



**Palestine Technical University (Kadoorie)**  
**Faculty of Engineering and Technology**  
**Computer Systems Engineering**

**E-MEDICAL ANALYSIS LABORATORY SYSTEM**

**By:**

<b>Alia Abduljaleel</b>	<b>201911311</b>
<b>Batool Saleh</b>	<b>201911844</b>
<b>Raghad Suwan</b>	<b>201912704</b>
<b>Raja' Asad</b>	<b>201911051</b>

**Supervisor:**

**Dr. Mahmoud Moshref**

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## Acknowledgement

Praise be to Allah, and prayer and peace be upon the Messenger of Allah - may Allah's peace and blessings be upon him - Sayyid Al-Anam.

Despite the siege, the occupation and the difficult circumstances surrounding us, innovation and challenge have continued and will continue in our schools and universities, foremost among them the Palestinian Technical University - Kadoorie.

This warm lap has ensured for years that we have faced many difficulties, but in the end, we will reap the fruits of tiredness and staying up late. This is our modest work, which finally sees the light. We cannot help but express our sincere thanks to our dear university, represented by the distinguished administrative board and its professors in charge of its affairs.

Special in appreciation and gratitude to dear Doctor: Mahmoud Moshref who has provided us with our training and assistance and guidance. His continued dedication and effort have had a positive and effective impact. He has deep thanks and gratitude for his preference and supervision of this research. Allah is Conciliator

## ABSTRACT

Waiting for a long time for medical tests or receiving some ready results; More often some patients lost their medical tests after a certain period, Lack of patient's knowledge of the instructions before the test. All these are problems for a normal lab. **Our Electronic Medical Analysis Lab System** will be like an **online Medical Management service provider with easy-to-use** customizable options. The system is **accessible from anywhere**, it will basically **decrease the manual work** and **improve the quality** of maintaining records. Our platform **collects a patient's history** in one place, and **saves your time and effort by booking and showing your ready results** online by using our application or our website. Finally, it **provides the necessary instructions** before any medical test. After long reading, our goal is about **making our platform the most widespread lab system in Palestine**, distributed to all laboratories, hospitals, and clinics to track patients' treatment in an efficient way. Surely, we **verified all the standards** in our EMR system **to make our platform HIPAA fits** for the **highest security**.

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## CHAPTER 1: INTRODUCTION

### 1.1 Problem Statement

- Patients waiting for a long time for medical tests or receiving their ready results, which wastes their time.
- More often some patients lost their medical tests after a certain period
- patients do not know their appointments before coming to the lab
- Lack of patient's knowledge of the instructions before the test

### 1.2 Objectives

Our project aims to provide an integrated platform for E-medical analysis to achieve some goals:

- To deliver the medical results in an easier and faster way to the patient without hard work and saving time and effort (quick response and best results).
- To provide a consistent and reliable database that keeps patients' medical data available at any time labs and patients want to check a patient's history.
- To give a space of privacy and confidence accessing data by giving a private account for each patient.
- To Provide a lot of information about medical tests.

### 1.3 The Target Groups of The Project

- Medical laboratories
- Health centers
- Patients who want to do medical analysis.

## CHAPTER 2: PRELIMINARY LITERATURE REVIEW

Electronic medical record (EMR) systems, defined as an electronic record of health-related information that can be created, gathered, managed, and consulted by authorized clinicians and staff within one health care organization<sup>[3]</sup>, or USF Health defines it as digital equivalent of paper records, or charts at a clinician's office<sup>[10]</sup>. And in Capterra Article helps us to use basic definitions like medical laboratory software and its benefits and the typical features of medical lab software<sup>[6]</sup>.

First things first, we must mention the advantages of the e-medical analysis laboratory system. like, accessibility to the patient's data in an easy-to-understand form, schedule appointments and meetings, the patients can receive reminders and notifications about billing and appointments<sup>[5]</sup>. And according to (Capterra) EMR will track samples in a more efficient way, organize inventory management<sup>[6]</sup>.

Essentially, governments have become increasingly interested in E-Medical analysis laboratory system, GOV.SA laboratory results is one of the best, high quality, and efficiency platforms that provide these services. This platform inspired us with a lot of features for our project. First, it allows the user to book appointments for him in primary health care centers through the "Maed" website and application available in Apple and Google Play stores. Second, The provided electronic service, which enables patients to view the details of laboratory tests and display their results at any time they want. Unfortunately, this platform is not available to everyone, It is only intended for citizens and residents of the Kingdom of Saudi Arabia. As a result, we will design a global platform that allows those who do not have citizenship or residency to use the program in their passport as an example<sup>[8]</sup>.

Also in Capterra Article discuss the considerations when designing a medical laboratory software platform like security and usability. Finally, guiding us to cloud-based deployment becomes the preferred choice<sup>[6]</sup>.

"Electronic Mother and Child Health App" is a mobile application for the UNRWA. It is a medical analysis system for pregnant women, shows the results of the analysis, and sends them to the specialist gynecologist via email, one of its main features it sends instructions to the pregnant woman before the analysis. This application helps us to add instructions for the medical tests tab to our platform<sup>[9]</sup>. After Searching for a model that simulated our platform. We found this website Medical Laboratory Management System using PHP MySQL<sup>[2]</sup>, the program aims to run a medical analysis center through the Internet with the help of PHP language, but we defect the user interfaces are numerous and complex for any new user. Our goal is to reduce symbols and make data accessible to the user.

On the other hand, few studies have focused on the barriers to Electronic Medical Record Systems (EMR) this paper indicates to some difficulties we will face. First, the sources of electronic patient information that do exist (e.g., laboratory data, pharmacy data, and physician dictation) reside on many isolated islands that have been very difficult to bridge. Second, we have not quite figured out how to capture the data from the physician in a structured and computer-understandable form. The solution to the first problem, that of merging data from many sources into one EMR, lies in standards that provide the bridges to the many islands of electronic patient data so the data can inexpensively be combined into an electronic medical record, for the second we will need efficient capture of physician gathered information -some of it in a computer-understandable format<sup>[1]</sup>.

In light of this, Pourasghar and Malekafzali (2008) were designed to identify the factors which influence the quality of medical documentation when paper-based records are replaced with electronic records. The results be like the electronic medical records system can be a good substitute for the paper-based medical records system. However, some factors such as low physician acceptance of the electronic medical record system, lack of administrative mechanisms (for instance supervision, neglecting physicians and/or nurses in the development and implementation phases, and also continuous training), availability of hardware as well as lack of specific software features can negatively affect transition from a paper-based system to an electronic system<sup>[7]</sup>.

We should be aware of how to make our EMR System Health Insurance Portability and Accountability Act (HIPAA) Compliant<sup>[5]</sup>. This means that they are responsible for protecting the patient's medical history. The HIPAA rules should look for an EHR that offers these features. First, should use access control measures, such as passwords. Second, encryption for the data it contains. Third, audit trail the EHR should be able to record which user accesses which information, as well as record changes, and when they were made. Fourth, Security updates<sup>[4]</sup>.

After huge reading, our goal crystallized to make our platform the most widespread in Palestine, distributed to all laboratories, hospitals, and clinics to track patients' treatment in an efficient way. Surly we will verify all the standards in our EMR system to make our platform HIPAA compliant.



## CHAPTER 3: METHODOLOGY, REQUERMENTS

### 3.1 Process Model

Software model used: Reuse-Oriented software engineering. with Incremental Model.

Why These Models?

- Reuse-Oriented Model because we will need some classes and implementations from previous successful projects and efficiency is high.
- Incremental Model because the system will be developed incrementally with amount of prototypes, more flexible to use and less expensive to change requirements and It is easier to test and debug.

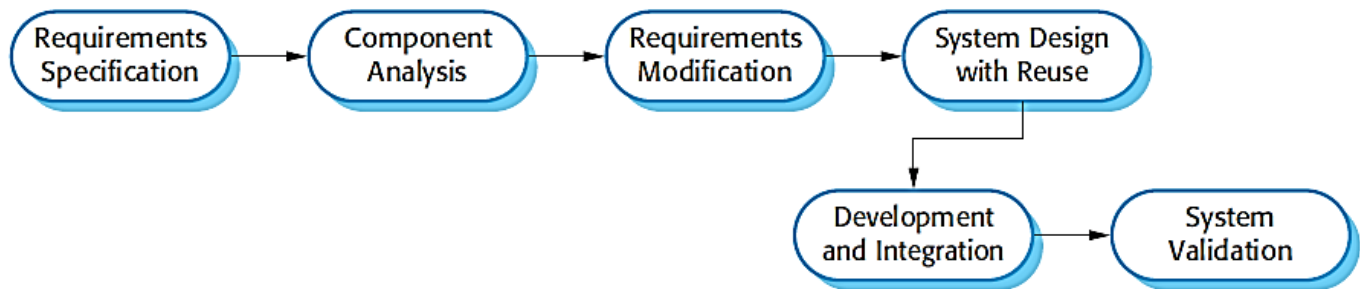


Figure 3.1 Reuse-Oriented software engineering

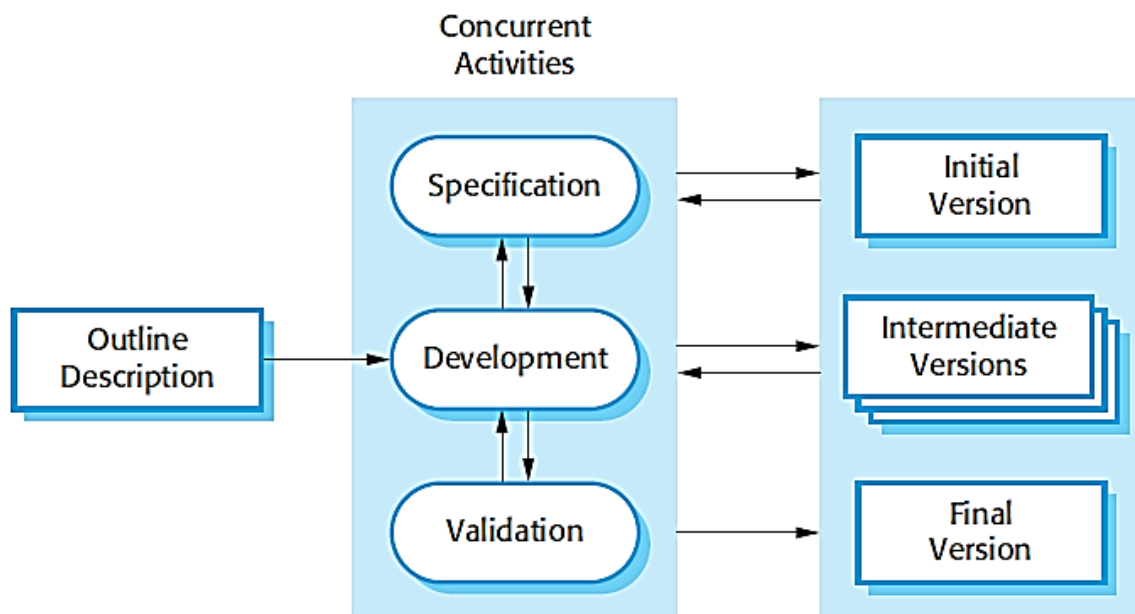


Figure 3.2 Incremental software engineering

## 3.2 Requirements

### 3.2.1 Functional Requirements (F.R.)

#### - User:

1. Knowing the **available analysis dates and the possibility of booking** an appointment in the reservation list.
2. The possibility of **knowing the dates of his analyzes** with the **possibility of canceling them** from the list of appointments.
3. After booking, the **user can see the instructions for each analysis** through the instructions list.
4. The user can **see the results** of the analyzes he performed, **share them, save them** on his device, and print them from the list of the analysis results.
5. If the results of the analysis are released, **the user receives an SMS message announcing** the results.

#### - Admin:

1. The administrator can **add new users**, give them a **unique number** (be it an ID number or a passport) and **password**, and **modify it or remove his account**.
2. The administrator **can see the appointments booked** for each type of analysis from the list of appointments.
3. **Enters the results** of the analysis for each user by the id number.

#### - System:

1. Giving **permissions to login** to the correct account by checking the authorization and authentication.
2. Reservations that meet the maximum limit will be **closed** and cannot be reserved.
3. **Sending an SMS** to the user's mobile in the event that the admin filled out the analysis and sent it to the user.

### 3.2.2 Non-Functional Requirements (N.F.R.)

#### ▪ Capacity

- The server should be loaded up to 90% utilization without any degradation in response time.

- Efficiency

- System Capacity Page size must be less than 10MB.
- The time to process any web server request should consume no more than 100ms of CPU time on cloud.

- Scalability

- Average response times for the second day should be less than 10% higher than the first day.
- Within a working day, the coefficient of variation for response time should be no more than 20%.

- security

- Our software system contains a login screen through the user number and a password that is kept in a protected database to ensure that users do not interfere with each other.
- All user data is encrypted with hard-to-decipher ciphers in order to ensure that the user does not leak his personal data (analysis, diseases or private information).

- Portability

- The system can be used by the user on several systems and devices. It works on [iOS](#) and [Android](#) devices and works on [web pages](#).

- Performance

- The system guarantees a peak business throughput of 5 widgets per second.
- Business peak synchronization 1000 users at the same time.
- Server-side Response Time must be less than 1.5 seconds, 95% of the time
- Client-side Response Time to Interact should be less than 2.0 seconds, 95% of the time

- Usability Requirement

- Any user can use the program regardless of age for the ease of interface and simplicity of use.
- Our system provides both Arabic and English languages.

## CHAPTER 4: SOFTWARE DIAGRAMS

### 4.1 SYSTEM DIAGRAM

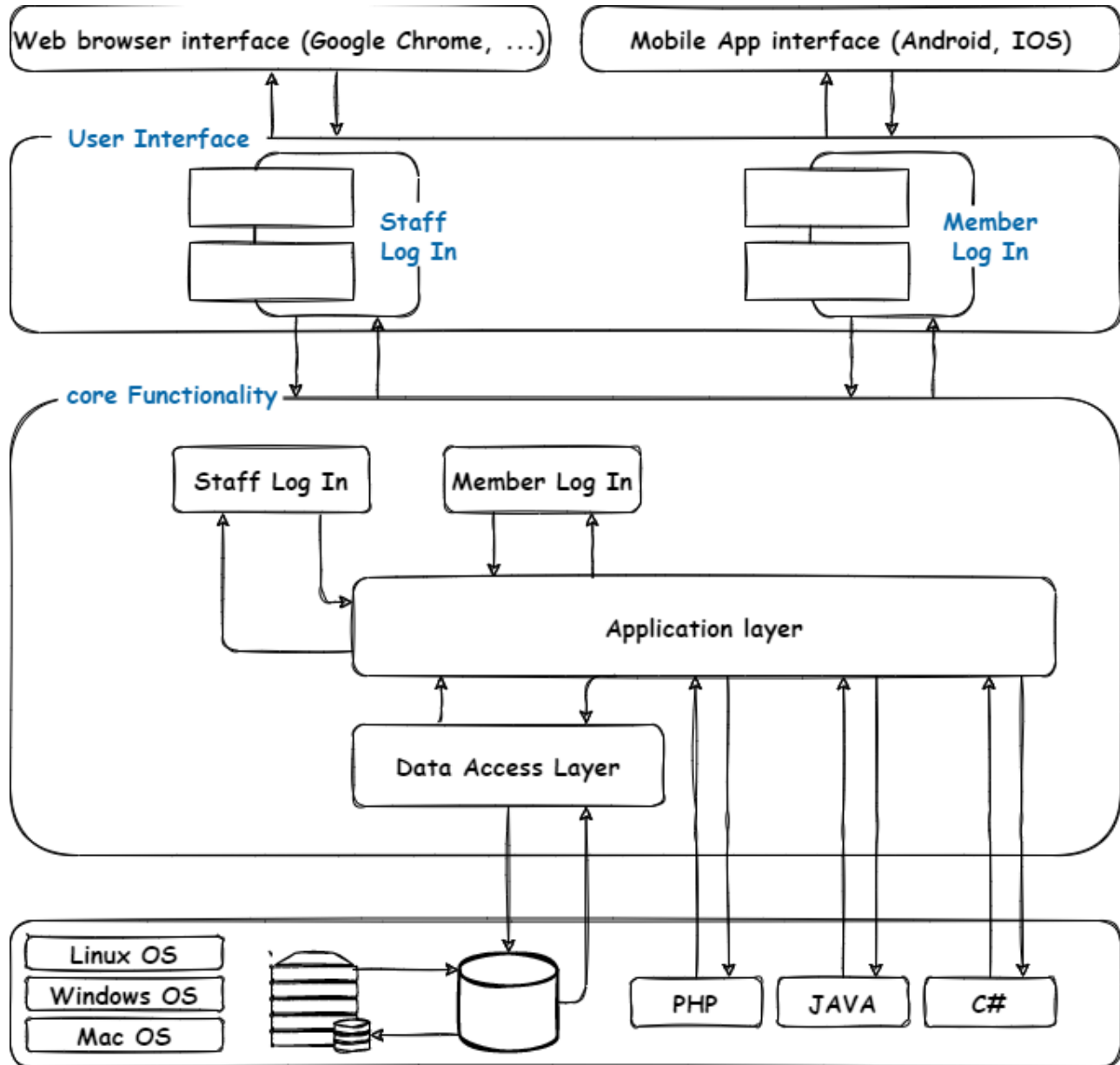


Fig 4.1 System Diagram

## 4.2 USE CASE DIAGRAM

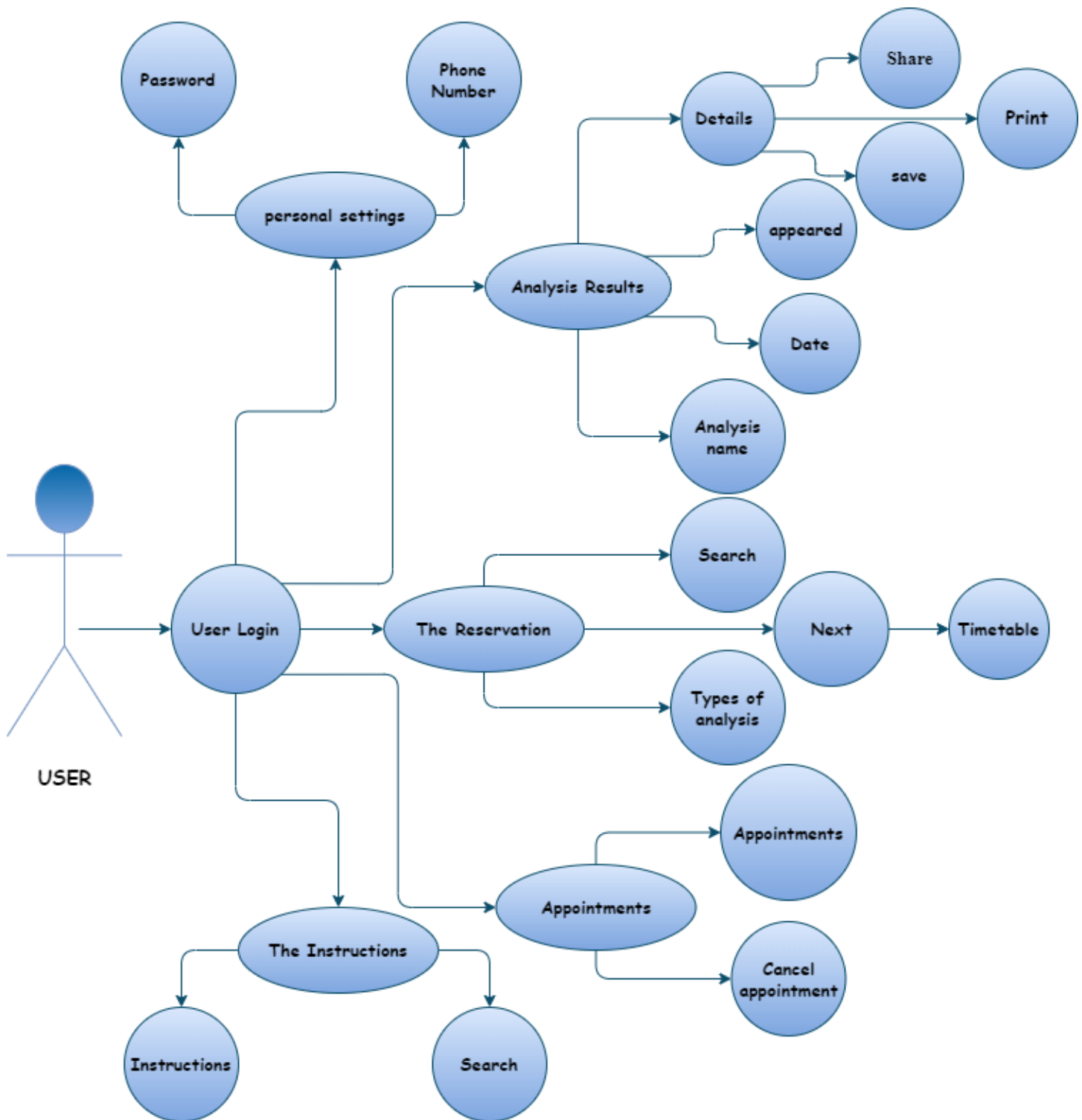


Fig 4.2: User Use Case Diagram

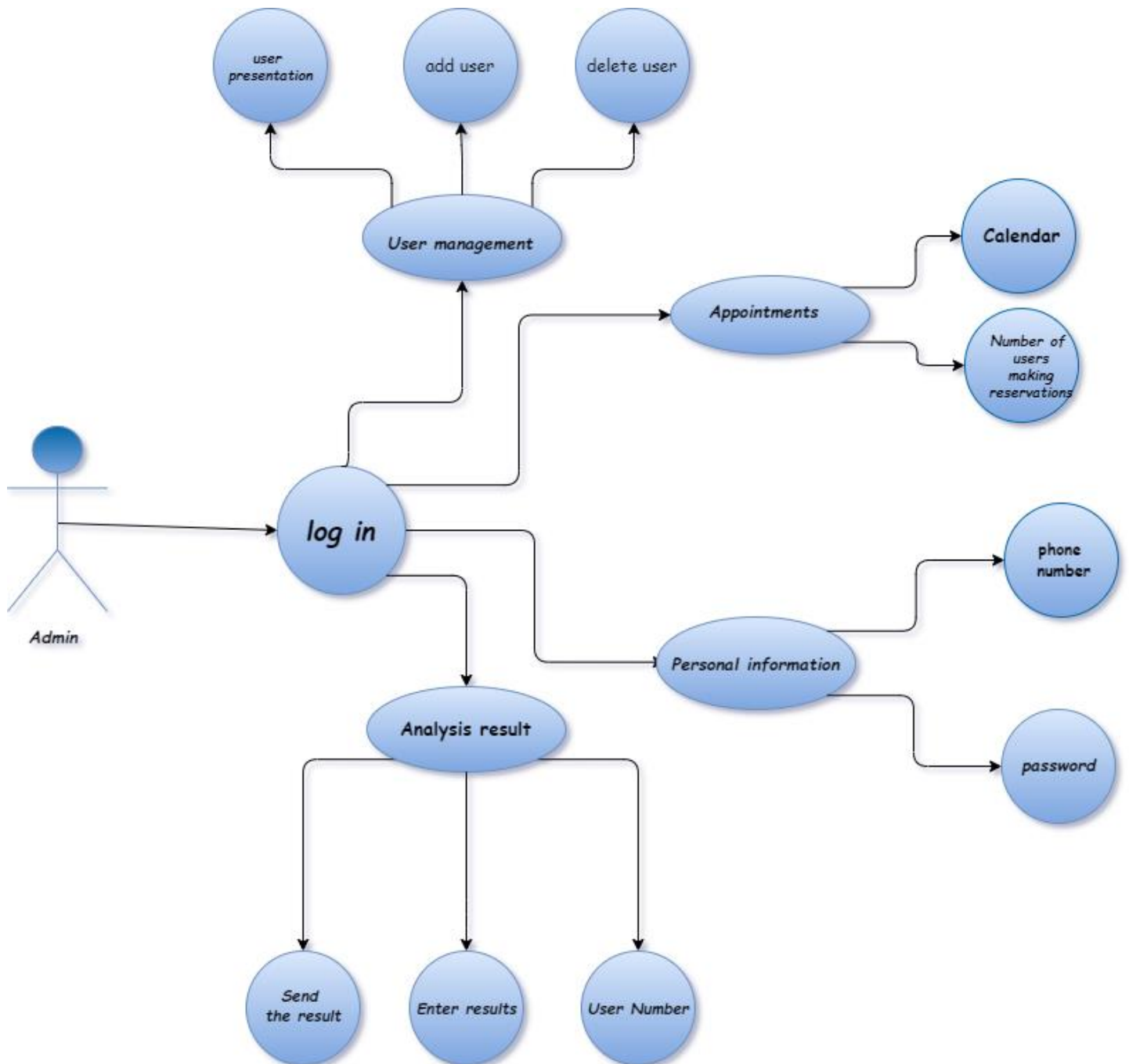


Fig 4.3: Admin Use Case Diagram

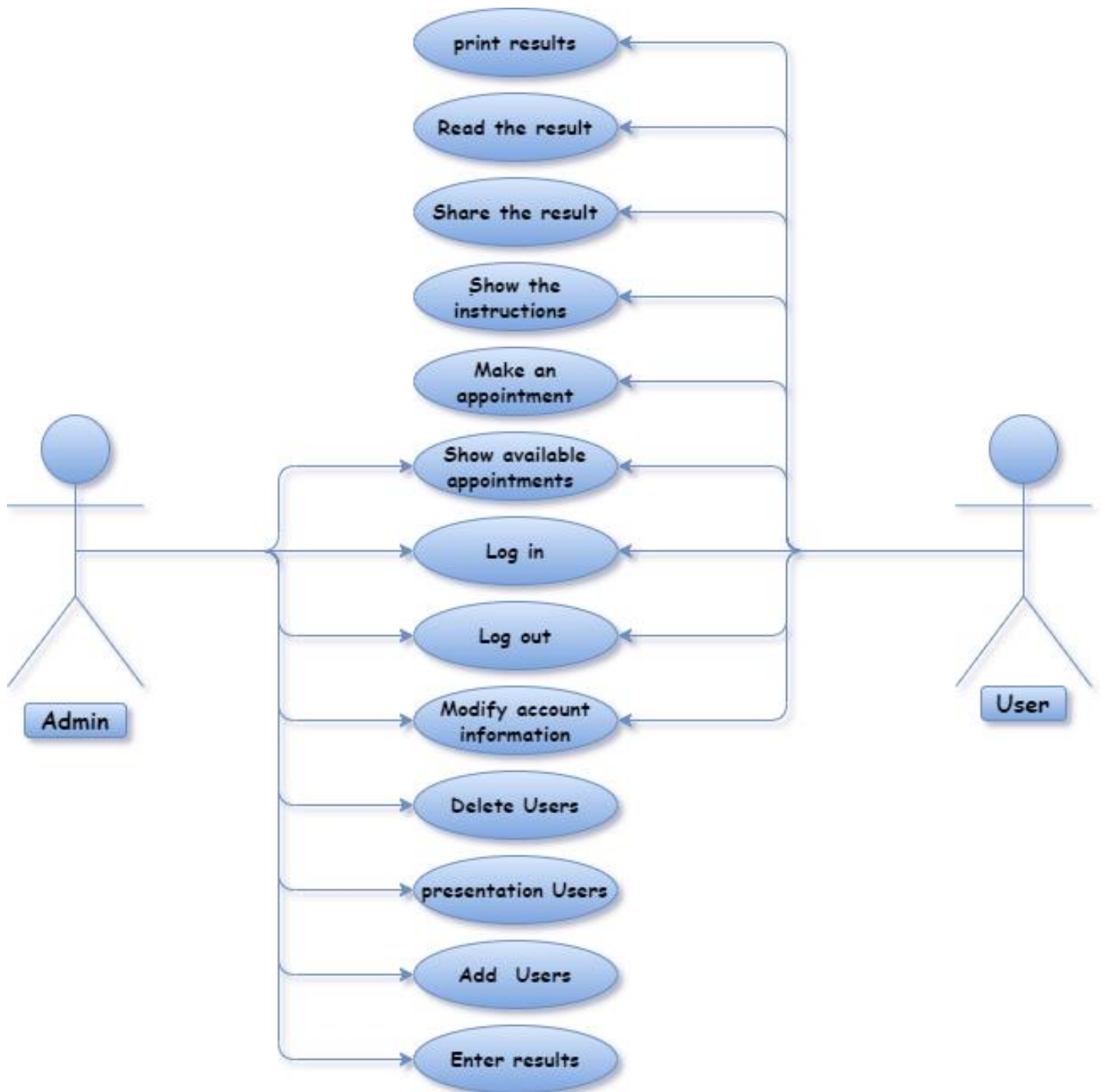


Fig 4.4: Use Case Diagram

### 4.3 SEQUENCE DIAGRAM

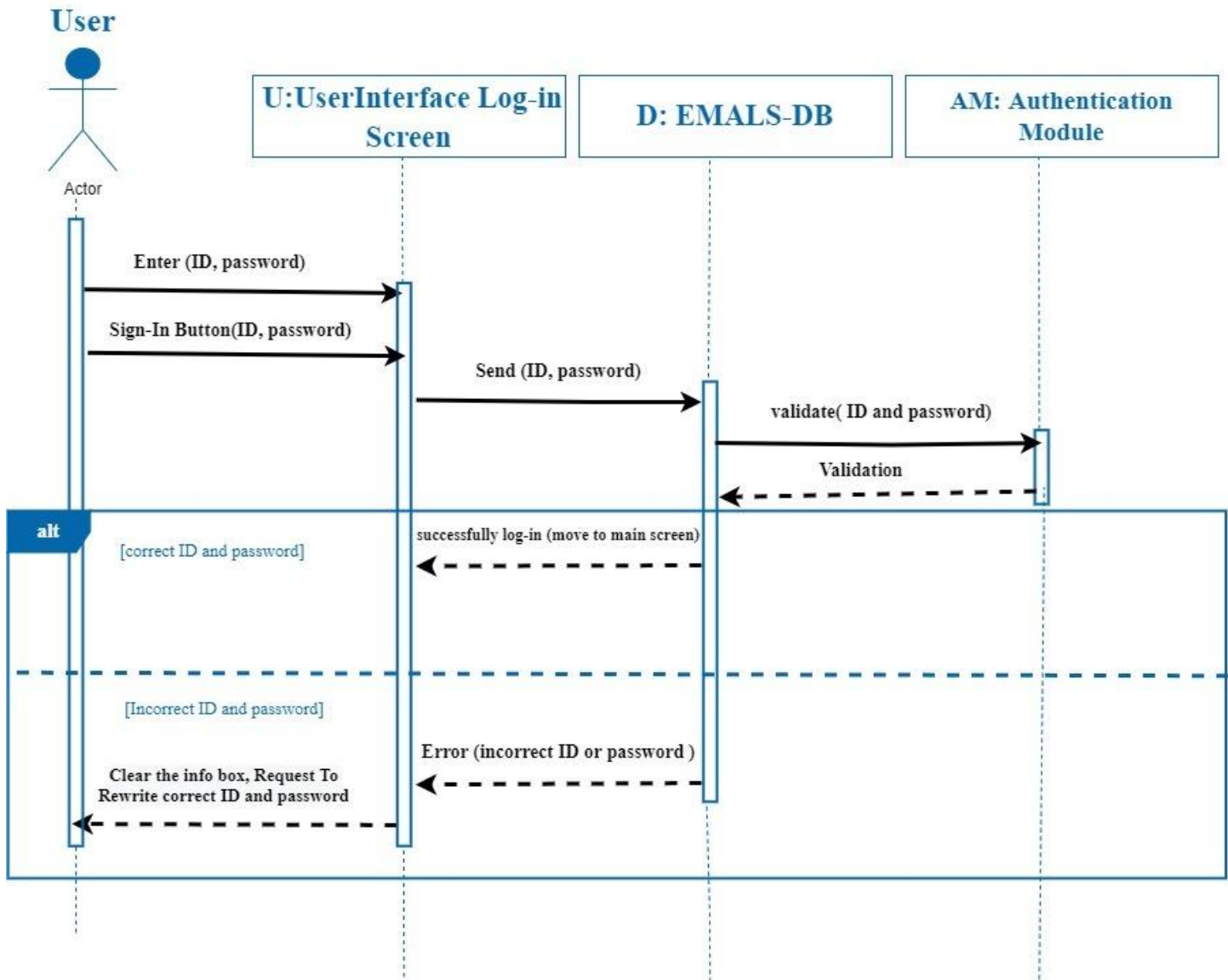


Fig 4.5: Sign-In Sequence Diagram



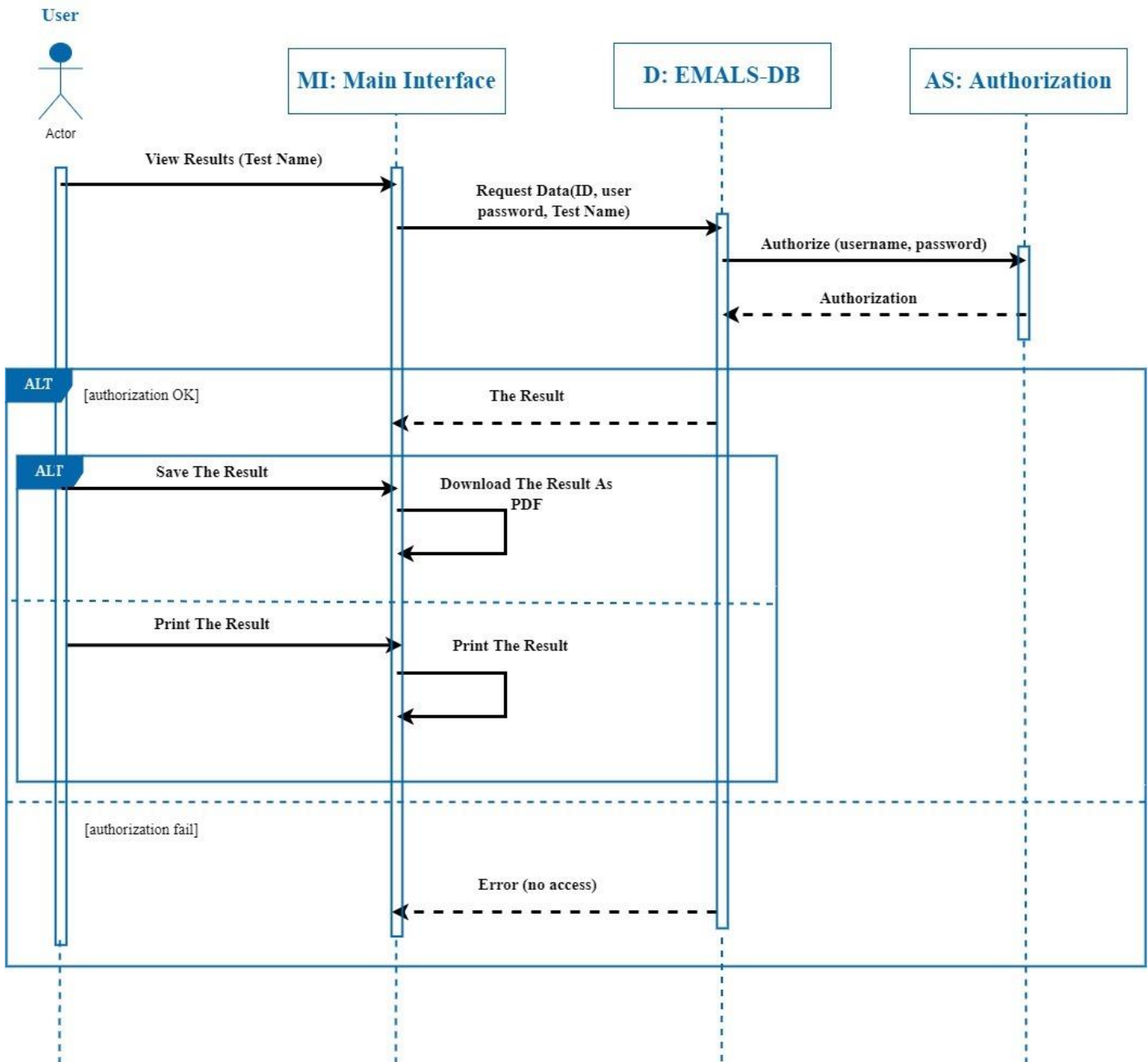


Fig 4.6: View the Result Sequence Diagram

## 4.4 CLASS DIAGRAM

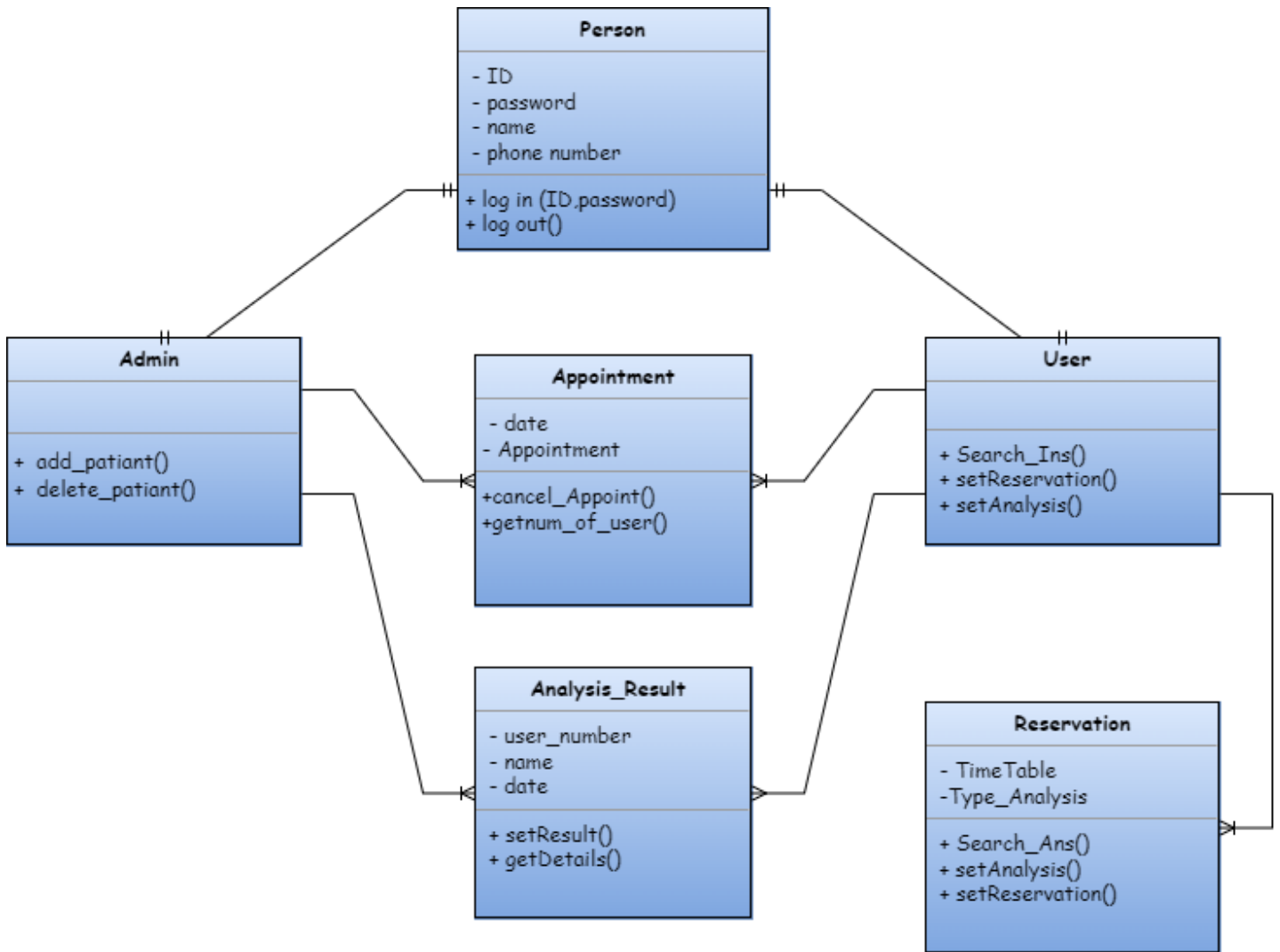


Fig 4.7: Class Diagram

## CHAPTER 5: USER INTERFACES

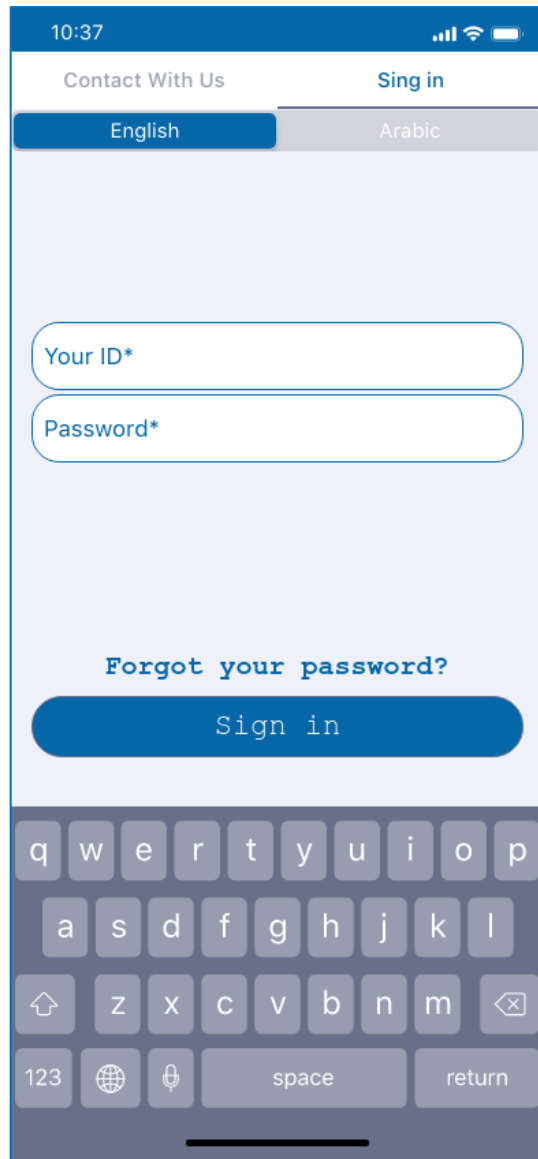


Fig 5.1: Sign-in Screen

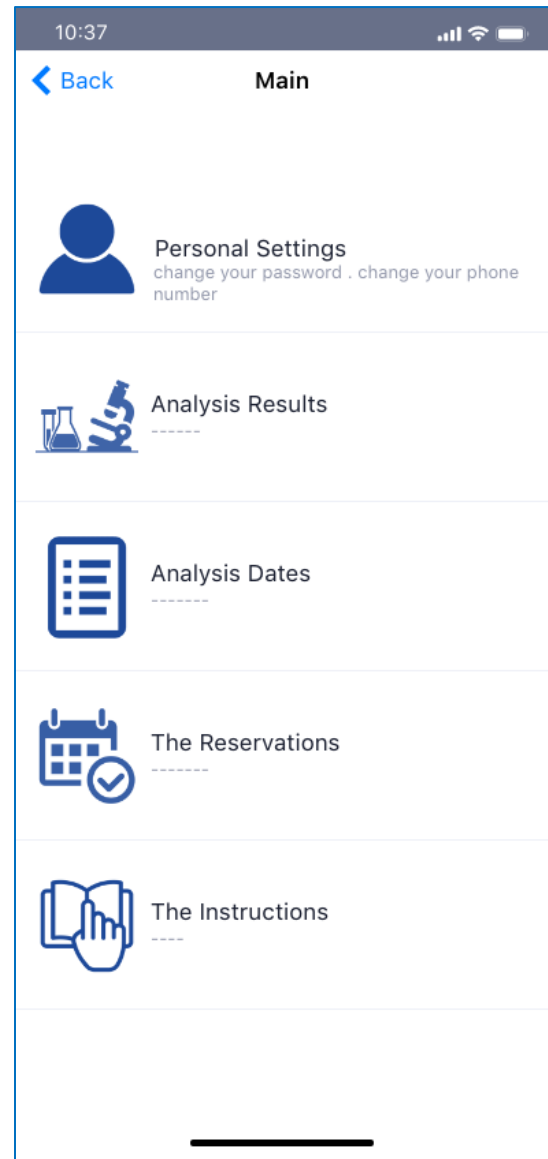


Fig 5.2: Main Screen

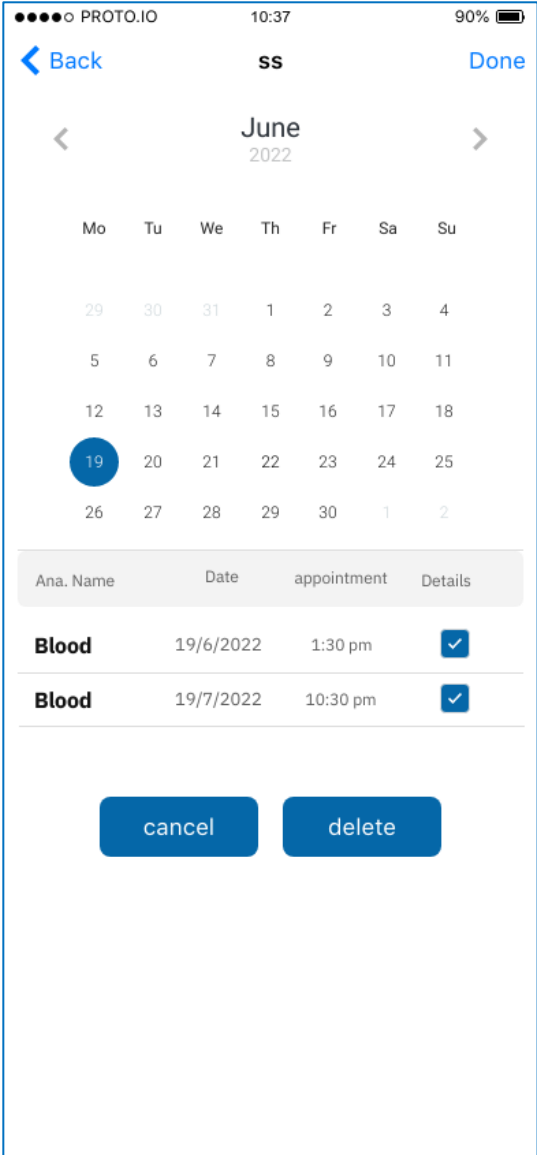


Fig 5.3: Reservation Screen

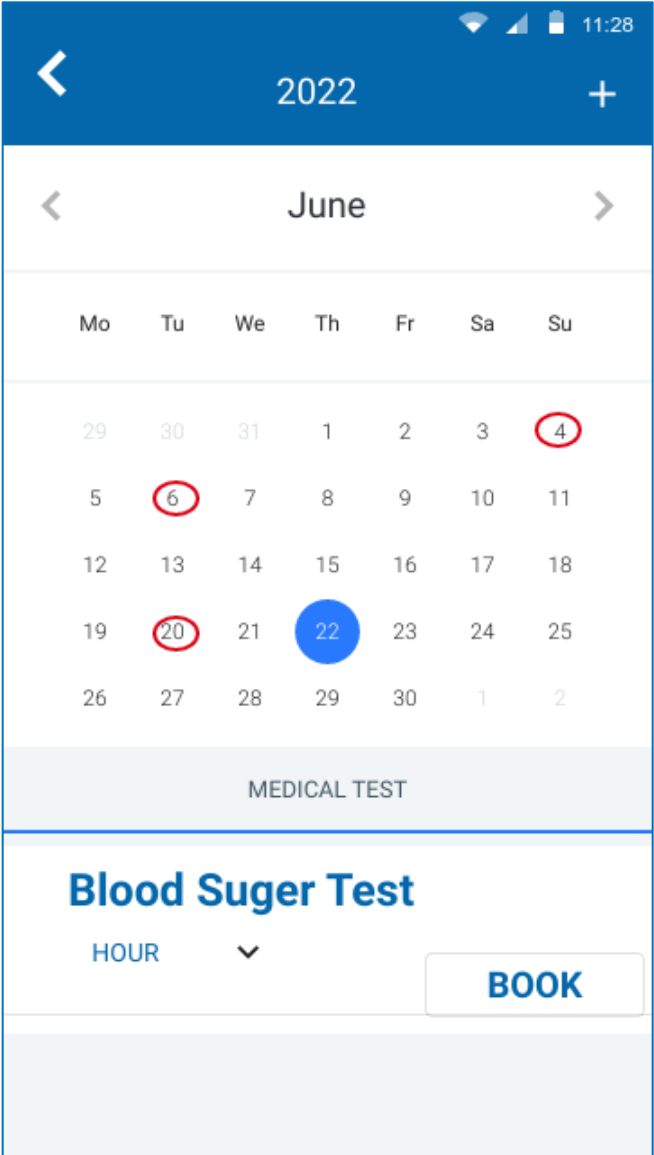


Fig 5.4: Booking Screen

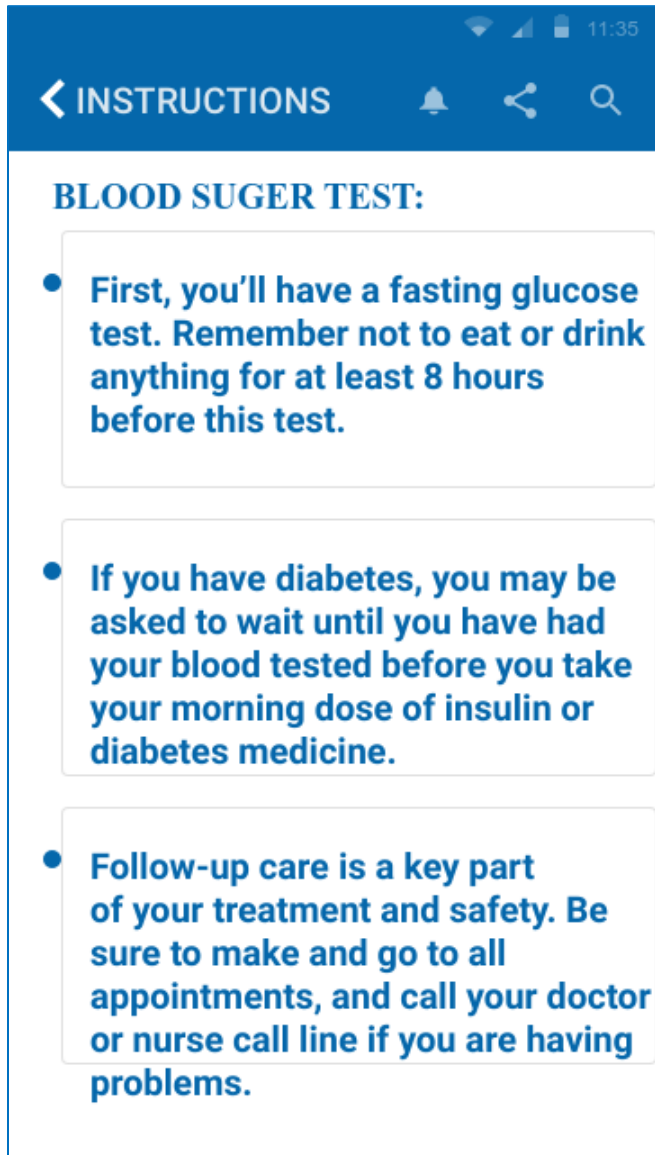


Fig 5.5: Instructions Screen for Blood Sugar Test

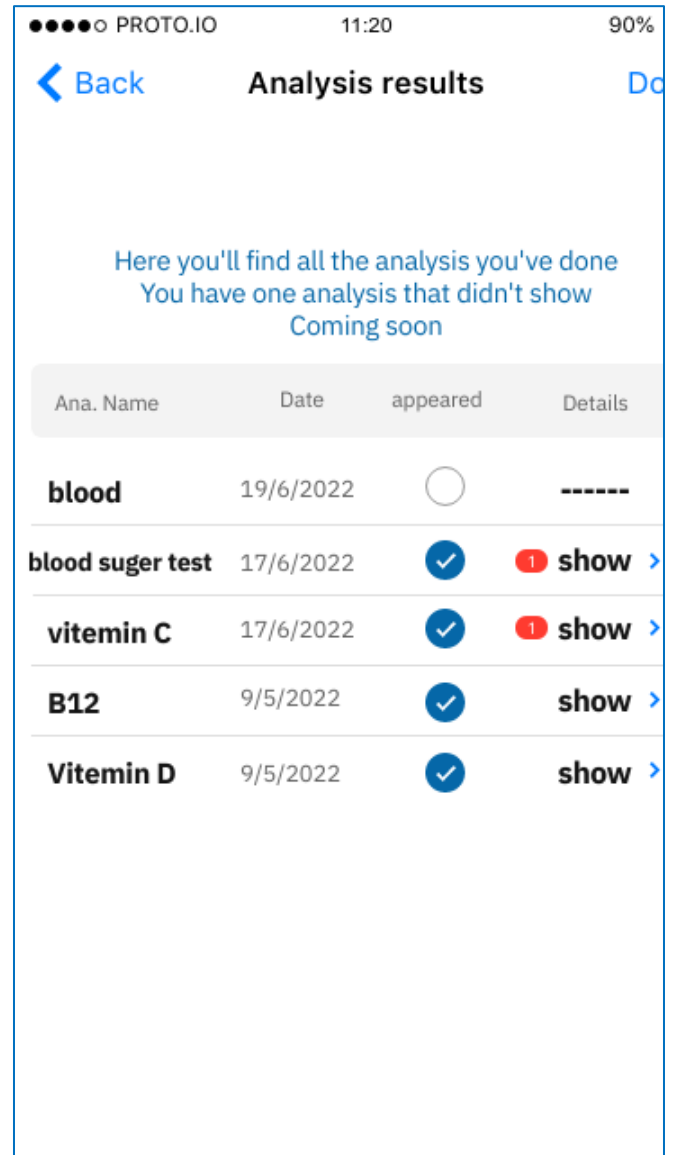


Fig 5.6: Analysis Results Screen

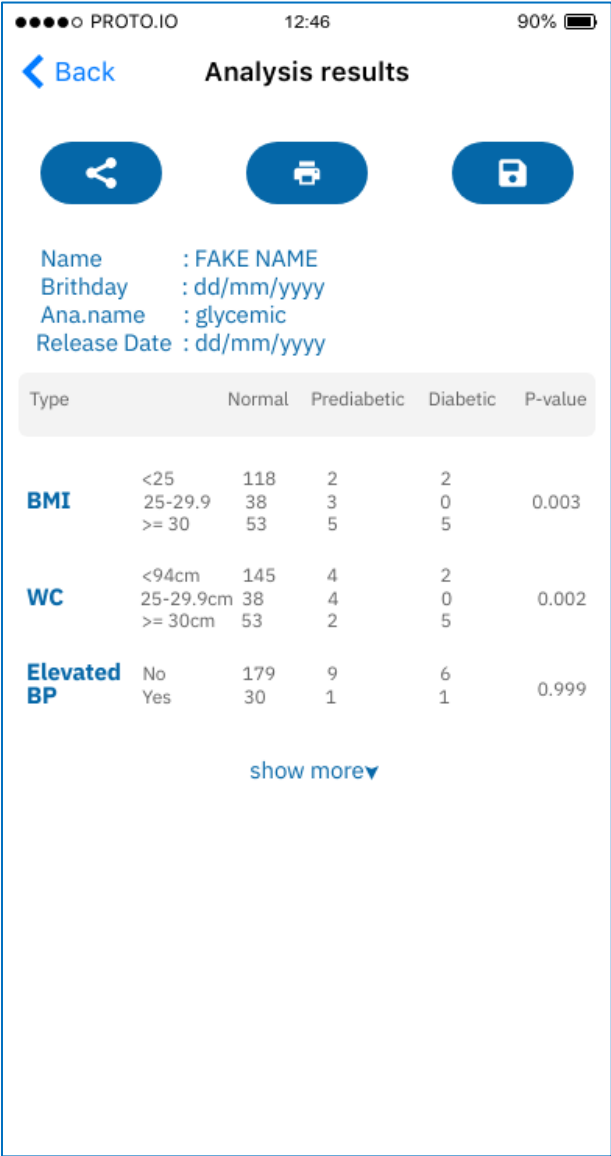


Fig 5.7: Test View Screen

## CHAPTER 6: TEAM WORK

Names	Work
Aliaa	Literature review, References, Diagrams design, Requirements, Process model, Introduction.
Batool	Literature review, References, Diagrams design, Requirements, User interfaces, Acknowledgement, Introduction.
Raghad	Literature review, References, Diagrams design, Requirements, Acknowledgement, Introduction.
Rajaa	Literature review, References, Diagrams design, User interfaces, Abstract, Introduction.

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