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Online Queue Management System For Postal Services

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Abstract

Waiting in line is a common experience in daily life, whether for a table at a popular restaurant or for the service at a post. This experience is not always pleasant for most people because they always have to wait for a long time to be serviced. The ability to interact with waiting customers is highly desirable because it allows businesses the opportunity to optimize their existing services and offer new services to waiting customers. However, interacting with individuals waiting in a queue has been inefficient and costly because employees must either talk with each waiting customer on an ongoing basis or the business must provide high-tech devices that interact with each waiting customer.

Keywords: E-Queue, Online System, Post services,Web application.

Resumé

Attendre en ligne est une expérience courante dans la vie quotidienne, que ce soit pour une table dans un restaurant populaire ou pour le service à un poste. Cette expérience n'est pas toujours agréable pour la plupart des gens parce qu'ils doivent toujours attendre longtemps pour être servis. La capacité d'interagir avec les clients en attente est hautement souhaitable car elle permet aux entreprises d'optimiser leurs services existants et d'offrir de nouveaux services aux clients en attente. Cependant, interagir avec des personnes en attente a été inefficace et coûteux, car les employés doivent soit parler à chaque client en attente de façon continue, soit fournir des appareils de haute technologie qui interagissent avec chaque client en attente.

M**ots Clés:** E-Queue, Système en ligne, Services postaux.

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General Introduction

Background and Motivations

WE are currently living in a world where every move, strategy, and plan is calculated exactly [10]. The traditional way of queuing in person has been a source of frustration for customers as it can be time-consuming, and they may have to wait for a long time, especially during busy periods.

The use of an online queue management system provides an alternative to the traditional queuing process, making it more efficient and convenient for customers. With online queue management, customers can join the queue from the comfort of their home or office using a smartphone or computer. This system provides customers with the flexibility to select a preferred time slot, thus avoiding long waiting times and the need to stand in long queues.

Moreover, online queue management can help postal services optimize their staffing levels and service efficiency. The system provides real-time information on customer demand, allowing postal services to better manage their resources and staffing levels based on the number of customers waiting in the queue. By optimizing resources and managing demand, postal services can provide better customer service, reduce waiting times, and increase customer satisfaction.

In this dissertation, we want to improve internet queue management for postal services.

Problematic and Contributions

The majority of services are provided and performed online in order to reduce face to face and prevent the spread of infection. Similarly, with postal, many services are

already available to perform online. However, some services are not available online or require face-to-face interaction. As a result, queuing is inevitable, as financial institutions only allow a limited number of people to enter. This forces people to spend time queuing, potentially creating unnecessary crowds. According to the completed research, many systems, and applications have been developed to solve these problems; however, they do not address the proposed features of this project, including presenting estimated wait times before being served.

Dissertation Organization

Our dissertation consists, in addition to the introduction and the conclusion, of three chapters. The first chapter is the state-of-the-art chapter, while the other last chapters are the contributions to development of an online queue management system for postal services. The dissertation is organized as follows:

Chapter 1: A general history about postal and specifically about Algerian postal. Then we touch on the advantages and disadvantages of queue management system.

Chapter 2: Research methods and data collection for the investigation will be presented in this study to allow us to start the development with a clear and detailed idea of the static and dynamic aspects of the solution.

Chapter 3: It includes a presentation of our system's implementation, tests, and outcomes.

List Of Abbreviations

Abbreviation	**Signification**
PTT	Post, Telegraph and Telephone
EPIC	Public Industry and Trade Organization
EMS	Express Mail Service
CCP	Compte Courant Postal
CNEP	Caisse nationale d'épargne et de prévoyance
UPU	Universal Postal Union
QMS	Queue Management System
SDLC	System Development Life Cycle
API	Application Programming Interface
App	Application
UML	Unified Modeling Language
HTML	Hyper Text Markup Language
PHP	Personal Home Page
UI	User Interface
OQMS	Online Queue Management System

Chapter 1

State Of The Art

1.1 Introduction

POSTAL services have existed for over 2000 years and are an integral part of the global communications infrastructure. Post offices generally provide mail-related services such as selling postage stamps, delivering letters and parcels, providing PO boxes, and packing. Despite the valuable public services it provides, postal services are considered a neglected part of the public sector in many developing and underdeveloped countries [11].

This chapter will focus on all about postal services and queue management system. We will start with the history and presentation of post network in Algeria and their services, then see the advantages, disadvantages, and highlight related works of queue management system for postal services.

1.2 Post network in Algeria

With more than 3,000 post offices and nearly 1 million daily visits, (Algeria Post) is a leading company in the postal sector and the number one public service provider in Algeria (Algeria Post, 2013). The Algerian Postal Service is also number one in the country in terms of funds held and managed. Understanding how customers rate this company's services is important for citizens, companies, and the economy [21].

1.2.1 Postal History

The history of the Algerian postal network dates back to 1888 with the establishment of the Algerian Postal and Telegraph Association, later renamed Algerian Postal and Telegraphic Company [4]. The (Figure 1.1) below represents the first post office established in Algeria.

Figure 1.1: Grand Post Office.

- **When was the birth of the postal services?**

  The first known postal document, found in Egypt, dates from 255 B. that one of the first postal services, consisting of fixed relays rallied by horsemen, was organized by the King of Persia, Cyrus the Great [13]. By establishing the (Cursus public us), a veritable imperial postal service that ensured official and administrative exchanges within the Roman Empire through a series of stopover lodges and intermediate relay stations along the Roman routes.

- **What is the origin of the Universal Postal Union (UPU)?**
  - In the 17th and 18th centuries, mail exchanges between countries were mainly governed by bilateral postal agreements.
  - By the 19th century, however, the system of bilateral agreements had become so complex that it began to hinder the rapid development of trade and commerce.
  - Most importantly, in England in 1840, Lord Rowland Hill first introduced the Frank Letter system. Issued the world's first postage stamp.
  - In 1863 Montgomery Blair, Postmaster General of America, organized a conference in Paris. But the scope of their decisions was limited, and they were unable to reach an international postal agreement.
  - This task was entrusted to a high-ranking official in the North German Confederation, Heinrich von Stephan. He drew up plans for the International Postal Union and at his suggestion the Swiss government held a meeting in Bern on his September 15, 1874, attended by representatives of 22 countries.
  - The Treaty of Berne, establishing the General Postal Union, was signed on 9 October of the same year, when World Post Day is now celebrated.

- **At the Origins of the Post in Algeria**

  The official name (Post, Telegraph & Telephone) was retained after independence, and everyone prefers his three-letter acronym (PTT).

  At the time of independence, the war left Algeria's postal service with a damaged infrastructure, limited and inadequate structures designed primarily to serve ethnic minority settlers.

  Blackfoot and the massive exodus of postal workers in big cities have left huge gaps in public services in general.Algerian staff, eager to regain sovereignty over the post office and have accepted the challenge, occupied a network that at the time consisted of nearly 600 post offices [3].

- **Ministry of Post**

  After a long period of purely administrative management of these two basic axes of economic life, the process of restructuring the post and telecommunications industry was initiated in 1999, then concretized in 2000. 2000-03, establishes common rules for Posts and Telecommunications.

- **Birth of (E.P.I.C Algeria Post)**

  Created by decree 02/43 of 14 January 2002 in favor of reforms implemented by the watchdog, Algeria Post only took off in 2003 to ensure both public administrations and commercial and industrial public service agencies, with its core businesses focusing mainly on parcels and postal financial services.

- **Postal Museum**

  Inaugurated in July 2015, part of Algiers‘ large post office has been converted into the postal museum of Algeria.

  Responsible for presenting and telling the history of the post office and the development of postal profession and philosophy through the exhibition of authentic objects.

1.2.2 Presentation

Algeria Post is a large Algerian company and EPIC (Public Industry and Trade Organization), born out of the restructuring of the postal and telecommunications sector, pursuant to Law 2000-200003 of 5 August 2000. Establishes general regulations for communications. Algeria Post was established by Decree 02/43 of January 14, 2002. Obliged to perform public duties All over the country as it is necessary to ensure the operation and provision of postal and financial services and services.

Since its creation in 2002, the Algerian Postal Service has, in a constant process of progress and transformation aimed at modernization, fulfilled the various tasks entrusted to it, thereby contributing to the economic development set by the public authorities. We have contributed to the achievement of our goals.

Algeria Post had 24,417 employees in 2016, including his 3,732 postmen and his 3,678 post offices. Post offices cover the entire territory of the country, with 3,374 post offices. This equates to a postal density of 10,130 residents per post office [1]. 10,623 counters and 28,300 employees.

1.2.3 Organization

The organizational structure of Algeria Post [5] can be broken down into the following main components as shown in the figure below (Figure 1.2):

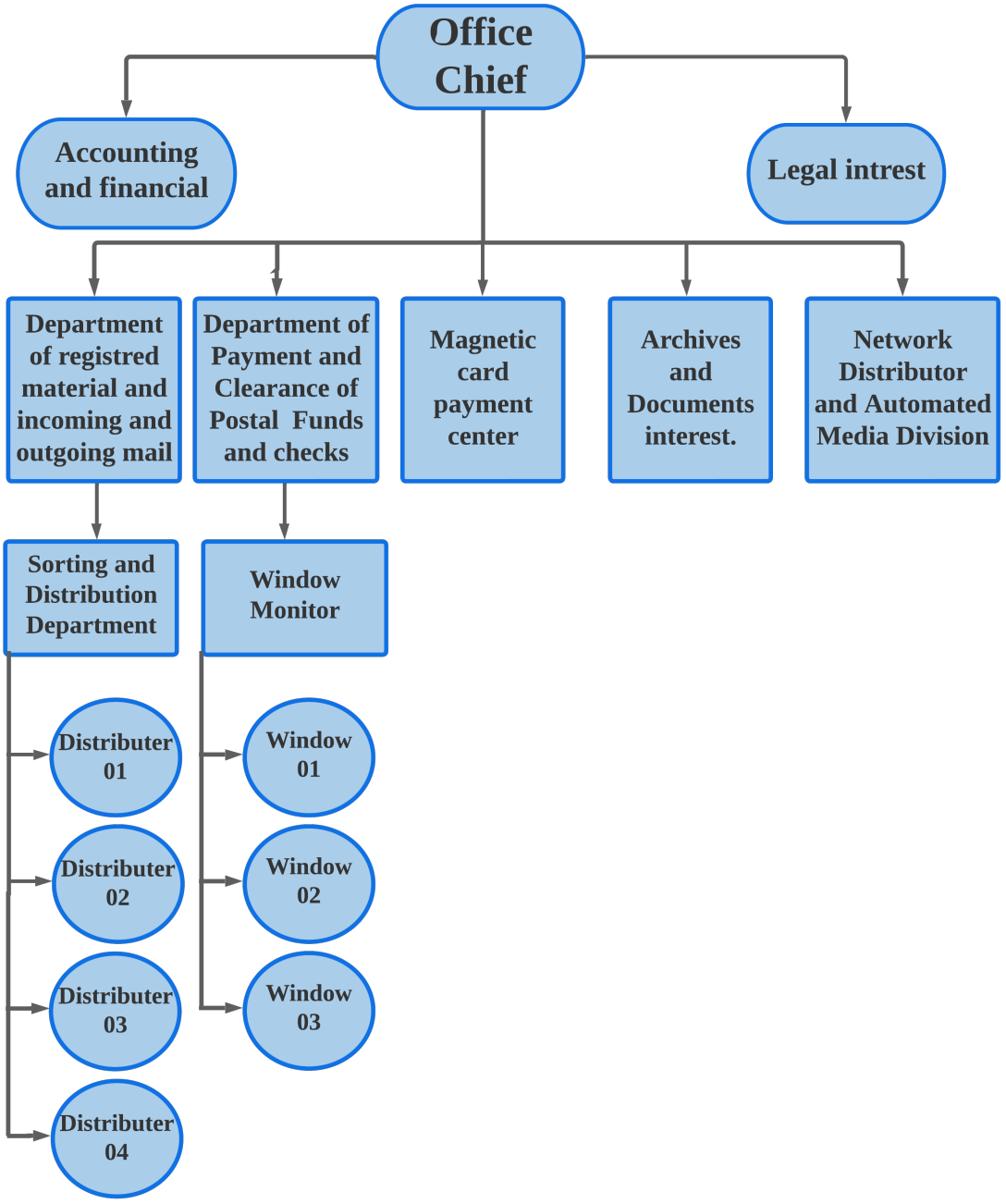


Figure 1.2: The organization of the Algeria Post Directorate.

Source Submitted by: Algiers Post Office Corporation Biskra.

1.2.3.1 Explanation of the function of each department

- **Section One (Section of the General Manager):** It completes the task of the manager to direct the administration, guide and motivate the employees and how they perform.
- **Section Two (Department of Interest Head):** its job remained to be unpacking the cargo that reached them through journals, arriving in mail bags containing missions, parcels and, in some cases, money, documents sent in the mail called Paper No. 12. to inspect the shipment. Confirmation checks for a decrease or increase in common mailing list to solve the problem. These are his third section tasks to record what it did. Because he is the number one next to the manager, he is a full-fledged person who can open with presence with the help of observers. When performing duties in his absence, he extracts registration materials such as: Sukuk. It's in your bag, where the process happens safely and transparently. send emails at the same time Transactions in Book No. 759 EGP.
- **The third section (the incoming and outgoing mail processing section) (the sorting process section):** This section contains three teams, and each team consists of two teams, where they sort the posts and each team take the posts according to their wave regions, where they do the most On official dispatches and report or deposit them as soon as possible as this process is completed There are very high risks for each of the teams, as well as tasks complementary to the second division.
- **The fourth section is the Postal Department:** in charge of the following:
  - Follow up on the implementation and monitoring of the implementation of the strategy of the General Directorate
  - Proposing development programs and plans in the light of the general directives of the Directorate General.
  - Conducting field studies at the office level regarding determining the necessary manpower.
  - Organizing and monitoring postal exploitation.

- **Section Five(Control Section):** This section monitors each of the work of the sections as a whole and solves problems or improves the work applied by the departments in order to reach the best effectiveness for the management of the following department: Well deserved and trustworthy.
- **Section of withdrawals and deposits:** This department serves customers (clients) to fulfill their desires in the shortest possible time. Through good treatment to achieve their mail boom.
- **Seventh Section(Postal Distributor Section):** This section is concerned with monitoring incoming and outgoing works from the first section to the last starting growth.

The organization of the postal network in Algeria is designed to provide reliable, accessible, and efficient postal services to all Algerians, regardless of their location.

1.2.4 The services

The national postal service of Algeria, offers various special and corporate services to its customers.

1.2.4.1 Special Services

Providing services to the public, which in turn is divided into 3 other types:

Figure 1.3: Mail services.

- **Postal Services (Mail):** Algeria Post provides national and international mail delivery services like in (Figure 1.3). The company offers several ways to send letters and parcels, including:
  - Basic mail services.
  - Complementary services for postal items.
  - Rental of Postal Boxes / Commercial Boxes: At Customer's request, PO boxes (or business boxes) may be provided at any postal facility located in the postal zone of Customer's residence.

    Subscriptions are annual and automatically renewed.
  - MAIL GUARD: Customers who habitually receive service at home for personal reasons, especially during extended absences, may request that correspondence of any kind be stored with their home postal service for up to three months.
  - Post Restante: Algeria Post offers a Post Restante service, which allows customers to have their mail delivered to a post office instead of their home address. This service is particularly useful for individuals who are frequently on the move, such as travelers or those who work in remote areas.
  - Redirection of correspondence : In the event of a temporary or permanent change of residency, the customer may arrange for the temporary or permanent redirection of letters to the new address indicated on the application submitted.
  - BARKI@TIC Electronic Telegram services: The traditional transmission of telegrams by telex or telephone has been replaced by a method of electronic transmission via the WEB called "Barki@tic". It is a messaging solution that electronically transmits customer messages from one postal company to another and physically distributes them to recipients.
  - EMS ALGERIA : EMS is a postal service (delivery/home delivery) that handles documents and goods. It is the only provider offering pickup and delivery in EXPRESS mode, covering a total of 48 cities.

- Accelerated postal delivery service: premium serviceThe "Premium Service" allows customers subscribing to this accelerated mode to receive high-quality, personalized benefit from the service.At your home within 5 business days maximum after confirming your order. The "Premium Service" is available to customers who apply for the "EDAHABIA" card for the first time and customers who wish to receive preferential treatment after card renewal.

- **Financial Services (CCP):** Algerian Post offers a range of financial services, including banking, savings accounts, and money transfers. The company operates a network of post offices where customers can conduct financial transactions. These services are particularly important in rural areas, where traditional banking services may be limited. The (Figure 1.4) below summarized all the service.

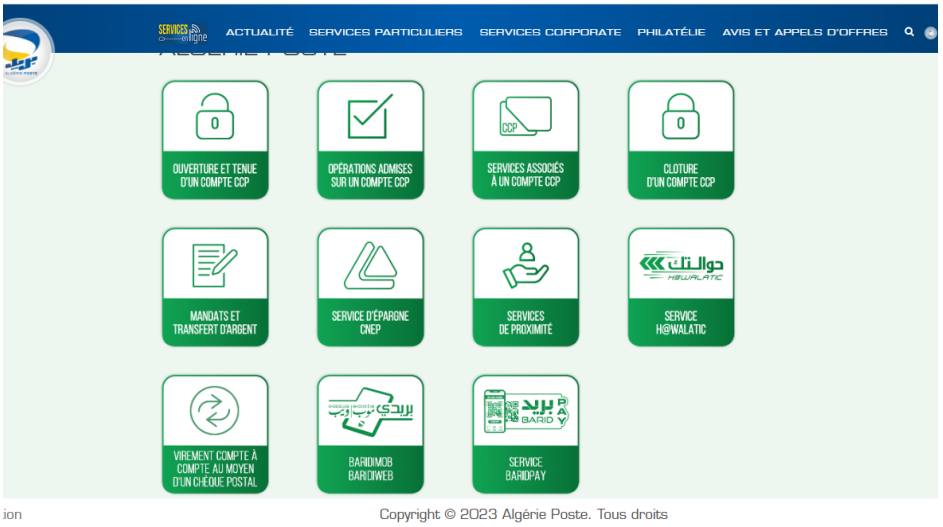


Figure 1.4: All financial services provided by Algeria's post.

1. Opening and maintaining a CCP account:Any natural or legal person of Algerian or foreign nationality residing in Algeria is permitted to open a Postal Current Account (CCP) subject to compliance with legal conditions. current laws and regulations.
2. Transactions admitted to a CCP account.
3. Services associated with a CCP account.
4. Money order and transfer.

5. Closing of a CCP account: The CCP account holder may request closure of their CCP account upon submission of a handwritten application and identification.
6. CNEP savings service.
7. Local services: To get closer, serve better and meet the growing demands of its customers, Algeria Post has set up many innovative services.
8. H@WalaTIC:H@walaTIC is a simple, secure and instant money transfer service via electronic orders that enriches Algeria Post's range of financial services.
9. The account-to-account transfer services by means of a postal check:The Direct Debit (CCP) to Account (CCP) Transfer Using Postal Checks offers customers an immediate, secure and easy-to-use service. Postal debit account holders can use postal checks at post office counters to make instant payments to recipients' postal debit accounts upon presentation of a duly served postal check and identification.
10. BARIDIWEB / BARIDIMOB
    - BARIDIWEB: The BARIDIWEB service enables Algerian postal customers to benefit from postal financial services through a web portal www.poste.dz that allows quick operations at any time (7/7 and 24/24).
    - BARIDIMOB: This is a mobile application that provides monetization and postal financial services for Algeria Post. Optimize your time and manage your CCP accounts and transactions anytime.
11. BARIDPAY mobile payment service: Barid Pay is a new user-friendly and highly secure mobile payment method based on two-dimensional barcode reading technology called QR Code (Quick Response Code).

- **Monetary services (EDAHABIA):** All EDAHABIA Card Services :
  - Order an EDAHABIA card.
  - Useful information about your EDAHABIA card.
  - Services offered by the EDAHABIA money card.

- CARDLESS: This new CARDLESS service allows Algerian Post customers, holders of the EDAHABIA electronic payment card, to make cash withdrawals in all ATMs across the national territory, without the use of the electronic payment card.
- Accelerated postal delivery service (Premium service): The "Premium Service" allows customers subscribing to this accelerated mode to receive high-quality, personalized benefit from the service.At your home within 5 business days maximum after confirming your order.

  The "Premium Service" is available to customers who apply for the "EDAHABIA" card for the first time and customers who wish to receive preferential treatment after card renewal.

1.2.4.2 Corporate Services

services for professionals and business as show in (Figure 1.5):

- Postal and monetary financial services.
- Postal services.
- Proximity services.
- Barid PAY mobile payment service.

Figure 1.5: Corporate services in Algeria post.

1.2.4.3 Online services

In addition to the above-mentioned services, the Algerian postal also provides online services (Figure 1.6) to reduce customers' availability in queues, namely:

- BaridiMob/Web.
- Pay your bills online.
- Order your EDAHABIA card.
- Selling stamps online.
- Selling books online.
- Open and/or view your CCP account.
- Download your prints.
- Pay for airline tickets or insurance.
- Track your shipment.
- Recharge your mobile line.
- Reload your Idoom account.

Figure 1.6: Online services provided by Algeria post.

1.2.4.4 Philatelic Services

Algeria Post issues stamps and other philatelic products, such as first-day covers and commemorative stamps. These products are popular among collectors and can be purchased at post offices throughout the country.

1.2.5 Protocols for services

Algeria Post provides various services to its customers, and each service has its own protocol.

1. **Postal services:** The postal services of Algeria Post follow the protocols of the Universal Postal Union (UPU). These protocols set the standards for international postal services, including mail and parcel delivery, money transfers, and other related services.

2. **Money transfer services:** Algeria Post provides money transfer services through a partnership with Western Union. The protocols that Western Union follows are designed to ensure safe and secure money transfers across borders.

3. **Electronic banking:** Algeria Post offers electronic banking services to its customers, including online payments, money transfers and bill payments. These services are managed by the Central Bank of Algeria, and the protocols are designed to ensure the safety and security of customer information and transactions.

4. **Savings and investment services:** Algeria Post offers a variety of savings and investment products to its customers, such as savings accounts, time deposits and investment funds. The protocols of these services are regulated by the Central Bank of Algeria and are designed to protect the interests of customers.

5. **Insurance services:** Algeria Post also provides insurance services to its customers, including life insurance and property insurance. The protocols for these services are designed to ensure that the customers are adequately covered and that their claims are processed promptly.

1.3 Queuing Management System

A queue management system that controls queues of people, either structured or unstructured queues. This type of system involves his one or more servers serving customers as they arrive. Customers waiting line sizes have two types of her: finite (limited size) or infinite (unlimited size) [8]. A customer just happened to come to the service center. A queue represents the number of customers waiting to be served and can be limited or unlimited. A financial institution is an example of an infinite row, and a parking lot is an example of a finite row [12].

1.3.1 Types of Queue

The following are the various types of queuing systems:

1.3.1.1 Structured

A structured queue is a type of queue where the elements that are added and removed from the queue follow a specific format or structure. For example, a structured queue used in a bank might include information like the name of the client, account number, and the transaction they want to perform.

This type of queue is commonly used in situations where there is a need to process multiple requests in a specific order, and where it is important to have consistent and uniform data about each request [20].

1.3.1.2 Unstructured

an unstructured queue is a type of queue where the elements that are added and removed from the queue do not follow a specific format or structure. For example, a queue of people waiting in line to buy tickets for a concert or a movie is an unstructured queue.

This type of queue is commonly used in situations where there is no need to capture specific data about each request, and where the main concern is simply to ensure that requests are processed in the order they are received [27].

1.3.1.3 Mobile, Virtual, and Online Queue

Customers won't have to wait around for too long and can go about their day as normal if you let them use their mobile devices to get real-time wait information and select a reason for visiting your service location. Customers are able to wait somewhere else as they wait for their turn. Real-time queue data statistics and customer input can also be included in mobile queues, especially those that are online. Qiwii is one example of a queuing system that may provide information about the queue in real-time along with a prediction of how long it will take to clear. Due to the abundance of queuing applications and the fact that not all companies use the same app, customers may wind up with hundreds of apps on their smartphones. [28].

1.3.2 Queue management for postal services

Queue management is an essential aspect of postal services, as it helps to ensure that customers receive efficient and effective services. With the increasing demand for postal services, the need for an effective queue management system has become increasingly important.

1.3.2.1 Current system

The current queue management system in postal services is a combination of manual and automated processes. Customers are required to fill in a ticket and wait in line for their turn to be served. The manual process involves a customer service representative calling out numbers or names, indicating who should be next in line for service. This process can be slow and time-consuming, particularly during peak hours.

1. Advance Queue System

   The system shown in (Figure 1.7) refers to an advance queue system. This system, based on (AQS) SAQS design, add additional service counters to make the queuing system process flexible [26]. And is more used in banks and companies that provide multiple services at the same time for several queues at different counters [29].

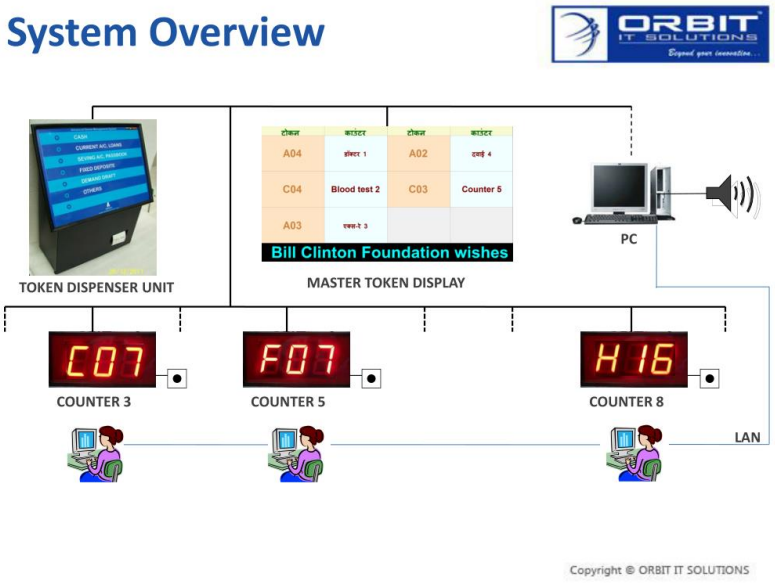


Figure 1.7: Advance Queue System.

system can accommodate many customers and apply a variety of services. Different customers coming for different purposes are recognized accordingly and called to the appropriate counter.

2. Tensator Delivers Queue Management System To The Post Office

would be used to help manage the queues of customers waiting to access postal services, such as sending or receiving mail and packages, buying stamps, or completing other transactions. The system can be used to provide customers with real-time information about their position in the queue and estimated wait times, as well as to streamline the process of serving customers and reduce waiting times [24].

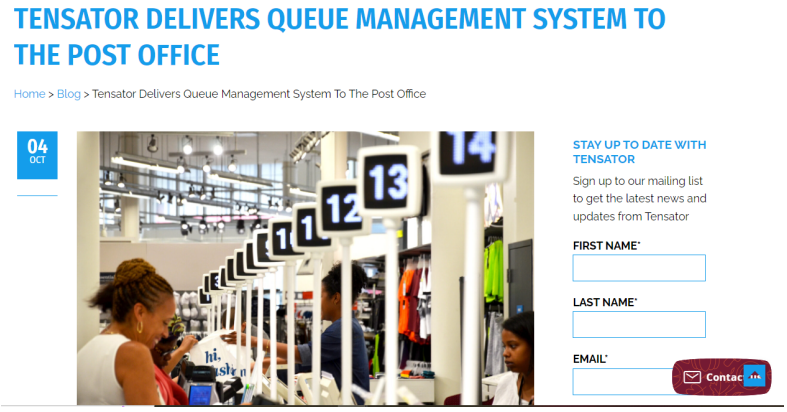


Figure 1.8: TENSTOR

1.3.3 Advantages of queue management system

A queue management system provides benefits to the customer service her provider or the customer itself [26], which benefits may be directly or indirectly related to the system. They are:

- Reduce waiting time and make them more tolerable.
- Track and forecast customer flow.
- Optimal use of headcount estimates [25].
- Constantly monitor staff performance [26].
- Enhance productivity and morale of the staff, as operations are efficient and systematic [27].
- Gives flexibility in dealing with customers [27].
- Increase service reliability, as customers are treated fairly and efficient.
- Producing statistical reports, which facilitate top Management's decision-making process.
- It eliminates the need for manual tracking of the queue and reduces the possibility of human error.
- It enables customers to monitor their position in the queue without having to ask a customer service representative.
- It improves the efficiency of the service center as customers are able to move through the center at a faster pace.

  Another aspect of current queue management systems is the use of online services. This reduces wait times and improves the overall customer experience. Customers can also use the online platform to track the status of their mail and parcels, eliminating the need to visit service centers in person.

1.3.4 Disadvantages of queue management system

- Technical issues: Queue management systems rely on technology, which can sometimes fail or experience technical difficulties. If the system goes down, it can cause delays and frustration for both customers and staff.
- Complexity: Some customers may find the queue management system confusing or difficult to use, which can lead to longer wait times and increased frustration.
- Cost: Queue management systems can be expensive to install and maintain, which may be a barrier for smaller post offices or those with limited budgets.
- Staffing issues: Queue management systems can sometimes result in a decrease in staffing levels, which can be detrimental to customer service if there are not enough employees available to handle customer inquiries or issues.
- Lack of personal touch: Some customers may prefer to interact with a human rather than a machine. If the queue management system is not properly designed or implemented, it may feel impersonal or unresponsive to customer needs.
- Inflexibility: Some queue management systems are inflexible and cannot easily be adjusted to accommodate changes in customer demand or staffing levels. This can lead to long wait times and decreased customer satisfaction.
- Maintenance requirements: Queue management systems require ongoing maintenance to ensure they are functioning properly, which can be time-consuming and expensive.
- Limited Customization Options: in queue management systems can hinder businesses with unique processes or specific service workflows. Pre-built systems may lack flexibility, leading to the need for workarounds and compromises that can impact the system's efficiency and effectiveness.

1.4 Related Work

Online queue management systems for postal services have become increasingly popular in recent years, as they provide customers with a more convenient and efficient way to access postal services without having to physically wait in a queue. These systems typically allow customers to reserve a spot in the queue remotely, either through a website or a mobile app, and receive updates on their estimated wait time.

Here are a few examples of online queue management systems used by postal services:

1.4.1 Walk-Away' Queue Management System

The first system that has been studied is called "The Walkaway Queue Management System" (The Walkaway QMS)(Figure 1.9).The system was based on MySQL as the central server, managing the customer's database and web application. Allows customers to take their queuing tickets anywhere [2]. And gives customers more flexibility in terms of waiting locations. Customers will receive notifications in the form of Telegram texts and SMS when tickets are validated [10].

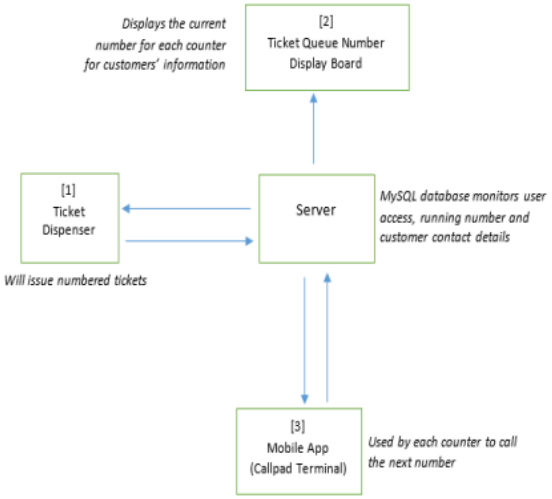


Figure 1.9: The Walk-Away QMS.

1.4.2 Qminder

Qminder (Figure 1.11) provides a cloud-based queue management system that allows postal services to streamline their customer service and reduce waiting times. Customers can join the queue remotely and receive real-time updates on their status through a mobile app [19].

Figure 1.10: Logo of Qminder

Figure 1.11: Qminder Application Mobile

1.4.3 Queue-it

Queue-it (Figure 1.12) is an e-queue management system that is designed to handle high-traffic events, such as online sales or ticket releases. Queue-it uses a virtual waiting room to manage traffic surges and prevent website crashes. Customers join a queue and are directed to the website once it is their turn to enter [9].

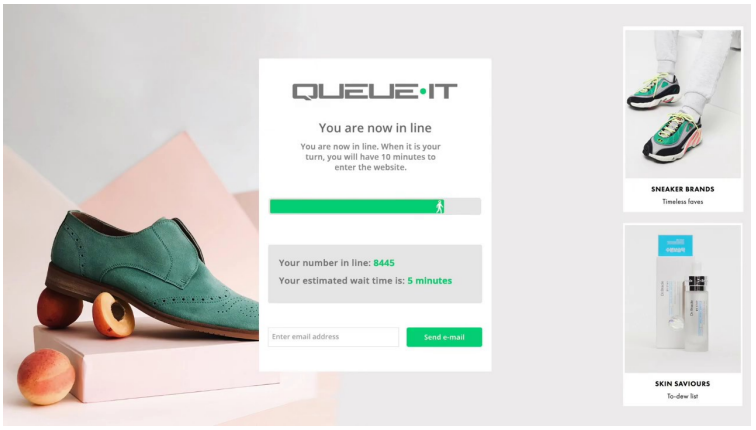


Figure 1.12: Queue-it website.

1.4.4 SimplyBook.me

Is an online booking and e-queue management system that allows customers to book appointments or join virtual queues through a mobile app or website. SimplyBook.me (Figure 1.13) also provides businesses with a range of tools to manage their bookings and queues, including appointment scheduling, customer management, and reporting [22].

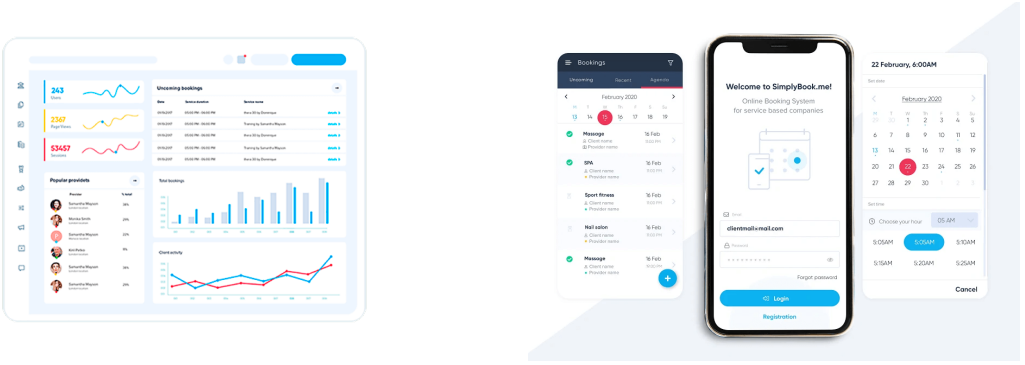


Figure 1.13: SimplyBook.me Application.

1.4.5 QLess

QLess (Figure 1.14) is a cloud-based queue management system that allows customers to join a virtual queue through a mobile app or website. Customers receive real-time updates on their place in line and estimated wait times. QLess also provides analytics and reporting tools for businesses to optimize their operations [18].

Figure 1.14: QLess app.

1.4.6 QueueForMe

This web application server (Figure 1.15) has two types of users: virtual queue creators and creator clients. This web application prompts the queue creator to enter a queue name and its description in order to start a virtual queue.

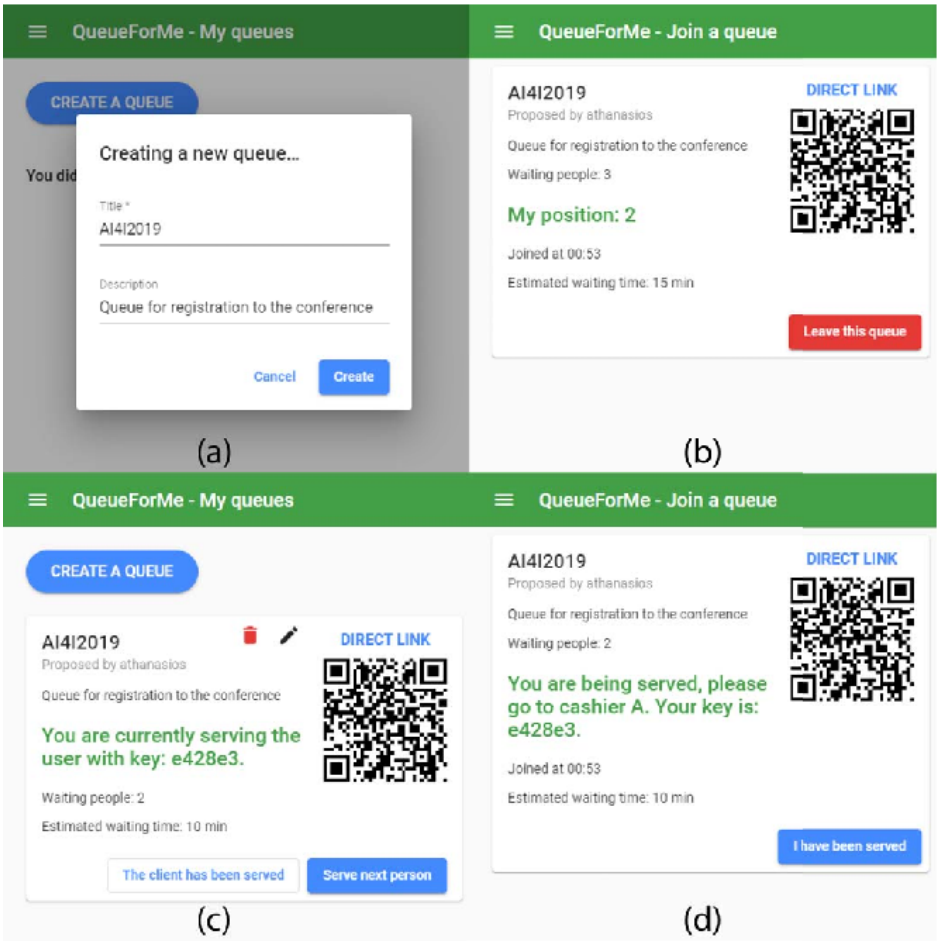


Figure 1.15: Queue for Me web application view.

Author clients, on the other hand, do not need to enter information credentials. Author clients can access queue information such as: B. Current queue position and estimated waiting time using previous queue data in neural network training. Authors can provide queues by requesting them. Apart from that, the system suggests options to customize wait times by defining a set of queue-specific parameters [14].

1.4.7 Comparisons

The functional comparison table that follows identifies the key distinctions between our application and popular internet remedies. The features utilized for comparison are:

- Updates: Real time update on queue length.
- Ticket: able to issue queuing ticket from wherever.
- Platform: Support all platform (Web-based, iOS, Android).
- Notification: Send notification as reminder.

Table 1.1 A comparison of existing applications.

Name	**Notification**	**Updates**	**Ticket**	**Platforms**
Walk-Away	Yes	Yes	Yes	Web-based
Qminder	Yes	Yes	Yes	All
Queue-it	No	Yes	No	Web-based
SimplyBook-me	Yes	Yes	Yes	All
Queue-For-Me	No	Yes	Yes	All
QLess	No	Yes	Yes	All
QMaster	Yes	Yes	Yes	All

1.5 Conclusion

The demand for Post-services is characterized by exceeding the optimal supply capacity for all customers to receive the required service, but its quality is not at the highest level, which troubles the contact person.

In the next chapter, we will introduce the research methods and data collection to investigate in this study so that we can start the development. Have a clear and detailed idea of the static and dynamic aspects of the solution.

Chapter 2

Proposed Online Queue Management System

2.1 Introduction

IN the previous chapter, we described some existing solutions applications and online applications.

In this chapter, we are going to go into further details, we are going to introduce our solution, and talk about more details, at the first section we are going to describe queue management system's architecture, and then we are going to introduce each component and include the needed diagrams.

2.2 Development Life Cycle

A system development life cycle (SDLC) is a standard business implementation used by system developers when developing system applications. It consists of specific phases of work beginning with system planning, requirements gathering, design, development, testing, and deployment. SDLC helps developers stay on track with policy development, helping developers reduce costs and speed up the system deployment process. In addition, we ensure that the development system is of the highest quality to meet user requirements. Expectations by processing all collected requirements.

The Systems Development Lifecycle (SDLC) is standard business Implementations used by system developers in systems under development application. It consists of specific phases of work beginning with system planning, requirements gathering, design, development, testing, and deployment. SDLC helps developers stay on track with policy development, helping developers reduce costs and speed up the system deployment process. In addition, we ensure that the development system is of the highest quality to meet user requirements. Expectation by processing all collected requirements.

2.3 General Conception

Our proposed queue management system application pertains to employees and users of postal services in order to help financial sectors run their businesses smoothly while abiding and to ease and save people time running their essential financial errand while staying as safe as possible.

2.3.1 System Architecture

Picture under (Figure 2.1) indicates the proposed system architecture for Q-master system application to visualize the flow of the system. This system has two structured flow, business owner's flow, and customer system application flow.

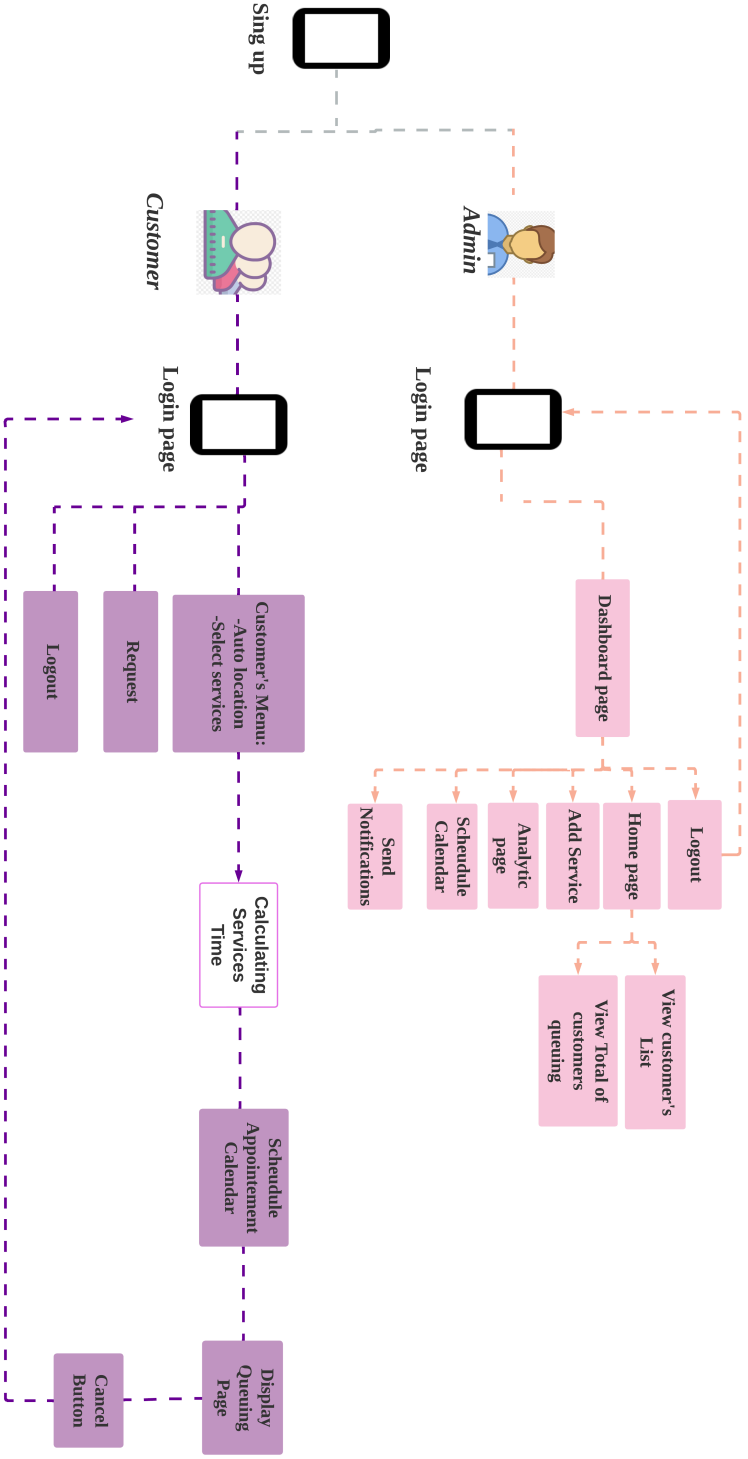


Figure 2.1: Queue-Master System Architecture

2.3.2 Users Module and System Functionalities

This system will have two different categories of users: administrators and customers. The list of use cases for each user module was depicted in the diagrams below. Wireframe and the Unified Modelling Language (UML) are used to illustrate the project's diagrams. Before moving on to building the user's interface, this project needs to design the use case diagram and the system structure.

2.3.2.1 Admin's Module

The user has the following sets of use cases in the admin module:

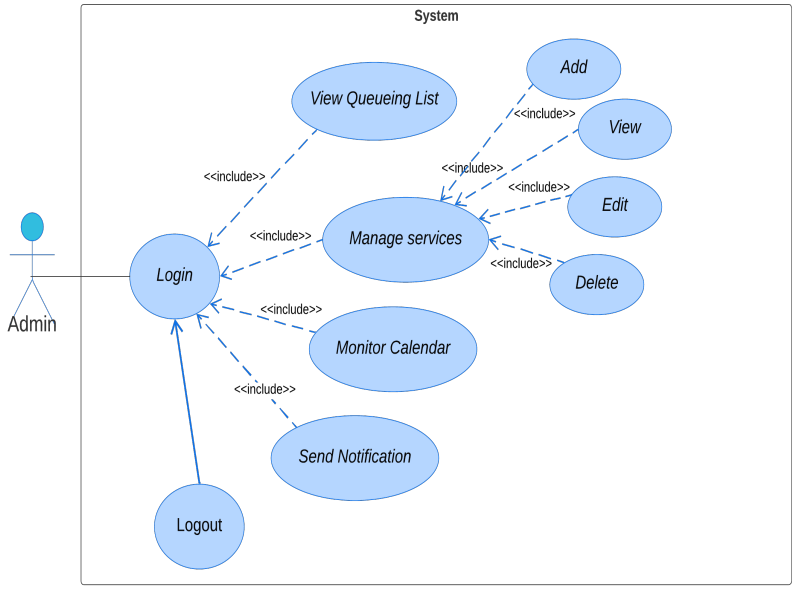


Figure 2.2: Use case diagram of the Admin (server).

2.3.2.2 Validate Sign in Authentication

This function is responsible for verifying the supervisor's identity.

Function: Admin Sign-in Validation()

begin

Input: Admin account credentials;

Output: Success or Failure message; ;

adminCredentials ← *RetrieveAdminCredentials*();

if *Admin account credentials are valid and match adminCredentials* **then**

LogInAdmin();

return *Success message*;

else

return *Access Denied message*;

end

end

2.3.2.3 Send notification to user

This function enables the administrator to notify users of anything.

Function: SendNotificationToUser($user, message$)

begin

$notification$ ← CreateNotification($user, message$);

SaveNotification($notification$);

$token$ ← GetUserToken($user$);

SendPushNotification($token, message$);

end

2.3.2.4 Add new service

With the help of this function, the administrator can add new services, which will automatically be added to the list of users.

Function: Add New Service()

begin

AddNewService($serviceName, serviceDuration, serviceImage$);

$service \leftarrow$ CreateService($serviceName, serviceDuration, serviceImage$);

SaveNewService($service$);

end

2.3.2.5 Customer's Module

The user in the customer's module has access to the following groups of use cases:

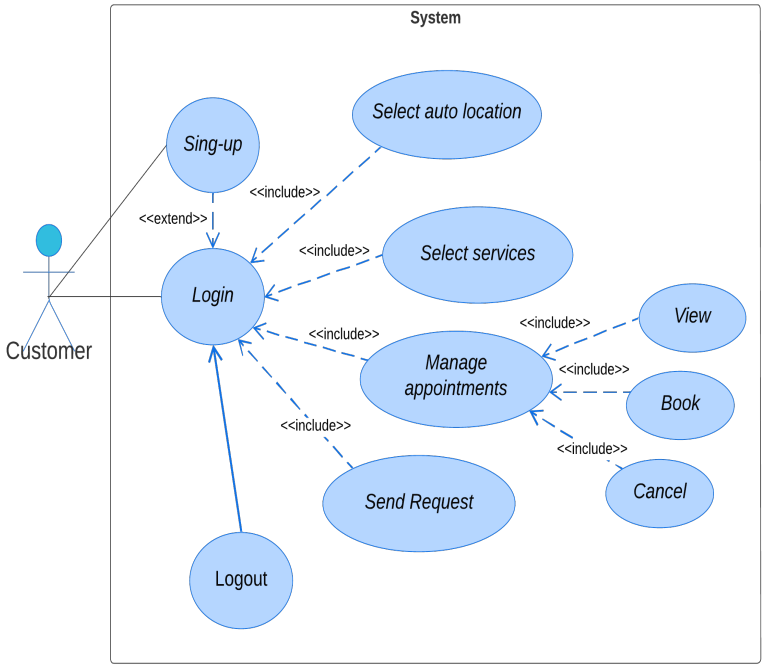


Figure 2.3: Use case diagram of Customer.

2.3.2.6 Activity Diagram

The activity diagram below (Figure 2.4) shows the flow of activities of a standard user who wants to book an appointment through to providing feedback after atten-

dance.

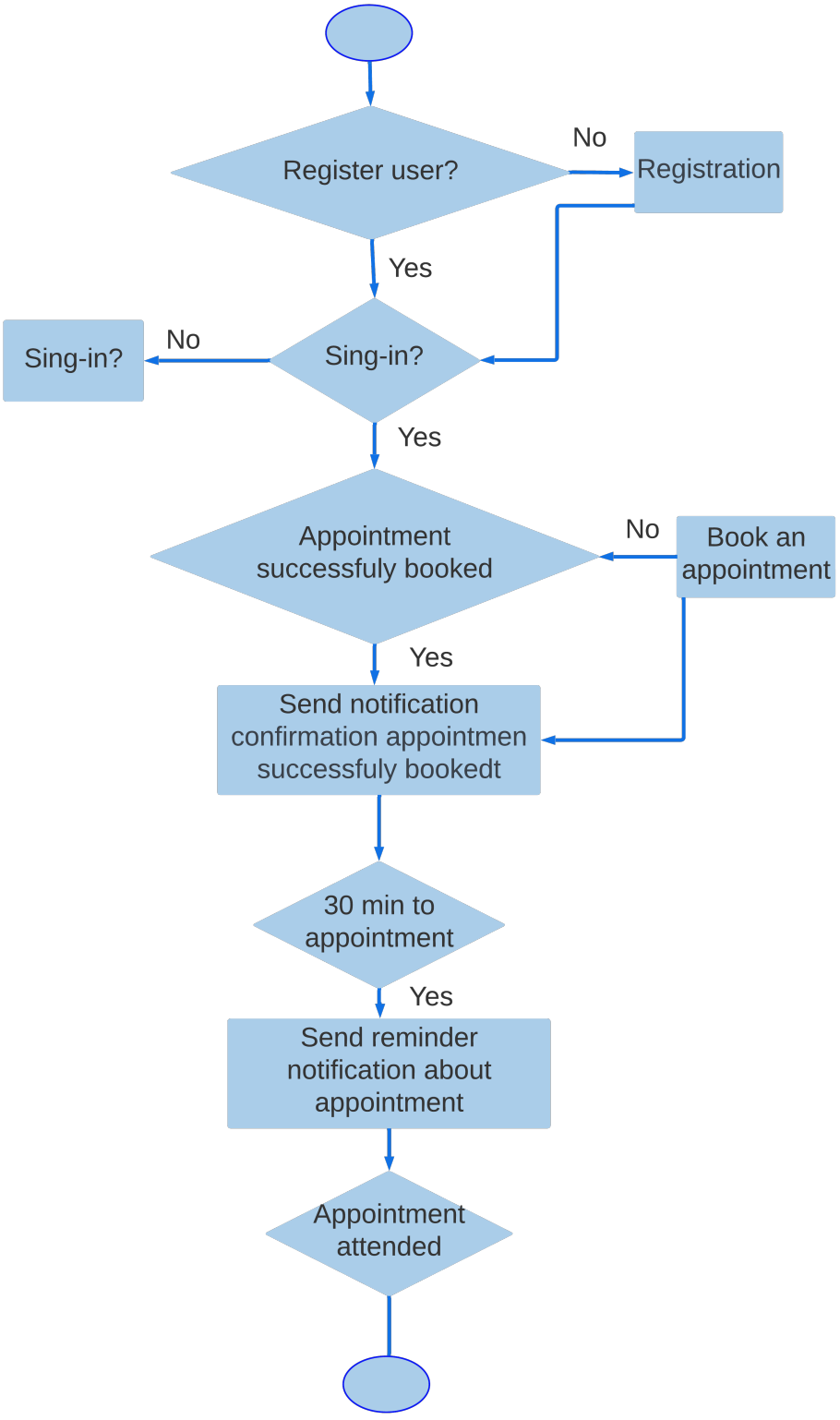


Figure 2.4: Activity diagram of Customer.

2.3.2.7 Validate Sign in Authentication

In accordance with this use case, the user will only be allowed to access the Customer's Module after completing authentication.

Function: Validate Sign-in Authentication

```
begin
    SignInValidation( );
    userAccount ← get user account information;
    if userAccount is registered under Customer category then
        login ← authenticate user sign-in;
        if login is successful then
            return user is logged in to the system:
        else
            errorMessage ← "Access denied";
            return errorMessage;
        end
    else
        errorMessage ← "User account not registered under Customer category";
        return errorMessage;
    end
end
```

2.3.2.8 Cancel Appointment

This function allows the customer to cancel an appointment.

Function: CancelAppointment(appointmentId)

```
begin
    appointment ← GetAppointmentById(appointmentId);
    DeleteAppointment(appointment);
end
```

2.3.2.9 Send Request Function

The algorithm first looks through every user to identify potential recipients who have appointments scheduled and a service time that is equal to or greater than the requestor's total. If the first receiver rejects the request, the program will start looking for another one.And if anyone accepted, the request will delete the acceptor's credentials and replace it with the requestor's credentials

Function: sendRequest(appointmentTime)

begin
- **Input:** User's appointment time T_{user}, List of other users' appointments L_{other};
- **Output:** New list of other users' appointments L'_{other}, Appointment replaced flag $flag$;
- $flag \leftarrow False$;
- **for** *each appointment time* T_{other} *in* L_{other} **do**
  - **if** $T_{other} \geq T_{user}$ **then**
    - Send request to the other user;
    - Wait for response;
    - **if** *Response is positive* **then**
      - Remove T_{other} from L_{other};
      - Add T_{user} to L'_{other};
      - $flag \leftarrow True$;
      - break;
    - **else**
  - **else**
- **end**
- **if** $flag = False$ **then**
  - Notify the user that no appointment is available;
- **else**

end

2.3.2.10 Book Appointment

This function allows the customer to book a new appointment.

Function: Book Appointment( )

begin

user ← *GetUserInputs*()

if *IsValid(user)* **then**

services ← GetServices( );

selectedServices ← SelectServices(*services*);

totalDuration ← CalculateDuration(*selectedServices*);

availableSlots ← GetAvailableSlots(*totalDuration*);

selectedSlot ← SelectSlot(*availableSlots*);

appointment ← CreateAppointment(*user*, *selectedServices*, *selectedSlot*);

ConfirmAppointment(*appointment*);

else

DisplayErrorMessage( );

end

end

2.3.2.11 Class Diagram

There are 6 classes in the conceptual class diagram of the system shown in (Figure 2.5) They are as follows:

- User Class (Customer):Represents a customer who uses the system to book appointments.
- Admin Class: Represents an admin who manages the system.
- Service Class: Represents a service that a customer can book.
- Notification Class: Represents a notification that is sent to a customer to inform them about an upcoming appointment.
- Appointment Class: Represent the date and the time that user was booked.
- Post Class: Represent where the customer want to book an appointment.

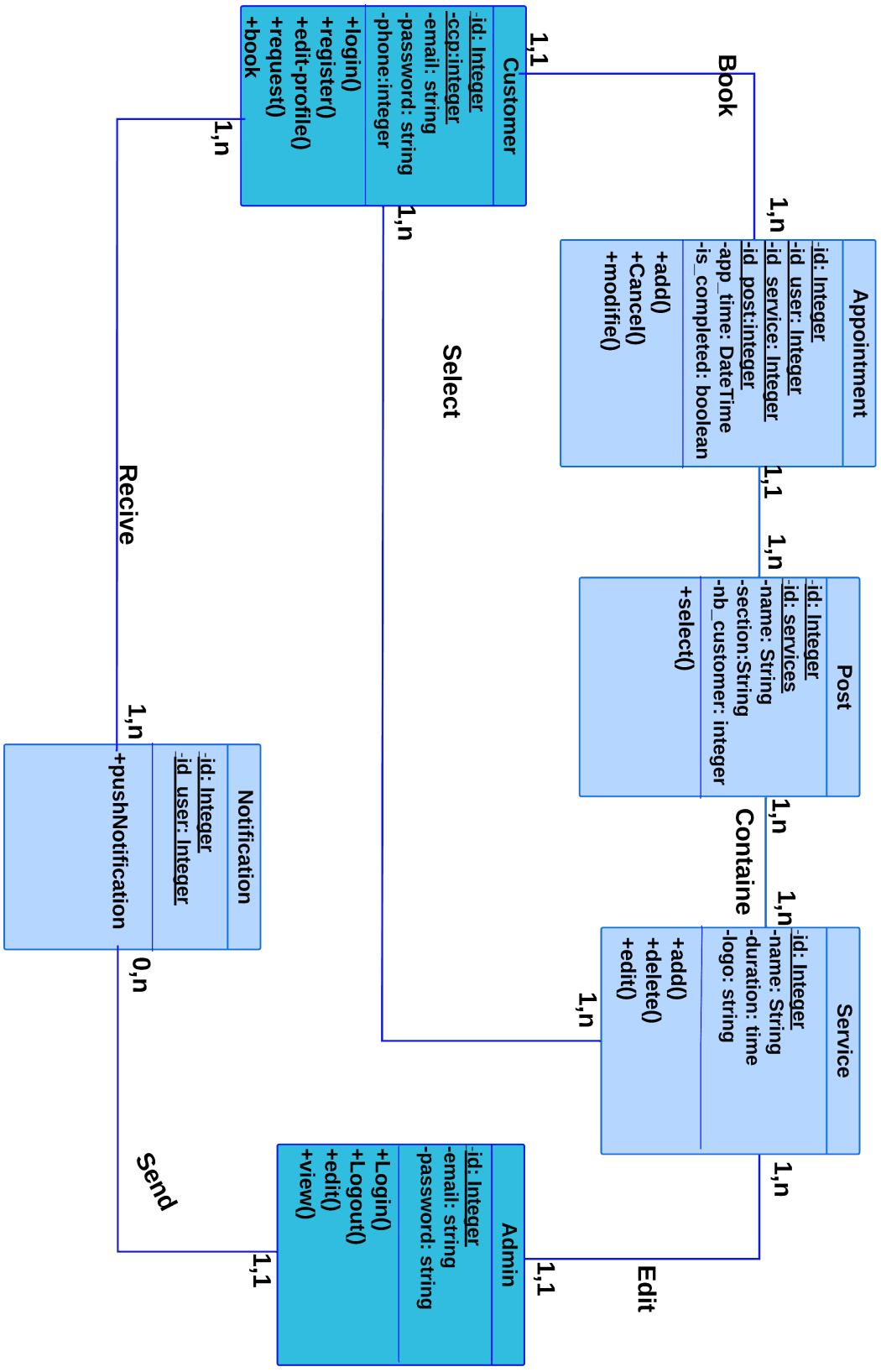


Figure 2.5: Conceptual Class diagram of the system.

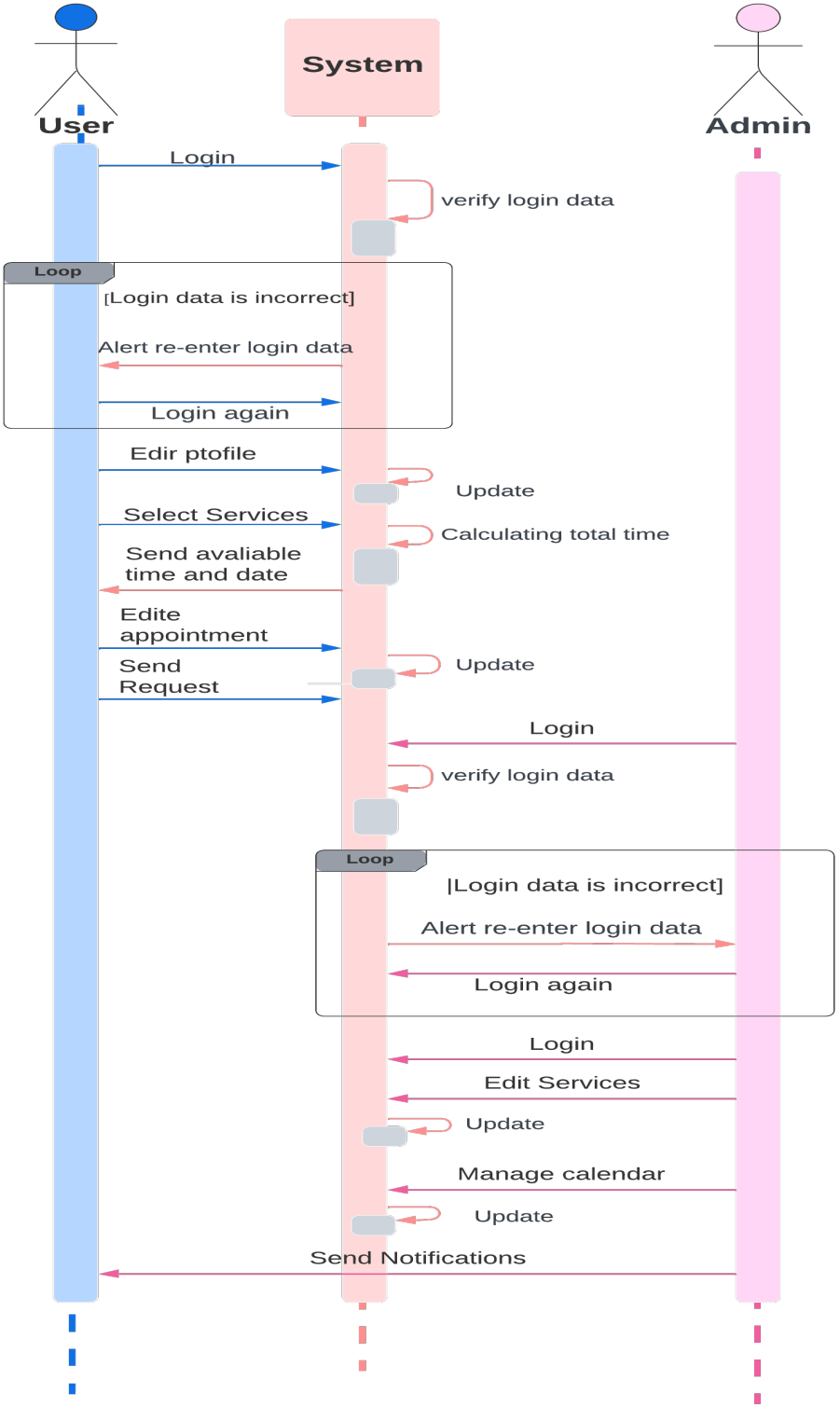


Figure 2.6: Sequence diagram of the system.

2.4 Conclusion

On this chapter we presented our solution, and we described it in distinctive, in form of various ways. In the beginning we introduce our trendy architecture that display the actors of our system, then we described an in depth structure, we delivered every factor and how it works, and we introduced a few used algorithms.

The implementation and testing of our system will be displayed in the last chapter.

Chapter 3

Implementation and Results

3.1 Introduction

IN this chapter, we will concentrate on the project's implementation and practical aspects after presenting the architecture of the online queue management system for postal services in the previous chapter and outlining its core idea.

We begin the chapter by outlining the hardware and software tools that were employed in the project. subsequently, we present the results in the form of screenshots and images.

3.2 Implementation

We are going to describe the hardware and software we used in our system.

3.2.1 Hardwares Description

We utilized an HP brand Pro Book with the following features to create our solution:

- Processor:Intel(R) Core(TM) i5-4210U CPU @ 1.70GHz.
- RAM: 4,00 GB.
- System-Type:64-bit operating system (Windows 10Pro),x64-based Pc.
- System-Model: HP ProBook 430 G2.

And The Xiaomi Note 10 phone with the following characteristics:

- Processor: Octa-core Max 2.20GHz.
- Storage and RAM: 4.0 GB.
- System: Android 12.0, with MIUI 14.0.2 user interface.
- Model: M2101K7AG.

3.2.2 Software Tools Description

The following programming languages have been employed in our project to meet the goal of creating a web-based queuing system:

3.2.2.1 Visual Studio Code

Since Visual Studio Code (Figure 3.1) is a potent source code editor and a breeze to use, it is utilized to create the HTML code for the Q-Master's user interfaces. This eliminates the need for constant debugging of the code.

Figure 3.1: Visual Studio Code logo.

3.2.2.2 Laravel

Laravel (Figure 3.2) is a robust, open-source PHP framework that uses the model-view-controller design pattern to create web applications that are more structured and practical [15]. Laravel offers a rich set of functionalities that incorporates the fundamental elements of PHP frameworks like CodeIgniter and Yii as well as other programming languages like Rub [6].

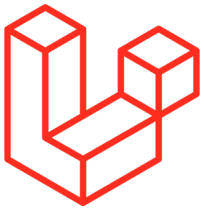


Figure 3.2: Laravel Logo

3.2.2.3 Flutter

In May 2017, Google unveiled Flutter, a free and open-source mobile UI framework (Figure 3.3). It enables the development of native mobile applications using just one codebase, to put it briefly. This indicates that the developer may produce two distinct apps (for iOS and Android) using a single codebase and programming language [17]. Two crucial components make up Flutter:

- An SDK (Software Development Kit): A group of instruments that are useful for creating apps. Tools for compiling code into native machine code (for iOS and Android) are also included.
- A Framework (UI Library based on widgets):A set of reusable UI components that anybody may customize for their own purposes, such as buttons, text inputs, sliders, and other features.

Figure 3.3: Flutter Logo

3.2.2.4 LDPlayer

LDPlayer (Figure 3.4) is a free Android emulator for Windows PCs. With it, you can change your PC into an Android stage and step up your involvement in highlights like smart key mapping, expanded FPS, large scale help, and multi-cases. Contrasted with different emulators like BlueStacks and NOX, LDPlayer performs discernibly better, taking up less assets and giving you more limited stacking times [16]. In this experiment, an Android emulator called LD player is utilized in place of actual Android hardware. The Samsung SM-N960N model of the simulated device and its IMEI were allocated to this emulator, which had just two cores [23].

Figure 3.4: LDPlayer Logo

3.2.2.5 XAMPP

The acronym XAMPP (Figure 3.5) is made up of the letters X for Cross-Platform, A for Apache, M for MySQL, and PS for PHP and Perl, respectively. It is a collection of open-source web solutions that includes the Apache server distribution for several servers and command-line tools.

include Apache server, MariaDB, PHP, and Perl modules. Before publishing a website to the primary server, XAMPP enables a local host or server to test its website and clients via desktop and laptop PCs. It is a platform that offers an appropriate setting for testing and confirming the operation of projects based on Apache, Perl, MySQL, and PHP through the host's system [7].

Figure 3.5: Xampp Logo

The Figure 3.6 below summarize all the needed software:

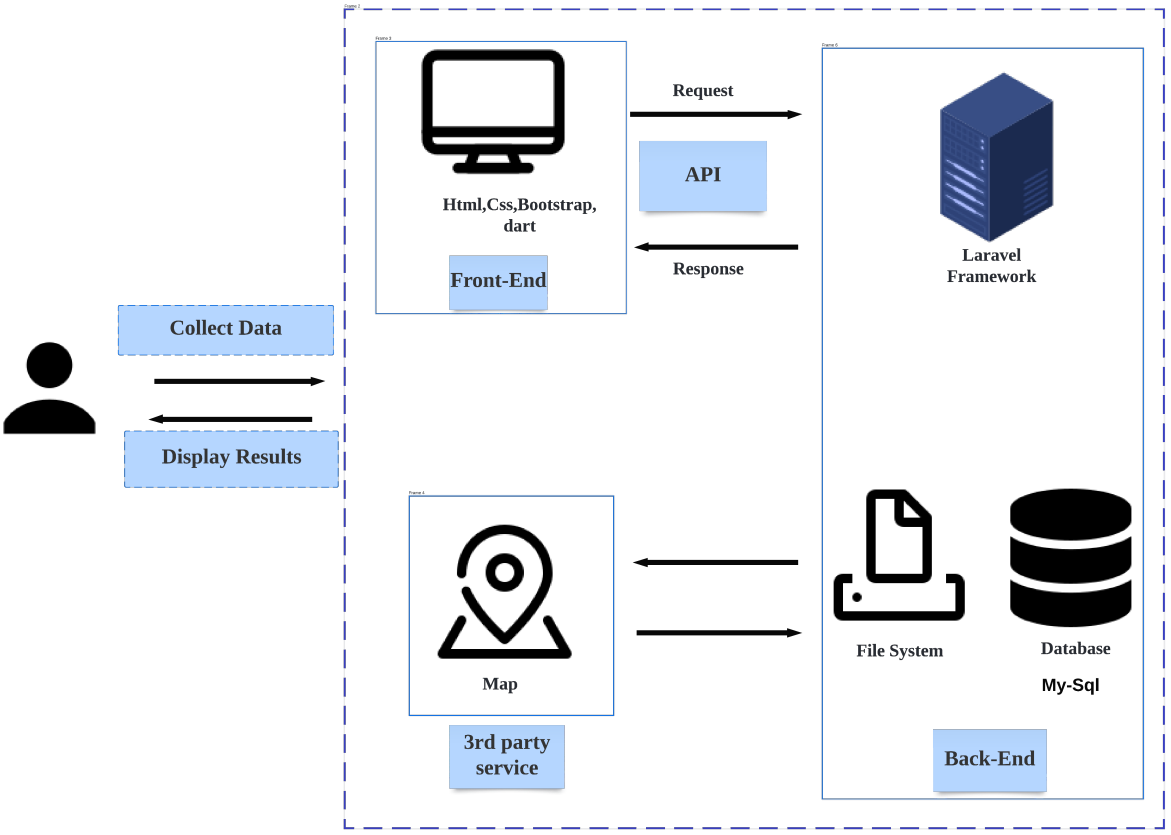


Figure 3.6: Web Application Architecture

3.3 Results

In this section, we are going to present the implementation of our system in form of screenshots.

3.3.1 Logo

The accompanying picture (Figure 3.7) shows our application's logo. Our program is called Q-master, the letters Q stand for the word "queue," and the cart and circuit in the logo stand for electronic payment and settings (administration), respectively. The blue and yellow colors are referring to the Algeria Post's logo color. The logotype is online queue management for post.

Figure 3.7: Q-Master Logo.

3.3.2 Admin's Dashboard

In administrative dashboards have many interfaces, we will display them in the next subsection:

3.3.2.1 Login Page

The login page is the initial page that appears when our server first starts up (Figure 3.8):

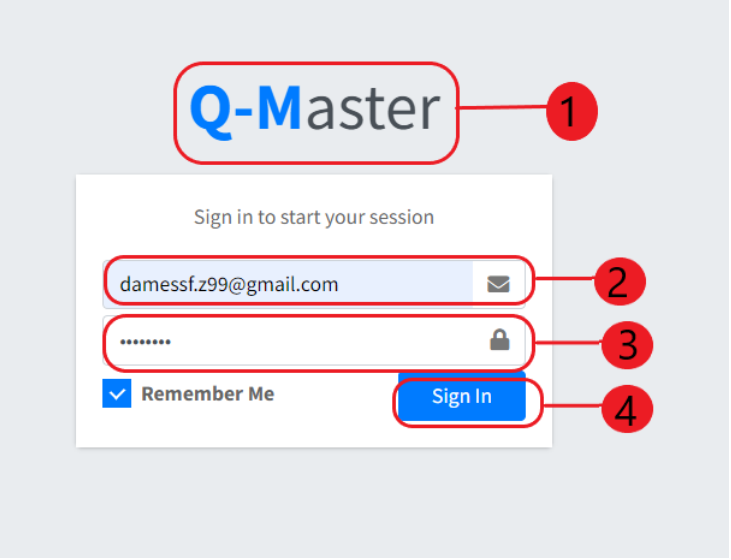


Figure 3.8: Login Interface

1. On the top of the login card, we can see the website's "Q-Master" logo.
2. Is an input for the admin's email.
3. Is an input for the admin's password.
4. logging-in button for the system.

3.3.2.2 Website architecture

The website's front end is divided into three sections:

1. A hamburger menu button to slide the sidebar in or out, a Home link to go back to the home page, a Search button, a Notification dropdown menu, a Full Screen button, a Language Dropdown menu, and a User Dropdown menu are all included in the navigation bar (Header) at the top of the page.
2. The navigational connections to the other pages of the website (Services, Customers, Calendar, etc...) are located below the search field in the sidebar on the left side of the page.
3. Middle of the page: the main material.

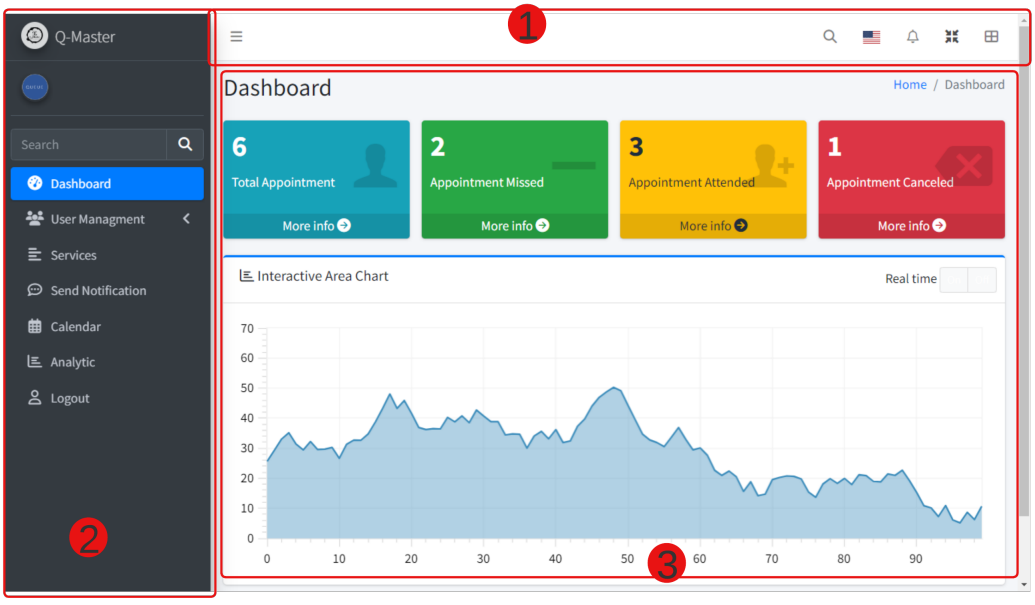


Figure 3.9: Dashboard View.

3.3.2.3 Services Page

Three parts make up the Services section: List Services, Add New Service, and Edit Service.

1. List of Services: This page displays a list of all the services with their information (Figure 3.10)

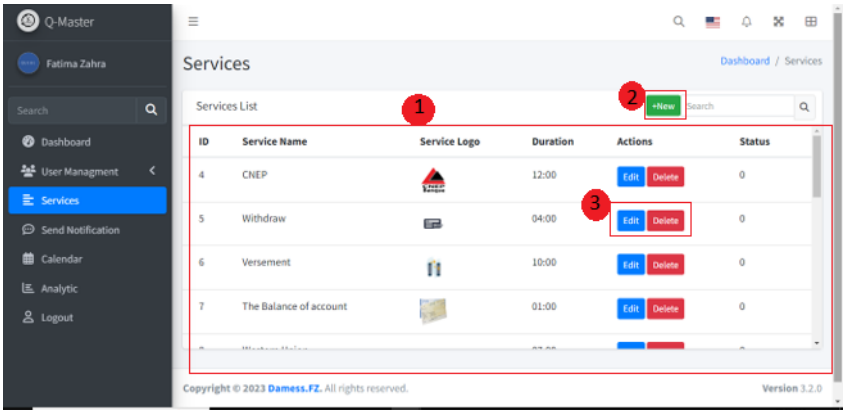


Figure 3.10: Services List

2. Add Service (Figure 3.11):From the previous page, admin can add new service by click on the button New to get the formulary of a service.

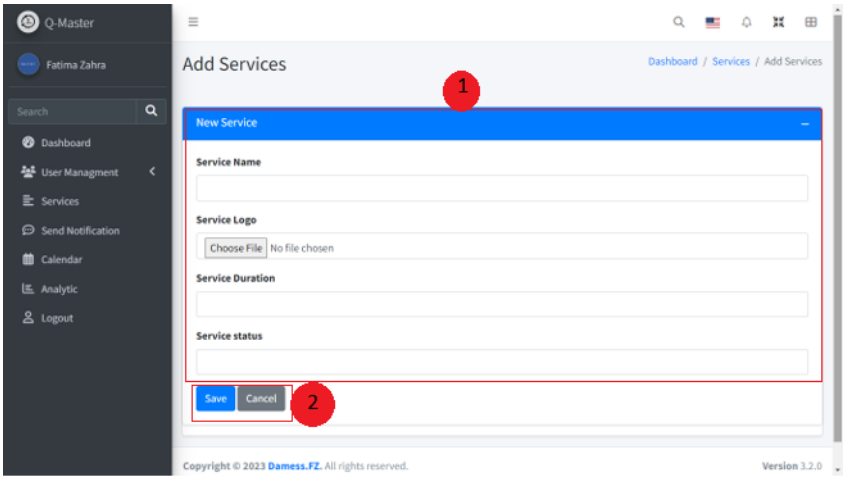


Figure 3.11: Add new Service

3. Edit Service: Also, the admin can edit a service by clicking on the button edit show in the List service Page.

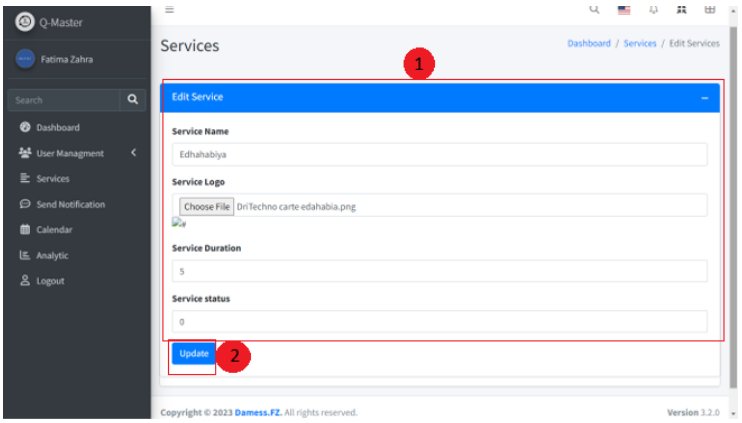


Figure 3.12: Edit Service

-And can delete a service by Delete button.

3.3.2.4 Calendar Page

The calendar shows all of the appointments at their precise times. By clicking on it, the administrator has the option to edit. Also, the calendar have many views (month, week, day).

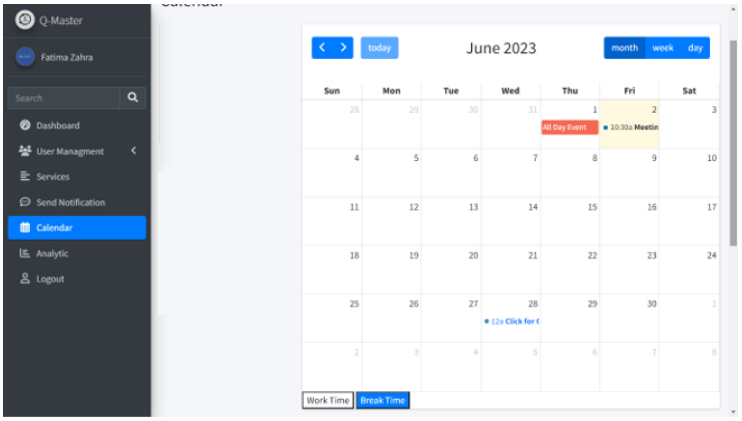


Figure 3.13: Schedule view

The figure below show how can admin manage Work Time of the week.

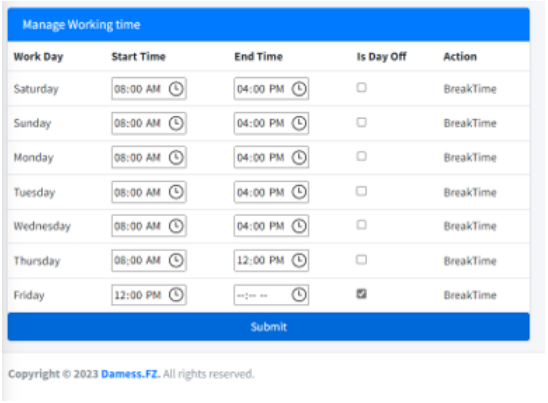


Figure 3.14: Work Time Setting

3.3.2.5 Notification

The admin can send notification to customer (Figure 3.15).

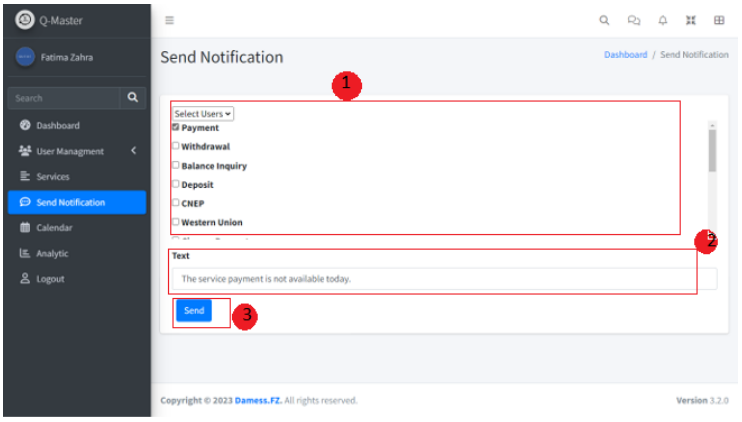


Figure 3.15: Notification Page

1. To designate the receptor in the queue, the administrator must choose the services that the clients chose.

2. Write notification text.

3. Send button to push notification to customers.

3.3.2.6 Analytic Page

The admin may view the number of users who use the app throughout the course of the year on this page as being in (Figure 3.16).

Figure 3.16: User Management Page

3.3.2.7 User Managment Page

On this page, the manager can see all users with their property information, who have taken appointments.

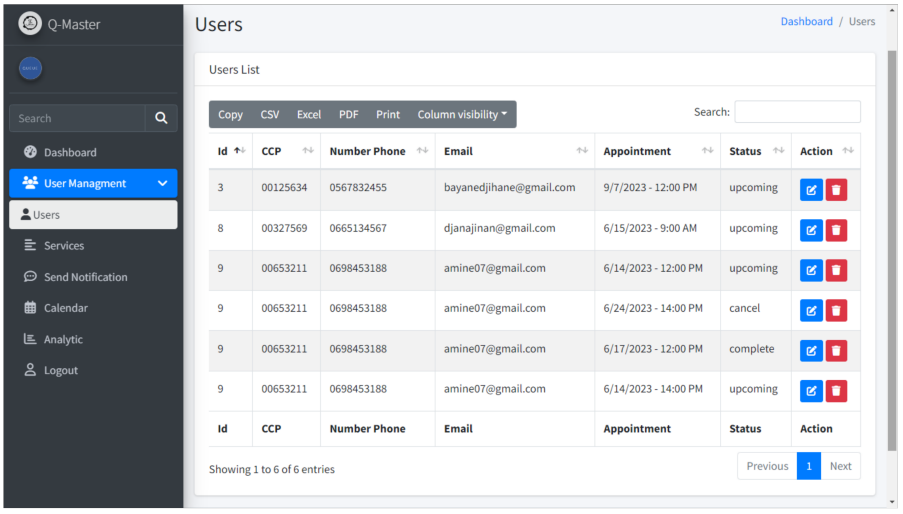


Figure 3.17: Analytic Page

3.3.3 Mobile Application Interfaces

3.3.3.1 Welcome Interface

When the customer starts the application, will see the welcome page, which contains the application logo and two options login or sign-up as shown in (Figure 3.18).

3.3.3.2 Home Interface

The home page come after the customer login to his account successfully (Figure 3.19).

Figure 3.18: Welcome Page.

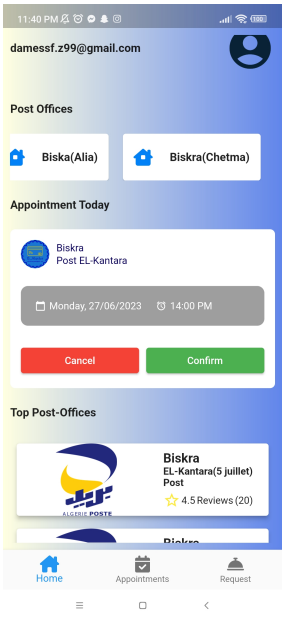


Figure 3.19: Home Page.

3.3.3.3 Login Interface

The user must enter his personal account's CCP and password (in the relevant field) in order to use the Q-Master application (Figure 3.20).

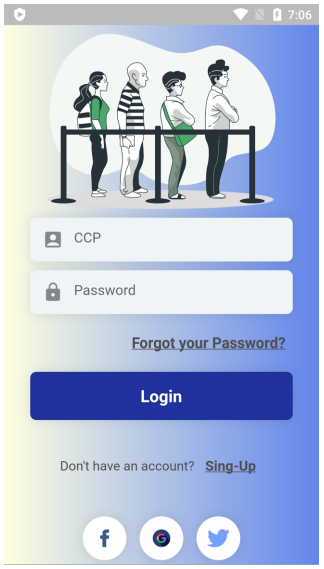


Figure 3.20: Login Interface

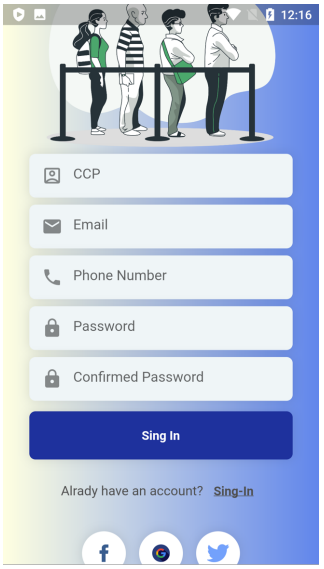


Figure 3.21: Registration Interface

3.3.3.4 Registration Interface

The customer using the app must first have an account, and this is the information needed to create an account.

3.3.3.5 Reset Password Interface

If the customer forgets their password, they can recover their password using this interface (Figure 3.22).

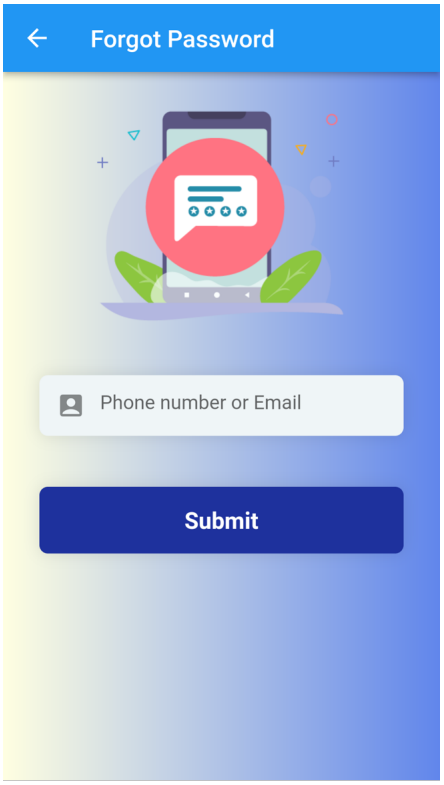


Figure 3.22: Reset Password Interface

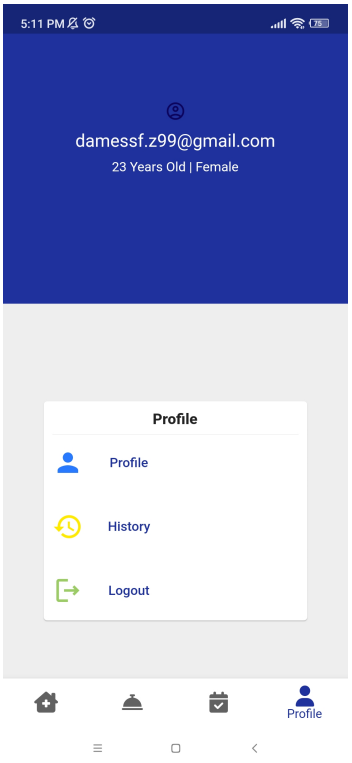


Figure 3.23: Profile Interface

3.3.3.6 Profile Interface

After success login of the customer, he accesses to him account profile (Figure 3.23).

3.3.3.7 Select Post-office Interface

The customer has the option of choosing which post office to go to by select one from the list of post-offices in the home page (Figure 3.19). After he select one will redirect to the post detail (Figure 3.25).

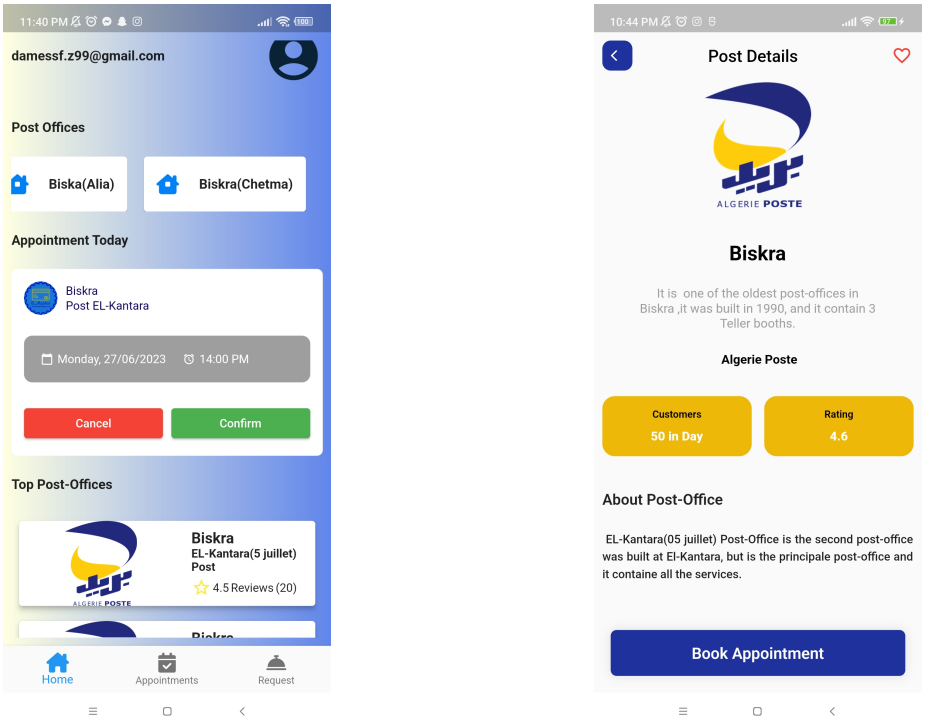


Figure 3.24: Select Post-office interfaces.

3.3.3.8 Select Services Interface

In addition, customers have to choose the services (Figure 3.25) they require and then calculate the total time of their choices using these windows.

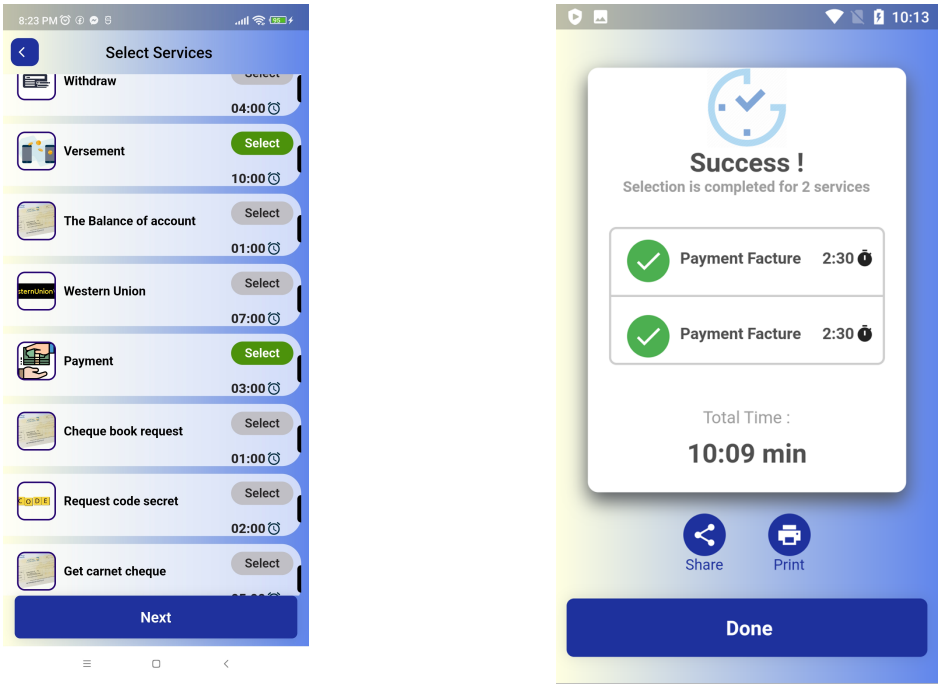


Figure 3.25: Select Services interfaces.

3.3.3.9 Appointment Schedule

The Customer can see the list of the canceled, upcoming or completed appointments (Figure 3.26).

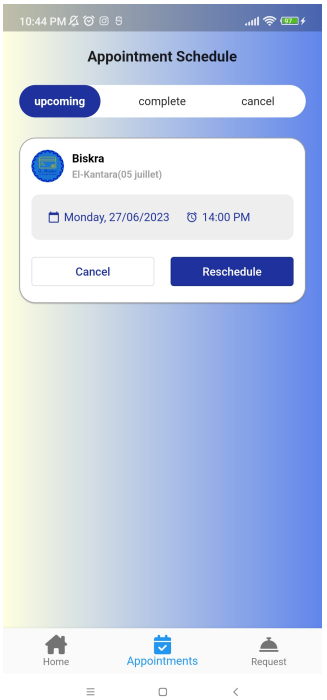


Figure 3.26: List Appointment

3.3.3.10 Appointment Interfaces

Customers may select the day and the time they require and than click on button make appointment will redirect to success appointment page as shown in (Figure 3.27) below.

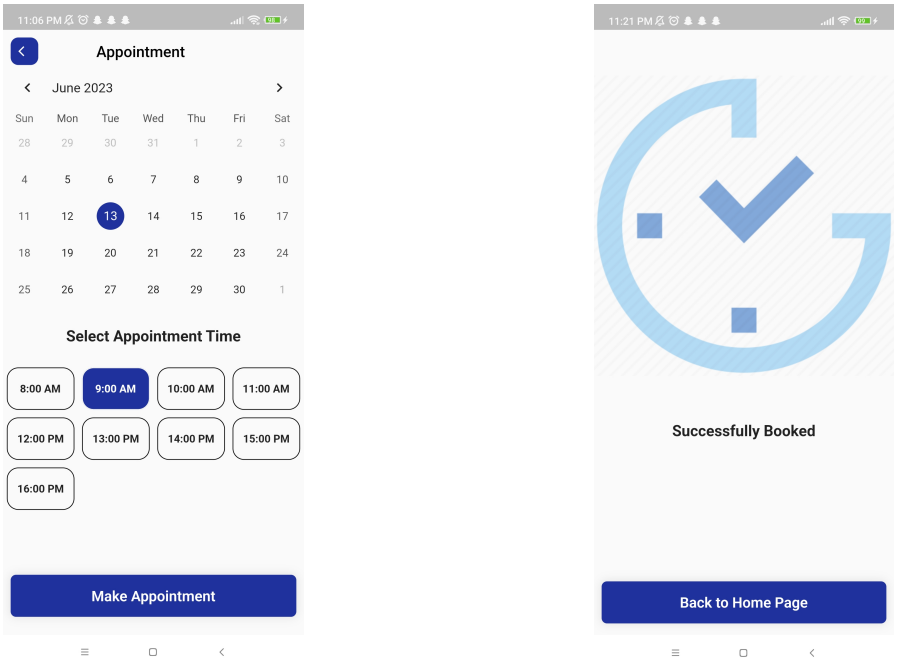


Figure 3.27: Appointment interfaces.

3.4 Discussion

Prospective users are presented and given a demonstrations of the Q-master mobile application during the system testing process. both are being captured.

We used the following features to compare our system (Q-Master) and the current system (QMS):

- Ticket: Average time to generate paper/digital ticket.
- Queue Number: Average time before queue number approaches.
- Waiting: Average waiting time spend at waiting area.
- Total: Total time spend waiting for queue.
- Time saved: Total time saved while in queue.

Table 3.1 QMS vs Q-Master

	QMS (Ticket machine)	Q-Master
Ticket	3 s	1.7 s
Queue Number	600 s	0 s
Waiting	1200 s	0 s
Total	1203 s	1.7 s
Time saved	0 s	15 min

The amount of time customers must wait in the waiting area before their queue number approaches is being studied during simulation testing for the Q-Master system, and the average wait times for both the present queue management system and Q-Master are being kept track of. As seen in (Table 3.1) above, the existing queue management system generates paper tickets at the number station on average in 3 seconds, whereas the Q-Master system does so on average in just 1.7 seconds. Create the digital ticket (appointment) on the screen as a form of day and time. Both systems are timed to determine the typical interval before calling a customer's queue number. Regarding the average wait time before calling a customer's queue number, current systems were timed at 600 seconds, or 10 minutes, whereas the Q-Master system does so on average in just 0 seconds, because the customer will be never go to the post and waiting. Since the Q-Master project's improvements have impact on how long customers wait at the counter, the time logged by both systems is comparable. Customers currently wait 1200 seconds on average in the waiting area with the current QMS, compared to 0 seconds on average for Q-Master.

3.5 Conclusion

In this chapter, we discussed how our solution was put into practice. We began by outlining the software and hardware that were utilized, followed by a page-by-page breakdown of the management dashboard, and finally, the introduction of the user mobile application.

General Conclusion

OUR dissertation focuses on creating a cutting-edge online queue management system that is specially designed for postal services. We successfully built and deployed a sophisticated mobile application that enables users to simply purchase tickets remotely after doing in-depth research and analysis. Furthermore, we created a thorough web-based management platform that acts as the central server at the post office and efficiently handles services while minimizing wait times.

Overall, our dissertation exemplifies how a postal service online queue management system may be revolutionary. This study makes a significant contribution to the expanding topic of digital transformation in the service sector and offers useful information for businesses looking to enhance client experiences while increasing operational effectiveness.

Future work

As prospects for our work, we propose to improve it by future work in order to obtain more efficient analysis. These future works are as follows:

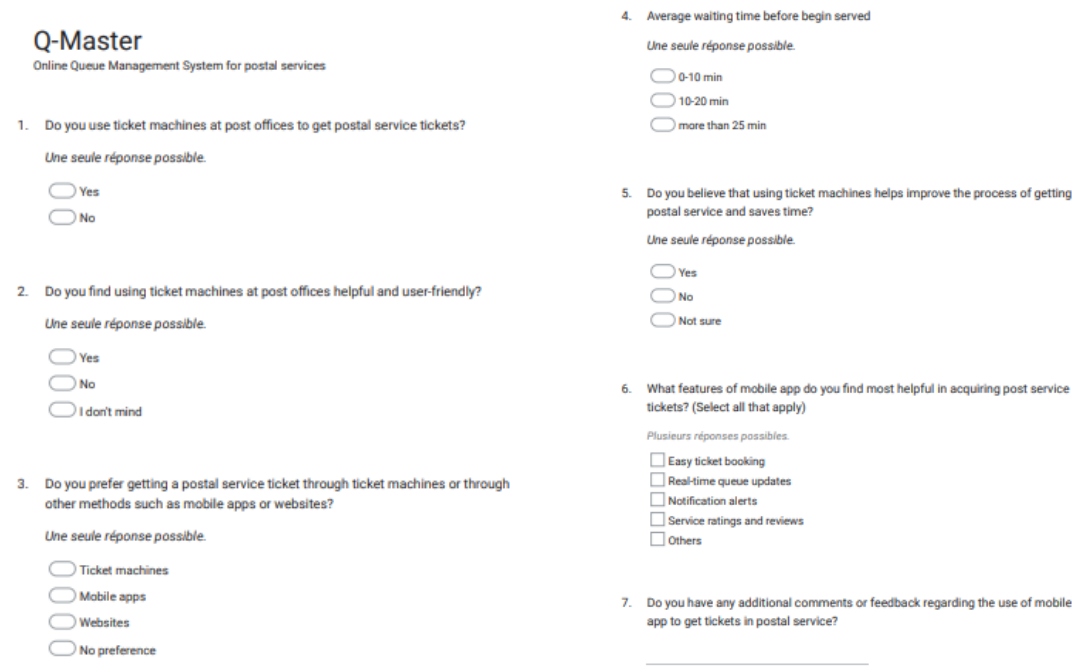
1. Implement Send Request function.
2. For automated customer management, add a QR code to the application.
3. Towards our system to startup opportunity.

Appendix A

Annex

Anyone who has ever made anything of importance was disciplined.
Andrew Hendrixson.
Creativity is intelligence having fun.
Albert Einstein
Sometimes you win, sometimes you learn.
John Maxwell.

To gather views and opinions from the general public about the need for an online queue management system (Q-Master) at the post office, questionnaires are distributed. To get this information, the questionnaire (Figure A.1) is being handed out in the EL-KANTARA post office and is being completed online by customers who have previously visited the post office in order to collect this data.From the questionnaire being distributed, the author is able to get 30 respondents to help out in answering the questions. Since it solely pertains to the post office service in Algeria, there is no age restriction on who may respond to this questionnaire, which is exclusively available to Algerians.



Q-Master

Online Queue Management System for postal services

1. Do you use ticket machines at post offices to get postal service tickets?

Une seule réponse possible.

- Yes
- No

2. Do you find using ticket machines at post offices helpful and user-friendly?

Une seule réponse possible.

- Yes
- No
- I don't mind

3. Do you prefer getting a postal service ticket through ticket machines or through other methods such as mobile apps or websites?

Une seule réponse possible.

- Ticket machines
- Mobile apps
- Websites
- No preference

4. Average waiting time before begin served

Une seule réponse possible.

- 0-10 min
- 10-20 min
- more than 25 min

5. Do you believe that using ticket machines helps improve the process of getting postal service and saves time?

Une seule réponse possible.

- Yes
- No
- Not sure

6. What features of mobile app do you find most helpful in acquiring post service tickets? (Select all that apply)

Plusieurs réponses possibles.

- Easy ticket booking
- Real-time queue updates
- Notification alerts
- Service ratings and reviews
- Others

7. Do you have any additional comments or feedback regarding the use of mobile app to get tickets in postal service?

Figure A.1: The Questionnaire Form.

The major goals of the questionnaire being circulated are to understand the existing state of the queue management system at the post office and to learn what consumers think of the concept of Q-Master. The questionnaire has seven questions, however only five of the most important ones are highlighted in this material.

The statistics below show the findings of the questionnaire in chronological order.

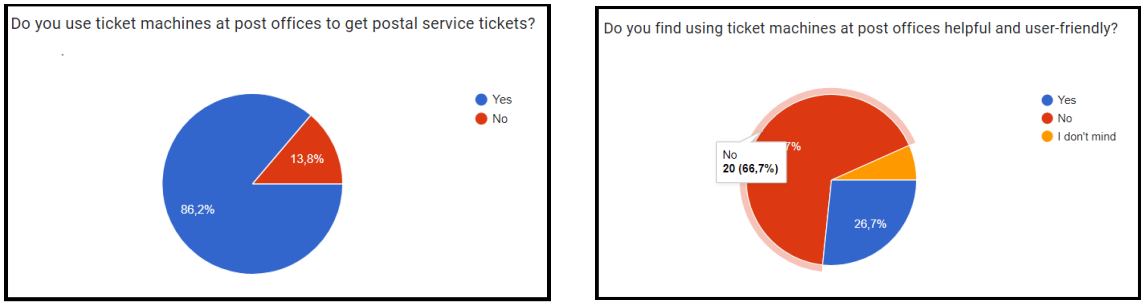
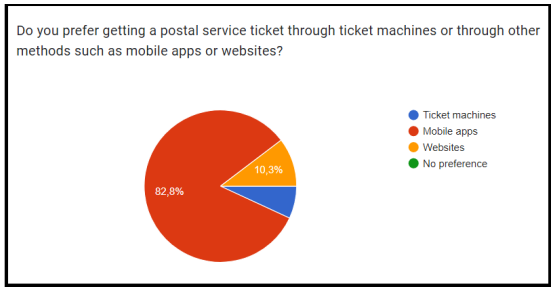


Figure A.2: Pie chart showing results of the 1st and 2nd questions

In the second question, find that most of them that using the ticket machines say that is not helpful.



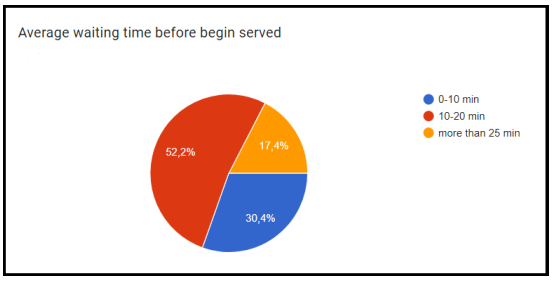


Figure A.3: Pie Chart results of 3rd and 4th questions.

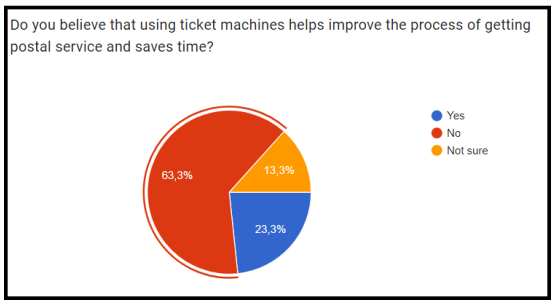


Figure A.4: Pie Chart of the 5 the question.

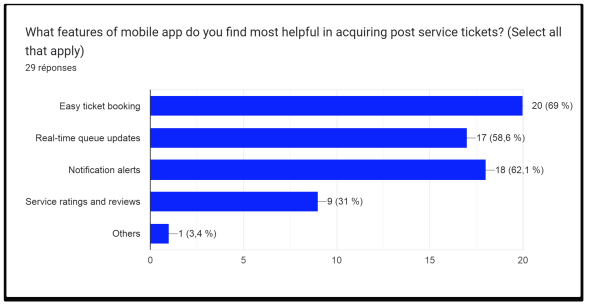


Figure A.5: Bar Chart of the 6th question.

For the last question, here are some answers:

- Getting tickets through mobile apps helps with booking without having to come too early to the post office and wait.
- Is very useful.
- One of benefits of using mobile apps to get tickets in postal service is: They can reduce paper waste and clutter by storing digital tickets instead of printing them. Some possible drawbacks of using mobile apps to get tickets in postal service are: They may require internet connection or data usage to function properly. They may not be compatible with all devices or operating systems. They may have technical issues or glitches that affect their performance or security.
- An excellent idea that will save time.

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