# *MOBILE LIBRARY RESERVATION SYSTEM REPORT*

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**TABLE OF CONTENTS**

# LIST OF FIGURES

# 1. INTRODUCTION

## 1.1. PROBLEM STATEMENT

There is a reservation system in many areas of the world. The reservation systems in the library area are generally specific to that library. When people want to enter libraries, libraries are often full and people have to wait for the library to be empty. Since libraries are quiet and convenient to work, they are preferred by most people, and there are queues in front of the library. This event also creates a waste of time. The Mobile Library Reservation System is a mobile application that prevents waste of time, enables people to easily make reservations and enter the library without waiting in line. Detailed explanations are made in the literature research section. Studies and similar applications on this subject have been reviewed.

## 1.2. SOLUTION STATEMENT

The Mobile Library Reservation System application allows people to easily reserve a table from an online system. Users can use the application by downloading it to their smart phone. By listing all the libraries in Ankara, users can check the occupancy rates and then select date, time slot and table in order to make reservation. In this way, users can see the empty library tables and make reservations easily without wasting time in queues. After making the reservation, a p QR code is created by application. Users can use the QR code as a library card. The QR code is special for each reservation and keeps the reservation informations such as user, library name, date, time slot, table no. This provides easy to access the library because users don't need to think about where their library card is.

## 1.3. CONTRIBUTION

There is no integration with QR code in many reservation systems. Unlike other applications, the QR code will contain the reservation information in it and this code will be used when entering the library. Although reservation applications have been developed in many different areas, there is no such application for the library. There are web-based reservation applications, but we will develop it mobile. In addition, we will direct users to be loyal users with the punishment system we added. Our contributions will be like this. Details of similar projects are explained in the Related Works section.

# 2. LITERATURE SEARCH

## 2.1. INTRODUCTION

Today, mobile applications have been developed to meet many needs of people. With the help of an online library reservation system, our goal is to offer users an application that will save time and be easy to use in daily life.

Thanks to this application, the users will be able to register online in libraries without dealing with registration documents. With the online library reservation system, we aim to provide users with the most realistic information about the occupancy of libraries instantly. Moreover, the application has the capability of listing libraries in their cities using a user-friendly interface, to provide information about the library floor plans, table locations and the time slot when the tables are empty. Making a reservation before going to the library will prevent possible queues in front of the library and will provide users with the opportunity to reserve the table they want. Thus, time will not be wasted searching for a place in the library and people who are looking for a place will not bother working people. QR codes defined specifically for reservations via the mobile application eliminate the use of library cards, so scenarios such as users forgetting or losing their library cards at the entrance to the library are eliminated. We ask the users to read the QR code specially defined for their reservations to the QR code reader via the mobile application. In this way, we can observe whether the users comply with the reserved hours. For example, the invalidation of the QR codes of people who arrive 15 minutes late from the reservation time causes people to take this system seriously. In addition, with the data in the database, whether a user arrives on time or not, a reward-penalty system can be developed to ensure that users comply with the reservation hours. To the best of our knowledge, the reservations systems developed so far have not the penalty-reward mechanism. Some web-based libraries offer an online reservation system, but they do not have mobile application studies on this subject. Our project differs from those systems by adding a mobile perspective to the online reservation system.

We will be using React Native language for our project because this language supports both operating systems. Moreover, since its syntax is similar to JavaScript syntax, we think it may be easier and more understandable than other languages. We have experience in this field as we have practiced the JavaScript language practically from a lesson that we all take as a team. As

a result, we chose the React Native language because its similarity to the language we worked on before may be more advantageous for us.

# 2.2. BACKGROUND

## a) Online Reservation System

Online reservation system is a software that enables reservations to be made online. It allows some facilities or organizations such as hotels, movie theaters, hospitals and bus companies to manage reservations more effectively. Online reservation systems can be developed by using web-based technologies or mobile applications. These systems, which can be used regardless of time and place, are easily taken care of after the user chooses the date, time and place. Today, we cannot imagine a modern life without the internet. It is important for businesses in every industry we see around us to have an accessible and online presence on the internet.

In our project, we will design a library reservation system in order to organize and manage facilitated access to the library and to avoid wasting time. People expect a quiet environment to work, so they prefer studying at the library. We have planned to develop such a mobile application in order to prevent many procedures to register to the library, to avoid waiting in the queue when entering the library and to eliminate problems such as forgetting or losing library cards, to learn the occupancy status of the libraries with a single click on mobile phones and not to waste time.

## b) QR Code

QR code is a type of matrix barcode (or two-dimensional barcode) first designed in 1994 for the automotive industry in Japan. **[1]** Speed up the flow of information with the QR code. Moreover, it accelerates the sharing of information and provides easier access to information. Its use is simple, if you have a mobile phone with a camera and you have a barcode engraver bif application, it is very easy to read all QR codes. It provides convenience in many areas. For example, when we go out, we can pay with the QR code without a wallet. We have used these privileges in our application in order to reduce the use of cards and to enable people to enter the library easily.

## c) Mobile Application Development

The languages most used in mobile application development are Swift, Kotlin, Dart and React Native. The oldest of these languages are the Swift and Kotlin languages. Since these languages are older than other languages, resources are abundant about mobile apps and languages related to them. Naturally, they provide great advantages for research. The disadvantage of these languages is that applications can only be made on a mobile operating system. Swift only allows application development on IOS operating systems, while Kotlin only allows application development on Android operating systems. Kotlin is very similar to the Java structure. While Kotlin is developed as an IDE on Android Studio, Swift can be developed as an IDE over AppCode.

Dart and React Native are languages that are increasing in popularity today. The biggest advantage of React Native and Dart languages is that they provide mobile application development on both IOS and Android operating systems. The React Native is quite similar to the JavaScript structure. While Dart can be developed as an IDE on Flutter, React Native can be developed over Visual Studio Code.

## d) React Native

React Native is the JavaScript framework used to create real and native mobile apps for IOS and Android. **[2]** There are many benefits that react native provides to us. We can update our applications remotely thanks to react native. It increases the speed to develop applications. The language that has been increasing in popularity since the first day of its release. Also, it allows development on many platforms after learning it once. Since we will implement our application on both IOS and Android platforms.Therefore, we chose react native to develop our project.

## e) VS Code

Visual Studio Code is a source code editor developed by Microsoft for Windows, Linux and MacOS. **[3]** Includes debugging, embedded Git checking, syntax highlighting, smart code completion, snippets, and code reconstruction support. It is very fast and a good application for the usability of file management. It's very good at debugging. For example, you can set which computer you want to debug on your computer with more than one program installed. We decided to design our project on this platform because it provides convenience in many ways and is an ideal that we have used before.

## f) Firebase

Firebase is a platform that adds new features every day by Google, and allows web and mobile applications to keep user inputs and data in real-time and synchronously without the need for the developer to deal with the server side. **[4]** A management panel is required where it can easily manage operations such as keeping recording session information, analyzing the usage data of applications, sending notifications to the user and testing the application at the same time to make new announcements. Firebase is a free-to-use platform that can meet all these needs.

# 2.3. RELATED WORKS

The article "Online Hotel Reservation System", one of the authors of which is Bemile Richard, mentions that people can make reservations quickly and easily through an online website. In this way, people will not have to look for vacancies from hotel to hotel in times of high demand and in congested times. **[5]** Taking the example from this article, we decided to make a mobile library reservation system where people can make reservations quickly and easily instead of looking for vacancies in libraries. Here, we are planning to fill this gap by developing our project as mobile instead of web based.

In the article "Development of an Online Bus Ticket Reservation System for a Transportation Service in Nigeria", which includes Oleyede M.O, people who prefer transportation with bus agencies today are asked to be able to book safely. **[6]** For this, it is aimed to make reservations easily, quickly and reliably from anywhere with internet and to provide access to correct information through the website. We aim to develop a library reservation system that is fast, easy, reliable and to minimize human errors by taking the example from this article.

According to what Fadi and Nael mentioned in their article "Students Attendance System Using QR Code", students' attendance to the class is checked in various ways. It is mentioned here that various authentications are made through face recognition, fingerprint sensor and bluetooth connection. QR code method is recommended to control the presence of students in classrooms. **[7]** This example sheds light on library entry and exit processes with the QR code we want to use in our project. We want to integrate this method with the reservation system.

We have researched projects that have the characteristics of our project, which is made in different countries of the world and for different sectors. We have observed that the project we

will work on is similar in many areas. By examining these previous projects, we investigated what we can add to our project, the main ideas in existing projects and how we can continue these projects. You can see four main projects that are similar to our project below.

## a) Hong Kong University of Science and Techology Library in China

With the mobile application made for the library of the Hong Kong University of Science and Technology in China, reservations can be made for study rooms in the library. **[8]** In addition, there are QR codes in the study rooms to control the occupancy rate of these study rooms. You can reach the video description of this mobile application by clicking the reference number. **[9]**

Similar aspects of the HKST library to our application are that you can make reservations from the library with the mobile application. The difference from our project is that qr codes are not personal. Since codes are specific to study rooms, they are not updated for every reservation. Moreover, in the HKST library application, there is no confidentiality of personal information, since when users scan the codes in their study rooms, they can see the information of other bookers. As a solution to this, we plan to increase the security by ensuring the confidentiality of personal information thanks to the QR codes to be generated in our project.

## b) ODEON E-ticket - ODEON Cinemas in United Kingdom

ODEON is an application that offers e-tickets to major cinemas for online reservations. These e-tickets are currently available at ODEON Luxe Leicester Square and ODEON Metrocentre. The e-ticket booking confirmation page and confirmation email contain a 2D barcode (QR code), so you don't need to buy your tickets at the movie booth or ATM. E-tickets are easier and faster, so all the user has to do is print the booking confirmation or email and bring it to the cinema. Alternatively, the user can view their ticket via their phone's email or Apple wallet. By showing this to the staff at the guest service point, you can scan it and the user is accepted on the screen. The user can optionally buy tickets from the movie booth or ATM. **[10]**

Making reservations with qr code in the Odeon e-ticket mobile application and verifying this code by scanning on the phone is very similar to our project. The difference of this project from our project is that it was made for cinemas.

## c) Hospital Reservation System in Turkey

It is a mobile application of "Central Physician Appointment System" offered by the Ministry of Health in Turkey. There are two different mobile apps available for IOS **[11]** and Android. **[12]** The name of the Android application is "MHRS Mobile" and the name of the IOS application is "CDAS Mobile". Both the application itself and making an appointment are free. All state hospitals in Turkey, the Ministry of Health, Oral and Dental Health Centers and Hospitals for citizens, provided they make an appointment with the doctor they want, and select the appropriate date. You can find out the date and time of the appointment and whether your doctor is working at the hospital that day, and you can cancel your appointments that you cannot go to.

The fact that the hospital mobile application has a personalized reservation feature is similar to our project. Its distinctions are that there is no QR code in the reservation and it is a special project for hospitals.

## d) QR Code Train Ticket Booking in India

UTS is the official iOS mobile application for the Indian railways. With this application, they can make reservations on the trains of Indian Railways using the Smartphones of daily train travellers. **[13]** Some of the features of this application are the ability to book tickets, cancel tickets, protecting your profile and managing frequent travel routes. Passengers can book tickets with or without paper. Paper tickets must be purchased at the box office. Whereas in case of Paperless ticket user's location will be captured to determine he/she is present in a valid ticketing area. Passengers can directly show his/her ticket from his/her smartphone to the TTE. In addition, an alternative to location control at limited stations where a user can scan a unique barcode (QR Code) located on the station premises to reserve their paperless ticket. **[14]**

The similar aspect of the mobile reservation application made for Indian railways with our project is the generation of QR codes for reservations. The difference of this project from our project is that the reservation is made using the location information.

# 2.4. CONCLUSION

There are reservation systems for many different sectors in our country and in the world. In our project, we specifically based the online library reservation system because we think there is a

need in this domain. The library is the most preferred place for people to study. We will develop a mobile library reservation system to make it easier for people to access the library. Nowadays, libraries are entered by reading cards. These cards are required to be removed periodically and sometimes the cards can be lost. In order to solve these issues, our system helps people to go to the library with a single click with the qr code sent to their phone after booking. Thus, by turning the card problem into mobile, we avoid a hassle. Thanks to this reservation system, people will not have to wait in line for hours to enter the library. Through the mobile application, reservations can be made from the desired hall regardless of time and place. We have added the reward system to our reservation system in order to prevent abuse. People can cancel their reservation or write a note in case of being late. In this way, we aim to save time and provide great convenience to users by integrating mobile application and QR code usage.

# 3. SOFTWARE REQUIREMENT SPECIFICATION

## 3.1. INTRODUCTION

The following subsections are an overview of the entire Software Requirements Specification (SRS) document.

### 3.1.1. Purpose

This document provides a technical description of all software requirements of the Mobile Library Reservation System. The document will not only define the product functions, user interfaces, product functions, user characteristics, system constraints, and specific system requirements, but also serve as a basis for the Software Design Document that will be prepared according to IEEE 830 [1]. This SRS is prepared to establish communication between the acquirers, users (Admin, Librarian, Library Members), and the software development team.

### 3.1.2. Scope

The mission of the project is to enable users who are members of the library to make reservations online through the mobile application and to check the availability of the library selected from the listed libraries and make it easier for them to make reservations. In order to make a reservation, users must complete their membership process and log into the system. When the users enter the mobile application, they select one of the libraries in their city. Then, they check the occupancy rate and make a reservation for their desired study desk in case of any space in the desired date and time slot. When the reservation is made, a special QR code is

assigned to the users by the system. Users can enter the library by having the QR code read into the system at the library entrance. MLRS will be accessible only to registered users. Thanks to this application, users will be able to access the libraries of their city online. The objectives of the project are:

- To create an effective communication channel between the library and its members.
- To make reservations quickly and easily.
- To facilitate reservation tracking via QR code.
- To create a healthy working environment by ending the look for an empty study desk
- To avoid wasting time by reducing queuing in libraries.
- To encourage compliance with reservations by creating a punishment system
- Ensuring data privacy and security

While developing this project in line with our purposes, we prefer React Native language to be used on both IOS and Android devices. We will keep the information on Google Firebase.

## 3.1.3. Definitions, Abbreviations, Acronyms

SRS: Software Requirements Specification

SDD: Software Design Document

MLRS: Mobile Library Reservation System

ORS: Online Reservation System

QR: Quick Response

IOS: IPhone/iPad OS

OC: Online Chat

OS: Operating System

IDE: Integrated Development Environment

## 3.1.4. Overview

In the first part of this document we explained why SRS is necessary and gave a brief description about the project. The remaining chapters and their contents are listed below.

In section 2, we explained product perspective, product functions, user characteristics, system constraints, assumptions and dependencies.

In section 3, we explain specific requirements for the project. External requirements, functional requirements, performance requirements, security requirements and design constraints will be explained. Also, we mention software system attributes in this section.

# 3.2. OVERALL DESCRIPTION

This section describes the general factors affecting MLRS and their requirements. This part of the SRS provides a background for the requirements to be easily understandable. Detailed definitions can be found in Chapter 3 of the SRS.

## 3.2.1. Product Perspective

### 3.2.1.1. System Interfaces

Mobile Library Reservation System is a cross-platform mobile application which aims to serve online library reservation for users. This mobile application works on both iOS and Android devices. Filtering, firebase realtime database management and mobile application emulators play an important role in the development of this application. Information of library members, librarians and admins will be kept on the database.

### 3.2.1.2. User Interfaces

User interfaces will be provided for the IOS and Android mobile operating systems.

#### 3.2.1.2.1. Initial Screen

This screen is the first screen that users encounter. There are two options for users on this screen. The first option is the "Sign Up" to register to the system. The second option is the "Sign In" that will allow them to log into the system and reach the main screen.

#### 3.2.1.2.2. Sign Up Screen

There are text boxes where users who will perform membership transactions can enter their name, surname, birthdate, email address, phone number and password. After the necessary information is filled, the registration is made by clicking the "Sign Up" button. With the data validation feature, a warning message is given to the user for incomplete or incorrect information entered. If the registration is successful, an information message is given that the registration was successful.

#### 3.2.1.2.3 Sign In Screen

This screen is accessed by clicking the "Sign In" button. On this screen, users enter their email address and password and access their main screen. If the email address or password entered is

incorrect, a warning message will be given to users. Main screen differs for admin, librarian and library members using this system.

#### 3.2.1.2.4 Menu Screen for All User Types

**A) Menu Screen For Library Member**

Library members can access this screen by logging in from the "Sign In" screen. On this screen, there is a menu for users registered to the library. In this menu, the following options are available for the user.

- View User Profile
- List Libraries
- View All Reservations

**a) User Profile Screen**

Users can access this screen by clicking the "View Profile" on the menu screen. This screen contains information entered by users on the "Sign Up" screen. Users can change their information on this screen.

**b) Reservation Screen**

Users can access this screen by clicking on the "List Libraries" on the menu screen. After selecting the library they want, they filter the study desks with date and time slots. After the user chooses the study desk, the reservation process is completed. If the user's reservation is successful, an information message is sent to the user and a special QR code is created for this reservation on this screen. The user can enter the library by scanning this code into the system at the library entrance where the reservation is made.

**c) View All Reservations Screen**

Users can access this screen by clicking on the option to "View All Reservations" on the main screen. Users can see their list of all reservations and cancel their created reservations. In order to cancel the reservation, there is a "Cancel Reservation" button next to the reservation. The reservation system will be closed for 10 days from the library for users who do not make any 3 reservations within the scope of the penalty system.

**B) Menu Screen For Admin**

Admin can access this screen by logging in from the "Sign In" screen. There are the following options on the Admin's menu screen.

- Deleting the library from the system
- Adding a new library to the library list in the system
- Viewing library lists
- Changing library availability statuses

**C) Menu Screen For Librarian**

Librarians can access this screen by logging in from the "Sign In" screen. The following options are available on the librarian's menu screen.

- View All Reservations in the Library
-View Library Members Profile
- Change Library Members' Account Details

### 3.2.1.3. Hardware Interfaces

For the use of Mobile Library Reservation System, a mobile phone that can run the current versions of IOS and Android mobile operating systems is required.

### 3.2.1.4. Software Interfaces

- IOS or Android operating system
- React Native (JavaScript framework)
- Firebase

### 3.2.1.5. Communication Interfaces

In order to use the Mobile Library Reservation System, users must have any accessible mobile network.

### 3.2.1.6. Memory Constraints

The Mobile Library Reservation System can be accessed from any phone that is connected to the internet and supports IOS or Android.

### 3.2.1.7. Operations

Users must be registered to use the system. If the user is not registered in the system, s/he can only view the Sign in screen. Registration is required to view the library list and reservation section.

## 3.2.2 Product Functions

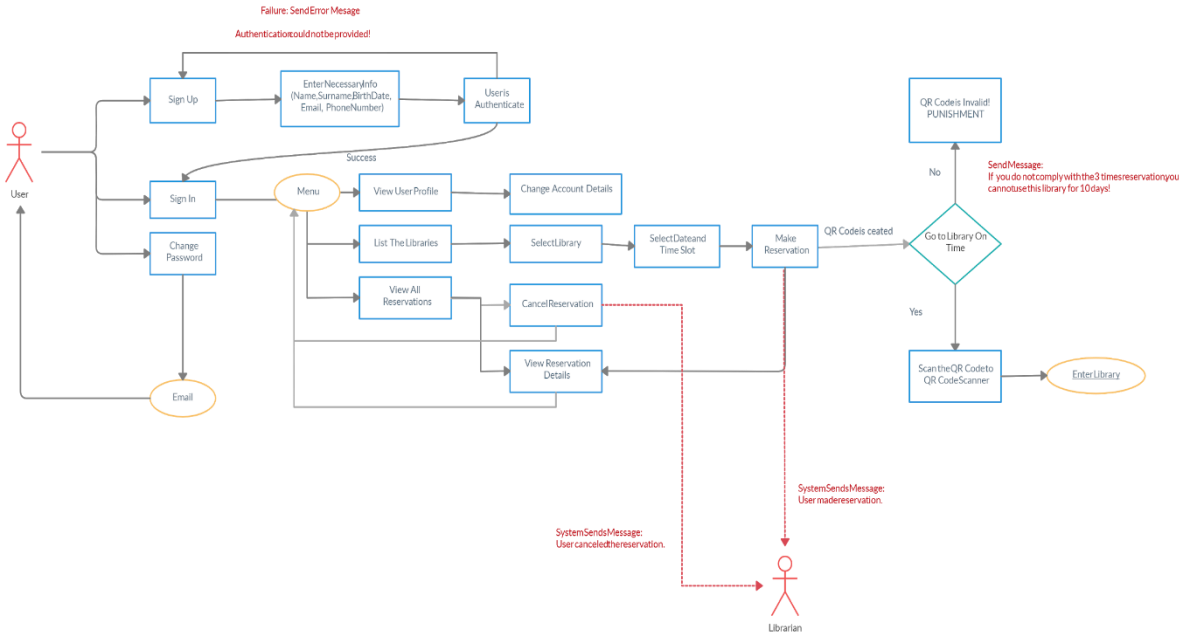



**Figure 1: Flow for Library Member**

After users download the application, there will be options to register or log in to the application. After users register to the system, there are different options according to the functions of the users on the menu screen of the application. There is a session duration that allows users to log out of the system automatically after a certain period of time. There is a certain penalty system for users who do not comply with their transactions in the application. Disposable and user-specific QR codes are generated automatically by the system for our users who make reservations through the application. Thanks to these codes, users will be able to reach the library shortly before the appointment time without waiting in line for the library and easily scan these codes to the library staff and use the library. At the same time, users will save time. If users do any action related to the system incorrectly or incompletely, warning messages specific to users actions will appear on the system. Users using the application are provided with a clear, easy, understandable and user-friendly interface.

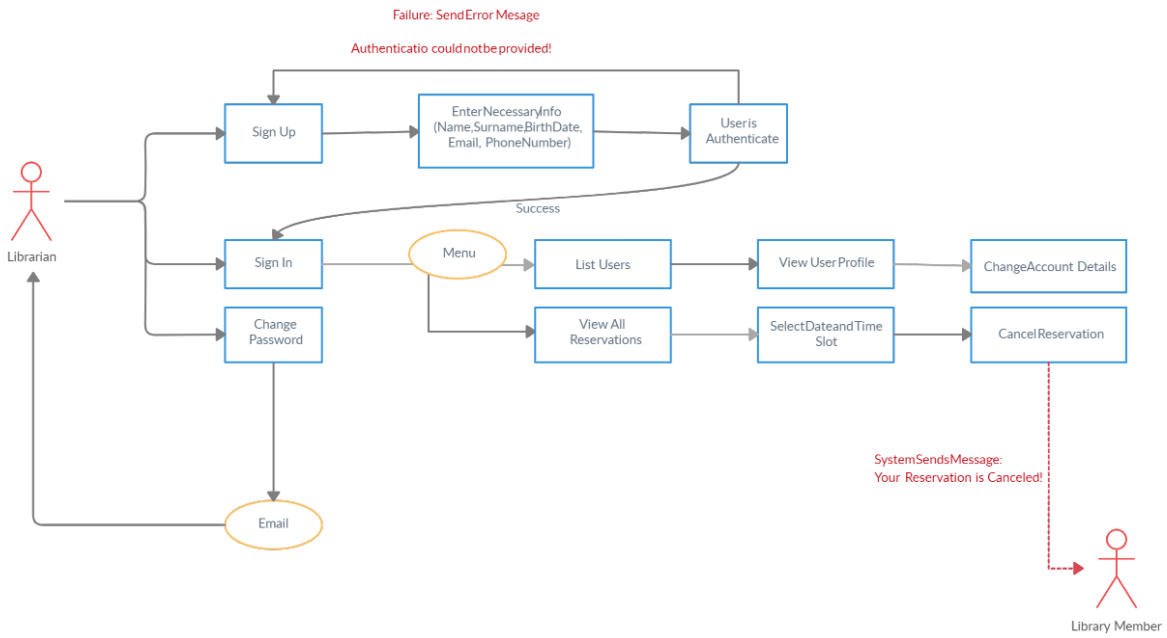



**Figure 2: Flow for Librarian**

If the librarians are not registered in the system, they can register. If librarians are registered, they can log in. When they forget their password, they can change their password via email. When registration is done successfully, librarians are directed to the Sign In screen. After logging in, librarians see the menu screen. The menu screen consists of two sections. The librarian can list all users and view the profiles of the users. At the same time, the librarian can see all reservations and cancel the reservations. They can cancel the reservation by selecting the information (date and time slot) of the reservation they want to cancel. In this case, it gives information to the user by sending a message.

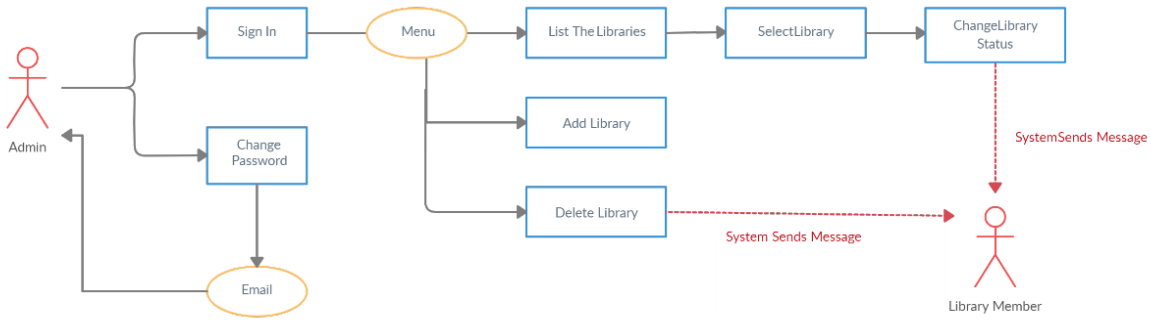



**Figure 3: Flow for Admin**

The admins are registered with the application. Admins can change and update their password as wishes. When they log in to the application, they are directed to the menu screen.

Admin can view the whole library list. By selecting the relevant library, they can change library status. After making the change, the system informs the user via a message. Admin is responsible for adding a new library to the list or deleting an existing library from the list. When they perform the library deletion, the system informs the user via a message.

## 3.2.3. User Characteristics

The system has three types of users: Library Members, Librarian, Admin.

### 3.2.3.1. Library Member

They are people who use the application and its services. In order to benefit from the application services, the person must be registered and logged in the system. Library members represent everyone who is a member to use the library, mostly students, teachers or researchers.

### 3.2.3.2. Librarian

Librarian is the person who ensures the security of the library by controlling the entrance and exit. They check the QR code scanning process at the entrance of the library when library members come to the library. The librarian can see all the reservation details on the system. Then can cancel the reservation upon request of the library member.

### 3.2.3.3. Admin

The admin has a mobile phone and appears as a registered user in the application. The admin sees the whole library list in the database. Admin can add new libraries to the library list or remove existing libraries from the library list. For any problem or special day, holiday, admin changes library status. Admin can notify all users by email that a library cannot serve for a certain reason.

## 3.2.4 Constraints

The software development team obeys the IEEE standards [1, 2, 3] for the software development process stated at the references section, which manipulates the whole requirements process.

Related hardware and software limitations were stated in sections 2.1.3, 2.1.4, 2.1.5, 2.1.6.

## 3.2.5. Assumptions and Dependencies

### 3.2.5.1. Dependencies

All user will have the appropriate hardware and software configuration stated in sections 2.1.3, 2.1.4, 2.1.5

### 3.2.5.2 Assumptions

- The system users use should support IOS and Android System.
- Each assigned QR code is personal and cannot be assigned to someone else.
- QR code check should be done by manually or by another hardware at the library.

# 3.3. SPECIFIC REQUIREMENTS

## 3.3.1. External Interface Requirements

There are no external interface requirements.

## 3.3.2. Functional Requirements

### 3.3.2.1. Common Functions

Functions in this section are common  for library members, librarians and admin.

#### 3.3.2.1.1. Sign Up Function

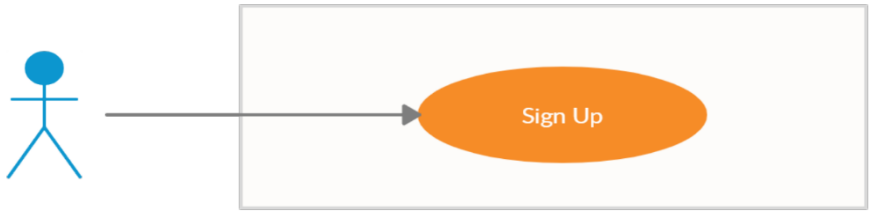



**Figure 4: Sign Up Use Case**

***Introduction***: User enters personal information to the system for registration to the reservation system.

***Input:*** Name, Surname, Birthdate, Email, Phone Number, Password

***Process:*** It is checked whether there is a user with this mail address in the database. If this email address is not available in the database, the new user information is saved in the database. This process cannot be completed if the email address is already registered in the database.

***Output:*** The warning that the registration is successful or there is a registered user is returned.

### 3.3.2.1.2 Sign In Function

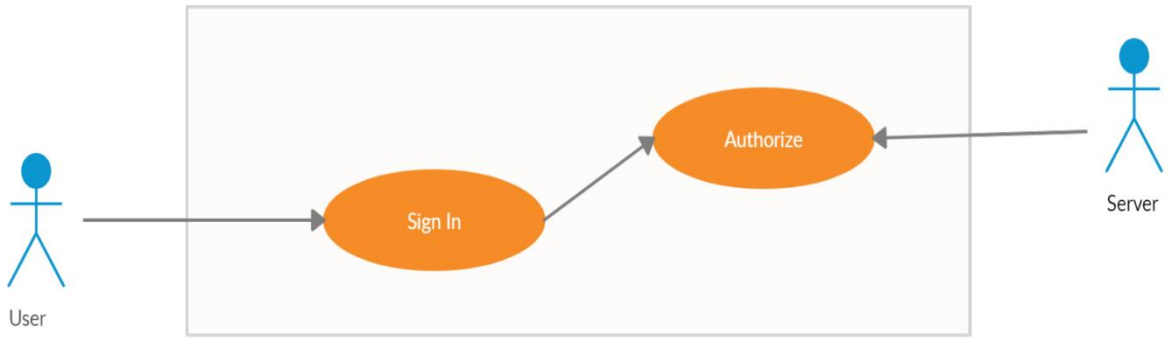



**Figure 5: Sign In Use Case**

***Introduction***: It is the login process to log into the system.

***Input:*** Email, Password

***Process***: The email address and password entered by the user are checked from the database. If the information is correct, the user is directed to the menu screen. If the information is incorrect, a warning message is given.

***Output:*** Menu Screen

### 3.3.2.1.3 Sign Out Function

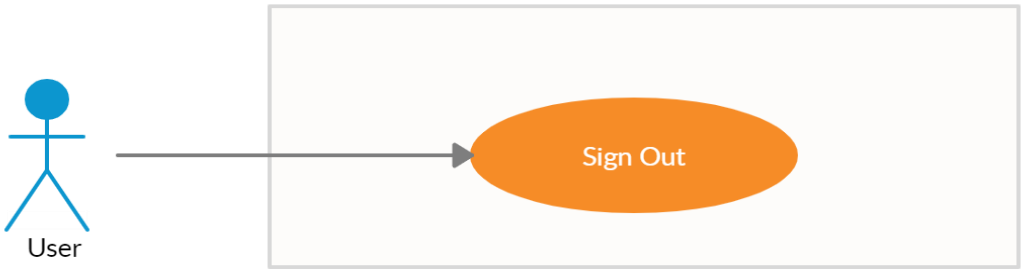



**Figure 6: Sign Out Use Case**

***Introduction:*** It is the process of logging out of the system.

***Input:*** -

***Process***: The user is enabled to exit the system and return to the Initial Screen .

***Output:*** Initial Screen

### 3.3.2.1.4 Send Message Function

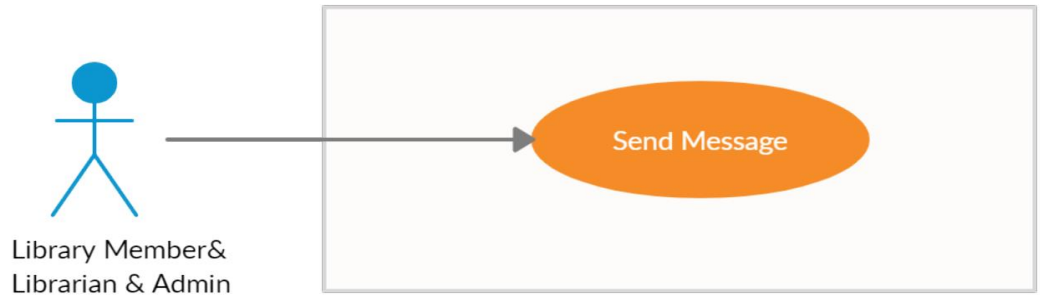



**Figure 7: Send Message Use Case**

***Introduction:*** Users are informed about the changes made on the system.

***Input:*** Conditions that users should be informed about the changes made in the system

***Process:*** A message is sent to the users as a result of the changes made in the system. This use case will be used in other functionality such as make reservations, cancel reservations and update library status. Finds customer's email from the database and sends mail to the customer.

***Output:*** Message

### 3.3.2.1.5 List Libraries Function

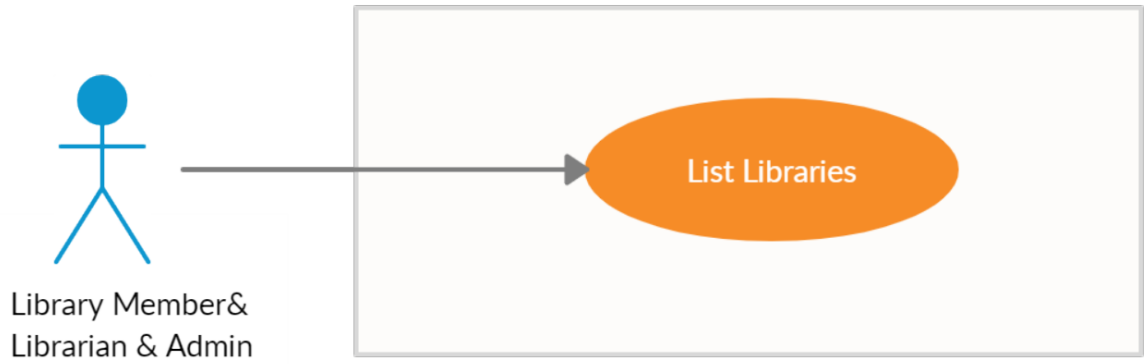



**Figure 8: List Libraries Use Case**

***Introduction:*** It allows users to view the library list.

***Input:*** **Click** "List Library" button

***Process:*** When a library member makes a reservation, it uses library listing.

***Output:*** Library List

### 3.3.2.1.6. Select Date and Time Slot Function

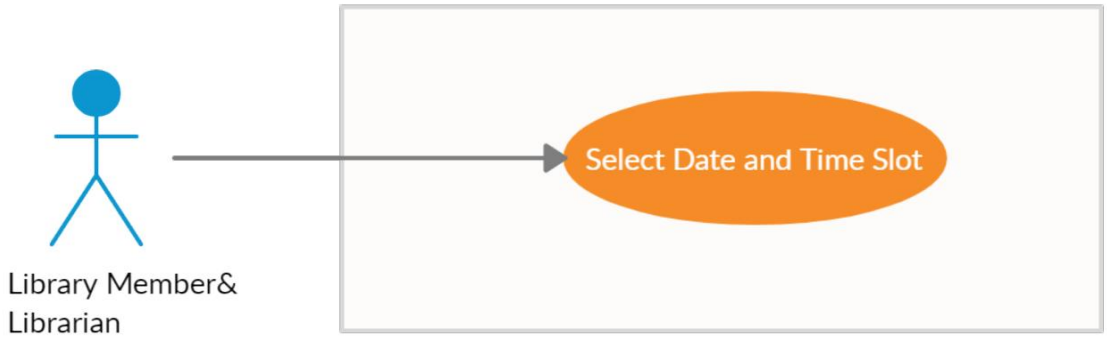



**Figure 9: Select Date and Time Slot Use Case**

***Introduction:*** Date and time slots are selected to view empty desks.

***Input:*** Date, Time Slot

***Process:*** After users reach the library list, they select the date and time slot and display the empty work tables.

***Output:*** List of Empty Study Desk

### 3.3.2.1.7. List Reservation Function

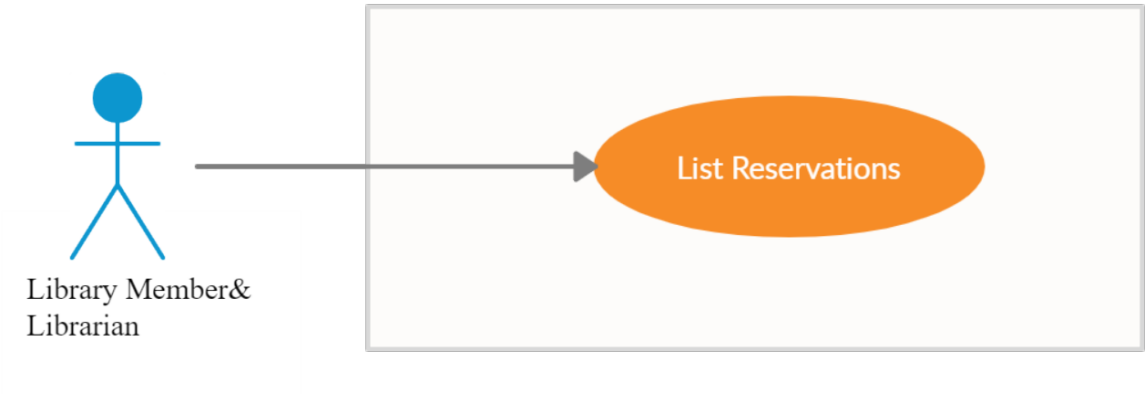



**Figure 10: List Reservation Use Case**

***Introduction:*** Boş çalışma masalarını görüntüleyebilmek için date ve time slot seçilir.

***Input:*** Date, Time Slot

***Process:*** Kullanıcılar library liste ulaştıktan sonra tarih ve time slotu seçerek boş olan çalışma masalarını görüntüler.

***Output:*** List of Empty Study Desk

### 3.3.2.1.8. Cancel Reservation Function

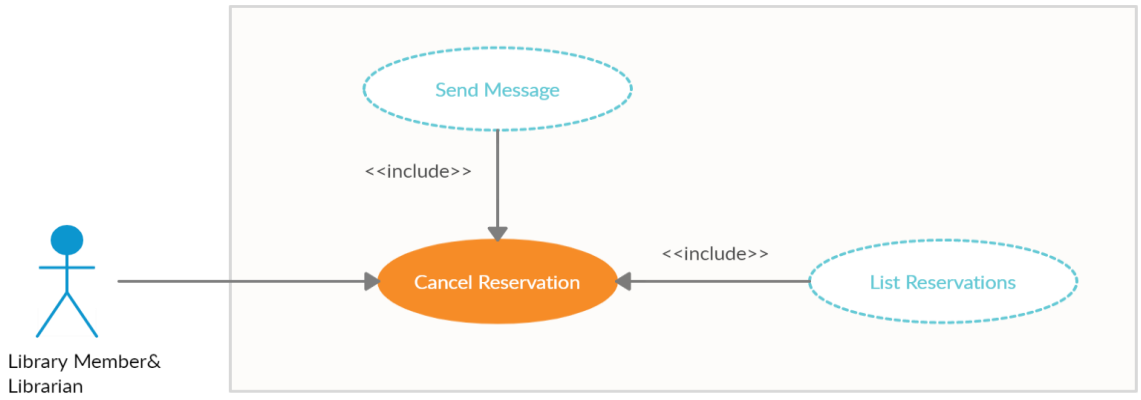



**Figure 11: Cancel Reservation Use Case**

**Introduction:** Reservation is canceled.

**Input:** List Reservations

**Process:** Library members can cancel reservations that have already been made. Librarian is notified of cancellation. Librarians can cancel the reservation made by the library member. The cancellation information is reported to the library memb.

**Output:** Reservation Cancellation

### 3.3.2.1.9. Change Account Details Function

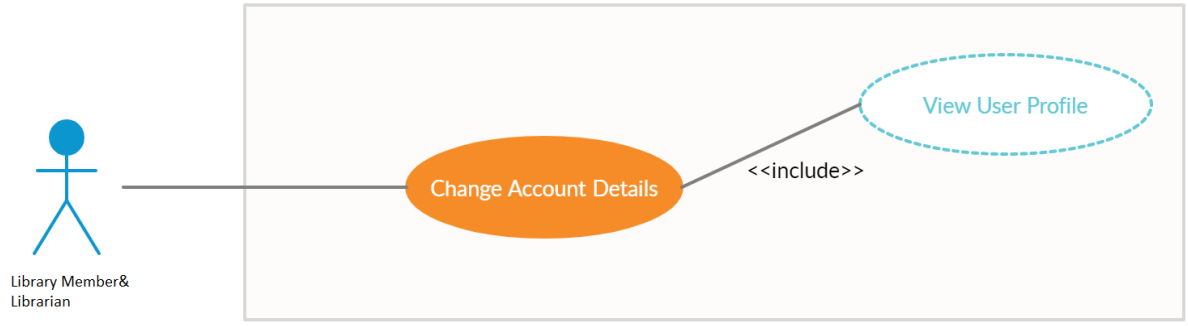



**Figure 12: Change Account Details Use Case**

***Introduction:*** Library members and librarians can change the user's account details.

***Input:*** View User Profile

***Process:*** If the library member or librarian user makes changes to the account changes, the changes are processed in the database.

***Output:*** Changes in User Account Details

### 3.3.2.2. Library Member Functions

#### 3.3.2.2.1. Make Reservation Function

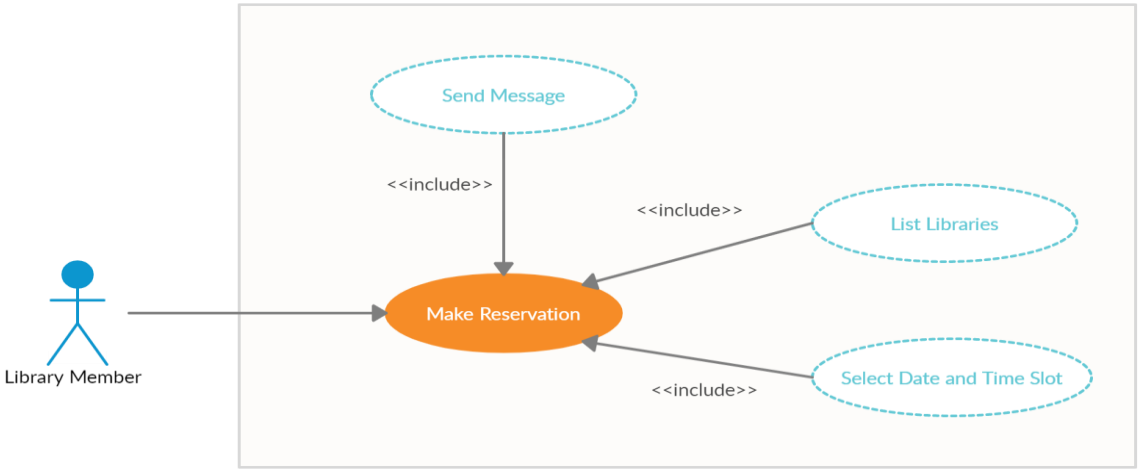



**Figure 13: Make ReservationUse Case**

***Introduction:*** It is the process of making a reservation for the selected desk by applying the necessary filters.

***Input:*** List Libraries, Choose Date and Time Slot

***Process:*** Libraries are listed. The appropriate date and time slot are selected. The study desk in the library is chosen. Reservation is made. The reservation information is sent to the user by message.

***Output:*** Confirmation Message

#### 3.3.2.2.2. QR Code Function

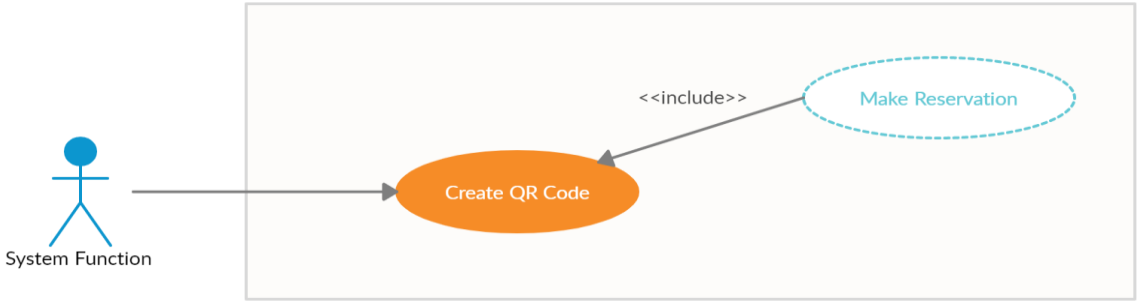



**Figure 14: QR Code Use Case**

***Introduction:*** Rezervasyon yapıldıktan sonra QR code oluşturulmasıdır.

***Input:*** Make Reservation

***Process:*** Kullanıcının sırasıyla seçtiği kütüphane, tarih, time slot ve çalışma masası bilgilerini içeren QR kod oluşturulur.

***Output:*** QR Code

### 3.3.2.3. Librarian Functions

#### 3.3.2.3.1. List Users Function

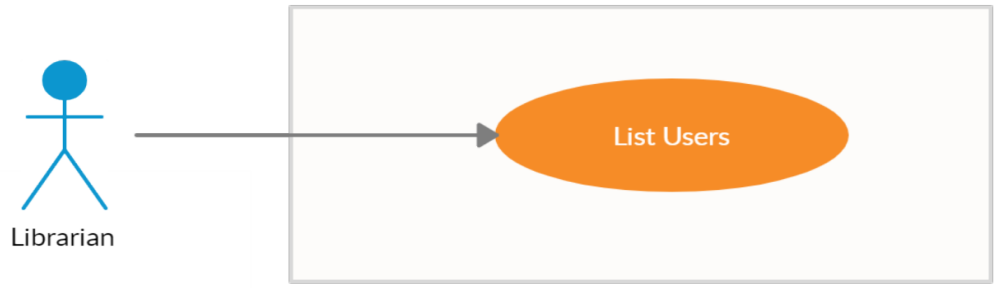



**Figure 15: List Users Use Case**

***Introduction:*** It is the process of showing the list of registered users in the database of the system.

***Input:*** Click "Users List"

***Process:*** Library members are listed.

***Output:*** Library Members List

### 3.3.2.4. Admin Functions

#### 3.3.2.4.1. Add Library Function

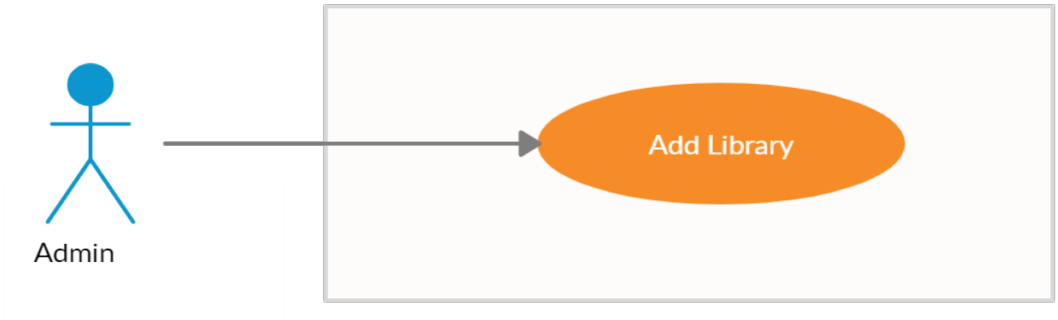



**Figure 16: Add Library Use Case**

***Introduction:*** It is the process of adding a new library to the library list in the database of the system.

***Input:*** Library Name, Library Table Numbers, Library Capacity, Working Hours

***Process:*** Adding new library information to the database by filling out an information form for the new library.

***Output:*** Current Library List

### 3.2.4.2 Delete Library Function

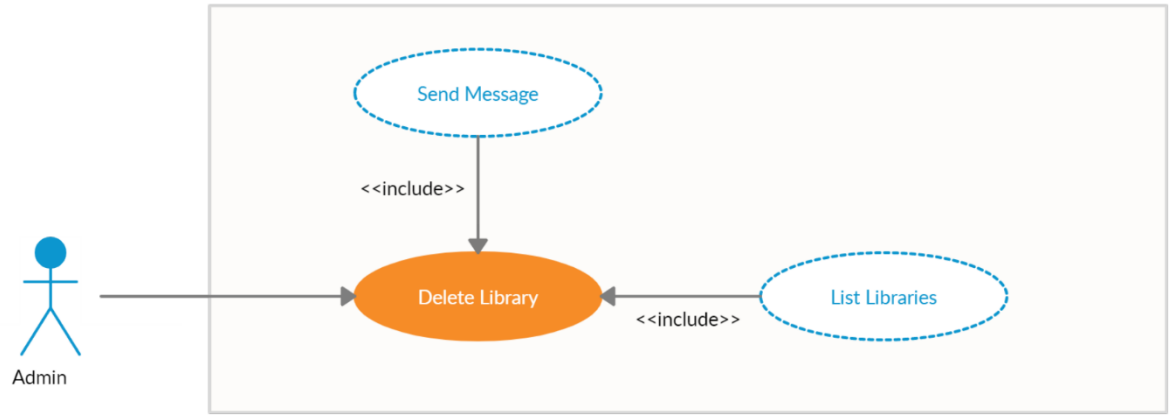



**Figure 17: Delete Library Use Case**

***Introduction:*** It is the process of deleting the library determined from the library list in the database of the system and sending an information message about the subject to the user.

***Input:*** Click "Delete Library"

***Process:*** The data of the selected library is deleted from the database. As a result of this process, an information message is sent to the users.

***Output:*** Current library list and Message

### 3.2.2.3 Change Library Status Function

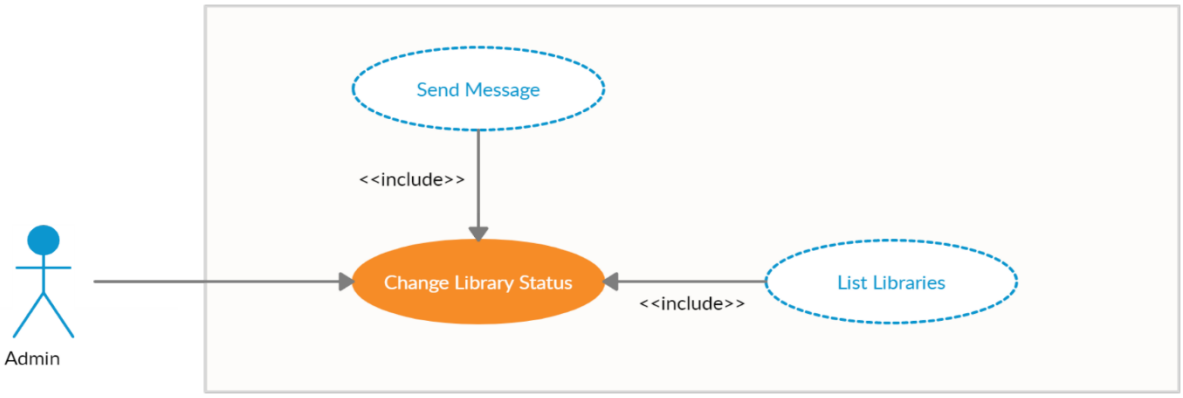



**Figure 18: Change Library Status Use Case**

***Introduction:*** It is the process of informing the users about the status of the library (open, closed, change of time) via message on certain days.

***Input:*** Library Open or Close, Date and Time Slot

***Process:*** Changes made for the selected library are saved in the database and status change messages are sent to the users.

***Output:*** Message

## 3.3.3. Performance Requirements

A mobile phone or tablet that can run the current versions of IOS and Android operating systems is recommended for good use. In addition, internet access is required to use and download the application.

## 3.3.4. Security Requirements

For us, the security and private information of our users is extremely important. Therefore, the registration information of all registered users will not be visible to any other registered or unregistered users. Only the Admin can view this information and, if necessary, can only use the email address to reach the user.

## 3.3.5. Design Constraints

React Native will be used as a programming language so object oriented programming paradigm is adopted. The system requires an internet connection.

## 3.3.6. Software System Attributes

### 3.3.6.1. Reliability

- We have a penalty system to ensure the reliability of the system. Thanks to this system, this penalty system will be activated when users using the MLRS application do not come to the reservations made by a certain number.
- Each user who makes a reservation in the library has a single use QR code. The fact that these codes are both personal and disposable increases the trust of our users who use the system.

### 3.3.6.2. Usability

Users using the application are provided with a clear, easy, understandable and user-friendly interface.

### 3.3.6.3. Availability

Mobile Library Reservation System will be available in the App Store for mobile phones with IOS operating system and in Google Play Store for mobile phones with Android operating system. Internet access is required to access these shopping applications from mobile phones.

### 3.3.6.4. Security

For the security of the system, users must be registered in the system, and these registered users will be logged on by the system after a certain period of time.

#### 3.3.6.5. Maintainability

We aim to make our product even more useful by updating the first product made to ensure the sustainability of our application.

#### 3.3.6.6. Adaptability

The system will not have an adaptive feature.

#### 3.3.6.7. Portability

The product will be specially designed for mobile phones. It will be supported by all operating systems found on mobile phones. In other words, our online MLRS application will be portable on all mobile phones with IOS or Android operating systems.

### 3.3.7. Other Requirements

No other requirements.

# 4. SOFTWARE DESIGN DOCUMENT

## 4.1. INTRODUCTION

Software Design Descriptions (SDD)[16][17] is a document that provides the details of how the software is built and how the hardware works properly with the software. This report aims to inform and guide the software development team about the design of software. The software design description and operating procedures of Mobile Library Reservation System mobile application will be presented in detail throughout the report.

### 4.1.1. Purpose

The purpose of developing the Mobile Library Reservation System is that people can make reservations easily and quickly. The proposed mobile application lists the libraries and provides the opportunity to check the occupancy rate and make reservations on mobile easily. We hope to contribute to our users' fast and practical booking experience in the most user-friendly and convenient way for them.

### 4.1.2. Scope

Mobile Library Reservation System is a mobile application that allows people to see the occupancy rate of any library they want and make reservations from any library without losing time. This document contains full descriptions and features of this application. Using class diagrams, activity diagrams, sequence diagrams, ER diagram, database diagram and the design of user interfaces will be detailed in this document.

### 4.1.3. Definitions, Acronyms, Abbreviations

User: Any user character that is yet to register to the system.

Admin: The user character that supervised the system and a registered administration user.

Librarian: Librarian is the person who observes the library members studying in the library and logging into the library read their QR codes into the system.

Library Member: Any character that is registered to the system and thus, is able to benefit from the services of the system.

QR Code: It is a special matrix barcode type that can be read from the cameras of mobile devices.

Database: The database where the registered users of the system are stored with their personal information.

Class Diagram: A modeling language that is used in the software development process.

IEEE: Institute of Electrics and Electronics Engineering

UML: Unified Modeling Language

SRS: Software Requirements Specifications

### 4.1.4. Overview

Chapter 1 contains an introduction to the software design description of the project.

Chapter 2 contains design considerations and design elements.

Chapter 3 contains software and hardware architecture of the project.

Chapter 4 contains system Interfaces.

Chapter 5 contains design of user interface.

Chapter 6 contains process design of the project and sequence diagrams which will be provided in the SRS Document.

Chapter 7 contains the design of the database.

# 4.2. Design Considerations

## 4.2.1. Application Design Approach

### 4.2.1.1. Class Diagram

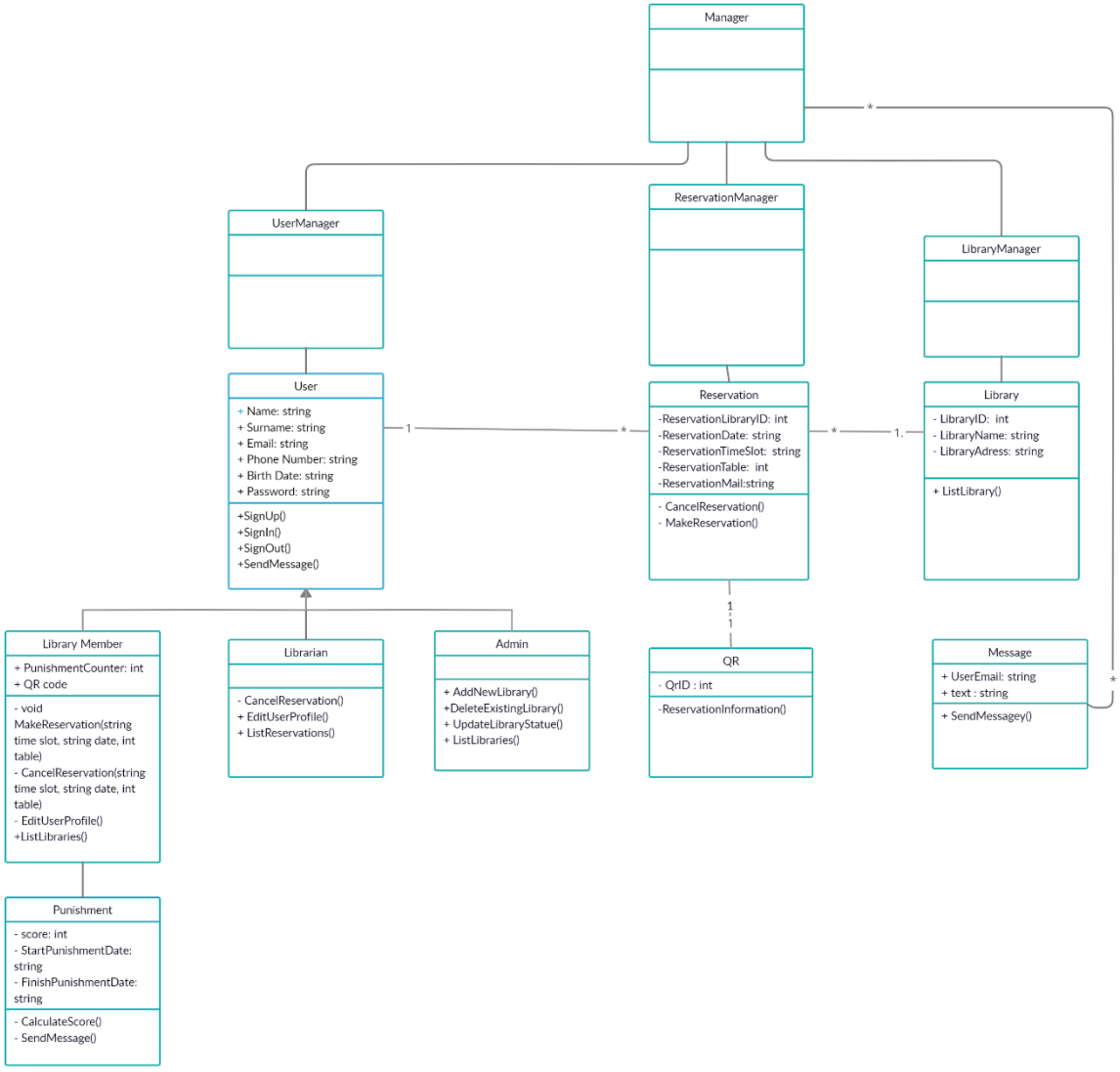



**Figure 19: Class Diagram**

The connections between the entities of the mobile application are shown in Figure 1. Library Member, Librarian and Admin are inherited from the User class because they are different characters that have some common properties. Also, they have different functions and common functions of their own. Reserved library, reservation date, time slot and table number are kept in reservation class. Each reservation has one QR code.

The library class contains the name, address and capacity information of the libraries. Admin checks on the system whether the new library is added, the existing library is removed or the library is open / closed.

## 4.2.2. Design Elements

### 4.2.2.1. View and Edit the profile

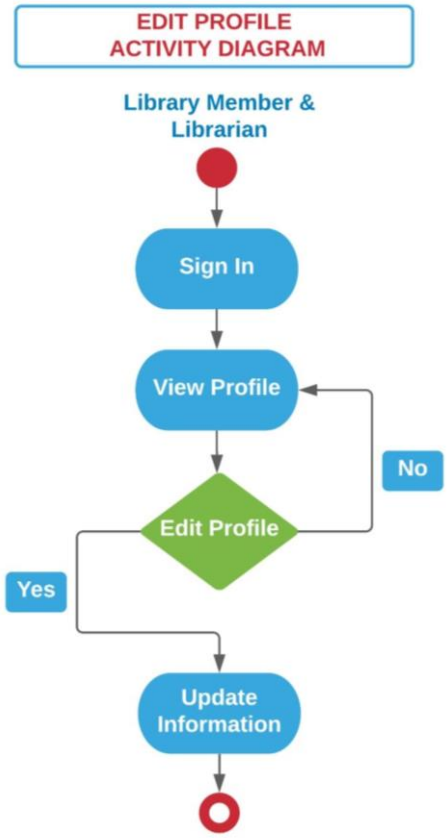



**Figure 20: View and Edit the Profile Activity Diagram**

Library members can update their own personal information by selecting the view profile option from the menu that appears after signing in.

After the librarian signs in, selects the list users option from the next menu. Librarian displays the profile of any library member from the list of members of this library and can make changes to the profile information at the request of the library member.

### 4.2.2.2. Make Reservation

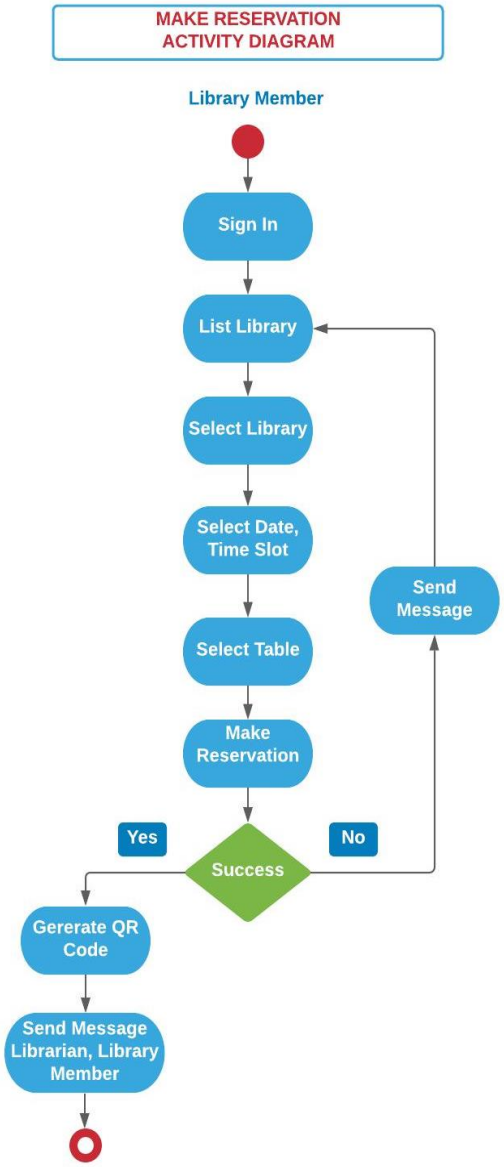



**Figure 21: Make Reservation Activity Diagram**

After signing in as a library member, the library member displays all libraries in the database by selecting the list library option from the Menu page. After selecting the library, it reaches the list of available tables by selecting date and time slot. After choosing a table, it completes the process by saying Make Reservation. If the process fails, a warning message is sent to the user and the library member is directed to the List Library page. If the transaction is successful, a QR code specific to the reservation is generated by the system. The details of the reservation are sent to the library member and librarian by the system

### 4.2.2.3. List - Cancel Reservation

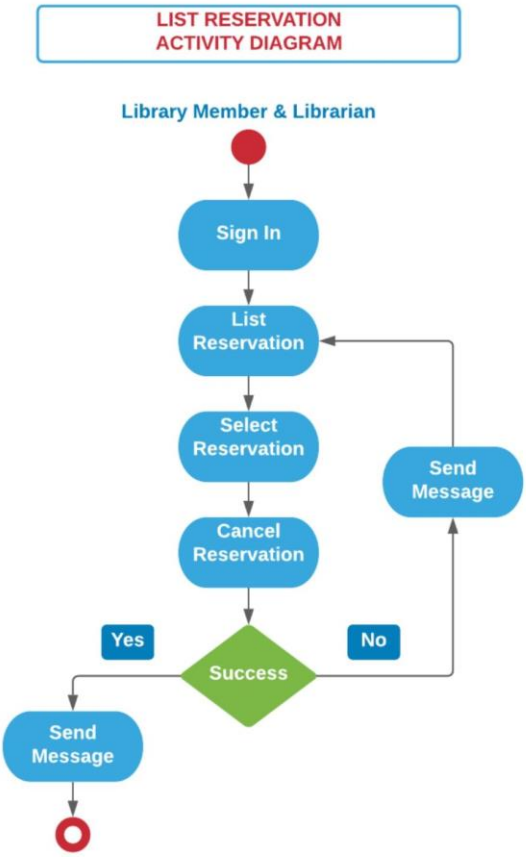



**Figure 22: List - Cancel Reservation Activity Diagram**

After signing in as a library member, the library member displays all reservations by selecting the list reservation from the Menu page. Library members can cancel by selecting the reservation they want from the list. If this process is successful, a confirmation message is sent to library members. If the process is not successful, an error message is sent to the library member and the library member is redirected to the List Reservation page.

After the librarian signs in, the librarian displays all the reservations of the library where the librarian works by selecting the list reservation from the Menu page. Librarians can choose any reservation from this list and cancel it. If this process is successful, a confirmation message is sent to library members. If the operation is not successful, a warning message is sent to Librarian and the librarian is redirected to the List Reservation page.

### 4.2.2.4. Admin Add, Delete, Update Library

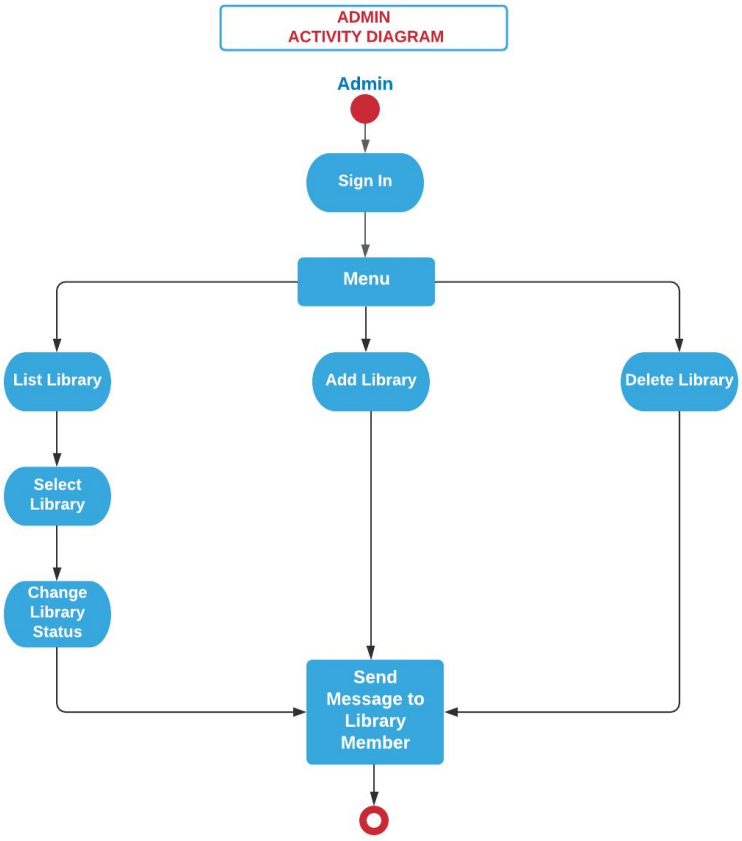



**Figure 23: Admin Add, Delete, Update Library Activity Diagram**

After the admin signs in, it reaches the Menu page. Here, the admin can add a new library by selecting the Add library option from the Menu page, or delete an existing library by selecting the Delete Library option. Likewise, by clicking List Library from the Menu page, it sorts the library list. The admin can change the status of the library he chooses here due to holidays or renovations. All changes made by admin are sent to all library members registered in the database via message.

## 4.2.3 Tools Used

Creatly.com[18] is used for class diagram in section 2.1. lucidchart.com[19] is used for activity diagram in section 2.2. Figma.com[20] is used for designing user interfaces in section 5.2. Draw.io[21] is used for sequence diagram section 6.1 and database design in section 7.

## 4.2.4 Constraints

For the software development process specified in the references section, not only the software development team complies with the IEEE standard [1], but there are also rules governing the entire requirement process.

-The library members can make a reservation maximum 7 days in advance.

-The library member can access own information and edit own information

-Admin and librarian can view library member information but cannot change.

All these issues are discussed in the sections below.

### 4.2.5. Assumptions and Dependencies

Every user must have an IOS or Android device with an internet connection and appropriate software and hardware configuration stated in above sections. Appropriate software configurations are Android 9.0 and iOS 14.3.

# 4.3. ARCHITECTURE

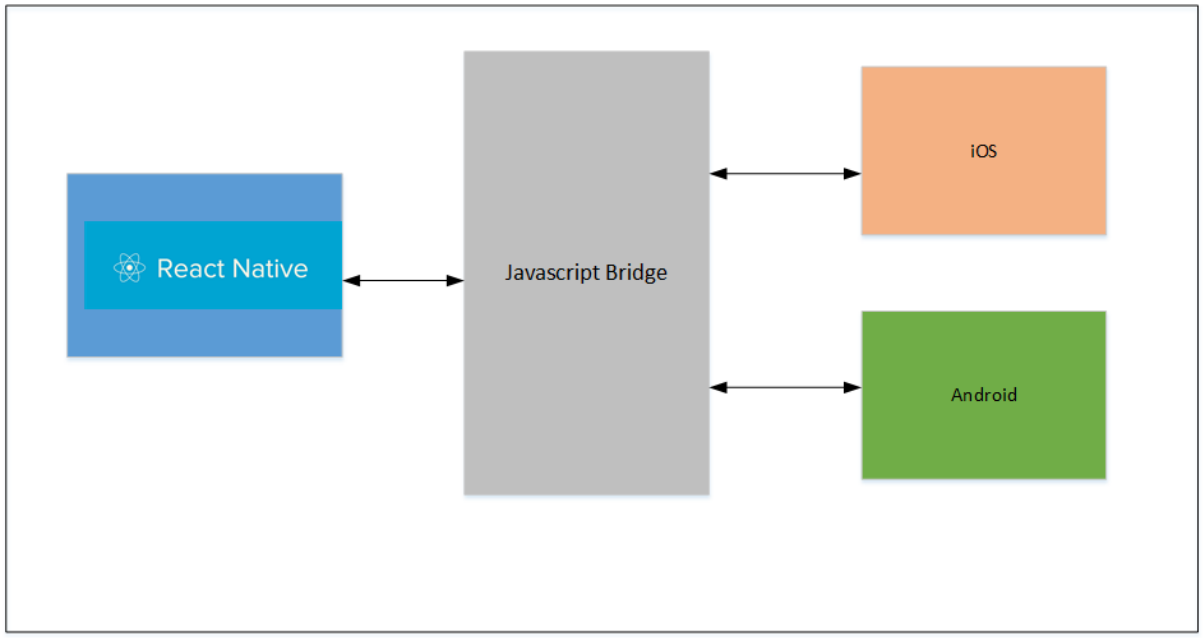



**Figure 24: Architecture Design**

## 4.3.1 Software Architecture

MLRS Mobile Application software will be designed according to Figure 6. The application can be accessed from Android and iOS software-based devices. The database can hold information of all registered users. The database includes basic information of library members, librarians and admin, all libraries empty and reserved tables, all of the details of reservations, cancelled reservations and reservations QR codes.

### 4.3.2. Hardware Architecture

Devices that run on Android and IOS software need to have enough storage to operate the Library Reservation System Mobile Application and a QR code reader in the library.

## 4.4. SYSTEM INTERFACES

### 4.4.1. External System Interfaces

There is no external system interface.

## 4.5.USER INTERFACE DESIGN

### 4.5.1. Navigation

Since this application will be developed to be used on IOS and Android devices, the application must be downloaded from Play Store or App Store. The user interfaces of the application will be discussed in more detail in section 5.2.

### 4.5.2. Screen Definitions

#### 4.5.2.1. Page descriptions

After developing the mobile library reservation system application, the screen images we aim to obtain are shown below.

#### 4.5.2.1.1. Home Page

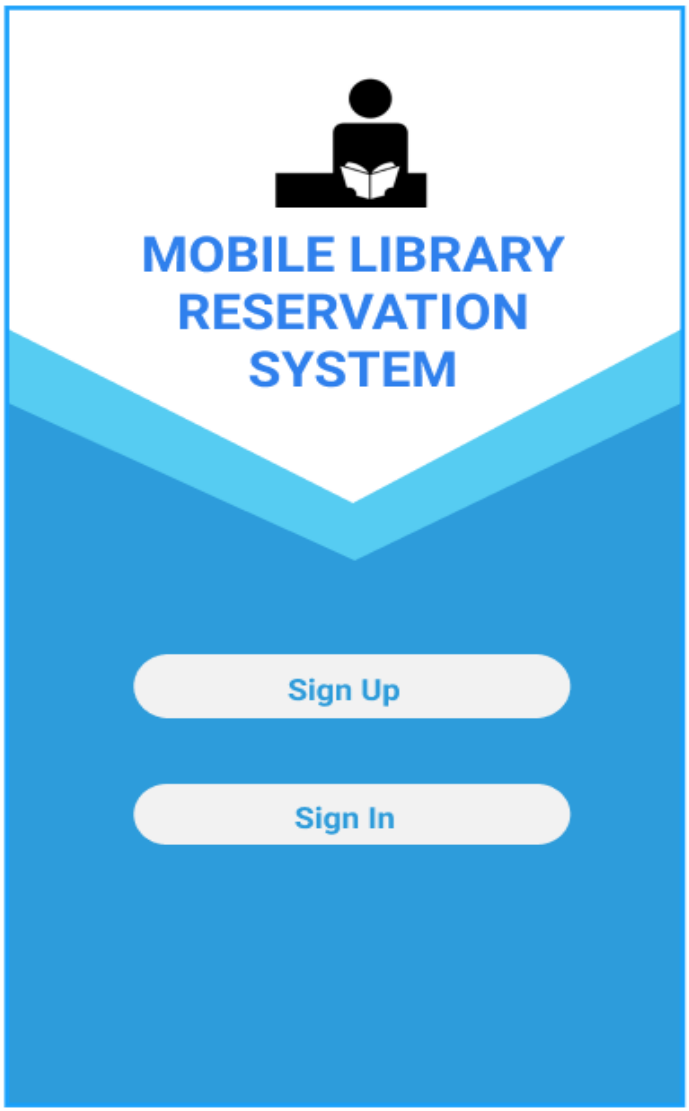



**Figure 25: Home UI**

#### 4.5.2.1.2. Sign Up Page

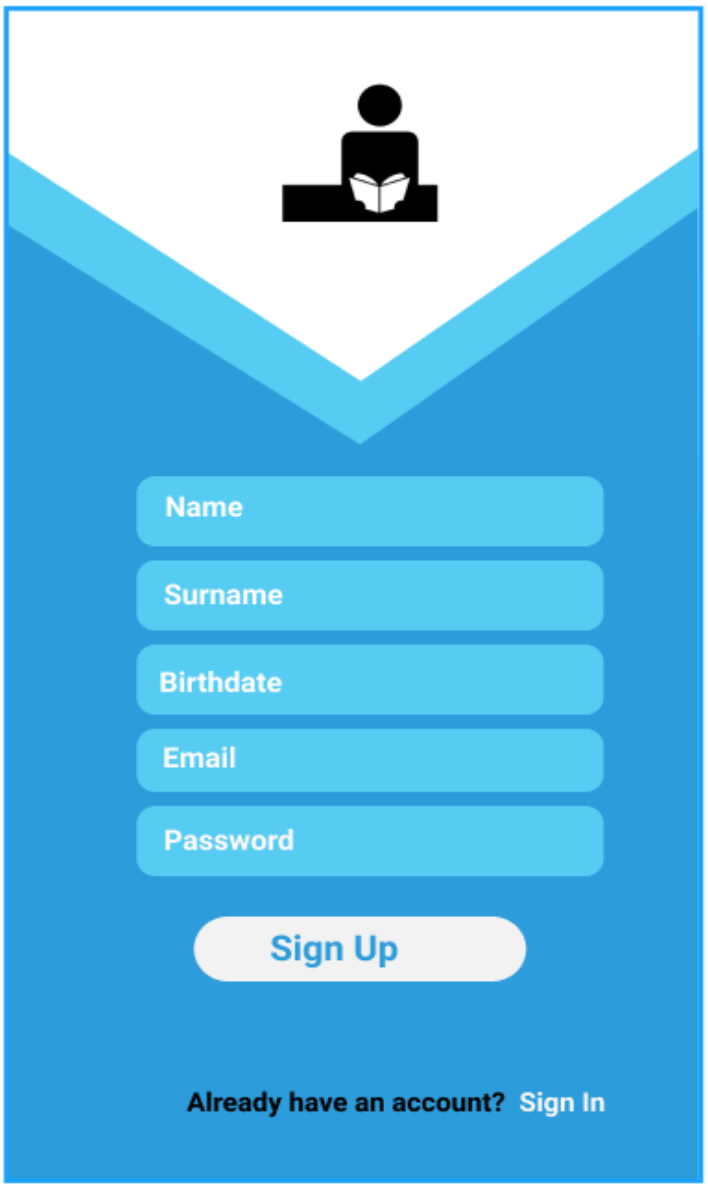



**Figure 26: Sign Up UI**

#### 4.5.2.1.3. Sign In Page

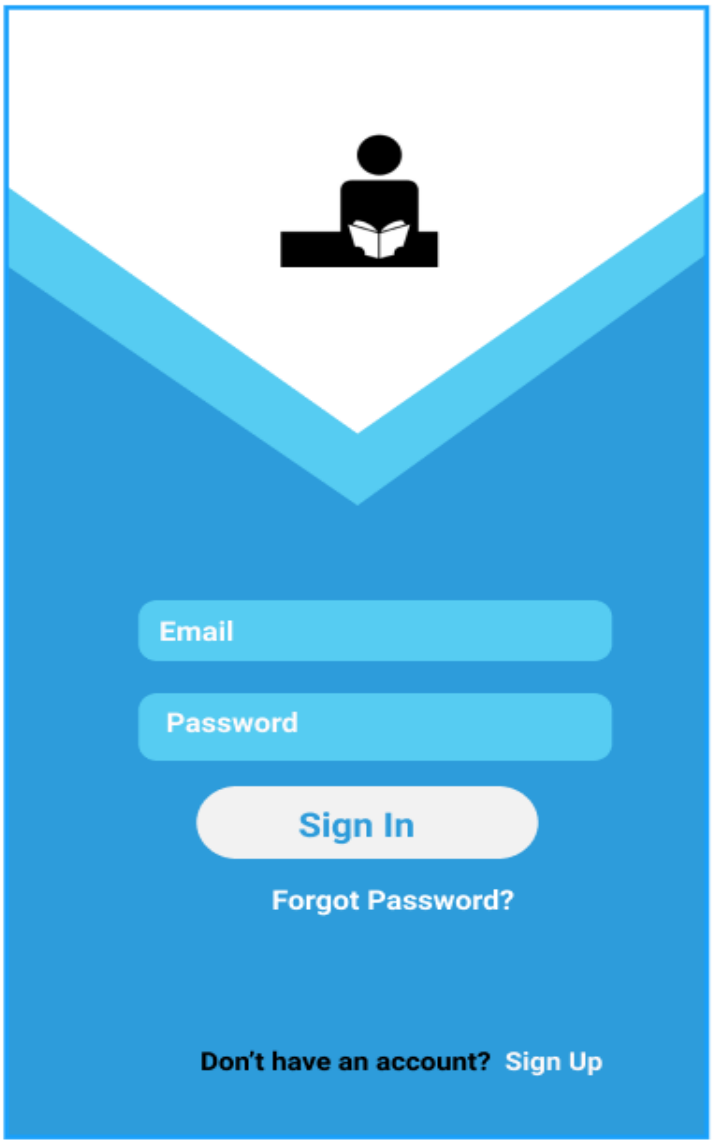



**Figure 27: Sign In UI**

#### 4.5.2.1.4. Library Member - Menu Page


**Figure 28: Library Member - Menu UI**

#### 4.5.2.1.5. Library Member - Edit Profile Page

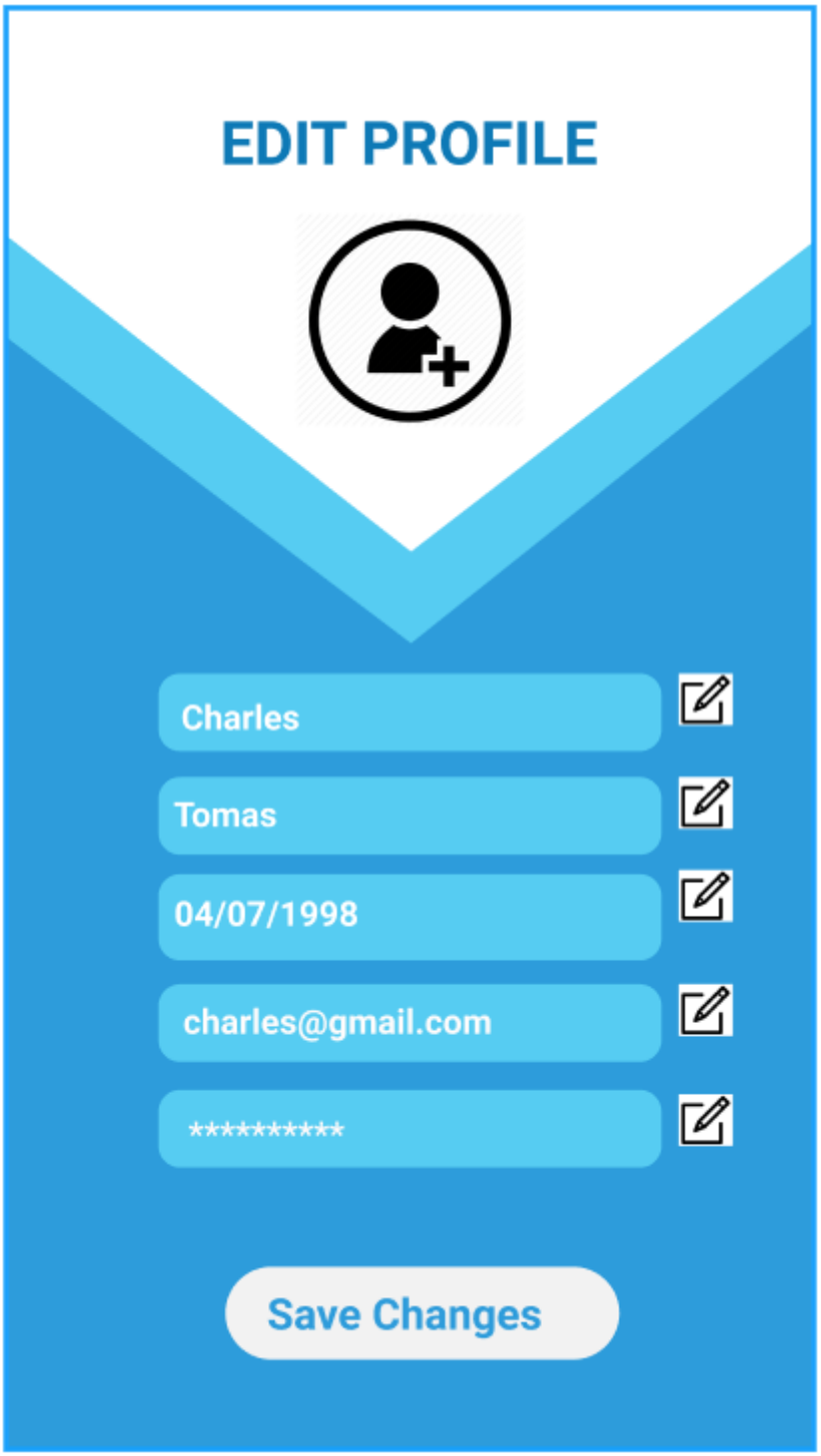



**Figure 29: Library Member - Edit Profile UI**

#### 4.5.2.1.6. LibraryMember - List Libraries Page


**Figure 30: Library Member - List Libraries UI**

#### 4.5.2.1.7. Library Member- Select Date and Time Slot Page


**Figure 31: Library Member- Select Date and Time Slot UI**

#### 4.5.2.1.8. Library Member - Choose Table Page

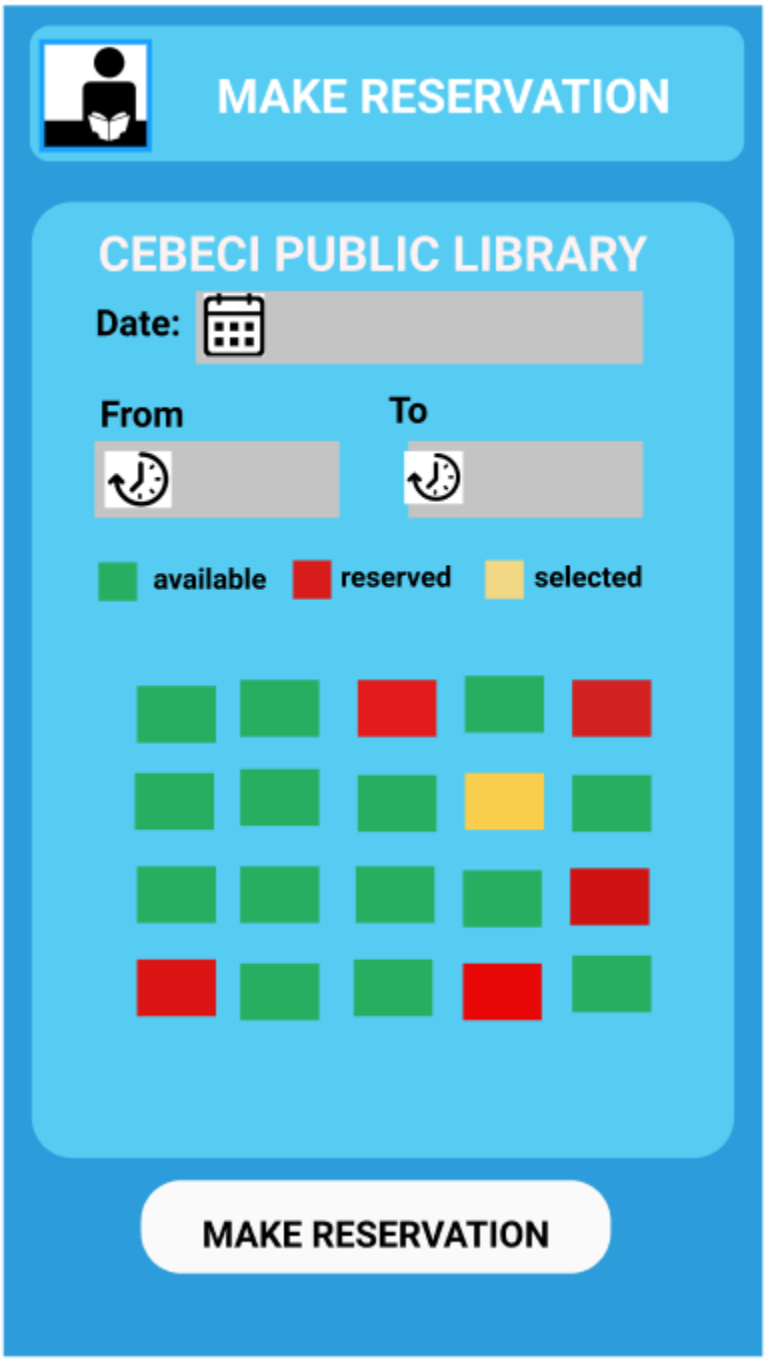



**Figure 32: Library Member - Choose Table UI**

#### 4.5.2.1.9. Library Member - List Reservation Page

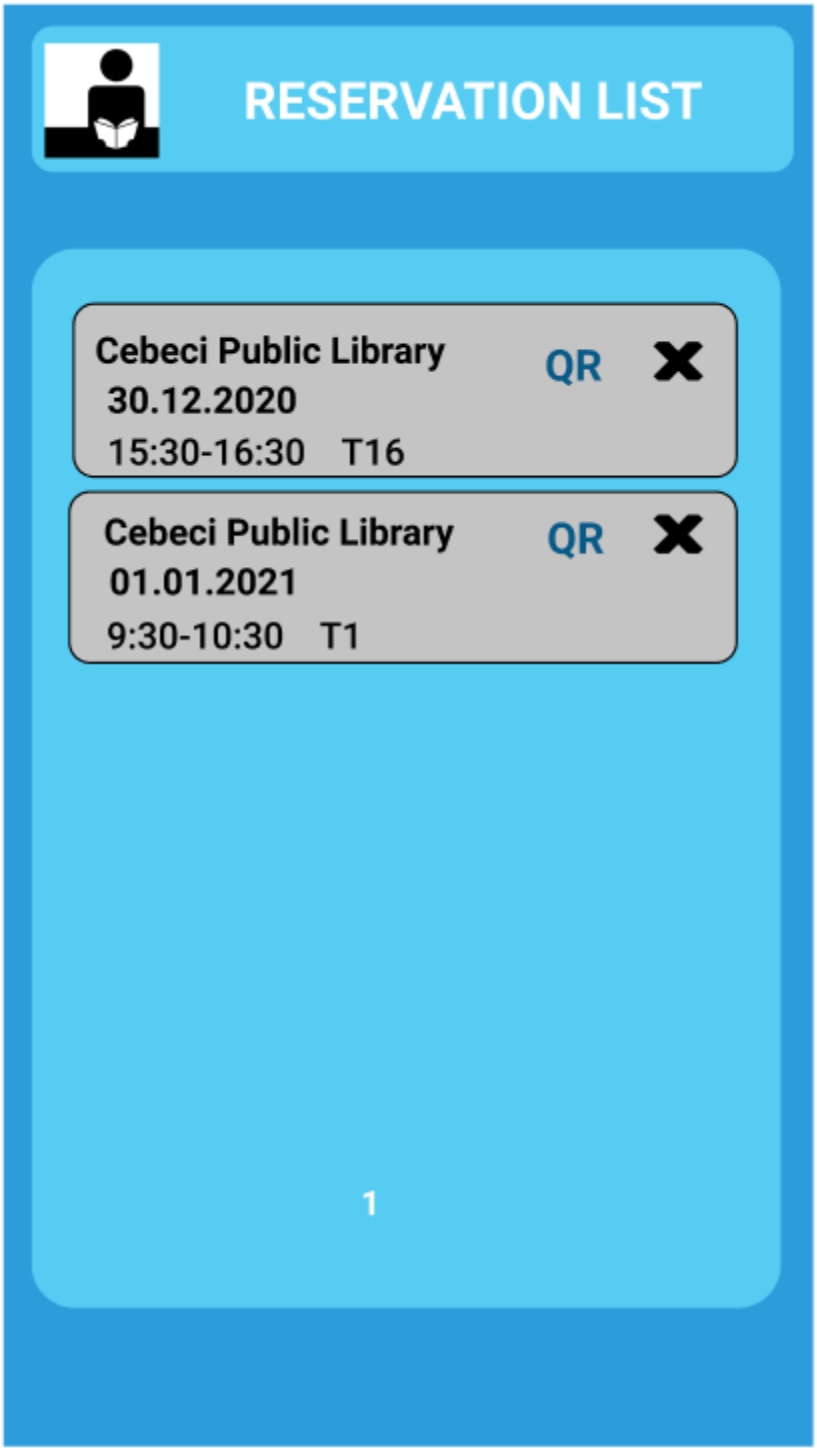



**Figure 33: Library Member - List Reservation UI**

#### 4.5.2.1.10. Library Member - QR Code Page

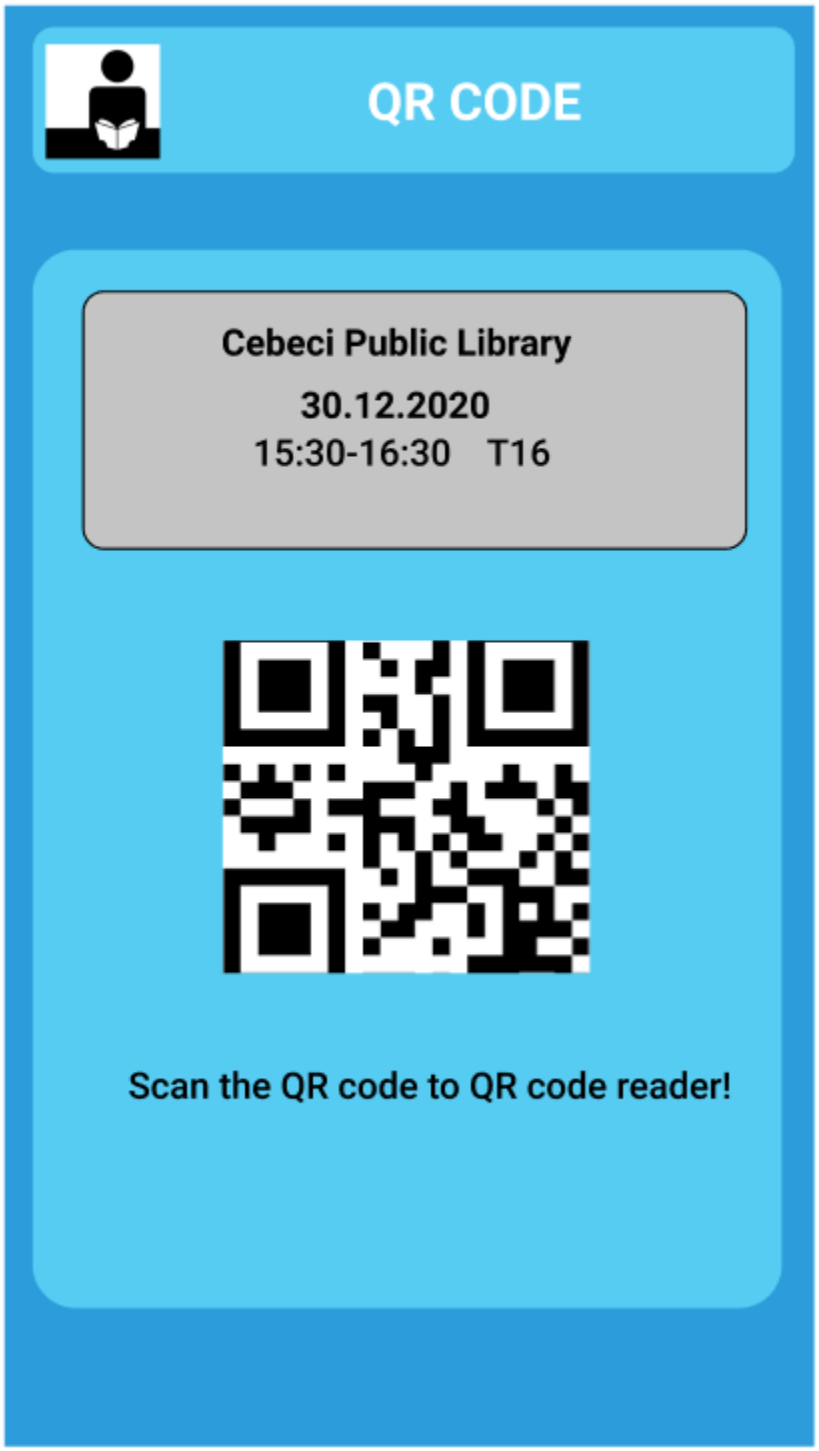



**Figure 34: Library Member - QR Code UI**

#### 4.5.2.1.11. Library Member - Cancel Reservation Page

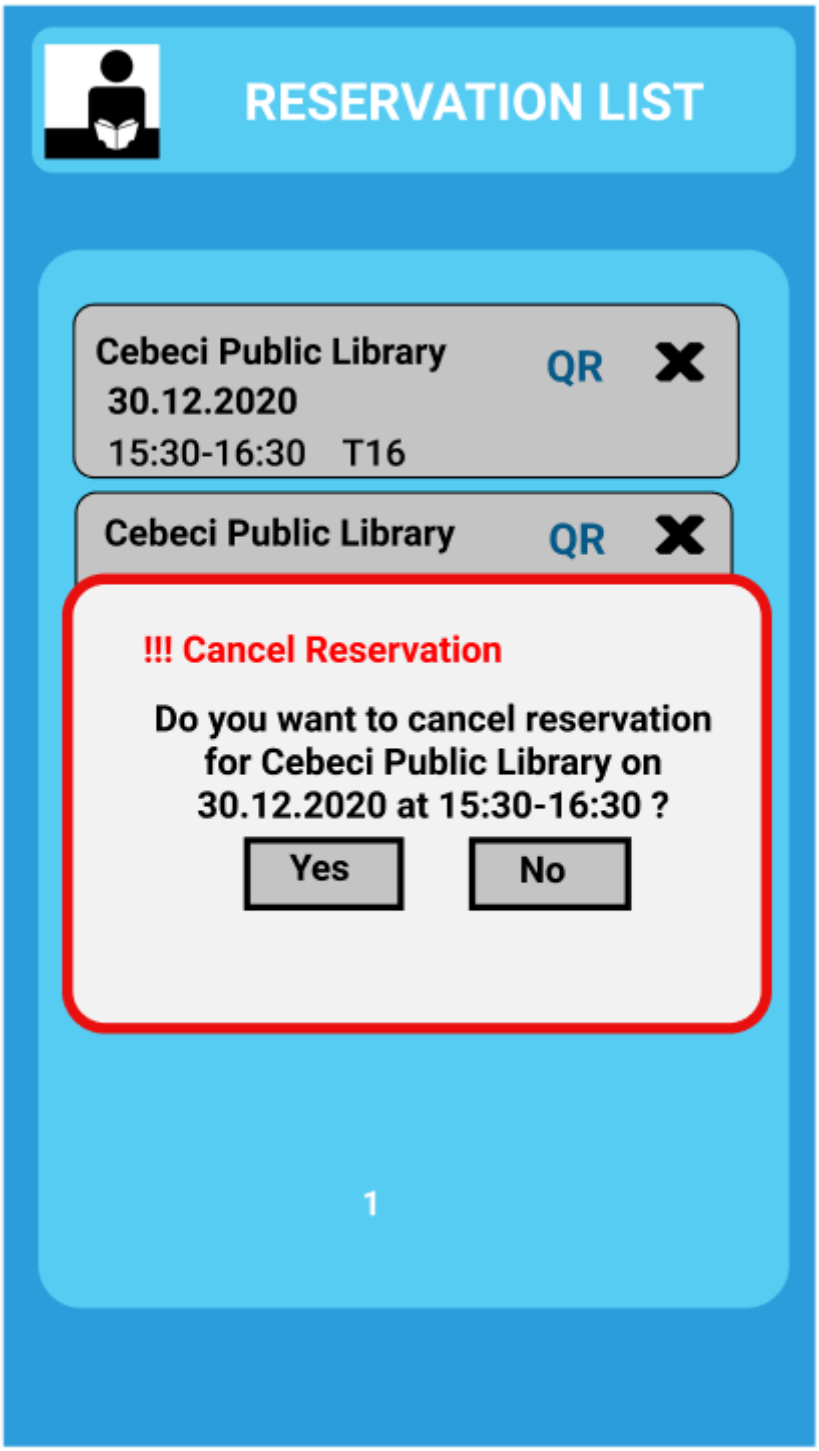



**Figure 35: Library Member - Cancel Reservation UI**

#### 4.5.2.1.12. Admin - Menu Page

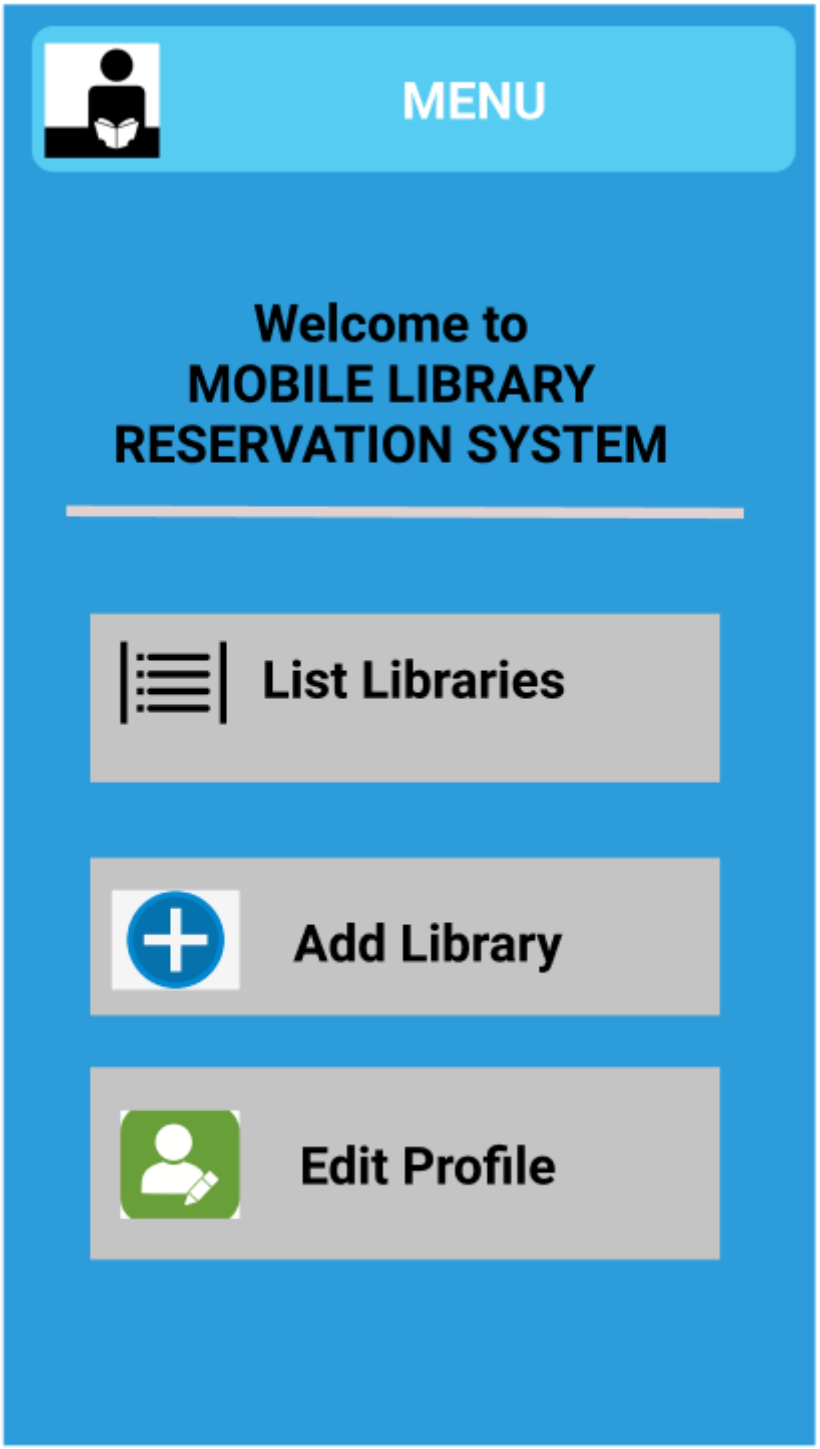



**Figure 36: Admin - Menu UI**

#### 4.5.2.1.13. Admin - List Libraries Page

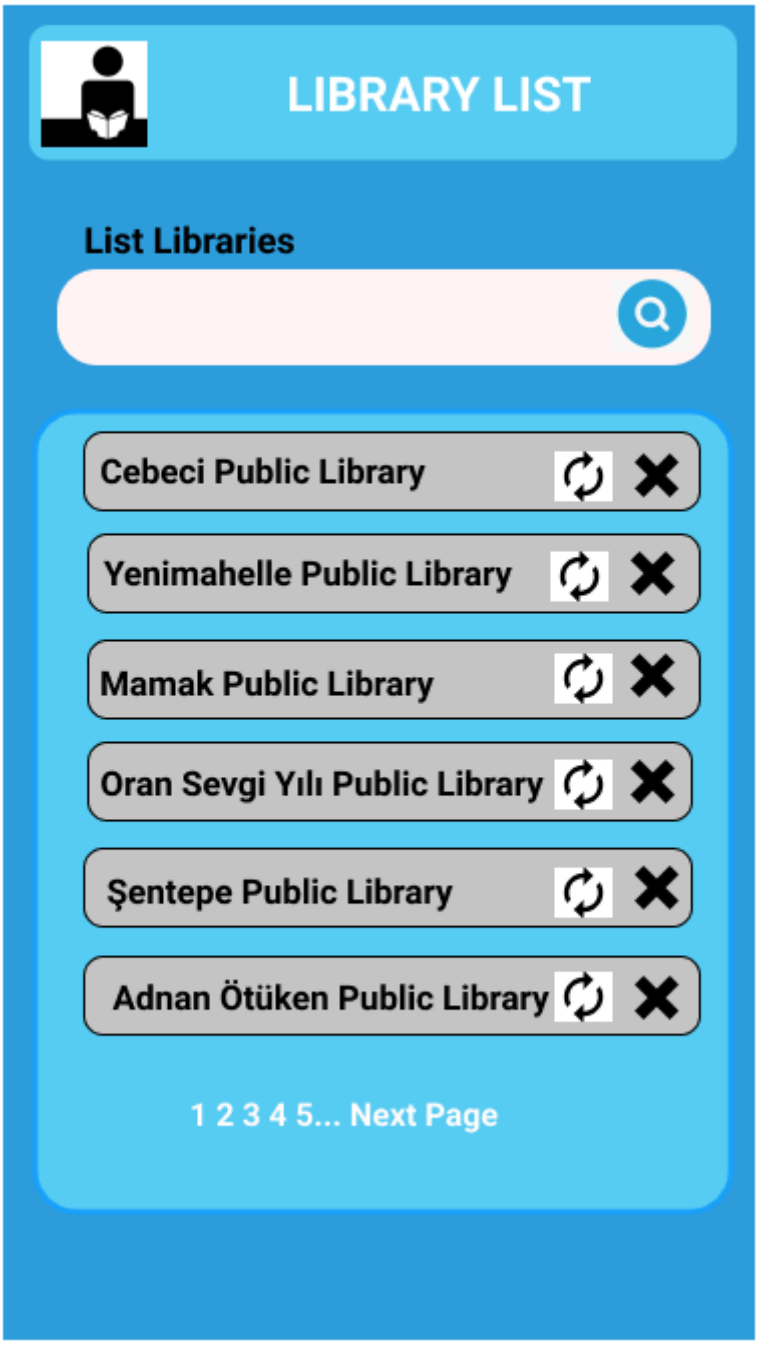



**Figure 37: Admin - List Libraries UI**

#### 4.5.2.1.14. Admin - Delete Library Page


**Figure 38: Admin - Delete Library Status UI**

#### 4.5.2.1.15. Admin - Change Library Status Page

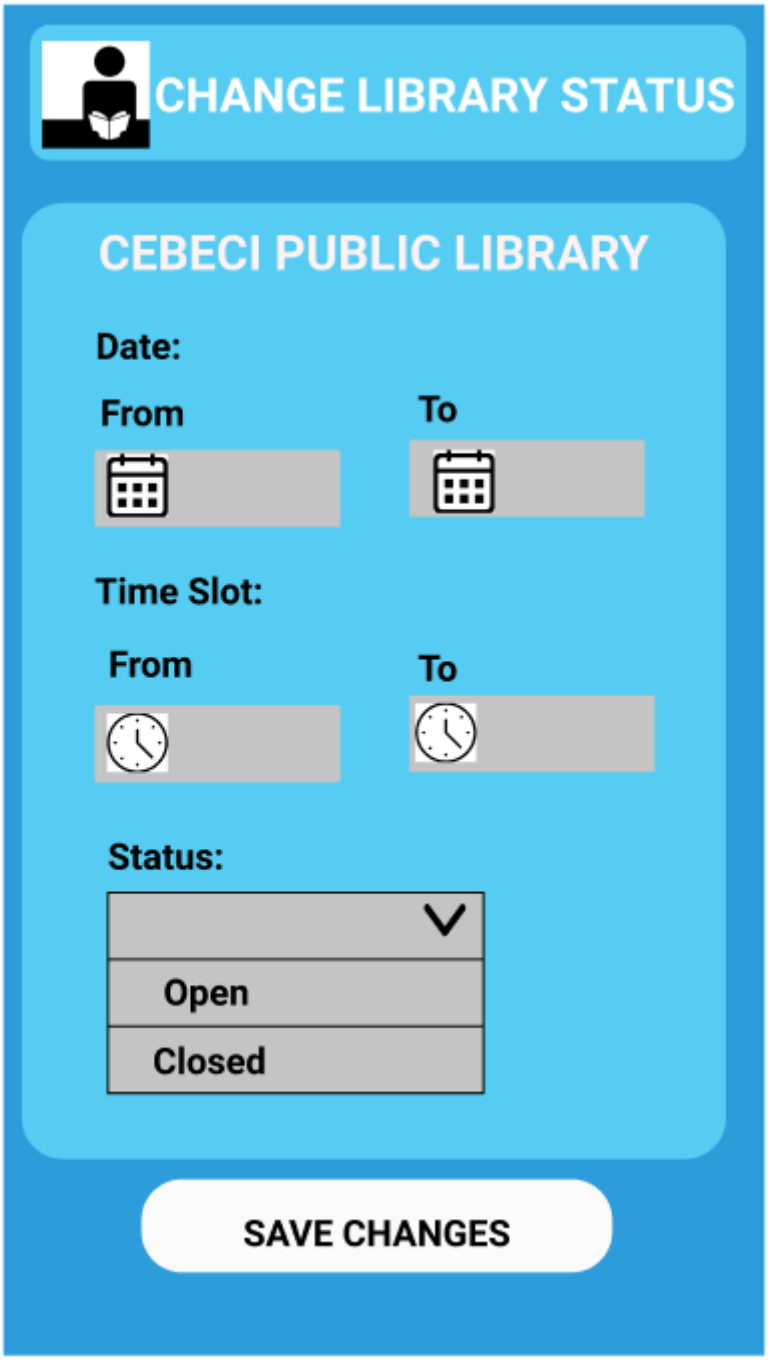



**Figure 39: Admin - Change Library Status UI**

#### 4.5.2.1.16. Admin - Add Library Page


**Figure 40: Admin - Add Library UI**

#### 4.5.2.1.17. Librarian - Menu

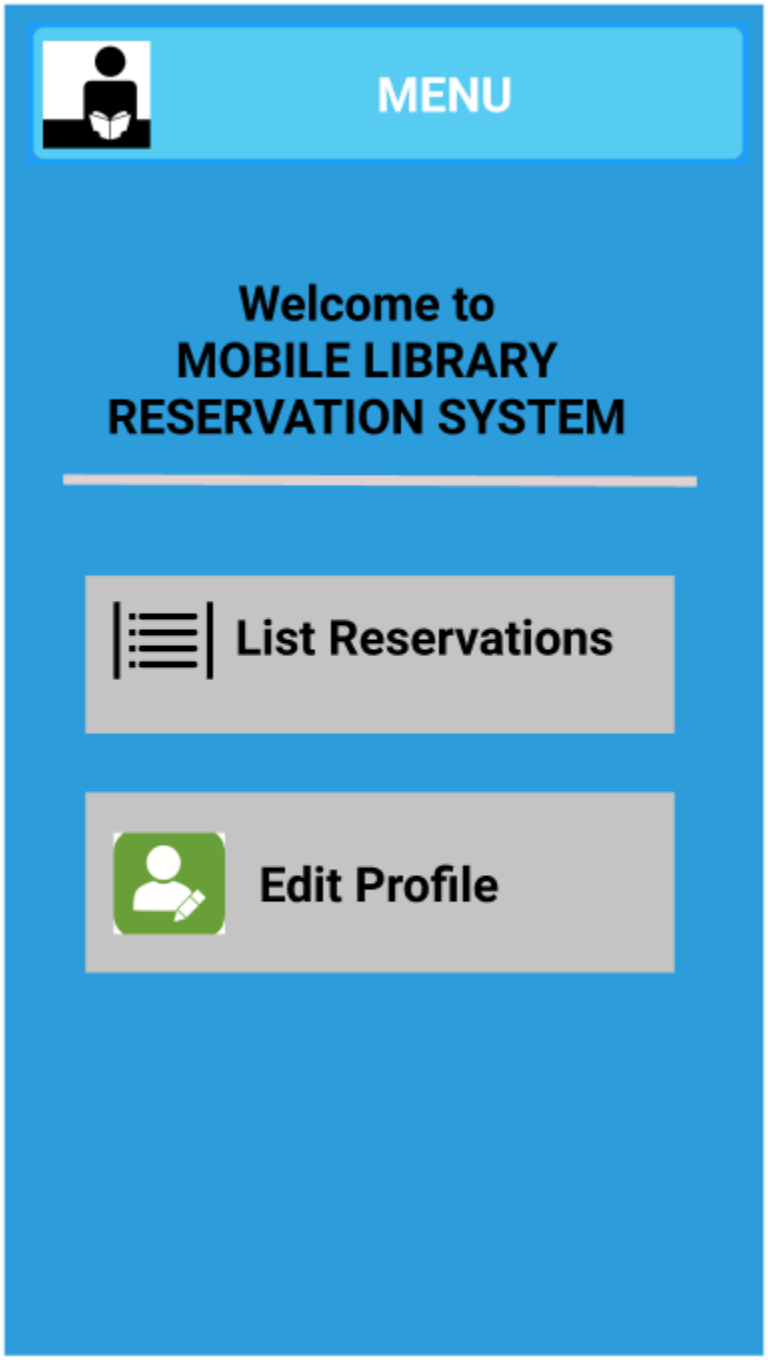
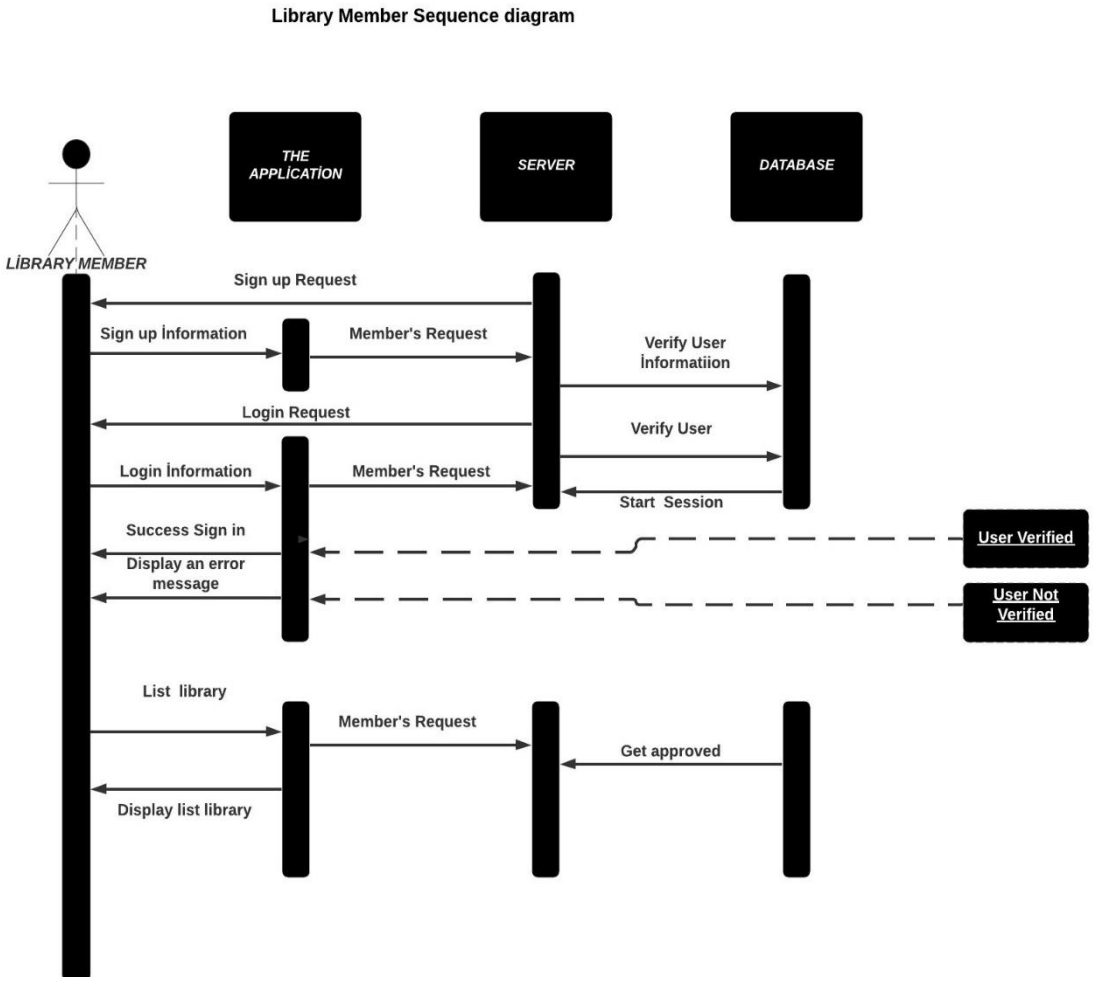



**Figure 41: Librarian - Menu UI**

# 4.6. PROCESS DESIGN

## 4.6.1. Sequence Diagrams

### 4.6.1.1. Library Member



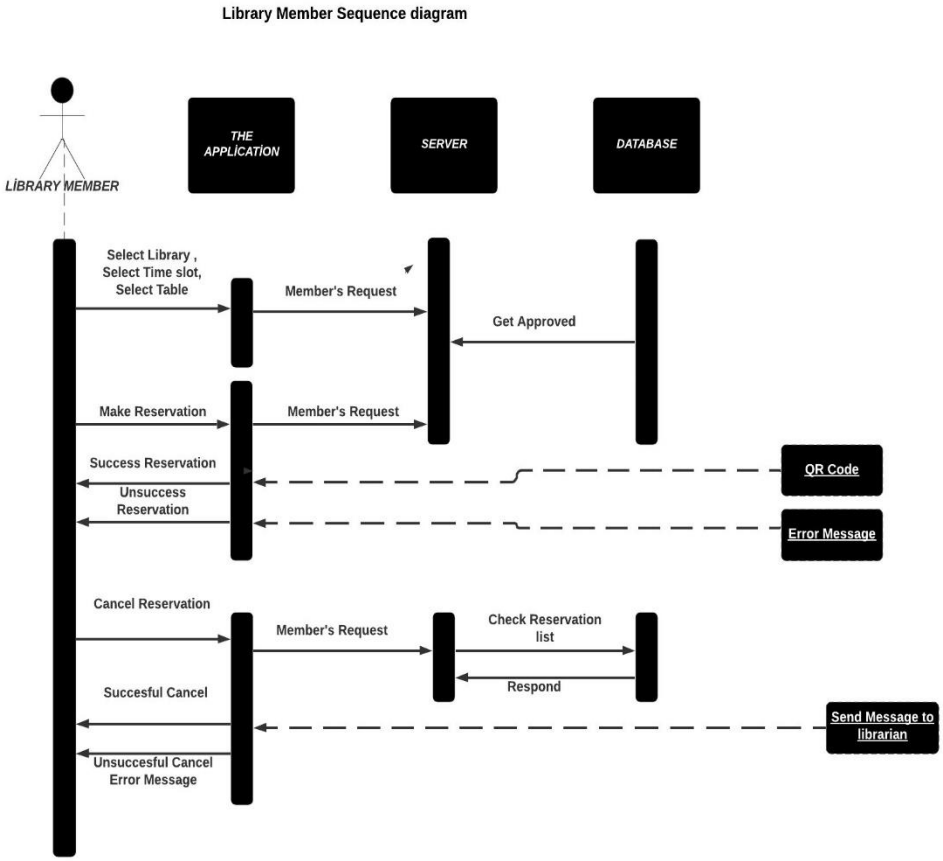



**Figure 42-43 : Library Member Sequence Diagram**

# 4.6.2.2. Librarian

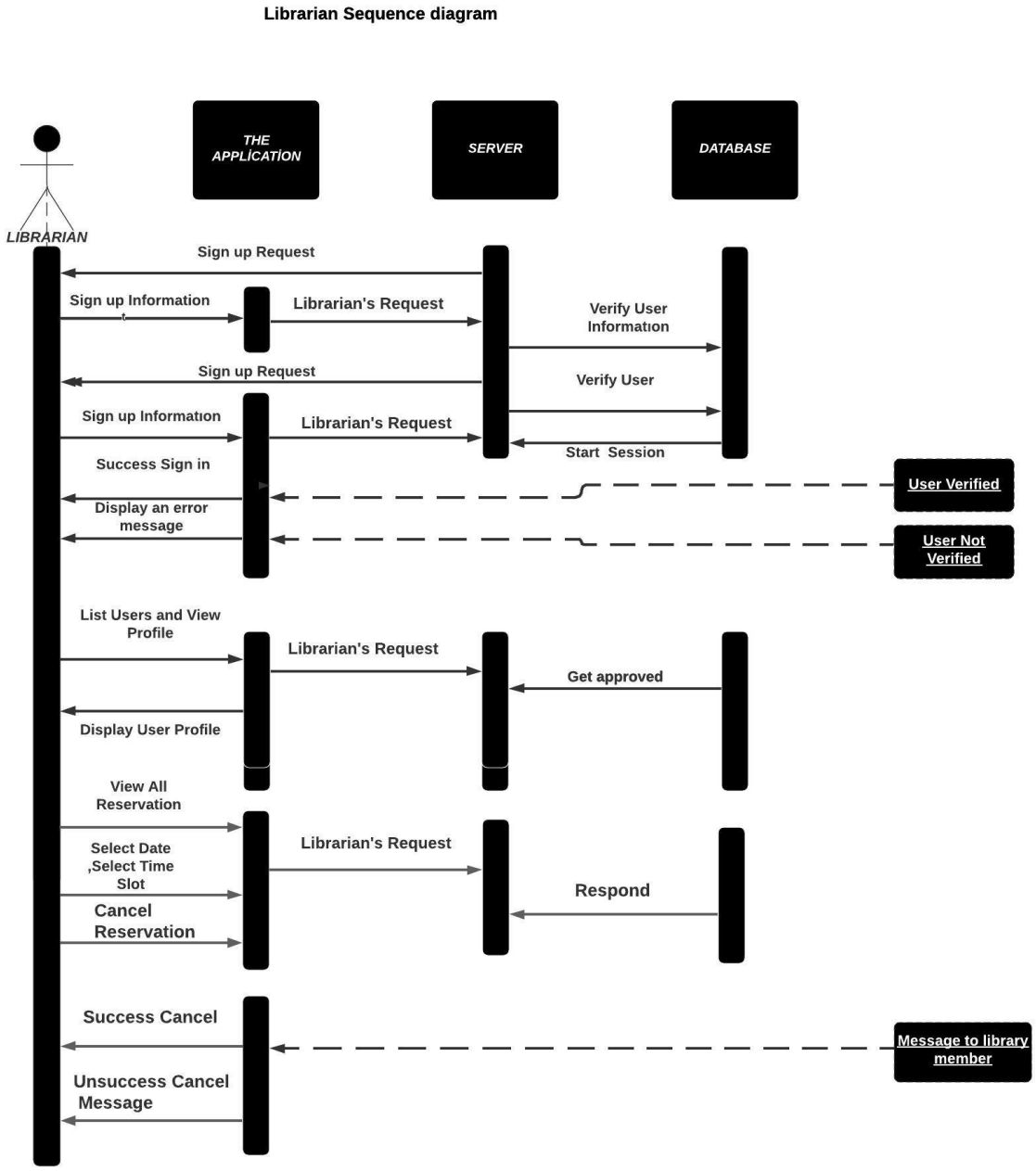



**Figure 44: Librarian Sequence Diagram**

## 4.6.2.3. Admin

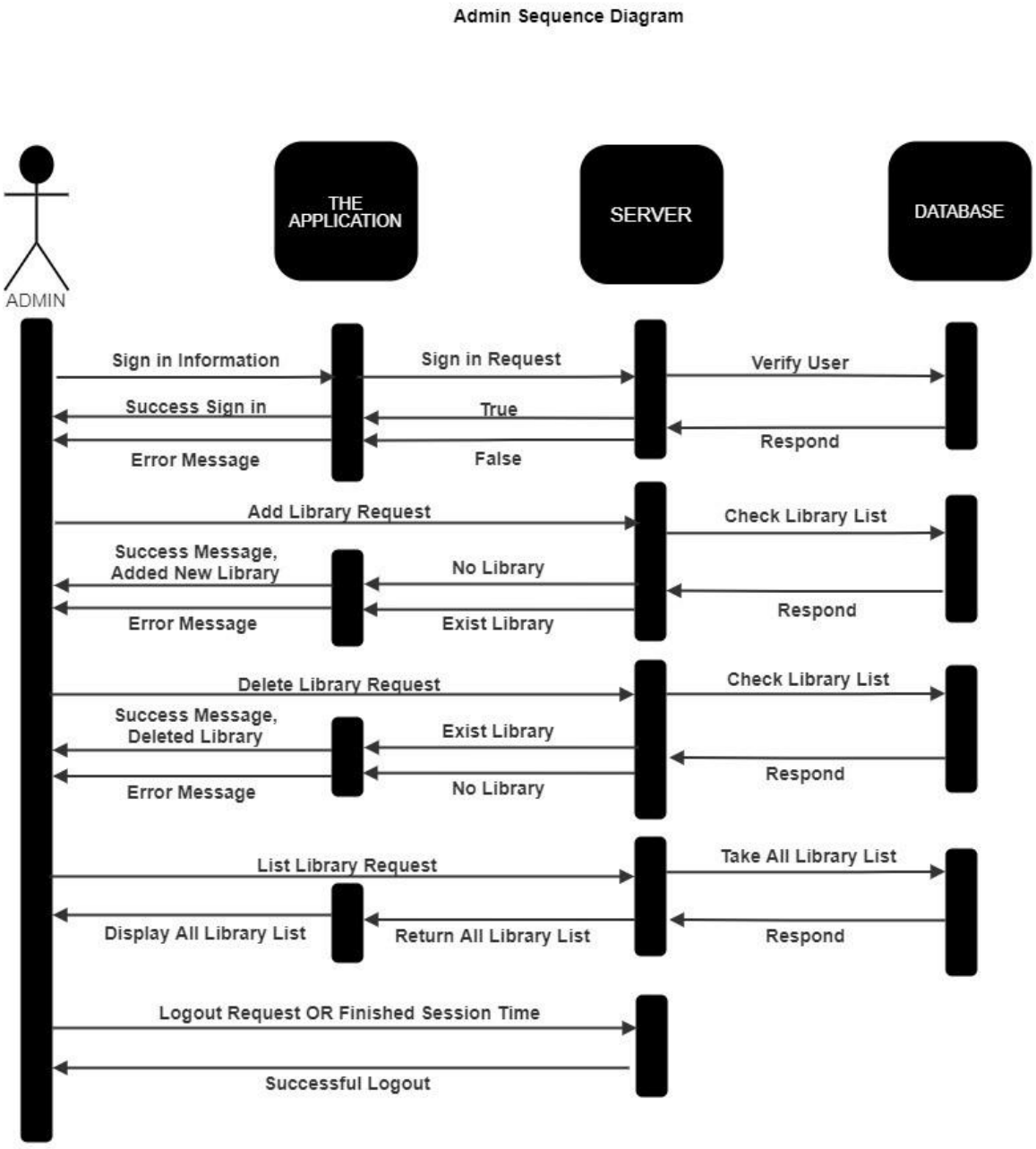



**Figure 45: Admin Sequence Diagram**

# 4.7. DATABASE DESIGN

## 4.7.1. ER Diagram

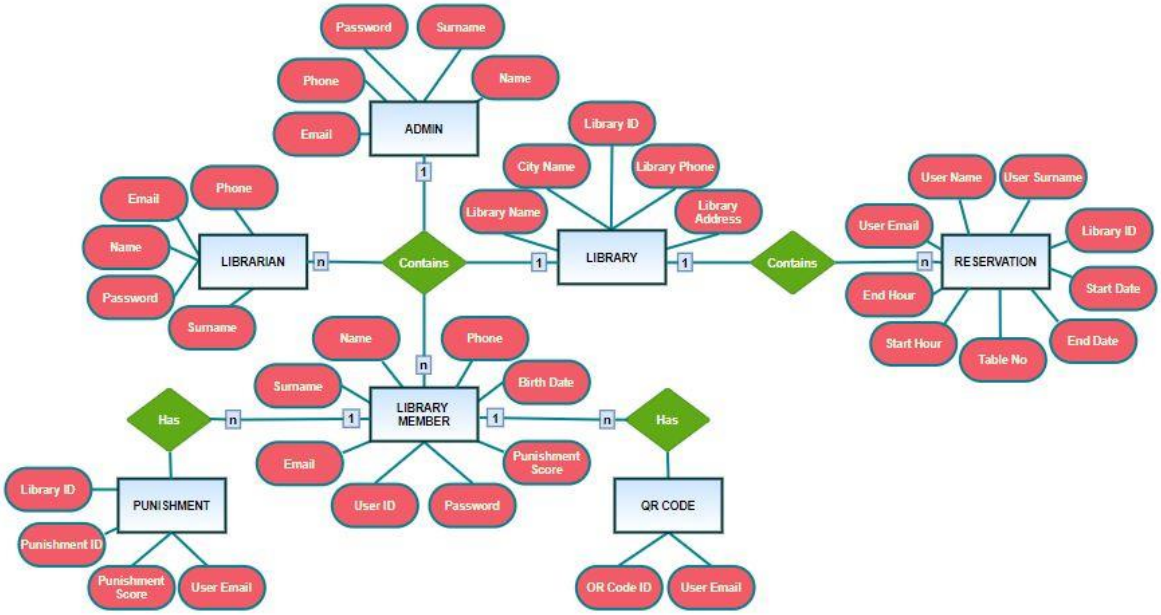



**Figure 46: ER Diagram**

## 4.7.2. Database Diagram

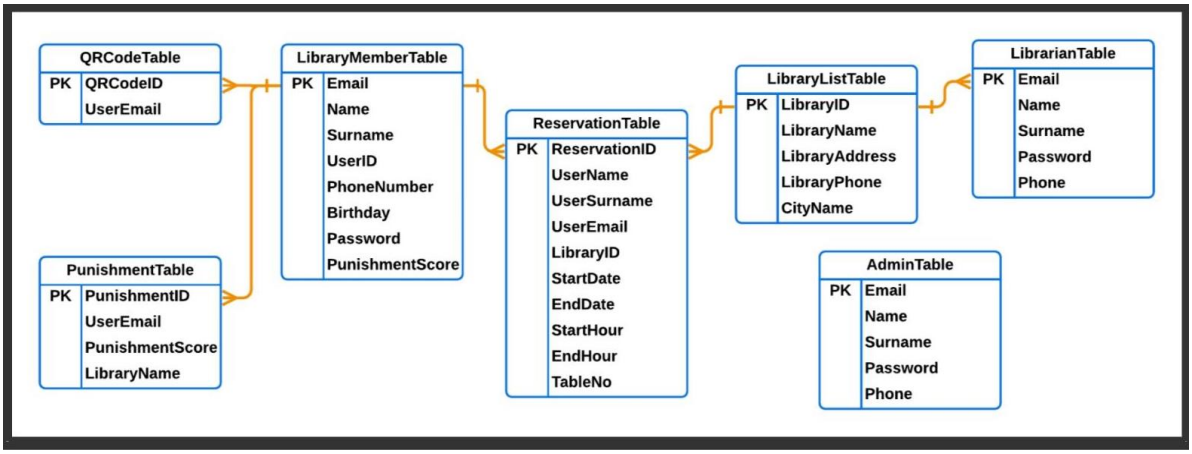



**Figure 47: Database Diagram**

# 5. CONCLUSION

We created LR, SRS and SDD documents for the project we will do in Ceng 407 course. We conducted a literature search on the LR document. We learned about similar projects and compared them with our project. We determined the roles of each user in the SRS document. In addition, we have explained the areas of use of the project in detail in this document. We designed special screens for users in the SDD document. We have explained the features on these user screens. We have designed various diagrams with functions that users can do on these screens. In addition, we have designed various diagrams in the code part of our project in this document. We are planning to implement our project in Ceng 408 course.

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