

People's Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research



Chahid Hamma Lakhdar University of El Oued
Computer Science department

Algerian Taxi QR barcode payment application

Presented by :

Fares Zelaci
Abdenour Nagoudi
Ayoub Gori

Framed by :

ABDELKADER LAOUID

Academic year:2021-2022

Abstract

The emergence of mobile phone technologies and technological developments in the field of information and communication have led to the proliferation of different mobile phone applications useful for different areas such as paying taxis via QR code. Online payment applications allow users to find taxis and pay anytime and anywhere using their mobile devices. In this work, we have developed an agent-based mobile application that will allow users in Algeria to take advantage of these new technologies in the field of taxi booking. The completed application will give drivers the ability to easily create and manage accounts, add services and present their offers to customers. For customers, the app offers many features such as taxi search, automatic geolocation, remote booking of taxis, etc. The application was developed using many methods and tools for mobile technology and multi-agent systems.

Keywords: mobile applications, taxi payment by QR, agents, multi-agent systems, MAS.

Résumé

L'émergence de la technologie des téléphones mobiles et les développements technologiques dans le domaine de l'information et de la communication ont conduit à l'apparition de différentes applications mobiles utiles pour différents domaines comme la réservation en ligne de taxi. Les applications de réservation en ligne permettent aux utilisateurs de trouver et de réserver des taxis à tout moment et n'importe où en utilisant leurs appareils mobiles. Dans ce travail nous avons développé une application mobile basée agent qui va permettre aux utilisateurs en Algérie de bénéficier de ces nouvelles technologies dans le domaine de réservation de taxis. L'application réalisée, va donner aux chauffeurs la possibilité de créer et de gérer facilement des comptes, d'ajouter des services, de proposer leurs services aux clients. Pour les clients, l'application offre plusieurs fonctionnalités comme la recherche de taxis, la géolocalisation automatique, la réservation de taxis, etc. l'application a été développée en utilisant plusieurs méthodes et outils de la technologie mobile et de systèmes multi-agents. .

Mots-clés : Applications mobiles, réservation de taxis, agents, systèmes multi-agents, SMA.

ملخص

أدى ظهور تكنولوجيات الهاتف المحمول والتطورات التكنولوجية في مجال المعلومات والاتصالات إلى انتشار تطبيقات مختلفة للهواتف المحمول مفيدة لمجالات مختلفة مثل الدفع سيارات الاجرة عبرك ركود. تتيح تطبيقات الدفع عبر الانترنت للمستخدمين العثور على سيارات الاجرة ودفع في أي وقت وفي أي مكان باستخدام أجهزتهم المحمولة. في هذا العمل، طورنا تطبيقًا للهاتف المحمول يعتمد على الوكيل والذي سيسمح للمستخدمين في الجزائر بالاستفادة من هذه التقنيات الجديدة في مجال حجز سيارات الاجرة. سيتمنح التطبيق المنجز السائقين القدرة على إنشاء حسابات وإدارتها بسهولة وإضافة خدمات وتقديم عروضهم للزبائن. بالنسبة للزبائن، يقدم التطبيق العديد من الميزات مثل البحث عن سيارات الاجرة، التحديد التلقائي للموقع الجغرافي، الحجز عن بعد لسيارات الاجرة، وما إلى ذلك. تم تطوير التطبيق باستخدام العديد من الاساليب والادوات لتكنولوجيا الهاتف المحمول والانظمة متعددة الوكلاء.

Contents

Abstract	I
Résumé	II
III.	ملخص

General Introduction

1.General context.	1
2.Objective	2

Chapter01: Mobile application

1.Introduction.....	3
2.MobileComputing.....	3
2.1. Mobile App.....	3
2.1.1. Definition	3
2.1.2. Characteristics of mobile applications.....	3
2.1.3. Development Strategies.....	4
1. Native app	4
2. Web App.....	4
3. Hybrid app	5
2.1.4. The advantages and disadvantages of a mobile application.....	5
1. The advantages of a mobile application.....	5
2. The disadvantages of a mobile application.....	5

2.1.5. Objectives of mobile applications	6
2.2. Mobile operating systems.....	7
2.3. The system used “Android”	8
2.3.1. Definition	8
2.3.2. Android versions	8
2.3.3. Android Architect	8
3. Taxi Booking	9
4. pay by Code.....	10
4.1. QR Code.....	10

Chapter 02: Analysis and Design

1. Introduction	11
2. Description of the completed system	11
3. Methodological choice.....	12
3.1. UML	12
3.1.1. Definition	12
3.1.2. UML diagrams	12
4. Analysis.....	13
4.1. Users identification	13
4.2. Interface agents	13
4.3. Identifying interactions	14
4.4. The environment.....	15

4.5. The organization	16
5. Design	17
5.1. The use case diagram	17
5.2. The Class diagram	18
5.3. The sequence diagram	19
6. Conclusion	21

Chapter 03: Implementation

1. Introduction	22
2. Languages and development tools.....	22
2.1. dart language	22
2.2. Flutter Framework.....	23
2.3. Android studio	23
2.4. Visual Studio Code.....	24
2.5. Firebase	25
3. Presentation of the Graphical Interfaces.....	26
4. Conclusion.....	28
General Conclusion	29

List of Figures :

Figure 1.1: The different mobile applications.	4
Figure 1.2: List of applications.....	8
Figure 1.3: Mobile app system.....	9
Figure 1.4: Components of the Android operating.....	11
Figure 2.1: System organization.....	14
Figure 2.2: The use case diagram	15
Figure 2.3: The Class diagram.....	15
Figure 2.4: The 'Create Account' Sequence diagram.....	16
Figure 2.5: The 'Find Taxi' Sequence diagram.....	16
Figure 2.6: The 'Book Taxi' Sequence diagram.....	20
Figure 2.7: The 'Add Service' Sequence diagram.	22
Figure 3.1: Flutter Framework	31
Figure 3.2: Android Studio	33
Figure 3.3: Visual Studio Code	36
Figure 3.4: Firebase.....	37
Figure 3.5: Login interface.....	38
Figure 3.6: Location interface.....	36
Figure 3.7: Customer.....	37
Figure 3.8: Qr scanner'.....	38

General Introduction

1. General context

Information and communication technologies can be considered As the most important and innovative revolution of recent years. This is amazing The revolution has allowed the emergence of the concept of portability and mobility which offers Instant remote access and continuous flow of information. In fact, it's It symbolizes the emergence of many high-tech devices such as Smartphones and tablets with many practical and useful applications for Various areas such as online transportation area and taxi payment.

Thanks to the many original features they offer, as well as the particular ergonomics in full respect of accuracy, smartphones and tablets are ready to drop computers around the world. This has led to the emergence of mobile applications o pay for taxis, which corresponds to the use of wireless technologies, and more The mobile phone in particular, to carry out research and Pay the taxis. presents this trend to users, customers or drivers, Great services like 24/7 online payment, so you know exactly what The distance is the designated taxi driver etc.

2. Objective

Unfortunately, despite the increase in the use of mobile devices and Applications, the concept of online taxi payment is independent in Algeria, of which computing is too late. For this, we decided to dedicate our project to Create an affordable mobile app to overcome this drawback. This is amazing The var application notably offers the option of automatic geolocation, the possibility of Find a taxi, book a car anytime 24/7, see it all Driver and location information. In addition to drivers, the possibility to easily add a service, easy access to customers, the possibility of contacting a customer in case of cancellation and delay etc. For the realization of our application, the multi-agent paradigm was chosen for the modeling of the different entities of our system. This choice is motivated by the nature of the realized system and by the characteristics of the multi-agent systems which have become a dominant paradigm in the field of the development of intelligent, distributed systems and complex.

Chapter 01

Mobile application

1.Introduction

As part of the graduation project, to implement this chapter, a study was conducted on applications, technologies, operating systems and mobile tools development, especially with the Android environment in which it operates Memory.

2. Mobile Computing

In order to solve the problems and achieve the above objectives, We used mobile computing which is defined as a possibility Users equipped with mobile devices or laptop computers to access the Services and To advanced applications, via the shared network infrastructure, independently The actual location or movement of its users.

2.1 Mobile app

Mobile applications have invaded our daily lives. Check your email, play, talk to Friend, go shopping, check news or weather, find route or hotel, Consult your accounts, you can do it in one click via your mobile phone. Businesses or individuals, you all (or almost) turn today to these Applications that are an integral part of our lives and without, for many It would be almost more complicated.

2.1.1 Definition

A mobile application is a type of software or software designed to run on a file A mobile device, such as a smartphone or tablet. Mobile apps are often used to Provide users with PC-like services. Mobile apps relatively lightweight, self-contained programs used for information services.

2.1.2 Characteristics of mobile applications

A mobile application is successful, it must have some very important criteria which are the following :

- Speed and fluidity, a first criterion for a successful application.

- The weight of the mobile application, an important factor for users.
- Ergonomics, a criterion for building user loyalty.
- A good display quality, a criterion to seduce the user.
- Maintenance and scalability, the key to good monitoring.

2.1.3 Development strategies

The design of mobile applications can be done according to three strategies of distinct development: web application, native and hybrid application, as shown in the following Mobile.



Figure 1.1 :The different mobile applications.

In the following, we provide a brief overview of each strategy:

1. Native app

A native application is a mobile application specifically developed for a mobile operating system. It is designed with the language and tools associated with its operating system, and installed directly on the mobile. This installation being done either by downloading via the Internet or by deployment from a computer connected to mobile. Tests to verify the behavior of these applications require specific technical skills and very expensive equipment.

2. Web App

A mobile Web application is an application developed in HTML, accessible and executable through an Internet browser for mobile phones. She uses the Smartphone browser and does not necessarily require downloading the application. The Web mobile applications complement the native applications that are developed specifically for an operating system and which must be downloaded and installed by mobile users. They are therefore intended for all mobile users,

and not for a specific population using a specific brand. However, web applications must be tested for each browser, resolution and screen size, just like any which website.

3. Hybrid app

The hybrid application is a mobile application that combines elements HTML5 as a mobile web app and elements of a native app allowing the use of the native functionalities of Smartphones and to be distributed as as an application on the stores of mobile systems (App Store, Play Store, etc.).

2.1.4 The advantages and disadvantages of a mobile application

1.The advantages of a mobile application

A mobile application has many advantages compared to a mobile website, in here are 5 main ones:

- ❖ Comfort of use and an unequalled user experience.
- ❖ Direct access to the content of the mobile application via the icon on the Phone or tablet .
- ❖ dashboard (access mode without URL).
- ❖ Operation in disconnected mode.
- ❖ It allows the use and integration of all telephone functions (accelerometer, gyroscope, GPS, camera, etc.), which is not necessarily the case with Web Apps.
- ❖ The implementation of native functionalities such as “notifications” PUSH .

2.The disadvantages of a mobile application

- ✓ The main disadvantage of a mobile application is that it must respect the rules defined by the different mobile platform companies. Whether the approval necessary from the Apps Store to distribute the application or its updates.
- ✓ The pricing conditions imposed or the non-compatibility with other systems mobile operations.
- ✓ The cost of developing a mobile application is a hindrance because generally higher if it is ported to multiple platforms (in order to be available for a maximum number of mobile users) than the cost of a mobile site or Web App. It should potentially provide for
- ✓ development on each technology, and therefore a cost additional if you want to position yourself on all models.

- ✓ For the user to have access to the latest version, he must update it from the store unlike mobile sites and Web App which update directly.

2.1.5 Objectives of mobile applications

Applications were initially aimed at improving productivity and facilitating the retrieval of information such as e-mail, electronic calendar, contacts, stock market and weather information.

Then, the application developers then respond to a request from the public and the availability of development tools have led to rapid expansion into other areas, such as:

- Mobile games.
- Industrial automation.
- GPS and localization services.
- Banking operations.
- Order follow-ups, ticket purchases.
- Mobile medical applications.
- Virtual reality.
- Listening to music or radio.
- Viewing videos or television channels.
- Internet consultation.
- General social networks (Facebook type).
- Specialized social network.



Figure 1.2: List of applications.

2.2 Mobile operating systems

- **Android:** Acquired by Google, Android defines itself as Open Source mobile suitable for Smartphone, PDA, MP3 and tablet .This mobile operating system is developed in principle with the Java language, this language programming allows any software to be easily compatible with different systems operating systems such as UNIX, Windows and others by making some corrections or Same direction.
- **IOS:** Designed by Apple only for its own mobile devices ,IOS is a mobile operating system developed by the Objective-C language, language part of ANSI C, known for conveying messages quickly as well as loading possible dynamically. Mobile operating systems.
- **Windows phone:** Designed by Microsoft, Windows Phone is an operating system mobile not restricted only to professionals but also individuals can use it. On the other hand, Microsoft has launched advanced offers aimed at companies since the appearance of Windows Phone 8 Windows Phone is developed by C#, it is a programming language similar to Java in terms of syntax and basic notions.



Figure 1.3: Mobile app system.

2.3 The system used “Android”

2.3.1 Definition

Android is a mobile operating system based on a modified version of the kernel Linux and other open source software, designed primarily for mobile devices to touch screen such as smartphones and tablets. Android is developed by a consortium of developers known as the Open Handset Alliance and sponsored commercially by Google. It was unveiled in November 2007, with the first device Commercial Android, the HTC Dream, launched in September 2008.

2.3.2 Android versions

The Android version history started with the release of version 1.0 in September 2008 Android has had several updates since its first version. These beta updates are usually used to fix bugs and add new features, the following table summarizes some Android versions.

2.3.3 Android Architecture

The architecture of the Android platform is broken down, using a bottom-up approach, into four main levels which are:

- ✓ The linux kernel
- ✓ The libraries and the runtime environment,
- ✓ The application development module.
- ✓ The different applications.

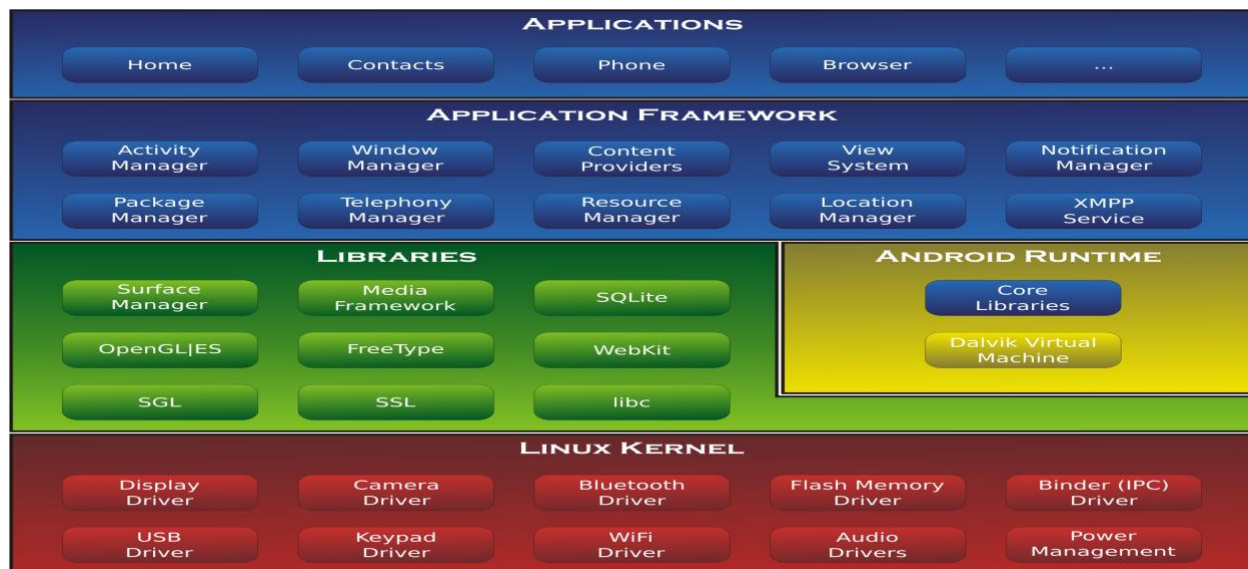


Figure 1.4: Components of the Android operating system.

3. Taxi Booking

- ✓ In recent years, the public transport offer has continued to develop and improve, and with it the demands and requirements of users, making these means of transport less competitive. The use of taxis remains quite popular in these areas due to its comfort and efficiency despite the few disadvantages they have in this case its timely availability, the time required to find a taxi, as well as the high cost. Our job is to explore existing solutions related to taxi booking and to design and develop an agent-based mobile application under Android. This application is intended for both customers and taxi drivers. For this we have taken the initiative to improve some disadvantages and to add functionalities to our application which are cited among the main objectives of the latter and which are the following:
- ✓ Booking a taxi in a simple and fast way in real time by having must have an Android smartphone.
- ✓ Collaborative application between the customer and the taxi driver.
- ✓ It is the customer and the taxi driver who allow the application to self-manage.
- ✓ Use of geolocation to see taxis within a radius of 5Km in time reel.

- ✓ The customer's position is located automatically.
- ✓ The client can indicate a meeting place if he wishes.
- ✓ After receiving a reservation request and in the event that the taxi driver accepts the request, He indicates the price he finds adequate, in turn the customer can either accept or refuse.
- ✓ The reservation request expires automatically after three minutes.
- ✓ After sending a reservation request, the customer cannot make a other request.

4 .pay by Code:

Several applications have recently adopted technology in their banking applications that allow customers to send money instantly to friends and family members directly or to merchants from their bank accounts .Mobile payments are made by scanning a barcode on an app on your phone ,and accepting payments from the customer to merchants .The cost of the purchase may be deducted from a value pre-charged to the account associated with the particular application ,or paid by credit or debit card .Payment information is encrypted during transmission so it is believed to be a more secure payment method than paying with a debit or credit card.

4.1.QR Code

QR code is a two-dimensional barcode, which consists of black units shown in a white box. QR code allows for quick decoding via barcode reader, smartphone, etc.

Chapter 02

Analysis and design

1. Introduction

After presenting the concepts of mobile applications and multi-agent systems in the previous chapters, we present in this chapter the phases of analysis and design of our system. In the first section, we will describe function of the system we want to develop. Next, we will present the owl method and the modeling language UML (Agent United Modeling Language) that we used to model our system. In the third section, we will identify the agents and the different interactions between them and we will finish by the design part where we will present the different diagrams describing our application.

2. Description of the system produced

In this end-of-study project, we want to develop a reservation system intaxi line based on mobile and multi-agent technologies. The developed system mustcontain in particular the following functionalities:

- ◀ The possibility of creating accounts either for customers or drivers.
- ◀ Automatic geolocation.
- ◀ Easy search for taxis.
- ◀ Taxi booking by customers.
- ◀ Easy contact between customers and drivers.

In this system, users (customers (passenger), driver and administrator) must be represented by software agents capable of autonomously carrying out all the spots instead of human users.

3. Methodological choice

3.1. UML

3.1.1. Definition

UML is a graphical modeling language that has been standardized by FIPA (Foundation for Intelligent Physical Agents) modeling technical committee. He was proposed as an extension of the Unified Modeling Language (UML). Until now there is no recognized standard for modeling multi-agent systems and UML has emerged as a candidate to assume such a position. It uses the features of “decomposition”, “abstraction”, and “organization”, which reduce the complexity of software development. AUML decomposes the system into small parts of objects, models, use cases or classes, and operational actions. Regarding “abstraction”, it offers an abstract specialized view of modeling (class, case of use, diagram, interface, etc.).

3.1.2. UML diagrams

As we stated in the definition, UML is an extension of UML in order to take into account the notions of agent that the latter does not have. UML inherits it inherits the different representations proposed by UML with extensions to allow represent the concepts of agent technology. Here is the list of the main diagrams of UML.

- ✓ Sequence diagrams.
- ✓ Collaboration diagram.
- ✓ Activity diagram.
- ✓ State transition diagram.
- ✓ Use case diagram.
- ✓ Class diagram.
- ✓ Object diagram.
- ✓ Packages.
- ✓ Component diagram.

4. Analysis

4.1. User identification

In the developed system, we identify three types of users: Customers, drivers.

Customers: these are the people who access the system to search and book a taxi. Some of the main customer activities in the system include:

- Research and consultation of taxis.
- Booking taxis.
- Consulting the account and all the information concerning its reservations.

The drivers: these are the people who use our system to drive the customers at their destination. Among the main activities of drivers in the system we find :

- The management of reservation requests.
- The update of services (addition, modification and deletion of service).
- Consulting information about the account.

The administrator: it is responsible for managing the system. Activities administrator's main functions in the system are:

- Manage user accounts: validate driver accounts and delete and disable user accounts.

4.2. Interface agents

➤ **Agent Interface Client:** it is an interface agent that runs in the device of the customer. It allows the user to interact with our system. This agent has an interface allowing customers to access all the necessary information and to carry out the operations of the reservations (the result of the search, the information on reservations (prices, taxi, location of drivers, etc.).

➤ **Agent Interface Chauffeur:** this is an interface agent that runs in the device of the driver and allows him, through a specific interface, in particular to consult

and respond to reservation requests, etc. This agent is the responsible for the automatic geolocation of the driver.

➤ **Agent Interface Admin:** this is an interface agent intended for the administrator of the system.

➤ **Client Agent:** It represents the virtual entity of the client within the system. So he is responsible for reservation operations (search, order, consult . . .). He receives data from the interface agent and makes contact with others system agents to perform these operations.

➤ **Driver Agent:** It represents the virtual entity of the driver within the system. So he is responsible for Driver operations (updating Services, managing and Consult customer orders), It receives the data from the agent interface and makes contact with the other agents of the system to carry out these operations.

Administrator Agent: It represents the virtual entity of the administrator within the system, he is responsible for administrator operations in the system as well as the creation of all other agents in the system.

4.3. Identifying interactions

▪ **Interaction Agent Interface Client / Administrator agent:** The agent Interface Client requests authentication from the administrator agent. The latter creates a linked client agent to this customer.

▪ **Driver Interface Agent/Administrator Agent interaction:** The agent Interface Chauffeur requests authentication from the administrator agent. This last creates a Driver agent linked to this Driver

▪ **Interaction Agent Interface Client / Agent Client:** The Agent Interface Client can send to the customer agent requests for taxi search, reservation. The agent Client responds by returning the processing results of these queries

▪ **Driver Interface Agent/Driver Agent interaction:** The Agent Interface Chauffeur sends a request to update services, consult orders and personal

information. The driver responds by sending him back processing results of these requests.

- **Interaction Agent Interface Administrator/Agent administrator:** The agent Administrator interface asks for application information, Validate and delete accounts to the administrator agent. The latter perform the operation.
- **Customer Agent/Driver Agent interaction:** the Customer Agent transmits requests for search for taxis to the Chauffeur agents of the system. The driver agents process the request and responds either with an acceptance or a refusal. In the event of a request for reservation, the customer agent sends the request to the driver agent concerned who responds either by a confirmation message or an error message.
- **Chauffeur Agent / Chauffeur Interface Agent interaction:** during reception a taxi search request, the Agent Chauffeur sends a request to Agent Interface Chauffeur to see the geographic location of the driver and his status (free or busy). In addition, upon receipt of a reservation request, the Agent Driver asks Driver Interface Agent for driver confirmation.

4.4. The environment

In SAMs, an agent's environment is made up of system agents and other physical or logical entities with which it interacts. The table below shows the environment of each agent in our system.

Agent	Environment
Driver interface agent	Driver + agent driver
Client interface agent	Agent interface client

Interface agent Administrator	Administrator + Administrator Agent
Driver	Agent Interface Chauffeur + Customer Agent + Administrator Agent + System Database.
Customer Agent	Customer Interface Agent + Driver Agent + Agent Administrator + System Database.
Admin agent	Agent InterfaceClient+ Agent InterfaceDriver + Agent Administrator interface + System database +

Table 3.1: The environment of each agent in our system.

4.5. The organization

The organization is a structure describing how the agents in the environment are relate and interact to achieve goals. The structural organization is:

- ❖ On the customer, driver or administration side, there are interface agents who interact with the system agents (the Customer agent, the Driver agent and the Administrator agent).These agents represent the points of interaction between the system and the users (Client, Driver, Administrator).
- ❖ In the server there is an Administrator agent, the Client Agents and the agent Drivers. The Administrator agent is responsible for the system (registration, authentication, creation of agents).

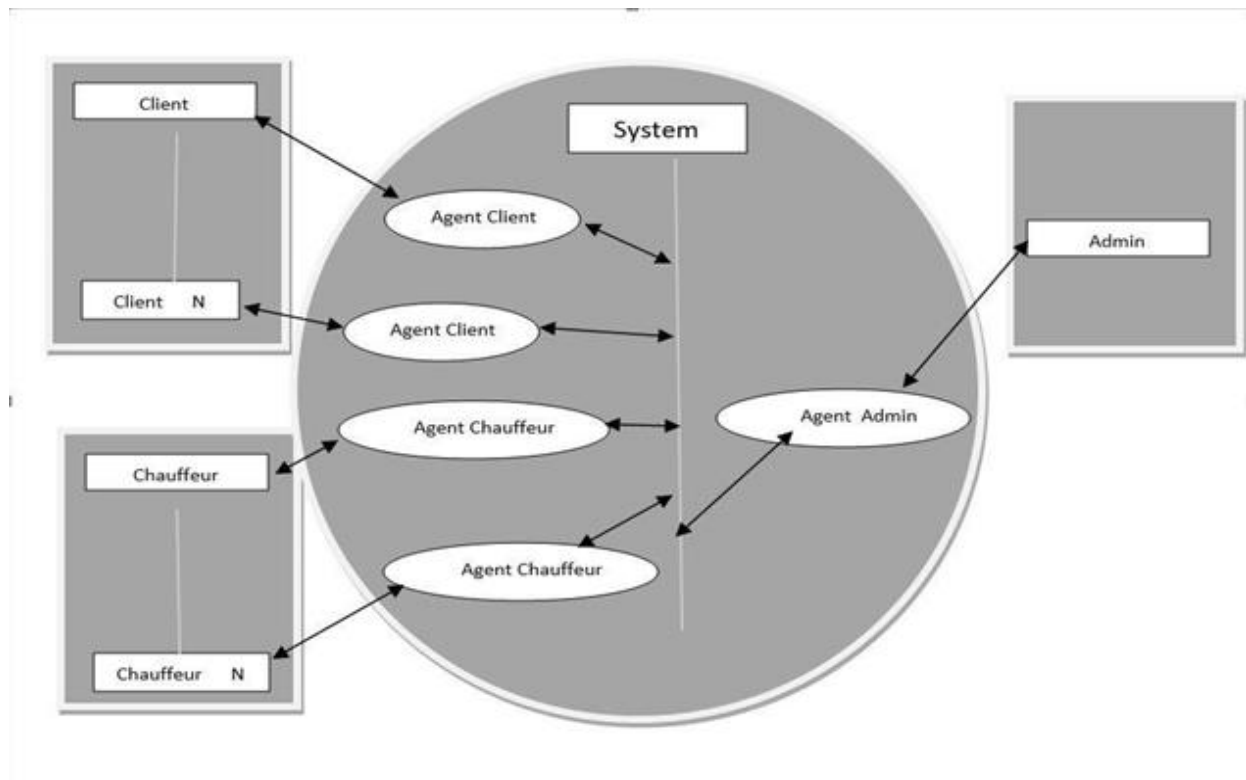


Figure 2.1. System Organization.

5. Design:

5.1. The use case diagram:

In Figure 3.4, we present the use case diagram which only lists of the essential general functions and the main actors of our System.

- ★ The main actors are:
 - **The customer:** who uses our system to search and book taxis.
 - **The driver:** who uses our system to manage orders and updates for their Services.
 - **The administrator:** who is responsible for managing the system.

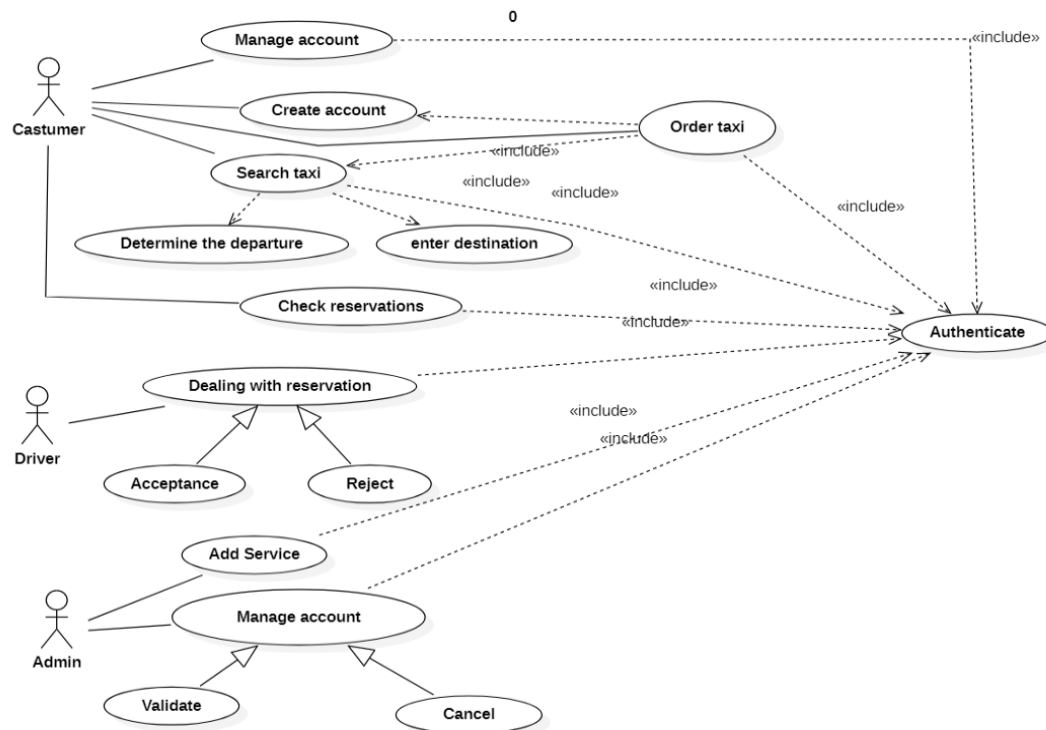


Figure 2.2: The use case diagram.

5.2. The Class diagram:

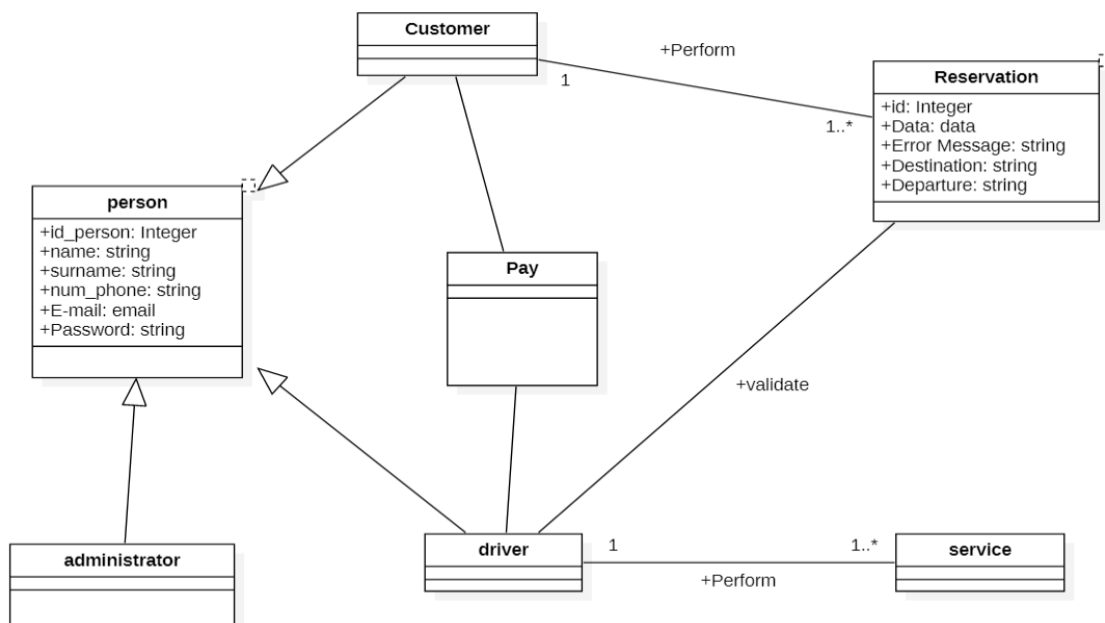


Figure 2.3: The Class diagram.

5.2.The sequence diagram:

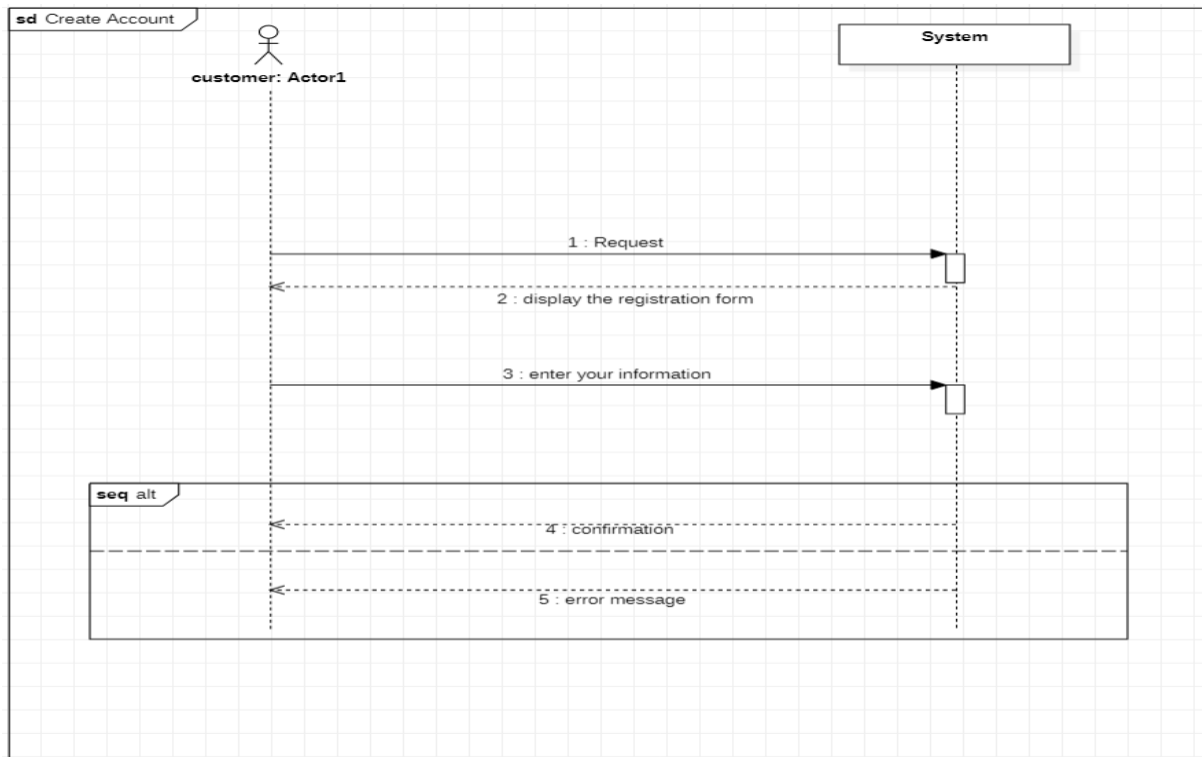


Figure 2.4 : The 'Create Account' Sequence diagram.

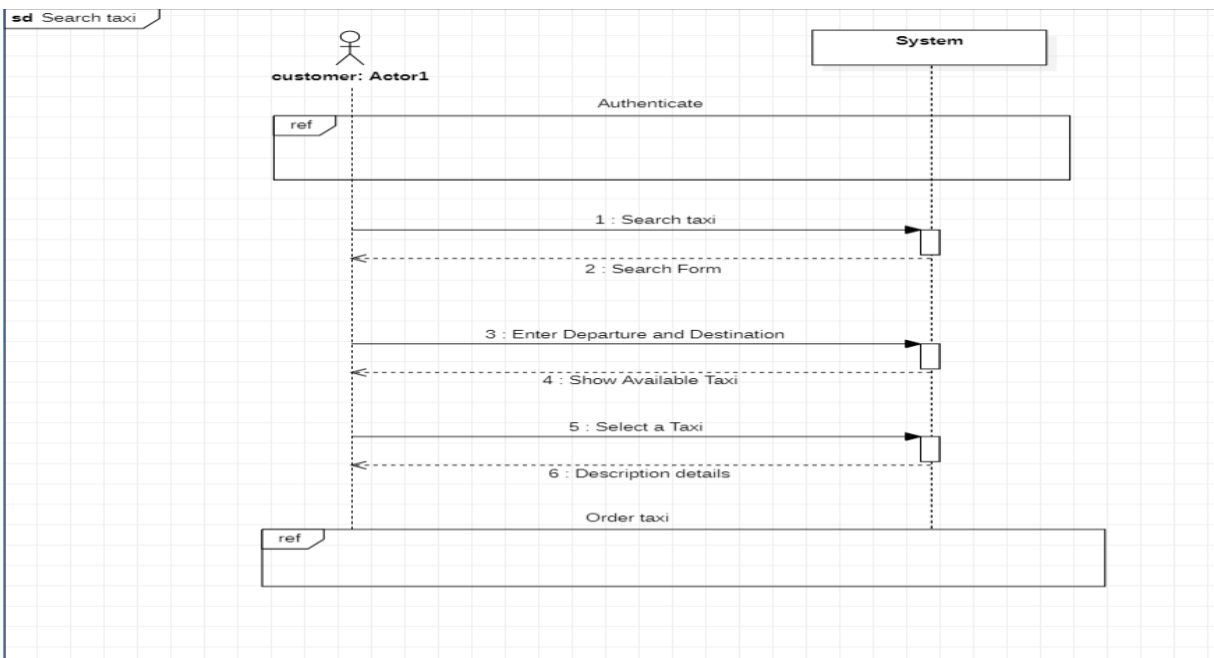


Figure 2.5:The 'Search Taxi' Sequence diagram.

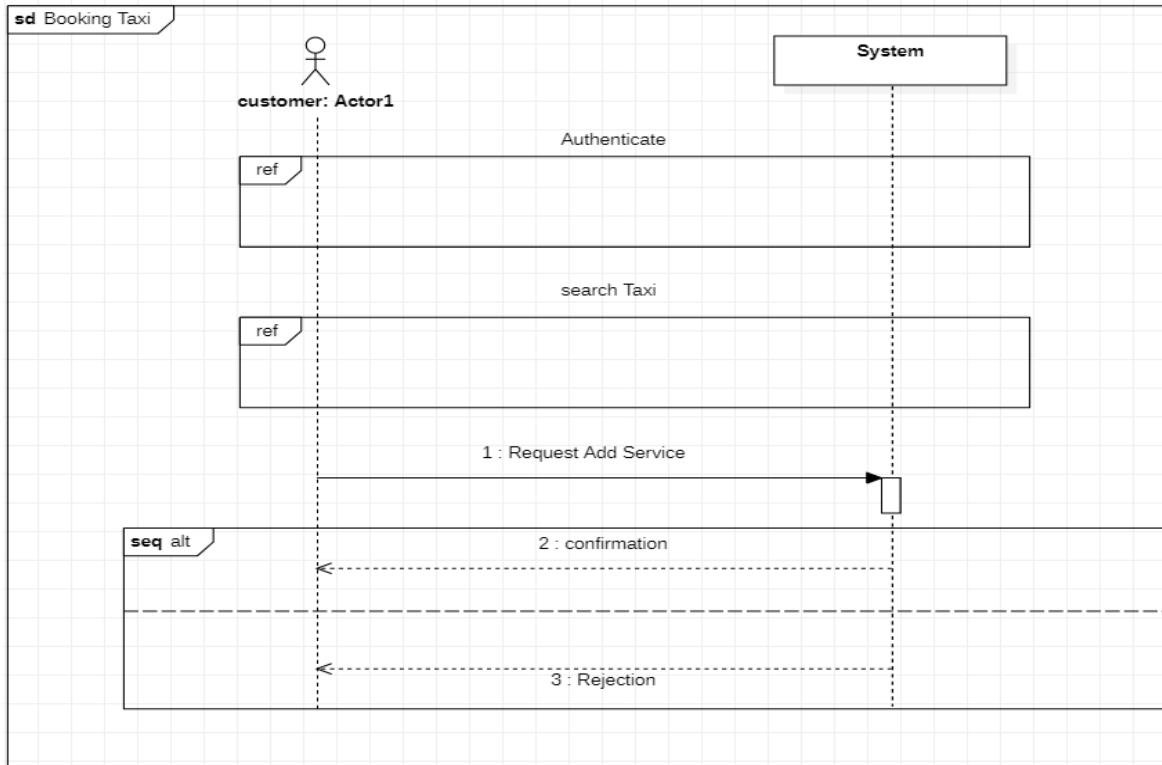


Figure 2.6 :The 'Booking Taxi' Sequence diagram.

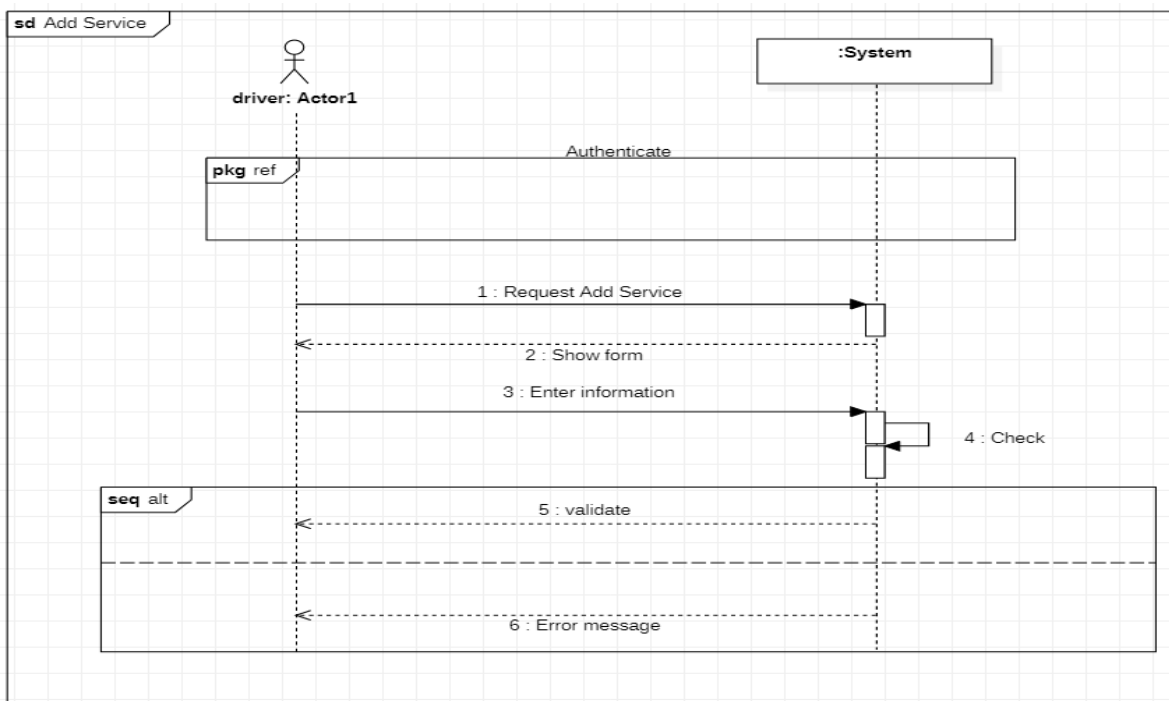


Figure 2.7 : The 'Add Service' Sequence diagram.

6. Conclusion

In this chapter, we have presented the analysis and design phase of our system, based on the vowel methodology and the UML language. After the identification of different components of the system, we have developed the diagrams UML necessary for its modeling, namely the use case diagram, the interaction protocol diagram and class diagram. The next chapter will be devoted to the implementation of this system.

Chapter 03

Implementation

1. Introduction

This is how we continue with the last stage of our work which translates through the implementation phase. This by specifying the software environment, the tools for developments used as well as the programming languages. These last have given us allowed to achieve the desired result, which we present through the different interfaces carried out.

2. Languages and development tools

We present in this section the different languages and tools used for the development of our app:

- ✓ Easy to install.
- ✓ Detailed documentation.
- ✓ Uses a powerful and stable language (DART).
- ✓ Integration with other development tools (Integration in VS Code).
- ✓ Integration with Android Studio.
- ✓ Framework Flutter.

2.1.dart language

Dart is a client-optimized language for developing fast apps on any platform. Its goal is to offer the most productive programming language for multi-platform

development, paired with a flexible execution runtime platform for app frameworks.

2.3.Flutter Framework

Flutter is an open source framework by Google for building beautiful, natively compiled, multi-platform applications from a single codebase.



Figure 3.1.Flutter Framework .

Top Characteristics of Flutter

1. open-source platform developed and backed by Google.
2. Hot Reload.
3. Rich Widgets.
4. Single Code Base.
5. Google Firebase Support.
6. Rapid App Development.
7. Single Codebase for Both Platforms.
8. Expressive Interfaces.

2.4.Android studio

Android Studio is a new environment for development and fully integrated programming that was launched by Google for Android systems. He has was

designed to provide a development environment and alternative to Eclipse that s the most widely used IDE.



Figure 3.2.Android Studio .

Among its advantages are the following:

- ❖ Android Studio development environment.
- ❖ Allows you to see each of the visual changes made in the application by real time.
- ❖ A simple way to test performance on other types of devices.
- ❖ Firebase is integrated into the IDE.
- ❖ A complete editor with a range of tools to speed up the application development.

2.5.Visual Studio Code

It is a script editor from Microsoft. The editor is open source and works on Windows, Mac OS X and Linux operating systems. The editor is based on the Electron environment and was launched by Microsoft in April 2015.



Figure 3.3. Visual Studio Code .

2.6. Firebase

is an app development platform that helps you build and grow apps and games users love. Backed by Google and trusted by millions of businesses around the world.



Figure 3.4. Firebase .

Firebase Pros:

- ◆ Email, Password, Google, Facebook and GitHub authentication.
- ◆ data in real time.
- ◆ Full API compatibility.
- ◆ An internal security system at the node level in the data tree.

- ◆ File storage is supported by Google Cloud Storage.
- ◆ Fixed file hosting service.
- ◆ Treat data (as streams) to create highly scalable applications.

3. Presentation of Graphical Interfaces

Login interface

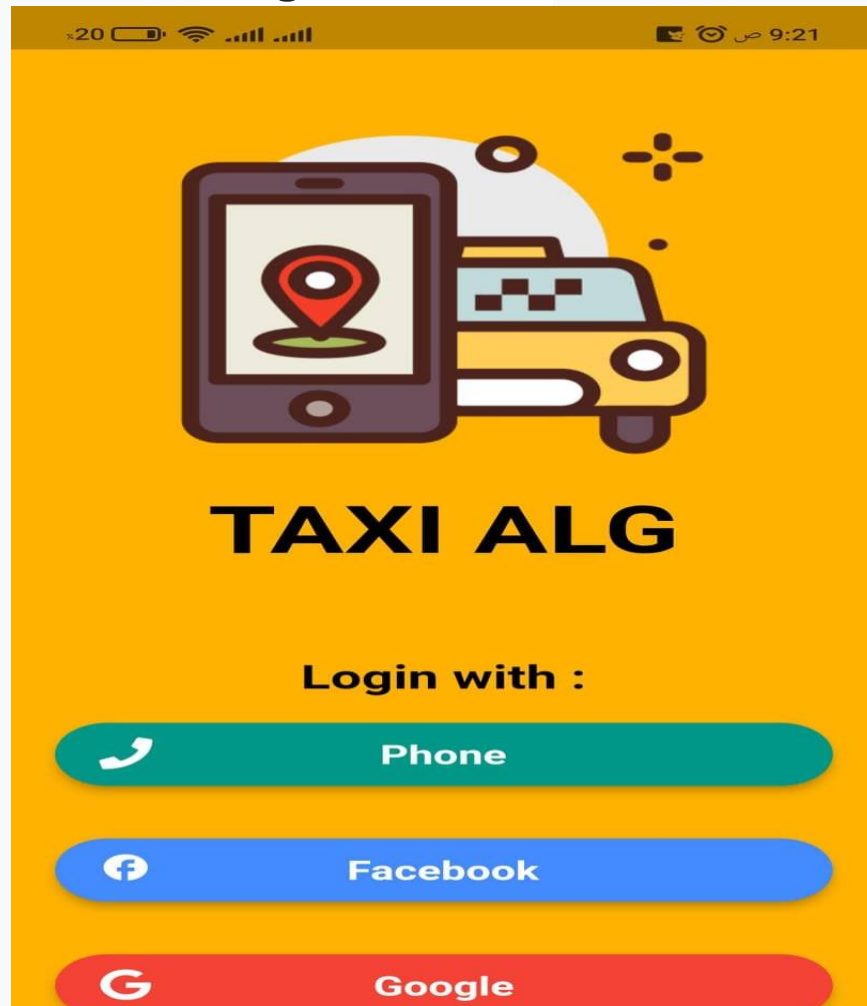


Figure3.5 :Login interface

Location Interface

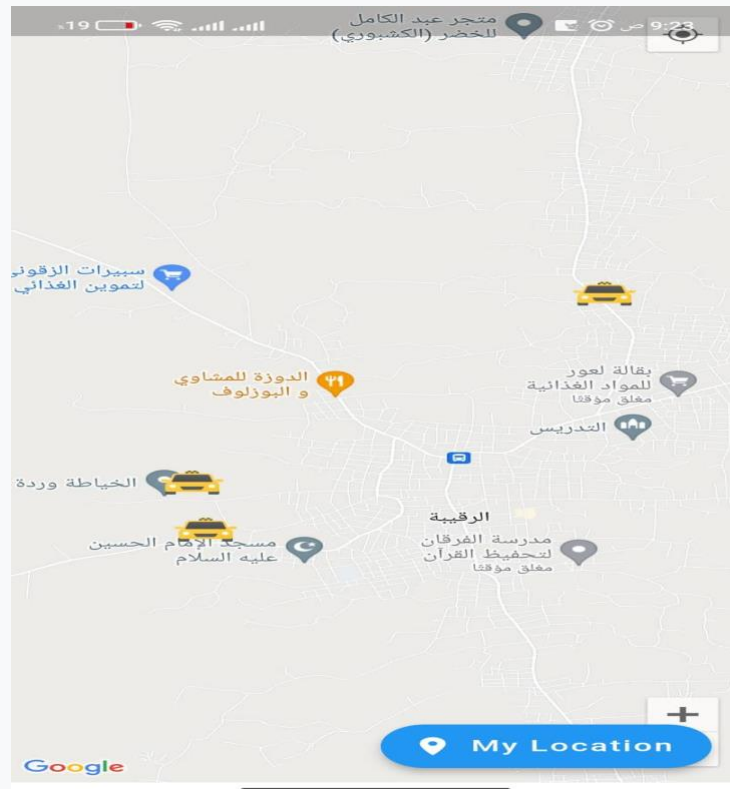


Figure3.6: Location interface

Customer Menu Interface

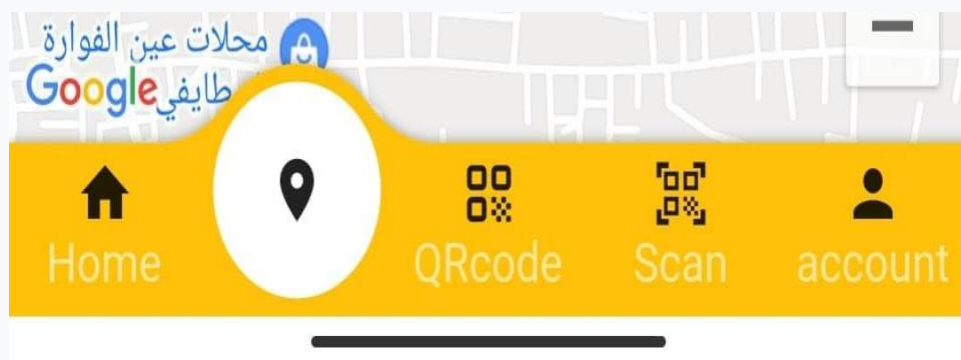


Figure3.7: Customer Menu .

Payment by barcode

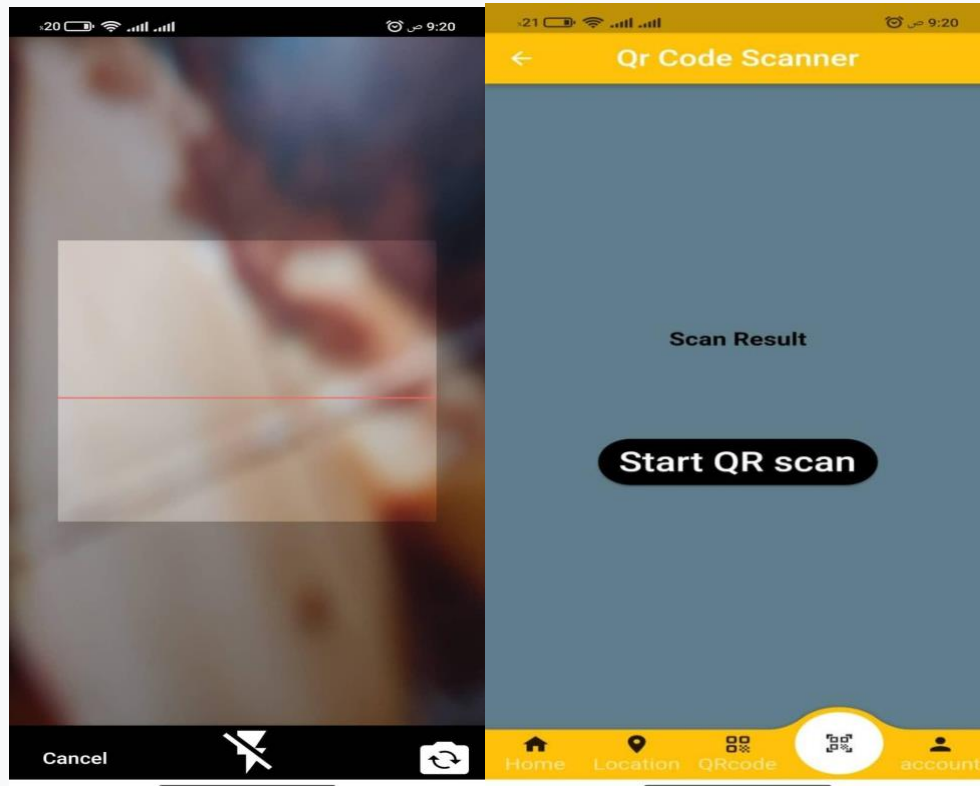


Figure3.8: Qr scanner

4. Conclusion:

The role of the JADE platform is to achieve the inter-agent communication layer of way to be able to make an argument without the intervention of the human and therefore in this to make them independent. For this, we use the ACL language so that the agents exchange their messages

General conclusion :

Technological innovations in the field of information and communication They have increasingly proven their effectiveness and importance. use this Technologies, especially mobile technology, have become essential and even Necessary in many areas such as the payment of taxis by QR which is Today as a promising trend for customers and taxi drivers.

The aim of our study was to propose an effective solution to allow Customers can make taxi reservations using their mobile devices. pay, In this work, we realized that the online payment application is based on Mobile technology and multi-agent systems. This app will broadcast:

- ◆ For drivers: create online accounts, add services and Receive notifications and process customer requests.
- ◆ For customers: taxi search, payment by QR survey The geographical location of the drivers, etc.

To create this graduation project, we followed the main steps Following:

- ✓ First, we reviewed the concepts of mobile apps and we have extracted from this study the aspects to be taken into account when development of our application.
- ✓ Next, we also describe the concepts of agents and multi-agent systems Its different characteristics and fields of application.
- ✓ When designing our system, we relied on the vowel method UML and its various systems.
- ✓ Finally, we used the JADE platform and many other tools Development to achieve this and we performed several implementation tests Which revealed that the system is working properly.

Finally, for the future, we propose to enlarge the structure Main suggested by:

- ✓ Integration of other types of transport.
- ✓ Use of QR payment mechanisms.