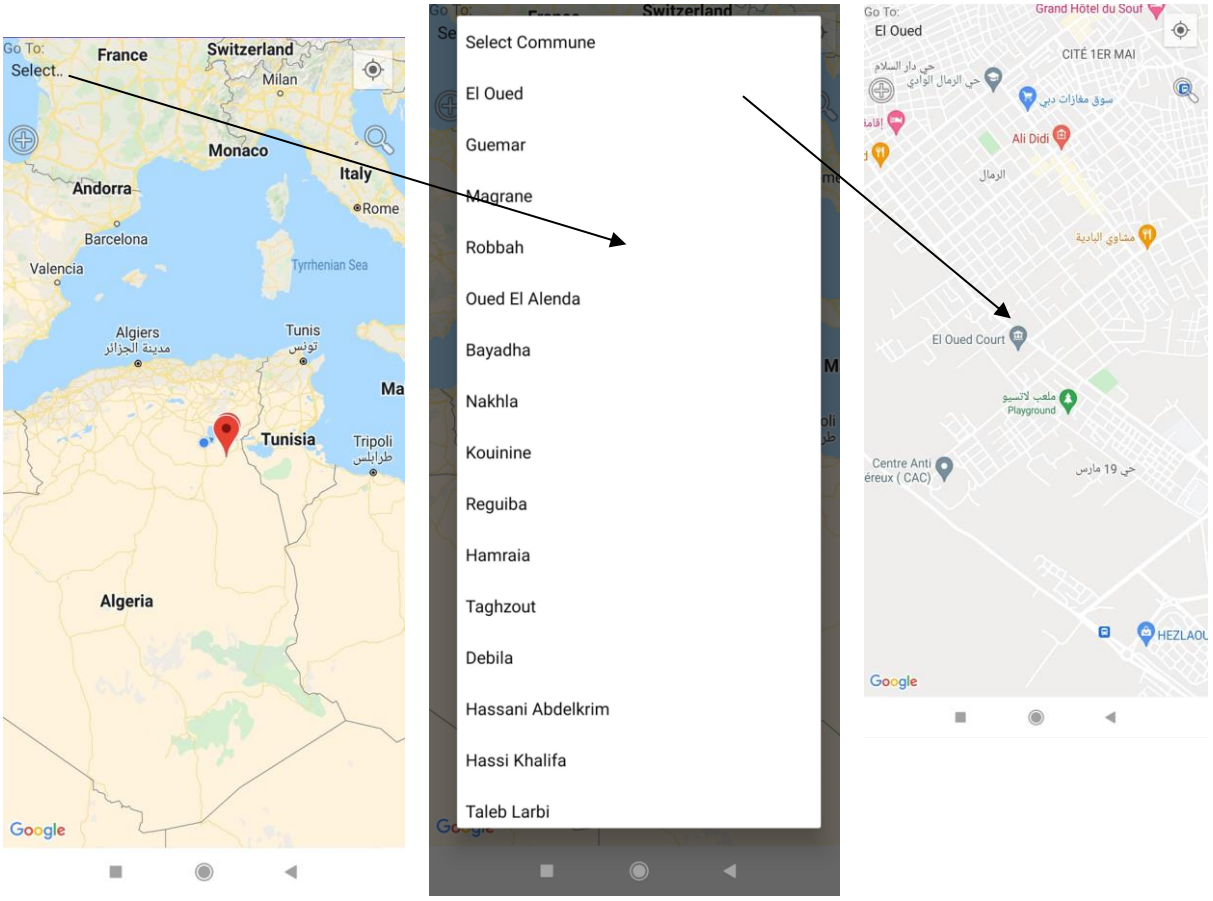


Figure 12: Navigation Through El-Oued Communes on the Map

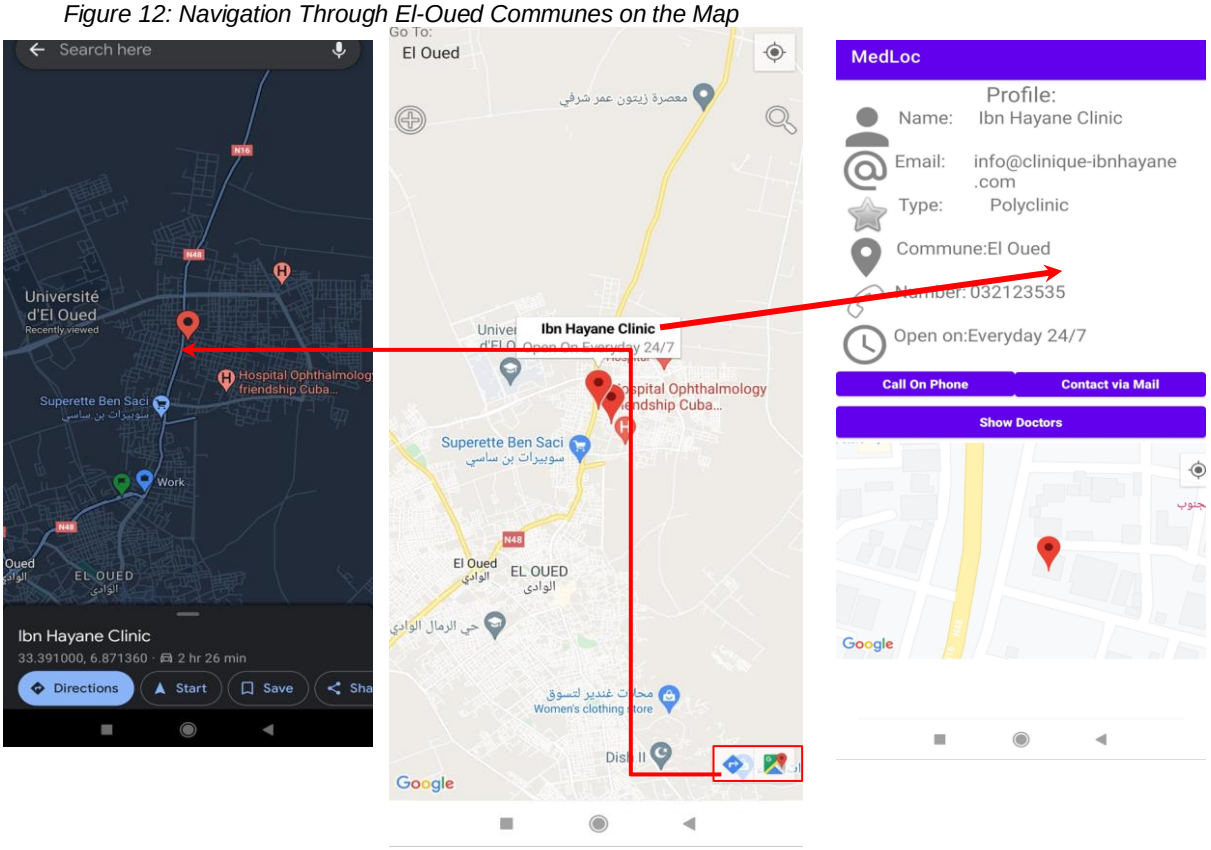


Figure 13:Interaction With Map Markers

❖ Adding Doctors/Clinics:

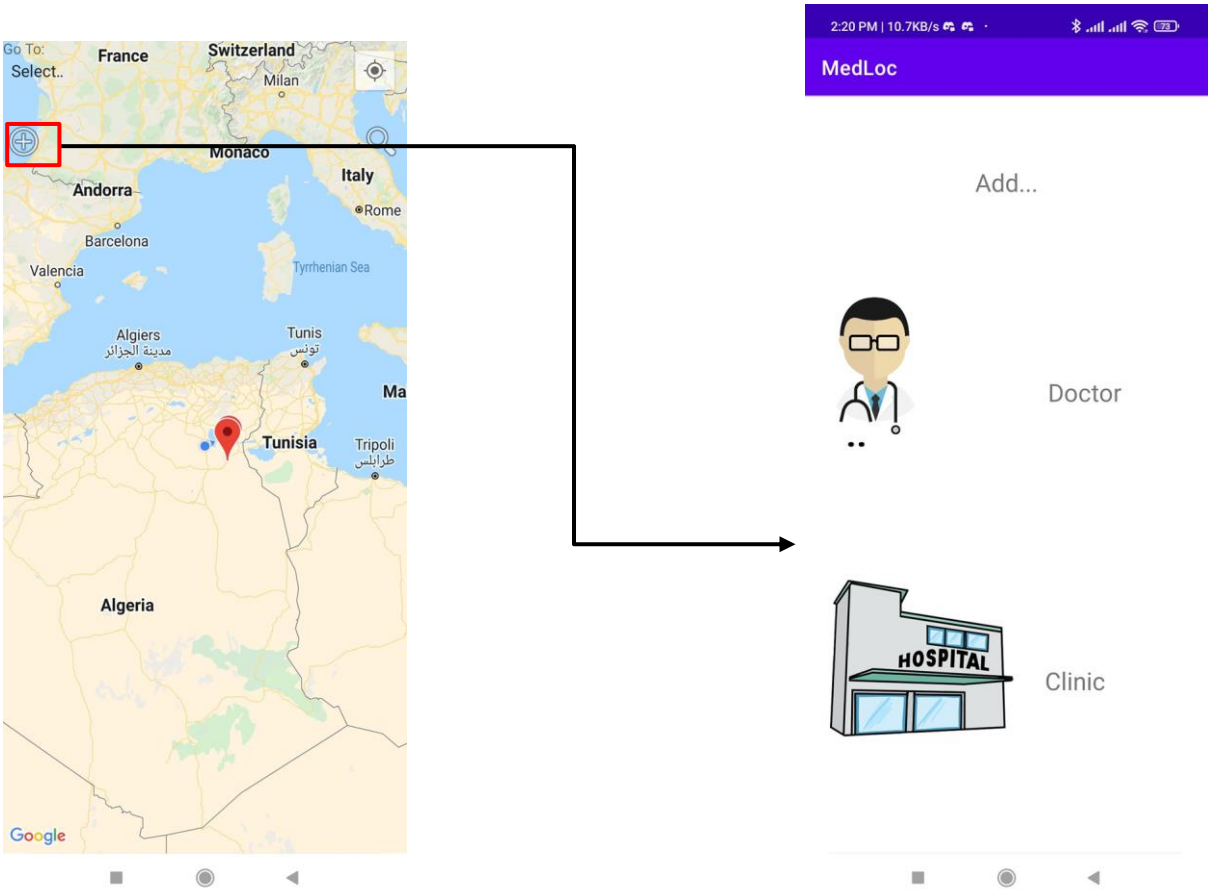


Figure 14:Addition Button Action

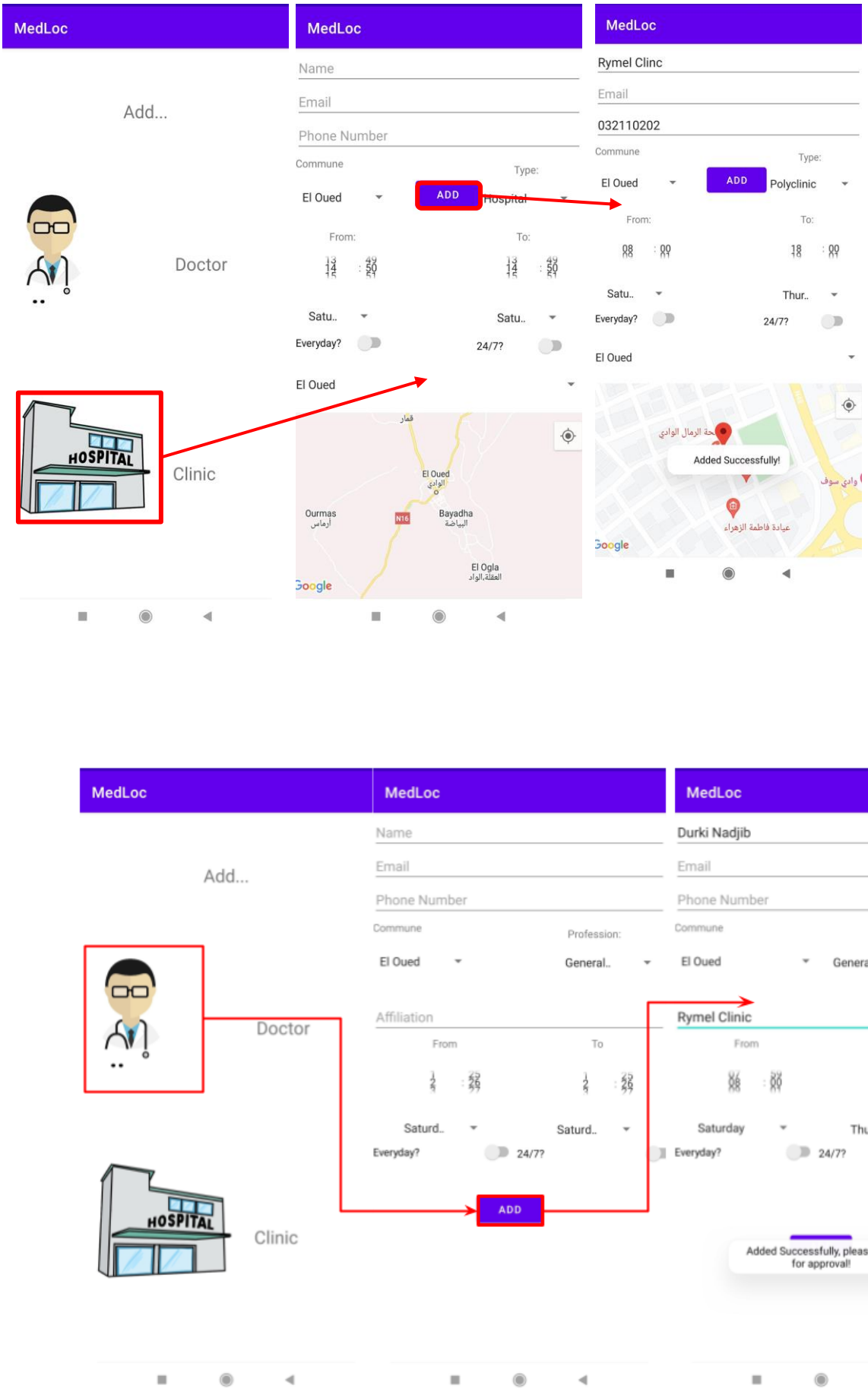


Figure 16:Adding Doctors

❖ Searching for Specific Doctors/Clinics:

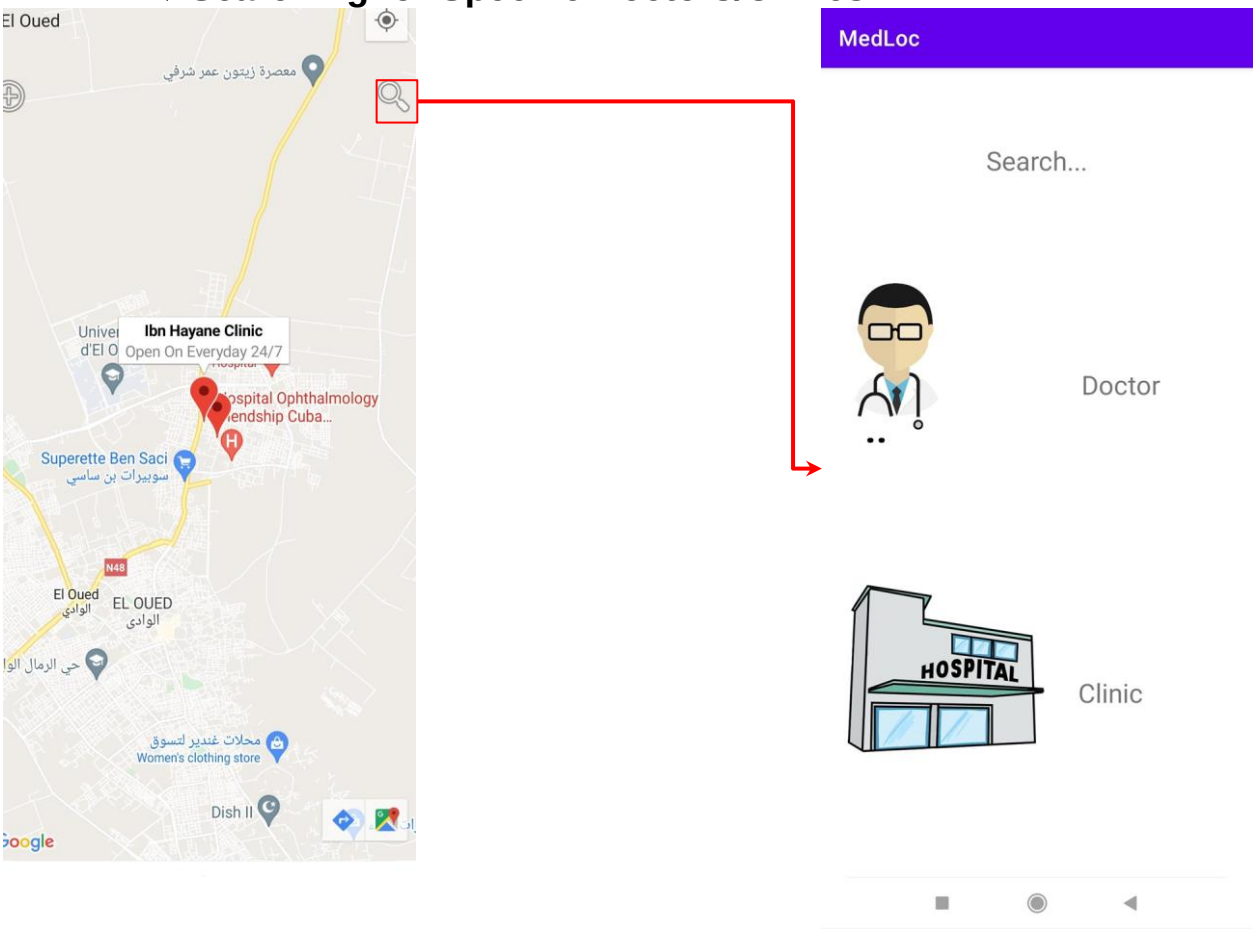


Figure 17:Search Button Action

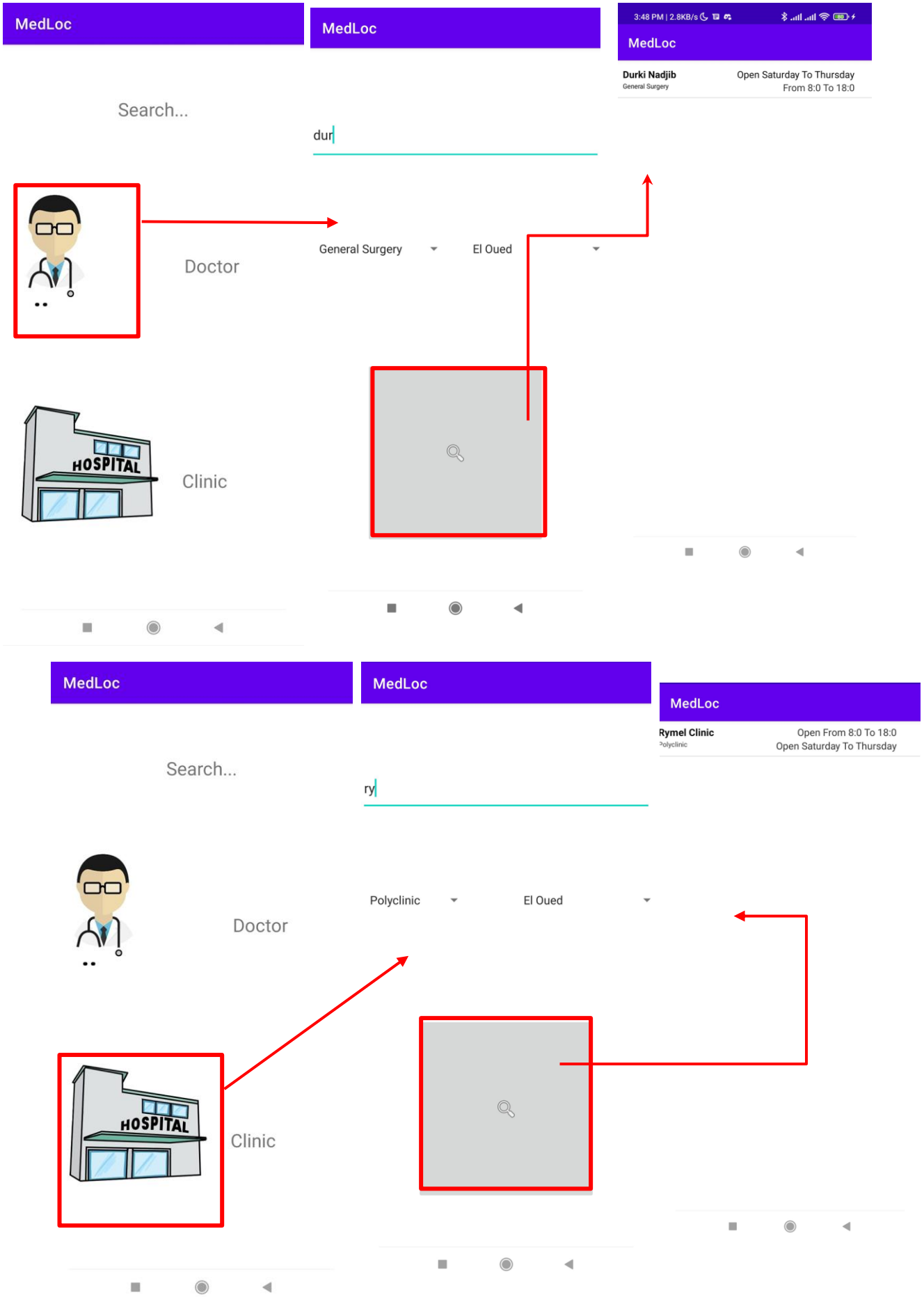


Figure 19:Searching Clinics

❖Show Details Screens:

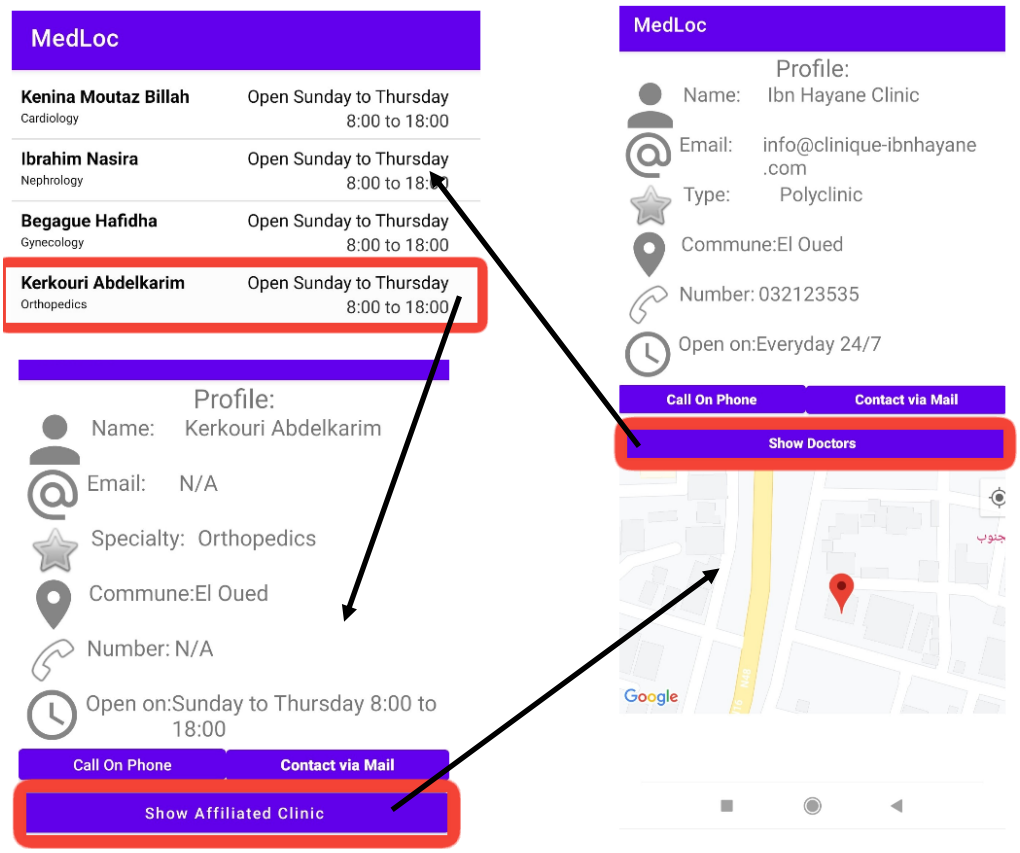


Figure 20:Navigation Between Clinics And Affiliated Doctors

❖Contact Doctor/Clinic:

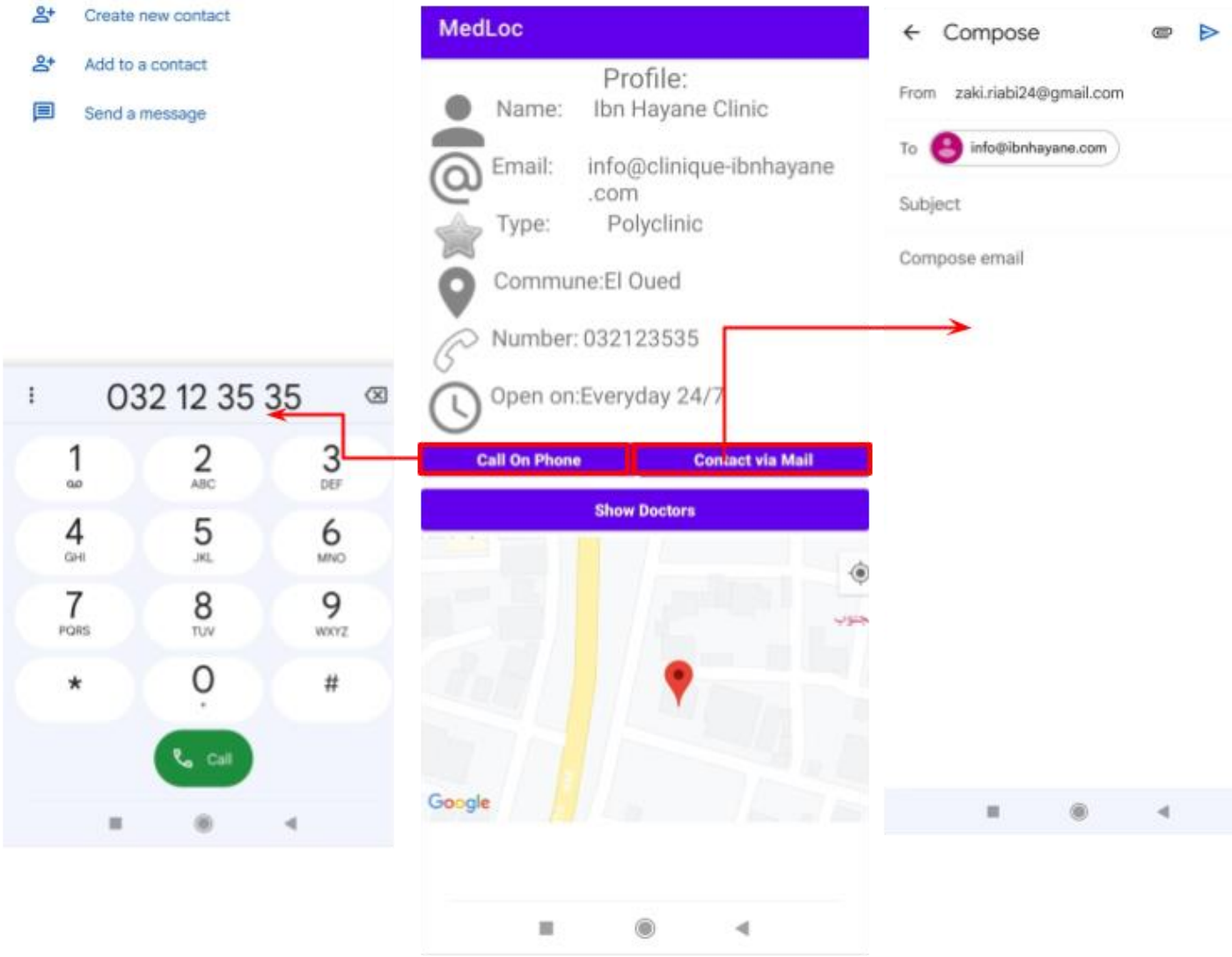


Figure 21:Contacting a Clinic via Phone & Email

Conclusion:

In summary, this chapter is dedicated to realizing our project, the hardware and software tools and means to make it possible, such as the languages and additional programs and their specific role in the project and the physical material it was built and tested on, as well as showcase the results through pictures that show what the app looks like and how it functions

General Conclusion:

The purpose of project “MedLoc El-Oued” was to develop a software application for mobile devices capable of providing the geographical locations for medical clinics and doctors situated all over Wilaya El-Oued, including access to other features for more convenient use such as finding routes to said locations as well as contacting doctors through phone and Emailing.

This project went through 4 different phases in order to obtain this final product. From researching the relevant domains related to the app’s conception such as geolocalisation and mobile devices, to analyzing the requisites and objectives it needed to reach, to the phase of laying out the schemas to represent the general plans for development and finally writing the code and manifesting the app in reality.

The end result managed to be quite a success, and working on it proved to be an insightful experience for the team members on the realities of software development, and especially surrounding mobile app development and server-client architecture. And regardless of any flaws or deficiencies it may have, the development team genuinely hopes that it would prove of any use as a reference to the creation of computer science related projects.

Abstract

The growth of the market for mobile application is increasing immensly year by year, due to the wide range of capabilities mobile phones can do

within an even wider range of domains.However, the medical and healthcare domain is potentially the least covered when it comes to mobile apps, especially

when it comes to locating the many doctors and medical facilities located anywhere on the globe.

The goal of our project "MedLoc" is to provide a convenient method to geographically

locate doctors and clinics in Wilaya El-Oued, alongside any useful information about them that may benefit the user

The creation of this project required the use of a variety of tools to visualize and develop it, such as Java, Android Studio, XAMPP, UML...etc

Keywords: UML, Mobile Application, Android, Geolocalization, Google Maps

ملخص

يتزايد نمو سوق تطبيقات الهاتف المحمول بشكل كبير عامًا بعد عام ، نظرًا للمجموعة الواسعة من الإمكانات التي يمكن للهواتف المحمولة القيام بها. ضمن نطاق أوسع من المجالات. ومع ذلك ، من المحتمل أن يكون المجال الطبي والرعاية الصحية هو الأقل تغطية عندما يتعلق الأمر بتطبيقات الأجهزة المحمولة ، وخاصة عندما يتعلق الأمر بتحديد موقع العديد من الأطباء والمرافق الطبية الموجودة في أي مكان في العالم.

الهدف من المشروع MedLoc هو توفير وسيلة ملائمة لتحديد الموقع جغرافيا لأطباء وعيادات ولاية الوادي إلى جانب أي معلومات مفيدة عنهم قد تفيد المستخدم.

تطلب إنشاء هذا المشروع استخدام مجموعة متنوعة من الأدوات لتصوره وتطويره مثل Java و Android Studio و XAMPP و UML ... إلخ.

الكلمات المفتاحية UML ، تطبيق الهاتف ، Android ، تحديد الموقع الجغرافي ، خرائط Google Maps