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Solemate: A Music App for Runners

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Date: June 7, 2019

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Solemate: A Music App for Runners

BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREES OF

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Solemate: A Music App for Runners

by

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Submitted in partial fulfillment of the requirements
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ABSTRACT

Solemate is a mobile application designed to enhance the running experience through music. Our feed-forward algorithm sets the runner's pace by playing music that varies in tempo. By encouraging the user to match their steps to the beat, our application cultivates a run that feels natural and inspires intrinsic motivation, especially for the beginner runner.

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Chapter 1

Introduction

Forming the habit of running can be difficult yet advantageous. Not only is running beneficial for cardiovascular health and overall fitness, but there is evidence that it boosts cognitive functions and mood. Incorporating running into your weekly routine, however, proves to be a challenge for many and requires consistent motivation. Music makes for a more enjoyable running experience and decreases feelings of apprehension towards the activity. Unfortunately, new runners are typically unaware of how to include music in their training. They become discouraged by the challenge to the point where they discontinue running after a short period of time. Current runners also stand to benefit from an improved running experience with a better strategy for selecting music.

Existing solutions strive to track the runners pace and integrate music into their running experience. These platforms lack critical features and are ineffective in motivating runners. Run tracking applications like Runkeeper are highly invasive and competitive, with features such as excessive coaching and leaderboards. These solutions have no retention of customers and are generally too intimidating for beginner runners.

Our goal is to build a mobile application that uses music as a tool to guide the runners training. Users can build their profile based on running experience for a well-structured training program. By matching the pace of their running with the song, a runner can experience a more fulfilling run. Based on the length of the run, songs will vary in beats per minute (BPM) alerting the runner when to walk or run. The user is encouraged to match their step to the beat of the song. For a beginner, this might be demonstrated through songs with slower BPM for a shorter total time in comparison to an intermediate runner. Progress will be monitored and presented in the form of data visualization, allowing the user to see how far along they are in the training process. We also plan to study the impacts and effects of Solemate on runners, specifically if they burn more calories or run for a longer period of time as a result of our application.

Using the power of music, Solemate intends to help any runner achieve their goals and stay motivated. Data for pacing used in the application will be collected from the mobile device and music will be gathered from the Spotify Developer API. We will also generate algorithms that build playlists and set pacing for each individual user. Our

solution will use music to inspire intrinsic motivation in aspiring runners. By facilitating a lifestyle change, our product has the potential to increase fitness, happiness, and overall quality of life.

Chapter 2

Background

2.1 Health and Fitness

This application is designed to encourage running with the intent of improving overall quality of life for its users. In order to effectively accomplish this goal, it is important to have a comprehensive understanding of how running and exercise impact mental health. Additionally, since our application incorporates music in order to enhance the running experience, we must also explore how music impacts running.

Individuals who integrate running into their workout routine experience benefits that extend beyond just the physical. Research suggests that runners experience improvements in mental health. A field study performed by Routledge Taylor and Francis Group tested the psychological effects of running on 50 recreational runners. Results demonstrated significant changes in mood characteristics between the pre-run and the post-run. These changes saw an increase in positive attributes [1]. This article references the abundant evidence in support of the numerous benefits of exercise from past research. Many scholars acknowledge the positive impacts of exercise on both physical and mental health [1].

Music is often utilized during exercise. Studies show the extent of influence of music on running performance. One study conducted by the *Journal of Sports Science and Medicine* concluded that music is an effective strategy for regulating the running experience [2]. Additionally, results demonstrated an awareness among runners that motivational music would positively impact their performance [2]. With the information that music will likely enhance an individual's run, and that running has a positive influence on mental health, we can use music to cultivate a influential method of exercise.

2.2 Market Research

According to recent market analysis, the fitness industry in the U.S. is worth $50 billion. Recent years have seen a steady growth in the value of fitness products and services. That being said, a vast majority of American adults are not getting the recommended amount of exercise. Surveys show that 72% of respondents express a desire to exercise more.

The lack of motivation to accomplish fitness related goals can relate to the inaccessible nature of fitness products. 49% of polled adults said that they were intimidated by the mere thought of going to the gym. These statistics demonstrate how a large portion of the American publics fitness needs are not being met. This application attempts to introduce fitness training to the masses in an affordable and accessible way. The only piece of equipment a user needs is their data enabled mobile phone.

2.3 Competition Research

Existing solutions, such as Runkeeper and C25K (Couch to 5K), strive to track the runners pace and integrate music into their running experience. These platforms lack critical features and are ineffective in motivating runners. Run tracking applications like Runkeeper are highly invasive and competitive, including features such as excessive coaching and leaderboards which are intimidating to beginner runners and causes those runners to overexert themselves. C25K, on the other hand, bases itself on an automated voice that naively tells the user when to run and walk based on the couch to 5k schedule, proving ineffective in motivating people to run. Both platforms include a music integration feature that simply plays music from your library in the background, meaning the training is not guided by music. These applications do not utilize the power of music to its fullest potential nor adds value to the application.

Chapter 3

Requirements

This project consisted of two major objectives that the team angled the requirements towards. One, integrate music into the running experience, and two, introduce and motivate people to maintain a healthy lifestyle. Below are the more detailed requirements used throughout the development process.

The functional and non-functional requirements, as well as the design constraints, are listed below in order to define the needs of the system. Critical requirements are those that are necessary, and recommended and suggested requirements are additional features that could be added given additional time.

3.1 Functional

3.1.1 Critical Requirements

The system must have the ability to:

- Process and collect pedometer data from an iPhone
- Build and customize a running playlist based on user data and experience
- Provide the user with progress reports

3.1.2 Recommended Requirements

The system is recommended to:

- Smoothen transitions between songs
- Have a calibration quiz/run to place a user at an appropriate level

3.1.3 Suggested Requirements

The system is suggested to:

- Allow the user to skip songs

- Allow for the selection of music genre
- Dynamically adjust running sessions to user feedback

3.2 Nonfunctional

3.2.1 Critical Requirements

The system must be:

- Usable, by providing an easy-to-use interface for the runner
- Secure, when storing user data
- Reliable, by constantly collecting data while run is in session

3.2.2 Recommended Requirements

The system is recommended to have:

- Portability, with the ability to expand to other platforms (e.g. Android)

3.2.3 Suggested Requirements

The system is suggested to have:

- An easy integration into the user's current running routine

3.3 Design Constraints

Our system will have certain limitations with regards to design.

- Our application will be built on an iOS platform, thus not integrate with Android in this phase of development
- The device running the application must have wifi or data connection to access the database and Spotify API
- Users must have Spotify Premium to play the songs in a determined order

Chapter 4

Use Cases

This system has a single user: the runner. In this section, we outline the different actions the user must be able to perform, as well as the goal, actor, preconditions and postconditions of each action. Figure 4.1 below demonstrates the set of actions the user can perform in the system.

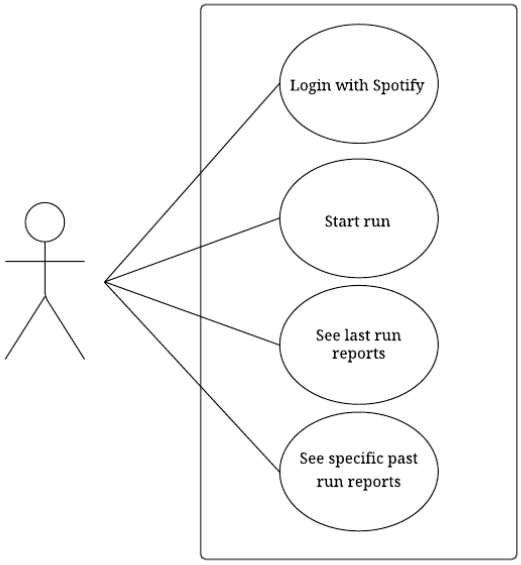

Figure 4.1: Use Case Diagram

The following outlines the goals, preconditions and postconditions of each use case.

1. **Login with Spotify**

   Goal: To login to the app

   Actor: User

   Preconditions: User must have a pre-existing Spotify Premium account

Postconditions: User has access to all the features of the app

2. **Start run**

   Goal: To start a music-guided run

   Actor: User

   Preconditions: User logs in to account that keeps track of users running progress

   Postconditions: App generates a collection of music that correlates to the users target length of run and pace, and the user progresses on the level upon completing run

3. **See last run reports**

   Goal: To see details on last run performance

   Actor: User

   Preconditions: User must have completed at least one run

   Postconditions: User sees how closely they match target performance level

4. **See specific past run reports**

   Goal: To monitor running progress

   Actors: User

   Preconditions: User selects which progress report they want to view based on the date of run

   Postconditions: User sees how closely they match target performance level

Chapter 5

System Sequence Diagrams

5.1 User

Figures 5.1 describe the activity flow for the user. The user controls all the actions within the app. Initially, the user must login to the app with through Spotify. Once they are granted access, the user is navigated to the home page. Once on the homepage, the user can either start run or see reports. Once a user finishes a run, they will be directed to a reports page for that specific run. Users can also choose between viewing details on their latest run or viewing past run reports. The user concludes their experience by exiting the app.

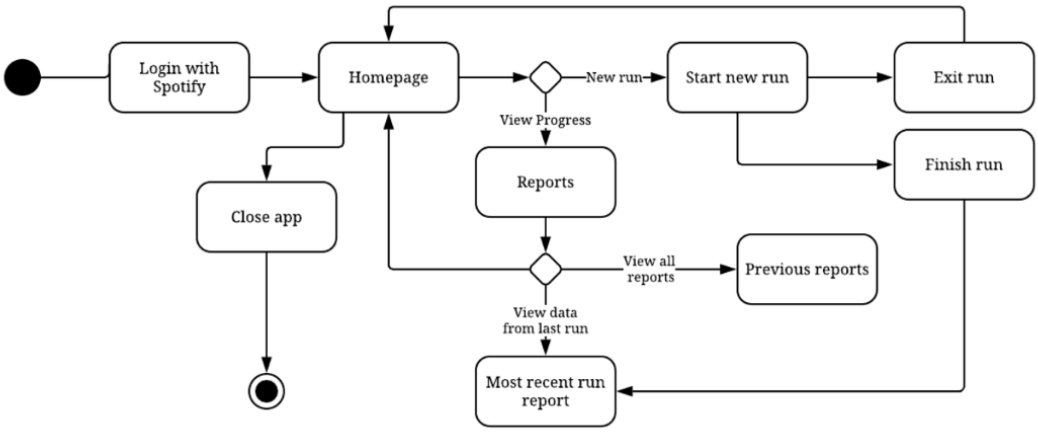

Figure 5.1: User Activity Diagram

Chapter 6

User Interface

Figures 6.1-6.5 demonstrate the various screens within Solemate. The user interface is designed to be intuitive and easy to navigate. The user can start their workout from the home screen, making for a quick start to their run. Additionally, the login screen interface will operate through Spotify's API.

6.1 Login Screen

Figure 6.1 displays Solemates login screen. Users log in via Spotify, therefore user authentication is handled on Spotify's end. Due to the nature of Spotify and the limitations resulting from the free platform, only users with a Premium subscription will be able to successfully log in to Solemate.

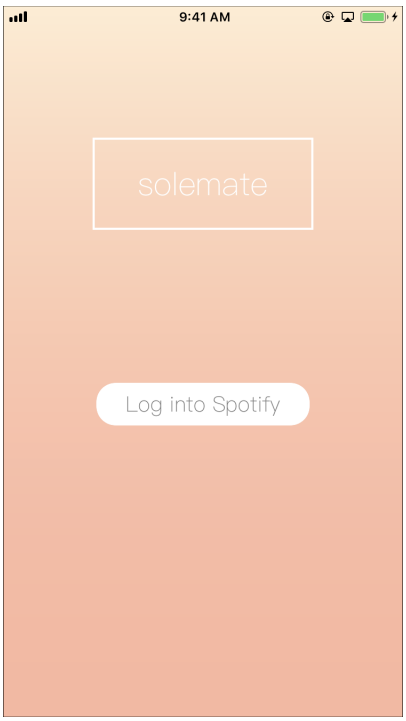

Figure 6.1: Login Screen

6.2 Home Screen

Figure 6.2 displays Solemate's home screen. The green progress bar at the top of the page indicates the user's progression into the current level. The module titled "Today's Run" conveniently lets the user know quick stats on the upcoming run, which includes the total run time, the breakdown in minutes between walking and running, in addition to the number of songs they will listen to on the run. In an effort to prevent overwhelming the beginner runner, the main focus of the page is the large play button at the center of the screen. This limits the issue of an overwhelming amount of choices for the beginner runner – all they have to do is press play. The home screen also provides the user with the accuracy of their previous run as a form of motivational feedback.

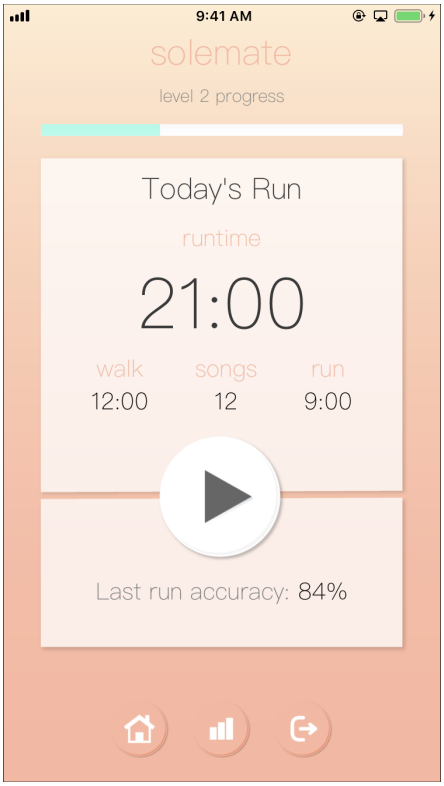

Figure 6.2: Home Screen

6.3 Run Screen

Figure 6.3 displays Solemate's run screen. This page is relatively simple, so as to not distract the runner or provide them with unnecessary or overwhelming information. The green circular progress bar indicates to the user how much time is left for that particular song (i.e., the circle resets once a new track begins playing). The run screen also displays the distance traveled, which is calculated in real-time based on the number of steps the user takes. The tempo of the current song is also displayed as additional information.

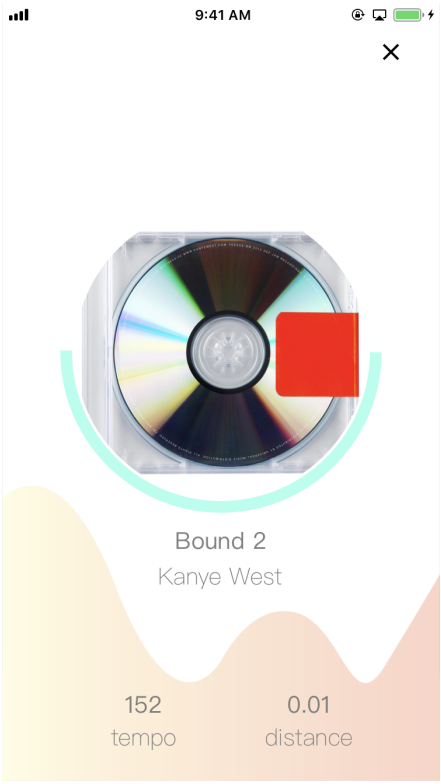

Figure 6.3: Run Screen

6.4 Progress Screen

Figure 6.4 displays Solemate's progress screen. This page provides the user with results on the most recent run. The graph displays the user's accuracy on the run. The green line graph demonstrates the user's steps per minute and the white line graph demonstrates the songs' beats per minute (BPM). This page also provides the user with useful statistics, such as the accuracy in a percentage form and the total distance traveled on the run. We also include a creative feature titled "Best Song", which indicates to the user which song they matched their steps to the "best", simply finding the minimum difference in all pairings between the song BPM and user steps per minute.

Figure 6.4: Progress Screen

6.5 Reports Screen

Figure 5 displays Solemate's reports screen. This page is identical to the progress page seen above, with the exception that the user can view progress reports for any run they have completed in the past by selecting the date of a run. For simplicity, there is no option on the navigation bar to navigate to this page. Users can navigate to this page by first going to the progress screen and then selecting the "View previous runs" button.

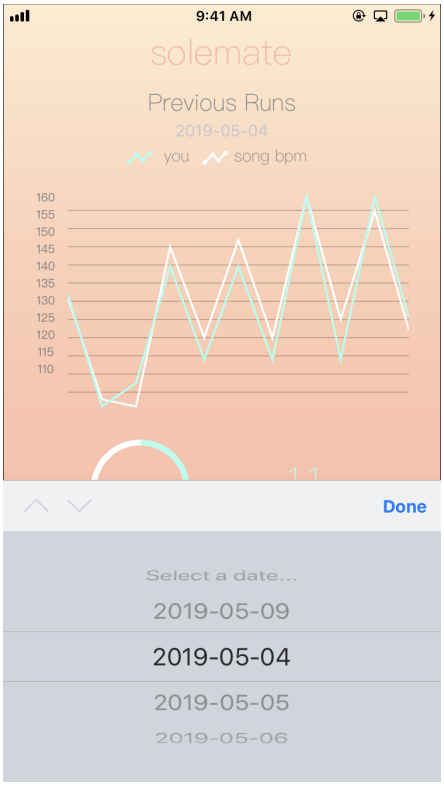

Figure 6.5: Progress Screen

6.6 Navigation Bar

Solemates navigation bar is present on the home screen, progress screen, and reports screen. The icons representing each page are very intuitive, with the left-most button representing the home screen, the middle button representing the progress screen, and the right-most button representing the logout button.

Chapter 7

Algorithm

This section breaks down the different aspects of our algorithm, including how playlists are made and how a run is deemed accurate.

7.1 Couch to 5K Model

Table 7.1 below displays the first two weeks of the Couch to 5K program, and how they pace the runners based off of time running and time walking. Since the Couch to 5K program aims to encourage non-runners to complete a 5K in 10 weeks, we believe that the schedule would fit our needs of targeting the beginner runner.

Table 7.1: Sample of the Couch to 5K Model

Week	Day 1	Day 2	Day 3
1	1 minute jogging and 1 1/2 minutes of walking x8 for total of 20 min	1 minute jogging and 1 1/2 minutes of walking x8 for total of 20 min	1 minute jogging and 1 1/2 minutes of walking x8 for total of 20 min
2	1 1/2 minutes of jogging and 2 minutes of walking x6 for total of 21 min	1 1/2 minutes of jogging and 2 minutes of walking x6 for total of 21 min	1 1/2 minutes of jogging and 2 minutes of walking x6 for total of 21 min

7.2 Song Classification

To implement the Couch to 5K model presented in section 7.1 above, we generated a method to classify songs that were of a walking pace versus that of a running pace. From research conducted online [3] and personally testing the validity of said research, we found that songs less than a BPM of 135 are of a walking pace, and songs greater than or equal to 135 BPM are of a running pace. We use this classification to determine if a particular song is meant for walking or running and measure the user's accuracy based on this model.

7.3 Playlist Generation

To simplify the playlist generation process, our team generated numerous song buckets (which are essentially distinct Spotify playlists) ranging from 110 BPM to 170 BPM in intervals of ten. The buckets chosen to pull songs from for a particular run vary depending on the user's current level. Levels of a higher difficulty will generally have songs with higher BPMs. As an example, Table 7.2 below demonstrates a sample playlist generated for a user on level 2 based on the corresponding week 2 Couch to 5K model presented in Table 7.1 on the previous page. The Couch to 5K model suggests the user must alternate between running for 1.5 minutes and walking for 2 minutes a total of 6 times.

Table 7.2: Sample Generated Playlist for Level 2

Playlist Index	Track Name and Artist	Approx. Song BPM	Song Classification
1	All of the Lights - Kanye West	140	Run
2	Payphone - Maroon 5	110	Walk
3	Toxic - Britney Spears	140	Run
4	Summer Days - Martin Garrix	110	Walk
5	Starry Eyed - Ellie Goulding	150	Run
6	American Boy - Estelle	120	Walk
7	Stitches - Shawn Mendes	150	Run
8	Cake By The Ocean - DNCE	120	Walk
9	Donald Trump - Mac Miller	160	Run
10	Save The World - Swedish House Mafia	130	Walk
11	Up All Night - Drake	160	Run
12	Mama Look At Me Now - Galantis	130	Walk

7.4 Pedometer

Using the built-in Pedometer in the Apple iPhone, we counted the number of steps that the user took through the duration of a song in order to calculate the steps per minute (SPM) of the user to compare to the beats per minute (BPM) for the song. SPM is calculated through taking the difference between steps taken at the beginning of the song to the end of the song, and dividing that value by the song time duration in minutes. This value is then saved in an array to be used at the end of the run for accuracy calculations.

7.5 Accuracy

Calculating accuracy is based on how close a user is to matching the BPM of the song. Through testing, we calculated a range of BPM±20 to determine whether a user is running and walking when they are supposed to through following the playlist. At the end of a run, the SPM values are saved into the database, and are compared to the original song's BPM. If the song is within that range, it is considered an accurate song. After finding how many songs are considered accurate, the value is divided by the number of songs in the particular playlist, which then is the accuracy of the run. If the run accuracy is above 75%, then the user will advance to the next run or the next level.

For the ”Best Song” value, that is the individual song accuracy calculated that has the smallest difference between the user’s SPM and the song’s BPM. That song’s values are saved for future reference in the individual run.

Chapter 8

Technologies

The following technologies are required for this system:

- *React Native*: client-side scripting language to render the application
- *Firebase*: database management system to store data
- *Apple CoreMotion*: built-in iPhone framework to retrieve the user's step data
- *Git*: version control in the form of GitHub to keep track of changes and maintain working copies of our application throughout the design process

Chapter 9

System Architecture

Figure 9.1 shown below demonstrates the data flow in a high level overview of our data-centric architecture. The center of our solution will be a central server and database which stores user account and run details. The singular Firebase database will hold all details about the user and aggregate the data from every run session. Solemate will fetch this data for use in our algorithms to generate progress reports and it will send collected data to the database after each run.

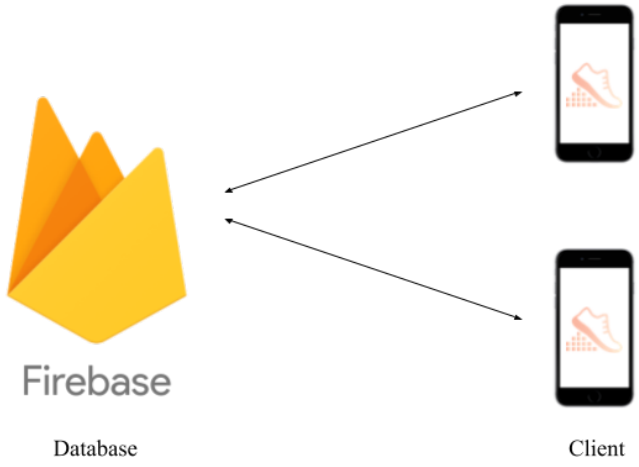

Figure 9.1: System Architecture Diagram

Chapter 10

Rationale

10.1 Technology

There are several choices we made with regards to the technologies we are developing with.

10.1.1 React Native

Given the restricted time frame, this is the library that is simplest to learn as all of the developers have experience in JavaScript. In addition, react Native can be deployed on both iOS and Android platforms, so while the team only tested with iOS, the product can be expanded in the future to run on Android devices as well.

10.1.2 Firebase

Firebase seamlessly integrates with React Native at no cost. It stores data in the JSON format, which is convenient for the developers to work with, and provides a strong API with critical functions to interact with the data.

10.1.3 Apple Coremotion Framework

All the developers have iPhones, therefore this would be the most accessible method to test with real accelerometer data as the hardware included in all Apple mobile phones. Additionally, it is critical our application collects real-time data accurately, and this framework has been proven and tested to do so.

10.1.4 Git

All the developers have had some experience using Git as a form of version control. This proved to be helpful throughout the design process when checking to see if the code worked on the various types of iPhones that the team owned, as well as keeping track of the working copies of the codebase.

10.2 Design

10.2.1 Spotify API

The Spotify Developer API has extensive functions to play and analyze music, as well as authenticate users and build playlists. Users that have Spotify Premium can log in through our application and access their playlist.

10.2.2 iOS Platform

Our system is built on an iOS platform because the developers have iPhones as well as Apple computers to develop, deploy and test the application via XCode.

Chapter 11

Test Plan

In order to test our application, we split up testing into three major subcategories: unit testing, integration testing, and user testing. Through these methods, we were able to assess if Solemate the requirements of the project.

11.1 Unit Testing

Unit testing took place earlier in the design process, where we tested the individual base elements of our system, interaction between the Spotify API and React Native app, Pedometer data, and database integration. This involved creating an app with minimal functionality that covered one of the base elements.

11.2 Integration Testing

Integration testing was combining the base elements together to piece our mobile application together. At first, it was connecting the Spotify and database aspects, to save user data and playlists/runs into the online database. Once that was completed and we could see the playlist on both Spotify and Firebase, the pedometer module was integrated.

The initial implementation of the pedometer worked as a standalone app, but it ended up not being compatible in combination, so we had to find an alternative. Luckily, we were able to find a solution that performed the same functionality that ended up integrating fairly easily, with the potential to add additional features onto the system in the future.

After putting the base components together, we integrated the user interface design. Through individual page testing to cycling through screens, we wanted to make sure that our product would be fully functional to demonstrate during the Senior Design Conference in May.

11.3 User Testing

As soon as we successfully combined the base components, we started to test the application by going on runs with it and keeping track of how we felt throughout the app usage and whether or not we felt if we could maintain user

retention. Based off of this particular testing, we were able to set an appropriate range of accurate steps per minute given a song.

In addition, we had volunteers look at the app and give us feedback on the design elements. Through their responses, we were able to alter the design to attempt to fit a wide range of potential users.

Chapter 12

Risk Analysis

Table 12.1 below describes the types of risks we predicted we would face during the development process, as well as techniques to mitigate the risks.

Table 12.1: Risk Analysis Table

Risk	Consequences	Probability	Severity	Impact	Mitigation
Insufficient Knowledge of Tech	- The system has errors, thus it does not compile or work as intended - The system has major vulnerabilities (i.e. security, data)	0.85	8	6.8	- Utilize resources (online and on-campus) - Read documentation when necessary for understanding
Behind Schedule	- The system is not completed by deadlines and/or not all aspects are finished	0.6	7	4.2	- Set and maintain deadlines - Prioritize core features - Ask other team members for assistance if necessary
Problems with external APIs and Node dependencies	- Trying to integrate external APIs (i.e. *Spotify*, HealthKit) could cause errors if the APIs are not updated - Attempting to align dependencies within the application can cause errors and hinder productivity - If both forms of dependencies are not up to date, then it would hinder the functionality of our app	0.7	6	4.2	- Ensure all of the packages are installed and up to date - Documenting a comprehensive installation guide to ensure all of the team members have the necessary software - If a similar linking error has occurred to another member, they will provide guidance to solve the issue
Platform Compatibility Issues	- The app developed on the computer does not function as desired on an our actual mobile devices	0.3	9	2.7	- Perform testing on our phones earlier in the development process to catch compatibility errors
Human Testing	- Busy schedules might lead to individuals not being able to test the application completely, leaving out testing on important features	0.5	5	2.5	- Designate certain times in our development schedule to test each feature properly

Chapter 13

Development Timeline

Table 13.1 describes the development timeline of the project, including which components were delegated to which team members and the deadlines set for each task.

Table 13.1: Development Timeline

	TASK TITLE	FALL QUARTER		WINTER BREAK	WINTER QUARTER		SPRING BREAK	SPRING QUARTER	
		10	F	BR	Weeks 1-5	Weeks 6-10	BR	Weeks 1-6	Weeks 7-10
1	**Implementation/Documentation**								
1.1	Playlist Integration								
1.2	Accelerometer/Pedometer Data								
1.3	Screen Creation (UI)								
1.4	Integrating the Databases								
1.5	Generating Progress Reports								
1.6	Documentation								
1.7	Installation/User Guide								
2	**Testing**								
2.1	Unit Testing								
2.2	System Integration Testing								
2.3	UI Testing								
2.4	Field Tests								
3	**Project Documents and Deliverables**								
3.1	Senior Design Conference Slides								
3.1.1	Senior Design Conference Presentation								
3.2	Project Report/Senior Thesis								

Color Key					
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	Arshi & Sam L		Arshi & Sam S		All

Chapter 14

Societal Issues

14.1 Social

The main social issue that Solemate addresses is that of health and fitness in America. As mentioned in the research portion of this report, most American adults are not getting the recommended amount of exercise. Exercise correlates directly to physical health, which has proven life enhancing qualities. This app was designed specifically to help non-runners discover the joys and rewards of running. Instead of acting as a solution to all of the worlds health problems, Solemate acts as a tool that will inspire intrinsic motivation from its users. Additionally, running is a great way to exercise without the heavy price tag of a gym membership. In this way, running is the most compatible type of exercise with our app, which prioritizes accessibility. Everyone should be able to access the tools necessary to live a healthy and happy lifestyle.

14.2 Ethical

The most prominent ethical concern of running applications is the collection and storage of user location data. Many mobile applications use location data with the goal of curating a better run experience. However, we made the conscious decision not to because we felt that having access to this data is not necessary nor would enhance the user experience in the context of our app.

14.3 Political

Our app may not concern itself with politics, but we believe that all social issues are intertwined in some respect. The economic gap in this country is the cause for many of the social issues that plague society. Policy that works to decrease this gap, or to aid the health and wellness culture of our country would also benefit our mission.

14.4 Economic

One of the contributing factors to the poor state of fitness in America is the inaccessibility of fitness products and services. Gym memberships are expensive. Their profit relies on the guarantee that people will not show up. Our goal in making the app free is to provide a fitness tool that anyone can use, no matter their economic status. We did not require any funding to build this product. That being said, future funds may need to be acquired if the product expands for scaling purposes.

14.5 Health and Safety

Since this app is a fitness app, we are very concerned with health and safety. We want to encourage users to improve their health. Additionally, user safety is paramount. Part of the reason we do not collect location data is so that people of malicious intent will not be able to illegally obtain this information.

14.6 Manufacturability

This product was easy to build as only a laptop, iPhone and access to a database were required. A user only needs to download the app from the App store. Issues may arise if we expand the application, but the frameworks we used are scalable.

14.7 Sustainability

The system will be sustainable as we add features. We plan on continuing to update the product over time. One of the next steps in the development phase would be to extend the product beyond the Couch to 5K format. This way, users can continue using the app throughout their fitness journey. More levels and features would allow for the product to flourish.

14.8 Environmental Impact

Our application has a small environmental impact. None of the technologies we used contribute to e-waste. It is still important to consider the potential harm of our project, as of all software engineering projects.

14.9 Usability

Given that this product was designed for users, we wanted to ensure that users would have a meaningful experience when using the app. In the early stages of planning, we spent a lot of time on visual design considerations. We generated high fidelity mock-ups in order to keep design at the forefront of development.

14.10 Lifelong Learning

Working on this project has helped us become stronger software engineers. Mobile applications are widely used and developed in the tech industry. It is important to understand the popular technologies of mobile development in order to better understand the industry overall. We also learned the intricacies of project planning and implementation. We also developed important teamwork skills over the course of the year.

14.11 Compassion

The entire premise of our project was inspired by sympathy for people whose fitness needs are not met by the culture of gyms, personal trainers, and fitness subscriptions that currently consumes America. We wanted to create a product for all users who want to experience the joys of running, and of any economic status. In the beginning stages of development, we considered all the reasons why forming healthy habits can be difficult. From this consideration, we strived to build a product that focuses on empowerment and intrinsic motivation.

Chapter 15

Lessons Learned

Throughout the development process, we encountered various challenges.

The first and most prominent was the learning curve associated with the new technologies. None of our team members had mobile application development experience, therefore much of the early development phase was dedicated to learning how to use the technologies chosen. We were able to overcome this challenge through smart and careful utilization of online resources.

The second challenge we faced was the modification of our technology choices. Initially we planned on using the Apple HealthKit to collect the pedometer data needed to calculate step count. However, we found that the response time was not fast enough for real-time data collection. While trying to find a real-time solution, we went through various frameworks, with one being expo-sensors which had the functionality our app needed but ended up not integrating well into the complete application. We eventually switched to the Apple CoreMotion framework, which proved to be successfully compatible with the application and provide us with the real-time data of steps.

Additionally, we experienced file loss in the later development stages which set back our timeline. As we were utilizing GitHub as our version control system, we had older copies of the files saved and did not have to re-engineer the app from scratch. This experience reinforced the critical importance of version control software in the software development process.

Chapter 16

Conclusion

The process of designing and developing this app was extremely valuable. Not only did we learn about important mobile development technologies, we were also able to gain insight into an impactful industry in the U.S. Working as a team throughout the year proved to be extremely rewarding, and we are grateful for the experience. We plan on eventually turning Solemate into a startup. Useful features will be added to grow the idea into a popular product. One of the features we hope to add in the near feature is a calibration run to test the runners current skill level. This way, more experienced runners will be placed on an initial level that corresponds to their ability. This feature may open the app to runners of various skill levels. Additional improvements include adding more metrics in order to provide more information to the user. This would give users a more comprehensive overview of their progress. We also hope to eventually extend beyond the C25K format and expand the type of running goals a user can work towards. For example, once a user feels comfortable running a 5K, they can start working towards a 10K. Another feature we plan on implementing is to incorporate personalization. Users should be able customize their run experience through music genre selections or adaptation to user feedback. We hope these changes will enhance the user experience and help everyone discover the joy of running.

Appendix A

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