



JUST Jordan University of
Science and Technology

Faculty of Computer and Information Technology

Department of Computer Engineering

Project title:

Dr. Heartbeat Monitor

CPE 592: Graduation Project II Report

A Graduation Project Submitted in Partial Fulfillment of B.Sc. Degree

Requirements in Computer Engineering

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I. Abstract:

In our project, created an application that a patient's heartbeat has been monitored by his doctor through Dr. Heartbeat Monitor, which will get BPM data from Dr. Heartbeat Monitor while Bluetooth and saved in a database to enable his doctor to monitor the medical condition. The device consists of an Arduino connected to a pulse sensor to take BPM (number of pulses per minute), displays this data on the patient's LCD screen, and sends this data via the Hc-417 Bluetooth module to the app and then save to the database. Therefore, the doctor can monitor his patient's heartbeat from any place through the internet by Dr. Heartbeat Monitor application, which will make this program classified as IOT (Internet of Thing) category.

II. Introduction

➤ Motivation:

- ◆ People, who suffer from accelerated or slowed heart rate, should visit continuously their doctor for not cause serious complications and this needs extra time, force and money for many reasons such as: Traffic congestion, Shells in the role for long times, and so on.
- ◆ Figure 1 below represents the average heart rate at rest for different ranges of age. It also indicates that if your resting heart rate is consistently above 80 beats per minute, you might need to talk to your doctor about how your heart rate and other personal factors influence your risk for cardiovascular disease.

Age	18-25	26-35	36-45	46-55	56-65	65+
Athlete	49-55	49-54	50-56	50-57	51-56	50-55
Excellent	56-61	55-61	57-62	58-63	57-61	56-61
Good	62-65	62-65	63-66	64-67	62-67	62-65
Above Average	66-69	66-70	67-70	68-71	68-71	66-69
Average	70-73	71-74	71-75	72-76	72-75	70-73
Below Average	74-81	75-81	76-82	77-83	76-81	74-79
Poor	82+	82+	83+	84+	82+	80+

Figure 1 : Heart rate by age span

➤ What is the heartbeat? ⁱ

- ✚ Normally, the heartbeat must be between 60 and 100BPM in the time of the comfortable, but there are some reasons cause in accelerated or slowed heartbeats.
- ✚ There are several diseases due to accelerate or slow heart rate, such as:
 1. Tachycardia
 2. Atrial fibrillation
 3. Wolff-Parkinson-White Syndrome
 4. Long QT syndrome
 5. Bradycardia
 6. Sick sinus syndrome
 7. supraventricular tachycardia

➤ Project Description:

- ✚ Our project is a device that has been programmed by the Arduino programming language. It measures the users' heartbeat average each 1minute and sends it via Bluetooth Hc-417 module to an application that was programmed by Android language. This application receives the heartbeat and calculates the average heartbeat per minute (BPM) and stores it in a firebase (online database) using application.
- ✚ Users must login into our Dr. Monitor application in order to be able to receive the BPM data and present it as Eco-Diagram. After that, the application will calculate the average BPM and save it in the user's database.
- ✚ Users can preview or edit their personal information through their profile.
- ✚ Users can see their current BPM and BPM records in BPM monitor page.

III. Professional Practice Constraints

- ❖ Manufacturability Constraints:
 - not giving accurate heart rate numbers.
- ❖ Economic Constraints:
 - The device can be economically expensive for the patient; but its cost may be less than the cost of transportation and the doctor's disclosure.
 - On the other hand, this device has saved time and reduced effort.
- ❖ Technology Constraints:
 - Design to enable older and the children who don't have technology skills, to deal with it (device and application).
 - Bluetooth and Internet are required in the phone, that used
- ❖ Health and Safety Constraints:
 - in accelerated or slowed heartbeat rate situation, the patient must contact his/her doctor by application or by Doctors' contact information that found application (Phone number or E-mail) and follow all doctor's instruction and when it returns to normal situation, the patient should go to doctors' clinic (if needed, according to doctor introduction).

IV. System Architecture and Designⁱⁱ

➤ How does the Arduino pulse sensor code work?

At the beginning, the program gives zero readings. When the sensor is placed on the finger, the interrupt starts working. Then timer 2 will be enabled. At the beginning, timer 2 will be at 124 and then it increases to reach 255. After that, it starts reading the signal of pulse sensor (affected by noise, so we have written a code that helps to get readings free of noise and calculate the correct Average BPM). When timer 2 reaches 255 it disables the interrupt and execute the subroutine code, when it finishes implementing the code it presents the BPM on the LCD.

After that, it enables the interrupt again and returns timer 2 to 124. In the meantime, as the BPM measures changes, they will be sent via Bluetooth to the application and displayed on the LCD. When the value of BPM is higher than 100 (rapid in heartbeat rate) or lower than 60 (slow in heartbeat rate), the buzzer will also be turned on and the Red Led will be on.

➤ Circuit

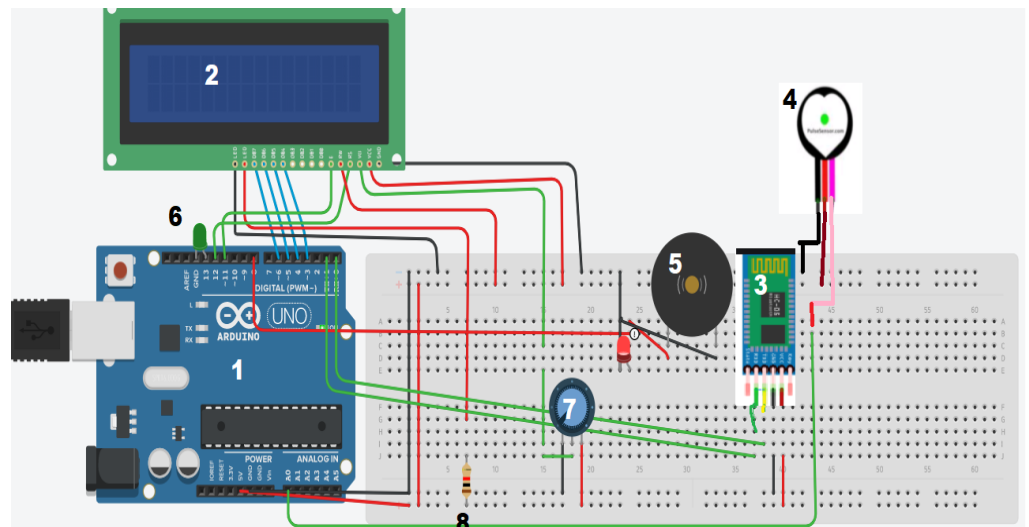


Figure 2: circuitⁱⁱⁱ

➤ Components

- 1) Arduino Uno: It is an electronic development board consisting of an electronic circuit with a computer programmer that depends in its programming on the open-source programming language, like C language. We are going to use it to connect between the devices and coding our program

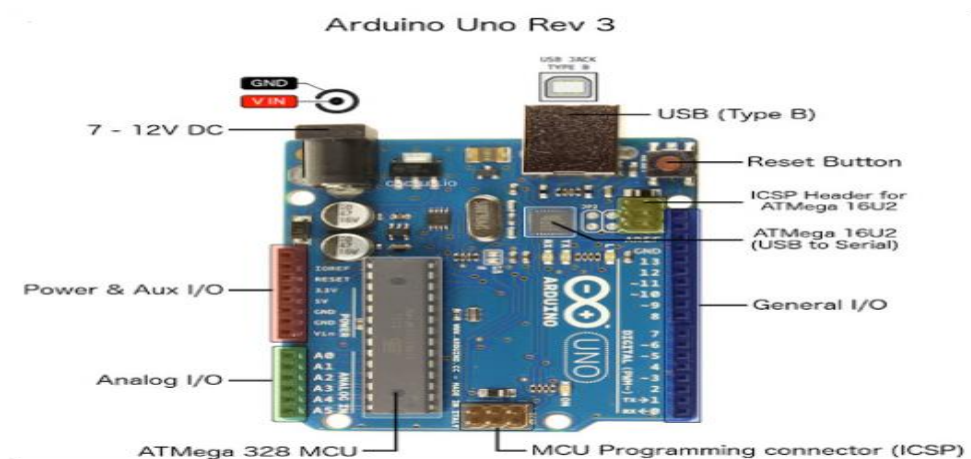


Figure 3: Arduino Uno^{iv}

- 2) 16*2 LCD Display: use to display heartbeat rate (bpm: beat per minute)

LCD	Arduino
1(V _{EE})	GRD
2(V _{CC})	VCC
3(V ₀)	Mid pin in potentiometer10k

4(RS)	12
5(R/W)	GRD
6(E)	11
11(D4)	7
12(D5)	6
13(D6)	5
14(D7)	4
15	VCC (using 1kohm)
16	GRD

1:LCD connection with Arduino



Figure 4 : LCD Display

- 3) Bluetooth Hc-417 module: use to send information to website when it takes any info from Arduino

Bluetooth	Arduino
RXD	TXD
TXD	RXD
GRD	GRD
VCC	VCC

2:Bluetooth connection with Arduino



Figure 5: Bluetooth Hc-417 module

- 4) Pulse sensor: is a plug-and-play heart-rate sensor for Arduino, clip it to earlobe or fingertip and plug it into Arduino then use it to measure heartbeat.

➤ This type of sensor is affected by disturbance (noise).
Therefore, we added a code to get a free-noise reading.

Pulse sensor pins	Arduino
S(signal)	A0
GRD	GRD
VCC	VCC

3: pulse sensor connection with Arduino

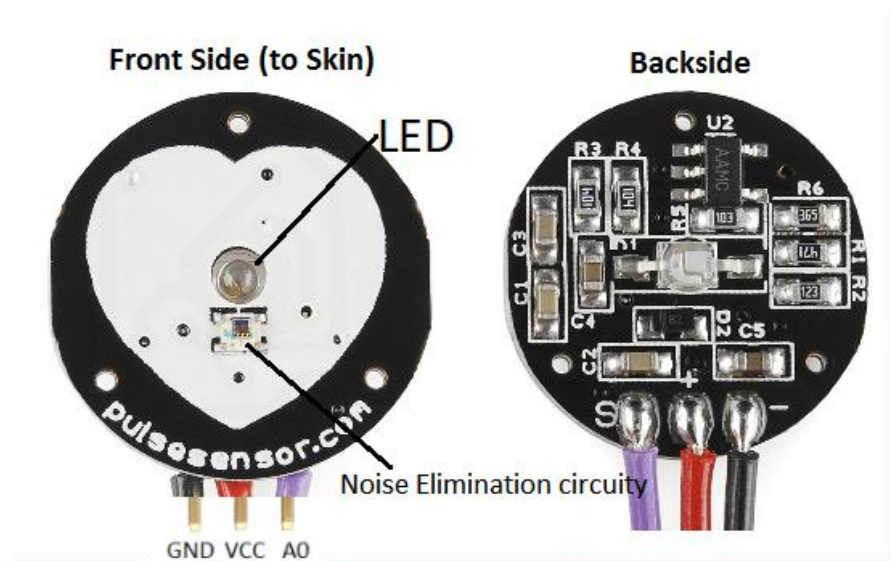


Figure 6: Pulse sensor

- 5) Buzzer: is device that converts electrical energy to audible sound, we use if your heartbeat rate is slowed or accelerated (when you are in danger), it will give a sound.



Figure 7: Buzzer

6) LED:

- a. Green LED, which connect with pin13 in Arduino, is on means that the Arduino has sent the BPM to the application via the Bluetooth module.
- b. Red LED is on means that the Arduino has sent the BPM is on means the BPM average is high than 100 or lower than 60



Figure 8: LED

7) Potentiometer 10K:

- a. The middle pin connects to pin 3(V0) in LCD and connect the other two ends to the VCC and the GND.
- b. The potentiometer is used to control the screen contrast of the LCD.



Figure 9 : potentiometer 10k

8) Bread Board: use to connect between devices by wires



Figure 10: Bread Board

9) Jumper wires



Figure 11: Jumper wire

10) 1k Resistor

V. Software Implementation

➤ Database

We link the application with online database (Firebase)

 ER diagram

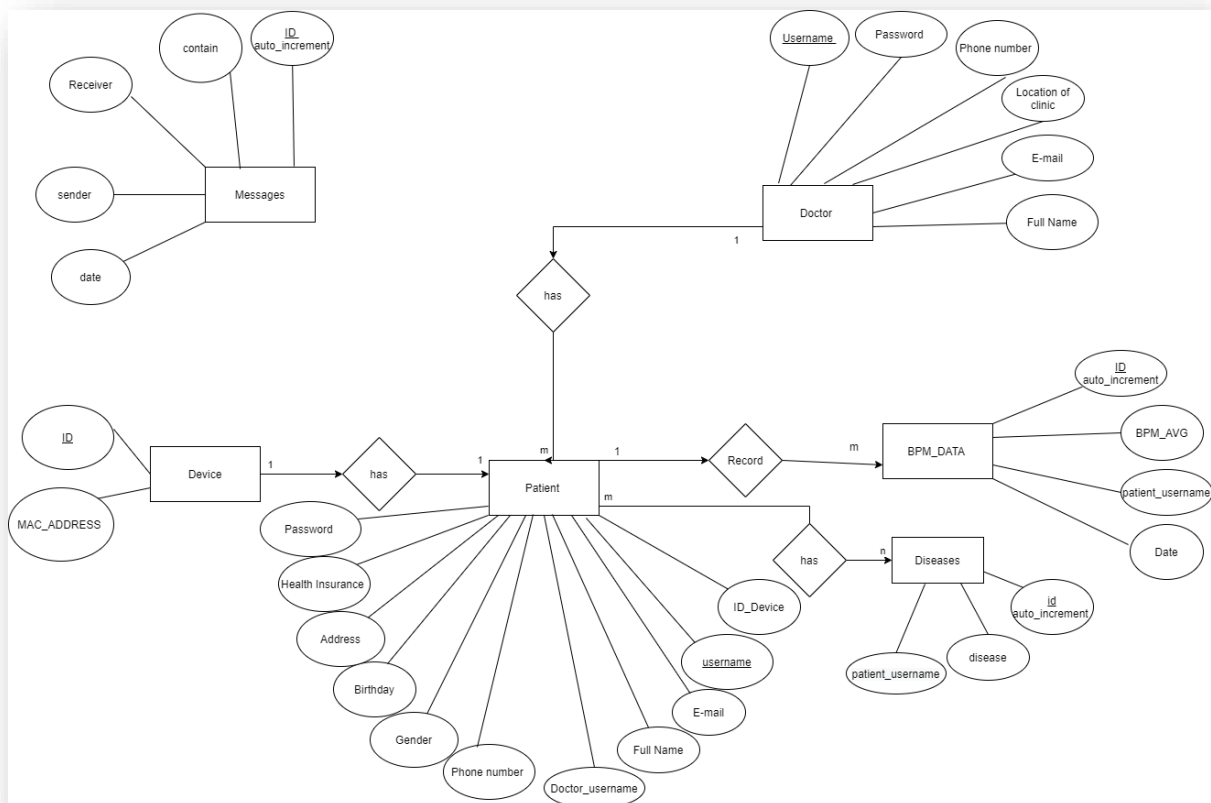


Figure 12:ER Diagram

➤ Dr. Heartbeat Monitor Application

✚ Use Case Diagram

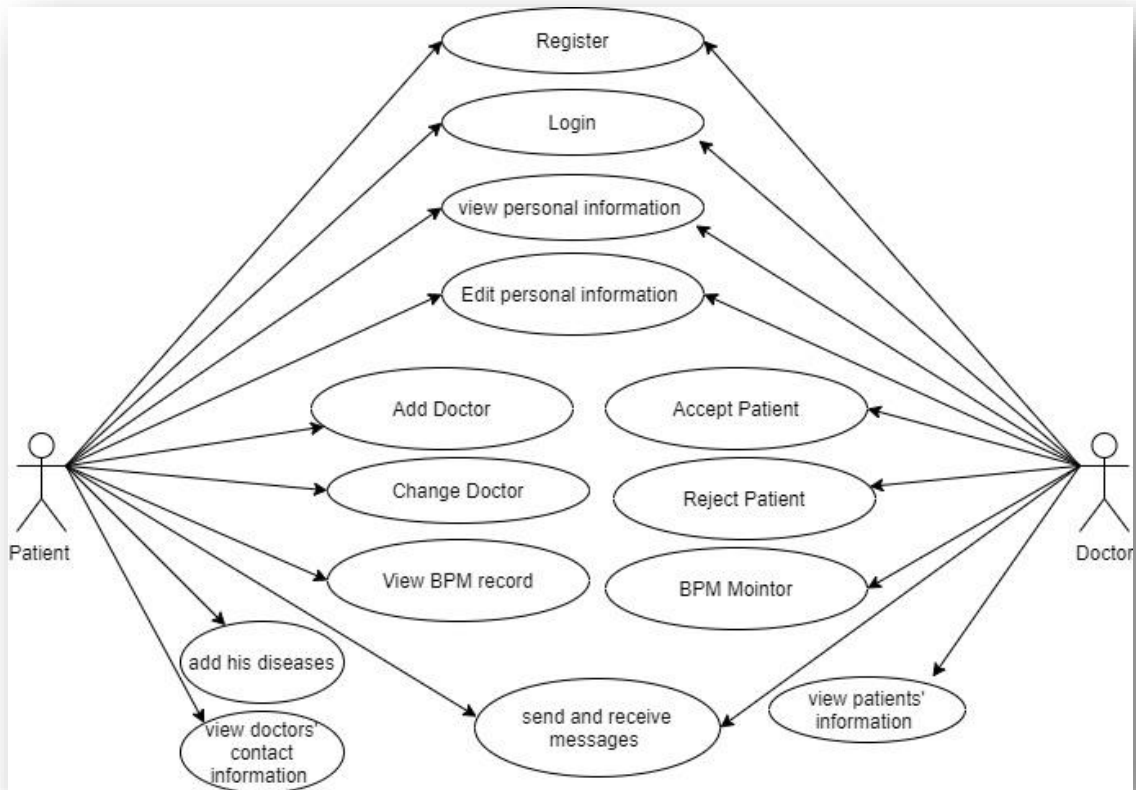


Figure 13:Use Case Diagram



Log in page

- The user can enter through his/her username or email and his /her password
- The user can change his /her password by click on change your password
- If user doesn't have an account, he/she register by click on create new account then make a register As Patient or Doctor

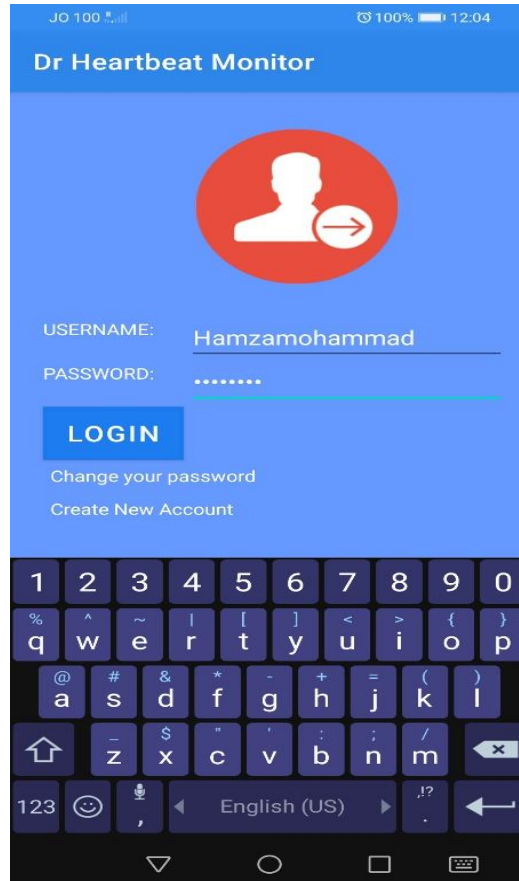


Figure 14: log page



Register page

- a. When user clicks on create new account this page will appear, and he/she can choose to register as patient or doctor

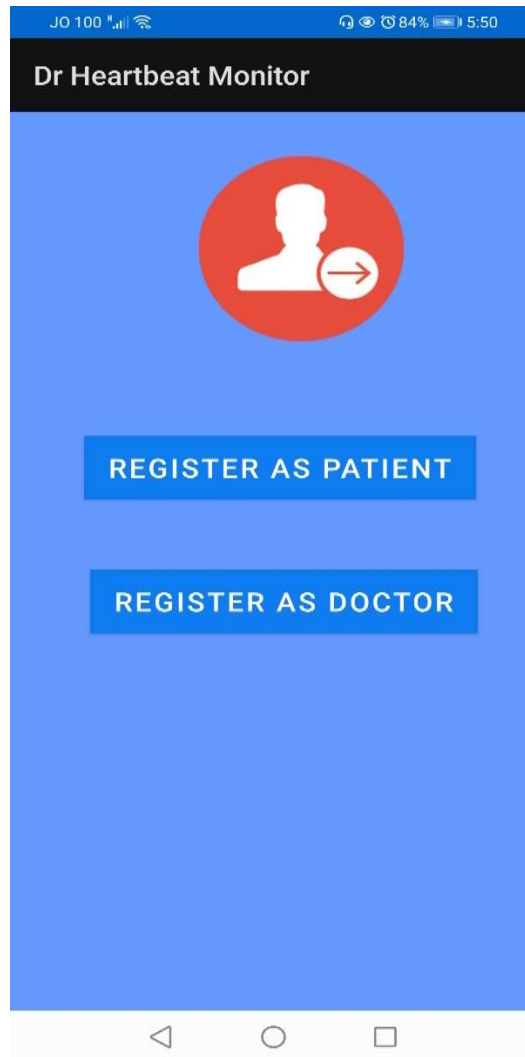


Figure 15: register page

- b. When user clicks on Register as patient, user will enter the data in the picture below:
- i. ID-Device (it must be valid, found in database and unique)
 - ii. Name (its name must be entered from 3 sections: first, middle, last)
 - iii. Username (unique)
 - iv. Password (at least 8 characters)
 - v. Health insurance (if he/she have)
 - vi. Birthday
 - vii. Gender
 - viii. Phone Number (valid and from 10 digit)
 - ix. Email (valid and unique)
 - x. Address

JO 100 % 84% 5:52

Dr Heartbeat Monitor

ID_Device: _____

Full Name:

USERNAME: _____

PASSWORD: _____

Health Insurance: _____

Birthday: click to select

Gender: ☒ Male ☐ Female

Phone Number: _____

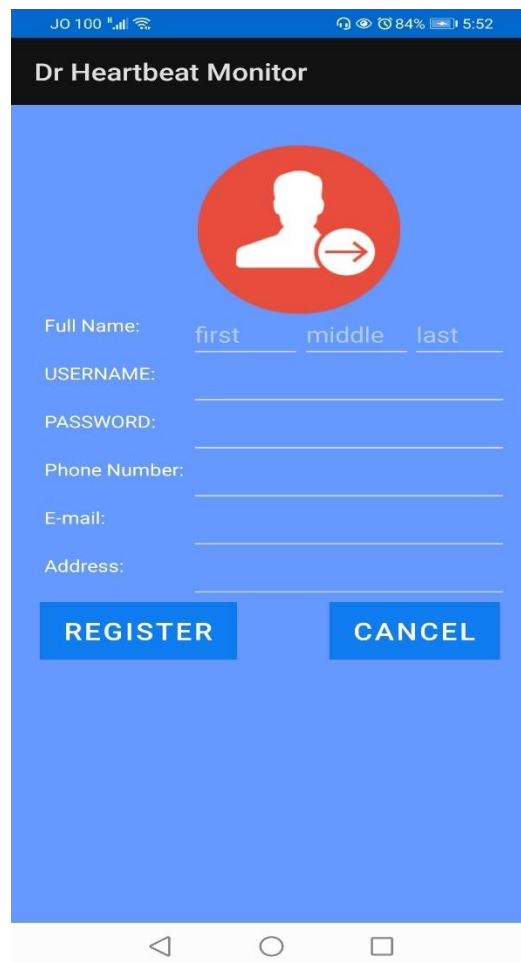
E-mail: _____

Address: --select city--

REGISTER **CANCEL**

Figure 16: Register as patient page

- c. If user clicks on register as doctor, user will enter the data in the picture below:
- Name (its name must be entered from 3 sections: first, middle, last)
 - Username (unique between patient and doctor)
 - Password
 - Phone Number (valid and from 10 digit)
 - Email (valid and unique)
 - Address (Location of clinic)



The screenshot shows a mobile application interface titled "Dr Heartbeat Monitor". The background is blue. At the top, there is a black header bar with the app name in white. Below the header, there is a red circular icon containing a white silhouette of a person's head and shoulders, with a white arrow pointing to the right. Below the icon, there are several input fields for registration:


- Full Name: with three sub-fields labeled "first", "middle", and "last".
- USERNAME:
- PASSWORD:
- Phone Number:
- E-mail:
- Address:

At the bottom of the form, there are two buttons: "REGISTER" and "CANCEL". The status bar at the very top shows "JO 100%", signal strength, Wi-Fi, battery at 84%, and time 5:52. The bottom of the screen shows the standard Android navigation bar with back, home, and recent apps icons.

Figure 17: Register as Doctor page



Patient Pages

- When patient login, he/she will see the home page at the beginning
- From tool bar using  button, navigation bar will appear. As figure below:

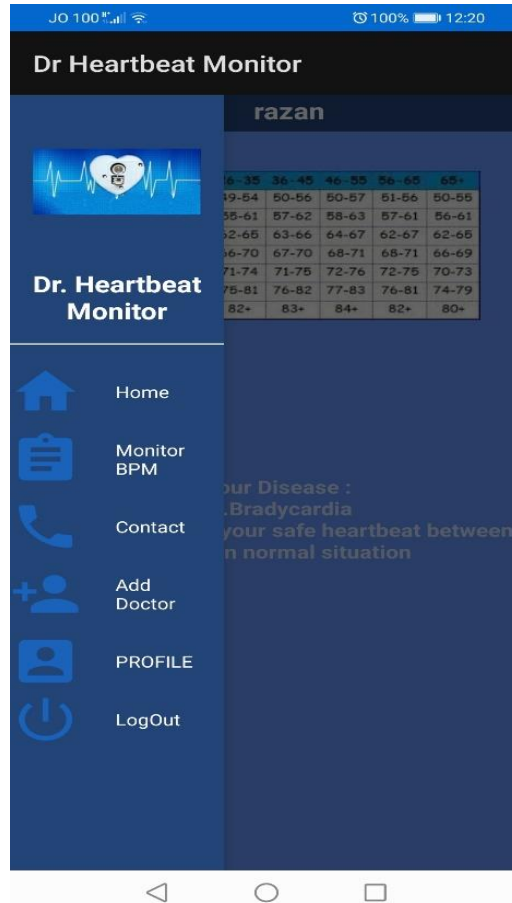


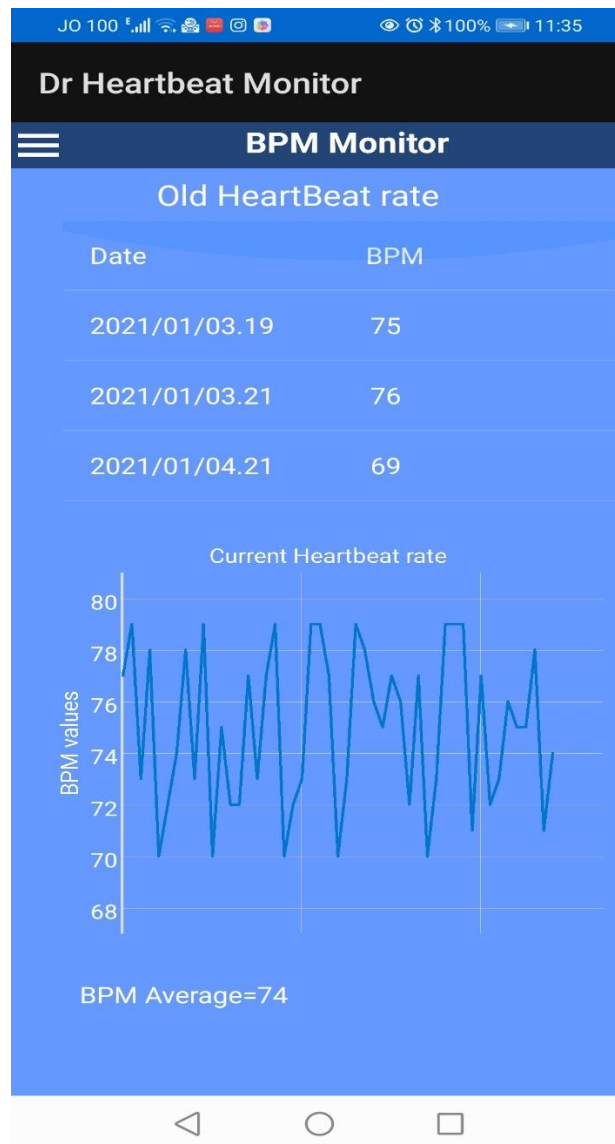
Figure 18:Patient navigation bar

- a. The Home page at first takes data from database and then displays the bpm values of the patient in the normal situation, based on his age and the diseases (if found).



Figure 19: Patient home page

- b. BPM Monitor page: Display old BPM records with its date as list and current BPM (take from device during Bluetooth) as diagram and BPM average for new data.



c. Contact Page:

- i. The doctor's data shows the patient's record, such as name, phone number, email, center location.
- ii. If patient doesn't have doctor, he/she will see message, it contains:

you don't have doctor, please go to add doctor page and choose one of the doctors



Figure 20: Contact page

d. Add Doctor page:

- i. If the patient did not choose a doctor, this page will present list of doctors and can choose one of him

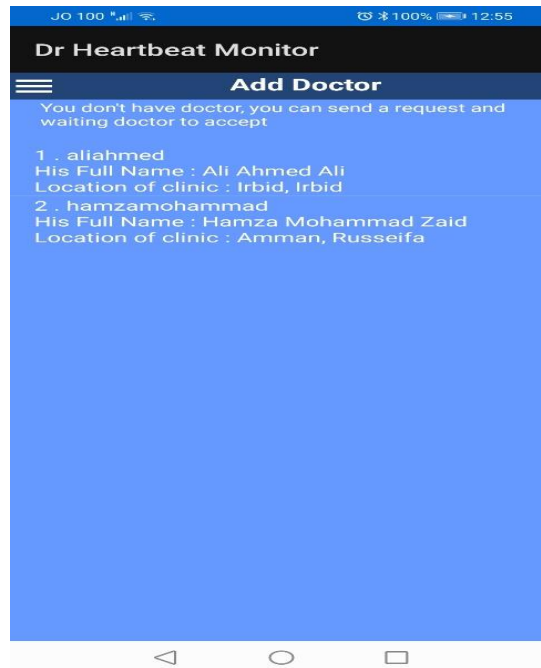


Figure 21: Add Doctor page

- ii. In case that patient have a doctor and wants to change to another doctor who can click on the name of the new doctor and then waiting new doctor to accept his/her request.

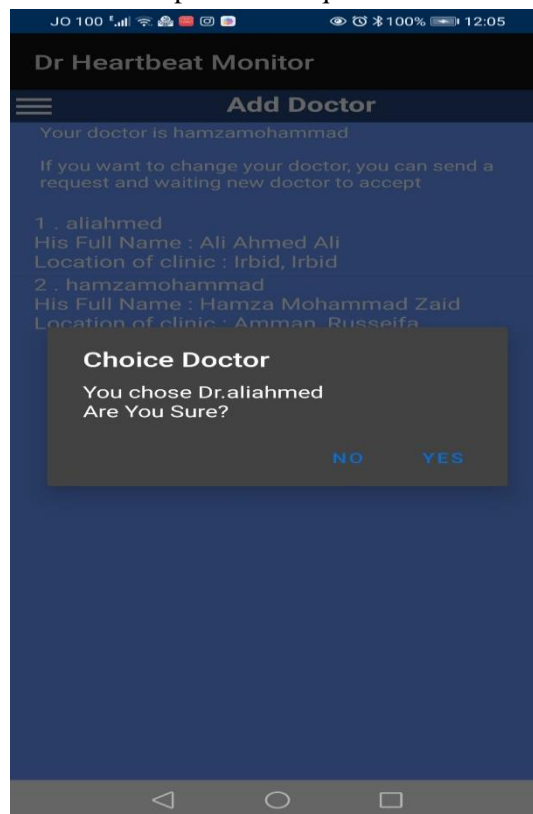


Figure 22: Change Doctor

- e. profile page:
- Present the patient's information
 - If patient has a certain disease due to the acceleration or slowing of the heart rate, he can add the diseases by select disease from diseases list and then clicks on Add button
 - If patient incorrectly added a disease, he can remove it by select it from his diseases list and click on the remove button.

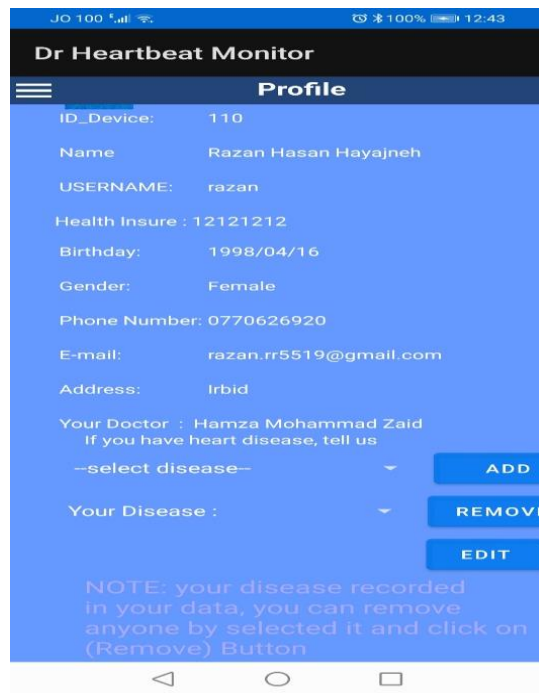


Figure 23: Patient profile

- f. The patient can edit Information by clicking on the Edit button, so the visible image appears below.

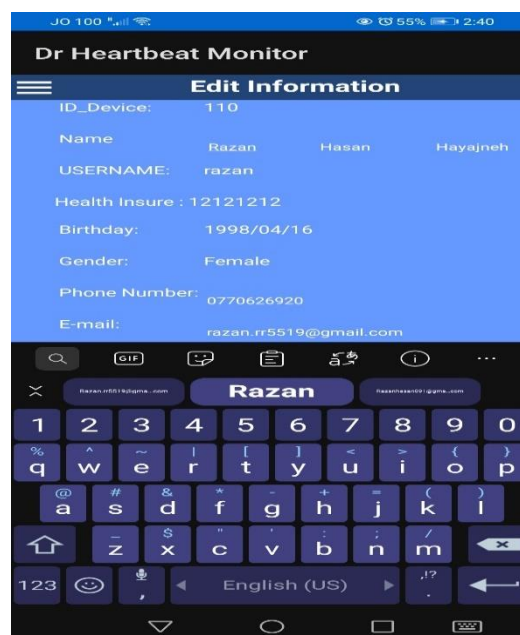


Figure 24: Edit Patient information page



Doctor Pages


- When Doctor login, he/she will see the home page at the beginning
- From tool bar using  button, navigation bar will appear. As figure below:



Figure 25: Doctor navigation bar

- a. Home page for Doctor:

- i. If a patient is working for the doctor add a notification that there is a patient who is working for you in addition so we go to the add patient page and make an add or remove .
- ii. If the patient has an acceleration or slowness in the heartbeat, doctor will reach a notice that patient has/had an rapid or slow in the heart rate, it shows the patient's name and the time when the acceleration and decrease occurred.

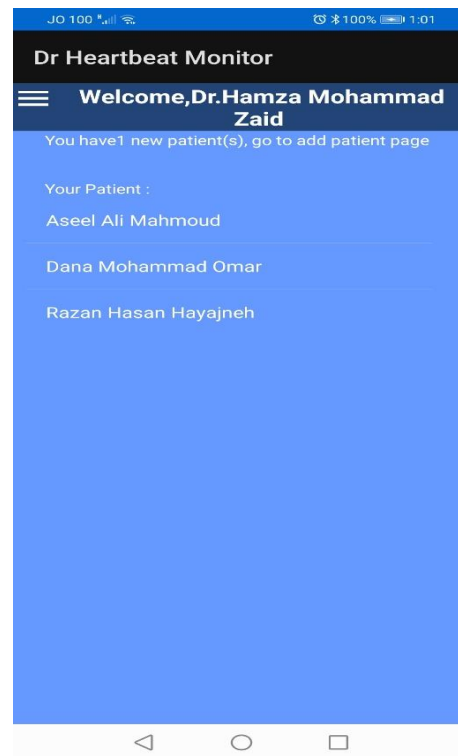
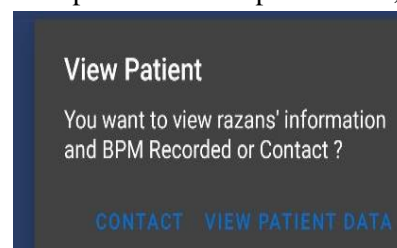


Figure 26:doctor home page

- iii. When click on patients' name, while appear choices to conact with patient or view patient data, as figure below:



- b. View patient information page:

- i. It opens when the doctor clicks on the patient's name from the patients list. Where the doctor can preview the patients data and the heartbeat rate records as a list.

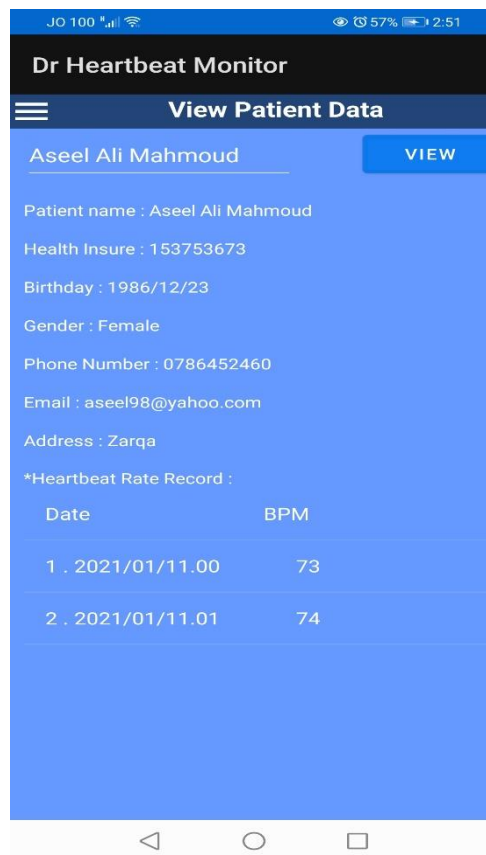


Figure 27:View Patient Data page

- c. Contact page:

- i. It opens when the doctor clicks on the patient's name from the patients list and choose contact.
- ii. The doctor can view the patient messages and reply to these messages.



Figure 28: Doctor contact page

- d. Remove page:
 - i. view List of doctors' patients
 - ii. By click on any patient's name, doctor can remove the patient. If he removes the patient then the patient will be removed from the list of the patients and the database.

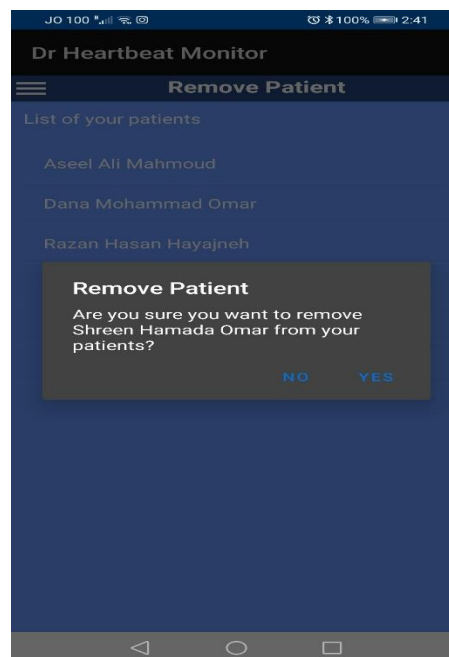


Figure 29: remove patient page

- e. Add patient page:

- i. After clicking on any patient's name, doctor can decide whether he accepts or reject the patient.
- ii. If he accepted the patient then he will be added to the doctor's patients list
- iii. If he rejected the patient, will appear message for patient, that contains: You were rejected by the doctor, please choose another doctor.

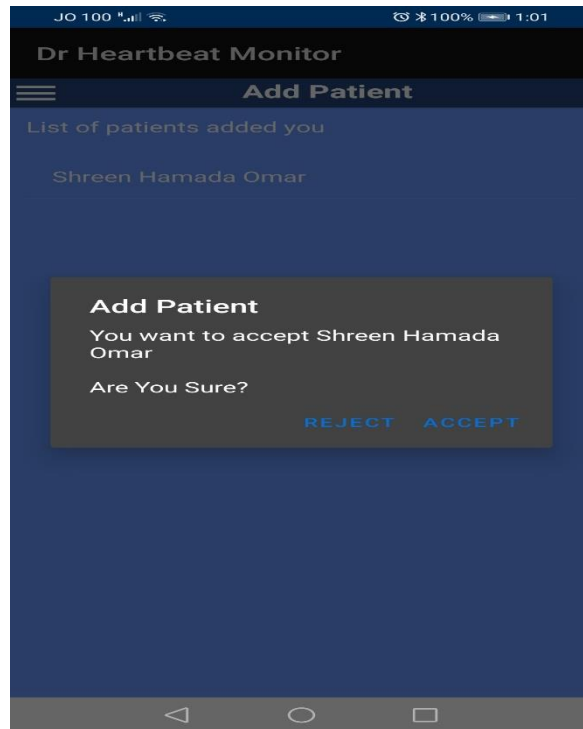


Figure 30: Add Patient page

- f. Profile page:

- i. Appear Doctors' information.
- ii. Can edit it by click on edit button.

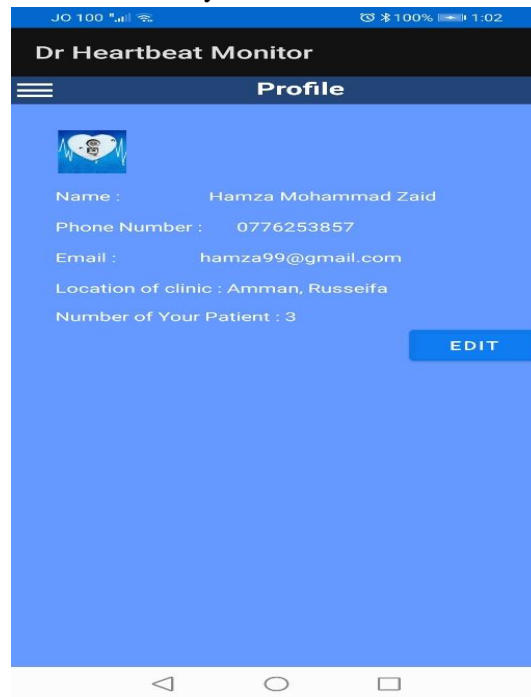
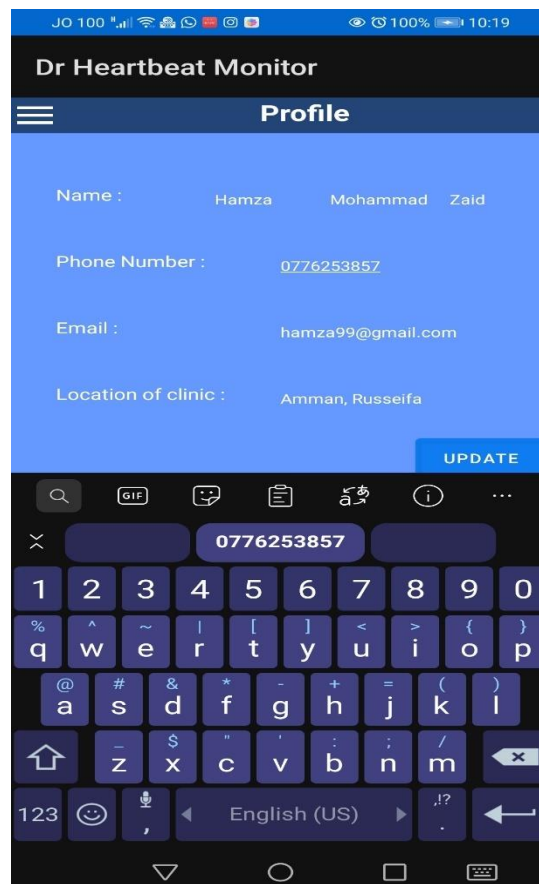


Figure 31: Doctor Profile page



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