Fulcrum Wellness Application
Detailed Design

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Glossary

- **Cache:** A hardware or software component that stores data so future requests for that data can be served faster. Caching is a verb that refers to storing data so it can be fetched quickly on any future memory accesses.

- **ER (Entity-Relationship) Diagram**: A graphical representation of an information system (in this case, Fulcrum's database) that shows the relationship between people, objects, places, concepts, or events within that system.

- **Firebase**: A Google-backed infrastructure that gives you functionality such as databases. Firebase by default provides a predefined set of rules which secures the user data stored in the database, regardless of buggy code. Firebase also eliminates the worry about having to keep a server safe from denial of service attacks, malware, and hackers in general. Moreover, Firebase enables confidentiality, integrity, and availability (CIA triad) within the Fulcrum application.

- **Foreign Key:** A Foreign Key is designated to uniquely identify a row of another table in a database. The Foreign Key must point to a primary key of another table or a Foreign Key of another table which eventually points to a primary key of another table.

- **Hamburger Menu:** A button or menu usually placed in a top corner of a graphical user interface. It is also known as hamburger, side menu, or navigation drawer. The Hamburger Menu icon looks like this: ≡.

- **Identifying Relationship:** An Identifying relationship is a required relationship because an entity, usually a weak entity, can not stand alone and is dictated by another entity.

- **JSON (JavaScript Object Notation)**: A lightweight data-interchange format used between a web browser and a server because the data can only be represented in plain text (that way humans can read it).

- **Likert Scale**: A scale that uses an odd number of choices. This allows for a neutral answer, while using an even number of choices elicits a forced response.

- **Local Identifier:** A Local Identifier is a type of a foreign key and it is usually specific for a weak entity. Additionally, a Local Identifier is necessary for a weak entity because it gives a specific meaning to the tuples that the weak entity is associated with in the database.

- **Mandatory Participation:** Mandatory participation is a relationship constraint in databases. This constraint is usually used in conjunction with an identifying relationship and a weak entity type.

- **Physical Tracker**: A Physical Tracker is an application that monitors physical activities over a period of time. Examples of such activities include, but are not limited to, the amount of calories burned, the hours of sleep attained, and calorie consumption and quality of sleep. Examples of physical trackers are Fitbit, Google Fit, Jawbone, or Apple Health.

- **Primary Key:** A Primary Key is designated to uniquely identify an entity in a database.

- **UI (User-Interface)**: The means by which a user interacts with a computer. More specifically, it is the use of input and output with software.

- **Weak Entity:** A Weak Entity can not uniquely identify itself by its own attributes. It must rely on a foreign key.

1. Introduction

In a 2011 National College Health Assessment, nearly 90% of students at the Georgia Institute of Technology reported being very stressed, which is almost double the national average of 53%" (Chandler et al). Our team, Team All-Star, believes that college students who are struggling with stress need a tool to help restore balance to their lives and potentially reduce the stress they feel.

Our team is developing an application for the Fulcrum Grand Challenges Project, which aims to help students (especially Georgia Tech students) keep track of their wellness in terms of academic, emotional, physical, and social dimensions. Fulcrum asks its users fill out a daily survey (modeled off a Likert Scale) that questions students how well they think they handled various situations throughout the day, such as their interactions with others and their academic performance. Based off the users' responses, it will calculate scores for the individual dimensions and display the scores graphically so the users can see a visual representation of their progress over time. For the physical dimension, users can optionally link a fitness tracker such as Fitbit, Google Fit, or Apple Health to their account for a more comprehensive measurement.

Initially, our team received mock-ups from our clients detailing what they had envisioned Fulcrum to be. After analyzing the materials we received, our team assessed that it would be best to approach the user-interface of the Android application with a minimalist design. Moreover, our team applied Don Norman principles such as visibility, consistency, and natural mapping to our designs, with the goal of not adding any unnecessary frustration to the user. We tested our prototype for usability requirements on a few Georgia Tech students and we received great feedback, which our team used to enhance Fulcrum by making it more intuitive for users to operate.

Fulcrum gives users the ability to track their academic, emotional, physical, and social dimensions of wellness independently through the use of a trends graph. Our team believes this will help students gauge which facets, if any, of their overall wellness need improvement. Throughout this document, our team will analyze the system architecture, data storage design, component detailed design, and the UI of Fulcrum. The system architecture assesses the application components and analyzes the relationship between them. Next, the data storage design will explain how application data is stored. The underlying processes and low-level details for each component are explained with static and dynamic component diagrams. Lastly, this document will inspect the design decisions made for the user interface.

2. System Architecture

i. Static Element Diagram:

Figure 2.1 below shows the system architecture of the Fulcrum application. Additionally, the logical relationships between the components are shown. The three major stages of the diagram are the Login Screen, the Home Screen, and the Database. The Database this application is using is Firebase.

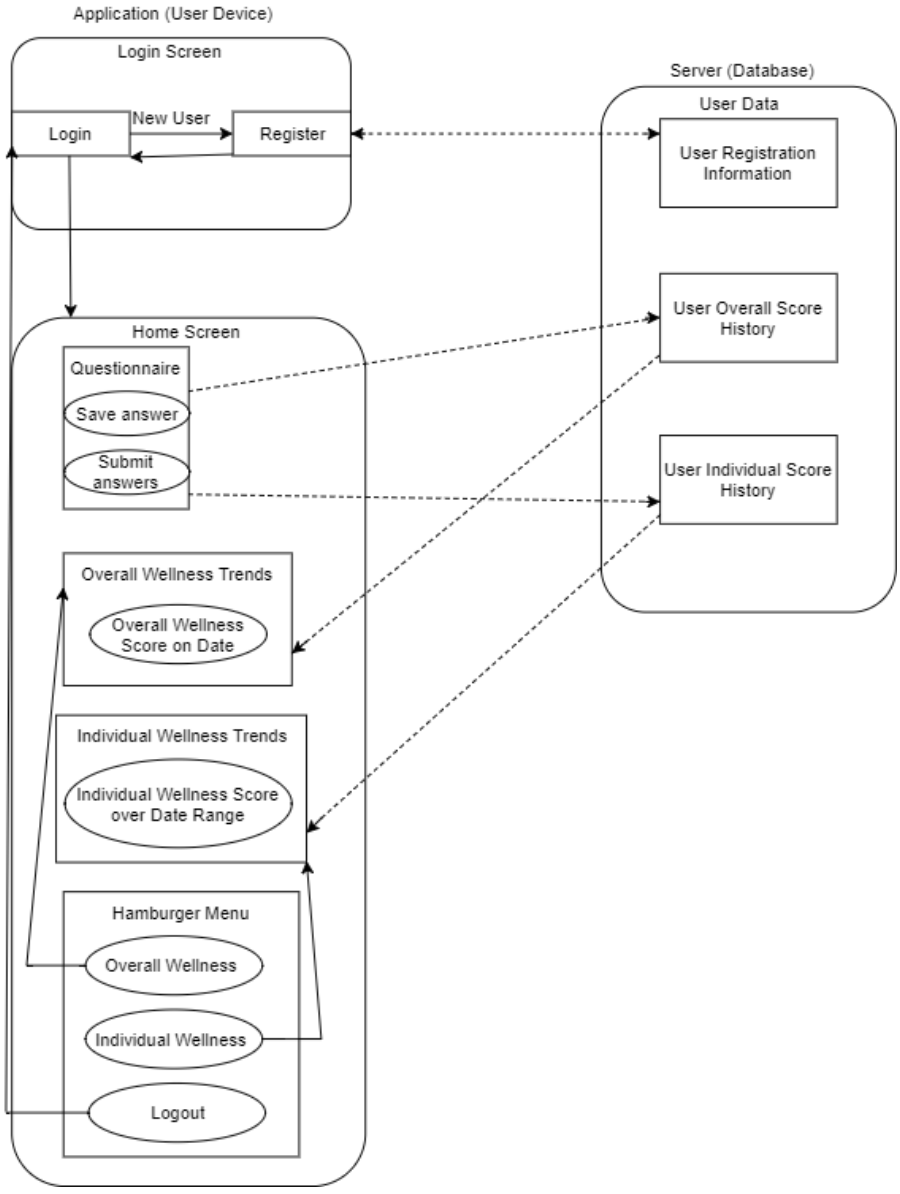

Figure 2.1 Static System Architecture Design for the Fulcrum application

The dashed arrows indicate the flow of information and the solid arrows represent the navigation flow of the static system architecture design diagram above (Figure 2.1).

1. **Application:** Fulcrum will operate on an Android mobile operating system.
    a. **Login Screen:** There are two options for the user to choose from. The end-user may choose to log in to the application or register to Fulcrum if that user is not a registered user.
        i. **Login:** The two fields required for logging in are email and password. If the user has forgotten the user's password, then the user will have to enter the user's email and correctly answer the user's security question to retrieve a token to reset the user's password. After the user presses the Login button, the database (Firebase) authenticates the user. If authentication has failed, then the user interface will display a message saying that the user has entered an incorrect username or password. Otherwise, the user is redirected to the Home Screen of the application.
        ii. **Registration:** Upon pressing the register button, the user is redirected to the registration page where the user must enter the user's first and last name, email, height, sex, weight, password, confirm the user's password, and choose a security question. If the user does not fill a field or check off the box for 'Accept Terms and Conditions' and presses submit, a message will alert the user to fill out all the fields. The 'Accept Terms and Conditions' is a hyperlink to the terms and conditions. The user should read these before agreeing to use the Fulcrum application. If the user agrees, then the user is giving the user's consent to allow Fulcrum to store the user's information entered in the registration page, the user's wellness scores, and the user's daily assessment responses. Once successfully registered, the information will be transferred and stored in the database.
    b. **Post Login:** The core functionality of the application is mainly contained within 1 page, with 5 other pages that explain the subjects on the home screen with greater detail.
    c. **Home Screen:** This is where we have the questionnaire, overall wellness trends, and the individual trends.
        i. **Questionnaire:** This is where the user can click to take the daily assessment, in which the user will be redirected to another page to take the questionnaire composed of ten questions. Once the user's questionnaire has been submitted, the user's overall wellness score and individual scores will be updated.
        ii. **Overall Trends:** There will be a score over time graph. Moreover, this graph will be updated with every daily assessment the user fills out. The user can get the analysis for the overall wellness for a

specific period of time by going to the Overall Wellness page of the application.

iii. **Individual Trends:** There will be a bar for the academic, emotional, physical, and social dimensions of wellness. This bar will represent how big of an impact each dimension of wellness has on the user's overall score.

iv. **Hamburger Menu:** The user can navigate to any page of the application from wherever the user is. In addition to the user inspecting the user's overall wellness for a certain time frame, the user can navigate and do the same thing with each of the individual trends page. The user can navigate to the academic, emotional, physical, and social Individual Trends page. Moreover, the user can navigate to the Home Screen, Help and Feedback page, Settings page, and the user can log out of the Fulcrum application.

2. **Database:** Stores all the necessary data needed for the application.
    a. User Data: Stores all the fields on the Registration page of the application. Moreover, the email is the primary key for a user in the database. Firebase uses bcrypt which is a password hashing function that hashes and salts the user's password. Therefore, the user's data is not stored in plain text. Moreover, the database requires the password to be a minimum of six characters. If a user's password is not at least six characters, then the user-interface will warn the user that the user's password must be at least six characters long. The maximum password length is seventy-two characters. Any password longer than seventy-two characters will be truncated to seventy-two bytes (one character = one byte on all system architectures).
    b. Daily Assessment: The database also stores a user's responses to determine the users score (calculated by an algorithm). Each response is associated with a question number and the particular individual wellness score it impacts.
    c. Scores: The database also stores the user's individual scores for each dimension of wellness. Consequently, the database stores the user's overall scores over time.

3. **Logout:** Once the user logs out of the application, the user is redirected to the login page of the application.

ii. Dynamic Element Diagram:

Figure 2.2 shows the runtime behavior of the application after a user presses the application from the user's Android device. More specifically, it shows what happens and the course of action that can be taken at every page of the application. Additionally, this also shows how the components of the application logically interact with one another.

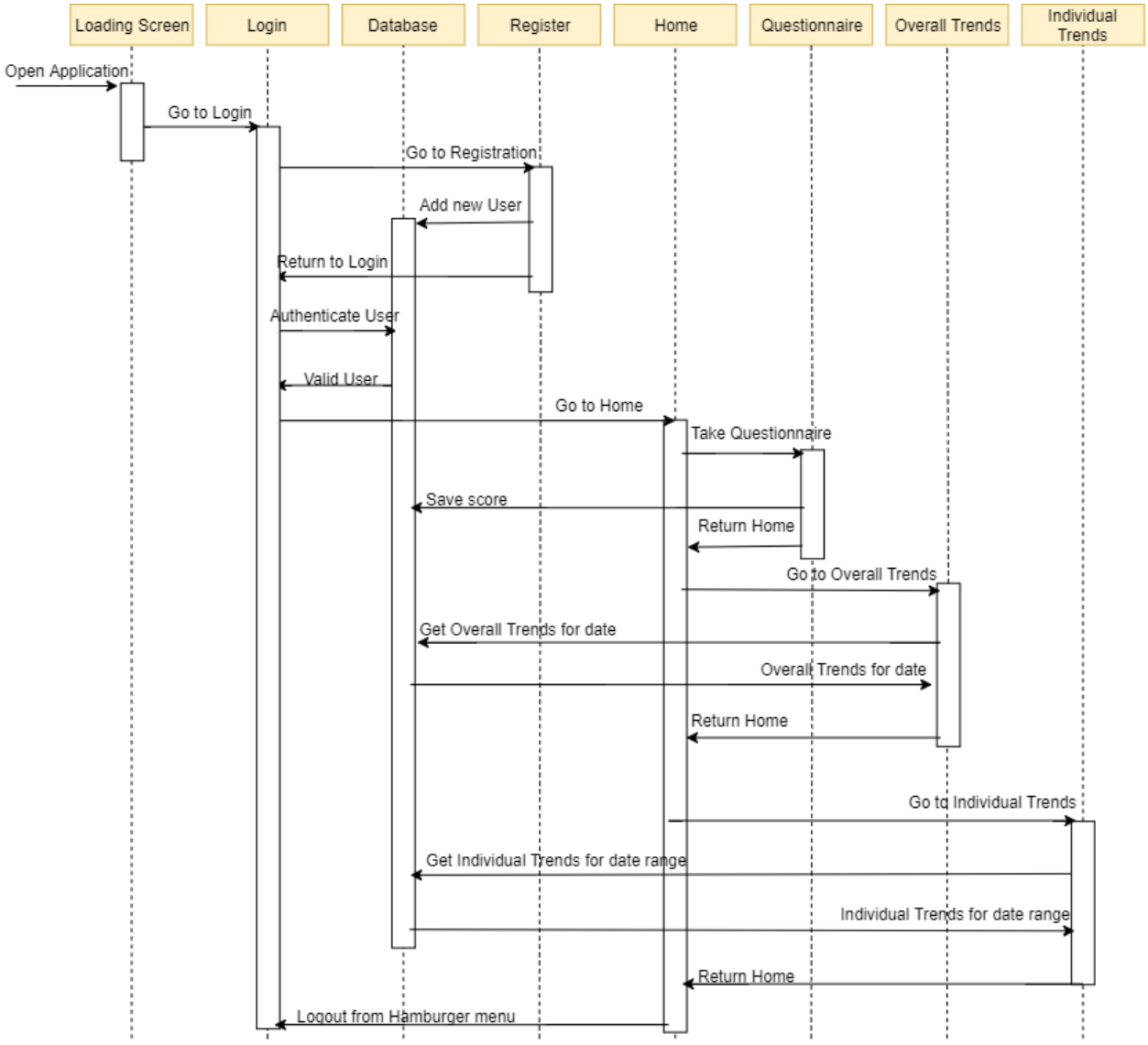

Figure 2.2 Dynamic System Architecture Design for the Fulcrum application

3. Data Storage Design

For Database Use:

In order for our application to remember the information and scores of each user, we have set up a database server that saves the user's login information and questionnaire responses as JSON. In Figure 3.1 below, we show the entities and their attributes that we are storing in the database as rectangles and circles, respectively. Additionally, the relationships between the entities are shown as lines and diamonds.

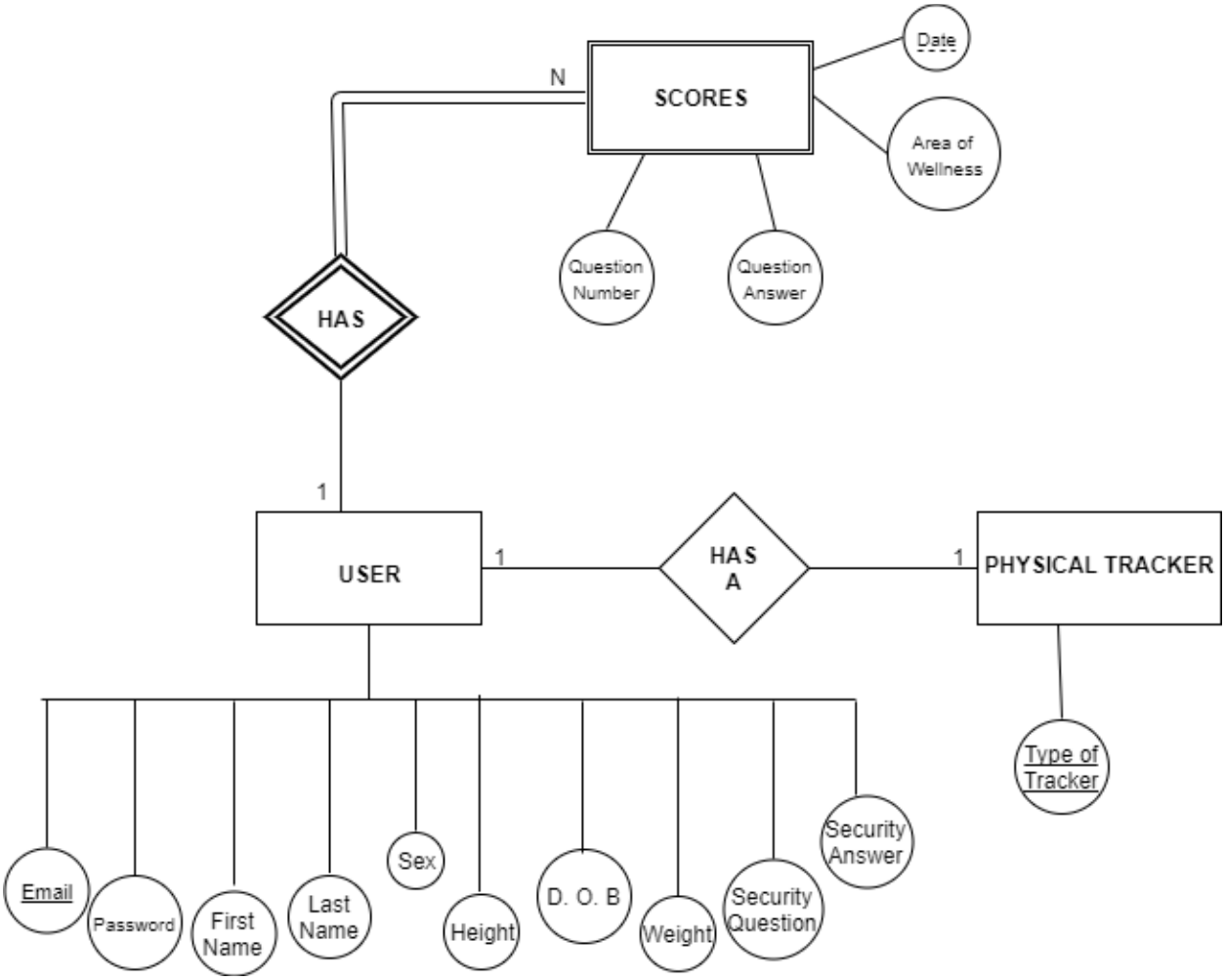

Figure 3.1 ER Diagram for the Fulcrum application Database

The main part of the ER Diagram in Figure 3.1 is the User entity. When the user registers for the Fulcrum application, the user must fill out numerous fields including the user's email, password, first and last name, date of birth, sex, height, weight, and the user must pick a security question and give an answer to it. The email attribute will uniquely identify each user in the database. The Date of Birth, Sex, Height, and Weight

attributes will be used to modify a user's Physical Wellness score if used with a physical tracker. Google Fit will be the likely choice as the physical tracker for Fulcrum.

SCORES is a weak entity that has the USER entity as its parent. SCORES also has four attributes, which are a Date attribute as a weak key and a local identifier, Question Number, Question Answer, and Area of Wellness to specify which one of the four wellness dimensions a question covers. Date is a local identifier because there are many scores over a period of time and the date is what identifies a particular set of scores to its respective user.

Once a user has registered, the user will be able to take a questionnaire every day. This gives us the SCORES entity, which will be used by the database to store the user's answer to each question, along with the current day and the category of wellness that each question belongs to. A user's overall score is derived from the user's academic, emotional, physical, and social dimensions of wellness scores.

For File Use:

We do not use any files to save data on the user's local device because this is not a web-based application. More specifically, there is no need to save data on the user's local device because our application will not cache any data. Since Fulcrum is not a web-based application, there is no need to optimize the application by caching the data.

For Data Exchange:

We use the JSON format because the only data exchange that occurs in our app is to communicate with the Firebase server, and it uses JSON. The user's login information and the questionnaire responses are stored as JSON files.

4. Component Detailed Design

i. Static Component Detail Design

Figure 4.1 shows the static form of the low-level components in the system. Each rectangular box represents a component of the system. More specifically, each component is an interface the end-user has access to and the functions that can occur at every layer of the application. We will explain the course of action that can occur at every component of the Fulcrum application.

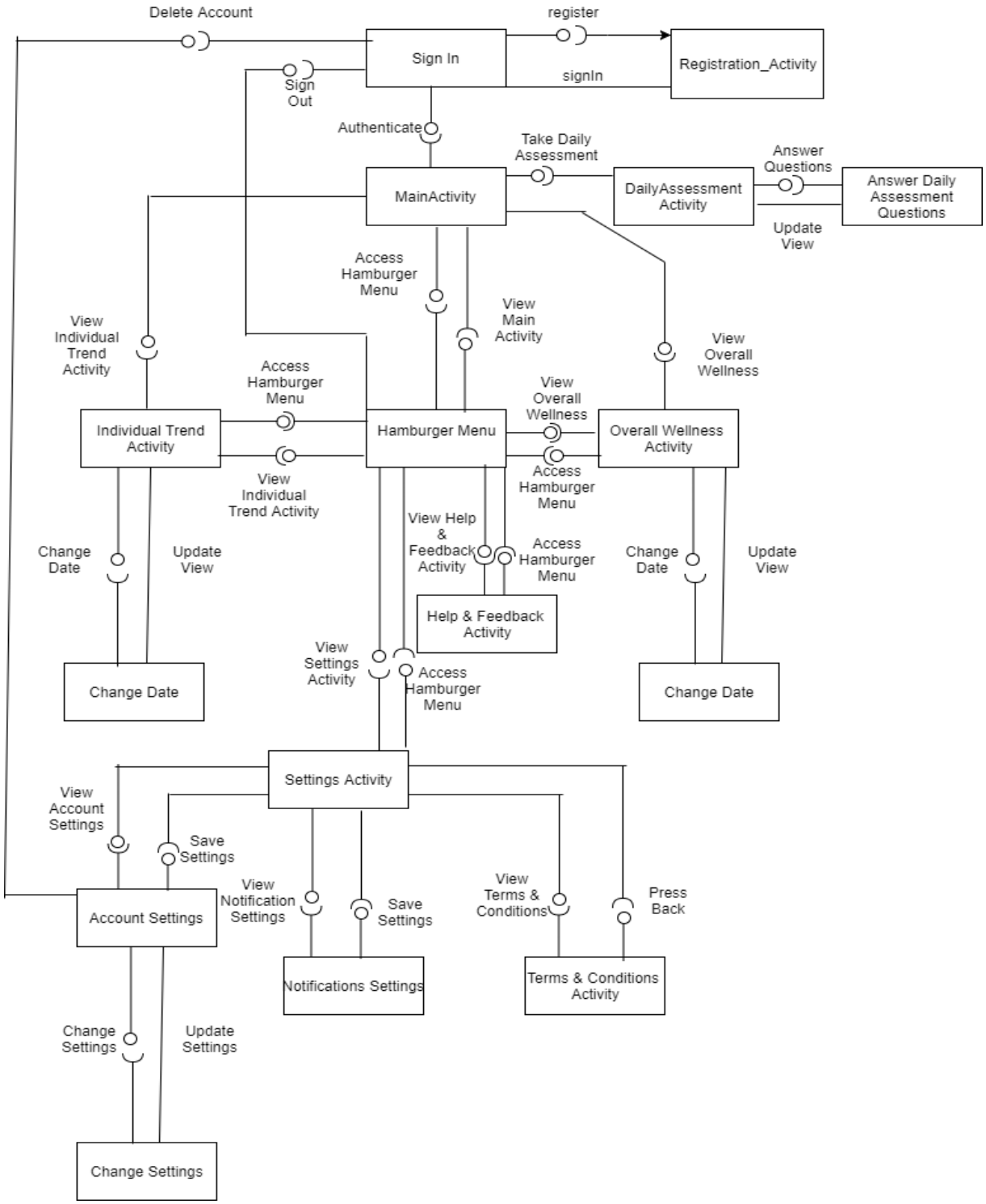

Figure 4.1 Static Component Diagram for the Fulcrum application

After the applications loads, the user is redirected to the Login Page of the application and can choose to either log in or register. In the case of a new user, the user is redirected to the Registration Page to fill out the required fields for registration. Upon

pressing submit from the Registration Page, a tuple is created in the USER table in the database (Firebase). The user is then forwarded to the Login Page of the application. After a user enters the user's credentials (username and password), the Firebase system authentication is invoked. Firebase will first check to see if the primary key (the user's email) exists in the USER table and then will check to see if the password the user entered matches the password that is stored for the user. If not, there will be a warning to the user notifying him/her of invalid credentials. Once authenticated, the user is redirected to the Main Activity (Home Page) of the application.

After the user has logged into application, the user can access the Hamburger Menu from any page in the application. From the Hamburger Menu, the user can access the Home Page, Individual Trends Page, which consist of the the user's academic, emotional, physical, and social trends, the Overall Trends Page, Settings, Help and Feedback, as well as Logout of the application. If the user chooses to sign out of the application from the Hamburger Menu, then the user is redirected to the Fulcrum Login Page.

One course of action the user can take from the Home Page is to take the Daily Assessment. Upon clicking the Daily Assessment icon, the user is redirected to the page, which contains the ten daily questions. The user can answer each question, save the user's response(s), and either save the questionnaire to finish later or submit the assessment to update the user's scores. If the user chooses to submit the assessment, the user's Overall Wellness score and Individual Wellness scores are updated. The user is also redirected back to the Home Page. If the user chooses to save the user's responses to the Daily Assessment, the user is redirected back to the Home Page of the application.

Within the Home Page, the user can view a graphical representation of the user's Overall Wellness score over time. If the user clicks on a specific point of the aforementioned representation, the application will display the user's Overall Wellness score for that day within the Home Page.

Additionally, there is a bar representation of the user's Individual Trends within the Home Page. These bars correspond to a specific dimension of wellness and they signify how each dimension of the user's wellness impacts the user's Overall Wellness score. If the user decides to click on one of the bars of the user's Individual Trends on the Home Page, then the user will be redirected to the Individual Trends Page with a more in-depth analysis of that specific trend. The in-depth analysis of each Individual Trend is shown on its own page.

On each of the four Individual Trends Pages, the user can analyze the user's score over a period of time. We give the user this capability by providing a calendar feature within each wellness trend page. Every time the user changes the date, the application has to read the database and update the pictorial representation of the specific trend.

The Help and Feedback Page can only be accessed from the Hamburger Menu. Once the user clicks on this label, the user is redirected to the Help and Feedback Page of the application. Within this page, the user can learn how to use the application and can contact Fulcrum administrators if the user has any questions or concerns. After the user is finished doing what the user need to on this page, the user can go to the page the user desires from the Hamburger Menu.

Moreover, the user can also access the Settings Page from the Hamburger Menu. From the Settings Page, the user can access Notification Settings, Account Settings, and the Terms and Conditions for Fulcrum. If the user decides to access the Notification Settings, then the user can change when the user can receive notifications. The user can save the user's Notification Settings and return to the main Settings Page by touching the back button on the user's Android device. Additionally, the user can view the Fulcrum Terms and Conditions and then return back to the main Settings Page. Lastly, the user can access the Account Settings where the user can change the user's password, height and weight, or delete the user's account. If the user decides to delete the user's account, then there will be a confirmation message that will notify the user that this is an irreversible action. If the user confirms, then everything related to that user in the database will be cleared and the user will be redirected to the Login Page of the Fulcrum application. The user can return to the main Settings Page by either the Hamburger Menu or the back button on the user's Android device.

ii. Dynamic Component Detailed Design

Figure 4.2 depicts the dynamic relationships between the low-level components in the system. Each rectangular box represents a component of the system. More specifically, each component is an interface the end-user has access to, with the arrows connecting the components representing the functions that can occur to move from one interface to another. Furthermore, each diamond represents a selection to be made by the user, where arrows leading into the diamonds represent what component the selection is made in and arrows leading out represent which decisions lead to what components. Overall, Figure 4.2 is similar to Figure 4.1, but Figure 4.2 allows for run-time decisions and conditionals to be shown.

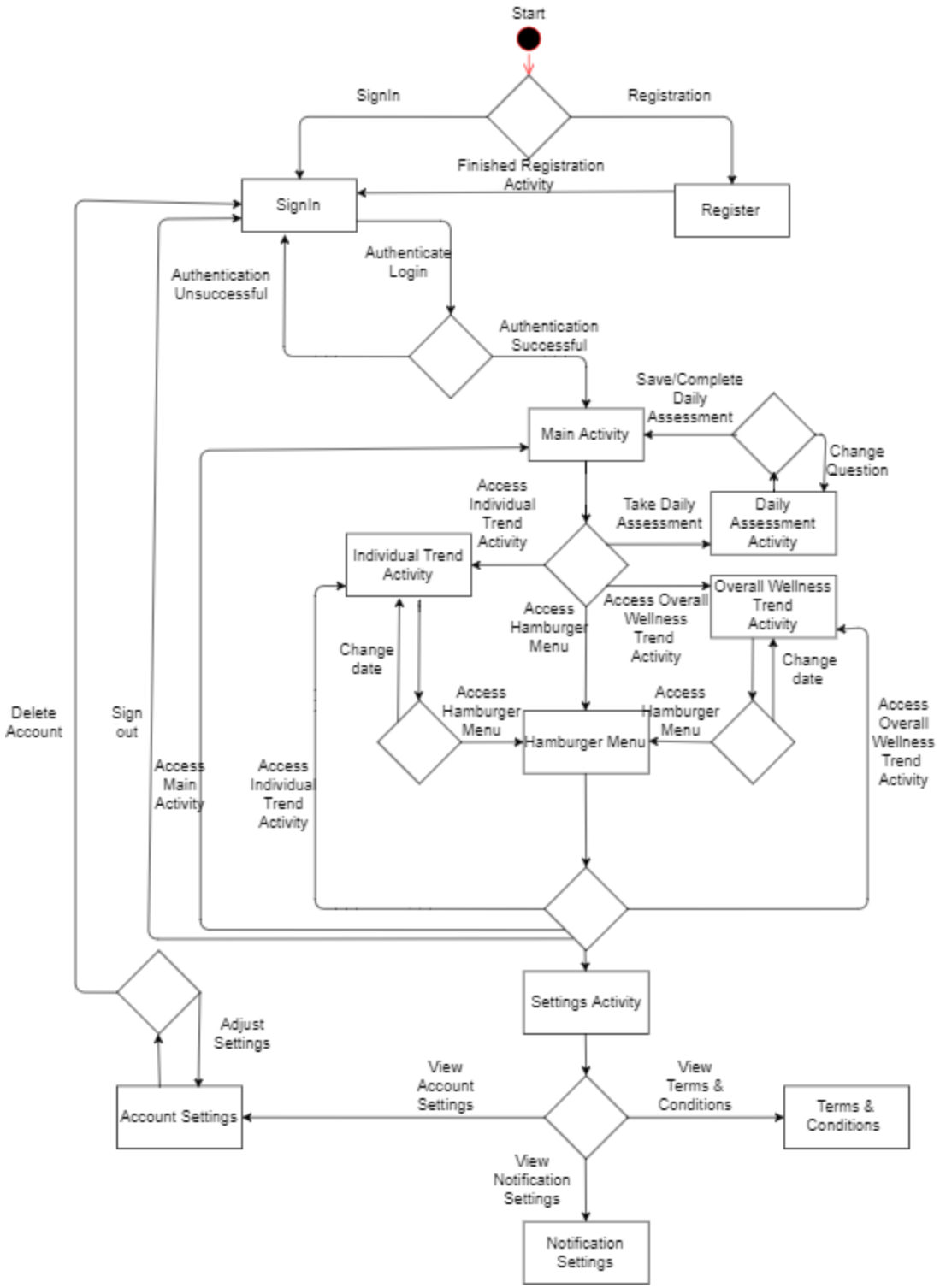

Figure 4.2 Dynamic Component Diagram for the Fulcrum application

5. User-Interface Design

In this section, we have our user interface that we have implemented in our application. Users trying to improve and monitor their wellness will use this interface on a daily basis. We will present each page in the Fulcrum application accompanied by a detailed description to explain the decisions we made throughout the development of the application.

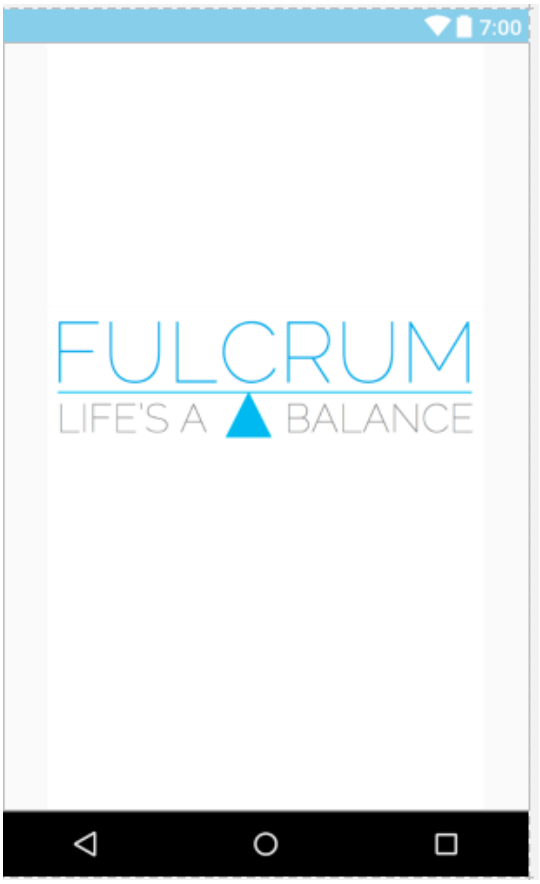

Figure 5.1 Loading Screen of the Fulcrum application

When a user first launches the Fulcrum application, the user is presented with the Loading Page (Figure 5.1). This screen will appear until the application establishes a connection with Firebase before moving onto the home page. This page lets users know the application is actively trying to start up. The mock-up design of the Login Page was provided to us by our client, along with the color scheme of the application.

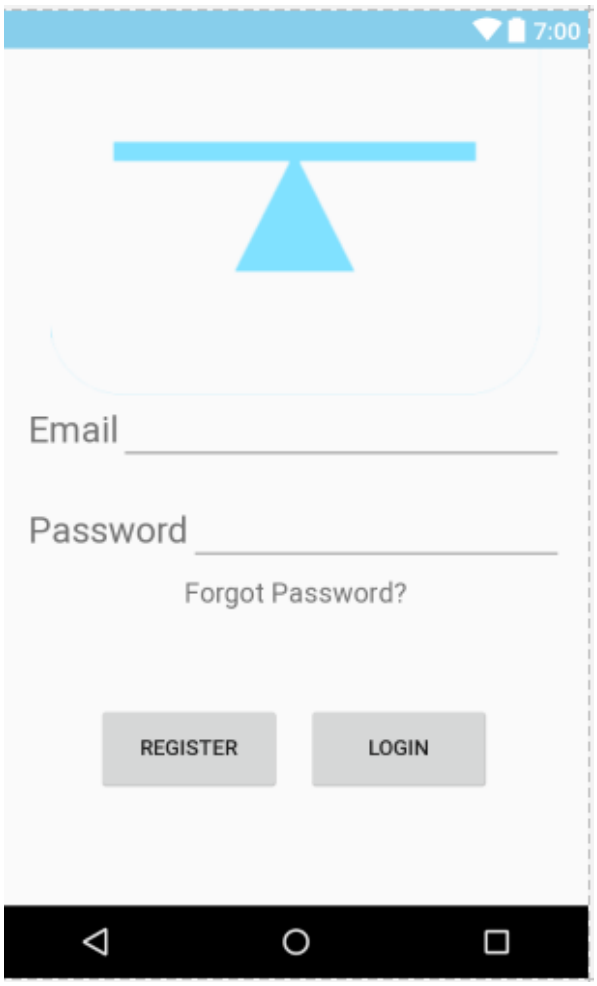

Figure 5.2 Login Page of the Fulcrum application

The Login Page (Figure 5.2) is where users are redirected to after the loading screen. This is a page with a minimalistic design where users can enter in their account information to log in. If the user does not already have an existing account, the user can register to create one. In the case the user forgets the user's login information, the user can press the "Forgot Password?" link. This page looks very similar to most login pages so that users can quickly recognize and easily understand it.

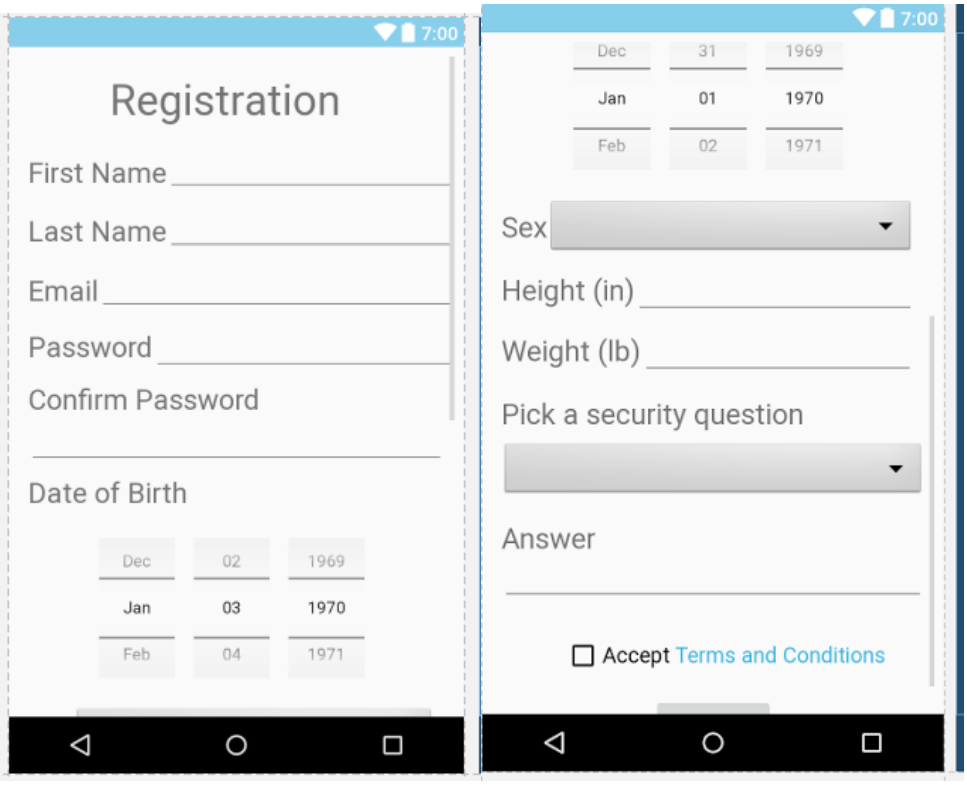

Figure 5.3 Registration Page of the Fulcrum application

This is the Registration Page (Figure 5.3), where new users will create an account to use Fulcrum. It includes many typical items needed to create an account such as name, email, and password. The page scrolls down because there are numerous fields of information Fulcrum needs in order to calculate each user's wellness. This keeps all the information on one page so it does not confuse users. To register, the user must 'Accept Terms and Conditions' which is also a hyperlink to the terms and conditions of the Fulcrum application. If the user does not fill out a field or check off the box for 'Accept Terms and Conditions' and presses submit, a message will alert the user to fill out all the fields. The user should read the Terms and Conditions before agreeing to use the Fulcrum application. If the user agrees, then the user is giving the user's consent to allow Fulcrum to store the user's information entered in the Registration page, wellness scores, and daily assessment responses.

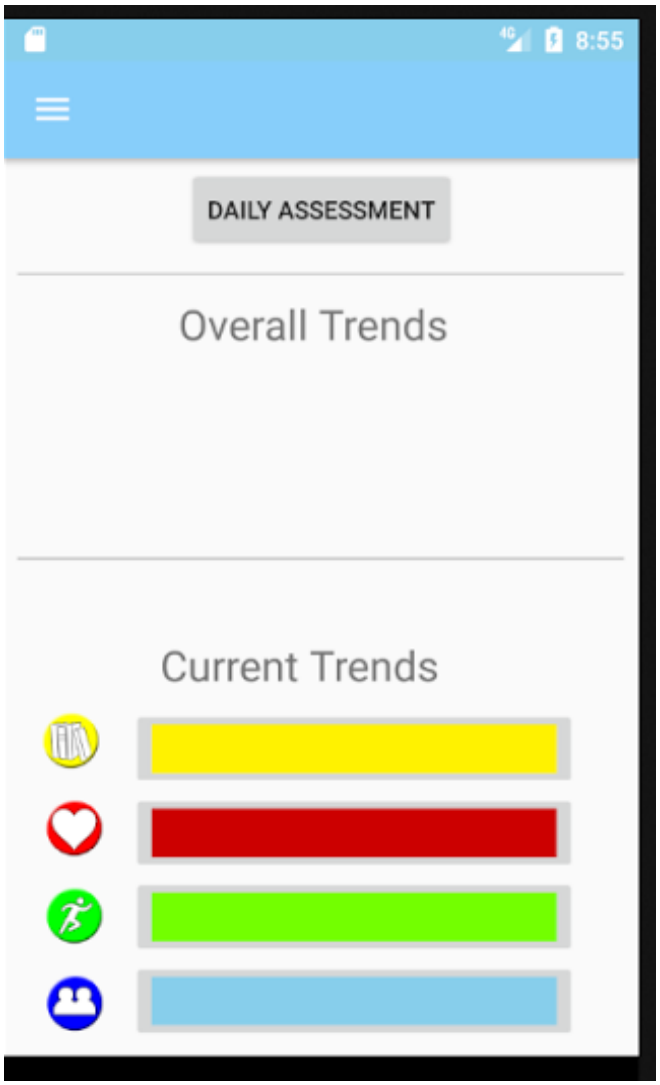

Figure 5.4 Home Page of the Fulcrum application

The Home Page (Figure 5.4) is where users will be taken after they log in. The most important features of Fulcrum are shown here. Overall Trends and Current Trends can be pressed to be looked at in more depth. The daily assessment is the top item because it is the most accessed aspect of the application since it needs to be taken daily. Later on, there will be graphs for the overall trends and individual trends. There is also a Hamburger menu in the top-left corner to navigate to all the different pages.

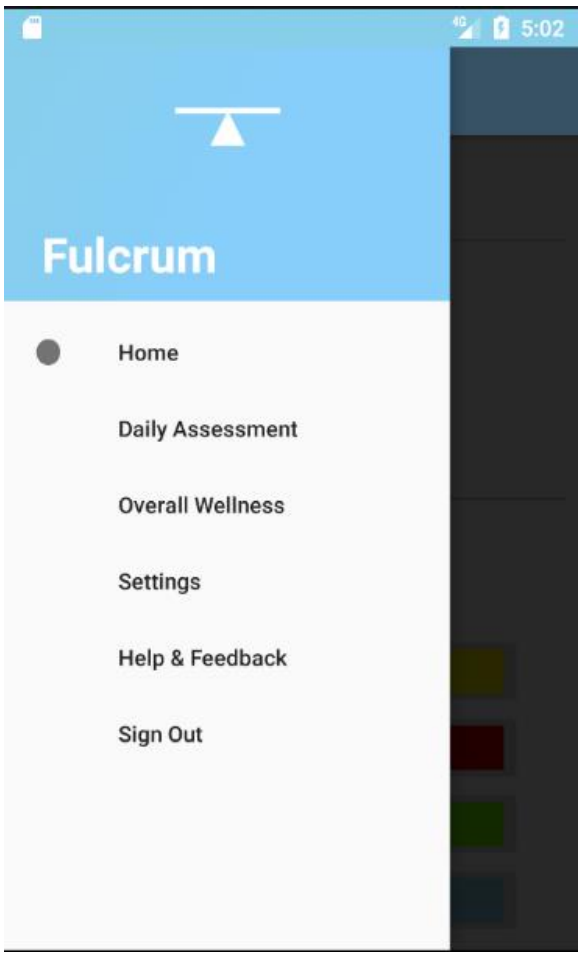

Figure 5.5 Hamburger menu of the Fulcrum application

When the Hamburger menu icon on the top left of the application is pressed, this menu appears (Figure 5.5). This menu is a navigation tool for the application in which every page of the application can be reached. The Fulcrum logo and name can be seen at the top of the application so users know what application this is. All the different pages can be seen in the menu and when pressed will redirect the user to that page. The sign out feature is also here at the bottom of the menu for natural mapping because in most mobile applications, the sign out feature is placed at the bottom of the Hamburger menu as well.

Figure 5.6 Daily Assessment Page of the Fulcrum application

The Daily Assessment Page (Figure 5.6) should be taken every day by the users. This is why it has a very simplistic design. The buttons are all labeled so that users know exactly what each one does. Radio buttons are very recognizable as they tell users to choose one of the options. The 10 questions are all on different pages but look mostly identical.

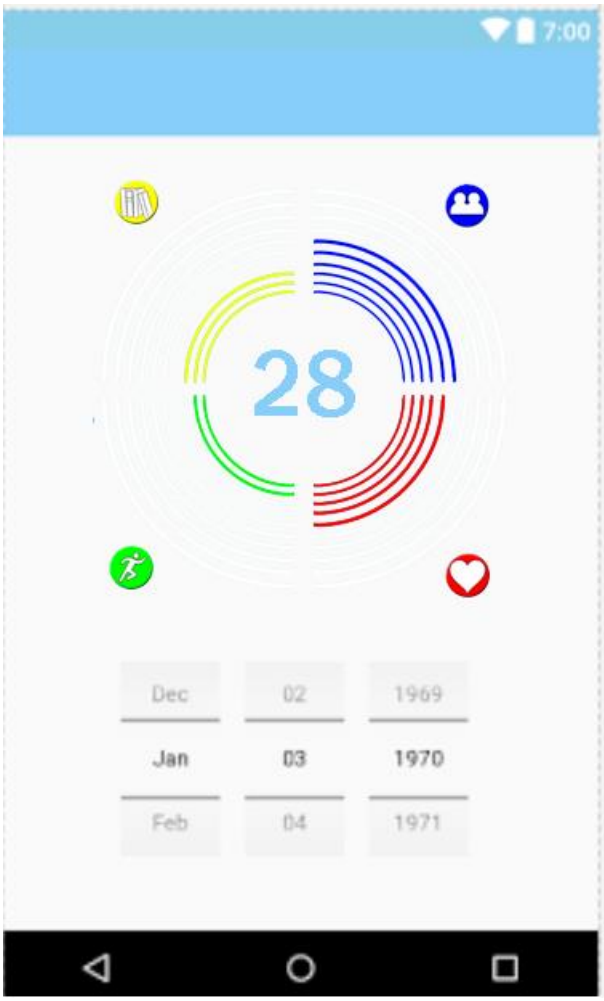

Figure 5.7 Overall Wellness Page of the Fulcrum application

The Overall Wellness Page (Figure 5.7) is where users can see their wellness from all four wellness scores combined. The four quadrants of the circle show the score in a visual way for users instead of as just being a number. The colors correspond to the color of that wellness. The date selector is for users to easily change the date and find their overall wellness for that day.

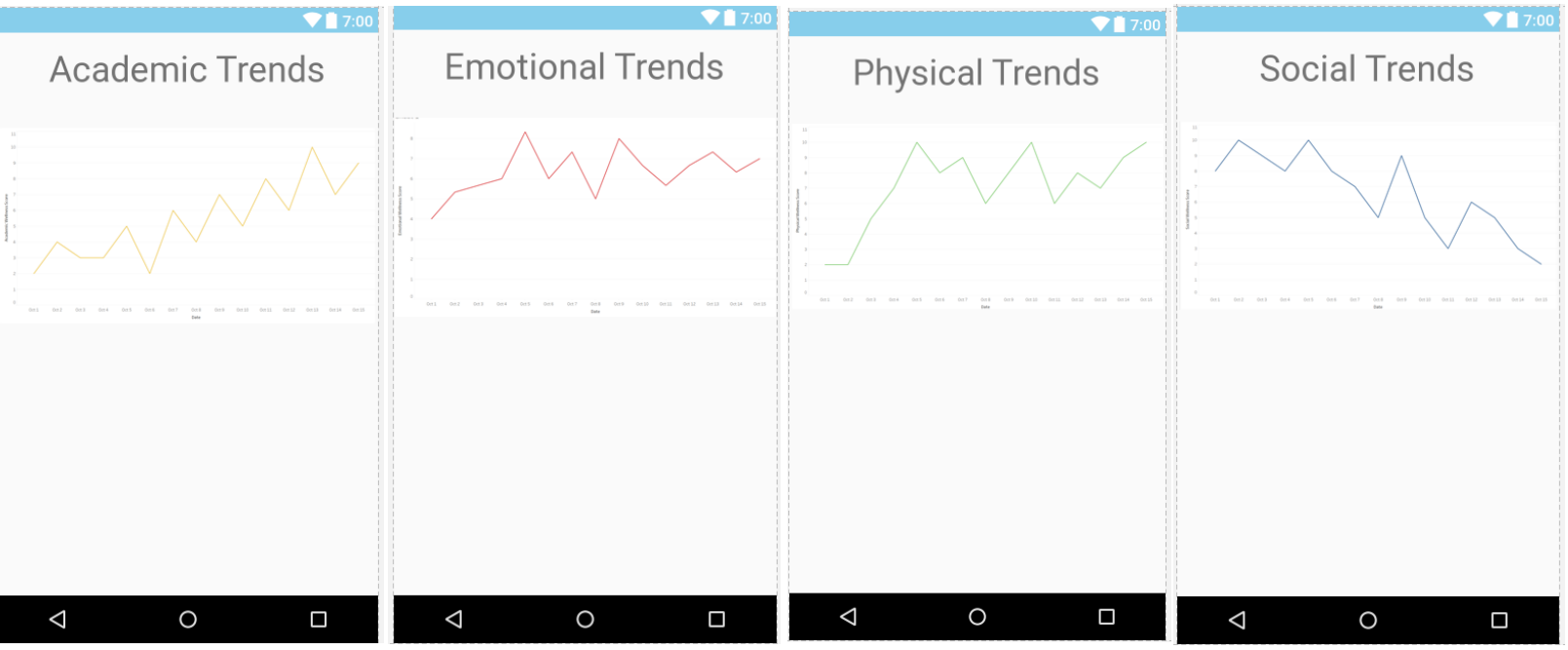

Figure 5.8 Individual Wellness Pages of the Fulcrum application

The Individual Wellness Pages include academic, emotional, physical, and social (Figure 5.8). These pages show the individual scores between a chosen time period. A calendar that looks very similar to the one in the Overall Wellness Page will also be added because we wanted consistency in our design. The calendars are used to see the trends of the individual wellness between two dates.

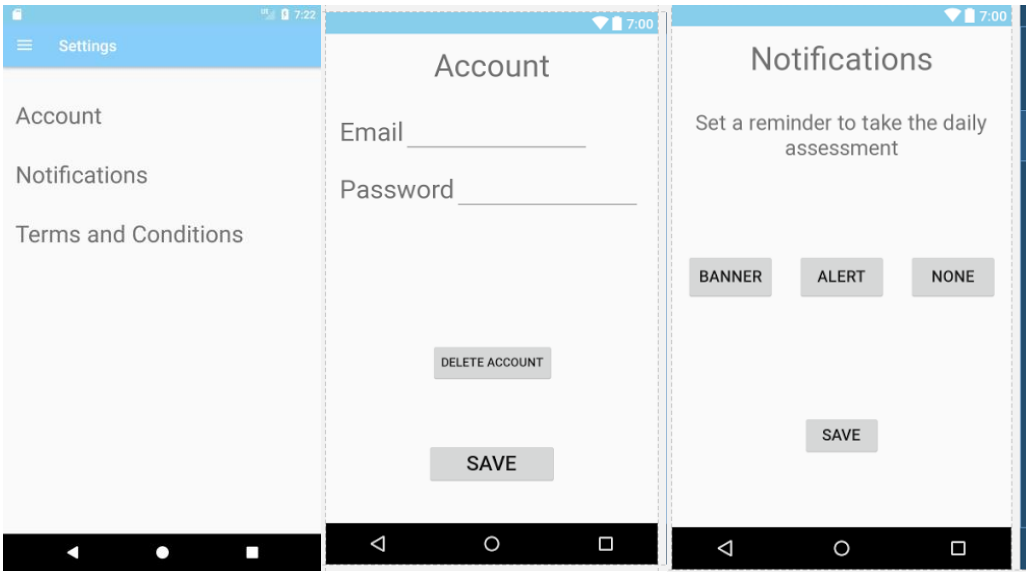

Figure 5.9 Settings Pages for the Fulcrum application

The settings can be accessed through the Hamburger menu. In the Settings page, (Figure 5.9) users can change their Account settings and Notification settings as well as look at the Terms and Conditions. These were all grouped together because they are all types of settings and things users can change. In the Account settings page, users can change their passwords or delete their accounts. In the Notifications page, users can change the type of alert they will receive between the three given (banner, alert, or none). The Save button is at the bottom of the page and by itself so users can easily see it.

Appendix

Team Collaboration Form:

Detailed Design Team Collaboration Form
For the purpose of grading, it is the expectation of your course instructors that all team members take an active role in developing the Detailed Design. For this assignment, students are expected to take on one or more of the following four “roles” throughout the drafting, revising, and delivery process for the Detailed Design:

1. Pre-Writer/Brainstormer
2. Drafter
3. Copyeditor/Proofreader
4. Delivery Coordinator (confirms draft is complete; submits google doc link or final PDF)

Keep in mind that some of these roles can apply to diagram design/production and overall document design in addition to traditional prose writing.

To track each student’s contribution to the Detailed Design, please complete this form and include it with the final draft of this assignment. The form may be included either as an Appendix in the final deliverable or, should your team prefer to omit the form from the deliverable that it sends to your client, as a separate document/file.

Team member name	Role(s) performed for each draft (1st, final)
Jimmy Dinh-Nguyen	Pre-Writer/Brainstormer, Drafter (1st, 2nd, final)
Yamin Mousselli	Pre-Writer/Brainstormer, Drafter, Copyeditor/Proofreader (1st, 2nd, final)
Arvind Narayan	Pre-Writer/Brainstormer, Drafter, Copyeditor/Proofreader (1st, 2nd, final)
Jarrett Serrian	Drafter, Copyeditor/Proofreader, and Delivery Coordinator (1st, 2nd, final)
Tyler Serrian	Pre-Writer/Brainstormer, Drafter, and Copyeditor/Proofreader (1st, 2nd, final)

Chris Thai	Pre-Writer/Brainstormer, Drafter, Copyeditor/Proofreader (1st, 2nd, final)

Additional Information: If there is any additional information that is pertinent to the way your team divided up the labor for this deliverable, please describe it below.

Works Cited

Barre, Chandler, et al. “Fulcrum Final Proposal.” *Gatech.* Gatech, n. d. Web. 13 Oct. 2017. <http://grandchallenges.gatech.edu/sites/default/files/pdf_project/fulcrum_final_proposal.pdf>