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Institute of Technology
Faculty of Informatics
Department of Information System
Industrial Project I Report on:

Title: “Maternal health advisory mobile application for Alatyon general hospital (MHAS)”

A Senior Project Submitted to the Department of Information Systems for the Partial Fulfillment of the Degree of Bachelor of Science in Information Systems.

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Declaration

This is to certify that I have read this project and that in my opinion, it is fully adequate, in scope and quality, as a senior project for the degree of Bachelor of Science.

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Acknowledgment

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Abstract

To standardize the health management of pregnant women, improve the health level of pregnant women, and improve the outcome of pregnancy with the help of the smartphone mobile app [1]. According to object-oriented system analysis and design methodology, this proposal is developing and passes through several phases needed for planning, analysis, design, and implementation. After all, the application will be installed on mobile phones. The application provides a user-friendly GUI in order to make it easy and efficient for the mothers to use the application. The application will allow a mother to be registered and can also read the necessary information from it. If the mother needs advice from a physician she can communicate with the doctor by chatting through the system. The system also provides drug-taking time reminders for the mothers and also helps family planning workers to provide necessary information through this application. Maternal and child service mode has been realized through mobile internet technology. It has been proved that the use of smart mobile terminals in the out-of-hospital health care management of pregnant women not only facilitates medical staff to provide timely personalized medical services for pregnant women but also is convenient for pregnant women to obtain health care knowledge through multiple channels, improve the quality of home health management for pregnant women, and effectively improve the pregnancy outcome [2]. This project aims to develop a mobile application that provides maternal health advice to pregnant women.

Keywords: *mother, physician, fp-worker, MHAD*

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List of Abbreviation

MHAS	Maternal Healthy Advisory System
AGH	Alatyon general hospital
FP	Family Planning
UML	Unified Modeling Language.
OO SAD	object-oriented system analysis and design
SRS	System Requirement Specifications
GDP	Gross domestic product
ANC	Antenatal care
GUI	Graphical User Interface

CHAPTER ONE

1 INTRODUCTION

Maternal health is one of the most important public health concerns globally. Improving maternal health outcomes is crucial for reducing maternal mortality and morbidity, promoting healthy pregnancy and delivery outcomes, and improving the overall health of women and newborns. Despite significant progress in recent years, many challenges still exist in ensuring the best maternal health outcomes for all women. One of these challenges is the lack of access to maternal health information and resources, especially for women in low- and middle-income countries like Ethiopia.

1.1 Background of the Project

In Ethiopia, the Maternal mortality ratio is the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births. The data are estimated with a regression model using the information on the proportion of maternal deaths in women ages 15-49, fertility, birth attendants, and GDP [3]. Alatyon general hospital in Ethiopia increases quality access to family planning (FP) methods, while in the middle clinic and higher hospital franchisees safe abortion services are also supported. Other services provided by all franchisees include FP counseling and emergency contraception.

Since the number of mobile subscribers to phones and the number of internet users gradually increase in Ethiopia. That makes mobile applications preferable to reach these entire people with a little cost. The widespread adoption and use of mobile technologies are opening new and innovative ways to improve health and healthcare delivery in the world. Mobile applications can help people manage their health and wellness, promote healthy living, and gain access to useful information when and where they need it.

Mobile-based mothers health advisory system is not a solution to all of the problems confronting health systems in countries like Ethiopia, but it does hold the potential to greatly improve the efficiency of communication, reduce life-threatening delays in the delivery of care and extend the reach of the health system to underserved community, especially for mothers.

Even if this project is intended to serve as the implementation of projects in Alatyon General Hospital(AGH) it is also customizable to other hospitals and clinics that designated maternal Health as giving the highest priority in the Health Sector.

Mobile assisted maternal health advisory system is simply a mobile application that helps mothers or physicians to get necessary information about maternal health and perform communication between mothers and physicians or family planning workers. Typically, this application is exceedingly useful for a mother or physician when they are far from each other and busy.

1.1.1 Background of Alatyon General Hospital

Alatyon Hospital is one of the largest private hospitals in Hawassa designed with the highest standards and strategically located in the heart of Hawassa - Welde Amanueal Street. provides all sorts of medical diagnosis and treatment services. The hospital also encompasses the finest physicians in all specialties and a highly-qualified and professional team of nurses and technicians in different fields. This private hospital comprises 70 beds, it provides medical diagnosis, treatment, and nursing care by the finest and most proficient doctors and nurses in a serene and comfortable environment. It includes 12 private patient rooms, 8 ICU beds, and 5 NICU beds the hospital has skillful and experienced customer service employees, who are trained to process all patients' paperwork efficiently and promptly. Additionally, the hospital provides the highest standards in hospitality services offered to patients, with the use of the most advanced technologies [4].

The hospital was established to offer integrated and exceptional medical services through highly qualified physicians with extensive experience and an excellent reputation, using the latest technology in treatments. We also strive to provide the latest medical equipment and devices to assist the medical and nursing teams in giving their best care to patients.

So, Alatyon general hospital (AGH) contributes to the reduction of maternal mortality and morbidity, AGH continues to play a proactive role by fostering a value-added partnership with the government of Ethiopia, and civic society organizations.

mission: Provision of high-quality integrated patient care service.

Vision: We will be a leading center for integrated high-quality health care service that enhances the health and well-being of our community.

1.2 Statement of the problem

Over 500,000 women die unnecessarily every year due to complications from pregnancy and childbirth, with 99 percent of those deaths occurring in developing countries, according to a new report released by the United Nations Children's Fund (UNICEF) [5]. The pregnancy-related mortality ratio (PRMR) for Ethiopia is 412 deaths per 100,000 live births for the seven-year period before the survey [6]. The maternal death, of a woman in reproductive age, has a further impact by causing grave economic and social hardship for her family and community. Other than their health problems most women in developing countries lack access to modern healthcare services which increases the magnitude of death from preventable problems.

In the existing system, maternal and newborn deaths can be prevented by skilled, trained people assisting women before, during, and after childbirth manually. Mothers can get this service by going to Alatyon hospital (AGH) but if they missed the appointment, and forget the drug taking time no one is there to remind them to take their drugs, this consequence maternal health in danger. Most pregnant women when beget a child they will get tired and couldn't walk long distances up to the hospital to get advice.

Most pregnant women do not receive antenatal care deliver without the assistance of trained health workers. So, the lack of access to modern health care services has a great impact on increasing maternal death. The problem is the Reproductive and health behavior of women that involves, the age at which a woman becomes pregnant, whether the pregnancy is wanted, and what kind of health care the woman seeks. So, there is an awareness problem in society.

Since most pregnant women do not receive antenatal care, maternal mortality and unnecessary pregnancy increased, time and cost wastage to get health centers, poorly timed unwanted pregnancies to carry high risks of morbidity and mortality, as well as social and economic costs particularly to the adolescent, and many unwanted pregnancies end in unsafe abortion. There is also work overload in Alatyon Hospital (AGH) so mothers may not need to communicate with a physician physically whenever and wherever they need also it is difficult to make appointments manually.

The MHAS project aims to improve maternal health outcomes at Alatyon General Hospital by providing mobile health advice and support to pregnant women. However, there is a lack of clarity as to where the mothers located whenever needed for emergency. This statement of the problem aims to identify the optimal location for the mothers involved in the MHAS project.

1.3 Objectives

1.3.1 General objectives

The general objective of this project is to develop a Maternal health advisory mobile application for Alatyon general hospital (MHAS).

1.3.2 Specific Objectives

Specific objectives of this proposed project are:

- To find out the way mother can care themselves at home by providing them baby care advice and pregnancy health related topics.
- To identify problems and analyze the existing maternal health care system.
- To improve access to maternal health services by enabling expectant mothers to book appointments and receive reminders for prenatal checkups.

- To develop a prototype for the proposed system.
- To collect requirement and model system.
- To design and develop the system based on the requirements identified
- To Perform requirement analysis.
- To Find a solution to the existing problem.
- To develop an easy-to-use interface that allows users to quickly access relevant information.
- To Design a persistent database.
- To implement mobile applications and acquiring a new knowledge.
- To develop a system that allows users to easily connect with healthcare professionals for advice and support.
- To develop a system that allows users to easily access and book appointments with healthcare professionals.
- To test the new system.

1.4 Scope of the project

Our system focuses on mobile based Maternal Health Advise Mobile Application for Alatyon General Hospital and will perform the following activities:

- **User Authentication:** The application should allow the admin to create a user account and authenticate their identity.
- **Prenatal Care Information:** The application should provide comprehensive information on prenatal care, including the importance of regular check-ups, tests, and screenings.
- **Common Complications:** The application should provide information on common complications during pregnancy and their treatments.
- **Communication Platform:** The application should provide a platform for expectant mothers to communicate with healthcare providers at Alatyon General Hospital and receive personalized advice.
- **Appointment Scheduling:** The application should allow expectant mothers to schedule appointments with healthcare providers at Alatyon General Hospital.
- **Push Notifications:** The application should provide push notifications to expectant mothers to remind them of appointments and provide important information related to their health and pregnancy.

1.5 Limitations of the project

- The system is not offline.
- Integration with healthcare systems: The integration of the mobile application with Alatyon General Hospital's systems may present technical challenges and may require significant resources to implement and maintain.
- The system cannot update the mother's location once it registered.
- The system has no online payment system.

1.6 Significance of the Project

The significance of the project is to create a platform that can be used to improve the quality of life of people in the community. This platform will provide access to resources, services, and information that can help people in the community to better manage their lives and improve their overall wellbeing. The mobile assisted maternal health advisory project is an important initiative that seeks to improve maternal health outcomes in developing countries. By providing access to information and services through mobile phones, the project seeks to reduce maternal mortality and morbidity rates in these countries. The project also seeks to improve access to quality healthcare for pregnant women and mothers, as well as providing support for their families. In addition, the project aims to increase awareness of maternal health issues and provide a platform for sharing information and resources. Ultimately, the project aims to improve access to quality healthcare, and improve maternal health outcomes in developing countries.

1.7 Methodology

The purpose of this project is to identify the best methodology to achieve the desired outcome. To accomplish this, we will need to analyze the scope of the project, determine the objectives, develop a plan of action, and decide on the appropriate methods and tools to be used. We will then assess the effectiveness of the chosen methodology, and make any necessary adjustments. Finally, we will document the entire process for future reference.

1.7.1 Data Collection Methodology

For the collection of data, we used observation, interview, and literature view.

Observation: We have observed the existing system in Alatyon General Hospital (AGH) how they assist maternal health advisory system and how they take appointments manually.

Interview: we have used interviews in order to get information about the existing system for developing our project. We have conducted interviews with healthcare professionals in Alatyon Private Hospital.

Brainstorming: since the project will be done in a group, every group member will provide their idea on the requirements.

Literature review: we use this method to get additional information from different research applied to maternal health by using internet.

1.7.2. System Analysis and Design Methodology

A system development methodology refers to the framework that is used to structure, plan, and control the process of developing the system. There are different types of system development methodologies to develop applications; among these, we select object-oriented system analysis and design (OO SAD)

Since object-oriented software development (OOSD) is a type of software development methodology that uses objects and their interactions to design and develop software. It is based on the concept of object-oriented programming (OOP), which is a programming language model organized around objects rather than "actions" and data rather than logic.

OOSD is a process that focuses on the reuse of software components and the development of software applications that are easier to maintain and extend. It is a popular approach to software development because it allows for the development of more complex and robust applications. OOSD also allows for the development of applications that are more easily maintained and extended over time. Additionally, OOSD encourages the use of design patterns, which are reusable solutions to common software development problems. This makes it easier for developers to create applications that are more efficient and reliable.

So, the reason why we selected object-oriented system analysis and design (OO SAD) is it promises to reduce development time, and resources required to maintain existing applications, increase code reuse, and provide a competitive advantage to organizations that use it.

1.7.3 Development Tool and Technologies

The working environment of the mobile Assisted Maternal Health Advisory System (MHAS) project using android would consist of both an Android development environment and a server-side environment. The Android development environment consists of the Android SDK, Android studio, and any other necessary tools for developing an Android application. The server-side environment and Firebase database to store the application data.

1.7.4 System Implementation

The mobile application will be developed using the Android operating system and will include features such as appointment scheduling, and health advisory.

- ✓ The cloud-based server will be used to store and manage the data collected from the mobile application.
- ✓ The server will also be used to send notifications to users regarding appointments and health advisories.
- ✓ The system will be tested for functionality and performance before deployment.
- ✓ The system will be deployed and made available to users.
- ✓ The system will be monitored for any issues or bugs and will be updated and maintained regularly.

1.7.5 Testing and Deployment Methodology

The Mobile based maternal health advisory application will be tested using the following system testing procedures.

- ✓ **Test Planning:** The first step in Test and Deployment Methodology is Test Planning. This involves creating a Test Plan, which defines the overall approach to testing the mobile application along with other details such as the test environment, type of tests to be performed, and resources required for testing.
- ✓ **Test Development:** The next step involves developing a comprehensive set of tests for the mobile application. This includes both functional and non-functional tests such as usability and security tests.
- ✓ **Test Execution:** The next step is to execute the tests on a variety of devices and platforms. This will help ensure that the application is functioning correctly on different devices and platforms.
- ✓ **Test Automation:** Test automation is an important part of the Test and Deployment Methodology. Automated tests can be used to quickly and accurately detect and report any bugs or issues in the mobile application.
- ✓ **Deployment:** The final step is to deploy the application to the desired platform. This includes ensuring that the application is properly configured and integrated with the platform.

1.7.6 Security Methodology

The system shall be secured with different security mechanisms like Encrypt Data which is used to encrypt data stored on the device and in transit to prevent unauthorized access. In another way authentication is provided to all the users, only authenticated users can use it. It means if the user is an administrator, then he/she can be able to manage all the data.

1.7.7 Backup and Recovery Methodology

Database System is stored sensitive data of the Hospital. Those data don't need to be lost If they lost it by some of reason may be crashing of storage device occurs and vulnerable to hackers. So that it has different methodologies to back up and recover such as

- ✓ Incremental backup
- ✓ Full backup
- ✓ Differential backup

Besides its advantage and disadvantage such as consumption of time and requirement space to backup data are different. So, for this purpose, we are selecting an incremental backup methodology. The incremental backup methodology is operational and will result in copying only the data that has changed since the last backup operation of any type. The main advantage of this backup use of storage is smallest and the organization uses time stamps for modified data so we can find easily the data which we want it.

1.8 System Requirement

The system requirements for a mobile Assisted Maternal Health Advisory and Appointment System project using Android would include:

- ✓ Android OS version 4.4 or higher
- ✓ A minimum of 1GB of RAM
- ✓ A minimum of 8GB of internal storage
- ✓ A minimum of 1GHz processor
- ✓ A compatible Wi-Fi device
- ✓ A compatible GPS device
- ✓ A compatible camera device
- ✓ A compatible speaker device
- ✓ A compatible display device
- ✓ An internet connection.

1.8.1 Software Requirement

Table 1.1 software requirement

Software Requirement	
Activities	Tools/ Programs
Operating System	Window 11 x64 (64 bits)
Documentation	MS Office 2016
Programming Language	Android programming (Java)
Editors	Android Studio, Visual studio code
Database server	Firebase
Emulator	Android virtual device, Samsung smartphone,
Diagram design	Draw.io

1.8.2 Hardware Requirement

Table 1.2 hardware requirement

Hardware Requirement	
Activities	Tools/ Programs
Testing app	Smartphone with Android 8 or higher
Storage devices	Hard disk and flash disc
Computer	Lenovo Intel(R) Core (TM) i3-4000M CPU @ 2.40GHz 2.39 GHz
Displaying device	Printer and Monitor
Other	Paper and pen

1.9 Feasibility of the Project

Since Mobile based maternal health advisory system is very useful for mothers in that it provides different information on their health, it is expected that this application system will grow more productively if mothers or physicians recognize the role of strategic financing from the system and interventions in to using it. This application simplifies their work by providing much functionality.

So, our system will be economically, technically, operationally as well as timely feasible.

1.9.1 Technical feasibility

Technical issues that are involved in the hardware part to the software should be properly working with input of hardware should be considered to determine the feasibility. There are also services provided from the mobile for which we don't need to rebuild again, additionally in simple term long-range portable mobile device required available in the market. It is evident that the necessary hardware and software are available for the development and implementation of the proposed system. Therefore, the system will be technically feasible.

1.9.2 Operational Feasibility

The user should not misuse the system. To determine the operational feasibility of the system we should take into consideration the knowledge level of the users. Initially, this system is proposed to be designed for those who use a mobile phone. The application is expected to be very flexible for its users. And this is also one of the factors that make it operationally feasible.

1.9.3 Economic Feasibility

The development cost is one of the affecting factors which results in the inefficiency of the new system. In the current system users get the problem of cost in different situations. This means the proposed system should be economically feasible to reach its desired goal. In addition, the developing materials are freely available the only thing the user requires is that mobile phone.

As all the resources are already available, it gives an indication of the system is economically possible for development.

1.9.4 Time feasibility

Time feasibility is the most important and superior thing to be considered. The period of time considered as a resource under user control and sufficient to accomplish some work and it is an instance or single occasion for some work. This system is feasible by time since it reduces the time required to do work through physical contact.

1.10 Cost Estimation and Schedule Breakdown

1.10.1 Cost Estimation

In this portion, we estimate some hardware costs and training that is needed for this project. The cost that is needed to download and install software is covered by the university because of free access to the internet.

Hardware costs

Table 1.3 hardware cost estimation

Hardware Material	Amount	Total price
A4 size paper	1 pack	550 Birr
Smart mobile (Samsung)	1	24,000 Birr
Flash disk	1	350 Birr
For Print	95 sheets	475 Birr
Laptop	3	75,000 Birr
Pen	4	80 Birr
Transport	120 Birr
TOTAL		100,575 Birr

1.10.2 Schedule Breakdown

In order to accomplish time effectively and efficiently, we used the Gant charts to schedule times in all phases of the project we do. Its major phases are listed below.

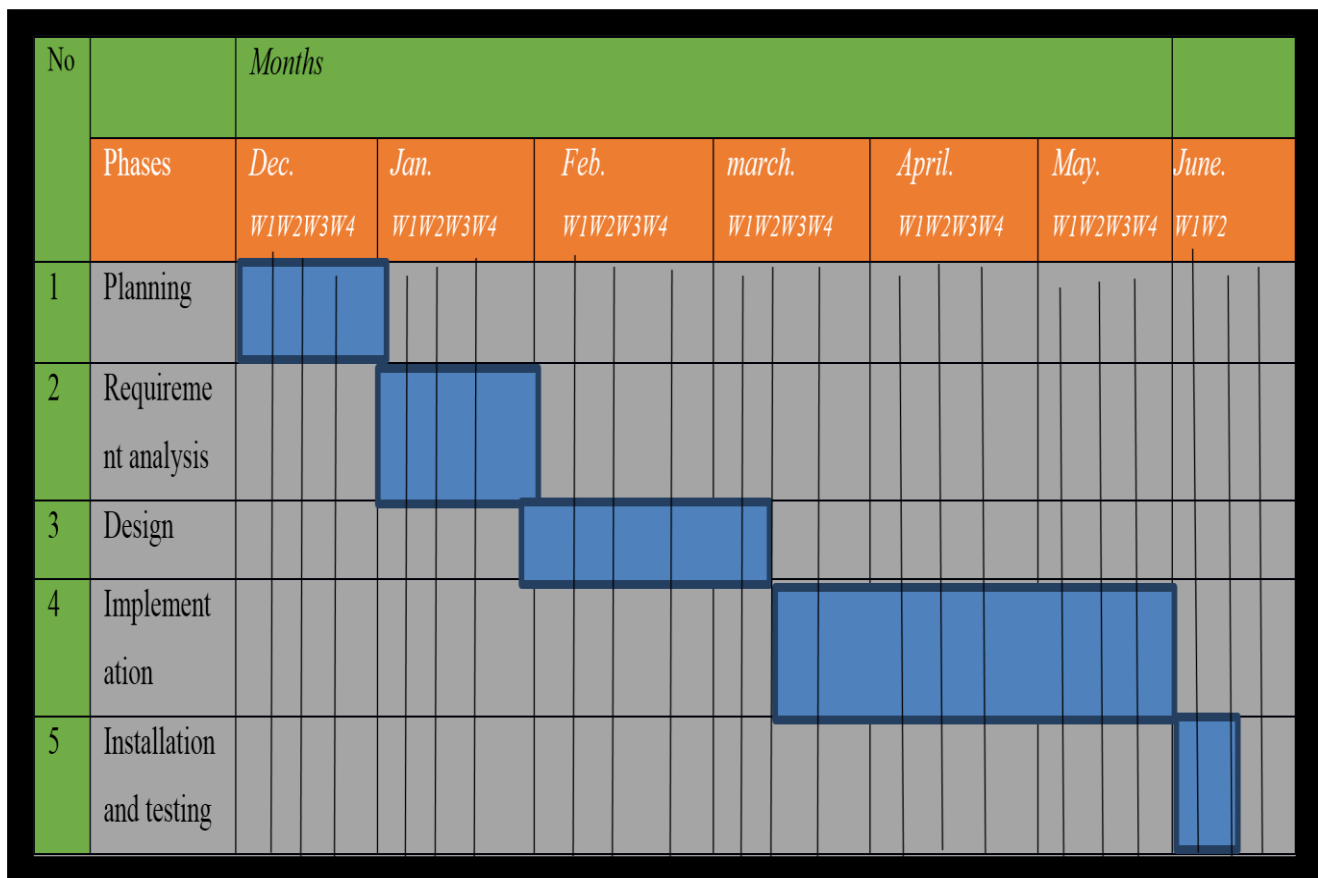


Fig 1.1 grant chart

CHAPTER TWO

2 DESCRIPTIONS OF THE EXISTING SYSTEM

This chapter covers the description of the existing system, the problem of the existing system and what issues the proposed system going to improve, and details about functional and nonfunctional requirements of the proposed system.

2.1 Introduction of the Existing System

Maternal health is the health of women during pregnancy, childbirth, and the postpartum period. It encompasses the health care dimensions of family planning, preconception, prenatal, and postnatal care in order to reduce maternal morbidity and mortality.

Preconception care can include education, health promotion, screening, and other interventions among women of reproductive age to reduce risk factors that might affect future pregnancies. The goal of prenatal care is to early detect any potential complications of pregnancy, to prevent them if possible, and to direct the woman to an appropriate specialist for medical services. Postnatal care issues include recovery from childbirth, concerns about newborn care, nutrition, breastfeeding, and family planning.

Family planning is defined as the ability of individuals and couples to anticipate and attain their desired number of children and the spacing and timing of their births. It is achieved through the use of contraceptive methods and the treatment of involuntary infertility. Any reproductive-age person whether male or female regardless of marital status is eligible for FP services, including information, education, and counseling. Antenatal care is the care mothers receive from healthcare professionals during their pregnancy. The purpose of antenatal care is to monitor the mother's health and baby's health and support mothers to make plans which are right for them.

Mother's first appointment with a health professional is called a booking. During each antenatal visit, health professionals will check the mother's health. Mothers will be asked to supply a sample of urine at each visit.

An important part of antenatal care is getting information that will help mothers to make informed choices about their pregnancy.

Services offered at each level of the health system are Counseling, the Provision of contraceptive methods, Screening for reproductive organ cancers, Prevention, screening, and management for Sexually transmitted infections (STIs), including HIV, and Prevention and management of infertility. Among the services registering the client, training the community, Counseling, and Giving a Reminder are our project focus.

2.2 Proposed System Description

The Mobile Assisted Maternal Health Advisory System project aims to provide healthcare advice and appointment management services to pregnant women. The system will be accessible through a mobile application, allowing users to receive personalized healthcare advice and to schedule and manage appointments with healthcare professionals.

The system will also provide users with reminders and notifications about upcoming appointments, as well as updates on any changes to their appointments. The system will also provide users with the ability to communicate with their healthcare providers through chat on the application.

The system will be developed using modern programming languages and technologies, which are java and Firebase DB. The system will be hosted on a secure cloud platform. The system will be built with a focus on scalability and security, to ensure that the system can handle large volumes of data and user traffic.

The system will be tested extensively before it is released to the public. The system will be designed to be easy to use, with intuitive user interfaces and clear navigation.

And this proposed system has several advantages include

- ✓ Less error
- ✓ User-friendly interface
- ✓ Cost reduction
- ✓ Easy to handle
- ✓ Fast access from the Database

2.2.1 Proposed solution

Since the practice performed in the existing system is manual. To overcome or improve these operations, our team comes up with a new proposed system mobile-based maternal advice android application. This new system is an android-based application that enables users to access many services given by the system through the Internet. The new system is targeted to address the problems of the current system.

The new systems that solve the existing system are:

- Easy way to join mothers and physicians based on their interests.
- Storing the data in a database.
- No need of more human power and money.
- Security of data.
- Effective and interactive chatting.
- User-friendliness and interactive

2.3 Strength of Existing System

The strength of the existing manual-based maternal health advisory system in this hospital lies in its ability respond to maternal health concerns provide comprehensive recommendations manually for those who don't have such technologies. The existing manual-based maternal health advisory system in the hospital have strength as follow:

- **Appointment system:** Allows patients to make appointments and be seen by physicians and appointment history is set on documented file in order to get what they need to remind.
- **Advisory system:** The system allows patients to receive reliable information and advice from physicians face-to-face.
- **Get reliable information:** The system allows patients to get reliable information about their health and the health of their unborn child from physicians.
- **Face-to-face communication with physicians:** The system allows patients to have face-to-face communication with physicians, which can help them to better understand their health and the health of their unborn child.

2.4 Weakness of Existing System

- **Lack of accuracy:** Manual-based systems are prone to human errors, leading to incorrect data and unreliable results.
- **Poor data security:** Manual-based systems do not offer adequate security measures to protect confidential patient data and records.
- **Time-consuming:** Scheduling appointments and updating health records can be a time-consuming task as staff must manually input the data each time.
- **Limited capacity:** Manual-based systems can only accommodate a limited amount of data and have limited capacity for storing patient records.
- **Less flexibility:** Manual-based systems are not easily modified and cannot easily adapt to changing needs or technology trends.

Increased risk of data loss: Manual-based systems are vulnerable to data loss due to human error or natural disasters.

CHAPTER THREE

3 SYSTEM FEATURES

3.1 Introduction

System feature covers the functional aspect of the whole analysis, which is Functional modeling. We have used an object-oriented methodology to analyze the requirements that are needed to model the functionality of the proposed system. We have used different types of UML diagrams which include use case diagrams, sequence diagrams, activity diagrams, user interface prototyping and analysis level class diagram to model the proposed system. And every diagram has documentation to show its functionality and how they are operated.

3.2 Business Rules and Logic

Since the mothers are responsible to be visited 4 times regularly in pregnancy period
We can see the business rules as follow.

Table 3.1 business rule description

Id	Name	Description
BR1	first visit	this visit must be before 16 weeks of pregnancy
BR2	second visit	this visit must be between 24-28 weeks of pregnancy
BR3	third visit	this visit must be between 30-32 weeks of pregnancy
BR4	forth visit	this visit must be between 36-40 weeks of pregnancy

A. Steps of Antenatal care

BR1: First visit or registration (when pregnancy is suspected)

Services to be provided

- A personal medical health is taken.
- Physical and abdominal examination.
- Check blood pressure
- Counsel on needs for 3 ANC
- visits, healthy diet, need for rest
- In endemic populations, treatment for malaria, hookworm, iodine deficiency
- First dose of tetanus toxoid

Purposes of services

- To diagnose pregnancy and identify any complications
- during a previous pregnancy
- To detect and manage any
- co-existing complication i.e.
- TB, malaria, pre-eclampsia
- To identify and manage hypertension
- To establish a baseline weight
- To prevent anemia
- To prevent tetanus in new
- born and mother

BR2: Second visit (between the fourth and sixth month)

Services to be provided

- Check blood pressure
- Do a physical examination
- Second dose of tetanus toxoid (TT) provides
- additional months of Iron and folic acid

Purposes of services

- Detect and manage hypertension
- To detect and manage pregnancy complications
- Pre-eclampsia or severe anemia
- To prevent anemia

BR3:- Third visit at (eighth month of pregnancy)

Services to be provided

- Check blood pressure
- Do a physical examination
- Assist women and families in developing birth preparedness.

Purposes of services

- Detect and manage hypertension.
- To detect and manage co-existing conditions or complications.
- To be prepared for a safe and clean delivery in the event of an emergency.

BR4:- Fourth visit checkup at the ninth month

Services to be provided

- Check blood pressure
- Do an abdominal and physical examination
- Counsel on breastfeeding and birth spacing and limiting
- Review BP/CR

Purposes of services

- To detect and manage hypertension
- To detect and manage any co-existing condition or complication
- To prevent any delays in case of an emergency.

3.3 Functional Requirements

Describe the interactions between the system and its environment, independent of its implementation. The environment includes the user and any other external system with which the system interacts. These are statements of services the system should provide, how the system should react to particular inputs, and how the system should behave in particular situations. It specifies the software functionality that the developers must build into the product to enable users to accomplish their tasks. The main purpose of functional requirements within the requirement specification document is to define all the activities or operations that take place in the system.

- The system allows the admin registers mothers, physician and Family planning workers.
- The system should allow mothers to get detailed advice and recommendation from physicians or family planning workers using chat.
- The system should allow physicians or FP workers to upload information to the application which helps mothers.
- The system should allow mothers to read information like images, videos and other file format which is uploaded by physicians or FP workers.
- The system should allow the physician to set the appointment he/she has with mothers to the application and the mother views the appointment settled by the physician.

3.4 Non-Functional Requirements

Our team identified the following non – functional requirements for the proposed system.

Here are some non-functional requirements that could be considered:

- **Performance:** Response time for key functionality should be no more than 3 seconds. The application should be able to handle a large number of users simultaneously.
- **Security:** The system should be secured in that; it prevents unauthorized access into the system. Only the administrator can be able to modify or delete the data. All other users have the right only to retrieve the information from the database.
- **Usability:** The user interface should be intuitive and easy to use. The application should be accessible to users with different abilities and disabilities.
- **Scalability:** The application should be designed to handle future growth in the number of users and features.
- **Compatibility:** The application should be compatible with a range of devices and operating systems. The application should be able to integrate with other systems and applications as needed.

- **Maintainability:** The code should be well-structured, readable, and maintainable. The application should be designed for easy future updates and maintenance.
- **Reliability:** The system should be able to perform a required function free of errors.

3.5 System Analysis Models

3.5.1 Introduction

System Analysis covers the functional aspect of the whole analysis, which is Functional modeling. We have used an object-oriented methodology to analyze the requirements that are needed to model the functionality of the proposed system. We have used different types of **UML diagrams** which include **use case diagrams**, **sequence diagrams**, **activity diagrams**, **user interface prototyping**, and **analysis level class diagram** to model the proposed system. Each and every diagram has documentation to show their functionality and how they are operated.

3.5.2 Essential Use case Description

A Use Case diagram is a graphical representation of the high-level system scope. It includes use cases, which are pieces of functionality the system will provide, and actors, who are the users of the system.

Actors

With essential use case modeling an actor represents a role. An actor is a person, organization, or external system that plays a role in one or more interaction with the system. Actors are always external to the system being modeled they are not part of the system. The different actors in the system with their description are as follow. This system needs five actors. These are

- **Admin:** responsible for managing users and registering new users.
- **Physician:** physician is a health professional that is responsible for giving advice for mothers, uploading information, which he/she has with mothers.
- **Mothers:** mothers get service from the system by advisory chatting through the system, view information, view appointment.
- **Fp worker:** responsible for giving advice to mother, uploading information, and registering new user (mother).

3.5.3 Use Case Diagram



Figure 3.1 Use case diagram of the MHAS

3.5.3.1 Use case documentation

Table 3.2 Use case description for Login

Scenario name	Login	
UCID	UC1	
Description	The user is trying to get access to the system	
Participating actor instances	Administrator, mothers and Family Planning workers, and Physician	
Pre-condition	The user must have username and password, user start the application	
Flow of events	<u>Actor's Action</u> Step 1: user enter valid user name, and password.	<u>System Response</u> Step 2: system checks the input value in the database. Step 3: if valid System displays their corresponding user menu. Step 4: If the username and password are not valid, system displays error message. The system let the user to try again/go back to the previous page.
Alternative condition	Step 5: The inserted information is not valid Then The system let the user to try again/go back to previous page Step 6: Use case ends	
Post condition	Successfully logged to the system	

Table 3.3 Use case description for Register user

Scenario name	Register user	
UCID	UC2	
Description	The user wants to register to the system	
Participating actor	mothers	
Pre-condition	The Application must be on Android device	
Flow of events	<u>Actor's Action</u> Step 1: The user starts the application. Step 2: The user selects the register button Step 3: The user fills required information Step 4: The user selects the register button	<u>System Response</u> step5: The system checks if the account is valid step 6: The system saves the account detail in the databases step7: The system allows the user to use service.
Alternative condition	Step8: The account already exists in the database Step9: The system let the user to try again/go back to the previous page	
Post condition	Successfully registered	

Table 3.4 Use case description for Upload information

Scenario name	Upload information	
UCID	UC3	
Description	The user wants to post information that will be retrieved by the mother	
Participating actor	FP workers	
Pre-condition	The User must have FP worker's account.	
Flow of events	<u>Actors action</u> Step1: - the user selects upload information Step2: - the user fills the information	<u>System response</u> Step3: -the system displays upload form. Step4: -The system checks, if valid save uploaded information. Step5: - if invalid the system displays an error message.
Alternative condition	Step6: - Use case ends	
Post condition	Successfully uploaded information to the system	

Table 3.5 Use case description for Retrieve information

Scenario name	Retrieve information	
UCID	UC4	
Description	The system enables the mother to view information posted	
Participating actor	Mothers	
Pre-condition	The User must have login with mother account.	
Flow of events	<u>Actors action</u> Step1: the user selects browse information Step2: the user visits information.	<u>System response</u> Step3: the system checks if there is uploaded information and display browsed information. Step4: If there is no uploaded information the system displays empty.
Alternative	Step5: Use case ends.	
Post condition	Successfully retrieved	

Table 3.6 Use case description for Advisory

Scenario name	Advisory
UCID	UC5
Description	The Physician and FP worker will give advice and answer the user's question
Participating actors	mothers, FP workers, physician
Pre-condition	1. mothers and physician/FP workers must be online at the same time

Flow of event	<u>Actors action</u> Step1: mother selects physician list Step2: select physician Step3: mother sends chat message	<u>System response</u> Step4: the system retrieves the physician with status. Step5: system sends the mother's message to physician Step6: Physician is not online mothers send.
Alternative condition	Step7: use case end.	
Post condition	Users are chatting with each other	

Table 3.7 Use case description for Create account

Scenario name	Create account	
UCID	UC6	
Description	The administrator creates an account for physicians and FP workers. The FP worker creates an account for the mother.	
Participating actor	Administrator, FP worker	
Pre-condition	The user must log in with admin account. Or FP account	
	<u>Actors action</u> Step1: user selects create an account. Step2: fills required information and Administrator select save	<u>System response</u> Step3: the system displays create account form. Step4: System checks if the account is valid, then the System saves the account in the database. Step5: If The account already exists in the database The system let the administrator to try again/go back to the previous page
Alternative condition	Step6: use case end.	
Post condition	Successfully created	

Table 3.8 Use case description for Edit account

Scenario name	Edit Account	
UCID	UC7	
Description	The administrator wants to edit the account of physicians, FP workers and the mother.	
Participating actor	Administrator.	
Pre-condition	The user must login with the admin account.	
Flow of events	<u>Actors action</u> Step1: the user selects edit account	<u>System response</u> Step2: the system checks. if it is valid then update database Step3: If invalid in the database, then the system shows empty/go back to previous page.
Alternative condition	Step4: use case end	
Post condition	Successfully update account	

Table 3.9 Use case description for delete account

Scenario name	Delete account	
UCID	UC8	
Description	The administrator wants to delete account of physicians, FP workers and the mother.	
Participating actor	Administrator.	
Pre-condition	The user must login with the admin account.	
Flow of events	<u>Actors action</u> Step1: the user select delete the account	<u>System response</u> Step2: the system check if valid delete database Step3: If invalid in database the system shows empty/go back to the previous page.
Alternative condition	Step4: use case end	
Post condition	Successfully delete account	

Table 3.10 Use case description for Set appointment

Scenario name	Set appointment	
UCID	UC9	
Description	Physician set an appointment with the mother	
Participating actor	Physician	
Pre-condition	The user must login with the admin account.	
Flow of events	<u>Actors action</u> Step1: the user selects set an appointment button. Step2: the user Enters date, time. Enter the mother's name with whom he/she has an appointment. And Press save button to save the appointment.	<u>System response</u> Step3: the system displays set an appointment form. Step4: the system check, save if not exist before. Step5: If the appointment is already existed the system lets the physician to try again/go back to previous page
Alternative condition	Step6: use case end	
Post condition.	Successfully set appointment.	

Table 3.11 Use case description for View appointment

Scenario name	View appointment	
UCID	UC10	
Description	The Mother wants to view an appointment sited by physician, physician wants to view his sited appointment	
Participating actor	Mother, Physician, FP Workers	
Pre-condition	The user must login with the mother or physician account.	
Flow of events	<u>Actors action</u> Step1: the user selects view an appointment list.	<u>System response</u> Step2: the system checks, if the appointment exists and displays an appointment list. Step3: If there is no appointment, show empty.
Alternative condition	Step4: use case end.	
Post condition	User have to view an appointment.	

Table 3.12 Use case description for Manage users

Scenario name	Manage users	
UCID	UC11	
Description	The administrator creates, delete and edit Pre-condition the user must login with the admin account.	
Participating actor	account for physicians, FP workers and mother Administrator	
Include	Login	
Flow of events	<u>Actors action</u> Step1: The user login with a valid user type, Password ,and username. Step2: The admin selects manage users.	<u>System response</u> Step3: system checks, if admin account exists then, the system displays manage user's layout. Step4: if invalid account the system let the administrator to try again/go back to previous page.
Alternative condition	Step5: use case end.	
Post condition	Successfully manage users.	

Table 3.13 Use case description for Manage appointment

Scenario name.	Manage appointment	
UCID	UC12	
Description	The Physician wants to manage the appointment.	
Participating actor	Physician	
Pre-condition	The user must login with the physician account	
Flow of events	<u>Actors action</u> Step1: The user enters user type, Password and username. Step3: the user selects manage an appointment.	<u>System response</u> Step2: system checks, if the physician account exists then system displays manage an appointment. Step4: If the physician account is invalid the system let the physician to try again/go back to previous page.
Alternative condition	Step5: use case end	
Post condition	Successfully manage appointment.	

Table 3.14 Use case description for Edit appointment

Scenario name	Edit appointment	
UCID	UC13	
Description	The physician wants to update mother appointment.	
Participating actor	Physician	
Pre-condition	The user must login with the physician account.	
Flow of events	<u>Actors action</u> Step1: The physician selects edit appointment. Step2: physician edits the appointment then click save.	<u>System response</u> Step3: the system checks, if valid update database. Step4: If invalid in database the system shows empty/go back to previous page
Alternative condition	Step5: use case end.	
Post condition	Successfully update account	

Table 3.15 Use case description for Set alarm

Scenario name	Set alarm	
UCID	UC14	
Description	The mother wants to set an alarm.	
Participating actor	Mother	
Pre-condition	The user must login with the mother account.	
Flow of events	<u>Actors action</u> Step1: The user selects set an Alarm. Step3: the user fills alarm form.	<u>System response</u> Step2: the system displays an alarm form. Step4: the system checks, and save if it not existed before. Step5: If the account already exists in the database The system let the administrator to try again/go back to the previous page
Alternative condition	Step6: use case end	
Post condition	Successful Set alarm.	

Table 3.16 Use case description for Track user location

Scenario name	Track user location	
UCID	UC15	
Description	Admin needs to track the location of a user.	
Participating actor	Admin	
Pre-condition	1. The admin must have access to the tracking system. 2. The user must have enabled their location-sharing settings.	
Flow of events	<u>Actors action</u> Step1: The admin logs into the tracking system. Step2: The admin searches for the user they wish to track. Step4: The admin can view the user's location history by selecting the appropriate option. Step5: The admin can update the tracking settings for the user, if necessary.	<u>System response</u> Step3: The tracking system displays the user's current location on a map.
Alternative condition	Step6: use case end	
Post-condition	1. The admin can view the user's current location and location history. 2. The admin can update the user's tracking settings, if necessary.	

3.5.4 Sequence Diagram

3.5.4.1 Introduction

A sequence diagram in a unified modeling language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a message sequence chart. A sequence diagram shows object interactions arranged in a time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario.

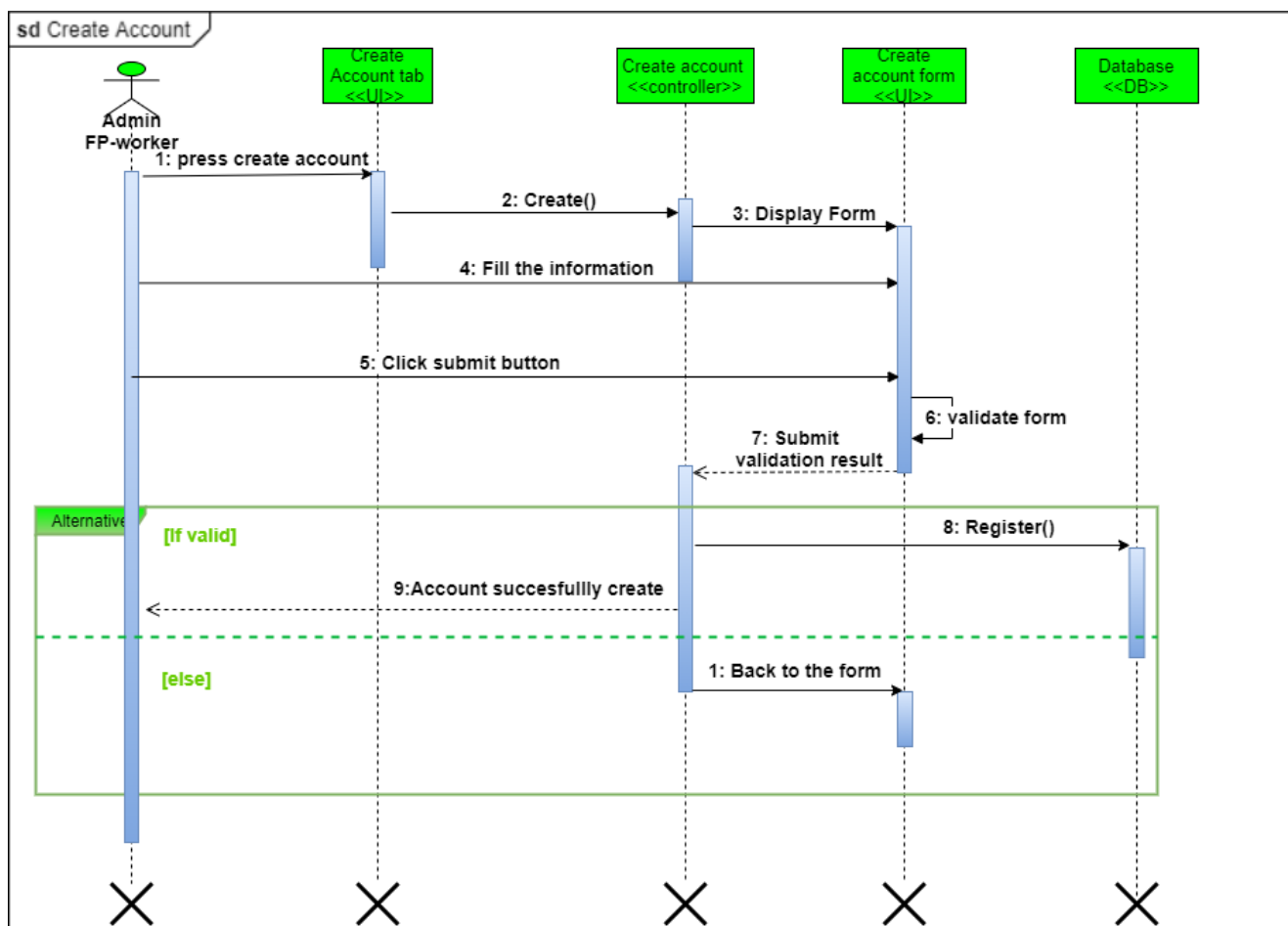


Figure 3.2 sequence diagram for create account

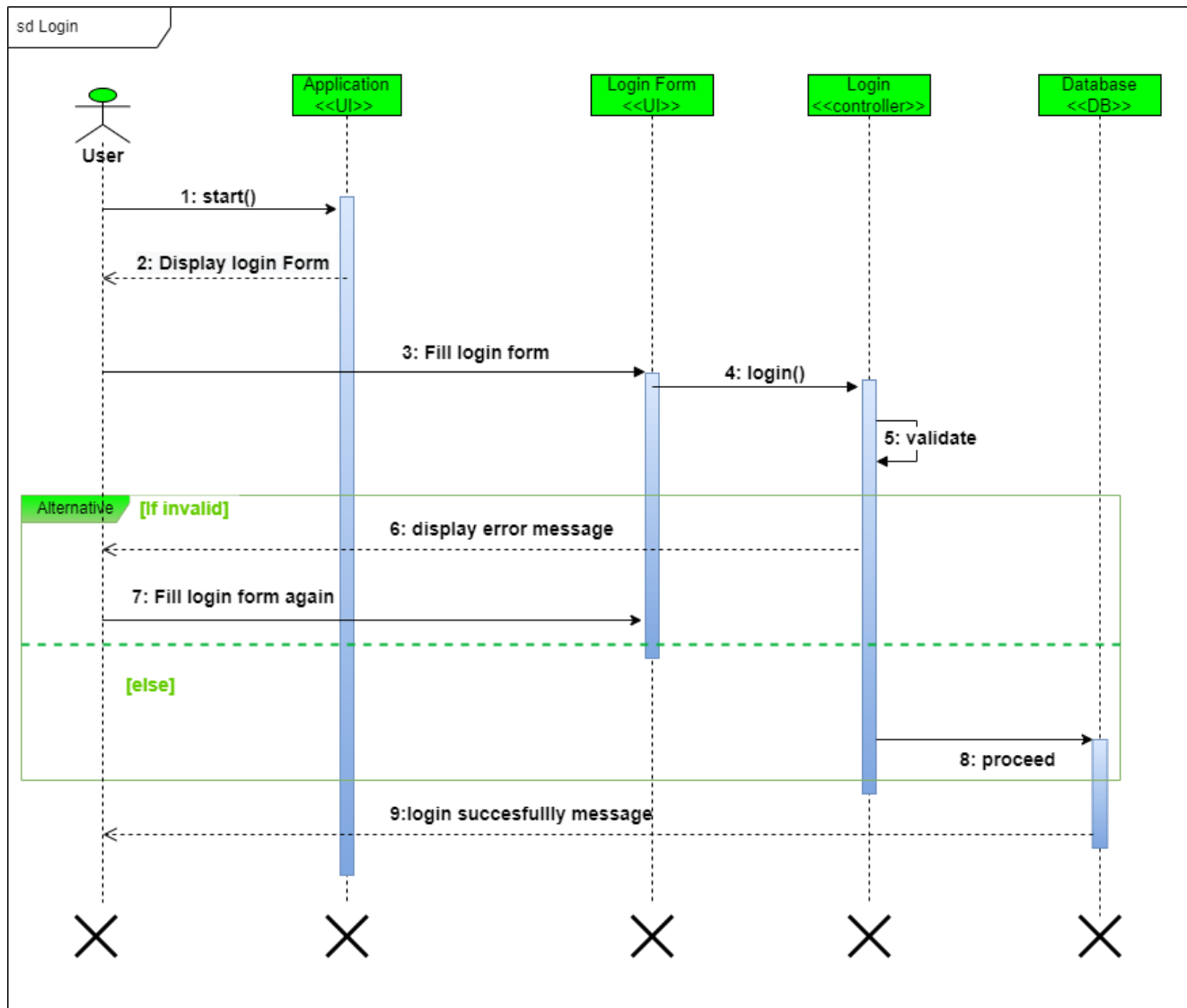


Figure 3.3 sequence diagram for login

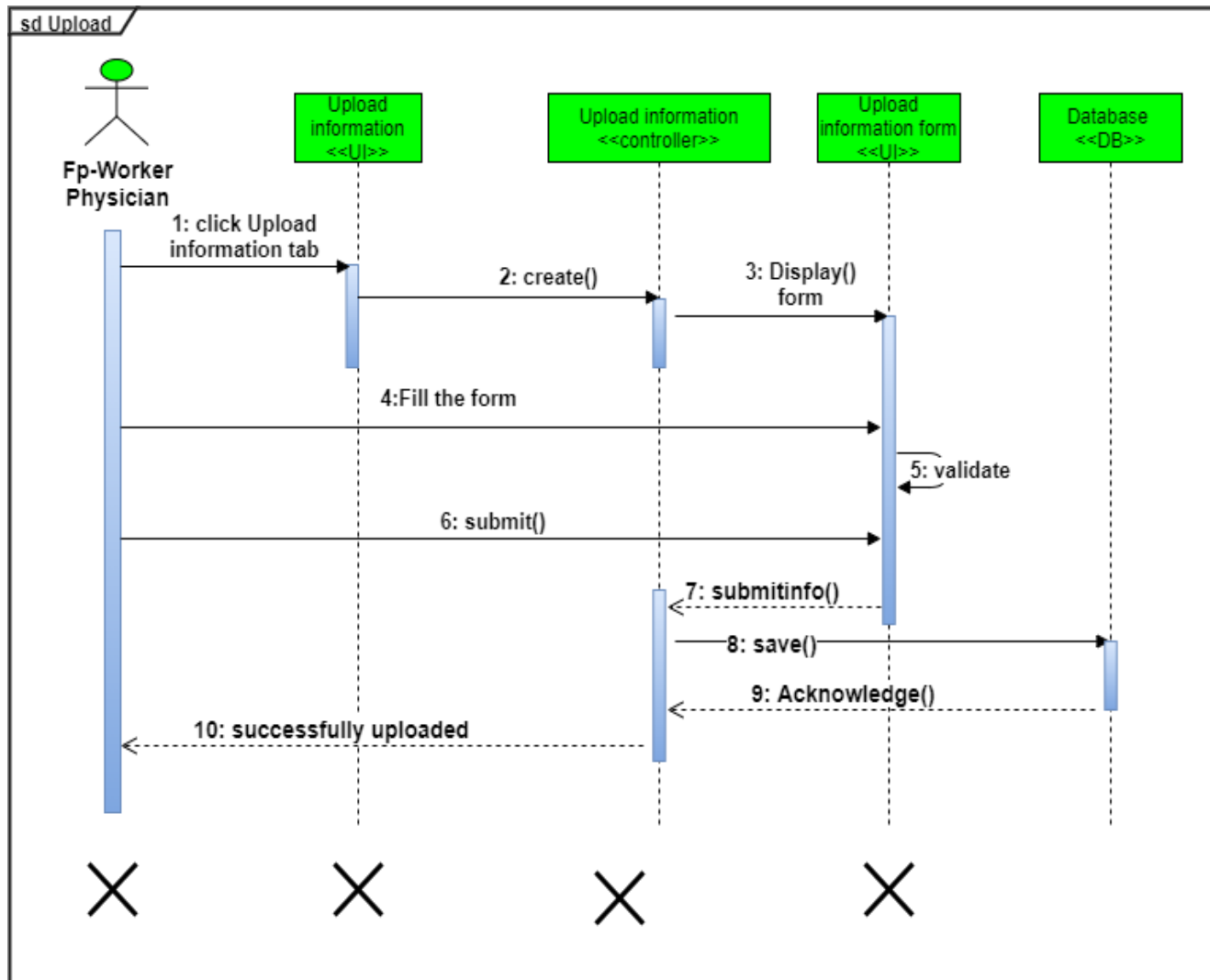


Figure 3.4 sequence diagram for upload information

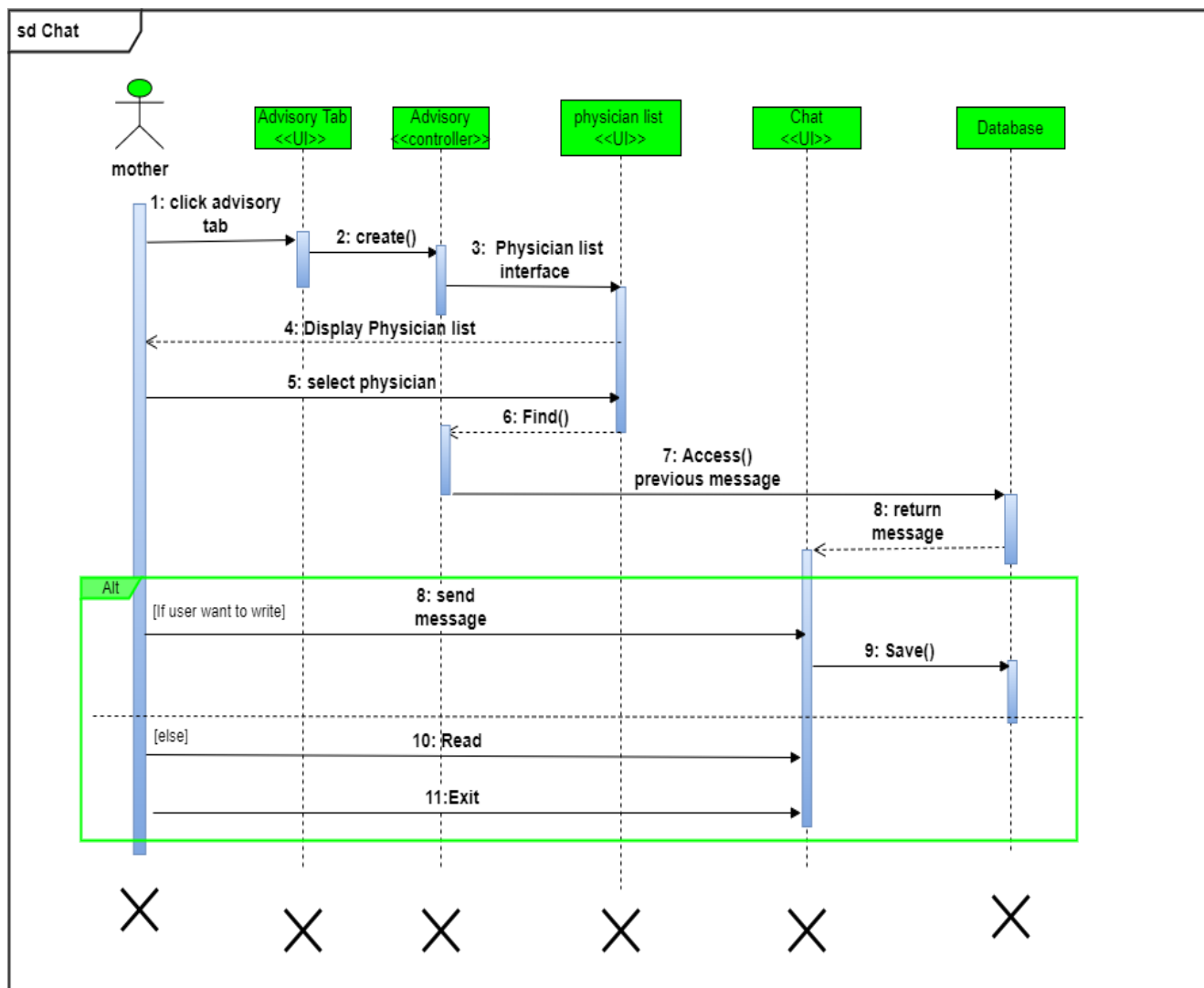


Figure 3.5 sequence diagram for Advisory

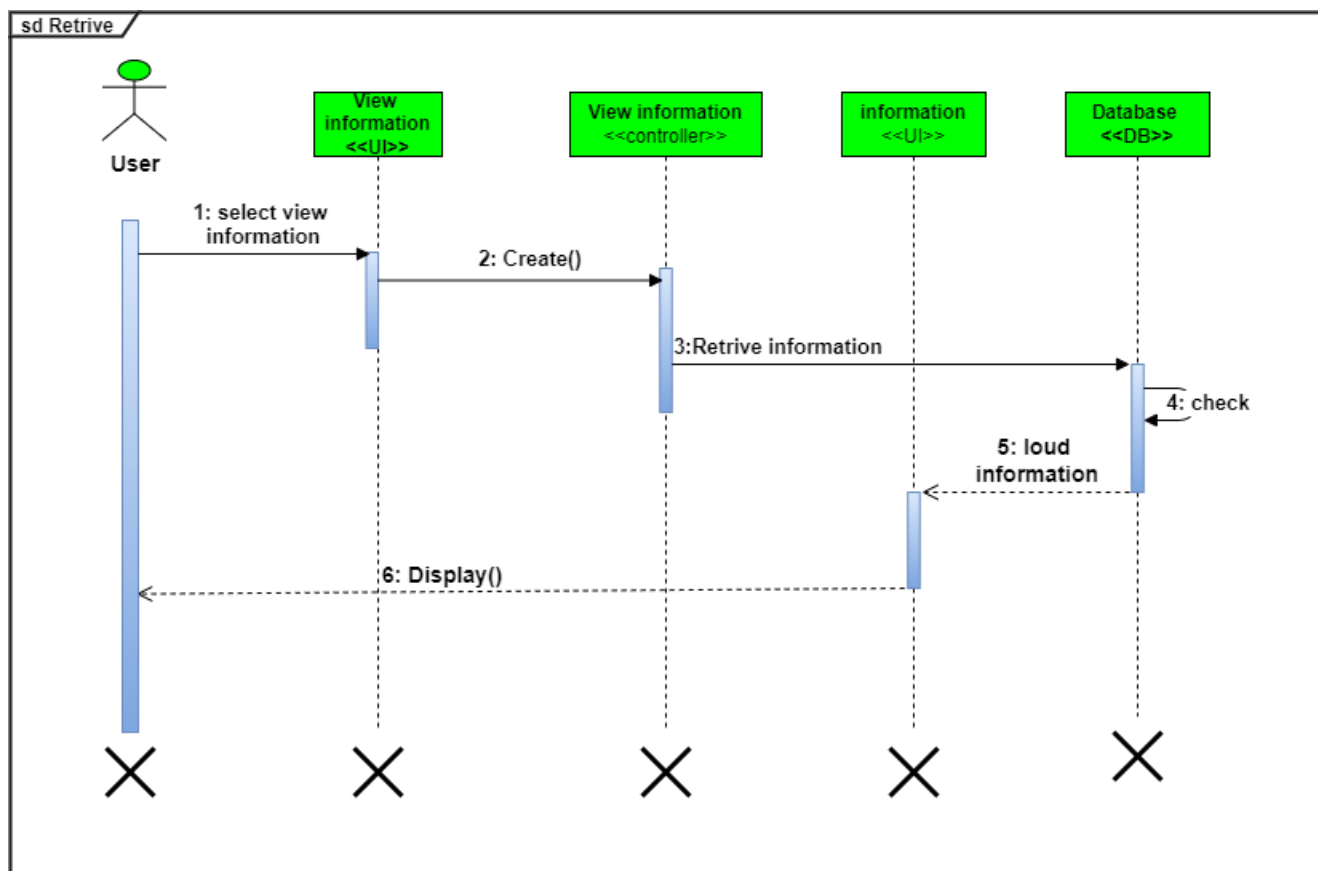


Figure 3.6 sequence diagram for retrieve information

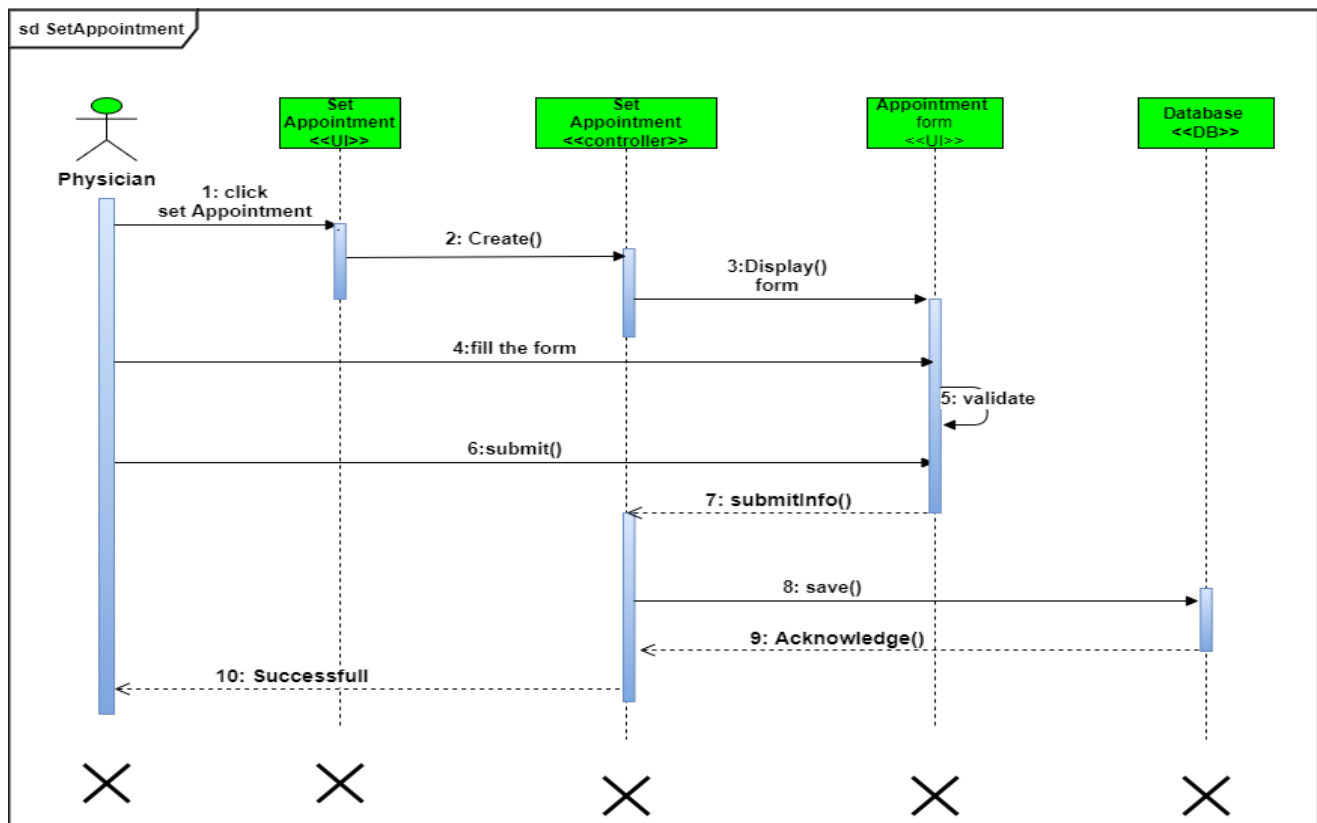


Figure 3.7 sequence diagram for set appointment

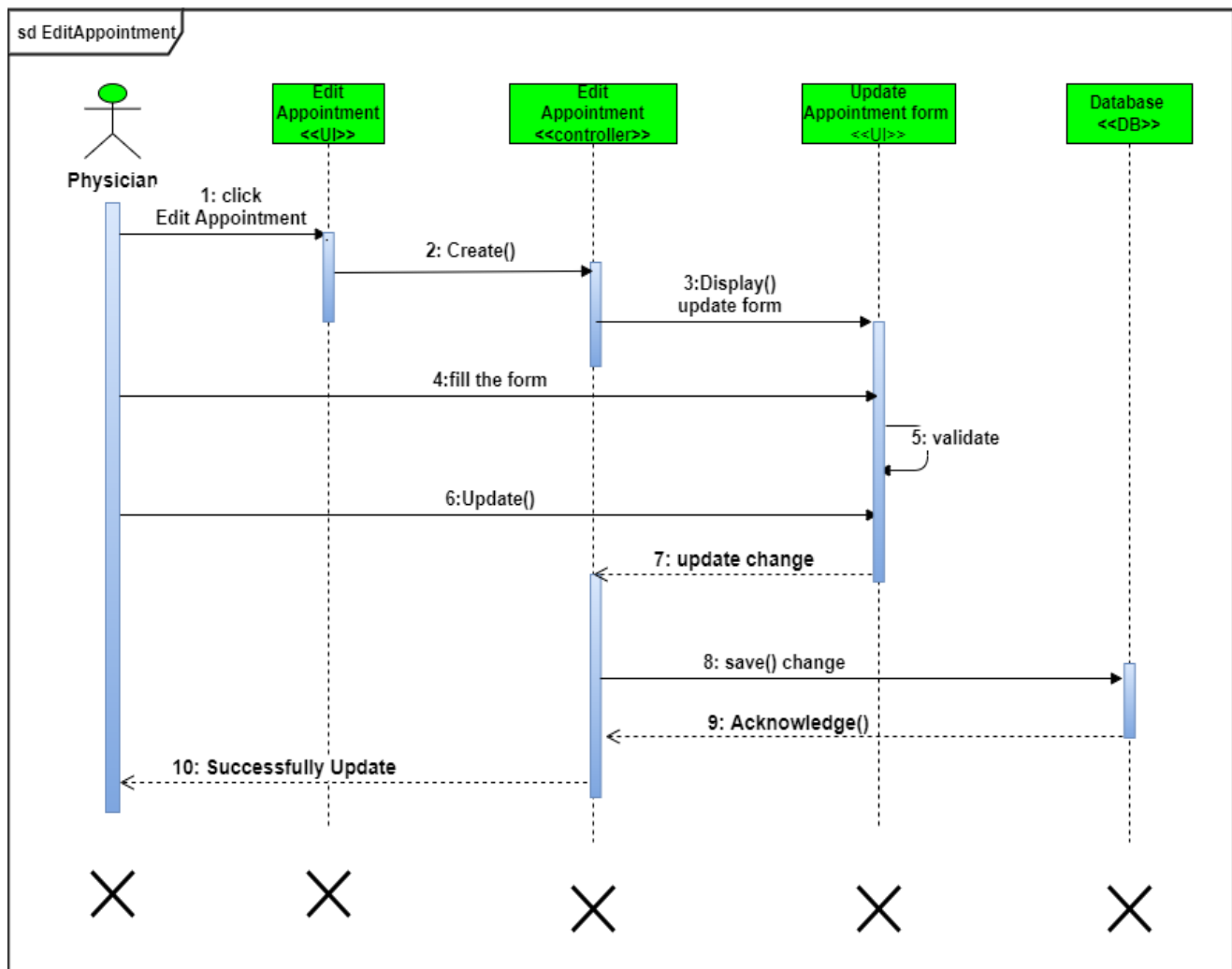


Figure 3.8 sequence diagram for edit appointment

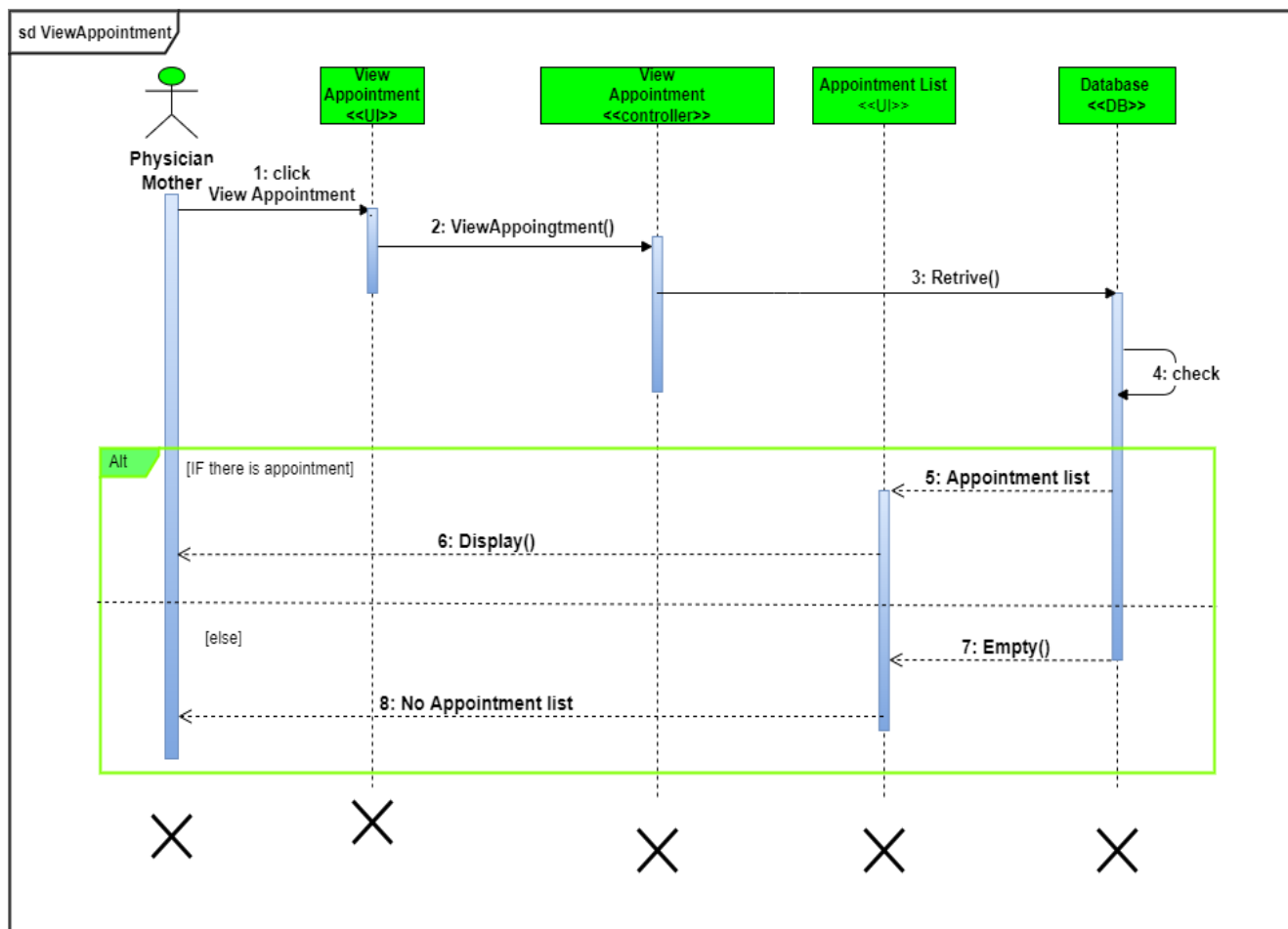


Figure 3.9 sequence diagram for view appointment

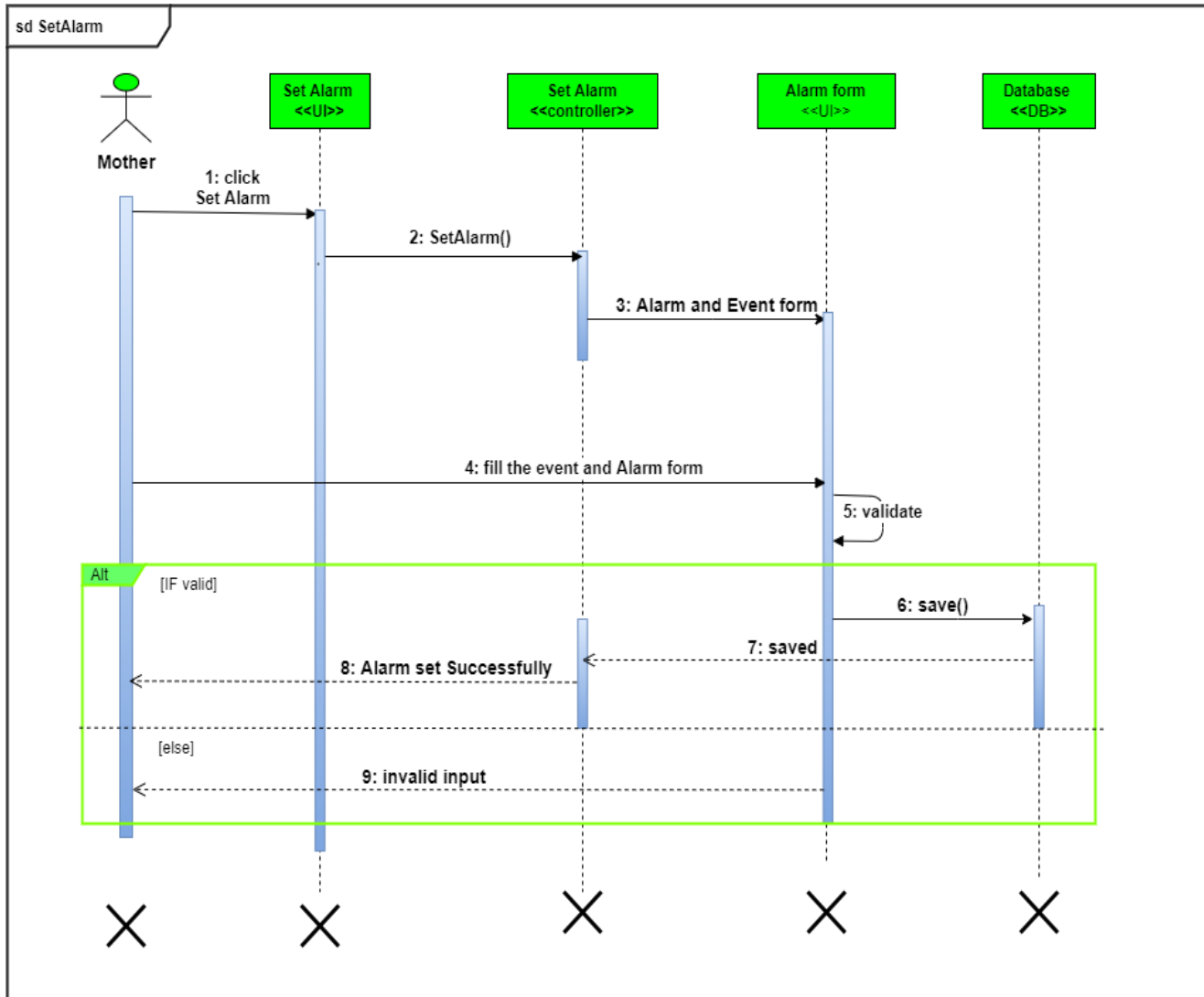


Figure 3.13 sequence diagram for set alarm

3.5.5 Activity Diagram

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration, and concurrency. In the unified modeling language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control. In its basic form an activity diagram is a simple and intuitive illustration of what happens in a workflow, what activities can be done in parallel, and whether there are alternative paths through the workflow.

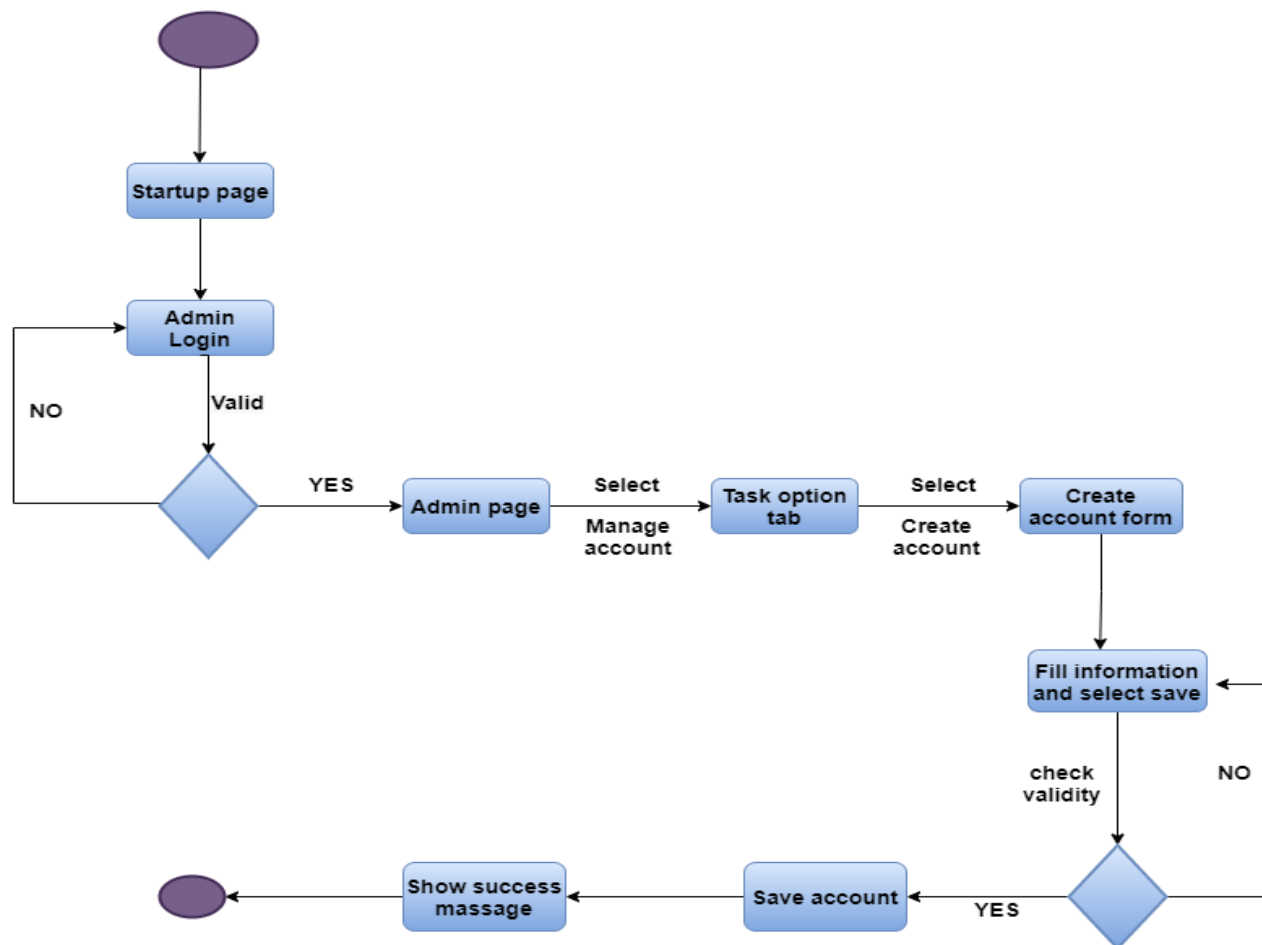


Figure 3.15 Activity diagrams for create account

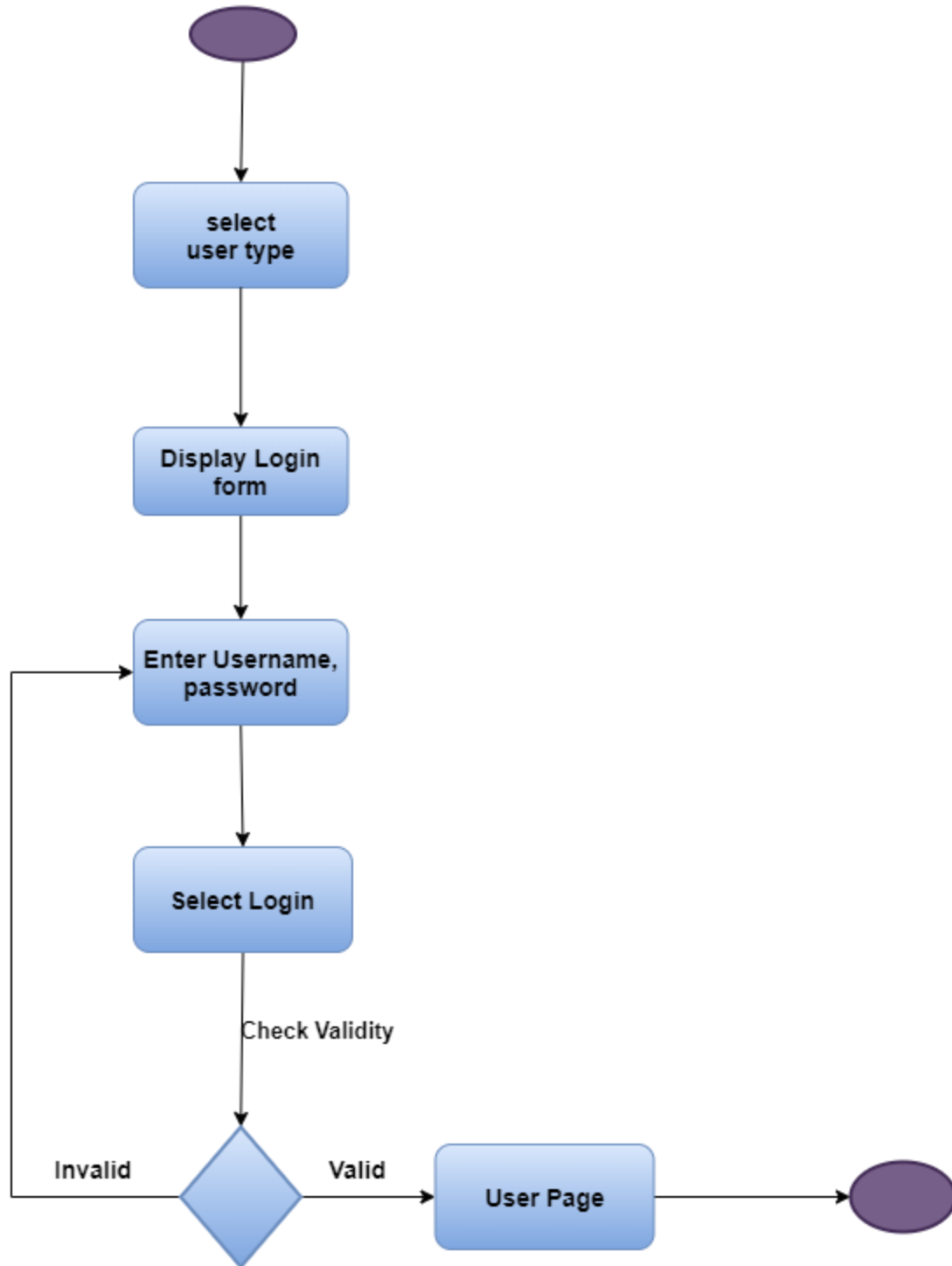


Figure 3.16 Activity diagrams for Login

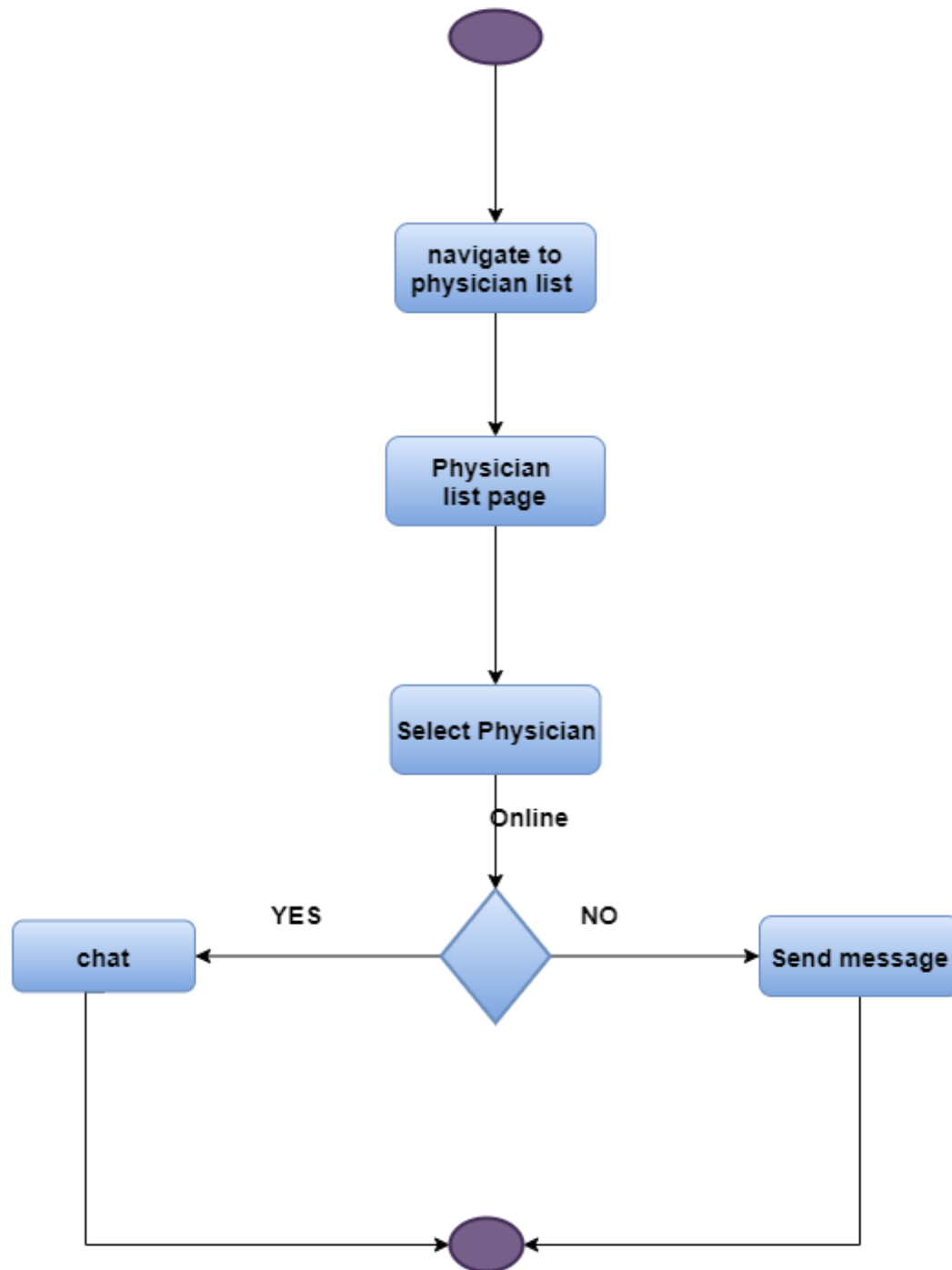


Figure 3.17 Activity diagrams for advisory

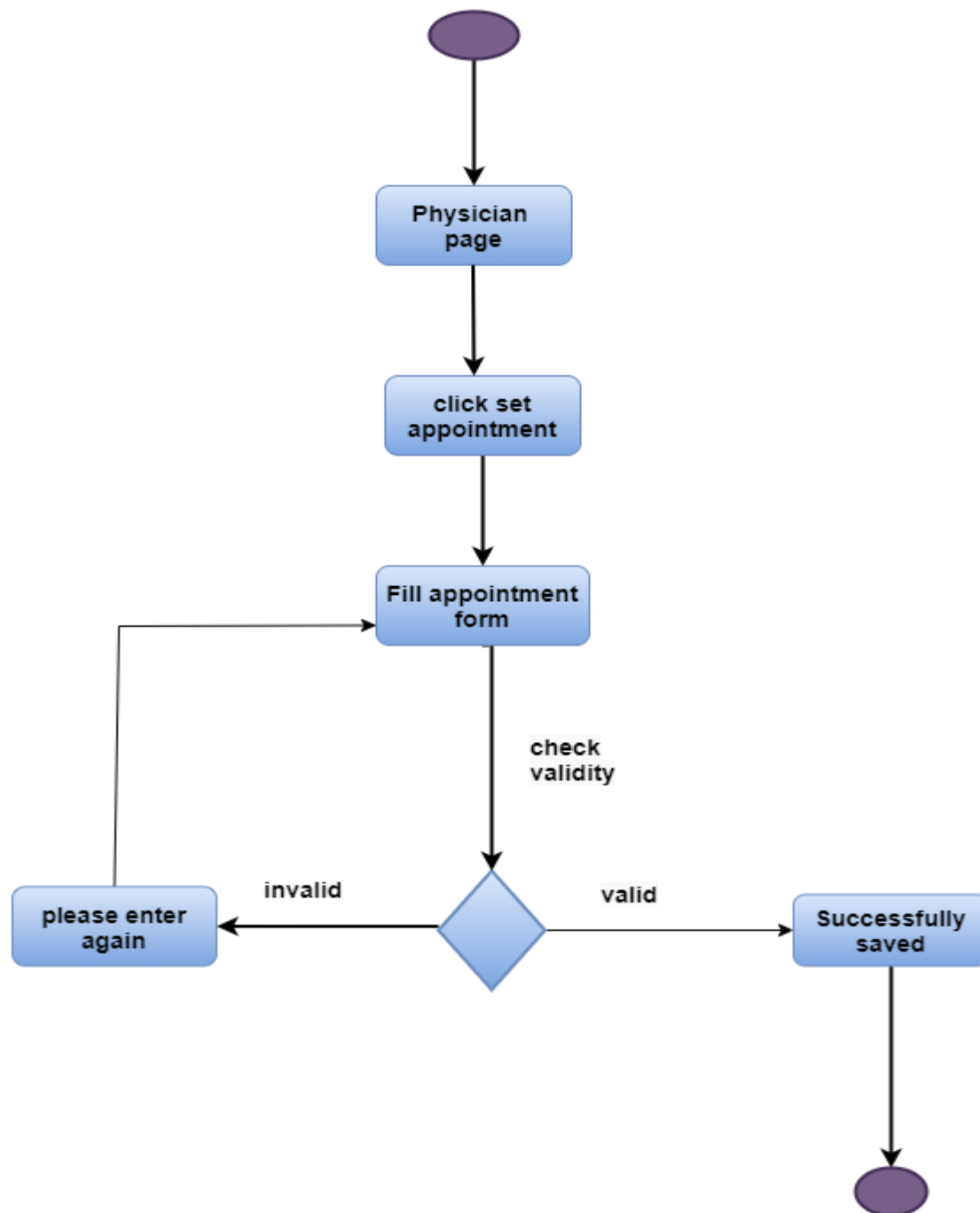


Figure 3.18 activity diagrams for set appointment

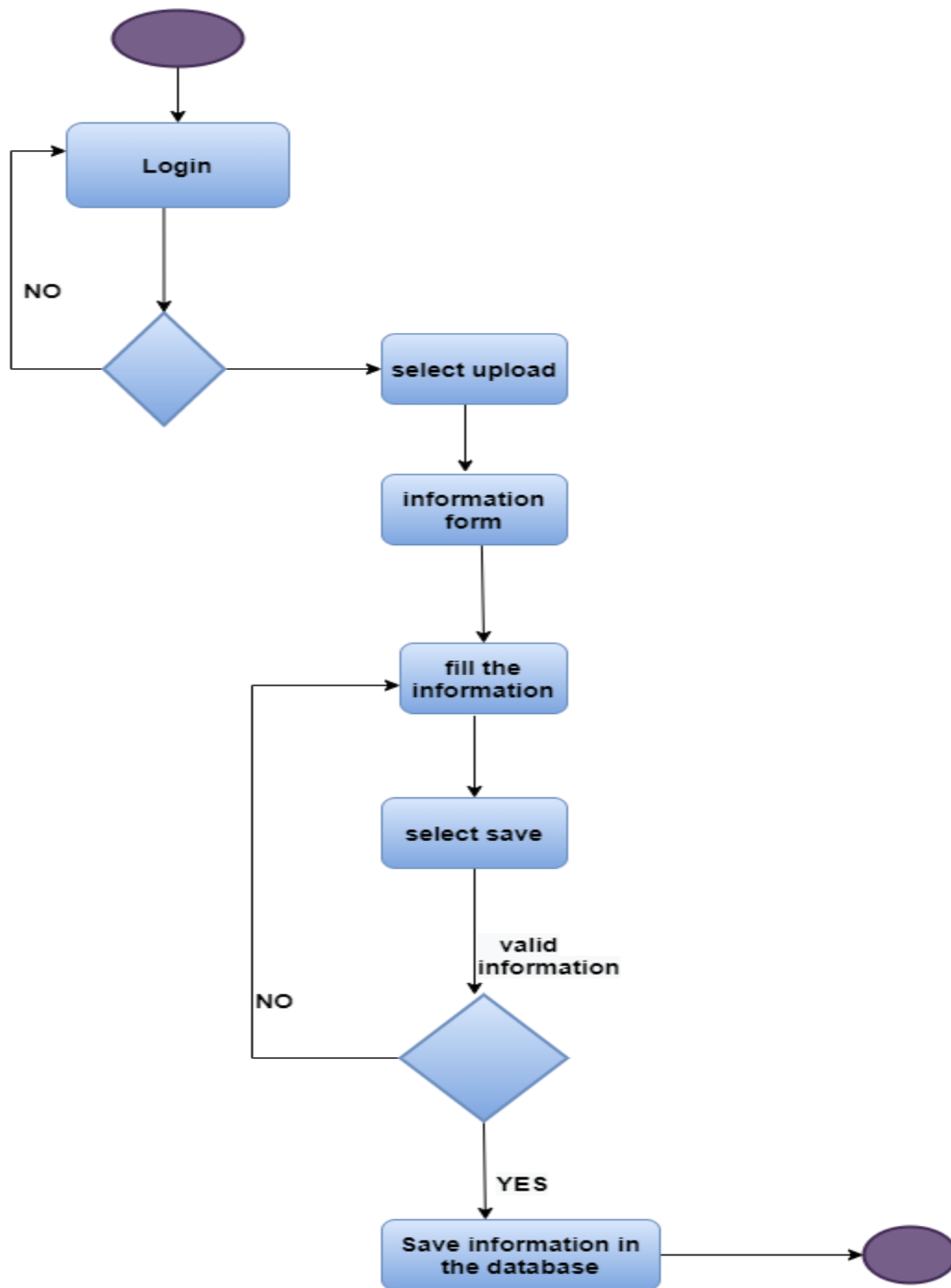


Figure 3.19 activity diagrams for upload information

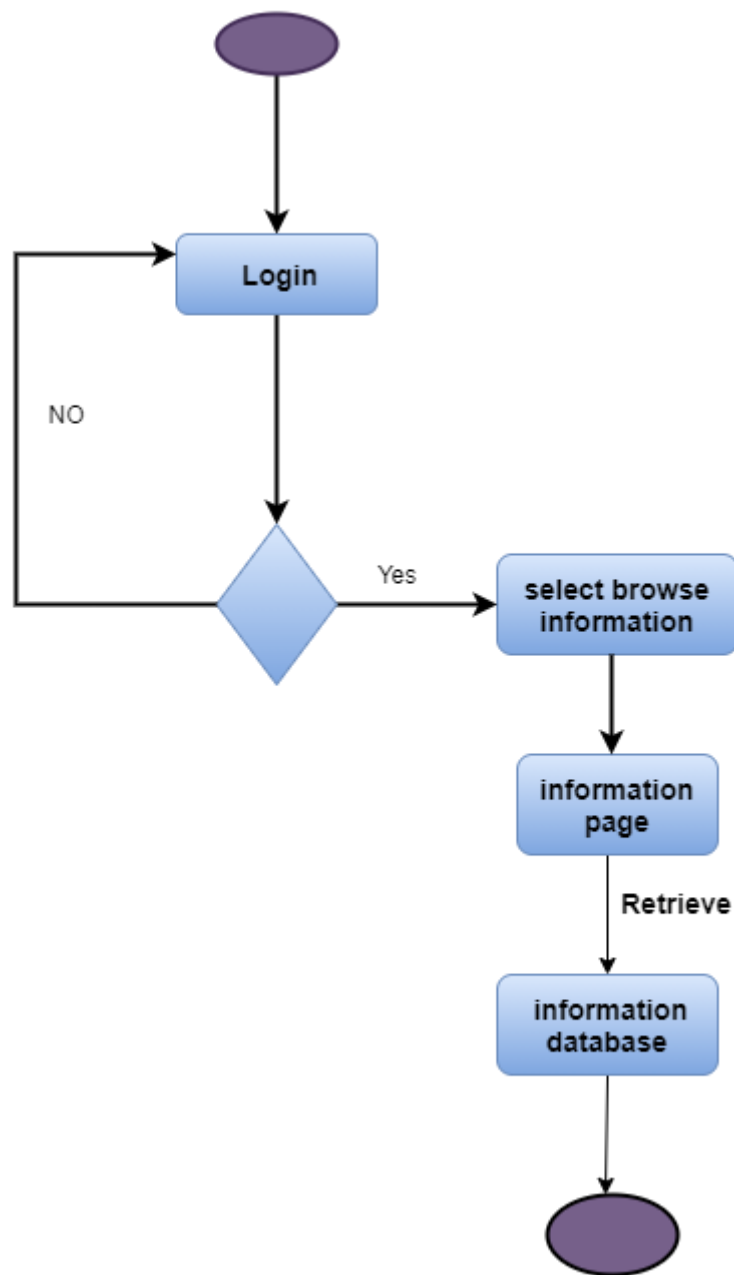


Figure 3.20 activity diagrams for Retrieve information

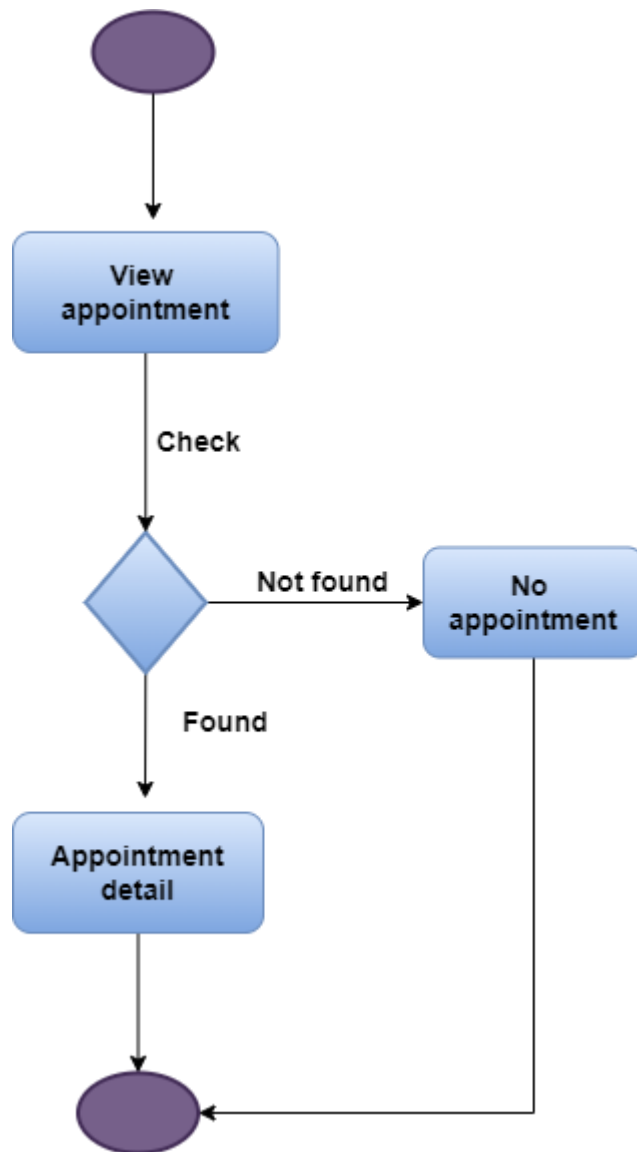


Figure 3.21 activity diagrams for view appointment

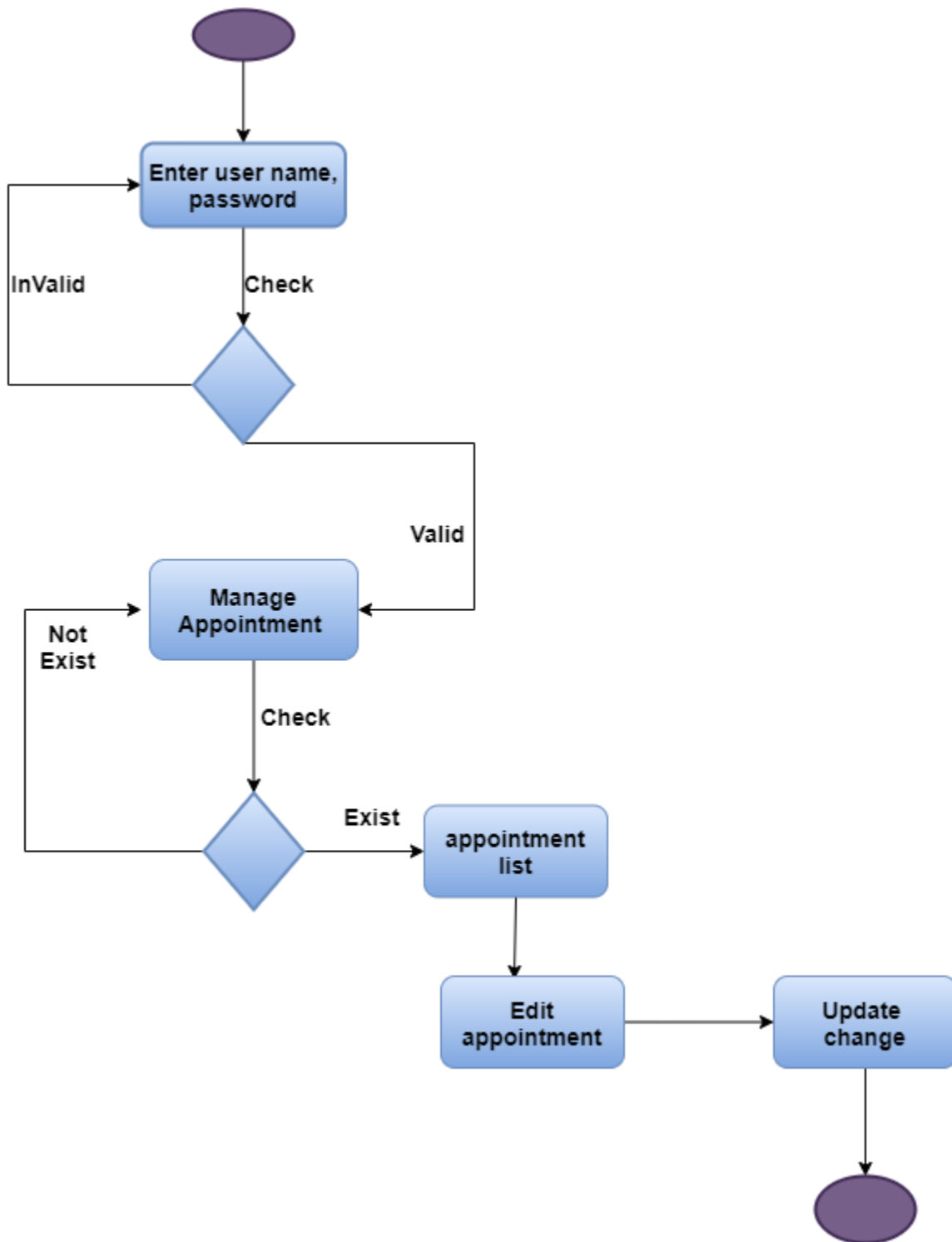


Figure 3.22 activity diagrams for edit appointment

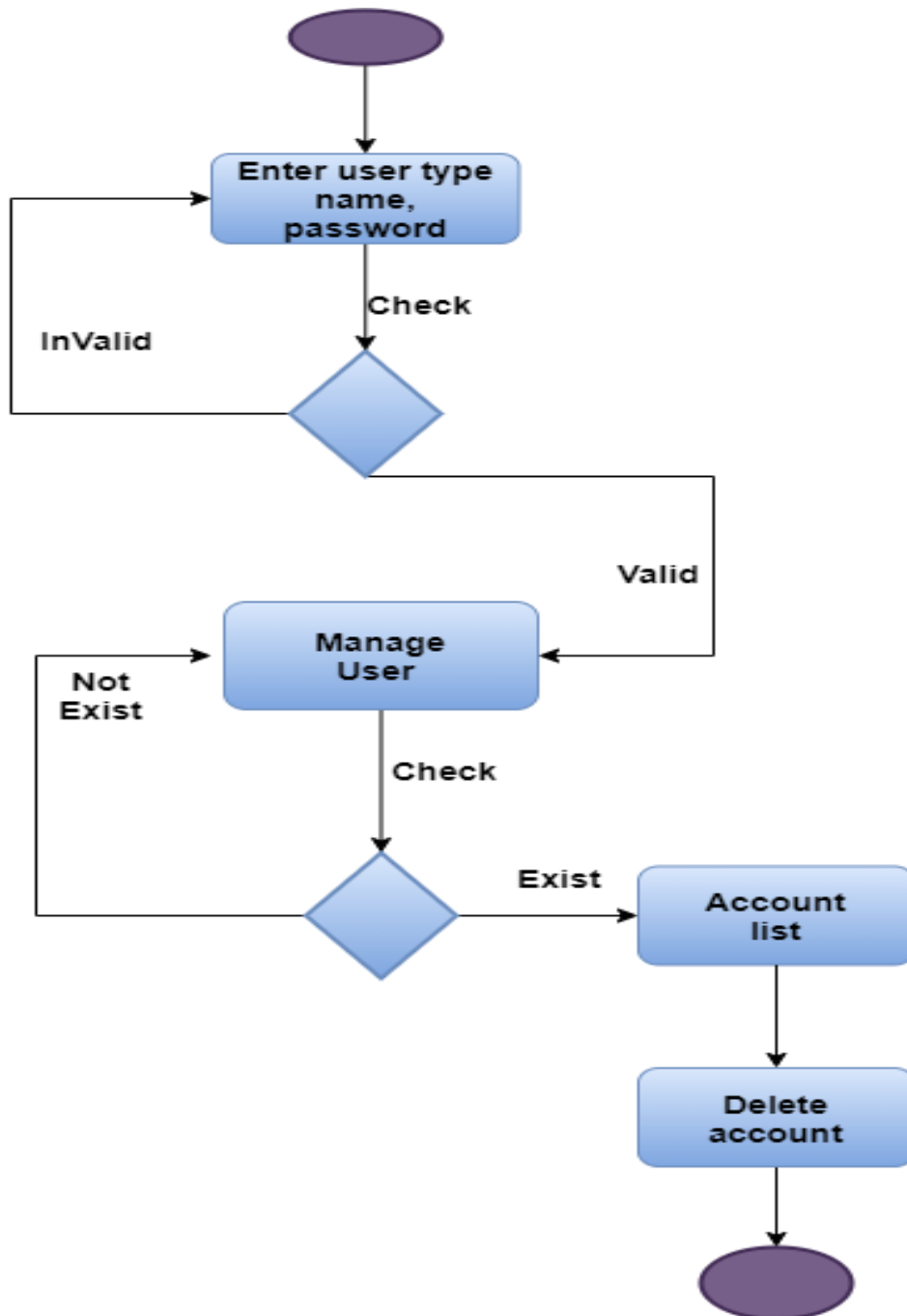


Figure 3.23 activity diagrams for delete account

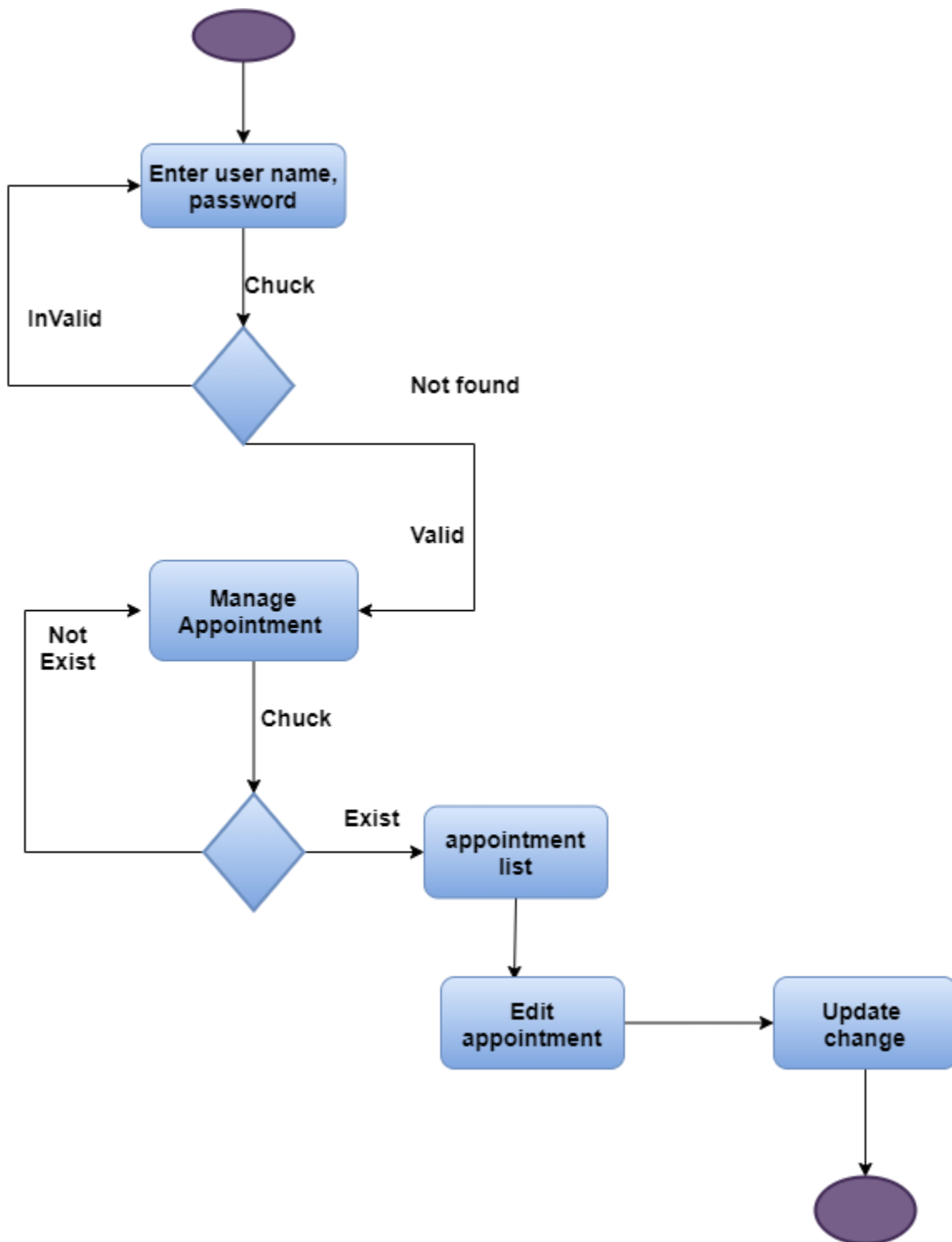


Figure 3.24 activity diagrams for edit account

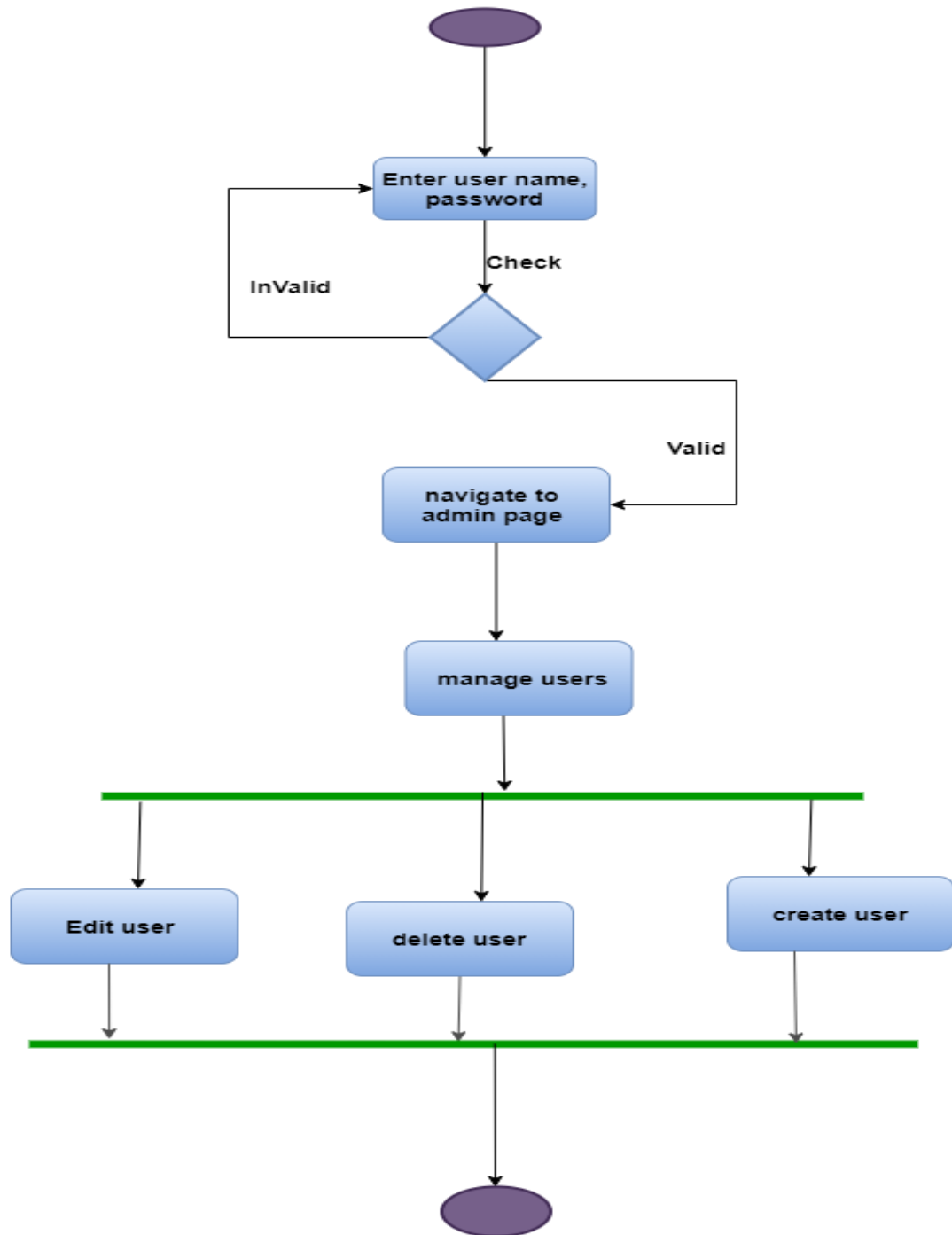


Figure 3.25 activity diagrams for manage user

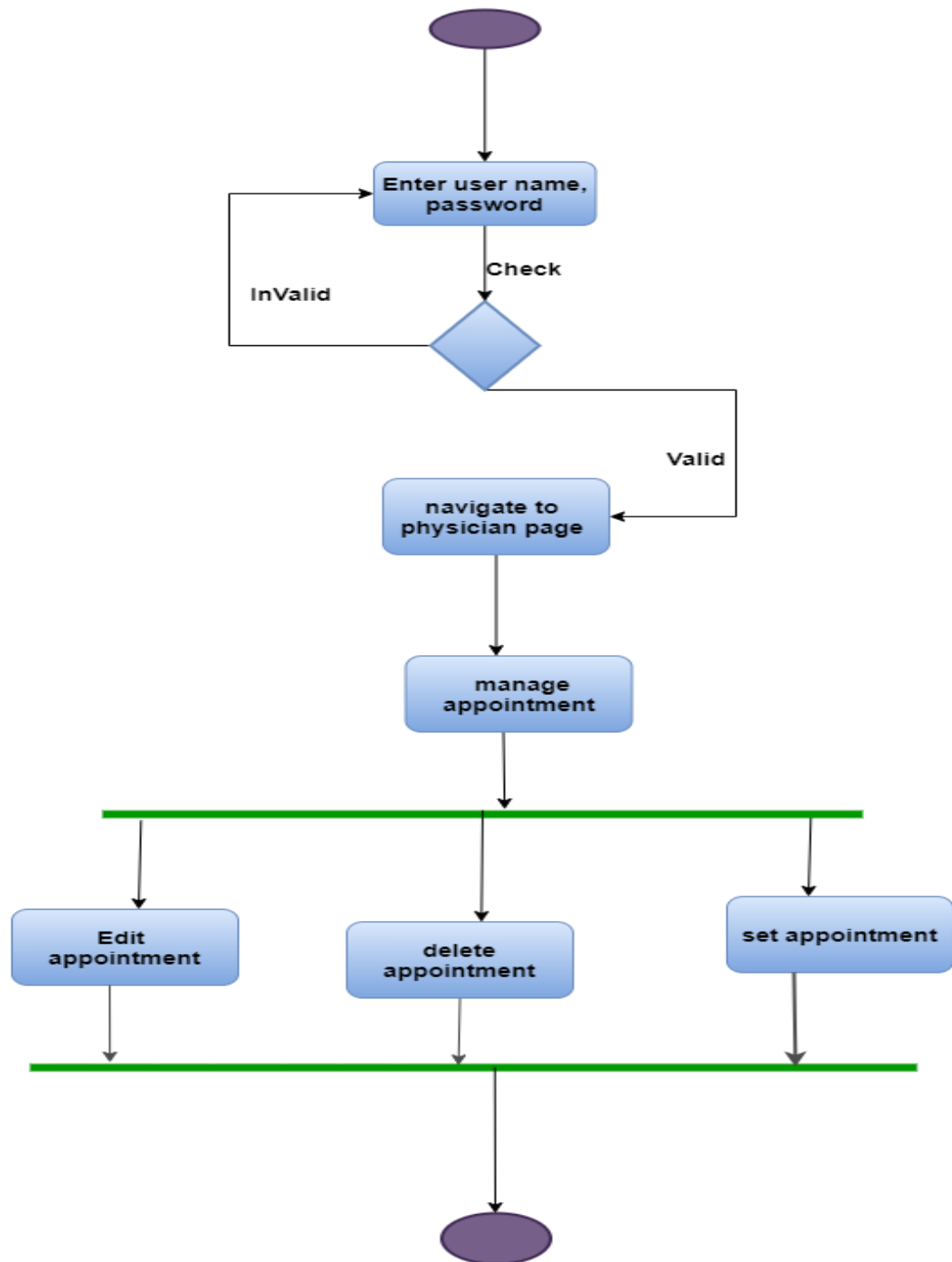


Figure 3.26 activity diagrams for manage appointment

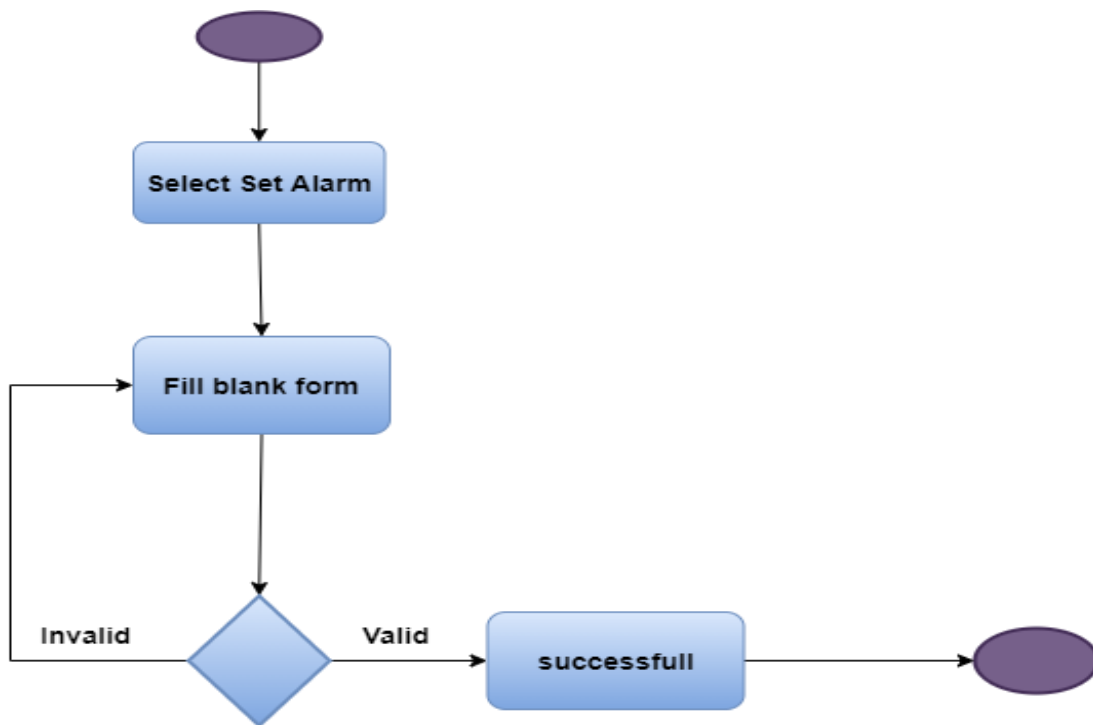


Figure 3.27 activity diagrams for set alarm

3.5.6 Analysis Level Class diagram

In a project, Analysis Level Class Diagrams are used to specify the structure of the system before design and implementation. This allows for a more efficient development process as it helps to identify potential problems before they occur. A good Analysis Level Class Diagram should clearly define the classes, interfaces, and relationships between them. This helps to ensure that the system is properly architected and will be able to meet the requirements of the project.

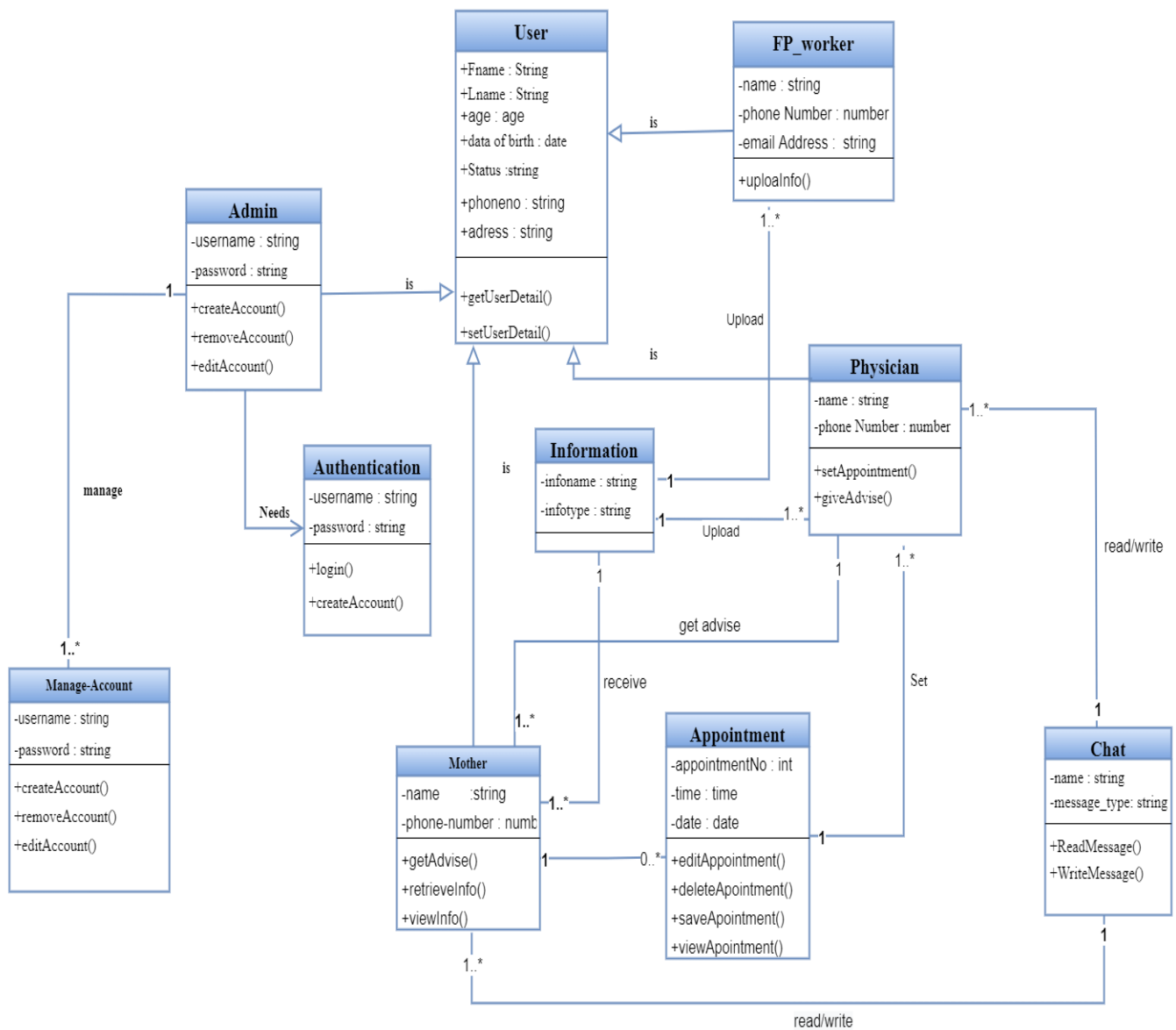


Figure 3.28 class diagram for MHAS

3.5.7 User Interface Design

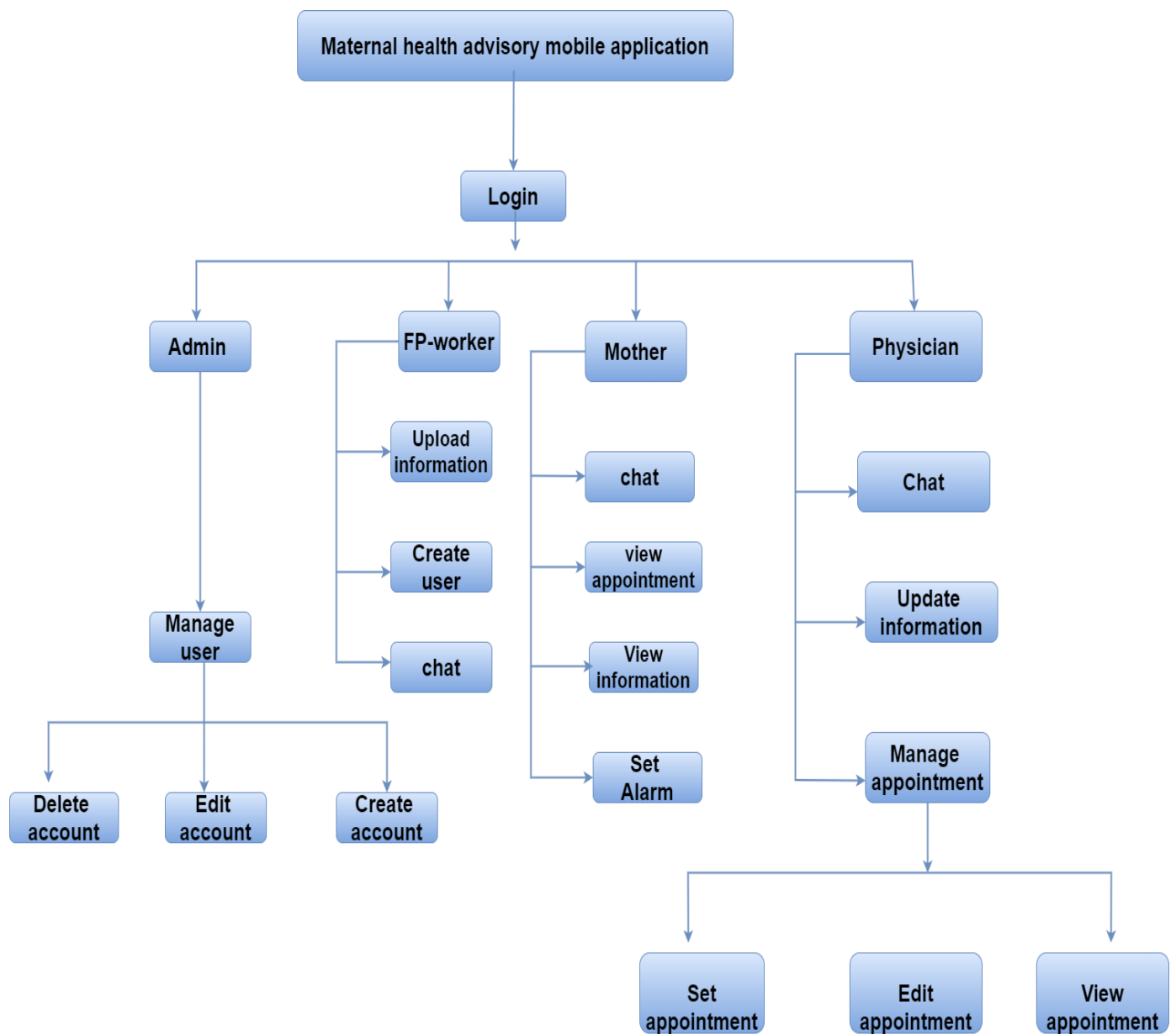


Figure 3.29 User Interface Design for MHAS

3.5.8 User Interface Prototyping



Figure 3.30 Start Up page interface



Figure 3.31 login interface

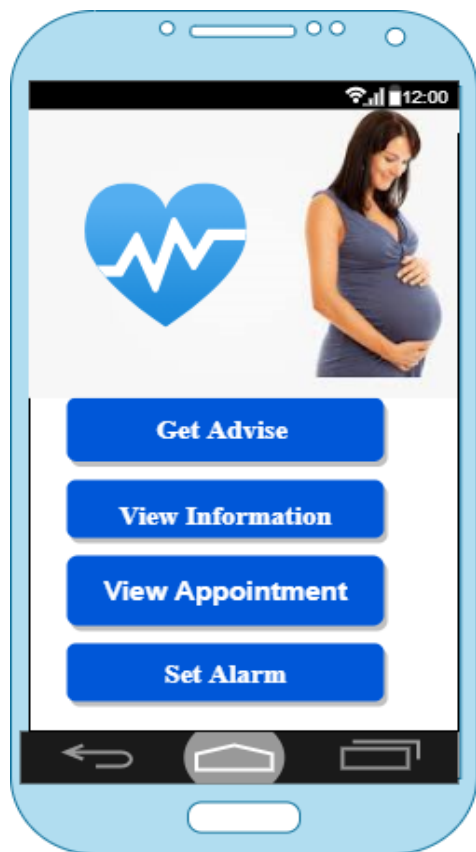


Figure 3.32 mothers page

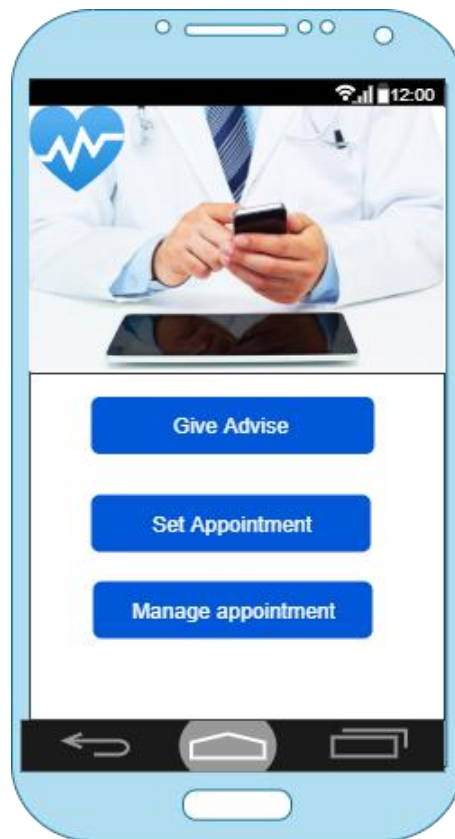


Figure 3.33 Physician page



Figure 3.34 FP-planers page

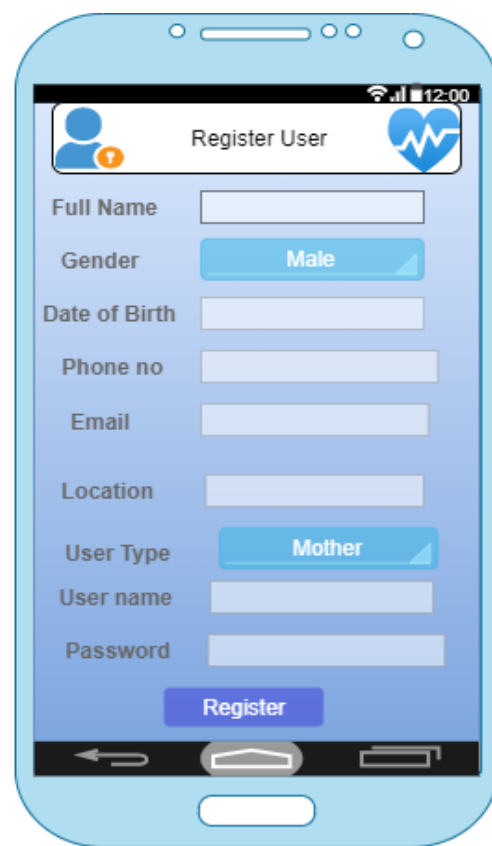


Figure 3.35 Register page

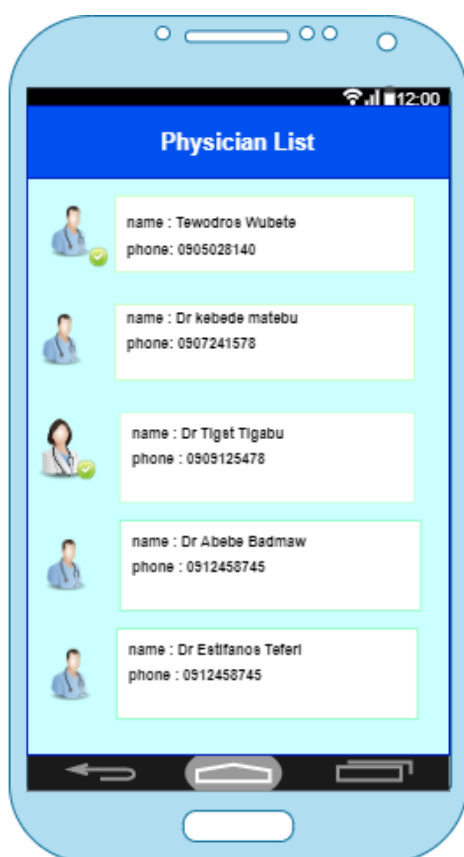


Figure 3.36 Physician list page

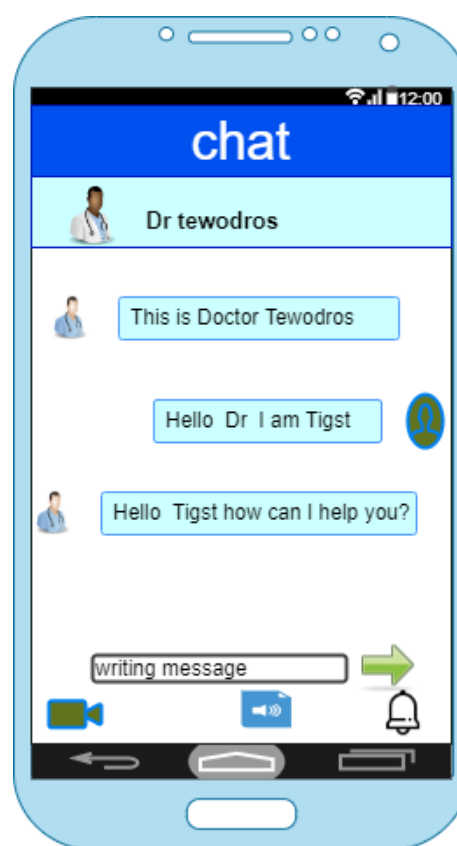


Figure 3.37 chat page

CHAPTER FOUR

4. SYSTEM DESIGN

4.1 Introduction

This chapter contains the system design of the maternal health advice mobile application. The objectives of this design are to define if the system fulfills system requirements. Systems design is the process of defining architecture modules, interfaces, and data for a system to satisfy specified requirements [2].

The purpose of designing is to show the direction of how the Application is built and to obtain clear and enough information needed to drive the actual implementation of the application. It is based on an understanding of the model the Application built on system design also focuses on decomposing the system into manageable parts.

4.2 Purpose of the System Design Document (SDD)

In the system development process system design part is very important to make the implementation of the proposed system is to become very easy. Different type of system modeling techniques that are used to make easy the implementation of the system such as deployment and component modeling are shown in detail. Not only the system modeling technique but also some system design techniques such as system decomposition design are covered in detail in this phase. The nonfunctional requirement is the description of the feature character and attributes of the system.

4.3 Design Goal

The design goals represent the desired qualities the system should have and provide a consistent set of criteria that would be taken into consideration when making design decisions. The following are mentioned as the design goals of “mobile assisted maternal health advisory system”.

- **Security:** The system should be secure to maintain data confidentiality. The system should authenticate its users by prompting them to enter their user name and password in order to get access to the system.
- **Extensibility:** The system should allow any additional services easily if needed, in other words, it should not be difficult to extend the system if additions are necessary.
- **Availability:** The system should be available every time the user needs to access it.
- **Usability:** The system should have user-friendly user interface to allow the user to interact with the system easily.
- **Performance:** The main performance measure for a project is time, so the system should give fast responses to user requests.
- **Error handling:** To reduce failures, the system will enable users to confirm the inputs they enter and respond to inputs that are not in the correct format by tasking the user to re-enter correctly.

4.4 Architectural Design

We use 3-tier for our project because 3-tier architecture provides scale-ability, performance, and availability for the project.

- **User (Presentation) Tier:** End-users operate on this tier and they know nothing about any existence of the database beyond this layer.
- **Application (Middle) Tier:** At this tier reside the application server and the programs that access the database. For a user, this application tier presents an abstract view of the database. End-users are unaware of any existence of the database beyond the application. At the other end, the database tier is not aware of any other user beyond the application tier. Hence, the application layer sits in the middle and acts as a mediator between the end user and the database.
- **Database (Data) Tier:** At this tier, the database resides along with its query processing languages. We also have the relations that define the data and their constraints at this level.

4.4.1 Logical View of the Architecture

The Logical view describes how the system is structured in terms of units of implementation. The elements are packages, classes, and interfaces. The relationship between elements shows dependencies, interface realizations, and part-whole relationships [3].

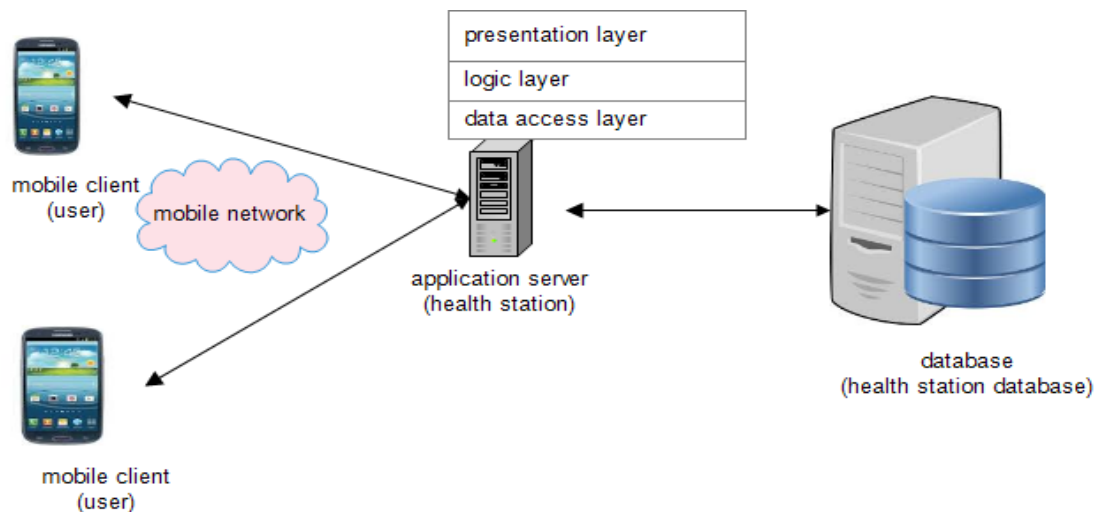


Figure 4. 1 Architecture View

4.4.2 Sub System Decomposition

Subsystem decomposition will help reduce the complexity of the system. The subsystems can be considered as packages holding related classes or objects. The MHAS is decomposed into the following subsystems.

- **Mothers' subsystem:** The mother's subsystem is responsible for viewing information, viewing appointment and getting advice from physicians or family planning workers in the form of chatting.
- **Admin subsystem:** the administrator subsystem is responsible for managing accounts.
- **Physician subsystem:** The physician subsystem is responsible for giving advice for mothers, uploading information and set appointment for mothers.
- **FP worker Subsystem:** The FP worker subsystem responsible for give advice about family planning for mother, upload information, view information, and registering mothers.

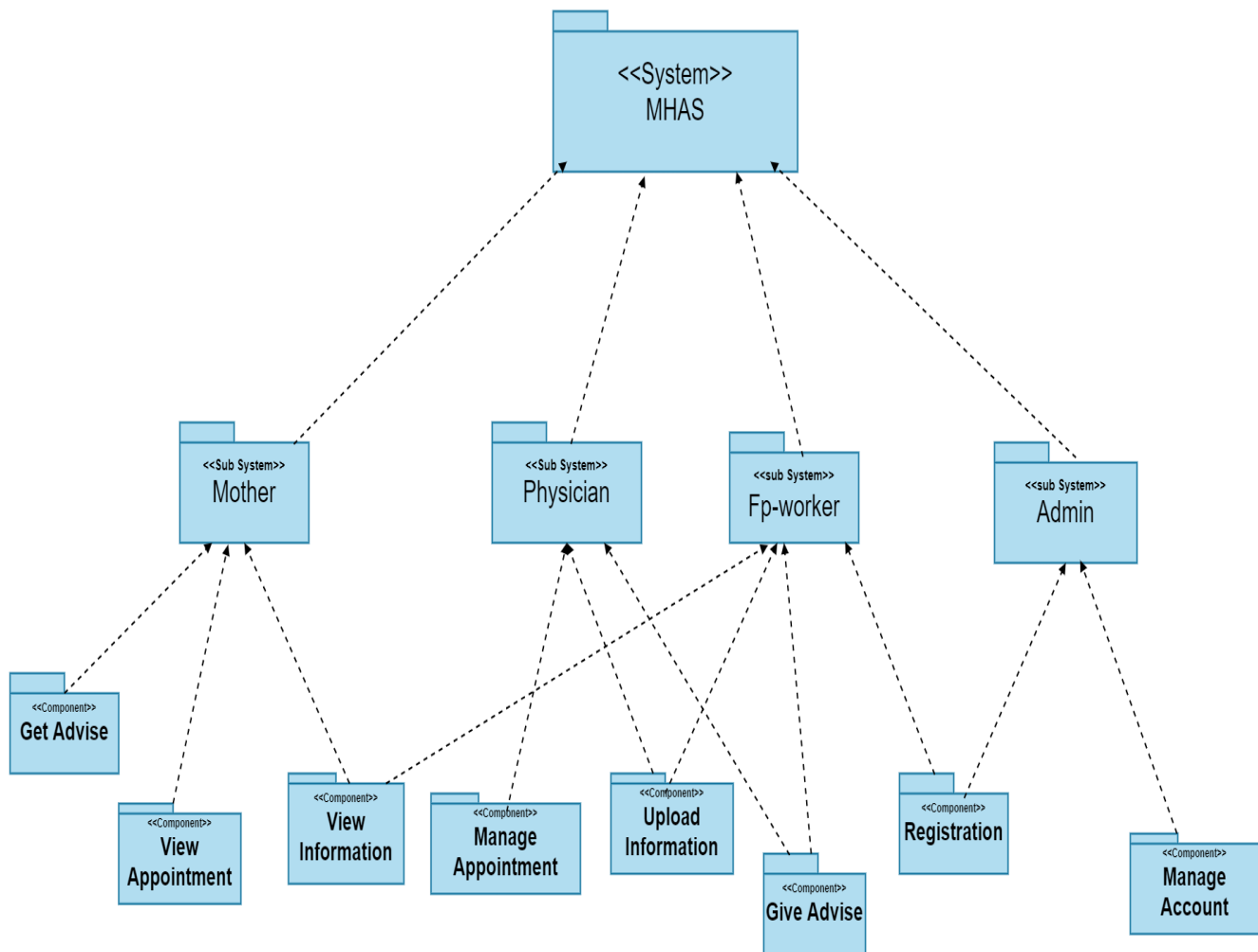


Figure 4.2 subsystem decomposition diagrams

4.4.3 Process View

Process view explains the system processes and how they communicate and focuses on the run time behavior of the system.

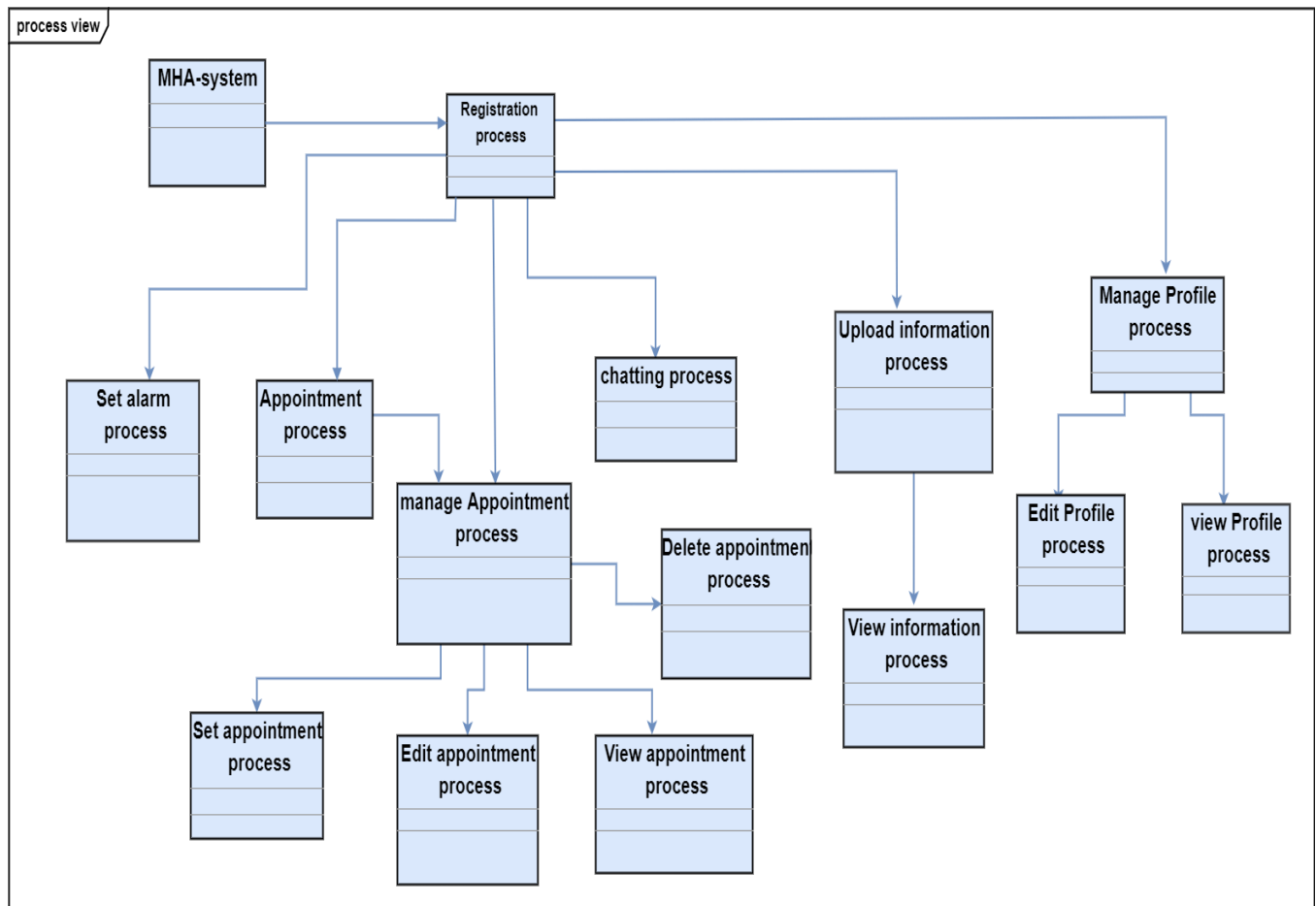


Figure 4.3 process view

4.4.4 Deployment View

A deployment diagram shows the hardware of your system and the software in that hardware. It maps a system's software components to the hardware that will execute them, also it models a system's logical element, their physical location, and how they communicate. The following diagram is the new systems deployment diagram which shows the physical device phone with its software components.

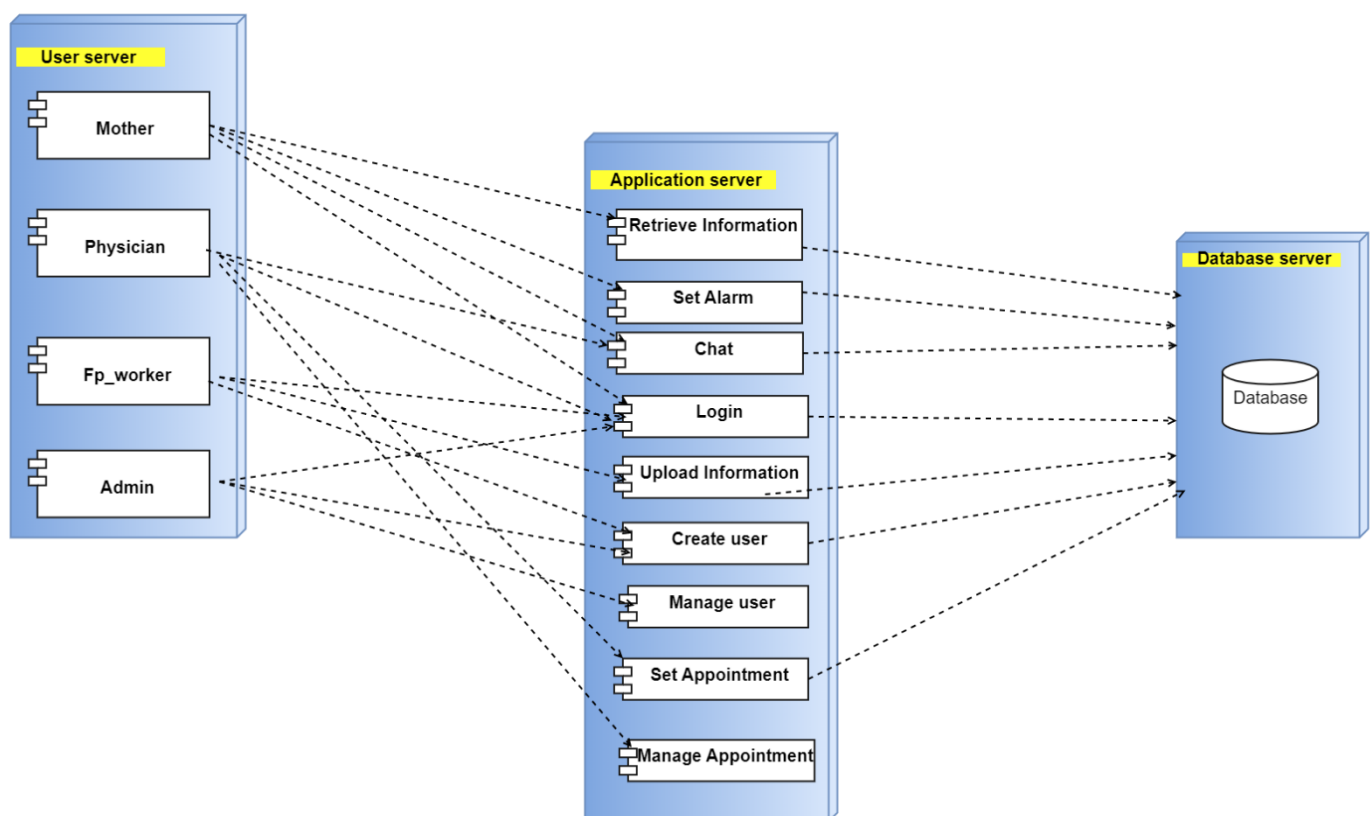


Figure 4.4 Deployment diagram

4.5 Database Design

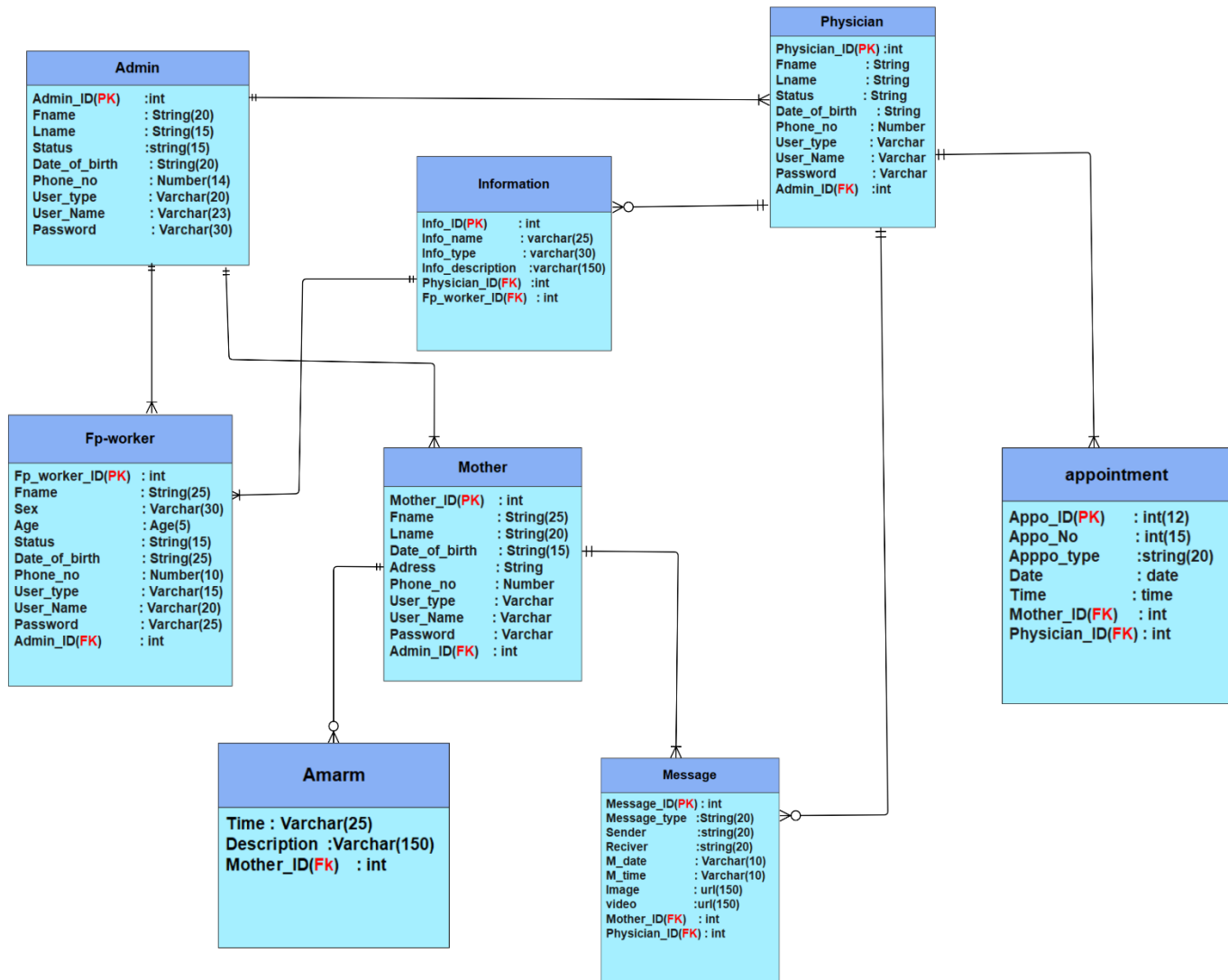


Figure 4.5 Database design for MHAS

4.6 Access Control and Security

The system we are developing will be deployed on mobile phones which are owned by a mother or physician, hence as long as the user is the actual user authenticated user can access whatever functions are provided by the system.

Table 4.1 Access control and security

functionality	Mother	Physician	FP worker	Administrator
Login	✓	✓	✓	✓
Get advice	✓			
View information	✓		✓	
View appointment	✓	✓		
Give advice		✓	✓	
Upload information		✓	✓	
Set appointment		✓		
Manage accounts				✓
Register user			✓	✓
Set alarm	✓			

CHAPTER FIVE

5 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

A maternal health advisory mobile application is an important tool for enhancing maternal health care services in Alatyon General Hospital. Our project Maternal Health Advisory System (MHAS) was aimed at developing a mobile application that would provide maternal health advice to expectant mothers who attend Alatyon General Hospital for prenatal care. The main objective of the project was to improve the quality of maternal health care services in the hospital by providing expectant mothers with reliable and up-to-date information about prenatal care.

The development of the MHAS mobile application involved conducting a thorough review of the existing literature on maternal health care and mobile health technology. The project team also conducted surveys and focus group discussions with expectant mothers and healthcare professionals at Alatyon General Hospital to gather information about the needs and preferences of the target user group. This information was used to inform the design and development of the MHAS mobile application.

The MHAS mobile application was designed to be user-friendly and easy to use, with a simple interface that enables expectant mothers to access information about prenatal care and other maternal health-related issues. The app includes information on prenatal care and postpartum care. The information provided by the app is based on current best practices in maternal health care and is updated regularly to ensure that expectant mothers have access to the most up-to-date information.

One of the key features of the MHAS mobile application is the ability for expectant mothers to receive personalized health advice based on their individual needs and circumstances. The app uses an interactive questionnaire to gather information about the expectant mother's health status, lifestyle, and other factors that could impact her pregnancy. Based on this information, the app provides personalized health advice to the expectant mother. This feature is particularly important because expectant mothers often have unique health needs and require important advice to ensure a healthy pregnancy.

Another important feature of the MHAS mobile application is the ability for expectant mothers to communicate directly with healthcare professionals at Alatyon General Hospital. The app includes a messaging system that enables mothers to ask questions, seek advice, and provide feedback to healthcare professionals. This feature is particularly important because mothers often have questions and concerns about their pregnancy and require support and guidance from healthcare professionals.

In conclusion, the Maternal Health Advisory System (MHAS) mobile application is a valuable tool for enhancing maternal health care services in Alatyon General Hospital. The app provides expectant mothers with reliable and up-to-date information about prenatal care and other maternal health-related issues and enables them to communicate directly with healthcare professionals. The personalized health advice feature and the ability to receive support and guidance from healthcare professionals are particularly important features of the app. The success of the MHAS project demonstrates the potential of mobile health technology to enhance maternal health care services and improve maternal health outcomes.

5.2 Recommendation

We highly recommend the Maternal Health Advisory Mobile Application for Alatyon General Hospital (MHAS) for its potential to improve maternal health outcomes and provide expectant mothers with the support and resources they need to have a healthy pregnancy. The combination of professional medical support and access to valuable resources makes this a truly innovative and ground-breaking project that has the potential to make a real difference in the lives of mothers and their families.

We also recommend that maternal health has broad and huge scope. However, we intended to finish the application with the basic task which is capable of communicating mothers with physicians and family planning workers but if there is another group that is interested in this application can add activities and features which is used to improve maternal health.

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Appendix

Interview Questions

1. The background of the organization.
2. How to enable mother to get advice from health center physician?
3. What is the way Family Planning workers give necessary information to the patient?
4. How to communicate mother with physicians from distance without physical contact?
5. How to inform pregnant mother about their appointment with physician?
6. How pregnant mother can inform to their physician when emergency case?
7. How family planning workers give information to the mother before and after child birth?
8. How mothers get information about Postnatal care issues include recovery from childbirth, concerns about newborn care, nutrition, breastfeeding, and family planning.