Cairo University
Faculty of Computers and Information
Department of Computer Sciences

Metro Tickets Reservation

Supervised by

Dr. Cherry Ahmed

TA. TA Ashraf Mohey

Implemented by

20170008	Ahmed Ibrahim Mohamed Abdelmottaleb Kassab
20170033	Ahmed Mostafa Elsayed
20170232	Mohamed Sameh Omar
20170224	Mohamed Bakr Abdelhafez
20170253	Mohamed Mohsen Abdelsallam

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1. Abstract

With this large number of Metro passengers, stations become extremely crowded, especially in times previous and after the work day for employees or school day for students, as result of that each person become binding to stay at a too long queue in the station in front of tickets window.

In addition to delays in their journeys, in days like we live now (a period of serious illness) the infection becomes more common in this crowded queue, as it happens in this period, since these lines cannot be controlled effectively enough.

Our goal is to solve the extremely crowding of metro stations by handling all the process of booking a ticket by the mobile app.

2. Background

Large number of Metro Passengers:

In a comprehensive report issued by the Egyptian Council of Ministers Information Centre in 2019, which includes numerous figures and details, the Centre indicated in its report published at Facebook, that the number of passengers served by the subway amounts to 3.5 million per day by completing the implementation of the third line of the metro, as well as 1662 trips per day in 2019, compared to 1544 trips per day in 2014.

The prevalence of mobile applications:

Mobile Applications, or apps, have taken over in terms of user reach. Here are some stats to support our argument:

- An annual report on mobility from Ericsson states that smartphones are poised to reach 6.1 billion users by 2020.
- Gartner predicts that by the end of 2017, mobile apps will have been a downloaded excess of 268 billion times which will generate revenue somewhere over $77 billion.

As a result, organizations or companies are heading to develop mobile applications to make its services easier for users, solve some problems they face or to get more profit by Sponsorship Agreements, given the many users of this application.

NFC Technology:

Near-Field Communication is a set of communication protocols for communication between two electronic devices over a distance of 4 cm or less. NFC offers a low-speed connection with simple setup that can be used to bootstrap more-capable wireless connections.

Though Near Field Communication (NFC) first came to use in the mid-2000s, a far wider population is now familiar with the technology than ever before, and many are using NFC on a

regular and frequent basis. And according to LearnBonds and eMarketer estimates there will be 69.4 million NFC mobile payment users by the end of 2020; that number will rise to 80.1 million users by 2023.

3. Problem definition

Problem: Large number of Metro passengers which make stations become extremely crowded and each person become binding to stay at a too long queue in the station in front of tickets window takes too much time & effort.

Our solution:
- Handle all the process of booking a ticket by the mobile app.
- Use mobile phones instead of Metro smart cards for subscriptions and handle the process of activate or renew the subscription by the mobile application.
- Let the user can easily charge his balance using secured payment method.
- Handle the ticket or subscription validation process by using NFC (Near Field Communication) technology instead of normal tickets, by the same machines in stations which Depend on RFID technology.
- Develop some features to make the application better and more usable.
- Our Mobile Application will be implemented by Flutter framework and Dart programming language to support both Android and IOS Operating Systems.

4. Related work

There are some Applications that similar to our App, for example:

- Q Ticketing: which serving the Greater Houston, Texas region.
- Metrolink: which serving the Southern California.
- Ridlr App: which serving Delhi & Mumbai, India.

All these Applications have common Features like:
- Handling all the process of booking a ticket by the mobile app
- Secure ticket purchasing
- User device is his ticket
- Easy to select User's origin and destination to purchase

The main difference between our app and all those ones is the NFC technology which will be used rather than QR Code to make it easier to be implemented in the real life since it will be suitable for the same machines in Metro stations which Depend on RFID technology.

5. Project specifications

6.1. System architecture
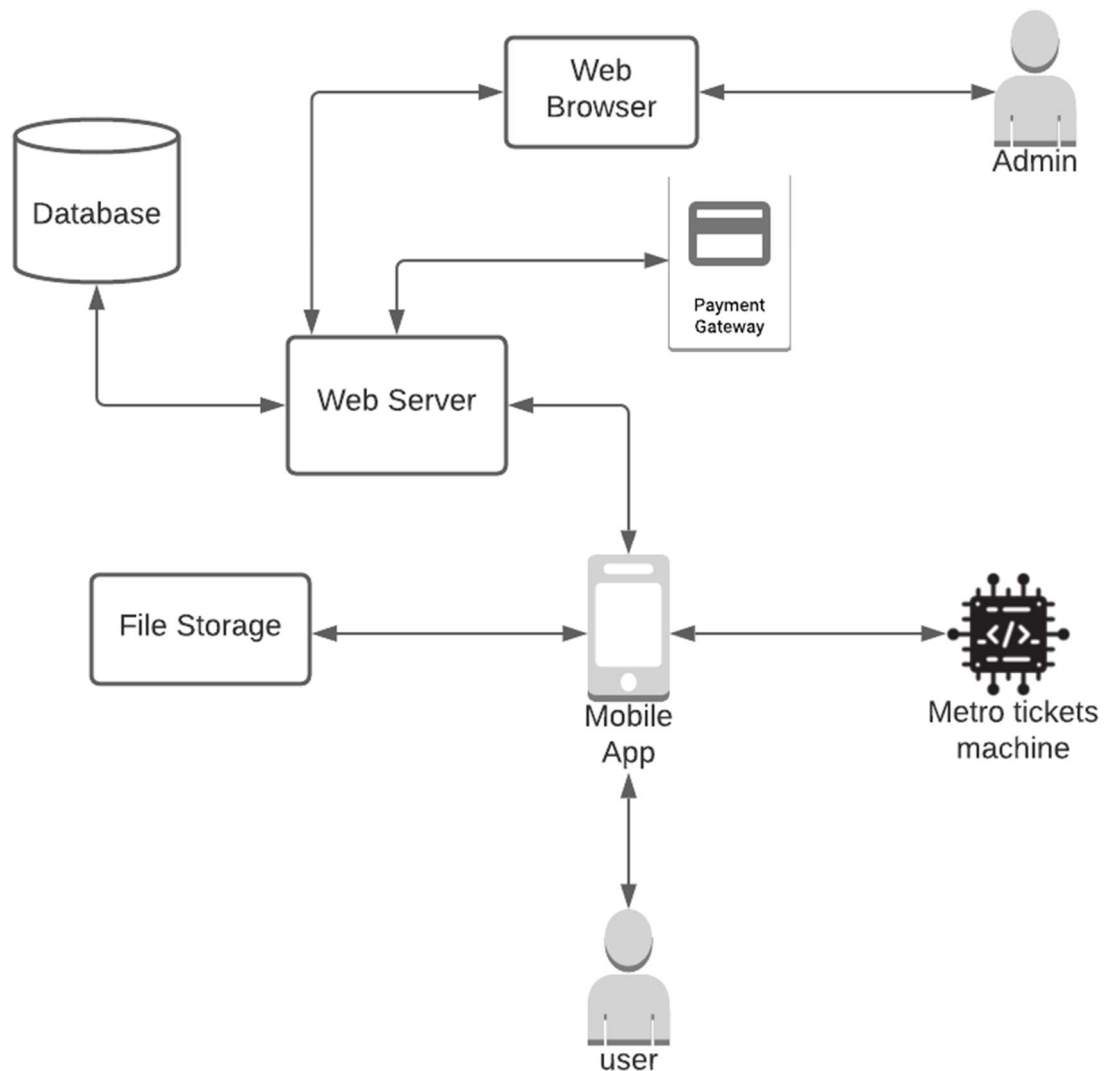
6.2. Stakeholders

1- Direct users:

All Metro Passengers who have an Android or IOS mobile device that support NFC technology

2- Beneficiaries:

Any organization or company want to advertise to it or its product can benefit from this app by add their advertising on the app or by studying the characteristics of App users.

3- Project build team:

- Metro Organization
- Transportation government
- Project Managers
- Developers

6.3. Functional Requirements

- The system shall allow users to register in the Application.
- The system shall allow users to login in the Application.
- The system shall allow users to charge his wallet using payment method.
- The system shall allow users to buy one ticket or more at the same process.
- The system shall allow users to save tickets on the mobile's file storage to be used offline.
- The system shall allow users to determine the price of a ticket using source and destination.
- The system shall allow users to determine the closest station from a specific location.
- The system shall allow users to determine estimated time for the entire trip (from Specific Station to another).
- The system shall allow users to get full directions (path) to go from one subway to another.
- The system shall allow users to apply for or renew a normal subscription.
- The system shall allow users to add a subscription by reading Metro subscription card.
- The system shall allow users to apply for or renew an Educational subscription after complete all the verification process.
- The system shall allow Admins to add, update and delete basic ticket if any changes needed.
- There is a map showing all the subways lines.

6.4.   Non-functional Requirements

Performance Requirements:

Using cloud server storage for our database will improve scalability as we will have the ability to increase or decrease IT resources as needed to meet changing demand.

This also will make the login information be verified within less seconds. Response time of the system will not take long time, almost in a few seconds. The system works 24 hours per day 7 days in a week. The passengers' information must save in the database in few minutes after the end of registration.

Security Requirements:

Using firewall that can help protect your network by filtering traffic and blocking outsiders from gaining unauthorized access to the private data which will protect the integrity and avoid changes or access by unauthorized users.

Consideration of the security of the system has a great advantage for this system, because the database should be secured from the unauthorized users. Only authorized user can get access to the database. To prevent from the unauthorized user, the user should have their username and password that help them to login to the system. Additionally, the users should have to take care of their own username and password. They should have to keep in a secret manner.

Software Quality Attributes:

Should be easily maintainable, using the MVC design pattern will make the system easy to upgrade and make adjustments as it is known, every system needs to be maintained and modified, so we the code will be readable.

The system will check user inputs to the system to handle error. It handles and show error by displaying the error message when the user enters invalid input.

Our system describes the logical characteristics of each interface between the system and the users.

This may include any graphical user interface (GUI) standards or product family style guides, screen layout constraints, standard buttons and functions that will appear on every screen, error message display standards, and so on. so, our system does these all functions in easy and efficient way. In other words, the system is user interactive.
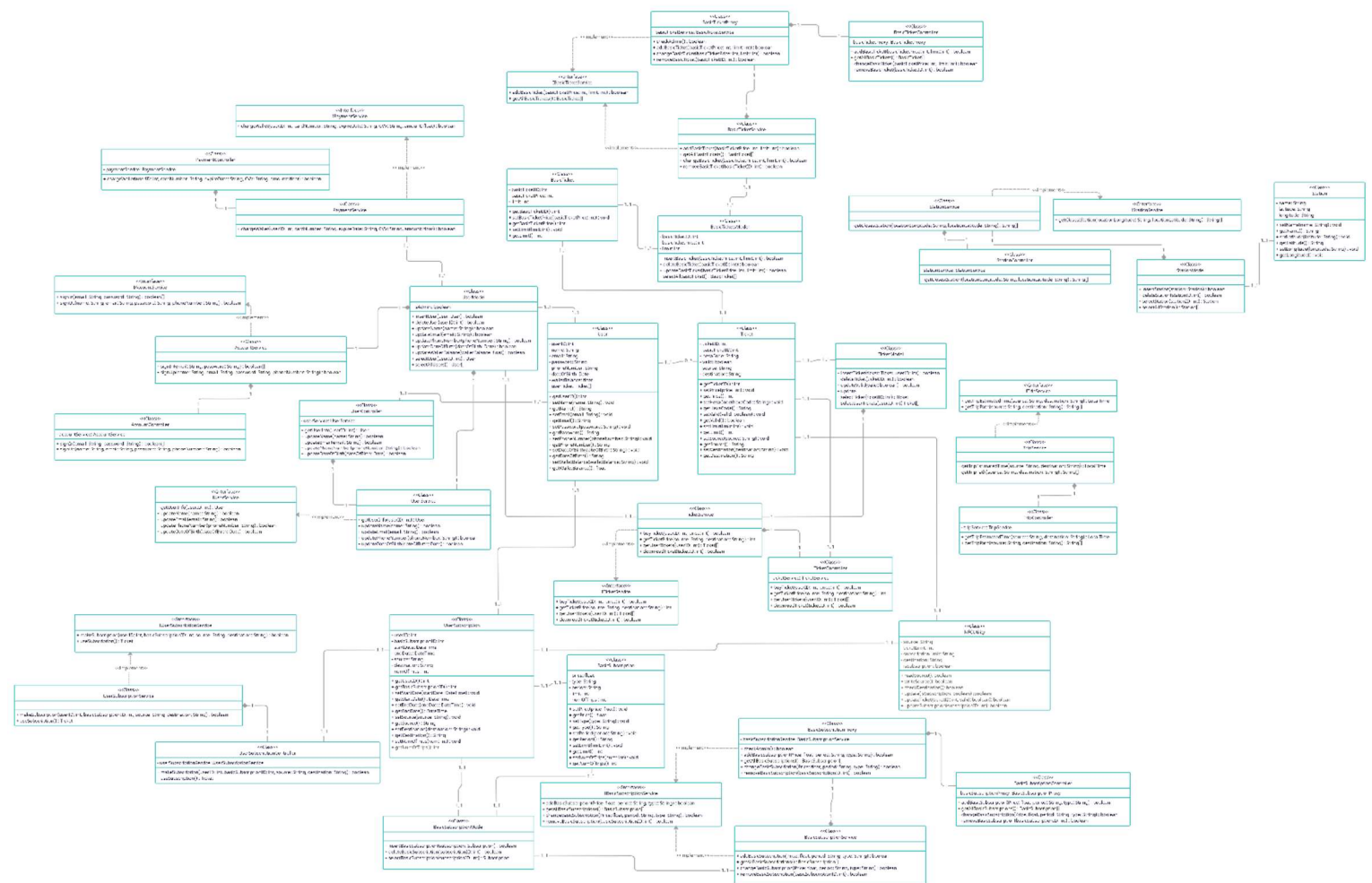
6.5. Use-case Diagram

6.6. Class Diagram
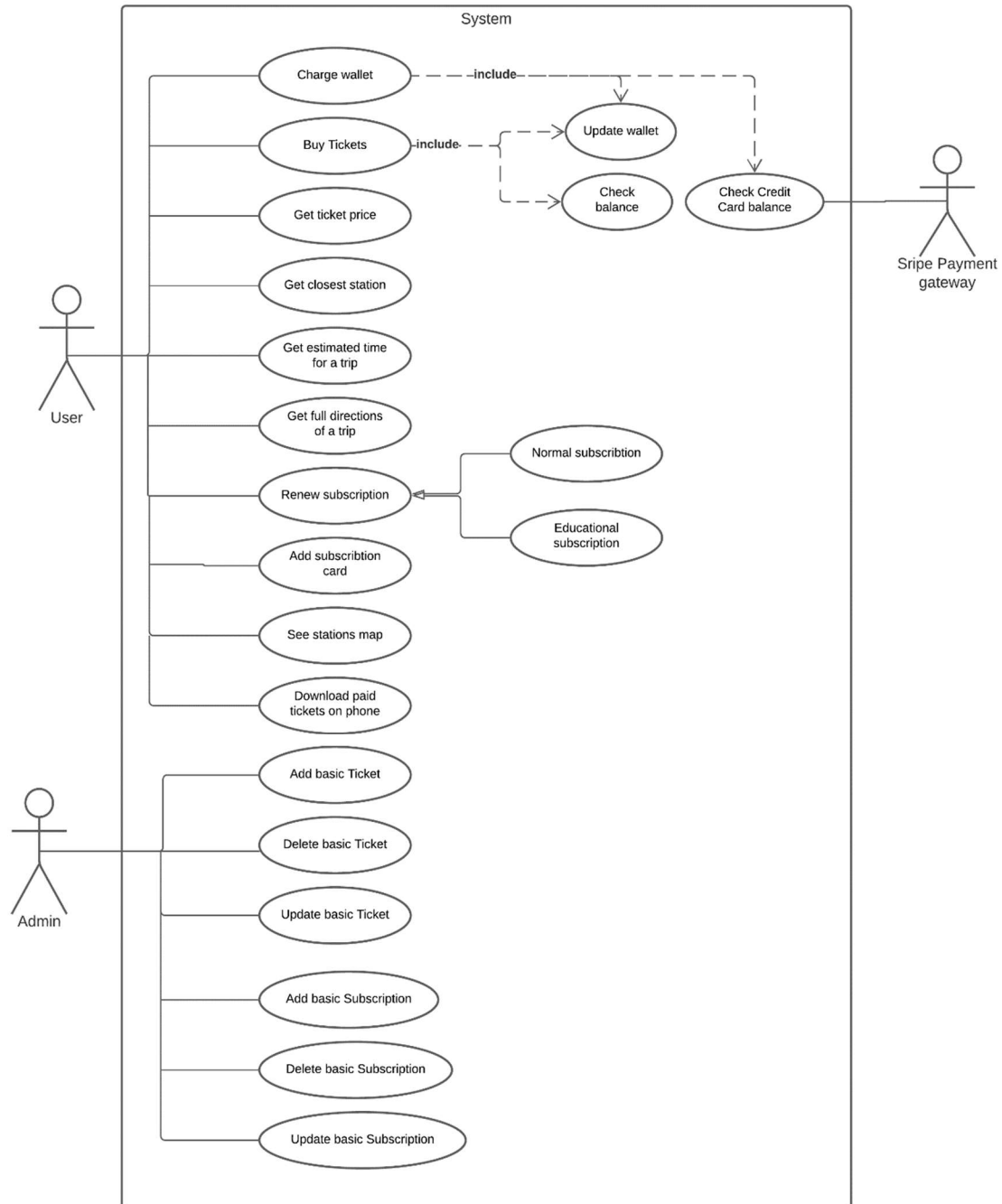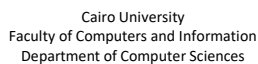
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https://ibb.co/5xFjZTJ

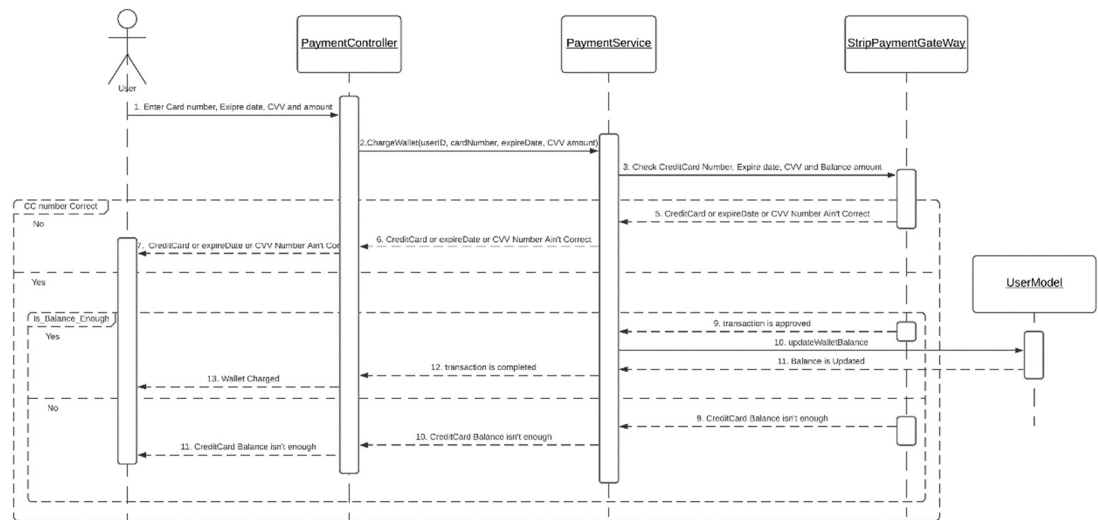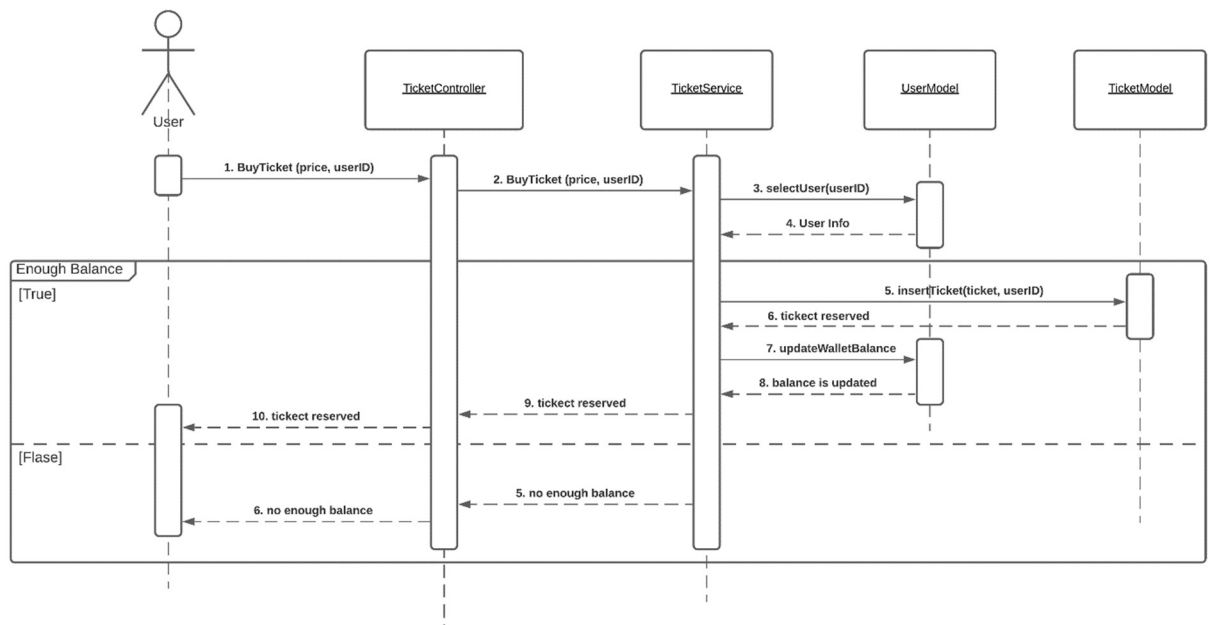## 6.7.   Sequence Diagram

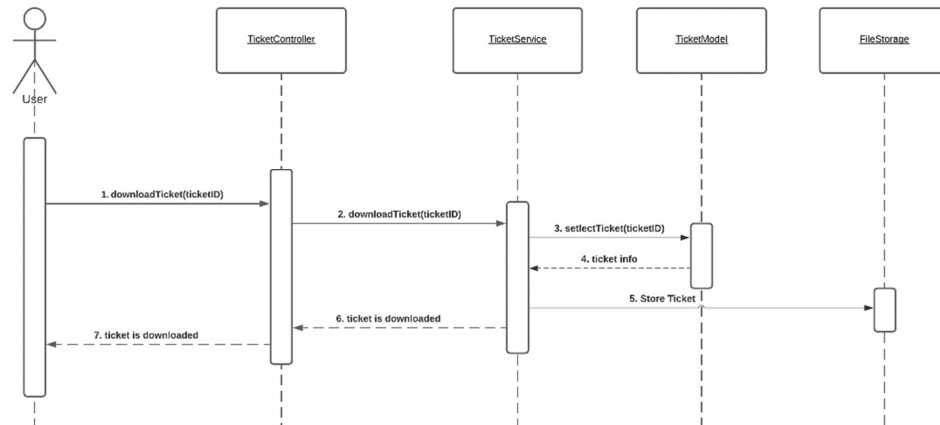- Charge Wallet Sequence Diagram

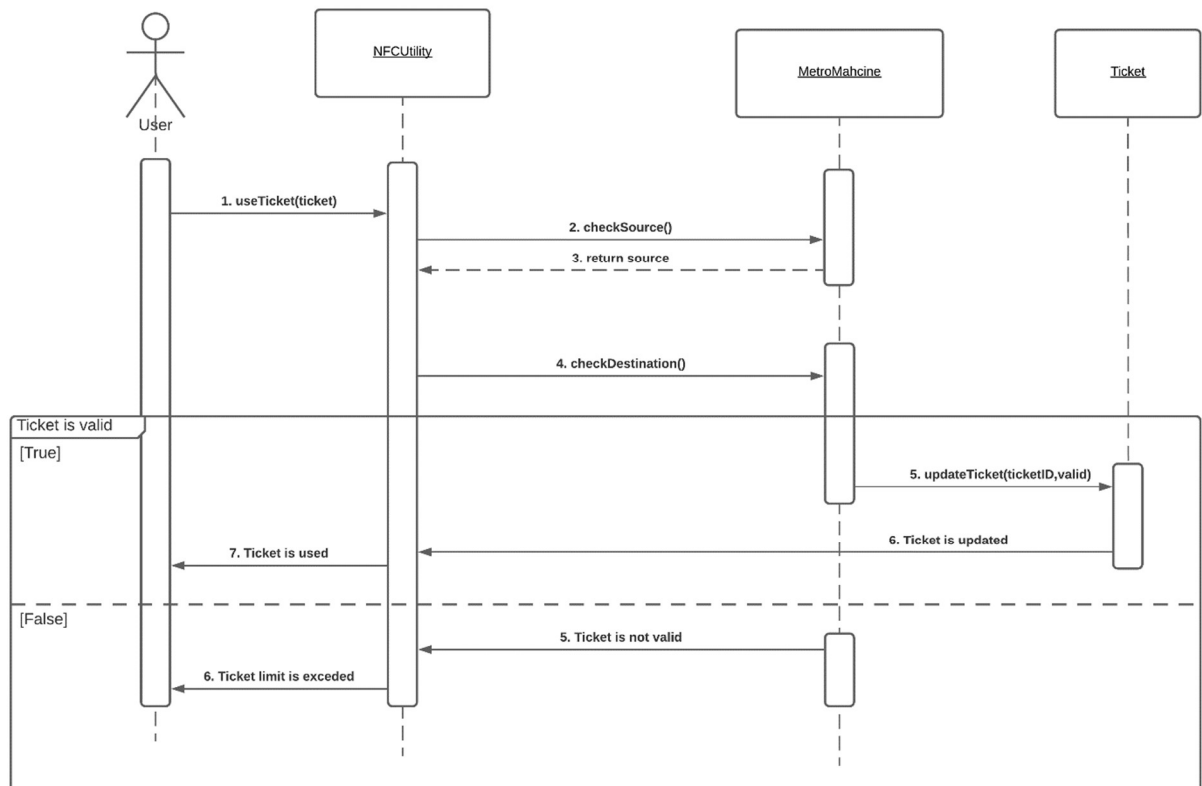

- Buy Ticket Sequence Diagram
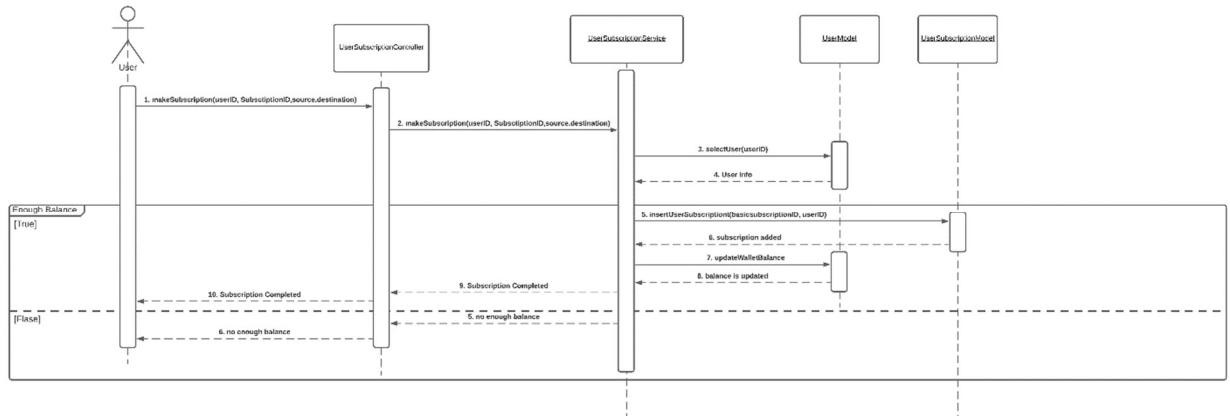
- Download Ticket Sequence Diagram

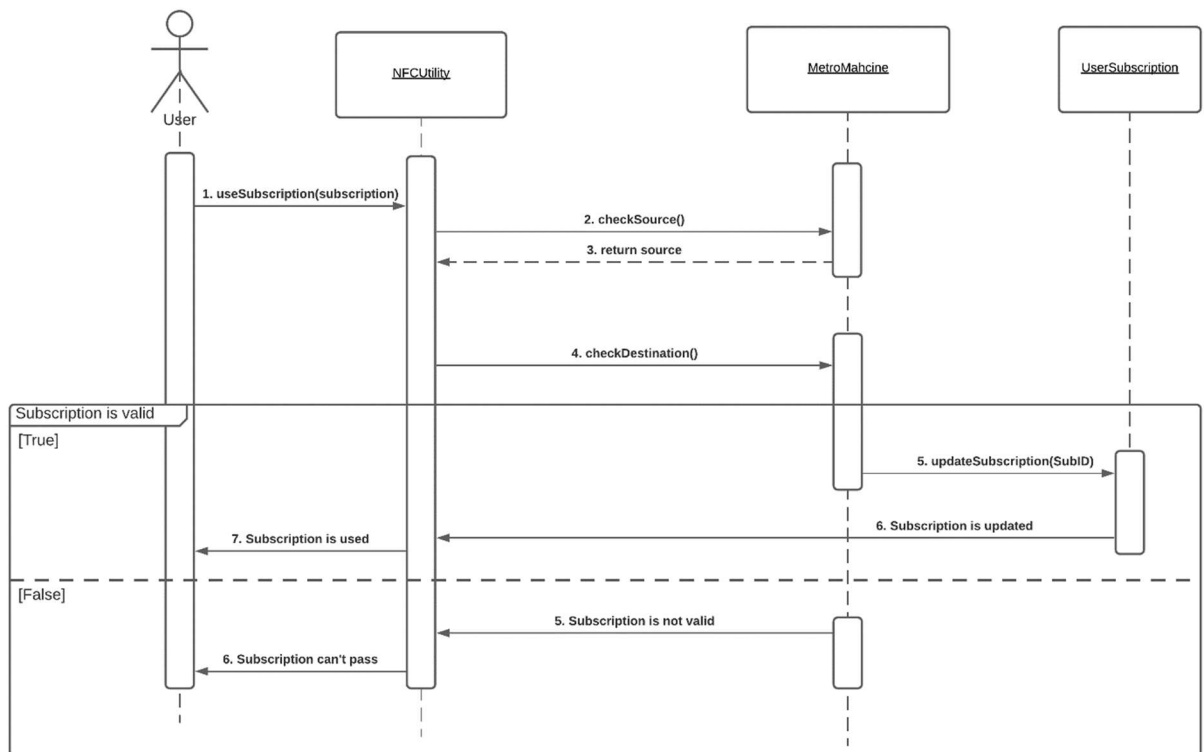- Use Ticket Sequence Diagram

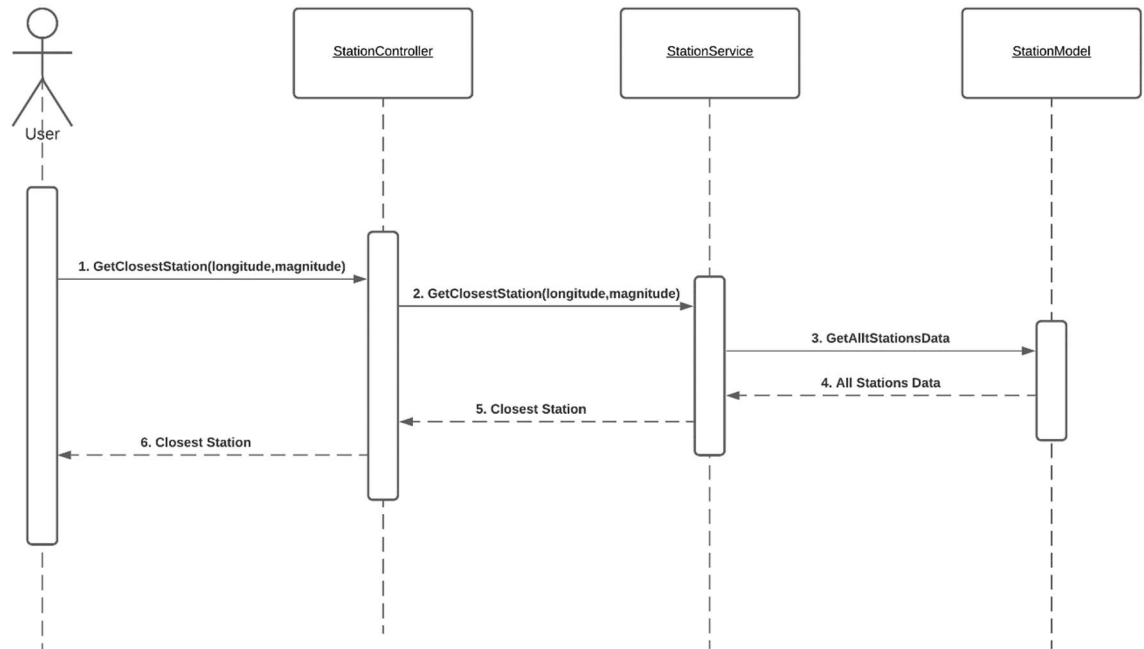- ## Make Subscription Sequence Diagram
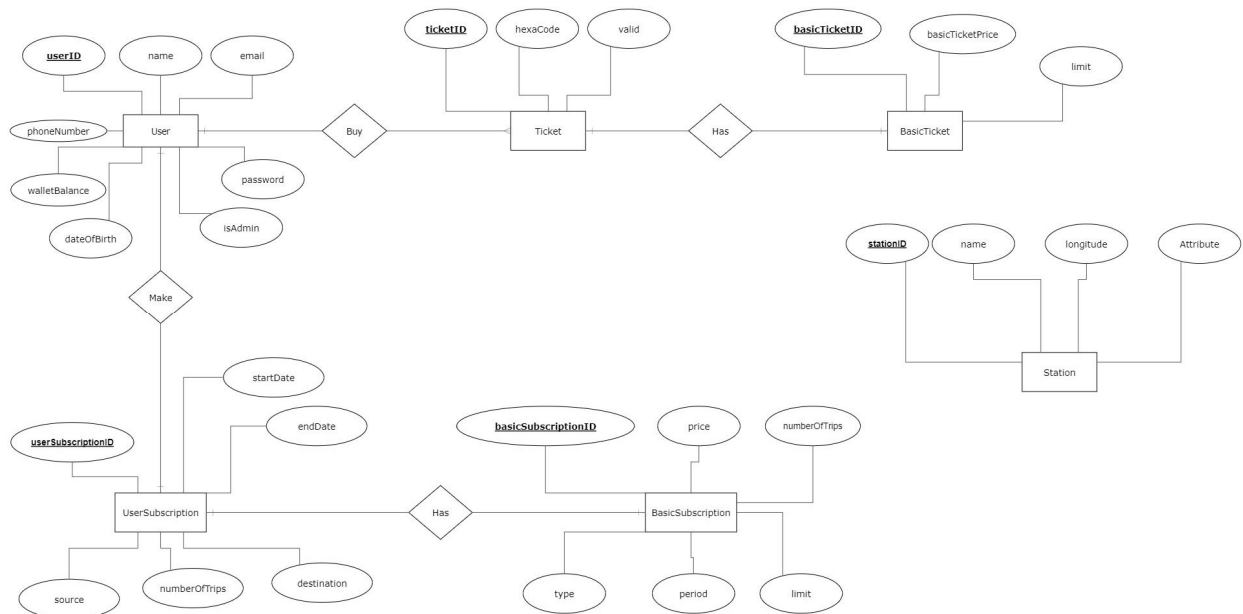

- ## Use Subscription Sequence Diagram

- Get Closest Station Sequence Diagram

6.8. Entity Relationship Diagram (ERD)

6. Work plan

Task	Task title	Description	Task Status
1	Determine the project idea	Searching and discussing some ideas that can be implemented and evaluate them to choose the most effective one.	Completed
2	Project Proposal	Make a proposal for the chosen idea and specify the main objectives and technologies to make the idea clearer.	Completed
3	Basic SRS	Write the first version of the software requirements specification to get deep into our design, architecture and requirements of our software.	Completed
4	Learn project Technologies	Learn some basics of flutter that will be used to implement the mobile application and java spring boot that will be used to implement our web server.	Completed
5	Analysis and design	Design Class diagram and use case diagram, some of sequence diagrams.	Completed
6	Application Prototype	Design some screens of our mobile application using adobe XD.	Half-completed/ expected in 1st April
7	Mobile App implementation	Code the designed screens using flutter.	Expected in 20 April
8	Back-end implementation	Design database and implement our web server using MySQL and Java Spring Boot	Expected in 15 May
9	Ticket machines simulation	Implement a mobile app that simulate the tickets machines in Metro station, the application will read and check the NFC code.	Expected in 20 May
10	Testing	Create Unit and Integration test to our system.	Expected in 1st June