**QUAID-I-AZAM UNIVERSITY ISLAMABAD**

**DEPARTMENT OF COMPUTER SCIENCE**



**IOT BASED MOTHER AND FETUS HEALTH MONITORING**

**SOFTWARE PROJECT TECHNICAL DOCUMENTATION**

|  |  |
| --- | --- |
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# **Chapter No 1 Software Project Management Plan**

# 1 Introduction

## 1.1 Project Overview

* **Purpose**: To develop an **IoT-based real-time MOTHER and Fetus Health Care Monitoring SYSTEM** that enables pregnant women to track vital health parameters at scheduled intervals, facilitating early detection of potential pregnancy-related risks.
* **Objectives**:
  + Design and implement a wearable device capable of measuring
    1. Blood pressure,
    2. Pulse Rate
    3. Body temperature,
    4. Blood sugar levels,
    5. Fetal movement.
  + Store the measured data on an online database for risk analysis.
  + Design a mobile application that will:
    1. Check patient data to detect pregnancy risks related to the above parameters & generate alerts for both patient and DOCTOR if there is any risk.
    2. Connect DOCTORs with their patients. The DOCTOR can mark the risk as accurate or non-accurate after a detailed medical checkup and DOCTORs can prescribe personalized diet plans and medicine if applicable.
* **Scope:**
  + Development of hardware (smart wristband) and software (mobile application) components.
  + Implementation of data collection at scheduled intervals, transmission, and analysis functionalities.
  + USER interface design for both patients and healthcare professionals.
  + This app will not suggest any medicine to the patient because it is illegal to do so without a license.

## 1.2 Project Deliverables

Project deliverable includes:

1. **Technical Documentation:**
   1. Software Project Management Plan
   2. Software Requirement Specification
   3. Software Design Description
   4. Software Test Documentation
2. **Mobile Application**
3. **Wearable Wristband:**
   1. Arduino Uno Micro-controller
   2. Arduino ESP8266 Micro-controller
   3. Sensor
      1. Blood Pressure and Pulse Monitor
      2. Body Temperature Sensor
      3. Blood Glucose Sensor
      4. Heart Rate Sensor
      5. Fetal Movement Buttons

## 2 Project Organization

### 2.1 Software Process Model

For the development of IoT Based MOTHER and Fetus Health Care Monitoring SYSTEM, An **Agile Software Development Model** is chosen.



Figure 1: Agile Software Development Model

Agile methodologies are iterative and incremental, which means they are known for dividing the project into smaller parts and adjusting to changing requirements. It prioritizes flexibility, collaboration, and customer satisfaction.

### 2.2 Roles and Responsibilities

1. **Student (Khurram Shahzad):**
   1. SYSTEM Analyst
   2. Software Architect
   3. Database Designer
   4. UI / UX Designer
   5. Front-end Developer
   6. Software Developer
   7. Quality Assurance Engineer
2. **Project Supervisor (Prof. Dr. Muazzam Ali Khan Khattak)**
   1. Mentor, Reviewer, Technical Guidance.

### 2.3 Tools and Techniques

|  |  |
| --- | --- |
| **Tools / Technique** | **Purpose** |
| Project Libre | For creating Project Timeline & Gantt Charts & tracking milestones. |
| Microsoft Word | For creating technical project documentation. |
| Draw.io | For designing UML diagrams. |
| Android Studio | As an IDE for Mobile Application Development for MOTHER and DOCTOR. |
| Vs Code | A lightweight code editor for NodeJS, ExpressJS programming. |
| Database | For storing data by syncing real time health data from sensor to the cloud. |
| NodeJS & Express.JS | NodeJS & Express JS for Backend Development. |
| Dart | Backend Programming Language for Mobile Application development. |
| Flutter | For cross platform Mobile Application’s Front end. |
| Git GitHub | For version control and collaboration. |
| Postman | For API Testing. |
| Figma | For creating UI design. |
| Arduino IDE | As an IDE for writing the code to program Arduino/ESP32 micro-controllers to read sensor data and transmit it. |
| C++ | Language supported by Arduino Micro-controller. |

## 3 Project Management Plan

The Project Management Plan describes how time and resources are managed throughout the project life cycle.

### 3.1 Tasks

These are the task that will be carried out through the software development life cycle.

## 3.1.1 Requirement Analysis Phase

### 3.1.1.1 Requirements Identification

|  |  |  |
| --- | --- | --- |
| **Task Description** | The initial step of this project is the identification of requirements which are functional and non-functional. | |
| **Deliverables** | Requirements are collected and reviewed | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | None | |
| **Risks** | None | |

### 3.1.1.2 Defining Use Cases

|  |  |  |
| --- | --- | --- |
| **Task Description** | After finalizing all **Software** requirements, Use Case Description and Diagrams will be created. | |
| **Deliverables** | Use Case Description, Use Case Diagram | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word, Draw.io |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | All functional requirements should be clear. | |
| **Risks** | Requirements may change frequently. | |

### 3.1.1.3 Develop Domain Model

|  |  |  |
| --- | --- | --- |
| **Task Description** | After finalizing the Use Case description and diagrams, Domain Model will be created. | |
| **Deliverables** | Domain Model | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word, Draw.io |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | We must know all the Use Case before developing domain model. | |
| **Risks** | Addition of new use cases may affect the domain model. | |

### 3.1.1.4 ERD Design

|  |  |  |
| --- | --- | --- |
| **Task Description** | This task includes creating of entity relationship diagram. | |
| **Deliverables** | ERD Diagram. | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word, Draw.io |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | We must know the Domain Model Design in order to know the flow of data and what data we will need in this step. | |
| **Risks** | An update in the domain model will also require change in ERD Diagram. | |

### 3.1.1.5 Software Requirements Specification Completion

|  |  |  |
| --- | --- | --- |
| **Task Description** | This task includes making **Software** Requirement Specification document. | |
| **Deliverables** | Complete SRS Document. | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | None | |
| **Risks** | None | |

## 3.1.2 Design Phase

### 3.1.2.1 Develop Design

|  |  |  |
| --- | --- | --- |
| **Task Description** | Development of Architectural Design | |
| **Deliverables** | Architectural Diagram | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | Requirement Analysis must be completed. | |
| **Risks** | None | |

### 3.1.2.2 Developing Interfaces

|  |  |  |
| --- | --- | --- |
| **Task Description** | This task includes how each screen will look like and which feature would come on which screen. | |
| **Deliverables** | Figma Design | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word, Figma |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | Requirement Analysis must be completed. | |
| **Risks** | None | |

### 3.1.2.3 Class Diagram Designing

|  |  |  |
| --- | --- | --- |
| **Task Description** | This task includes creation of Class Diagram. It shows the flow of data and how they are related to each other. | |
| **Deliverables** | Class Diagram. | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word, Draw.io |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | Architectural Design must be completed. | |
| **Risks** | If architectural design and domain model are not well defined, it may cause problems. | |

### 3.1.2.4 Sequence Diagram Design

|  |  |  |
| --- | --- | --- |
| **Task Description** | In this step we will create Sequence Diagrams to show the flow of data between USER and SYSTEM classes. | |
| **Deliverables** | Sequence Diagrams | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word, Figma |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | Architectural Design must be completed. | |
| **Risks** | If architectural design and domain model is not well defined, it may cause problems. | |

### 3.1.2.5 Design Phase Verification

|  |  |  |
| --- | --- | --- |
| **Task Description** | In this step we will verify all the previous steps of this phase. | |
| **Deliverables** | Design Phase is completed and it’s document will be reviewed. | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word, Figma |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | The whole Design Phase must be completed. | |
| **Risks** | If architectural design and domain model is not well defined, it may cause problems. | |

### 3.1.2.6 Software Test Documentation

|  |  |  |
| --- | --- | --- |
| **Task Description** | In this step we will define the test cases. | |
| **Deliverables** | Tests are reviewed. Design Phase is complete. | |
| **Resource Needed** | **People** | Khurram Shahzad,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word |
| **Hardware** | Laptop |
| **Dependencies and Constraints** | Design Phase should be completed. | |
| **Risks** | None. | |

## 3.1.3 Implementation Phase

### 3.1.3.1 SYSTEM Implementation

|  |  |  |
| --- | --- | --- |
| **Task Description** | In this step we will connect the sensors to Arduino microcontroller, send data to Database, create the web server, write code for mobile application. | |
| **Deliverables** | Mobile App, Wristband | |
| **Resource Needed** | **People** | Khurram Shahzad,  Electronics Expert,  Prof. Dr. Muazzam Ali Khan Khattak |
| **Software** | Microsoft Word, VsCode, Android Studio, Database |
| **Hardware** | Laptop, Arduino ESP8266, Sensors, Wires, |
| **Dependencies and Constraints** | Would need to learn technologies such as Dart, Flutter. | |
| **Risks** | None. | |

## 3.2 Assignments

|  |  |  |
| --- | --- | --- |
| **Task** | **Assignee** | **Role** |
| Requirement Identification | Khurram Shahzad | SYSTEM Analyst |
| Defining Use Cases | SYSTEM Analyst |
| Develop Domain Model | SYSTEM Analyst, Software Architect |
| ERD Design | Database Designer, SYSTEM Analyst |
| Software Requirement Specification | Technical Writer |
| Develop Design | Software Architect, SYSTEM Designer |
| Develop Interfaces | UI/UX Designer, Front-End Developer |
| Class Diagram Designing | Software Architect, SYSTEM Analyst |
| Sequence Diagrams | SYSTEM Analyst, Software Architect |
| Design Phase Verification | Quality Assurance Engineer, Software Architect |
| Software Test Documentation | QA Engineer, Test Analyst |
| Implementation Phase | Software Developer |

## 3.3 Timetable

A table with numbers and letters

AI-generated content may be incorrect.

Figure 2 Timetable

## 3.4 Gantt Chart

A screenshot of a computer

AI-generated content may be incorrect.

Figure 3 Gantt Chart

# **Chapter 2 Software Requirement Specification**

## 2.1 Introduction

This document describes the expected software features, constraints, interfaces and other attributes. In this document we will define cases, sequence diagrams, domain model and database design of the project.

## 2.2 Functional Requirements

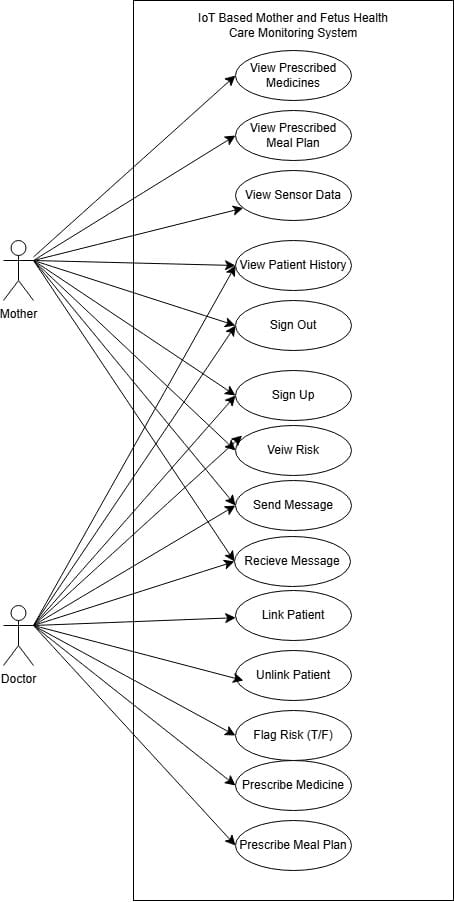
The functional requirements for the IoT Based MOTHER and Fetus Health Monitoring SYSTEM wearable device are:

1. The wearable device should be capable of measuring:
   1. Body Temperature.
   2. Heart Rate.
   3. Blood Pressure.
   4. Pulse Rate.
   5. Fetus Movement
   6. Blood Sugar Level.
2. The wearable device should save data on an online database.
3. The device should provide a set of buttons that will help the MOTHER to count kicks, flutter, roll, jabs etc.

The functional requirements of Mobile App are:

1. It should allow the patient and DOCTOR to sign up on the app.
2. It should allow the DOCTORs and patients to sign in to the app.
3. It should allow the patient and DOCTOR to link with each other.
4. It should allow the patient and DOCTOR to unlink once delivery is successful or ends
5. It should allow text messages between a patient and her DOCTOR.
6. It should display the live sensors output to the patient and her DOCTOR.
7. It should send push notifications to patients and DOCTORs if there are any risks.
8. Clicking on the push notifications should show an interface to the patient and DOCTOR displaying the reason why alert was generated and what is the risk?
9. It should allow the DOCTOR to mark the risk as true or false.
10. It should keep track of pregnancy days and trimesters.
11. It allows the user to keep data of all pregnancy i.e first, second, third etc.
12. It should allow the DOCTOR to see the patient’s history if it is her second pregnancy and the patient is using the app for her second pregnancy as well.
13. It should allow the DOCTOR to prescribe medicine and meal plans.
14. It should allow the DOCTOR to update or delete the prescribed meal plan and medicines.
15. It should allow the patient to view prescribed meal plans and medicines.
16. It should analyze the patient data to detect and generate risks and inform the DOCTOR and patient immediately.
17. The body temperature should be measured continuously to check fever.
    1. If the MOTHER’s body temperature is between 36.1°C to 37.3°C (97°F to 99.1°F) then it’s normal temperature.
    2. If the MOTHER’s body temperature is greater than 38°C (100.4°F) then it is fever and there is risk of infection, preterm labor or birth defects (especially in early pregnancy).
    3. If the MOTHER’s body temperature is less than 35°C (95°F) then it is Hypothermia and there is risk of slow metabolism, fetal distress or poor circulation.
18. The blood pressure should be checked every 4 hours a day after 20 weeks of pregnancy.
    1. If blood pressure is around 120/80 mmHg, then the blood pressure is normal.
    2. If blood pressure is greater than or equals to 140 / 90 mmHg on 2 occasions in 4 hours apart in pregnancy, and blood pressure was normal before pregnancy then the patient is suffering from Pregnancy Induced Hypertension. This problem is resolved within 12 weeks of postpartum.
    3. If blood pressure is greater than or equals 140 / 90 mmHg after 20 weeks of pregnancy, then this type of hypertension is known as Gestational Hypertension. In this case there is no proteinuria or end organ damage.
    4. If blood pressure is greater than or equals 140 / 90 mmHg but less than 160 / 110 mmHg, then this type of hypertension is known as mild Preeclampsia.
    5. If blood pressure is greater than or equals 160 / 110 mmHg after 20 weeks of pregnancy, then this type of hypertension is known as severe preeclampsia. In this case there are signs of end organ damage.
    6. If blood pressure is greater than or equals 160 / 110 mmHg with generalized tonic seizures after 20 weeks of pregnancy, then this type of hypertension is known as eclampsia.
19. The heart rate should be measured continuously.
    1. If heart rate is between 60 to 100 bpm the heart rate is normal.
    2. If the heart rate is greater than 100 bpm then it is a risk known as Tachycardia.
    3. If the heart rate is less than 60 bpm then it is a risk known as Bradycardia.
20. The blood sugar should be checked
    1. In the first trimester if patient is overweight or has a family history of diabetes to diagnose gestational diabetes. If gestational diabetes is diagnosed, then sugar should be checked daily before breakfast and 1-2 hours after meals.
    2. If gestational diabetes is diagnosed between 24 to 28 weeks of pregnancy, then sugar should be checked daily before breakfast and 1-2 hours after meals.
    3. If blood sugar is 75 -95 mg /dL before meal or less than 140 mg/dL but greater than 120 mg/dL after 1 hour meal or less than 120 mg/dL after 2-hour meal, then it is normal blood sugar in pregnant women.
    4. If blood sugar is greater than 92 mg /dL before meal or greater than 180 mg/dL after 1 hour meal or greater than 153 mg/dL after 2-hour meal, then this risk in pregnant women is known as Gestational Diabetes Mellitus.
21. The MOTHER should be counting the baby kicks in the third trimester.
    1. The MOTHER should choose a time in which the baby moves well.
    2. 10 movements in 1 hour are considered typically normal.
    3. If a MOTHER feels less than 10 movements in the 1st hour, then it does not mean that something is wrong. In this case the machine should help the MOTHER to count the time until it reaches 10 kicks. After 2-3 days, MOTHER will know what the normal time for her baby is to reach movements. This technique is known as Cardiff count technique.
    4. If there is an enormous amount of change in movement patterns or no movement for i.e yesterday it took 1.3hrs to complete 10 movements and today it took 3-4 hrs., then the patients should inform the DOCTOR. It can be a sign of fetal distress.
    5. If MOTHERs are troubled to count kicks than others in case, they are higher BMI (overweight) or in case placenta is in the front side of the moves.
22. Pregnancy falls into a high-risk category if MOTHER has gestational diabetes, high blood pressure or fetal growth retaliation or cholestasis this calls for a stricter kick count. In case this going to hospital necessary for ultrasound.

## Use Case Diagram



## Use Case Descriptions

### **UC-1 Sign Up**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-1 |
| **USE CASE NAME** | Sign Up |
| **PRIMARY ACTORS** | * + - 1. DOCTOR       2. MOTHER |
| **SECONDARY ACTORS** | * + - 1. Database |
| **STAKE HOLDERS**  **AND INTEREST** | **DOCTOR:** wants to create an account to monitor patients.  **MOTHER:** wants to create an account to track personal and fetal health. |
| **PRE CONDITION** | 1. The USER has installed the Mobile App. 2. The USER account does not exist on the SYSTEM. |
| **POST CONDITION** | 1. A new USER account is created and stored in Database. 2. The USER is redirected to the Sign In screen. |
| **MAIN SUCCESS SCENARIO** | 1. The USER opens the mobile application. 2. The SYSTEM displays the Sign-up Screen. 3. The USER enters credentials (email, name, date of birth, password, confirm password and role selection: DOCTOR or MOTHER). 4. The SYSTEM checks the credentials provided. 5. The SYSTEM stores the account in Database. 6. The SYSTEM displays a confirmation message. |
| **EXTENSION**  **(ALTERNATIVE FLOW)** | **4a. SYSTEM detects invalid email format:**  1. SYSTEM displays “Invalid email format.”  2. USER re-enters a valid email.  **4b. SYSTEM detects that passwords do not match:**  1. SYSTEM displays “Passwords do not match.”  2. USER retypes the password.  **4c. SYSTEM detects that account already exists:**  1. SYSTEM displays “Account already exists.”  2. USER is prompted to sign in or enter another email. |
| **SPECIAL REQUIREMENT** | Email should be a valid email.  Minimum password length: 8 characters, including one uppercase, one number, and one special character. |
| **TECHNOLOGY**  **AND DATA VARIATION LIST** | Smart Phone,  Database (JSON data format). |
| **FREQUENCY OF USE** | Low. |
| **SPECIAL ISSUES** | None |

Table 1 Use Case Description UC-1 Signup

### **UC-2 Sign in**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-2 |
| **USE CASE NAME** | Sign in |
| **PRIMARY ACTORS** | * + - 1. DOCTOR       2. MOTHER |
| **SECONDARY ACTORS** | * + - 1. Database |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** Access the patient’s data.  **MOTHER:** Monitor health data. |
| **PRE CONDITION** | 1. The USER has installed the Mobile App. 2. The USER account exists in Database. |
| **POST CONDITION** | 1. The USER has signed in and redirected it to the home screen. |
| **MAIN SUCCESS SCENARIO** | 1. The USER opens the mobile application. 2. The SYSTEM displays a Sign in Screen. 3. The USER enters their email and password. 4. The SYSTEM checks the provided credentials against Database. 5. The SYSTEM authenticates the USER |
| **EXTENSION (ALTERNATIVE FLOW)** | **3a. Invalid email/password: The SYSTEM** displays “Incorrect email or password” and prompts re-entry.  **3b. Account does not exist: The SYSTEM** displays “Account not found” and prompts to sign up. |
| **SPECIAL REQUIREMENT** | - |
| **TECHNOLOGY AND DATA VARIATION LIST** | Smart Phone,  Database (JSON data format). |
| **FREQUENCY OF USE** | Low. |
| **SPECIAL ISSUES** | None |

Table 2 Use Case Description UC-2 Sign In

### **UC-3 Reset Password**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-3 |
| **USE CASE NAME** | Reset Password |
| **PRIMARY ACTORS** | * + - 1. DOCTOR       2. MOTHER |
| **SECONDARY ACTORS** | * + - 1. Database |
| **STAKE HOLDERS**  **AND INTEREST** | **DOCTOR:** Reset the password if forgotten.  **MOTHER:** Reset the password if forgotten. |
| **PRECONDITION** | 1. The USER account exists on the SYSTEM. 2. The USER has access to registered email addresses or phone number. |
| **POST CONDITION** | 1. The USER’s password is updated successfully, and they can log in with the new password |
| **MAIN SUCCESS SCENARIO** | 1. The USER selects the “Forgot Password”. 2. The SYSTEM prompts the USER to enter their registered email address. 3. The USER enters the required information and submits the request. 4. The SYSTEM validates the email/phone number against the USER database. 5. The SYSTEM sends a one-time password to the USER’s registered email/phone. 6. The USER receives the link/code and clicks the link or enters the code in the provided interface. 7. The SYSTEM verifies the link/code and prompts the USER to enter a new password. 8. The USER enters and confirms the new password, adhering to security requirements (e.g., minimum length, special characters). 9. The SYSTEM updates the password in the database and notifies the USER of a successful reset. 10. The USER can now log in with the new password. |
| **EXTENSION**  **(ALTERNATIVE FLOW)** | **5a. Invalid email format: The SYSTEM** displays “Invalid email format” and prompts re-entry.  **3b. One Time Password Wrong or Expired: The SYSTEM** displays “Expired One Time Password” and try again.  **3c. Account does not exist: The SYSTEM** displays “Account does not exist”. |
| **SPECIAL REQUIREMENT** | Email should be a valid email.  Minimum password length: 8 characters, including one uppercase, one number, and one special character. |
| **TECHNOLOGY**  **AND DATA VARIATION LIST** | Smart Phone, Database (JSON data format). |
| **FREQUENCY OF USE** | Low. |
| **SPECIAL ISSUES** | None |

Table Use Case Description Reset Password

### **UC-4 Logout**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-4 |
| **USE CASE NAME** | Logout |
| **PRIMARY ACTORS** | * + - 1. DOCTOR       2. MOTHER |
| **SECONDARY ACTORS** | * + - 1. Database |
| **STAKE HOLDERS**  **AND INTEREST** | **DOCTOR:** Logout From the App.  **MOTHER:** Logout from the App. |
| **PRE CONDITION** | 1. The USER is logged in. |
| **POST CONDITION** | 1. The USER is Logged out from the SYSTEM. |
| **MAIN SUCCESS SCENARIO** | 1. The USER selects the “Logout” option from the USER interface. 2. The SYSTEM terminates the USER’s active session. 3. The SYSTEM clears any session-related data (e.g., cookies, tokens) from the USER’s device. 4. The SYSTEM redirects the USER to the login page or a confirmation message indicating successful logout. |
| **EXTENSION**  **(ALTERNATIVE FLOW)** | - |
| **SPECIAL REQUIREMENT** | - |
| **TECHNOLOGY**  **AND DATA VARIATION LIST** | Smart Phone,  Database (JSON data format). |
| **FREQUENCY OF USE** | Low. |
| **SPECIAL ISSUES** | None |

Table Use Case Description UC-4 Logout

### **UC-5 Pair Wristband**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-5 |
| **USE CASE NAME** | Pair Wristband |
| **PRIMARY ACTORS** | 1. MOTHER |
| **SECONDARY ACTORS** | 1. Wristband 2. Database |
| **STAKE HOLDERS**  **AND INTEREST** | **MOTHER:** Pair wristband to send health data to the app.  **DOCTOR:** Receive accurate health data from paired device |
| **PRE CONDITION** | 1. The MOTHER has Signed In to the account. 2. The MOTHER has turned the Wristband on. 3. MOTHER has turned on Bluetooth phone. |
| **POST CONDITION** | 1. Device Pairing Success. 2. Failed pairing with device. |
| **MAIN SUCCESS SCENARIO** | 1. The MOTHER opens the Bluetooth setting in SYSTEM. 2. The SYSTEM displays a list of available Bluetooth devices. 3. The MOTHER selects the Wristband from the list. 4. The SYSTEM attempts to pair with WRISTBAND. 5. The SYSTEM establishes connection and display connected. |
| **EXTENSION**  **(ALTERNATIVE FLOW)** | **3a. SYSTEM detects Wristband connection failure:**   1. The SYSTEM displays "Failed to connect". 2. The SYSTEM prompts the MOTHER to retry.   **4a. SYSTEM detects no Wristband available:**   1. The SYSTEM displays "No Wristband found". 2. The SYSTEM prompts the MOTHER to ensure the Wristband is powered on and within range. |
| **SPECIAL REQUIREMENT** | The Wristband should connect to the phone within 30 seconds. |
| **TECHNOLOGY**  **AND DATA VARIATION LIST** | Wristband (Bluetooth)  Smart Phone. |
| **FREQUENCY OF USE** | Low, USER will remain signed into the app. |
| **SPECIAL ISSUES** | None |

Table 5 Use Case Description UC-3 Pair Wrist Band

### **UC-6 Link Patient**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-6 |
| **USE CASE NAME** | Link Patient |
| **PRIMARY ACTORS** | 1. DOCTOR |
| **SECONDARY ACTORS** | 1. Database |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** Connect with patient for monitoring.  **MOTHER:** Share health data with DOCTOR. |
| **PRE CONDITION** | 1. Both DOCTOR and MOTHER are signed in. 2. The MOTHER’s profile exists in Database. |
| **POST CONDITION** | 1. The DOCTOR and MOTHER are linked in Database. 2. Link request fails or is declined. |
| **MAIN SUCCESS SCENARIO** | 1. The DOCTOR opens the mobile app and navigates to Link Patient Screen. 2. The SYSTEM displays the Link Patient screen. 3. The DOCTOR enters the patient’s unique ID. 4. The SYSTEM validates the patient’s id and displays patient Name and profile picture to confirm DOCTOR connects with the correct patient. 5. The SYSTEM connects the DOCTOR with the patient and saves this info. |
| **EXTENSION (ALTERNATIVE FLOW)** | **3a. Invalid ID: The SYSTEM** displays “Invalid ID” and prompts re-entry.  **4a. No matching USER: The SYSTEM** displays “USER not found” and prompts to check ID.  **5a. Database error: The SYSTEM** displays “Failed to link” and retries after 7 seconds. |
| **SPECIAL REQUIREMENT** | The link process must be completed within 10 seconds. |
| **TECHNOLOGY AND DATA VARIATION LIST** | Smart Phone.  Database  Notification Service |
| **FREQUENCY OF USE** | Low. |
| **SPECIAL ISSUES** | None |

Table Use Case Description UC-6 Link Patient

### **UC-7 Archive Patient**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-7 |
| **USE CASE NAME** | Archive Patient |
| **PRIMARY ACTORS** | 1. DOCTOR |
| **SECONDARY ACTORS** | 1. Database |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** End monitoring after delivery and focus on active patients.  **MOTHER:** Stop sharing health data. |
| **PRE CONDITION** | 1. Both DOCTOR and MOTHER are signed in. 2. The DOCTOR and MOTHER are linked in Database. |
| **POST CONDITION** | 1. The patient is removed from an active patient list and will be displayed archive patients list. 2. Unlink request fails. |
| **MAIN SUCCESS SCENARIO** | 1. The DOCTOR opens the mobile app and requests to view **Linked Patients**. 2. The SYSTEM displays a list of **linked patients**. 3. The DOCTOR selects a patient to **archive** from the active patients list. 4. The SYSTEM prompts a **confirmation message** to archive the selected patient. 5. The DOCTOR confirms the **archive action**. 6. The SYSTEM removes the selected patient from the **active list**, moves them to the **archived patients list**, and saves the change in the database. |
| **EXTENSION (ALTERNATIVE FLOW)** | **5a. USER cancels: The SYSTEM** returns to the Linked Profiles screen.  **6a. Database error: The SYSTEM** displays “Failed to unlink” and retries. |
| **SPECIAL REQUIREMENT** | Unlink process must be completed within 5 seconds. |
| **TECHNOLOGY AND DATA VARIATION LIST** | Smart Phone  Database. |
| **FREQUENCY OF USE** | Low. |
| **SPECIAL ISSUES** | None |

Table Use Case Description UC-7 Archive Patient

### **UC-8 View Live Sensors Data**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-8 |
| **USE CASE NAME** | View Live Sensor Data |
| **PRIMARY ACTORS** | 1. DOCTOR 2. MOTHER |
| **SECONDARY ACTORS** | 1. Wristband 2. Database |
| **STAKE HOLDERS AND INTEREST** | **MOTHER:** View Own Health in real time.  **DOCTOR:** Monitor patient health in real time. |
| **PRE CONDITION** | 1. The MOTHER is wearing the wristband with all the sensors in contact with the skin. 2. MOTHER has paired the Wristband with the App. 3. The DOCTOR is signed in and linked to the MOTHER. |
| **POST CONDITION** | 1. Sensor data (e.g. heart rate, blood pressure) is displayed on the app. |
| **MAIN SUCCESS SCENARIO** | 1. The USER (DOCTOR or MOTHER) opens the mobile app and navigates to Live Sensor Screen. 2. The SYSTEM displays the Live Sensor Data screen. 3. The wristband collects physiological (e.g., heart rate, blood pressure, sugar level, fetal movements). 4. The SYSTEM receives sensor data and displays it to the USER. 5. SYSTEM simultaneously stores the data in the database. 6. Steps 3-5 are repeated while the live view is active. |
| **EXTENSION (ALTERNATIVE FLOW)** | **3a. Wristband disconnected:**   1. The SYSTEM displays “Device disconnected”. 2. The SYSTEM prompts USER to check Bluetooth connection and retry.   **3b. The MOTHER Removes Wristband:**   1. The SYSTEM displays “Please wear the wristband to get real-time data”. 2. The SYSTEM pauses data updates.   **3c. Sensor Malfunction:** (e.g. heart rate = 0bpm)   1. The SYSTEM displays “Sensor Errors”. 2. SYSTEM attempts to reinitialize the sensor.   **4a. Poor internet:**   1. The SYSTEM displays “Data uploading failed”. 2. The SYSTEM stores data locally. 3. The SYSTEM attempts to sync data once the internet is restored.   **\*a USER exits Live Sensor Screen:**   1. The SYSTEM stops receiving and displaying live sensor data. |
| **SPECIAL REQUIREMENT** | Real-time data syncing with less than 5 -second latency.  Data must be stored on |
| **TECHNOLOGY AND DATA VARIATION LIST** | 1. Band Wrist 2. Smart Phone 3. Database. |
| **FREQUENCY OF USE** | High |
| **SPECIAL ISSUES** | All sensors are not continuous sensors.  Available continuous sensors are not accurate. |

Table Use Case UC-8 Live Sensor Data

### **UC-9 Generate Risk**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-9 |
| **USE CASE NAME** | Generate Risk |
| **PRIMARY ACTORS** | SYSTEM |
| **SECONDARY ACTORS** | 1. Notification Service 2. Database |
| **STAKE HOLDERS AND INTEREST** | **MOTHER:** The MOTHER wants immediate alerts for any risk to her or her baby.  **DOCTOR:** The DOCTOR needs timely alerts to act on medical emergencies. |
| **PRE CONDITION** | Wearable Device is actively transmitting live sensor data.  Patient accounts are active and linked with doctors.  Pregnancy tracking is initialized. |
| **POST CONDITION** | 1. A risk is logged and stored. 2. Notification is sent to the doctor and patient. |
| **MAIN SUCCESS SCENARIO** | 1. The system receives real-time physiological data from the wearable device. 2. The system evaluates the incoming data against medical threshold rules. 3. The system determines if the data indicates any health risk. 4. System logs the identified risk in the database. 5. System sends notification to both the patient and the linked doctor. 6. Risk is displayed in the “View Risk” interface for both actors |
| **EXTENSION (ALTERNATIVE FLOW)** | **2a. Sensor Data Unavailable:**  If sensor data is missing or delayed, the system retries fetching or logs a data-fetch failure.  **3a. Elevated Body Temperature:**   * 38°C: Fever → Risk of infection, preterm labor, birth defects * <35°C: Hypothermia → Risk of fetal distress, slow metabolism   **3b. Abnormal Blood Pressure:**   * ≥140/90 mmHg on two occasions → Pregnancy-Induced Hypertension * ≥140/90 mmHg after 20 weeks → Gestational Hypertension * 140/90 to <160/110 mmHg → Mild Preeclampsia * ≥160/110 mmHg → Severe Preeclampsia * ≥160/110 mmHg + seizures → Eclampsia   **3c. Abnormal Heart Rate:**   * 100 bpm → Tachycardia * <60 bpm → Bradycardia   **3d. Abnormal Blood Sugar:**   * 92 mg/dL fasting or >180 mg/dL post-meal → Gestational Diabetes Mellitus   **3e. Abnormal Fetal Movements:**   * Less than 10 kicks in 2 hours or a drastic deviation from previous patterns → Fetal Distress * Special considerations applied for mothers with high BMI or anterior placenta   **4a. Multiple Risk Conditions:** The system logs each risk condition separately in the risk record.  **5a. Patient Not Linked to Any Doctor:** Notification is only sent to the patient; doctor notification is skipped.  **5b. High-Risk Category:** For mothers with chronic conditions (e.g., gestational diabetes), stricter thresholds may apply.  **6a. Doctor Later Marks Risk as False:** The doctor uses UC-9: Mark Risk to label the generated risk as false after review. |
| **SPECIAL REQUIREMENT** | Real-time data syncing with less than 5 -second latency.  Data must be stored on |
| **TECHNOLOGY AND DATA VARIATION LIST** | 1. Band Wrist 2. Smart Phone 3. Database. |
| **FREQUENCY OF USE** | High |
| **SPECIAL ISSUES** | All sensors are not continuous sensors.  Available continuous sensors are not accurate. |

Table Use Case UC-8 Live Sensor Data

### **UC-10 View Risk**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-10 |
| **USE CASE NAME** | View Risk |
| **PRIMARY ACTORS** | 1. DOCTOR 2. MOTHER |
| **SECONDARY ACTORS** | 1. Database 2. Notification Service |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** Review health risks.  **MOTHER:** Understand health alerts. |
| **PRE CONDITION** | 1. The DOCTOR or MOTHER is signed in. 2. A risk alert exists in the Database. 3. The DOCTOR and MOTHER are linked. |
| **POST CONDITION** | 1. The USER views risk details and associated data. |
| **MAIN SUCCESS SCENARIO** | 1. The USER receives a risk alert notification and taps over it. 2. The SYSTEM displays the Risk Details screen. 3. The SYSTEM retrieves and displays patient name, patient photo and active risk details (e.g., high blood pressure, reason). |
| **EXTENSION (ALTERNATIVE FLOW)** | **4a. No risks found: The SYSTEM** displays “No active risks.”  **4b. Database error: The SYSTEM** displays “Failed to load data” and retries. |
| **SPECIAL REQUIREMENT** | Display time: < 2 Seconds. |
| **TECHNOLOGY AND DATA VARIATION LIST** | Smart Phone,  Database  Notification Service |
| **FREQUENCY OF USE** | Medium. |
| **SPECIAL ISSUES** | Risk visualization format (e.g., graphs, text) TBD. |

Table Description UC-10 View Risk

### **UC-11 Validate Health Risk Alert**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-11 |
| **USE CASE NAME** | Validate Health Risk Alert |
| **PRIMARY ACTORS** | 1. DOCTOR |
| **SECONDARY ACTORS** | 1. Database 2. Notification Service |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** Validate SYSTEM-generated health risks to ensure accurate alerts.  **MOTHER:** Be informed of validated health risks. |
| **PRE CONDITION** | 1. The DOCTOR is signed in and linked to the MOTHER. 2. A risk alert (e.g. high blood pressure) exists in Database. |
| **POST CONDITION** | 1. The risk is marked as True or False in Database. 2. The MOTHER receives a notification if the risk is True. |
| **MAIN SUCCESS SCENARIO** | 1. The DOCTOR receives a risk alert notification. 2. The DOCTOR opens the mobile app. 3. The SYSTEM displays the Risk Details screen displaying patient name and risk type. 4. The DOCTOR reviews the risk data (e.g., blood pressure readings). 5. The DOCTOR marks the risk as True or False. 6. The SYSTEM saves the decision to Database. 7. The SYSTEM sends a notification to the MOTHER about the validity of risk. |
| **EXTENSION (ALTERNATIVE FLOW)** | **4a. Insufficient data: The SYSTEM** prompts the DOCTOR to request additional data.  **6a. Database error: The SYSTEM** displays “Failed to save” and retries. |
| **SPECIAL REQUIREMENT** | Notification Delivery in less than 5 seconds. |
| **TECHNOLOGY AND DATA VARIATION LIST** | Smart Phone  Database  Notification Service |
| **FREQUENCY OF USE** | Medium |
| **SPECIAL ISSUES** | None |

Table UC-11 Validate Health Risk Alert

### **UC-12 Prescribe Medicine**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-12 |
| **USE CASE NAME** | Prescribe Medicine |
| **PRIMARY ACTORS** | 1. DOCTOR |
| **SECONDARY ACTORS** | 1. Database |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** Prescribe medications for the patient.  **MOTHER:** Receive prescription. |
| **PRE CONDITION** | 1. The DOCTOR is signed in to the SYSTEM. 2. The DOCTOR is linked to the MOTHER. 3. The MOTHER’s profile exists in Database. |
| **POST CONDITION** | 1. The prescription is saved in DATABASE and associated with the MOTHER’s profile. 2. The MOTHER receives a notification with prescription details. |
| **MAIN SUCCESS SCENARIO** | 1. The DOCTOR opens the mobile application. 2. The SYSTEM displays the list of linked patients. 3. The DOCTOR selects the MOTHER. 4. The DOCTOR navigates the Medicine Prescription section. 5. The DOCTOR enters medicine prescription details (e.g., medicine name, dosage, frequency). 6. The SYSTEM saves the prescription to Database. 7. The SYSTEM sends a notification to the MOTHER with the new prescription. 8. Mother views prescription from the app. |
| **EXTENSION (ALTERNATIVE FLOW)** | **4a. Incomplete input (e.g., empty fields):**  1. SYSTEM displays “Please complete all fields.”  2. DOCTOR re-enters missing information.  **5a. Input exceeds limits or incorrect format:**  1. SYSTEM displays “Input format error” or “Text too long.”  2. DOCTOR corrects and resubmits.  **6a. Database error while saving:**  1. SYSTEM displays “Failed to save prescription.”  2. SYSTEM retries saving up to 3 times or notifies the DOCTOR of the failure.  **7a. Notification delivery fails:**  1. SYSTEM queues for the notification and attempts delivery later.  2. SYSTEM marks the notification as “pending” until successful delivery. |
| **SPECIAL REQUIREMENT** | None. |
| **TECHNOLOGY AND DATA VARIATION LIST** | Smart Phone  Database |
| **FREQUENCY OF USE** | Medium |
| **SPECIAL ISSUES** | None |

Table Use Case Description UC-6 Prescribe Meal Plan

### **UC-13 View Prescribed Medicine**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-13 |
| **USE CASE NAME** | View Prescribed Medicine |
| **PRIMARY ACTORS** | 1. DOCTOR 2. MOTHER |
| **SECONDARY ACTORS** | 1. Database |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** Review prescribed medications.  **MOTHER:** View prescribed medications. |
| **PRE CONDITION** | 1. The USER (DOCTOR or MOTHER) is signed in. 2. A prescription exists in Database for the MOTHER. |
| **POST CONDITION** | 1. The USER views the prescribed medicine details. |
| **MAIN SUCCESS SCENARIO** | **Use Case: DOCTOR Views Prescriptions**   1. DOCTOR opens the mobile App. 2. The SYSTEM displays a home/dashboard. 3. DOCTOR selects a linked Mother from patient list. 4. DOCTOR navigates to “Prescriptions” section. 5. SYSTEM retrieves and displays full list of prescriptions for the selected MOTHER. 6. The DOCTOR selects a prescription to view full details (e.g., medicine name, dosage, frequency, notes). 7. DOCTORs may edit or delete the prescription. 8. SYSTEM updates the database if any edits or deletion are made.   **Use Case: MOTHER Views Prescriptions**   1. MOTHER opens the mobile application. 2. SYSTEM displays the home screen. 3. MOTHER navigates to **"My Prescriptions"** section. 4. SYSTEM fetches the MOTHER’s prescription records from the DATABASE. 5. SYSTEM displays each medicine with details (dosage, frequency, instructions, notes). |
| **EXTENSION (ALTERNATIVE FLOW)** | **4a. No prescriptions available:**   1. SYSTEM displays “No prescriptions available” and returns to previous screen.   **4b. DATABASE error (timeout or connectivity issue):**   1. SYSTEM displays “Failed to load data. Please try again.” 2. SYSTEM retries fetching data up to 3 times.   **7a. Edit/Delete failure (for DOCTOR):**   1. SYSTEM displays “Failed to update/delete prescription” and logs the issue for retry or manual correction. |
| **SPECIAL REQUIREMENT** | Data must be displayed within 2 seconds. |
| **TECHNOLOGY AND DATA VARIATION LIST** | Smart Phone.  Database |
| **FREQUENCY OF USE** | Medium |
| **SPECIAL ISSUES** | None |

Table Use Case Description UC-1 View Prescribed Medicine

### **UC-14 Prescribe Meal Plan**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-14 |
| **USE CASE NAME** | Prescribe Meal Plan |
| **PRIMARY ACTORS** | 1. DOCTOR |
| **SECONDARY ACTORS** | 1. Database |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** Prescribe dietary recommendations for the patient.  **MOTHER:** Receive meal plan. |
| **PRECONDITION** | 1. The DOCTOR is signed in to the SYSTEM. 2. DOCTOR is linked to the MOTHER. 3. The MOTHER’s profile exists in Database. |
| **POST CONDITION** | 1. Meal Plan is stored in the DATABASE. 2. MOTHER is notified of the newly assigned meal plan. |
| **MAIN SUCCESS SCENARIO** | 1. DOCTOR opens the mobile app; SYSTEM displays the home screen. 2. DOCTOR requests a list of linked patients. 3. SYSTEM displays all patients linked to the DOCTOR. 4. DOCTOR selects a MOTHER. 5. DOCTOR navigates the "Meal Plan" section. 6. DOCTOR enters meal plan details (e.g., food items, quantity, timing, frequency). 7. DOCTOR submits the meal plan. 8. SYSTEM saves the meal plan to the DATABASE. 9. SYSTEM sends a push notification to the MOTHER. 10. MOTHER views the meal plan on her app. |
| **EXTENSION (ALTERNATIVE FLOW)** | **4a. Incomplete input (e.g., empty fields):**  1. SYSTEM displays “Please complete all fields.”  2. DOCTOR re-enters missing information.  **5a. Input exceeds character limits:**  1. SYSTEM displays “Input too long.”  2. DOCTOR is prompted to shorten the input.  **8a. Database save error:**  1. SYSTEM displays “Failed to save meal plan.”  2. SYSTEM retries up to 3 times or notifies user of failure.  **9a. Notification delivery fails:**  1. SYSTEM stores the notification in a pending queue and retries delivery when connection is restored. |
| **SPECIAL REQUIREMENT** | Meal plan saving and notification delivery must be completed within 5 seconds under stable network conditions. |
| **TECHNOLOGY AND DATA VARIATION LIST** | Smart Phone  Database |
| **FREQUENCY OF USE** | Medium |
| **SPECIAL ISSUES** | None |

Table 14 Use Case Description UC-1 Prescribe Meal Plan

### **UC-15 View Prescribed Meal Plan**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-15 |
| **USE CASE NAME** | View Prescribed Meal Plan |
| **PRIMARY ACTORS** | 1. DOCTOR 2. MOTHER |
| **SECONDARY ACTORS** | 1. Database |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** Review prescribed meal plans.  **MOTHER:** View dietary recommendations. |
| **PRECONDITION** | 1. The USER (DOCTOR or MOTHER) is signed in. 2. A meal plan exists in Database for the MOTHER. |
| **POST CONDITION** | 1. The USER views the prescribed meal plan details. |
| **MAIN SUCCESS SCENARIO** | **Use Case: DOCTOR Views Meal Plan**   1. DOCTOR opens the mobile App. 2. The SYSTEM displays a home/dashboard. 3. DOCTOR selects a linked patient. 4. DOCTOR navigates to “Meal Plan” section. 5. SYSTEM retrieves and displays full list of Meals. 6. DOCTORs may edit or delete the meal.   **Use Case: MOTHER Views Meal Plan**   1. MOTHER opens the mobile app. 2. The SYSTEM displays the home screen. 3. MOTHER navigates to “My Prescriptions.” 4. The SYSTEM fetches only her own prescriptions from the database. 5. SYSTEM displays each medicine with dosage, frequency, and instructions. |
| **EXTENSION (ALTERNATIVE FLOW)** | **4a. No meal plans found: The SYSTEM** displays “No meal plans available.”  **4b. Database error: The SYSTEM** displays “Failed to load data” and retries. |
| **SPECIAL REQUIREMENT** | Data must be displayed within 2 seconds. |
| **TECHNOLOGY AND DATA VARIATION LIST** |  |
| **FREQUENCY OF USE** | Medium |
| **SPECIAL ISSUES** | None |

Table Use Case Description UC-8 View Prescribe Meal Plan

### **UC-16 Count Fetal Movements**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-16 |
| **USE CASE NAME** | Count Fetal Movements |
| **PRIMARY ACTORS** | 1. MOTHER |
| **SECONDARY ACTORS** | 1. Wristband 2. Notification Service 3. Database |
| **STAKE HOLDERS AND INTEREST** | **MOTHER:** Track Fetal movement to monitor baby health.  **DOCTOR:** Receive alerts for abnormal patterns. |
|  |  |
| **PRECONDITION** | 1. The MOTHER has signed in to the app. 2. MOTHER has successfully paired with the wristband. 3. The MOTHER is in third trimester. 4. The wristband has functional fetal movement buttons. |
| **POST CONDITION** | 1. Fetal Movement Data is saved in the database. 2. A risk movement is generated if movement patterns are abnormal. |
| **MAIN SUCCESS SCENARIO** | 1. MOTHER opens the mobile app and navigates to the **Fetal Movement Tracking** screen. 2. SYSTEM displays the tracking interface. 3. MOTHER presses the wristband button each time a movement (e.g., kick) is felt. 4. SYSTEM logs each press and calculates the time taken to record 10 movements. 5. SYSTEM saves the movement data to the Database. 6. SYSTEM analyzes data to determine if movement pattern is normal. 7. SYSTEM sends a risk alert to both MOTHER and DOCTOR if movement is insufficient. |
| **EXTENSION (ALTERNATIVE FLOW)** | **3a. Wristband is disconnected:**   1. SYSTEM displays “Device disconnected” and prompts user to reconnect the wristband.   **6a. Fewer than 10 movements in 2 hours:**   1. SYSTEM flags as potential risk and sends alert to DOCTOR and MOTHER.   **6b. High-risk pregnancy identified:**   1. SYSTEM uses stricter evaluation criteria before triggering risk alerts.   **7a. Database error while saving data:**   1. SYSTEM displays “Failed to save” and retries automatically. |
| **SPECIAL REQUIREMENT** | 1. Button presses must be logged in **real time with <1-second delay**. 2. Risk analysis should not delay user interaction. |
| **TECHNOLOGY AND DATA VARIATION LIST** | Smart Phone,  Wristband (Bluetooth),  Database (JSON data format),  Notification Service. |
| **FREQUENCY OF USE** | Medium (daily in third trimester) |
| **SPECIAL ISSUES** | None |

### **UC-16 Track Pregnancy Progress**

|  |  |
| --- | --- |
| **USE CASE ID** | UC-16 |
| **USE CASE NAME** | Track Pregnancy Progress |
| **PRIMARY ACTORS** | SYSTEM |
| **SECONDARY ACTORS** | Patient and Doctor |
| **STAKE HOLDERS AND INTEREST** | **DOCTOR:** Needs accurate gestational tracking to make timely decisions.  **MOTHER:** Wants to stay informed about pregnancy milestones like trimesters. |
| **PRECONDITION** | 1. Pregnancy start date (e.g., LMP or conception date) is recorded in the system. 2. Patient accounts are active. 3. Pregnancy tracking is enabled for the current pregnancy. |
| **POST CONDITION** | 1. Current pregnancy day count is updated. 2. Current trimester status is stored and accessible. 3. Personalized alerts and monitoring thresholds are adjusted accordingly. |
| **MAIN SUCCESS SCENARIO** | 1. System retrieves the stored pregnancy start date for the patient. 2. System calculates the number of days/weeks passed since the start date. 3. System determines the current trimester based on week number. 4. System updates the trimester status in the patient’s current pregnancy record. 5. System adjusts risk monitoring thresholds and alert criteria accordingly. 6. System displays updated progress (day count and trimester) in the patient and doctor interfaces. |
| **EXTENSION (ALTERNATIVE FLOW)** | **1a. No Start Date Found:** System prompts user (via doctor or patient interface) to input or confirm the pregnancy start date.  **3a. Trimester Ranges:**   * Week 1–12: First Trimester * Week 13–27: Second Trimester * Week 28–40+: Third Trimester   **5a. High-Risk Condition Present:** If a high-risk condition is present (e.g., gestational diabetes, hypertension), additional monitoring thresholds are activated specific to the trimester.  **6a. Historical Pregnancy Tracking:** If patient has previous pregnancies recorded, the current one is tagged as “Pregnancy #N” and tracked separately.  **6b. Post-Term Pregnancy:** If day count exceeds 280 (40 weeks), system flags the pregnancy as “Post-term” and notifies doctor for follow-up. |
| **SPECIAL REQUIREMENT** | 1. All date calculations must consider leap years and time zone (UTC+5 for Pakistan). 2. Pregnancy progress should update daily at midnight. 3. System must allow user (via doctor or admin) to correct the start date if entered incorrectly. |
| **TECHNOLOGY AND DATA VARIATION LIST** |  |
| **FREQUENCY OF USE** | Medium |
| **SPECIAL ISSUES** | None |

Table Use Case Description UC-8 View Prescribe Meal Plan

### **SYSTEM Sequence Diagrams**

SYSTEM Sequence Diagrams illustrate the interactions between external actors and The SYSTEM, showing the flow of events and data over time

### SSD – UC 1 Sign up

A close-up of a login form

AI-generated content may be incorrect.

Figure 4 UC-1 Signup

### SSD – UC 2 Sign In

A close-up of a login form

AI-generated content may be incorrect.

Figure 5 SSD UC-2 Sign in

### SSD UC-3 Reset Password

A screen shot of a login form

AI-generated content may be incorrect.

Figure 6 SSD UC-3 Reset Password

### SSD UC-4 Logout

A diagram of a system

AI-generated content may be incorrect.

Figure 7 UC-4 Logout

### SSD UC-5 Pair wristband

A diagram of a system

AI-generated content may be incorrect.

Figure 8 UC-5 Pair wristband

### SSD UC-6 Link Patient

A diagram of a patient

AI-generated content may be incorrect.

Figure 9 SSD UC-6 Link Patient

### SSD UC-7 Archive Patient

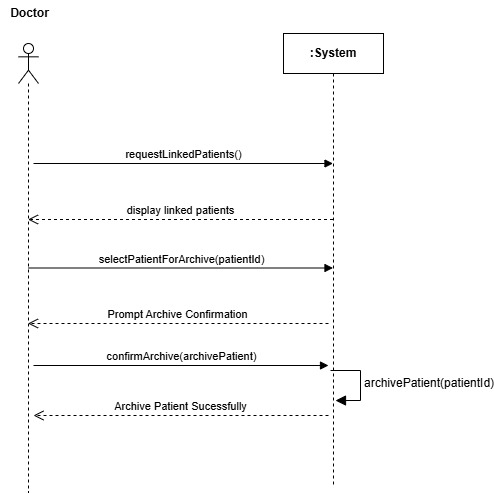


Figure 10 SSD UC-7 Archive Patient

### SSD UC-8 View Prescribed Meal Plan

A screenshot of a computer

AI-generated content may be incorrect.

Figure 11 SSD UC-8 View Prescribed Meal Plan

### SSD UC-9 Mark Risk (T / F)

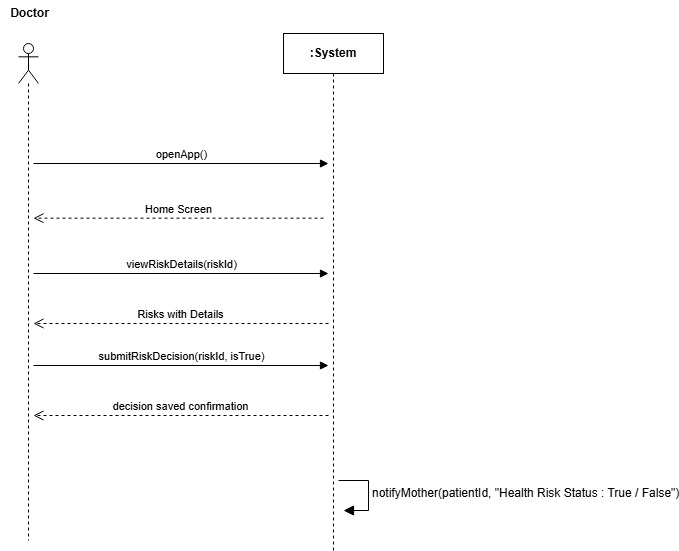


Figure 12 SSD UC-9 Mark Risk (T / F)

### SSD UC -10 Link Patient

A diagram of a patient

AI-generated content may be incorrect.

### SSD UC -11 Unlink Patient

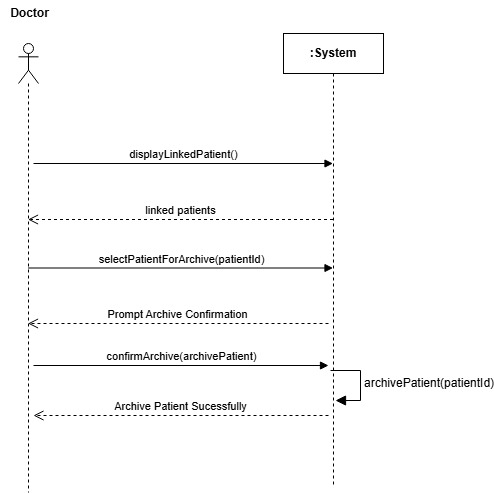


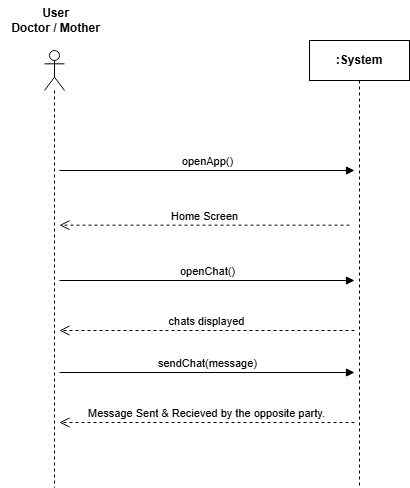
Figure 13 SSD UC -11 Unlink Patient

### SSD UC-12 View Risk

A diagram of a medical system

AI-generated content may be incorrect.

### SSD – UC -13 Send / Receive Message



### SSD UC-14 Count Fetal Movements

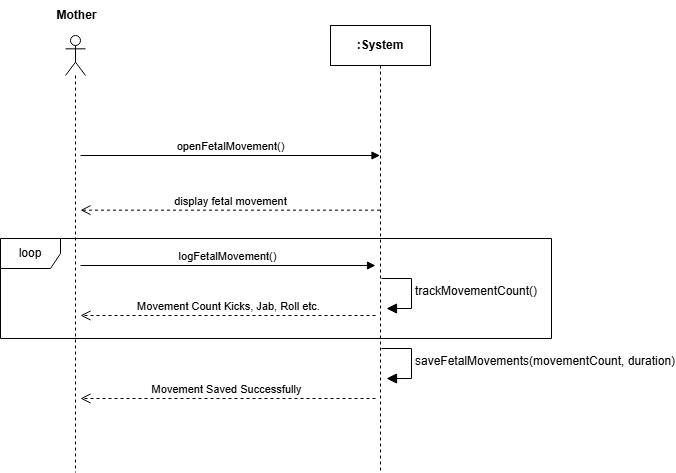


Figure 14 SSD UC-14 Count Fetal Movements

SSD UC-15 Reset Password

A diagram of a system

AI-generated content may be incorrect.

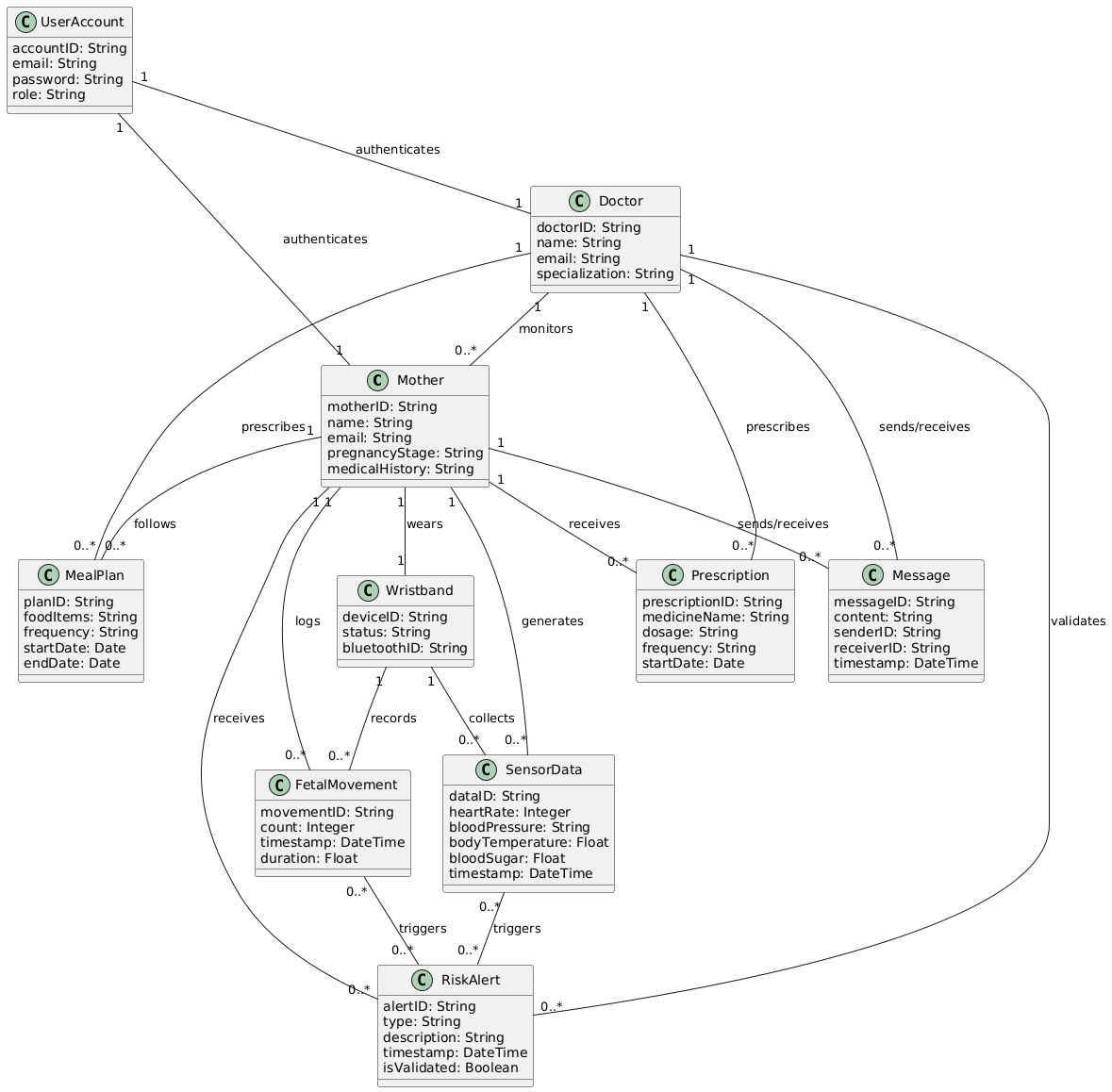
SSD UC-16 Logout

A diagram of a system

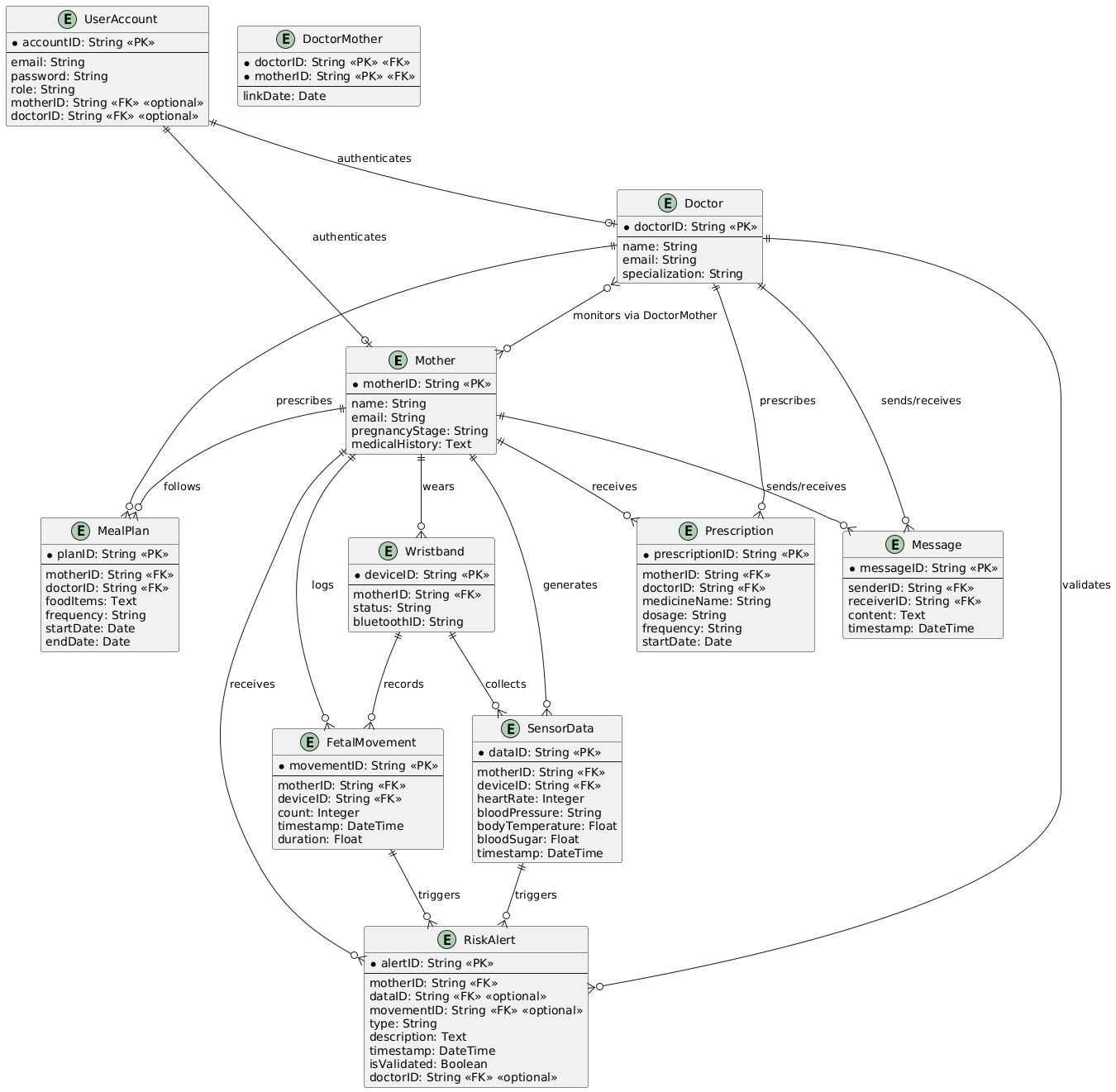
AI-generated content may be incorrect.

Figure 15 SSD UC-16 Logout

### Domain Model



ERD DIAGRAM



# **Chapter No 3 Software Design and Description**

Sequence Diagrams

SD UC-1 Signup

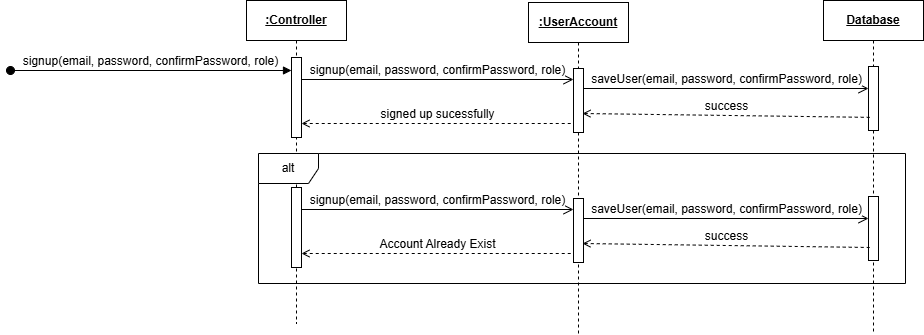


Figure 16 Sequence Diagram Signup

SD UC-2 Sign in

A diagram of a block diagram

AI-generated content may be incorrect.

Figure 17 Sequence Diagram Sign in

SD UC-3 Pair Wrist Band

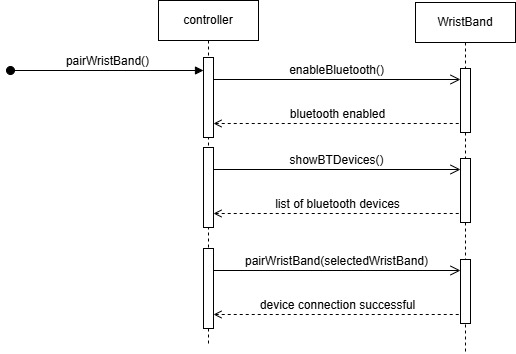


Figure 18 SYSTEM Sequence Diagram Pair Wristband

SD UC-4 View Live Sensor Data

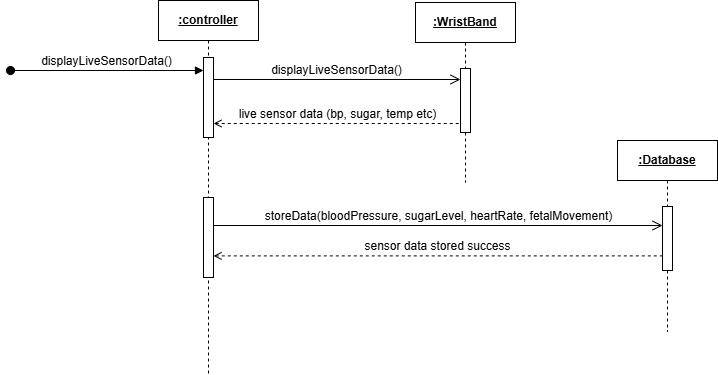


Figure 19 Sequence Diagram View Live Sensor Data

SD UC-5 Prescribe Meal

A screenshot of a computer

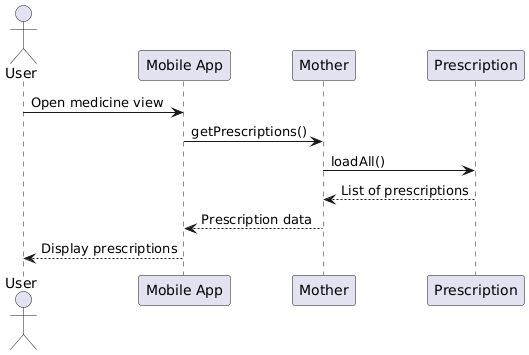
AI-generated content may be incorrect.

SD UC-6 Prescribe Medicine

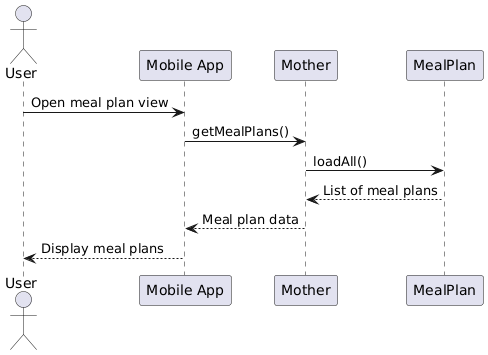
A diagram of a medical application

AI-generated content may be incorrect.

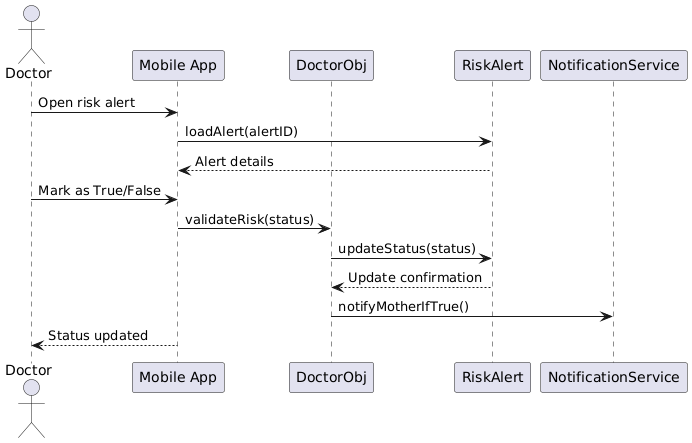
SD UC- 7 View Prescribed Medicine



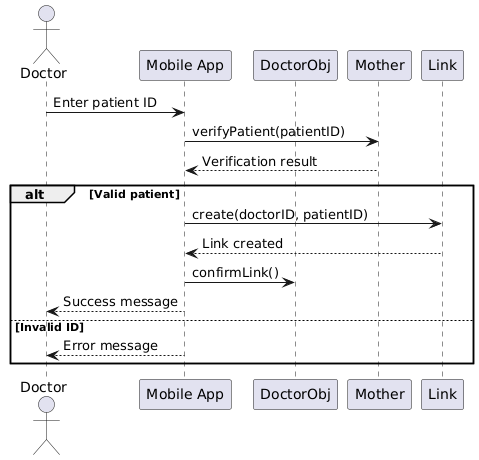
SD UC-8 View Prescribed Meal Plan



SD UC-9 Mark Risk (T/F)

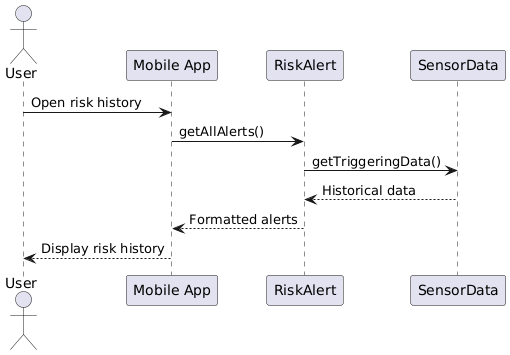


SD UC-10 Link Patient

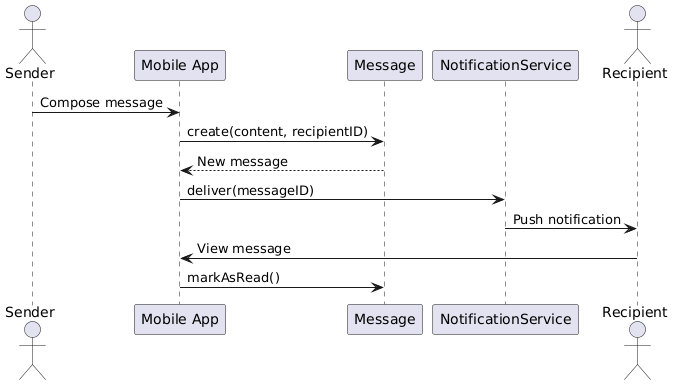


SD UC-11 Unlink Patient

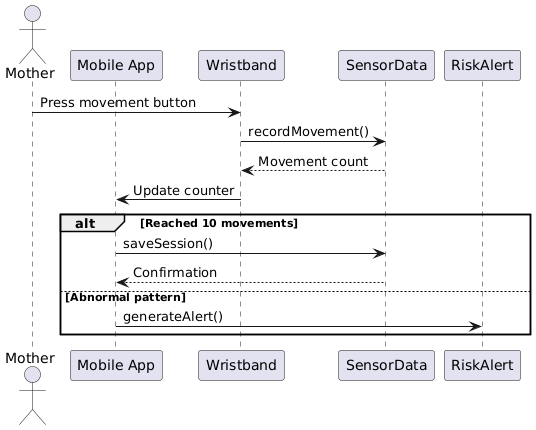
SD UC-12 View Risk



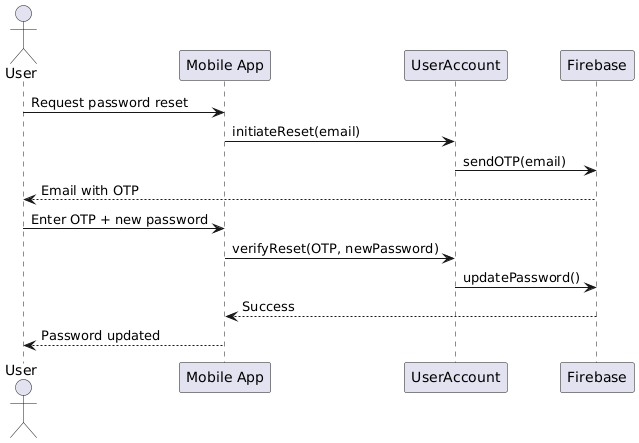
SD UC-13 Send/ Receive Messages



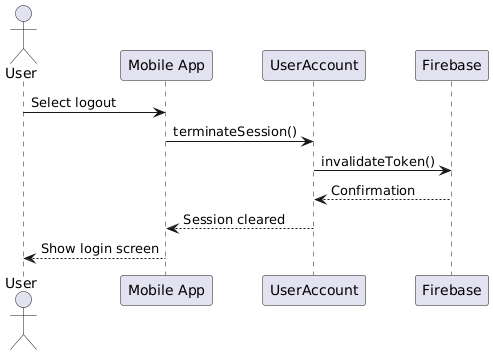
SD UC-14 Count Fetal Movements



SD UC-15 Reset Password



SD UC-16 Logout



Class Diagram

