

Monitoring Health Device (MHD)

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Principles of software engineering
Dr. Omniya wajeih

TABLE OF CONTENTS

	PAGE
Lab 1- introduction and project definitions.....	3
Lab 2- information gathering	5
Lab 3- Planning phase1	11
Working list	14
Lab 4- planning phase 2	15
Working list	18
Lab 5- Analyze Phase 1.1	19
Working list	22
Lab 6- Analyze Phase 1.2	23
Working list	26
Lab 7-Analyze Phase 2.1	27
Working list	32
Lab 8-Analyze Phase 2.2	33
Working list	38
Lab 9-modeling phase.....	39
Working list	42
Conclusion and suggestion	43
Working list	44

Lab 1

Introduction and project definitions

Project Description:

Individuals who live alone and struggle with health issues frequently have trouble getting prompt medical attention and support, which can lead to an emergency situation or make their pain worse. In addition, their families won't be aware of the patient's suffering, so our device designed for the patient that aims to monitor the health condition by the hospital or relatives to alert when critical situations occur in order to take the necessary measures. The device also measures vital rates in the body and is often used for people with chronic diseases such as diabetes and heart disease. It notifies the patient when there is a defect in the rates, it alerts the patient about the monthly appointments.

Lab 2

Information gathering

- Interviews:

1)

- **Evaluation of user requests:**

- Guest: psychologist Tahani Alharbi.
- Interviewer: Amal Alharbi.
- Workplace: Elderly women's home (al-bir society) in Jeddah .
- Email: tahani4334555@gmail.com
- Date of the interview: 9/9/2023.

- **Description of problem:**

Q1: How does the hospice care for the elderly ?

The hospice monitors patients, examines them, and administers the required treatment to them. It also opens a specific medical file for each elderly person with the knowledge of the home's physician. The hospice has an interest in sports since it arranges certain mild activities, like walking, and some exercises that are appropriate for the elderly and take into account their advanced age. Additionally developed The elderly's health is improved and diseases are prevented thanks to diet and healthy lifestyle choices.

Q2: What percentage of hospice patients are in critical condition ? What illnesses affect the elderly the most frequently ?

As a result of the limits and care for the elderly that the center provides, the percentage of serious cases is just 2% annually, which is a very low number. My work at the center has made it abundantly evident to me that the majority of the elderly are afflicted with chronic conditions like diabetes, hypertension, heart disease, and lung ailments. Muscular system conditions include arthritis, mobility issues, etc.

Q3: Do you believe our product is useful in some situations ?

Of fact, I believe we will need it at least 30%. It helps to lessen the time and effort required to keep track of older patients' medical conditions. By notifying the center when an elderly person becomes unwell, it also lessens the likelihood that the elderly may be exposed to serious cases. This gadget, in my opinion, will increase flexibility.

- **Analysts comment:**

Through my meeting with the specialist Tahani, it is considered necessary and will help them completely in dealing with the cases as well, and it will also reduce their efforts to take care of the

2)

- **Evaluation of user requests:**

- Interviewer: Nadine Al-Sahafi
- Guest: Health practitioner Wajdy Abdalqadir
- Workplace: king Fahad hospital in Jeddah
- Email : wajdy5po@gmail.com
- Date of the interview:10/9/2023

- **Description of problem:**

Q1: As a health practitioner, how often do you encounter elderly patients in the hospital ? and What are some of the common challenges or difficulties that elderly patients face when seeking medical care in a the hospital ?

Elderly patients are a significant portion of our hospital population, and we regularly provide care for them. Common healthcare needs among the elderly include management of chronic conditions, treatment of acute illnesses. Elderly patients often face challenges related to Communication this is can be a challenge, as some elderly patients may experience hearing or vision impairments, or have difficulty understanding complex medical information and their medical conditions

Q2: what specific benefits do you think elderly patients could gain from using a device that tracks their medical history and sends health alerts ? How might it improve their overall healthcare experience ?

It may have several benefits for elderly patients, such as improved monitoring of chronic conditions, early detection of health issues or emergencies, and increased peace of mind for both patients and their families.

Q3: In your opinion, how might a device with communication capabilities positively impact the safety of elderly patients ? Can you provide specific scenarios where this feature would be particularly valuable ?

I think it may take an active role in their health management and enable healthcare providers to deliver personalized care based on a comprehensive understanding of the patient's medical history , such as during emergencies, when patients experience sudden health declines, or when they need assistance but are unable to reach a phone. Also enable patients to quickly connect with healthcare providers, family members, or emergency services, faster response and potentially preventing adverse outcomes.

- **Analysts comment:**

According to the health practitioner's responses shows a strong endorsement of the new device for elderly patients in the hospital including improved access to medical history, timely health alerts, enhanced communication, and coordination of care. The healthcare practitioner recognizes the importance of improving the healthcare monitoring and make it easier to the elderly patients.

3)

- **Evaluation of user requests:**

- Interviewer: Sarah Sadik
- Guest: The patient Mamdouh Sadik who has a diabetes.
- Email : mamsadik@hotmail.com
- Date of the interview: 9/9/2023

- **Description of problem:**

Q1: When you go through a condition, can you differentiate between high or low blood sugar, and can you control your carbohydrate intake?

Yes, I can distinguish between low and high sugar through the symptoms that occur, but it has become difficult to control sugar intake.

Q2: When you experience high blood sugar, low blood pressure, or heart pain, what do you need most at that time?

I need to eat anything that contains sugar and also to call someone who can help me.

Q3: Do you expect that our device will benefit you in many cases?

I expect that it will help me control my sugar intake and will also help many other elderly people.

- **Analysts comment:**

From my interview with the patient, this device will benefit many elderly people, especially those who live alone, and will help them realize the condition they are in.

4)

- **Evaluation of user requests:**

- Interviewer: Raghad Bawazeer
- Guest: Doctor Seba Alhebshi
- Workplace: king Abdulaziz university in Jeddah
- Email : Seba.alhebshi@gmail.com
- Date of the interview:9/9/2023

- **Description of problem:**

Q1: Which diseases are more common for elderly people?

diseases of the heart, Alzheimer's disease, and the effects of medications .

Q2: What's your opinion if we give a device for elderly people that can monitoring their health?

It's a good idea because it will provide and inform their family about their health conditions daily, also will let them handle the medical condition early if needed

Q3: Can you recommend what we can add features in our device ?

In my opinion you should add these options: Heart rate, sugar measurement, blood pressure, body temperature, alerts for their medication.

- **Analysts comment:**

From my interview with the doctor, I think this device have lots of benefits for elderly people and will reduce a lot of risk that could happened when they are alone.

5)

- **Evaluation of user requests:**

- Interviewer: Hadeel Abdulhadi
- Guest: Computer scientist Atheer Babkoo.
- Email: atheer.1421@gmail.com
- Date of the interview: 10/9/2023

- **Description of problem:**

Q1: How can we decrease the expected problems in our system ?

You should use simple algorithms in building the system to be more flexible for the user, and you have to test your system many times to ensure that it's working perfectly, we often as programmers present many scenarios for using our system to avoid expected problems.

Q2: How long time do we need to construct a perfect software system ?

We approximately need about 6 weeks to build a perfect software

Q3: What is the most importance requirement should we have known before we start ?

Absolutely you have to realize the main goal of your software system, and who will use it.

Q4: In your opinion, how can we develop our software to be more efficient ?

I think you can develop your watch maybe by make it work without charging to be easier, and also you simply able present your software system to some users to have a feedback from them, and then use this feedback to develop software.

- **Analysts comment:**

By this interview with a computer scientist, I realized that our software system will be helpful if it constructed very well, so that we have to test every property will be provided.

Lab 3

Planning phase 1

The purpose of the project

a- The user business or background of the project effort

- Content:
We will develop a software for monitoring health system to be in a wearable wristwatch which will help the patient to be safe by monitoring their vital signs and alert them and people who connected previously in the system to help the patient as soon as possible.
- Motivation:
Monitor the vital signs of patient to avoid emergencies.
- Considerations:
The features of our device exist.
There is more than one device used for the same purpose (measuring vital rate and nutrients), but these features have been collected in one device in addition to adding new features such as notifying the hospital when a critical condition occurs, notifying the family, and alerting the patient of appointments. For periodic checks.

b- Goals of the project:

- Helping the patient avoid critical injuries.
- Helping patients monitor health status.
- Avoid delaying the hospital in
- helping the patient when a critical condition occurs
- Balancing the patient's needs for nutrients

Preliminary report

1-The problem:-

When patients grapple with health problems while living alone, they often encounter difficulties in accessing timely medical care and assistance, which can cause an emergency case or increasing their pain, in addition their families will have no idea about the patient's suffering.

2-Findings :-

- Patients sitting alone at home without someone monitoring their health condition.
- Their failure to follow a diet suitable for their health condition, especially diabetics due to their inability to control sugar intake.
- Patients forgetting to take medications due to their age and inability to remember sometimes.
- Patients delay going to the hospital in emergency cases.

3-Recommendation or proposed solution :-

- This device will help them and their family in monitoring their health condition by continuously monitoring their vital rates.
- This device will help them develop a nutritional plan suitable for their medical condition and will give them notifications when changes in vital rates occur.
- There are notifications that alert them to the dates of medications and periodic examinations.
- There is a feature in this device for emergency cases that require them to go to the hospital, by sending notifications to the hospital or the family.

4- cost & schedule estimates:-

The monitoring health device (MHD) will cost 90,000 riyals and take 10 months .

Monitoring Health device	Description	Cost	Time
Specification	Defining device requirements and features for monitoring patients' health	10,000 Sr	1 month
Development	Designing and developing hardware and software components of the health monitoring device	30,000 Sr	6 months
Validation	Testing and validating the functionality, performance, and usability of the apps	10,000 Sr	2 months
Evaluation	get the patient's feedback and evaluate the device's effectiveness	40,000 Sr	1 months
Total	The total cost and time for the project	90,000 Sr	10 months

Student Name	Work
Amal Alharbi	Writing the considerations, goals of the project and the problem
Sarah Sadik	Writing the findings, recommendation and the problem
Raghad Bawazeer	Writing the findings, recommendation and the problem
Hadeel Abdulhadi	Writing the content, motivation and the problem
Nadine Alsahafi	Writing cost & schedule estimates and the problem Editing document

Lab4

Planning phase 2

2. Report writing:-

- **Problem Definition:**

It can be difficult for elderly individuals who are living alone and have health problems to get prompt medical care and support. When their families are unaware of their suffering, this might cause emergencies and make their anguish worse. Access to healthcare must be improved, and communications channels must be improved. Community support programs must be implemented, caregiver networks must be established, and knowledge of support services must be raised. To ensure the wellbeing and quality of life for people in such situations it is essential to address these problems.

Sub problems :

- Risk of falling
- Accidentally overdosing from medication
- Forget to take their medication
- Feel loneliness that no one monitoring them

- **Scope Objectives of “new system”:**

Monitoring health app aims to provide patient comfort as it is simple and understandable.

- **Alternative Solutions:**

A program that is downloaded on the mobile phone in which it helps the patient maintain their health.

- **Cost & benefits of Alternative:**

Benefits:

- More useable
- Less costs
- More comfortable
- More maintainable

-The table show the cost and time of “ Monitoring health app “ .

Monitoring health app	Description	Cost	Time
Specification	Defining device requirements and features for monitoring patients' health	10,000 Sr	1 month
Development	Designing and developing the hardware and software components of the health monitoring app.	20,000 Sr	3 months
Validation	Testing and validating the functionality, performance, and usability of the app.	10,000 Sr	1 months
Evaluation	get the patient's feedback and evaluate the device's effectiveness	25,000 Sr	2 months
Total	The total cost and time for the project	65,000 Sr	7months

- **Software impacts:**

The application will provide a simple interface to allow patients using their mobile phones to enter their vital rates and if they feel something unusual for getting helping advice, meaning that they are participating in monitoring their health data, this involvement fosters a sense of control and responsibility, leading to improved adherence to treatment plans and healthier lifestyle choices. This application has a simple components which occupies 200MB and it supports IOS and Android devices.

-

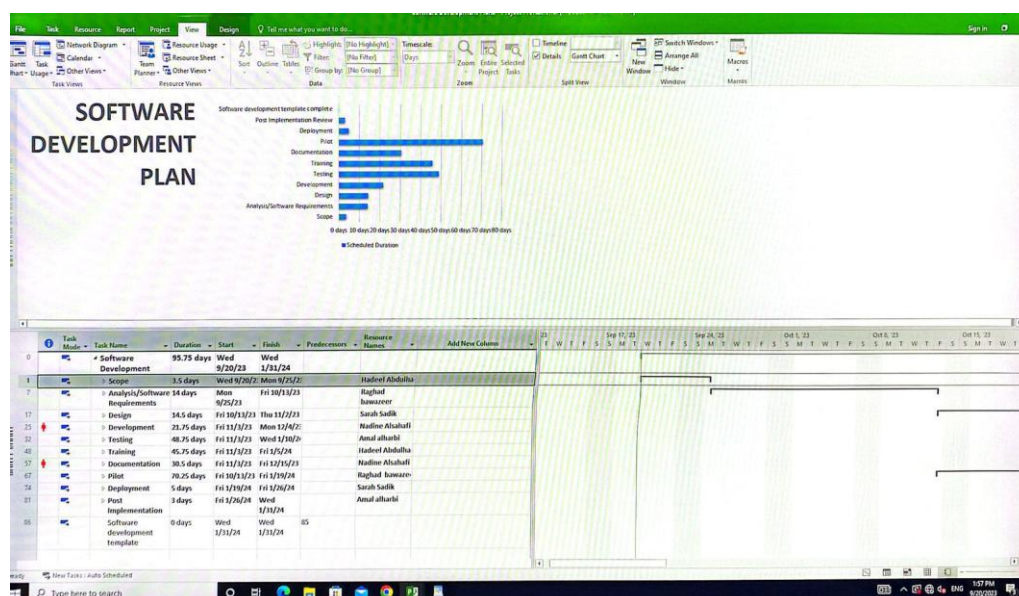
- **Potential Changes in the Organization:**

A program that is downloaded on the mobile phone in which it helps the patients maintain their health, as the patient records his information and the diseases that he suffers from, and it presents him with the appropriate nutritional plan for him and also tells him the normal rates for his condition, and this program can also help him find out what the condition is. Which the patient goes through by recording the symptoms and telling him what he is suffering from, patients can securely message their healthcare team, ask questions, or provide updates on their condition so that patient can take the appropriate treatment and act correctly regarding his condition. The program can also send videos and health posts to the patient to increase the quality of healthcare for the patient

- **Recommended Alternative of the course of Action:**

This healthcare app is designed to cater to the needs of the patients population, providing a comprehensive range of features and functionalities. It will help them to monitoring their health data, this involvement fosters a sense of control and responsibility , leading to improved adherence to treatment plans and healthier lifestyle choices

3. Project plan (By using Microsoft Project):



Student Name	Work
Amal Alharbi	Writing the problem , table of alternatives, and editing document
Sarah Sadik	Writing the alternative solutions and Potential Changes in the Organization, the Benefit, and editing document.
Raghad Bawazeer	Writing the sub problems.
Hadeel Abdulhadi	Writing the software impact.
Nadine Alsahafi	Writing the Potential Changes in the Organization.

Lab 5

Analyze Phase 1.1

Context Diagram

Stockholder definition

- The Client :
 - King Fahad General Hospital
- The Customer:
 - Patients who have chronic diseases
 - Patient's family
 - Doctors
- Other Stakeholder
 - Ministry of Health

The scope of the work

a. The Current Situation

- Content

Generally, ambulance response times can have a major negative influence on the health outcomes of people who are in life-threatening circumstances and need to call for help. The patients are more prone to falling and other medical emergencies as well as long-term health issues. Calling an ambulance as soon as possible guarantees quick access to specialized medical treatment and interventions. Delays in action, however, may worsen the patient's condition and worsen their symptoms, raise their risk of complications, and even have long-term effects. The well-being and safety of people must always come first in emergency situations, which means that timely access to emergency medical care is essential.

- Motivation

By offering real-time monitoring of vital signs, automated alerts for abnormal vital rate patterns, seamless communication between healthcare providers and patients, prioritization protocols, and smart routing for effective resource allocation, our application strengthens the communication network between hospitals and patients. This accelerates the delivery of healthcare services.

b. The Context of the Work

- Content

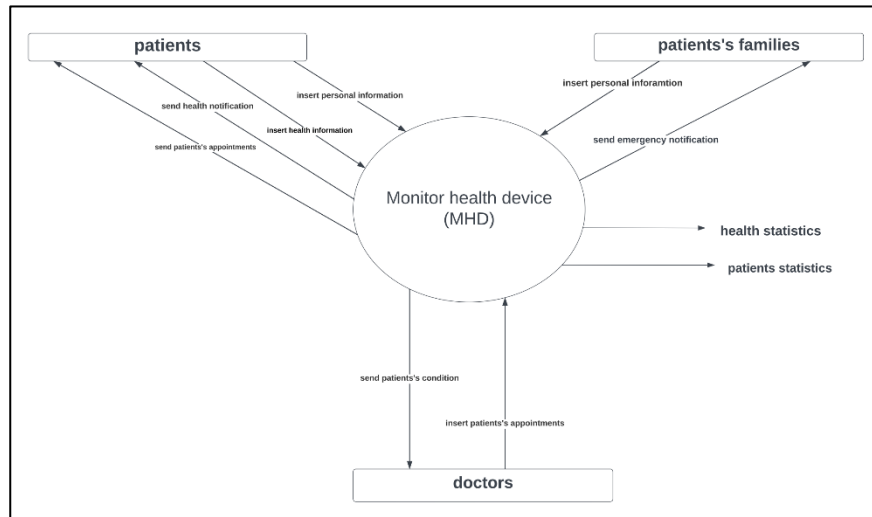
They will assist the patient in order to make the emergency situation possible.

Additionally, patients will be able to monitor their health and choose whether to seek help on behalf of themselves or their families.

- Motivation

In the future, each patient will have access to a specific doctor who will keep tabs on their health and who they may phone or talk with whenever they want.

c. Work Partitioning



Event Name	Input and Output	Summary
1. Insert health information	Insert patient's health information (in)	The patient inserts his health information to determine his normal vital rates
2. Insert personal Information	Insert patient's personal Information (in)	The patient inserts his personal information to know him
3. Send health notification	Send patient's health information (out)	The application sends the patient's a notification in need
4. Send patient's appointments	Send patient's appointments (out)	Application sends a patient his appointments
5. Insert personal information	Insert patient's families personal information (in)	The family of patient insert their personal information
6. Send emergency notification	Send an emergency notification (out)	The application sends patient's family a notification in emergency case
7. Send patient's condition	Send patient's condition to doctor (out)	The application sends details of patient's condition to his doctor
8. Insert patient's appointments	Insert patient's appointments (in)	The doctor inserts appointments of the patient
9. Reporting health statistics	Reporting health statistics (out)	The application provide a report of health statistics
10. Reporting patients statistics	Reporting patients statistics (out)	The application provide a report of patients statistics

Student Name	Work
Amal Alharbi	Writing the Current Situation
Sarah Sadik	Writing the Stockholder definition, and editing document.
Raghad Bawazeer	Writing the Context of the Work
Hadeel Abdulhadi	Writing the event table
Nadine Alsahafi	Context diagram of the project

Lab 6

Analyze Phase 1.2

Functional requirement:

ID	Requirement Definition
FR1	Create an account
FR1.1	The system shall enable the patients to create an account.
FR2	Login
FR2.1	The system shall allow to the all customers to gain the system throw supposed user name and password.
FR3	Send notifications
FR3.1	The system shall allow the application to send notification of the patient's daily report to their families.
FR3.2	The system shall allow the application to send notification of the patient's daily report to the doctors.
FR4	Update personal information
FR4.1	The system shall allow the patients to update their information.
FR5	Send emergency alert
FR5.1	The system shall allow the application to send an alert to the hospital to send help.
FR5.2	The system shall allow the application to send an alert to the patient's family to inform them about the patient emergency condition.
FR6	Export
FR6.1	The system shall allow the hospital to export patient health statistics.
FR7	Logout
FR7.1	The system shall allow to all actors to logout.

Non-Functional requirement:

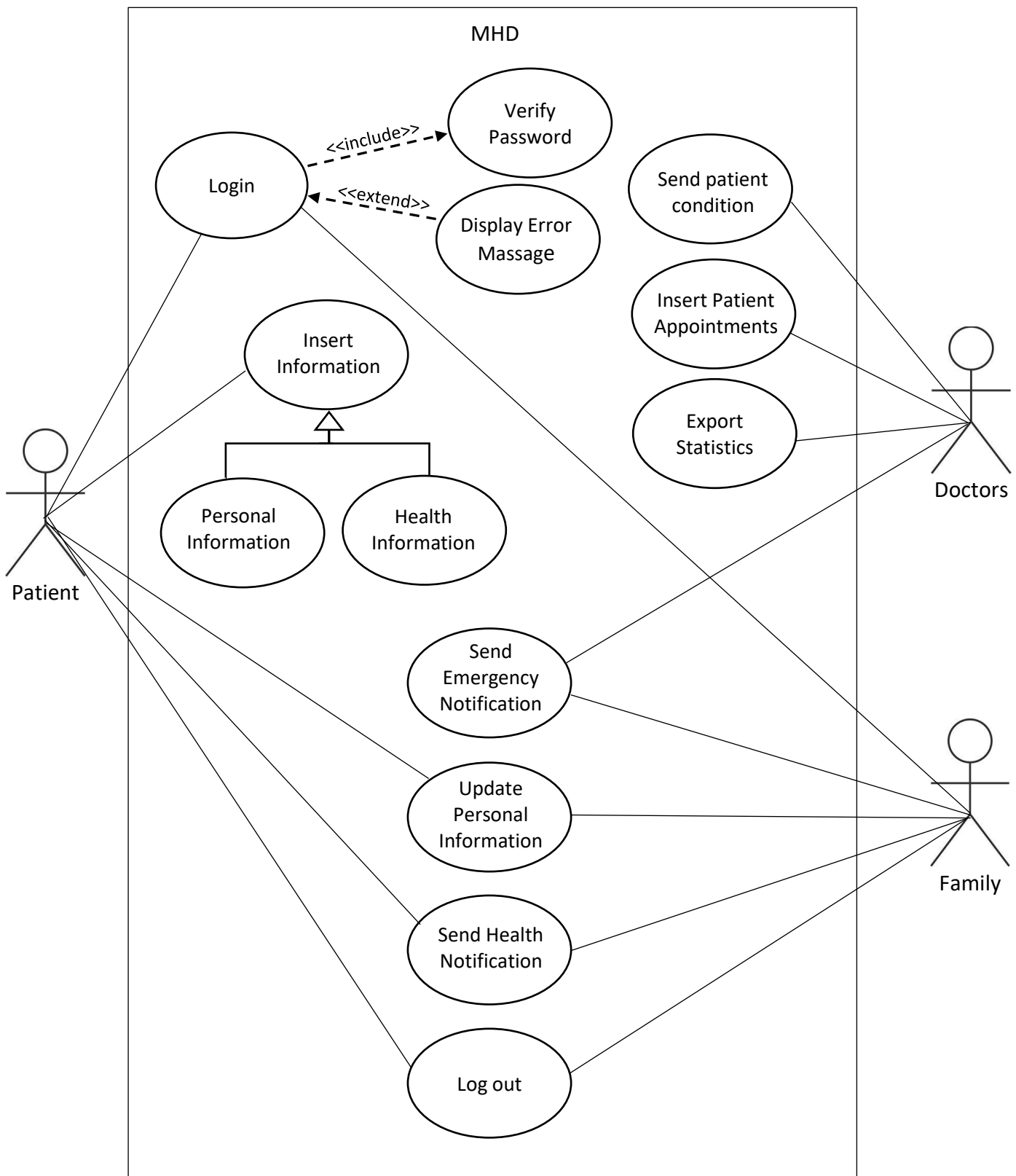
1	User Interface
UI1	The system shall provide certain functionalities in the user interface according to the user authorization.
UI2	The device should be user-friendly and intuitive, especially for people who may have limited technical skills. It should have a simple interface, clear instructions, and easy-to-understand visual cues.
UI3	The user interface shall be as GUI.
2	Hardware Interface
HI1	The system shall be implemented in a hardware-independent fashion and should not rely on any particular hardware interfaces.
HI2	The hardware interface should be lightweight, compact, and portable for easy handling and transportation. It should not impose unnecessary burden or inconvenience on users.
3	Software Interface
SI1	How fast the doctors will respond to an emergency alert.
SI2	the application that is connected with the device must be able to run on different platforms.
SI3	The device must be easy to maintain.
SI4	the alert shall keep alerting until someone turns it off.
SI5	The system must be available and operational 24 hours in 7 days.
4	Security Requirements
SE1	The system shall provide log in page.
SE2	The system shall allow user to access only the services which he/she authorize to access.
SE2.1	The system shall allow only authorized user to make and edit, delete.
SE3	Privacy and Security: The device should ensure the privacy and security of the health data it collects. It should incorporate encryption and secure data transmission protocols to protect sensitive information.

Student Name	Work
Amal Alharbi	Writing functional and non-functional requirements
Sarah Sadik	Writing functional and non-functional requirements
Raghad Bawazeer	Writing functional and non-functional requirements & editing the document
Hadeel Abdulhadi	Writing functional and non-functional requirements
Nadine Alsahafi	Writing functional and non- functional requirements

Lab 7

Analyze Phase 2.1

- Use Case Diagram:



- Use Case Description & process :

UC1	Login
Scope	Patient - Family
Level	Primitive
Primary Actor	Patient - Family
Precondition	Must be patient in King Fahad Hospital
Stakeholders & Interests	Doctors - Family - Patient
Scenario of UC1	After they bought the device and download the app the can access the system by log in

UC2	Insert Information
Scope	Patient - Family
Level	Primitive
Primary Actor	Patient
Precondition	After the actors log in
Stakeholders & Interests	Doctors – Family - Patient
Scenario of UC2	After they log in, they must insert their health and personal information

UC3	Send Emergency Notification
Scope	Doctors - Family
Level	Control the emergency notification
Primary Actor	Doctors - Family
Precondition	When an emergency condition occurs
Stakeholders & Interests	Doctors – Family - Patient
Scenario of UC3	When an emergency condition occurs, the system will send and alert to the family and doctors

UC4	Update Personal Information
Scope	Patient - Family
Level	primitive
Primary Actor	Patient - Family
Precondition	After they insert their personal information
Stakeholders & Interests	Doctors – Family - Patient
Scenario of UC4	When they want to update their personal information

UC5	Send Health Notification
Scope	Patient - Family
Level	Control the health notification
Primary Actor	Doctors
Precondition	They must log in and insert the information to receive health notification
Stakeholders & Interests	Doctors – Family - Patient
Scenario of UC5	After they log in and insert their information, they will receive health notification

UC6	Send patient condition
Scope	Doctors
Level	Control the patient condition notification
Primary Actor	Doctors - Patients
Precondition	The patient must insert the health information
Stakeholders & Interests	Doctors – Family - Patient
Scenario of UC6	After the patient insert the health information, the doctor will be announced about the patient's condition

UC7	Insert Patient Appointments
Scope	Doctors - Patient
Level	Primitive
Primary Actor	Doctors
Precondition	The patient must be in the system of the hospital
Stakeholders & Interests	Doctors – Family - Patient
Scenario of UC7	The patient will receive appointments dates from the doctor

UC8	Export Statistics
Scope	Hospital System
Level	Control the hospital patients
Primary Actor	Doctors
Precondition	Verify administrator
Stakeholders & Interests	Doctors – Family - Patient
Scenario of UC8	The doctors can export statistics of each patient

UC9	Log Out
Scope	Patient – Family
Level	Primitive
Primary Actor	Patient – Family
Precondition	If they log in, they could log out
Stakeholders & Interests	Doctors – Family - Patient
Scenario of UC9	After they log in, they could click log out button and they will be logged out

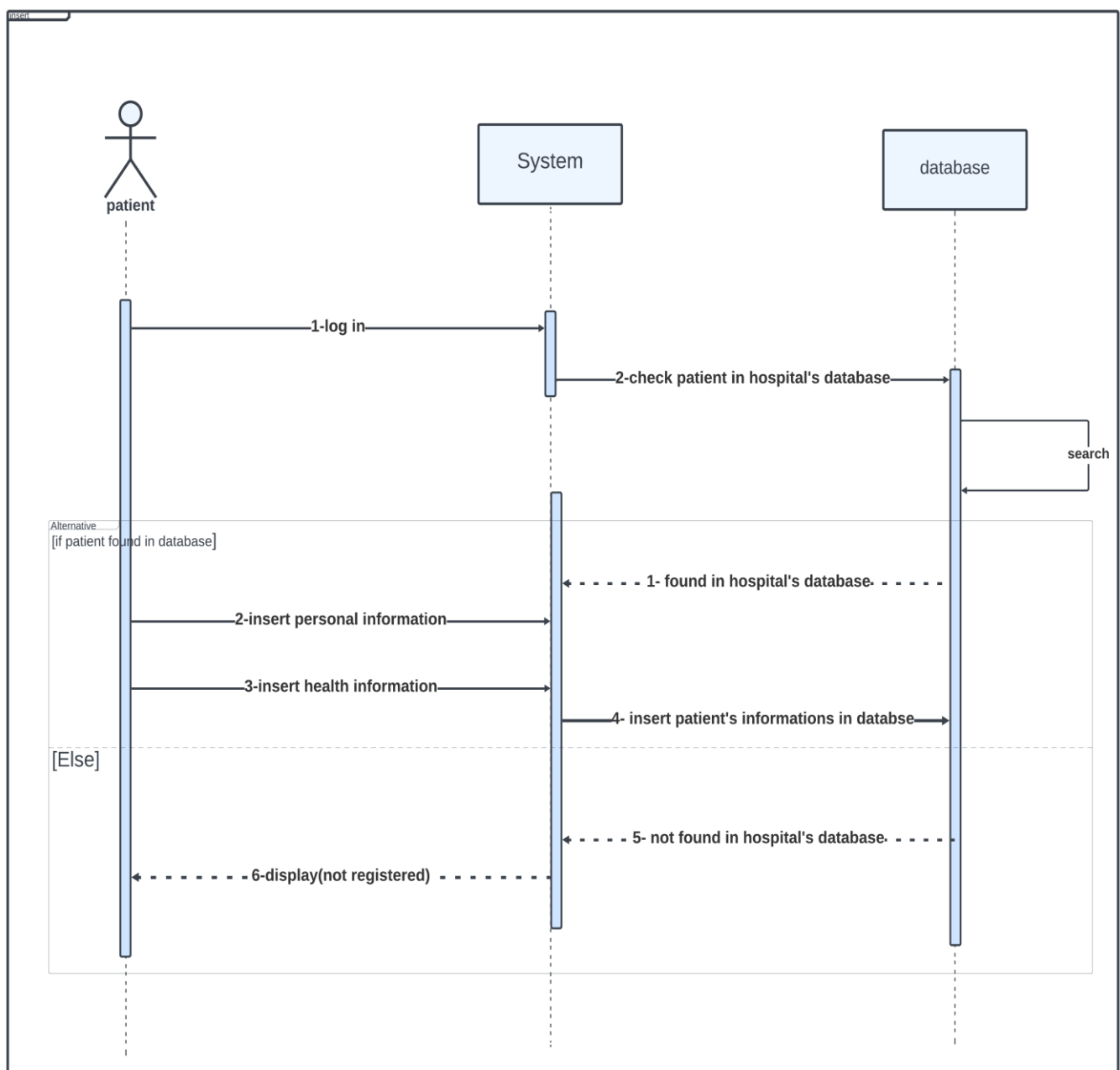
Student Name	Work
Amal Al-Harbi	Writing use case
Sarah Sadik	Writing use case
Raghad Bawazeer	Writing use case
Hadeel Abdulhadi	Writing use case & editing the document
Nadine Al-Sahafi	Writing use case

Lab 8

Analyze Phase 2.2

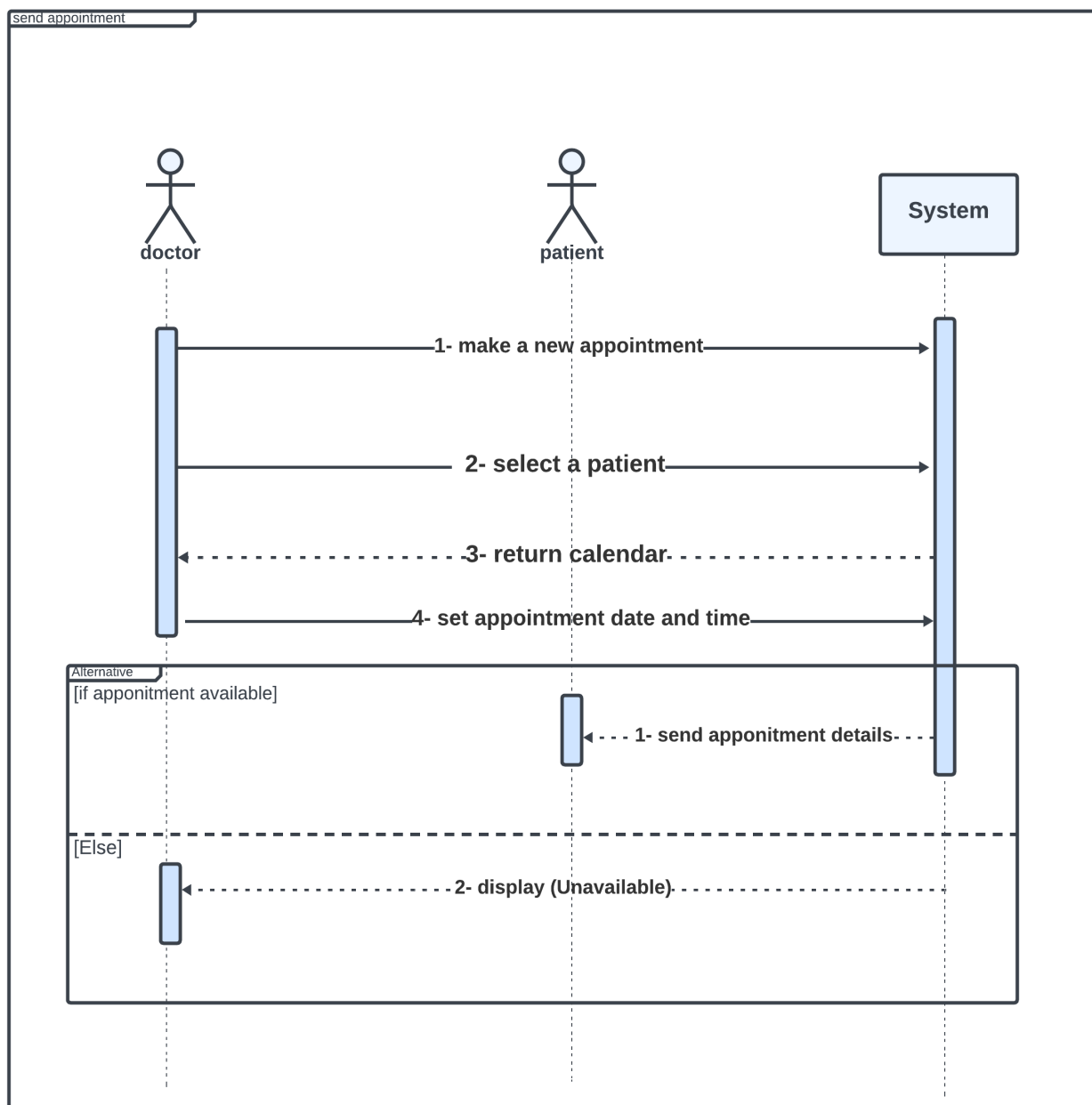
Sequence diagram 1 (Insert):

- The patient log in to the system
- The system checks if the patient is registered in the hospital database
- Search for the patient in the hospital's database
- If patient is found, the patient inserts personal and health information to the system
- The system inserts patient's information to the database
- Else, the database return to the system that the patient is not found
- The system displays to the patient "not registered"



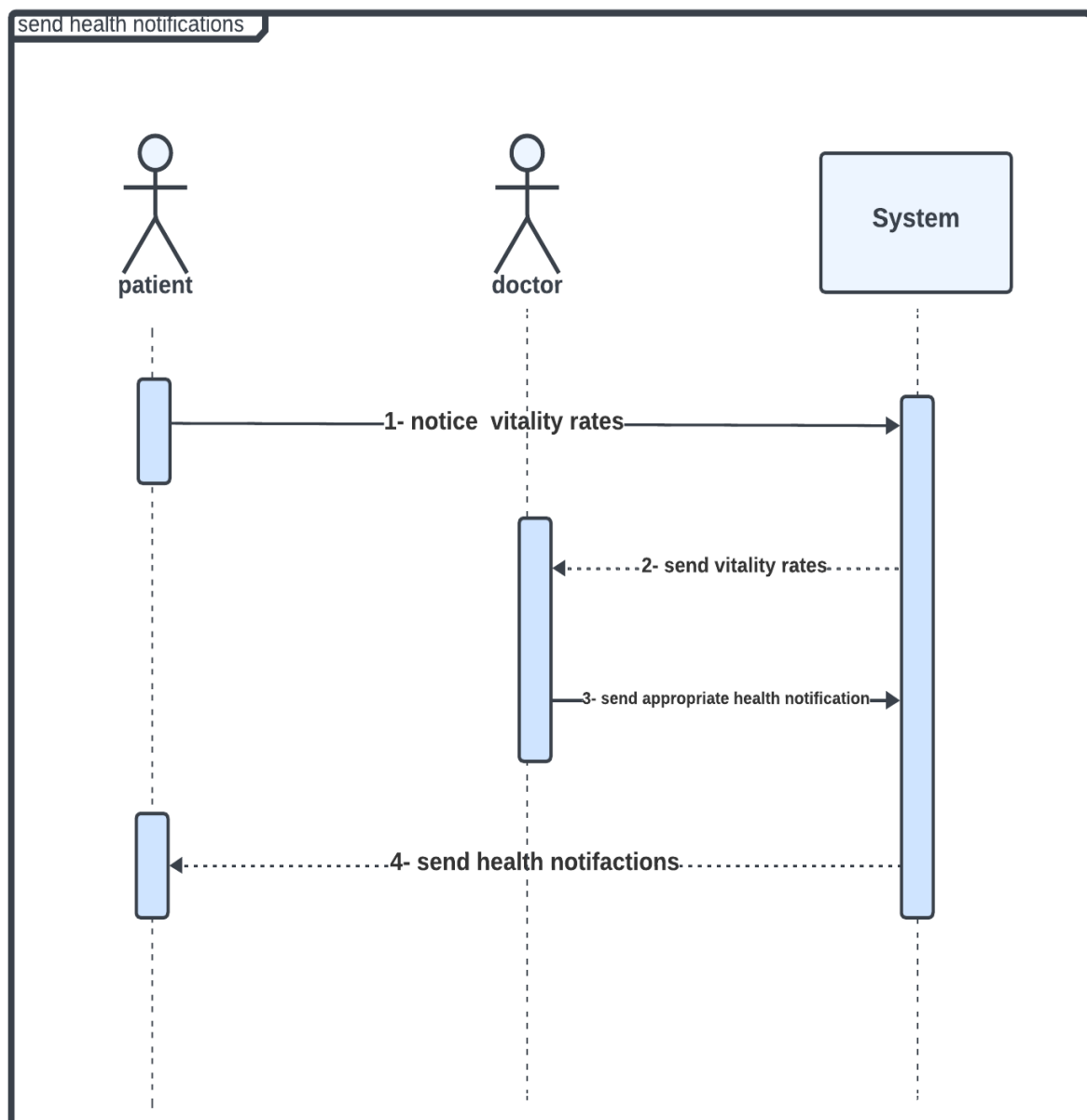
Sequence diagram 2 (Send Appointment):

- The doctor makes a new appointment in the system
- The doctor selects a patient from the system
- The system return calendar
- The doctor set appointment date and time.
- If the date and time are available the system will send appointment details to the patient
- Else, display message to the doctor involves "Unavailable"



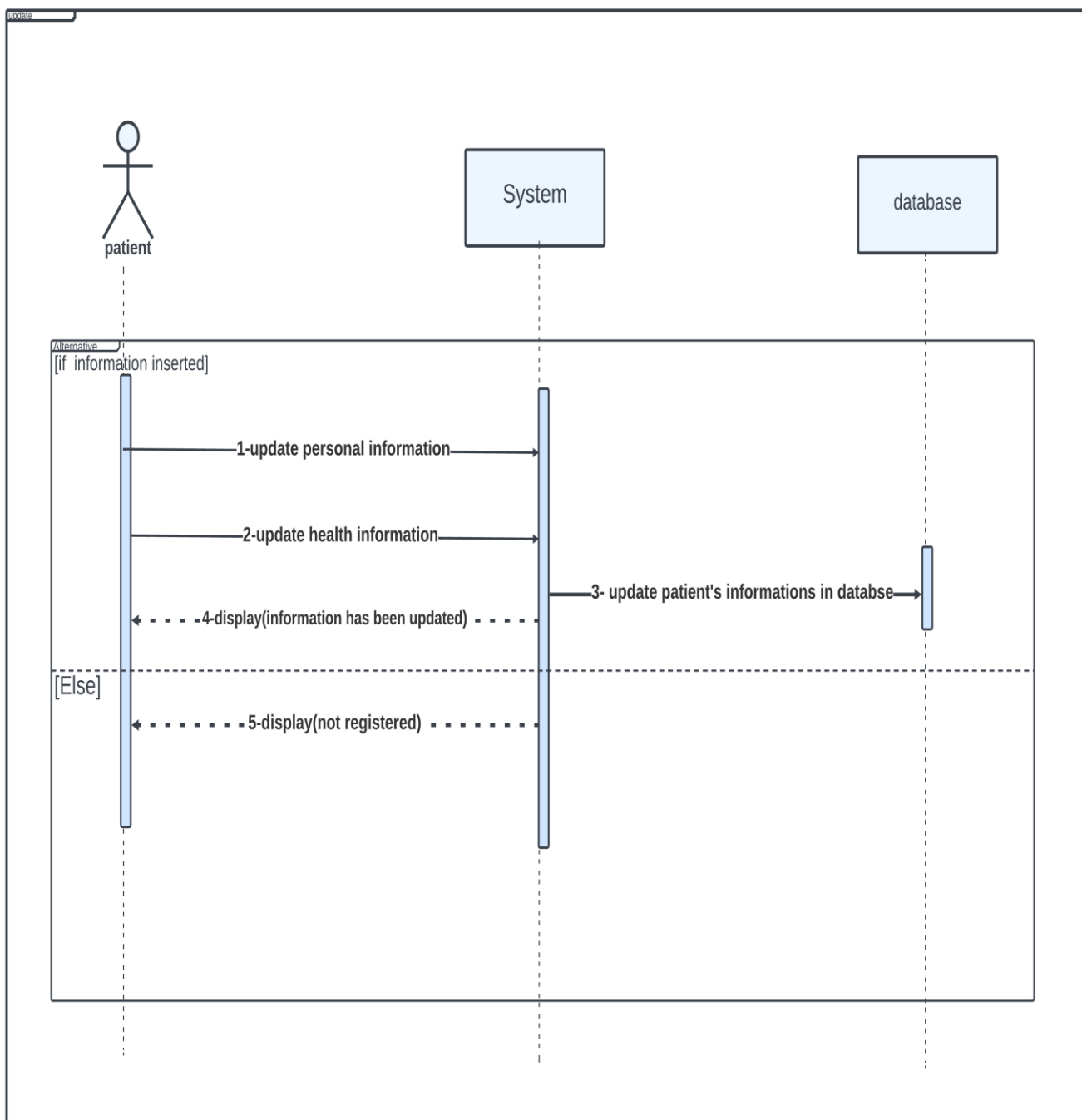
Sequence diagram 3(Send Health notifications):

- The MHD notice patient's vitality rates and send it to the system
- The system returns vitality rates to the doctor
- The doctor sends the appropriated health notifications to the system
- The system returns health notification to the patient



Sequence diagram 4 (Update):

- If the patient wants to update health and personal information which have been already inserted
- The patient can update the information
- The system display "information has been updated"
- Else the system will display message involve "not registered"

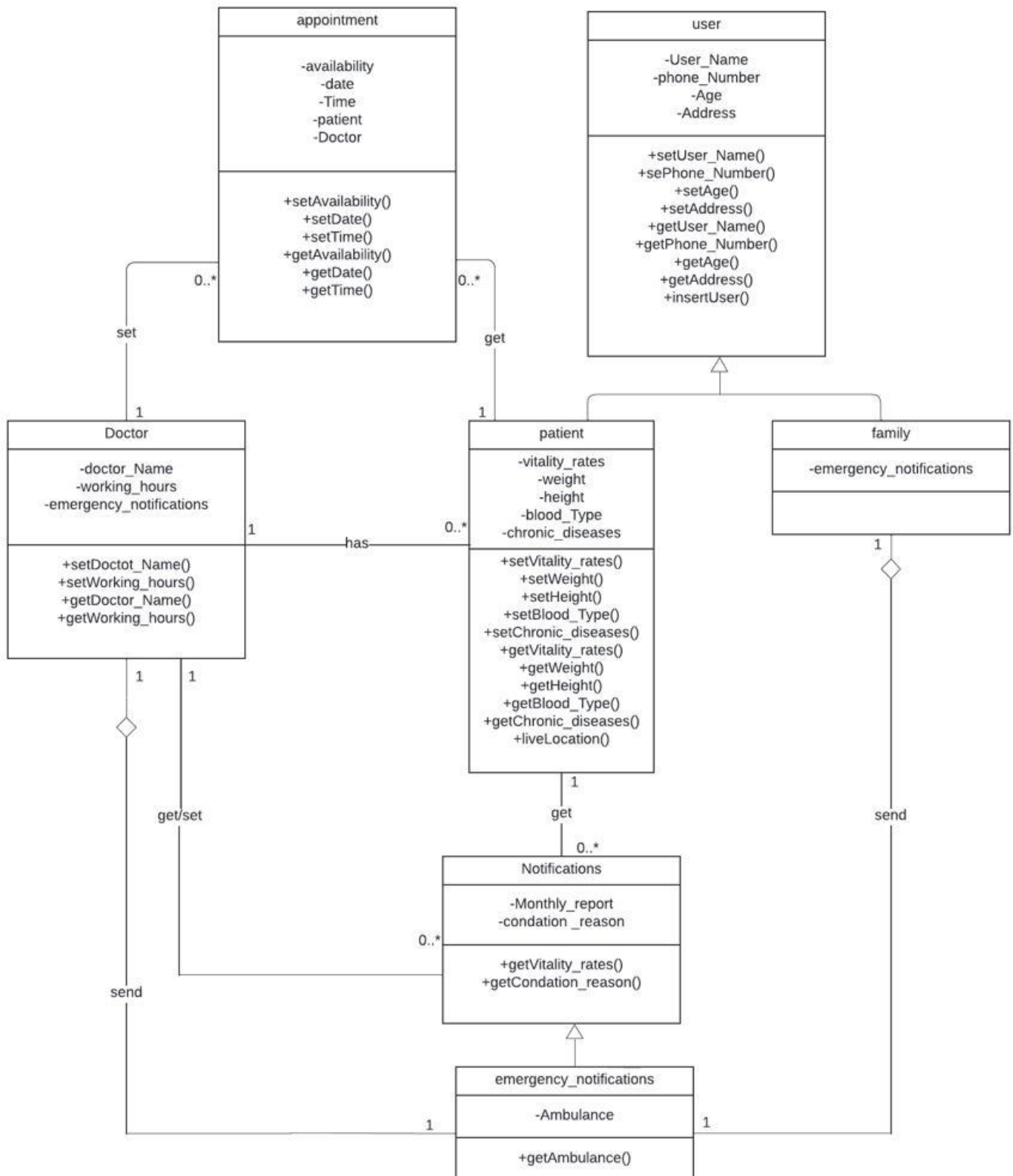


Student Name	Work
Amal Al-Harbi	Writing Sequence diagram
Sarah Sadik	Writing Sequence diagram
Raghad Bawazeer	Writing Sequence diagram
Hadeel Abdulhadi	Writing Sequence diagram
Nadine Al-Sahafi	Writing Sequence diagram & editing the document

Lab 9

Modeling phase

Class diagram:



Description :

The user must be registered in hospital database as a patient or family, they can sign in the system by inserting their names, ages, addresses, and phone numbers. Each patient has one doctor who has patient's vitality rates, weight, height, blood type and chronic disease. In addition the doctor can know the patient's current live location. The patient has the doctor's name, working hours. Each doctor can set appointments by entering date, time, and then checking the availability. The patient will get an appointments details including the date and time which are setting by the doctor. The doctor get vitality rates and condition of each patient, then the doctor set the appropriate health notification of the patient after that the patient will get it. The doctor will get notification about the patient including the reason of the condition and monthly report. If emergency condition occurs, emergency alerts will be send to the family and doctor, based on the patient condition the doctor will determine whether an ambulance is necessary or not.

Student Name	Work
Amal Al-Harbi	Writing class diagram & editing the document
Sarah Sadik	Writing class diagram
Raghad Bawazeer	Writing class diagram
Hadeel Abdulhadi	Writing class diagram
Nadine Al-Sahafi	Writing class diagram

Conclusion and Suggestion

Conclusion

In summary, the device's characteristics and system enhancements contribute to improving the patient's health and overall quality of life. Its integration into the daily routine of patients facilitates communication with healthcare providers, leading to a qualitative shift in the doctor-patient interaction. This shift empowers patients to take a more active role in their healthcare, ultimately leading to better health outcomes.

Suggestion

Based on conclusion, we strongly recommend the following action:

- Make the device serve a lot of hospitals
- Updating the app by adding an AI chat so the it answers the patients questions directly
- invest money on the device and the application due to its advantage for the patient and the hospital
- Make the interfaces clear to use for the patient and the doctor to facilitate the communication process between them
- provide technical support 24/7

Student Name	Work
Amal Al-Harbi	Writing conclusion
Sarah Sadik	Writing suggestion
Raghad Bawazeer	Writing conclusion
Hadeel Abdulhadi	Editing the document
Nadine Al-Sahafi	Writing conclusion and suggestion