HOLY SPIRIT UNIVERSITY OF KASLIK

Advanced Programming Project Report:

HemoAid, medical helper App

Roy Ibrahim

CSC 436: Advanced Programming Project

Dr. Georges Badr

30 April 2024

Table of Contents

1- Introduction

With the emerging era of advanced technology and innovation in the past years and more specifically since the release of the first known AI Model implementing the generative AI technology, it has shaped the future of development.

Consequently, this trendy advanced innovation has been integrated in different fields including marketing, designing, engineering and more. The lights were not shed on other important fields such as the medical field.

Therefore, HemoAid was born. HemoAid is a prototype developed for the purpose of the Advanced Programming Project course with an emphasis on the medical hematology aspect of the patient's life and bringing advanced technologies powered by powerful tools such as Gemini and Tesseract. The application aims initially at facilitating the process for the patient and having a personal medical assistant in the pocket.

2- Methodology

In order to bring HemoAid to life, and after a some research, React Native, being cross-platform, was chosen as the main framework for the mobile application with firebase and firestore as the backend service and database in order to manipulate the data in the most convenient way with react native and finally Python in order to realize the blood test scan.

The primary features of the app include:

- Chatbot powered by Gemini considering the patient's data through prompt engineering in order to answer the patient's questions most accurately.

- Blood test scan using Python (OCR) in order to include the patient's blood test data to the database (test name, value, and reference range)

- Dashboard to showcase the progress of the patient's medical history through charts.

The steps followed in order to achieve a full app with the following features.

1- The user is firstly prompted to sign up using his email and enter some personal information including date of birth, gender, height, weight, past operations, current medications and then is presented with a list of Chronic diseases via the API for medical conditions provided by the National Library of Medicine. The gathered data helps us in getting a more accurate answer by passing them to the chatbot.

2- After registering, the user has the option to add his blood test. The input required is an image taken by the python script. Indeed, it takes the script and using Tesseract it extracts the text from the image. It is then passed to Gemini via the API with the prompt to transform the data into a JSON format and then sent back to the application in order to manipulate the JSON string and insert each test done with the corresponding value and reference range in the database.

3- With the user's data now being in the database either the personal information entered manually on the signup phase or the data retrieved from the blood test, the chatbot is now aware of all these information through prompt engineering by passing the passing the data in a well-structured prompt to the API in order to feed the bot the data.

4- All the answers of the chatbot are saved in the database so the history remains when the user reopens the app. The answers given by Gemini now will be based on both the pre-

trained model's information and additionally filtering them using the data of the user to bring accurate answers for the users.

5- If the user enters multiple entries (multiple blood tests) with similar values such as glucose of cholesterol, a graph on the Home Screen is present to show the evolution of each test from one blood test to the other.
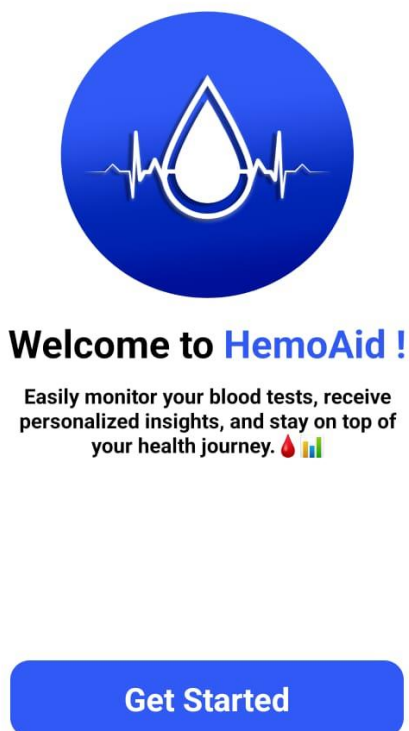
3- Results obtained.

I- Authentication flow

Figure 1: Welcome Screen

Figure 2: Login Screen

Figure 3: Sign up screen - Personal Info

Figure 4: Sign up screen - health info

Figure 5: Sign up screen - chronic diseases

II- Application flow
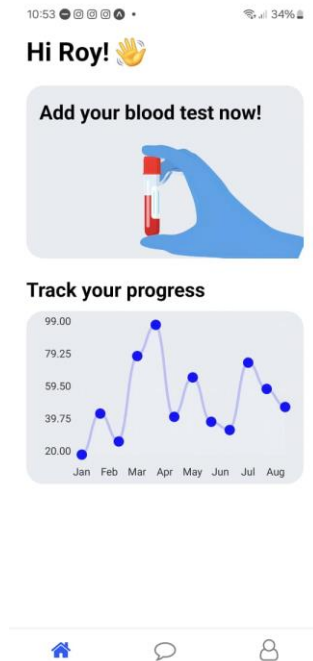
Figure 6: Home screen

Figure 7: Chatbot screen

Figure 8: Chatbot screen

Health summary

John Doe

Age: 30

Height: 170 cm

Weight: 70 kg

Gender: Male

Past Operations:

Operation 1, Operation 2,

Current Medications:

Medication 1, Medication 2,

Chronic Diseases:

Disease 1, Disease 2,

Blood tests

Test 1
Tuesday, April 30, 2024
Hospital A

Test 2
Monday, April 29, 2024
Hospital B

Add test

Edit

First Name:

John

Last Name:

Doe

Email:

john.doe@example.com

Password:

....

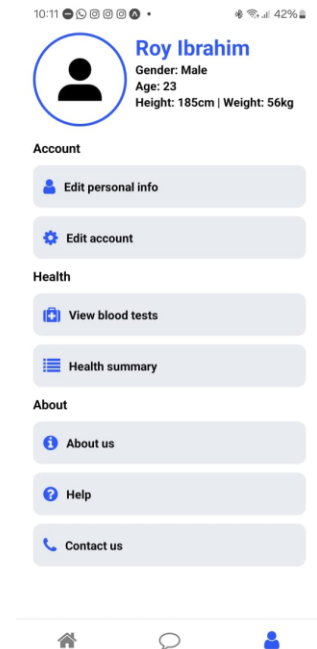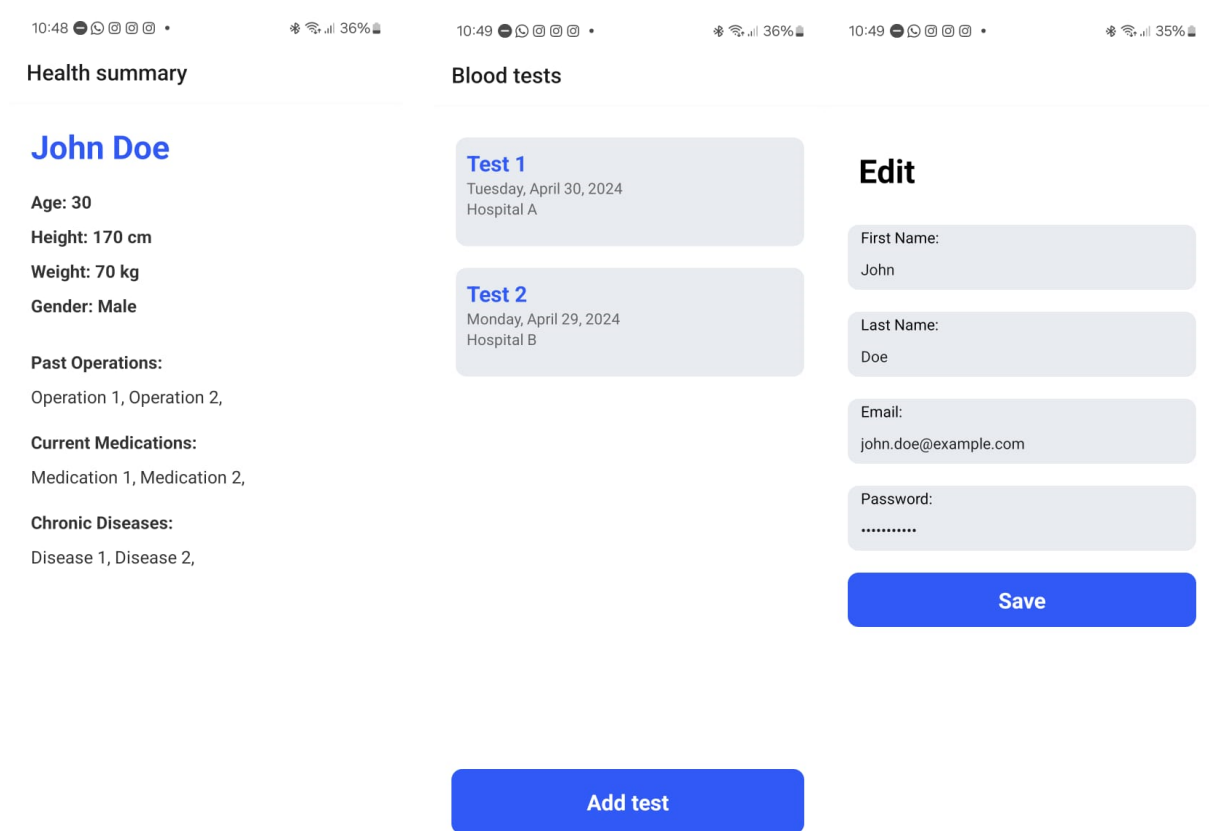**Save**

Figure 9: Health summary   *Figure 10: Blood tests screen*   *Figure 11: Edit info screen*

Dr. John's Test

Tuesday, April 30, 2024

Test Name	Value	Reference
Glucose	100	70-110
Cholesterol	200	125-200
Triglycerides	150	10-150
HDL	60	40-60
LDL	100	0-100
Hematocrit	40	37-47
Hemoglobin	14	12-16
MCV	80	80-100
MCH	27	27-31
MCHC	32	32-36

Figure 12: Blood tests Result

As shown in the flow above, the user is firstly prompted to enter personal information as well as additional ones related to their health. The screenshots from HemoAid showcases how the chatbot was integrated using Gemini API and answers the users inquiries all while taking into account the relevant information.

Plus, the user has the flexibility to change any information entered previously and has access to a health summary as a helper when in a certain situation as well as the history of old blood tests to keep track of the progress and the feature to add new ones using Tesseract's OCR.

4- Future work

The apps developed in the medical field are indeed rare and the ones present to help the patient are more uncommon. Therefore, the area of improvement of HemoAid is quite big.

1- Adding support for tests other than the blood test such as medical imaging results.

2- Integrate the chatbot the credible medical databases to feed the bot more medical and accurate information, which increases the accuracy level for the answer.

3- AI powered analysis of the blood test input in order to give the user an insight of what he/she might expect when they visit the dr.

III-   Integration with wearable devices such as smart watches and smart rings enabling the application to access real time values such as blood pressure, heart rate, oxygen rate, body composition and more.

References.

1- *Clinical Table search service*. (n.d.).

https://clinicaltables.nlm.nih.gov/apidoc/conditions/v3/doc.html