# BE THE BEST YOU - A wellness tracking app
# CSE 535: Mobile Computing Project Report

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## ABSTRACT

We demonstrate BeTheBestYou; a wellness tracking mobile application suite. BeTheBestYou is a context driven application [1] that is a one stop solution for tracking both your physical and mental health vitals using mobile based sensors like camera, accelerometer, GPS, etc. Using these vitals, the application can monitor the health vital with time and apt from that the application can also tracks vitals to detect anomalies if a drastic change in parameter is observed. During these anomalies the application can then send an SOS message to the emergency contact associated with the application and the application can also suggest to the user any nearby doctors for that health vital. The app also has a personal goals feature which helps you set your goal and then tailors the app to help you achieve the set goal.

## 1. INTRODUCTION

The pursuit of holistic well-being has become increasingly challenging in the digital age, as prevailing health applications predominantly concentrate on physical fitness, often neglecting the intricate connection between mental and physical health. Recognizing this limitation, there emerges an opportunity to innovate and address this gap by developing a comprehensive wellness application. This research envisions an app that goes beyond the conventional focus on physical fitness, aiming to provide personalized guidance for users to attain their health objectives across all dimensions of well-being.

In response to the identified problem, the proposed application employs advanced technology, incorporating features such as Google Sign-In for secure user authentication. Leveraging sensors like the camera and accelerometer, the app collects vital physical health data, while also assessing mental health through established tests. Users are empowered to personalize their health goals, and the collected data is stored locally for privacy and security. The application's functionality extends to tracking progress, detecting anomalies, and integrating emergency contact messaging and maps for prompt healthcare support.

This research envisions the app as a modern wellness companion, adept at adapting to individual needs and offering continuous support. The challenges encountered during the development process, particularly in the integration of APIs, have underscored the importance of adaptive error handling strategies within the Android Studio environment. The creation of such an all-encompassing health assistant holds immense potential to revolutionize how individuals manage and enhance their overall well-being in today's fast-paced digital landscape.

## 2. ARCHITECTURE

Our app mainly focuses on three aspects of the user the physical health, mental wellbeing and the personal development and goals. But before reaching that stage the user must log in which will create a new database and then they must create a profile. They will need to enter their personal details such as their name, age, height weight which gives their BMI, their water intake, sleep cycle and most importantly their emergency contact. All these have certain criteria which need to be satisfied (for example the emergency contact must be a valid 10-digit number). Once all the fields are filled with correct information and the user submits them, they are uploaded to the database and then the user moves on to the Navigation Page.

They we will have a menu which will take them to the various aspects of the app.

1. Physical Vitals Page – Here we measure the Heart Rate, Respiratory rate, and the user can self-report their symptoms.
2. Mental Health and wellness Page – The users can take anxiety and depression questionnaires and they get a score for each.
3. Personal Goals Page – The users can set a personal goal and get recommendations to achieve the said goal in this page.

   Database – All the above information is stored in a local database and retrieved for results and progress tracking.

4. Results – Checks if any of the physical or mental values are abnormal and if so, sends a message to the user's emergency contacts. It also suggests nearby doctors and hospitals based on the type of ailment.
5. Progress Tracking – The users can see how far they have come in terms of their health goals as a visual representation in forms of graphs.
6. Find Nearby Pharmacies: This button can help the user find the closest pharmacy around their current location within a 10 mile radius.

This is the basic design of our application. (Figure 2.1 and 2.2)

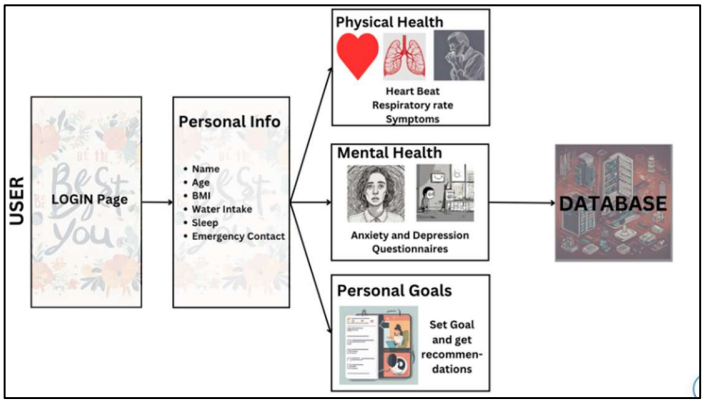



Figure 2.1 – Design flow of the input data collection

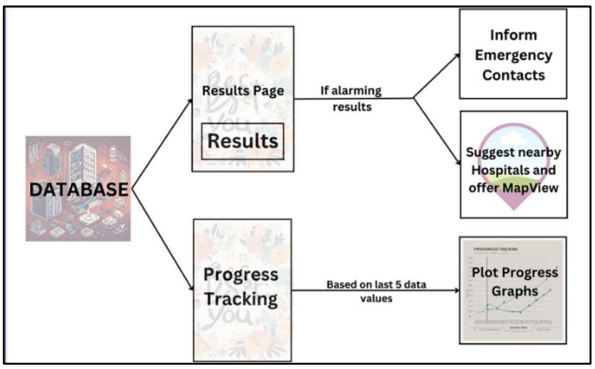



Figure 2.2 – Design Flow of the Output data representation

# 3. THE APPLICATION SUITE

The application is a combination of a data collection and a data inference. For the data collection part, the application either determines the physical health vitals or they are self-reported by the user. The data inference part basically works on this data to track the user's progress or suggest the user with the relevant doctor in case of an emergency.

## 3.1 Input Application

The data input application is an important half of this application. Health vital data is collected by multiple ways, Heart rate of the user is collected using an imaging algorithm and can be extracted by accessing the camera of the phone. Respiratory data of the user is collected using the accelerometer change in the phone by placing the phone on the user's chest. Mental health data is collected using clinically approved questionnaires and all the other vitals are self-reported by the user. After collecting this data the application can be personalized for the user by choosing a health goal. Some users may use the application to lose weight and some users may be using the application to reduce stress. By choosing a health goal the application personally recommends a few helpful blogs and videos.

## 3.2 Inference Application

The most valuable part in a wellness tracking application is when it raises an alert when an anomaly health vital is detected. The application detects an anomaly when there is a deviation from the regular health vital of the user. When the anomaly is detected, the application helps the user find a nearby doctor relevant to the abnormal vital using the user's current location. The application also the functionality to send a message to the user's emergency contact when the anomaly is detected, this way it alerts the user's friends or family. To check whether the user is making progress towards their goal, the application also has the functionality to track the progress of a particular vital.

# 4. IMPLEMENTATION

- **Login:** We want every user to be distinct from each other while using the app, so to ensure that we can identify every user uniquely and login safely without any data breaches, we use the google sign in functionalities of android studio. We let google take care of the privacy of the user, and basically if the user has a valid google account, they will be able to login to the application securely.

- **Physical Health Vitals:** Physical health vitals are very important to our application; they are basically the context part in our project. To extract the physical health vitals, we use some sensors provided by the phone. The heart rate of the user is extracted using an imaging algorithm, so we use the camera input of the phone to extract that data. The respiratory rate of the user can be extracted by placing the phone on the user's chest. The natural breathing of the user can be recorded by extracting the accelerometer data for a period of 30 seconds, and then there is an algorithm that can convert this accelerometer readings to respiratory rate. There are many other physical health vitals as well like water intake, sleep intake, symptoms, but all of these are self-reported by the user, as there is no sensor or an algorithm to track those vitals.

- **Mental Health Vitals:** Most wellness tracking applications, usually only tracking the physical health vitals, our application is a step above the rest as it can also detect the mental health vitals of the user. In our application we extract the context for anxiety and depression of the user. There are clinically approved and universally accepted tests like the GAD-7 [4][5][6] and PHQ-9 [2][3], which can accurately diagnose the anxiety and depression among the users. Through our application the user can take these tests and self-report the scores to the application.

- **Personal goals:** This is the personalization page inspired from project 2 of CSE 535 course, every user could be using the application for their own target. The goal of using the application could be different from one user to another so that is why in this page the user gets to personalize the application to their needs. In this page the user chooses their goal: is it to lose weight? is it to gain weight? does the user want to rescue stress, etc. We then give recommendations and tips on how they can achieve said goal. This is done through URL parsing of YouTube videos, articles, meal plans.

- **Database:** Database is a collection of contexts of a particular user. There are many ways to handle databases in Android studio. Cloud based application are certainly the ones that are implemented in a large-scale software, however because our application is a prototype, our database is small, and we have used the local storage of the phone using SQLite database.

- **Progress tracking:** The goal of any wellness tracking application is to aid the user in improving their health vitals, to monitor this progress, we have an activity defined that helps the user check their progress of health through their last 5 data entries. The data is obtained using MySQL queries to the SQLite database.

- **Toast:** Alerting is a big feature in wellness tracking applications, so whenever the user gives new vitals, we compare it to the previous vitals, if we observe a drastic change to the vital, we then create a toast to let the user know that their health vitals are abnormal.

- **Emergency contact:** It is during the times of abnormal health that the emergency contact information that we collected during the user info page is helpful. So, during the times that we have detected the

abnormal health vital, we send a message to the emergency contact stating that the <username> has detected an abnormal health vital, please check up on them. To process this, request the user needs to have permission to send an SMS through the phone.

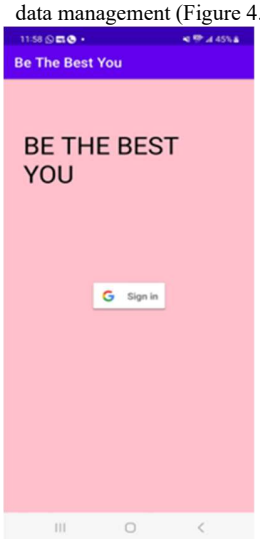
- **Maps:** Last but not the least the application also has functionality to track doctors through the phone. When the user is checking the vitals to detect any anomaly the application connects each vital to the relevant doctor, for example, if the user is checking for heart rate, there is an option to see the nearby cardiologist, if the user is check for respiratory rate, there is an option to see the nearby pulmonologist. etc. The application need access to the GPS sensor, along with that the application needs API access to Maps and the places API provided by google to perform maps-based queries. The application first request for location access to the user, and when granted permission by the user, the application then detects the location of the phone in the form of latitude and longitude. The application then sets a 10-kilometer radius from the location and then finds the relevant doctor associated with the health vital and plots the locations on the UI using a MapsFragment box.

## 5. RESULTS

The implementation of the wellness application yielded promising outcomes, showcasing the app's capabilities in addressing the identified problem of a lack of holistic well-being support in existing health applications. The key features and functionalities were successfully integrated, contributing to a comprehensive health monitoring and guidance system.

- **User Authentication:** Google Sign-In was implemented successfully, ensuring secure and user-friendly authentication (Figure 4.1).

- **User Information and Database Setup:** User Information page collects user data and saves it in the database. The SQLite database setup proved effective in storing user information, ensuring deamless data management (Figure 4.2)



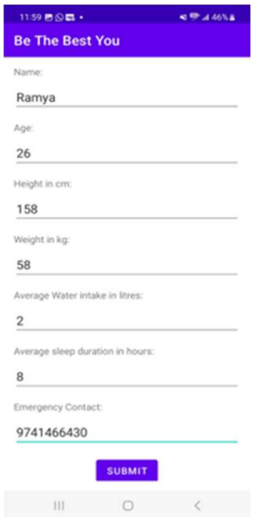




Figure 4.1. Google Sign-In. Figure 4.2. User Information

- **Physical Health Monitoring:** The app effectively utilized sensors like the camera and accelerometer to gather physical health data. Algorithms for calculating heart rate and respiratory rate demonstrated high accuracy in capturing vital health metrics (Figure 4.3 and Figure 4.4)

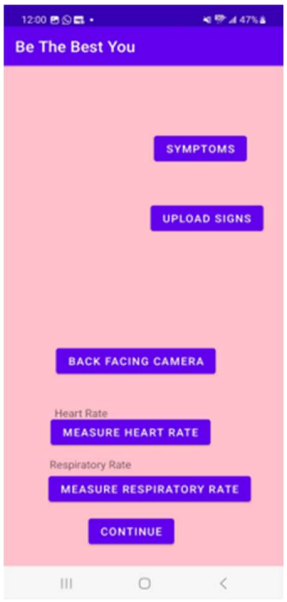




Figure 4.3 Physical Health Figure 4.4 Symptoms logging evaluation

- **Mental Health Assessment:** Established tests, including GAD-7 and PHQ-9, were seamlessly integrated for mental health assessment. User-friendly interfaces facilitated the self-reporting of anxiety and depression scores (Figure 4.5).

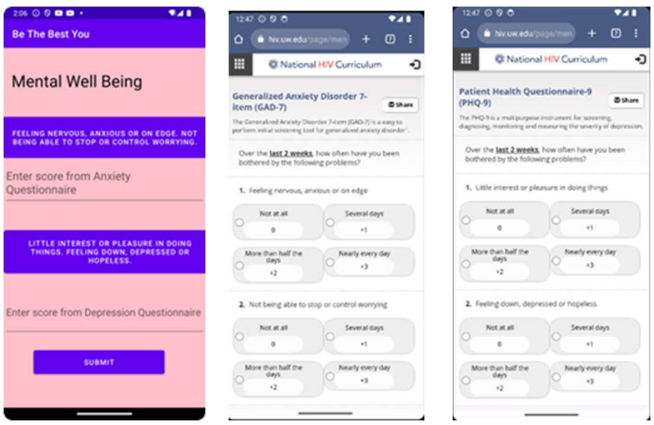



Figure 4.5 Mental Health Evaluation

- **Personal Goals:** In the personal goals page, the user could set any personal goals they wanted (for example weight gain, weight loss, stress reduction) and they got recommendations based on that. The recommendations were exercises, tips and tricks, meal plans, etc. (Figure 4.6)

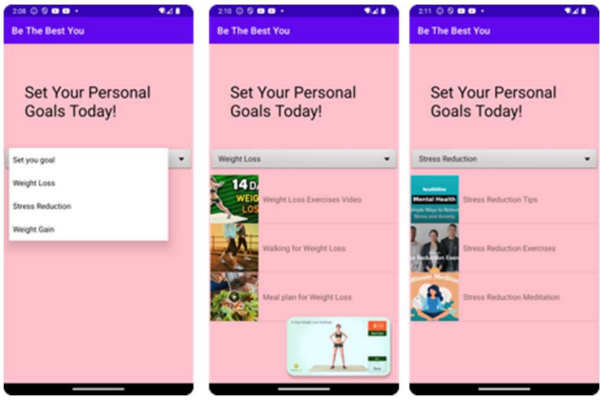



Figure 4.6 Personal Goals

- **Progress Tracking and Anomaly Detection:** The progress tracking feature, utilizing historical data, enabled users to monitor their journey towards health goals. The use of visual displays helped the users track their progress in a better manner. Anomaly detection, signaled through toast notifications, proved effective in alerting users to abnormal health vitals ( Figure 4.7,4.8 ,4.9)

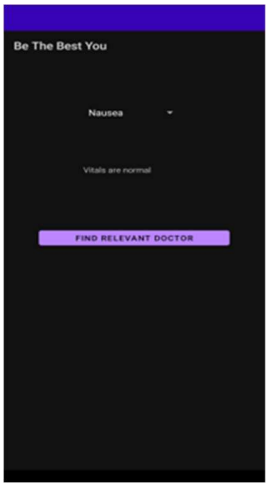



Figure 4.7 Symptoms are normal

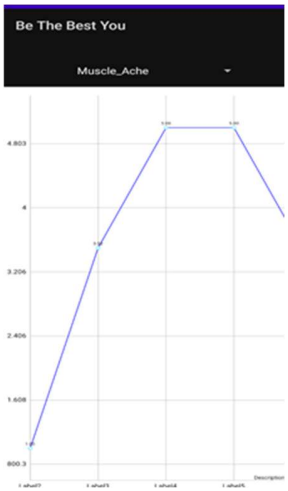



Figure 4.8 Progress Tracking

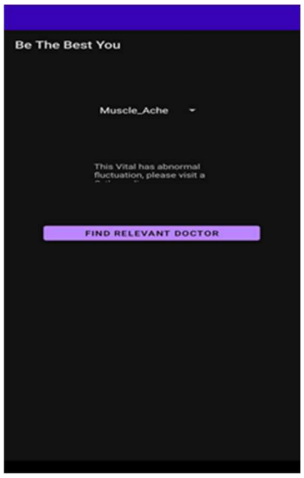
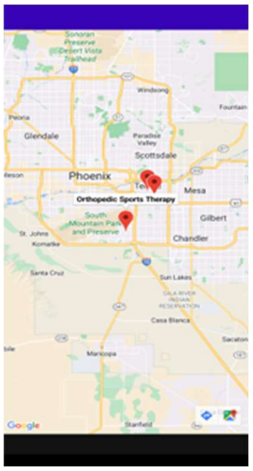



Figure 4.9 Symptom is Abnormal

- **Emergency Contact and Maps Integration:** The integration of emergency contact messaging ensured timely communication in critical health situations. Maps integration successfully suggested nearby healthcare services based on user location. (Figure 4.10,4.11).



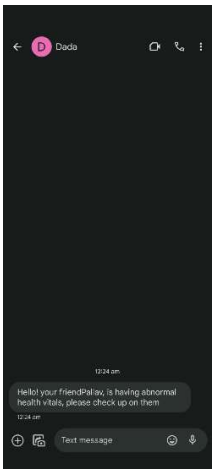




Figure 4.10 Maps Integration Figure 4.11 Message to emergency contact

## 6. CONCLUSIONS

The application stands as a cutting-edge wellness tracker, akin to a guardian angel, offering a comprehensive health solution. It operates by collecting contextual health vitals, uniquely tailored to each user. Users personalize the app to align with their health goals, allowing for the continuous monitoring of vitals and prompt anomaly detection. In case of an anomaly, the app guides users to nearby relevant healthcare professionals, ensuring timely intervention. This holistic approach positions the app as an ideal culmination of our efforts in CSE 535: Mobile Computing.

Throughout the development journey, we grappled with various challenges, particularly in Android Studio. As we embarked on Android development at the start of the course, the learning curve was steep. Our foremost challenge revolved around seamlessly integrating API access into the application. Handling cases such as denied API permission or inactive sensors required meticulous error handling to prevent disruptions. This experience taught us the value of an adaptive error-handling strategy, incorporating robust Try and Catch blocks. Additionally, recognizing the significance of data privacy, we implemented a Google Sign-In page to safeguard sensitive user information.

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## 7. INDIVIDUAL CONTRIBUTION

**Ramya:** My role in this project was crucial in establishing user authentication through Google Sign-On. I connected our app to Google Cloud, ensuring secure and seamless logins. Additionally, I played a key role in setting up the database using SQLite. This involved both the user interface (UI) and the database components. I focused on collecting comprehensive user information, handling UI interactions for data input, and ensuring the proper storage of this data in the database. Furthermore, I contributed to the physical health aspect of the app, implementing algorithms to calculate heart rate and respiratory rate based on sensor data. I also facilitated the collection of symptoms details from users, enhancing the overall

health data captured by the application. Testing the app was a critical part of my contribution. I conducted extensive testing, starting with Integration testing carried out to ensure the seamless integration of different app parts, verifying data flow and communication. Additionally, end-to-end testing was conducted to validate the correctness of the entire application flow.

**Sukruthi:** In Project 5, my focus was on mental health monitoring and personal goal management. I played a pivotal role in creating the Navigation Page, ensuring a smooth user interface (UI) integration.

For the Mental Health Assessment, I successfully integrated established tests such as GAD-7 and PHQ-9, providing users with intuitive interfaces to self-report anxiety and depression scores. These scores were securely stored in the database, contributing valuable insights into users' mental well-being. On the Personal Goals page, users had the flexibility to set diverse objectives like weight gain, weight loss, or stress reduction. Leveraging this input, the app delivered tailored recommendations, including exercises, tips, tricks, and meal plans. Rigorous testing across various Android devices and various users validated the app's functionality, ensuring a user-friendly design.

**Pallav:** My primary contributions revolved around reading and interpreting collected data. I played a pivotal role in implementing two key features:

Firstly, in Progress Tracking and Anomaly Detection, I designed a feature that allows users to monitor their health journey through insightful visual displays. Leveraging historical data, users gain an effective visualization of their progress. The incorporation of anomaly detection, signaled through toast notifications, ensures users receive prompt alerts for abnormal health vitals.

Additionally, I led the efforts in Emergency Contact and Maps Integration. I facilitated the seamless integration of an emergency contact messaging system, enabling immediate communication during critical health situations. Moreover, the integration of Maps enhances the user experience by suggesting nearby healthcare services based on their real-time location. My comprehensive testing on real devices and from various locations validated the app's ability to provide distinct pharmacy outputs within a 10-mile radius.

# 8. REFERENCES


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