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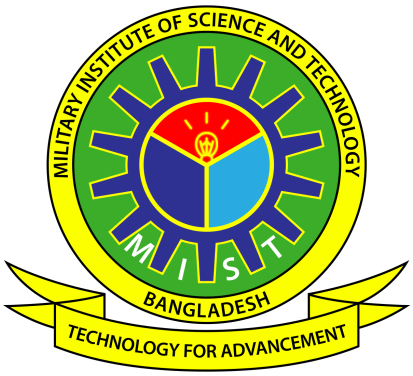

Department of Computer Science and Engineering

CSE-460:Integrated Design Project

Software Requirement Specification (SRS)

JONONI: An Intelligent Assistive System for Expecting Mothers

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Group: B2

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1. Preface

The signs and symptoms of pregnancy can range from minor annoyances to serious, occasionally life-threatening disorders. A woman may occasionally find it challenging to distinguish between typical symptoms and those that are not. Physical and mental issues that have an impact on the mother's or the baby's health might be problems during pregnancy. The intelligent assistive system for expecting mothers is a tool for reducing pregnancy problems. The system computes BMI and other medical information. Additionally, the system alerts a person if any substantial intricacy is recognized and sends a message when it's time to visit the doctor.

2. Introduction

2.1. Purpose

The intelligent assistive system for expecting mothers is a device that lowers pregnancy complications. Pregnancy-related health issues are those that develop while a woman is pregnant. They may concern the health of the mother, the infant, or both. Some women experience health issues that develop during pregnancy, while other women may experience difficulty due to health issues that existed before conception. About 810 women per day in 2017 passed away from pregnancy and childbirth-related avoidable causes [1]. In 2017, almost 295,000 women lost their lives during, immediately after, or soon after childbirth. The vast majority of these fatalities (94%) happened in areas with few resources, and the bulk of them could have been avoided [1].

Poor health service quality and insufficient use are significant causes. Complications can arise even in pregnant women who were in good health before. These issues could turn the pregnancy into a high-risk pregnancy. Receiving early and routine prenatal care can help lower the risk of complications by allowing medical professionals to identify, manage, or treat concerns early on. The signs and symptoms of pregnancy can range from minor annoyances to serious, occasionally life-threatening disorders. A woman may occasionally find it challenging to distinguish between typical symptoms and those that are not. Physical and mental issues that have an impact on the mother's or the baby's health might be problems during pregnancy. Being pregnant may either cause these issues or exacerbate them. Many issues are minor and do not worsen; nevertheless, if they do, the mother or her unborn child could be harmed. Remember that there are strategies for handling issues that arise throughout pregnancy. Again, it is exceedingly challenging for those who live in nuclear families to visit the doctor routinely.

In the past years, numerous studies and projects have been conducted on this topic to lessen the complications that can arise during pregnancy. But they only perform a few tasks. This method is not at all developed in Bangladesh. While some initiatives are underway, they lack some essential components.

Our goal is to put into practice the concepts and studies that have been conducted over the years in Bangladesh on pregnancy hazards to create a workable, accurate system that is simple to use, economical, and will decrease difficulties during pregnancy as much as possible.

2.2. Intended Audience

This system is mainly intended for expectant mothers. because expectant mothers are in need of frequent guidance. The system will guide them and ease their tasks. Through this system, doctors and family members can also be helpful in getting some important insights about the expectant mother's condition through this system.

2.3. Scope

The implementation of an intelligent assistive system is for expecting mothers to assist them during their pregnancy. It is an Android-based application that includes features that will help pregnant women with a FAQ for mental health updates, calculating and monitoring their regular BMI, pulse rate, body temperature, and most of the necessary activities that need to be monitored during pregnancy. This application will also serve the purpose during an emergency by informing and locating patients in their emergency situation using a GPS tracking system. A wearable device is required in this project in order to collect all the inputs that are going to be used. Additionally, the project’s accuracy and improved system security are of utmost importance.

3. Glossary

Android App: Android app is software that is designed to run on an Android device or emulator.

Artificial Intelligence (AI): Artificial intelligence is the simulation of human intelligence functions by machines, especially computer systems. It functions by ingesting a sizable amount of labeled training data, searching the data for correlations and patterns, and then using these patterns to forecast future states.

Assistive wearable device: An assistive wearable device is an external object that is created, manufactured, or modified to help someone carry out a specific task while they are wearing them on their bodies.

Baby Kick Count: During the third trimester of pregnancy, the doctor instructs the expectant mother to record the baby's daily movements**.** This is called a "kick count." A baby's movement patterns can be learned and changes can be detected by counting the baby's kicks. A change might indicate a problem.

Blood Pressure (BP): Blood pressure is the force of blood against the vessel walls. The healthy range for blood pressure in a pregnant woman is less than 120/80 mm Hg.

Blood Sugar(Glucose): The primary sugar in human blood is also known as glucose. It is the primary source of energy for our bodies, and it comes from the food we eat.

Body Mass Index (BMI): Body Mass Index (BMI) is a person's weight in kilograms (or pounds) divided by the square of their height in meters (or feet). The higher the BMI, the greater the risk of developing diabetes during pregnancy.

Chatbot: A chatbot is an artificial intelligence-based computer program that mimics human conversation. They are also referred to as digital assistants with human capabilities. It analyzes user intent, handles their requests, and provides quick, accurate responses.

Database: A database is a structured collection of information or data that is electronically stored on a computer system. A database is usually controlled by a database management system (DBMS). A database system (frequently abbreviated as "database") refers to the data, the DBMS, and the applications that are connected to it.

Global Positioning System (GPS): GPS, also known as the Global Positioning System, is a system of satellites used for global navigation that synchronizes time, speed, and location.

Google Map: Google Map is a web service that offers comprehensive data on locations and geographic areas around the world.

Machine learning (ML): Machine learning (ML) is a subfield of artificial intelligence (AI) and computer science that concentrates on using data and algorithms to mimic the process of human learning and progressively increase the accuracy of the system.

Pulse Rate: Pulse rate, also referred to as "heart rate" is the frequency at which a human body's heart beats per minute. For pregnant women, the normal heart rate ranges from 70 to 90 beats per minute.

Raspberry Pi: The Raspberry Pi is a credit card-sized minicomputer that can connect to any input and output devices, including a monitor, a television, a mouse, or a keyboard, to transform the set-up into a fully functional PC at an affordable price. The Raspberry Pi is a programmable gadget. An SD card inserted into the designated slot is required to configure the Raspberry computer.

Real-Time Data (RTD): Information that is provided instantly after collection is referred to as real-time data (RTD). The information is sent on time and without delay.

User Profile: The user profile consists of the necessary information about the user based on the information stored. In this system, the user profile consists of the necessary information about the expecting mother, such as name, user ID, password, age, conception date, height, weight, pulse rate, blood pressure, blood sugar, etc.

User-Friendly Interface: A user-friendly interface has no complex functionality and makes the system easily usable for a variety of people. This system aims to ease the task of an expecting mother and introduces no complexity.

4. Requirements discovery

4.1. Literature Review

More than twenty research papers on expecting mothers using assistive devices or programs have been found and studied by our team. Four of those papers that are most relevant are attached here:

No	Reference	Objective	Outcomes	Methodology
1	[3]	To study the mobile usability of the Amila Pregnancy app.	Task 5 (add and track baby kick progress) was successfully completed by 11 (73.33%) of the 15 participants. Ten people (66.66%) successfully completed Tasks 2 (add current weight and wife's weight) and 3 (add a date for the next doctor's appointment). Only 5 out of the 15 participants were able to accomplish Task 4 (Show the listing of notes and view any notes), and only half (46.66%) of the participants were able to complete Task 1 (view infant growth info on a weekly basis). From this outcome, it may be inferred that users of this	Before the test session started, informed consent was obtained from each participant. The tester greeted and welcomed the participants before starting the test. Participants completed a recording and nondisclosure consent form after being made aware of their responsibilities. The purpose of the video recording, according to the evaluator, was to capture the participants' verbal thoughts. He or she also provided an explanation of why it was to be used. While the evaluator provided answers to participants' queries and instructed them on where to start, thinking aloud was explained to them. A brief background questionnaire was filled out by the participants and had questions about their age, pregnancy status, education, and

			mobile app were more accustomed to it over time compared to their initial tries, which resulted in Task 5.	other details.
2	[4]	1. To classify the fetal state. 2 . To take decisions based on fetal health.	1. Reduces mortality rate by classifying the condition of fetal. 2 . To provide proper treatments using appropriate techniques.	1. Algorithms have been used to classify the fetal state into three regions, which are normal, suspect, and pathologic based on 21 attributes such as heart rate, number of fetal movements per second, number of urinating contractions per second, number of histogram peaks, etc . 2. Using R-tool classification, analysis and prediction of accuracy are measured by formulas. 3. A decision tree is created by using a divide-and-conquer approach and the fetus classification is done based on this.
3	[5]	Pregnant women's vital signs can now be monitored with a low-cost, portable hardware device that has cuff-free blood pressure, heart rate, and body temperature sensors.	It helps to monitor the vital signs of pregnant women since they are at high risk of developing many complications related to the pregnancy or the fetus. In low-resource settings, where there is a severe lack of vital signs	To measure blood pressure, a sphygmomanometer, a cuff-based monitoring device, is utilized. A stethoscope is used to measure the heartbeat, and a straightforward non-continuous thermometer is used to gauge the body's temperature.

			monitoring equipment, the created device would have a tremendous advantage in monitoring maternal vital signs.	
4	[6]	To monitor fetal wellbeing. To accurately measure fetal kick	This system will enable a remote, self-administered monitoring system of fetal movement by a wearable accelerometer.	An accelerometer will collect data, and the data will be processed by the use of random forests.

4.2. Interview

Ten interviews were conducted on specific issues facing expecting mothers during the pregnancy period. Five of them were job holders and five of them were housewives. They shared their experiences during pregnancy. We have come to a conclusion after conducting the interviews, and some points have come out of the discussion:

- Mostly during pregnancy, patients face problems with frequent checkups, etc. To solve them, the assistive system is the most needed one.
- The patient needs to check the temperature, heart rate, and BMI regularly to avoid the baby's health risks.
- It is time-consuming and costly to go for regular physical and mental health checkups for patients' families, as well as tiresome for patients to maintain them.
- Patients also have a lack of awareness about certain things, which they must learn about.

4.3. Survey

A survey has been conducted on our project with the help of Google Forms to learn about the requirements and perspectives of users. The questions are attached in Appendix 10.1. Twenty-six responses have come to our form. After compiling all the responses, it was discovered that 60%

of women are housewives, and 40% of women are in specific occupations. Specific points have come up after collecting all the responses.

- 83.3% of users are willing to have an intelligent assistive system, as they have given their opinion about its ease of use. 50% of people have already used pregnancy-related apps. Others are not familiar with such facilities.
- 70.7% of responses were optimistic about the features of our project.
- 66.6% of people argued over the usefulness of the assistive system because of the different issues they faced in real-time facilities. Mainly, 50% of people face problems finding medical providers because of financial issues.

5. User Requirement

5.1. Easy-to-Use Device.

5.2. User-Friendly Application.

5.3. BMI and heart rate should be calculated.

5.4. Users should be informed about health risks through the application.

5.5. Users should be informed by an alarm if the health parameters exceed the safety level.

5.6. Users' locations should be able to be tracked through the system.

5.7. Users' information should be stored in a database.

6. System Architecture

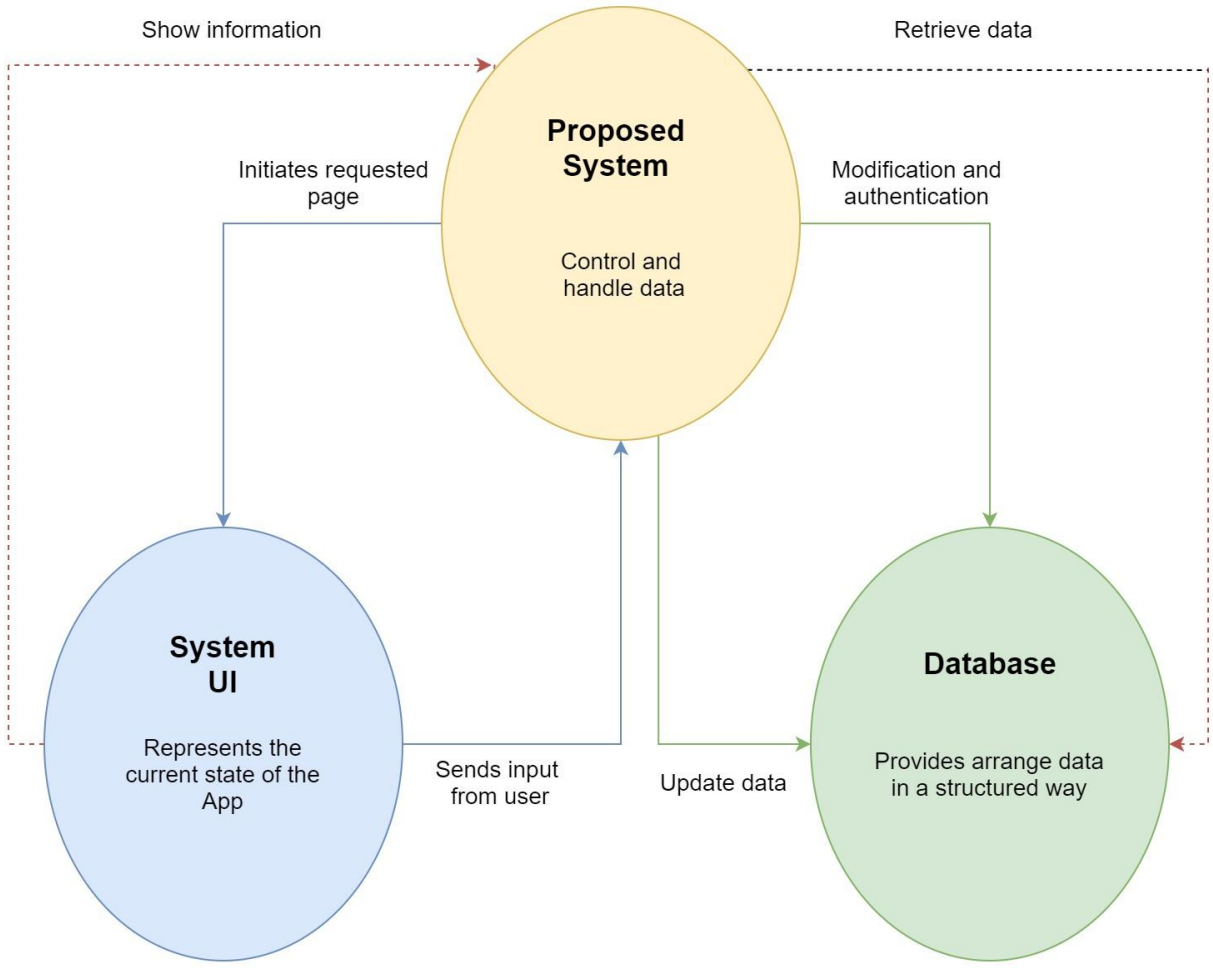


Figure 6.1: System Architecture

System UI	Represents the current state of the App
Proposed System	Control and handle data
Database	All the information for an account will be stored in the database. This database will be running in the background at all times.

7. System Requirements Specification

7.1. System Requirements

7.1.1. User-Friendly Interface

7.1.1.1. The interface shall be easy to handle for the user.

7.1.1.2. The device shall be easy to fit on an expectant mother's body or accessories.

7.1.1.3. There shall be a well-developed device using Raspberry Pi and an Android app.

7.1.2. Expecting Mothers' Profile

7.1.2.1. A database shall be created where the mother's name, age, conceived date, height, weight, user id, password, and contact information of her spouse and two close relatives are stored.

7.1.2.2. The heart rate, body temperature, and weight of the expecting mother shall be stored.

7.1.3. Assistive Wearable Device

7.1.3.1. There shall be wearable technology that will measure body temperature, heart rate, and track location, etc.

7.1.4. Emergency Situation Alarm

7.1.4.1. The system shall generate an emergency situation alarm if the heart rate is less than 70 beats per minute or more than 90 beats per minute.

7.1.4.2. The system shall also generate an SOS signal if the expecting mother explicitly wants it in cases of inconvenient situations.

7.1.5. Track Location

7.1.5.1. The concerned member shall be able to track the location in case of an emergency, and the hospitals will also be informed of the location.

7.1.6. Frequently Asked Questions

7.1.6.1. The FAQ will cover necessary queries from the user, such as recently faced problems, and assist the expectant mother using artificial intelligence and a given dataset.

7.1.7. Android App

7.1.7.1. An app shall be developed to display the necessary information to the user.

7.1.7.2. There shall be a FAQ in the app for further help for expecting mothers.

7.1.8. Security

7.1.8.1. The information of the expecting mother shall be secure enough.

7.1.9. Accuracy

7.1.9.1. The system shall reach the expected accuracy of 80%-90%.

7.1.10. Complexity

7.1.10.1. There shall be no complex functionality, and the system shall be easy to use for the expecting mother.

7.2. Requirements Classification

Serial No	System Requirements	Types of Requirements	
		Functional	**Non-functional**
1	User-Friendly Interface	×	✓
2	Expecting mothers profile	✓	×
3	Assistive Wearable Device	✓	×
4	Emergency Situation Alarm	✓	×
5	Track Location	✓	×
6	FAQ	✓	×
7	Android App	✓	×
8	Security of information	×	✓
9	Accuracy of the system	×	✓
10	Complexity	×	✓

8. System Model

8.1. Context Diagram

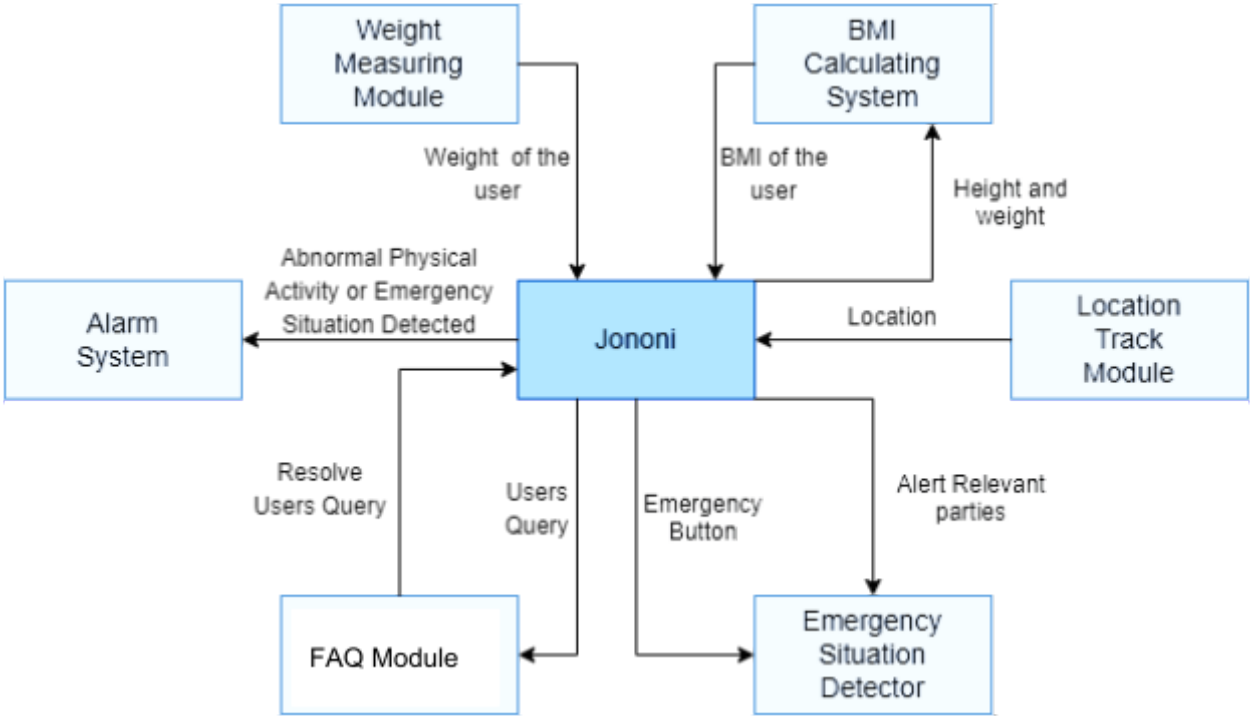


Figure 8.1: Context diagram for the system

A description of the context diagram

1. A component of the system called the weight measuring module measures the user's weight in order to determine the BMI.
2. Any unusual bodily activity or emergency circumstance is alerted via an alarm system.
3. The user's questions are answered by a module. It will offer diet recommendations. Additionally, it will work to improve the user's mental health.
4. If the user presses the emergency button, the Emergency Situation Detector will recognize an emergency and notify a family member.
5. The sub-system, Location Track Module, will provide the user's location.
6. A BMI calculator will be available to determine BMI using the user's input of height and weight.

8.2. Use Case Diagram

8.2.1. Use Case Diagram for Emergency Situation Detection

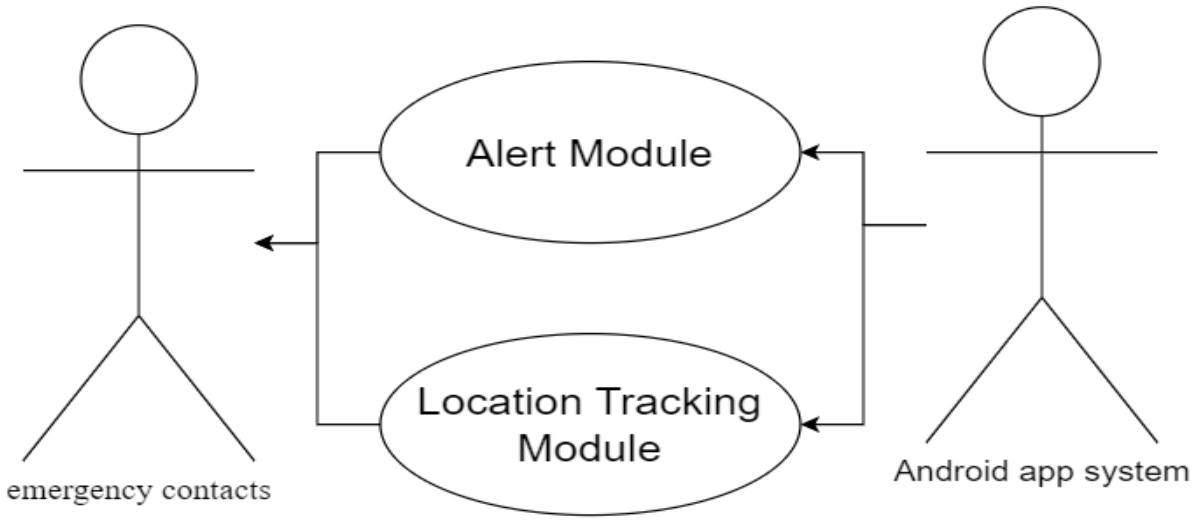


Figure 8.2: Use Case Diagram for Emergency Situation Detection.

Tabular description of Alert Module:

Alert module	
Actors	Nearest hospital and concerned family member (emergency contacts), android application system.
Description	The user will be using a device that will take inputs from the sensor, store them in the database immediately, and check if any of the data exists in the danger zone.
Data	Blood pressure, number of baby kicks, heartbeat.
Stimulus	For the data existing in the danger zone, the SOS signal will be activated.
Response	SOS signal.
Comments	The Android app must provide security for the user's data.

Tabular description of Location Tracking Module:

Location Tracking Module	
Actors	The user or stakeholder, android application system
Description	The system will track the user's location, and if any SOS signal is activated, it will immediately let the concerned family members and preferred hospital know to prevent any danger.
Data	The current location of the expecting mother.
Stimulus	For the SOS signal to be activated, the location will be tracked and sent to the concerned family members and their preferred hospital.
Response	SOS signal.
Comments	The Android app must provide security for the user's data.

8.2.2. Use Case Diagram for Chatbot Module

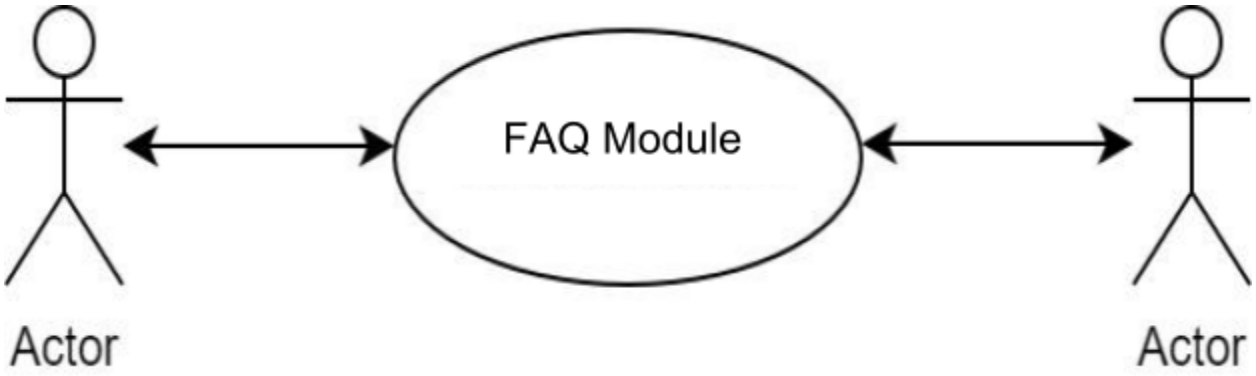


Figure 8.3: Use Case Diagram for FAQ Module

Tabular description of FAQ Use-Case Diagram:

FAQ Module	
Actors	stakeholders, users, or the Android application system.
Description	The user will use an Android application to get access in the FAQ module.The system will take input about patient's medication routine, mental & physical health condition ,then it will compare the given information with database ,also will set alarms if necessary.
Data	Medication routine, mental & physical condition, User's FAQ
Stimulus	Alarm has been set if it would have been set by the user.
Response	Alarm, answer the FAQ questions.
Comments	The answers to the FAQ questions must be accurate as per the given dataset.

8.2.3. Use Case Diagram for BMI Calculation:

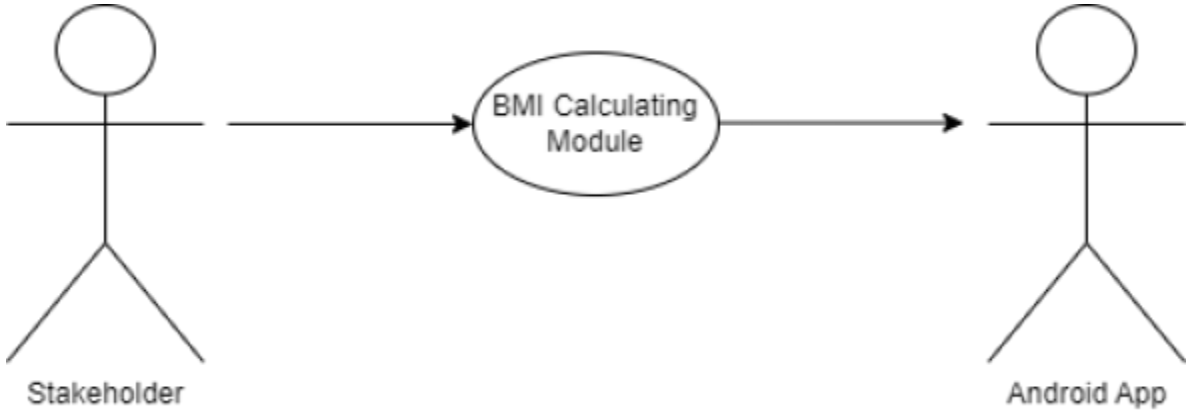


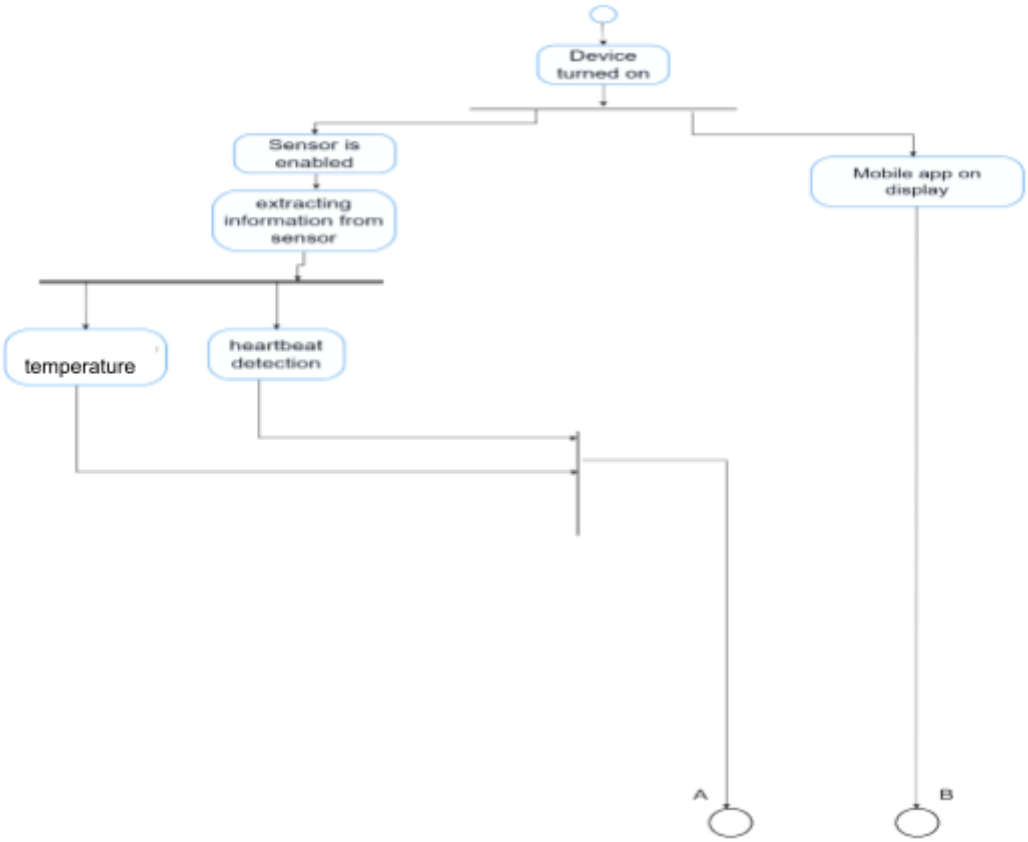
Figure 8.4: Use Case Diagram for BMI Calculation Module

Tabular description of BMI calculation Use-Case Diagram:

BMI Calculation Module	
Actors	The user or stakeholder, android application system
Description	The user will input their height or weight into the device and the device will compute user's BMI.
Data	Height, weight.
Response	BMI value.
Comments	The Android app must provide security for the user's data.

8.3. Activity Diagram

8.3.1. Activity Diagram for the System



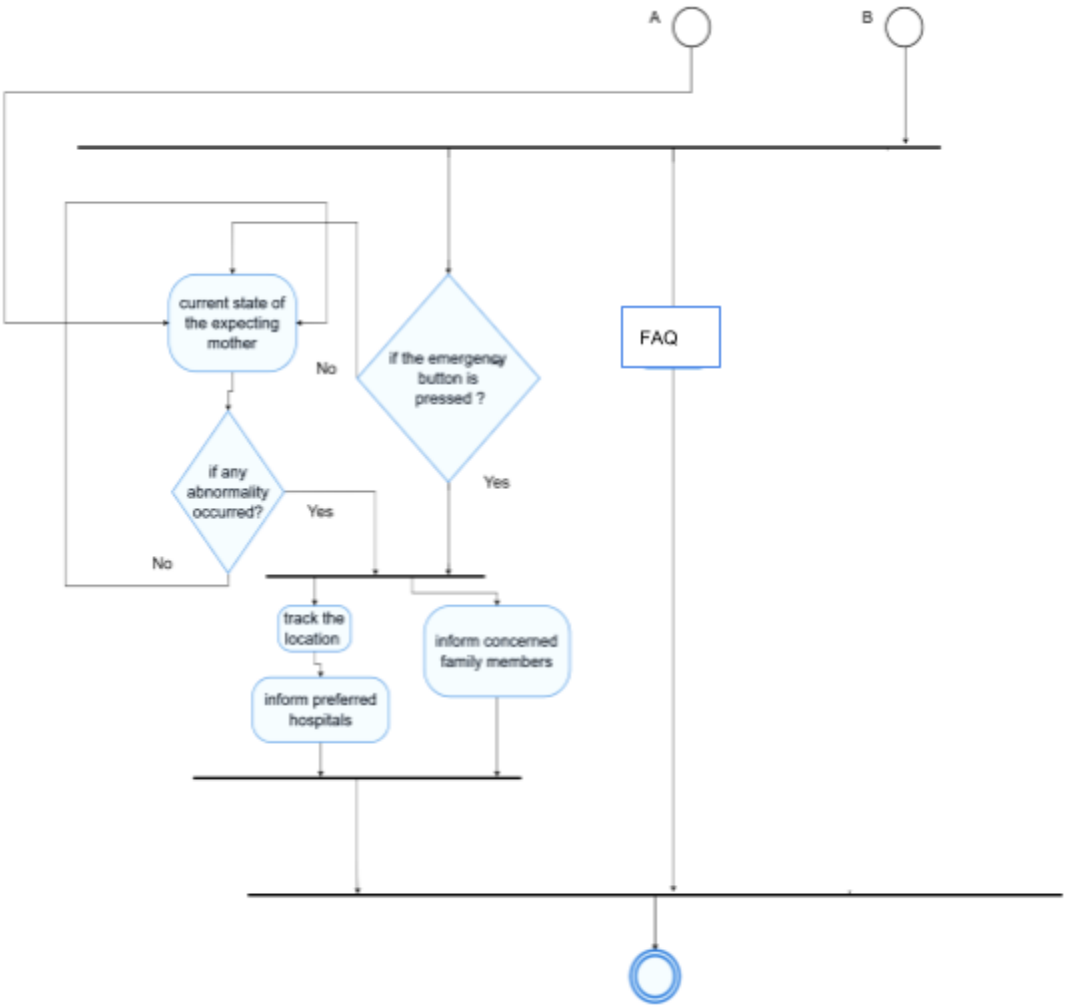


Figure 8.5: Activity diagram for the system

As soon as the device is turned on, it will serve the purpose of the mentioned modules.

8.3.2. Activity Diagram for Login

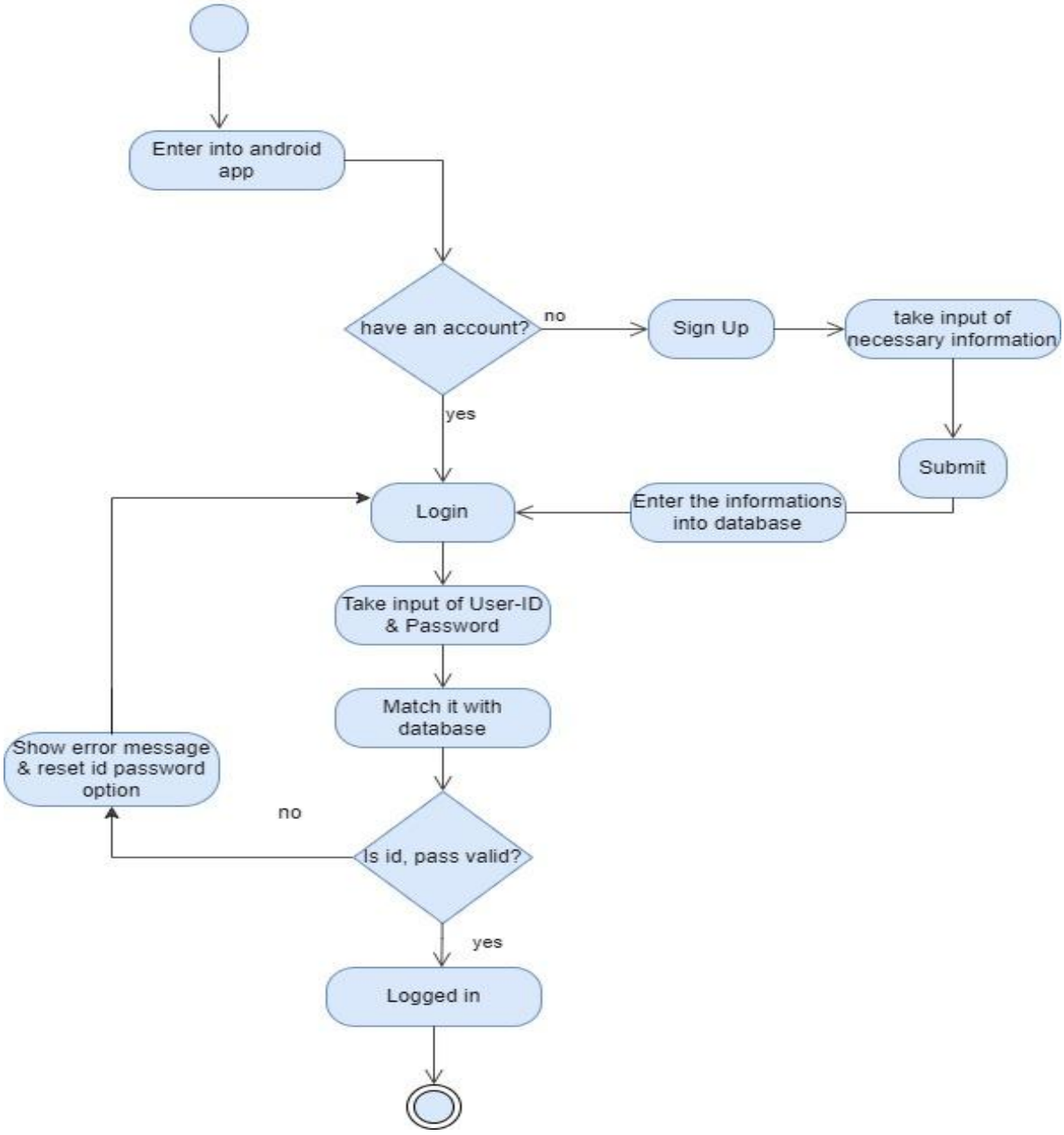


Figure 8.6: Activity Diagram for Login

Each user will have their own ID and password to log in to our app. Firstly, the user has to register or sign up if he/she has not yet registered. Otherwise, the user will be taken directly to the login page, where the app will ask for the user's ID and password, and then it will match the information with the already-stored one in the database. If the ID and password are valid, then the user will successfully log in or it will show the error message and reset password option.

8.3.3. Activity diagram for emergency situation detection

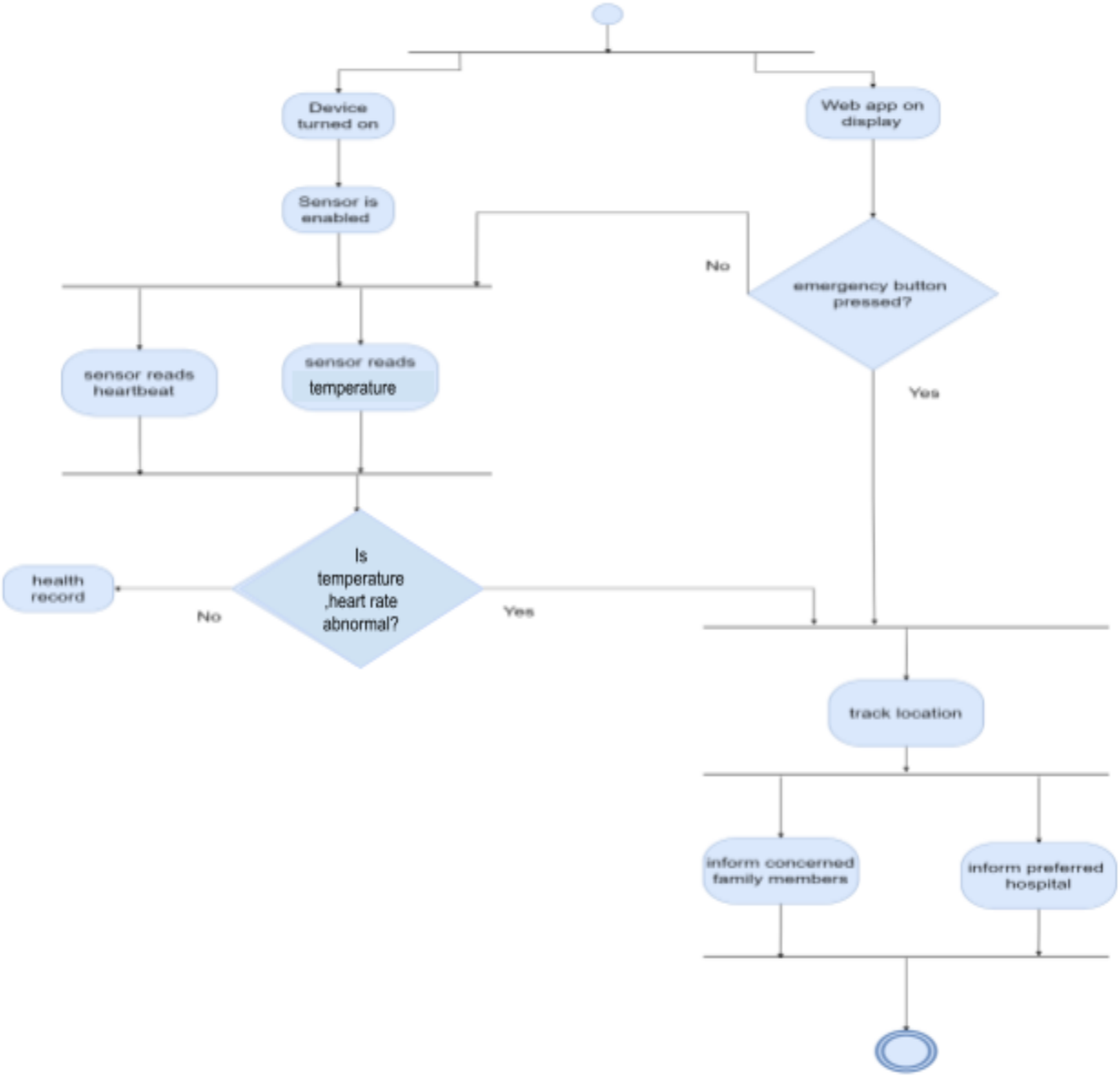


Figure 8.7: Activity diagram for emergency situation detection

As soon as the device is turned on, the sensors will collect data on the temperature and the heartbeat and compare them to determine if the expecting mother is fine. Otherwise, an SOS state will be detected with the necessary steps. This state can also be enabled in the event of the emergency button.

8.3.4. Activity diagram for temperature and heart rate

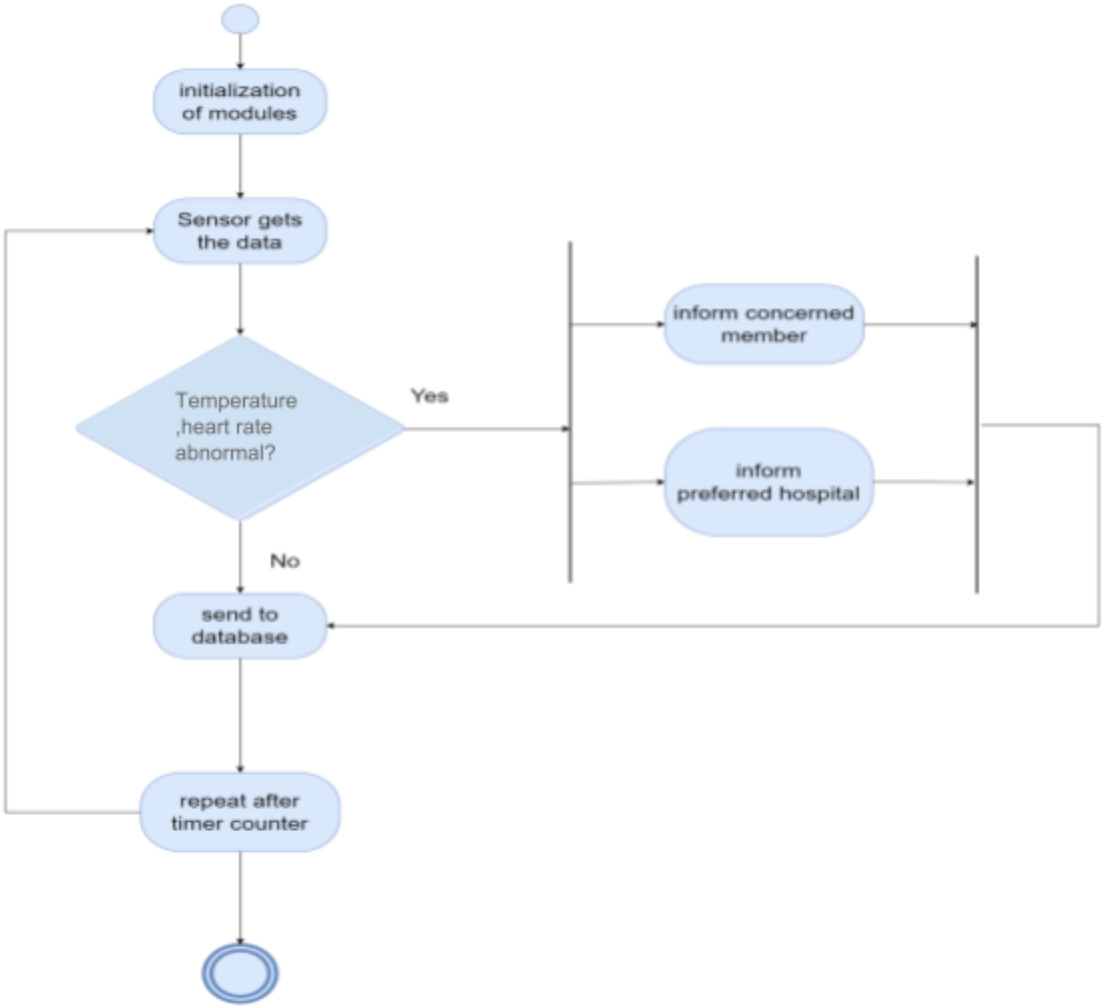


Figure 8.8: Activity Diagram for Temperature and Heart Rate Sensing

The sensor reads temperature , and heart rate and searches for abnormalities; upon finding them, necessary steps are taken.

8.3.5. Activity Diagram for FAQ

Figure 8.10: Activity Diagram for FAQ

As soon as the device is turned on, there will be a FAQ section. In the FAQ, it would give output per query .

8.4. Sequence Diagram

8.4.1. Sequence Diagram for viewing current Heart Rate/Pulse Rate:

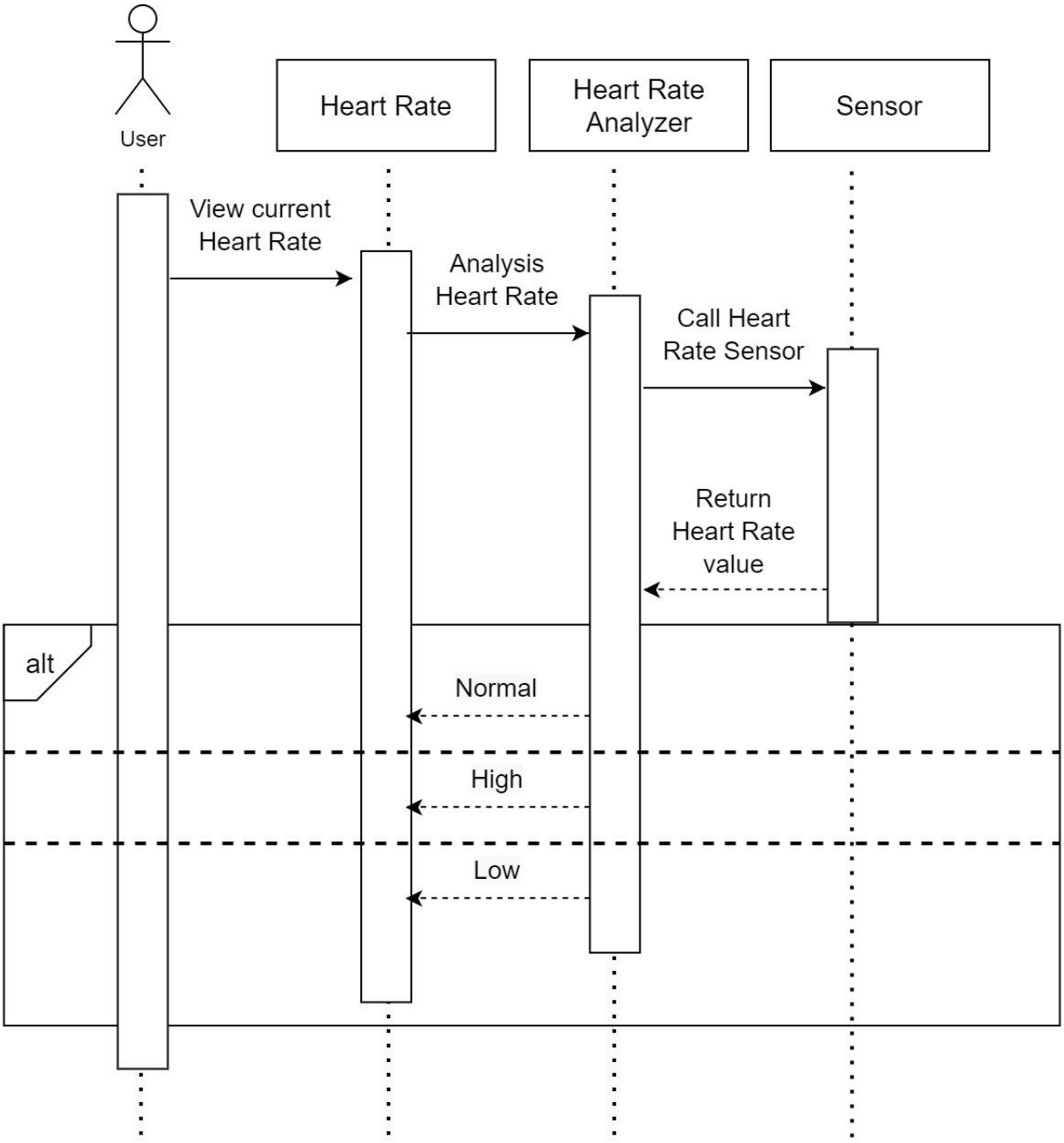


Figure 8.11: Sequence Diagram for Viewing Current Heart Rate

8.4.2. Sequence Diagram for BMI:

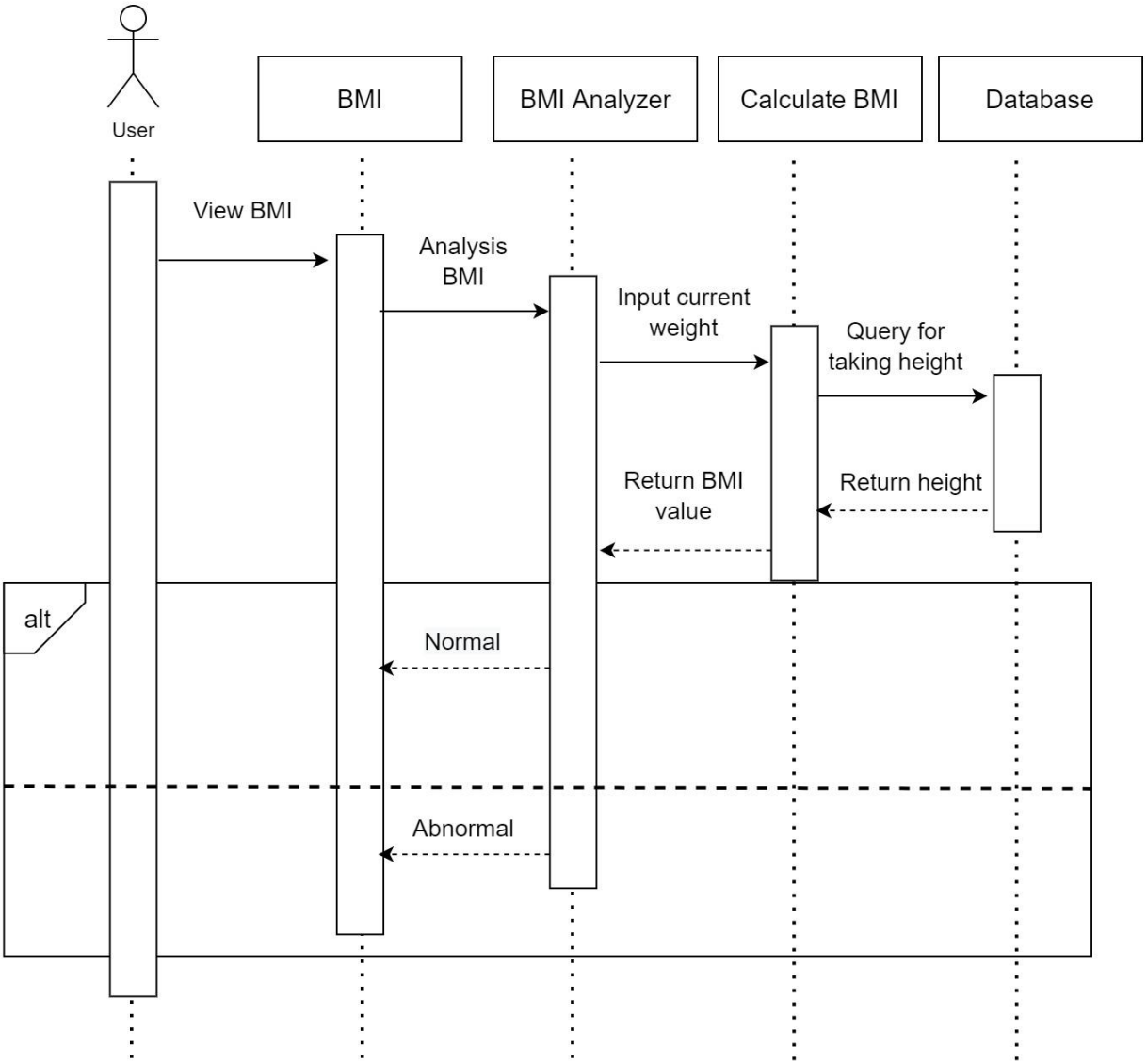


Figure 8.12: Sequence Diagram for BMI

8.5. State Diagram:

8.5.1. State Diagram for viewing current BMI:

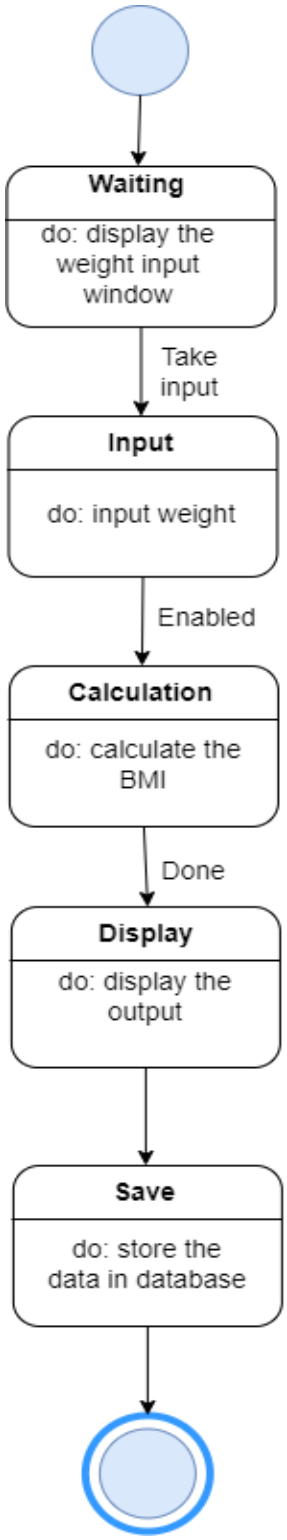


Figure 8.13: State Diagram for Viewing Current BMI

8.5.2. State Diagram for Viewing Current Heart Rate/Pulse Rate:

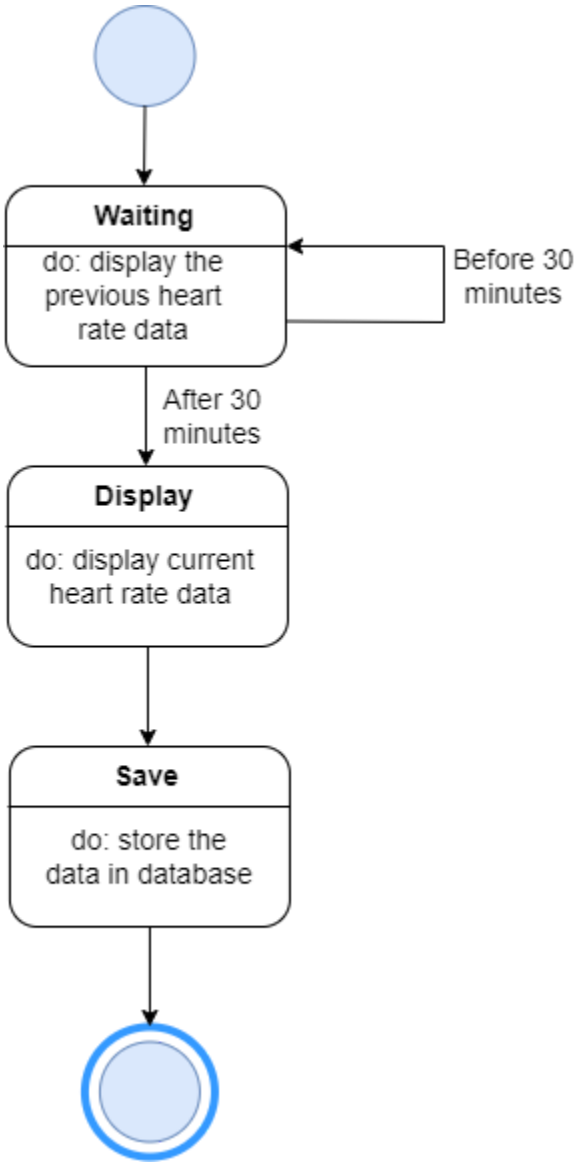


Figure 8.14: State Diagram for Viewing Current Heart Rate/Pulse Rate

8.5.3. State Diagram of SOS:

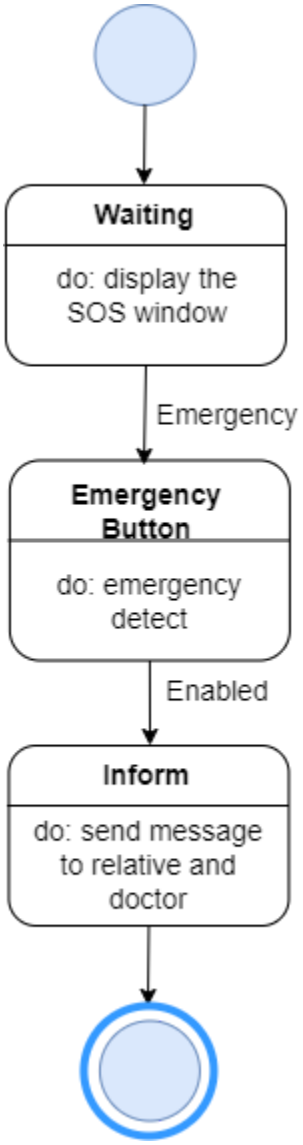


Figure 8.15: State Diagram of the SOS

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10. Appendix

10.1 Questions of the survey

1.1. What is your age?

1.2. What is your profession?

1.3. Did you get maternity leave?

1.3.1. (if no) Why didn’t you get maternity leave?

2. Have you seen a doctor about your pregnancy during this time?

2.1. (If yes) When did you last see your medical provider?

2.2. (If yes) When is your next appointment?

2.3. (If no), why don't you have any medical provider?

3. Do you think an intelligent assistive system will be helpful instead of a frequent checkup?

4. Have you used any kind of system or pregnancy-related app recently?

4.1. (If yes) , why have you used it?

5. Do you think you would benefit from assistive technology during pregnancy?

6. Have you had your weight and height checked frequently during pregnancy?

7. Do you think an automatic BMI tracker will be helpful for you?

8. Did you follow any special dietary restrictions while pregnant?

9. Have you faced problems following the diet chart? (if yes) do you need any suggestions about your diet chart from an intelligent system?

10. How often did you feel uneasy breathing during pregnancy?

11. Do you think a continuous pulse monitoring system would be helpful for you?

12. Do you think a GPS tracker is a good solution to track you in an emergency situation?

13. Why would you like to use a chatbot system instead of getting mental advice from a preferred doctor?

14. Would you like to use a wearable device?