Lab 1 - SuperU Overview

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Table of Contents

1. Introduction
   1.1. Background
   1.2. Societal Problem
   1.3. Solution Description
   1.4. Solution - SuperU

2. SuperU Product Description
   2.1. Key Product Features and Capabilities
      2.1.1. Mobile Client Application
      2.1.2. Cloud Architecture
      2.1.3. FitBit/SmartWatch API
      2.1.4. Administrator Roles
   2.2. Major Components

3. Identification of Case Study
   3.1. Who is the product for?
   3.2. What will it be used for?
   3.3. Who else might this benefit?

4. Glossary

5. References

List of Figures

Figure 1: Further Sleep Research

Figure 2: Current Problem Process Flow
Figure 3: Current Solution Process Flow

Figure 4: Generating Workout plan

Figure 5: Generating Recommended RPE

Figure 6: Database Scheme

Figure 7: Major function Component Diagram
1. Introduction

SuperU is an intelligent fitness app intended to help lifters increase their one rep maximum lifttable weight (1RM). The application can also be used by trainers who want to oversee their clients progress. SuperU will use data tracked by FitBit compatible smartwatches in real-time in order to be analyzed to help lifters improve their lifttable weight or 1RM. SuperU, in addition to collecting user data, will deploy algorithms to predict future progress for weightlifters and determine what weekly and daily exercise schedules lifters should follow in order to maximize their results.

1.1 Background

Many lifters encounter plateaus, where they fail to increase their lifttable weight for prolonged periods of time. Almost fifty percent of weight lifters' plateaus are caused from undertraining or overtraining [5]. According to a study involving 20 male weightlifters, these athletes improved in the 1RM in a supervised training environment [1]. According to the CDC, about thirty three percent of people fail to get enough sleep [2]. The US National Library of medicine that high stress training can hinder athletes performance by associated sleep deprivation [12]. Many weightlifters fail to take into account many critical factors affecting their performance.
1.2 Societal Problem

In the context of critical weight training, many lifters fail to take into account many critical factors that have been shown to heavily influence their performance. Some critical factor that affects performance including a lifter’s 1RM include:

- Lack of sleep
- Lack of proper guidance
- Ignoring critical target intensities (RPE)
In addition to recognizing critical factors that influence performance, weight trainers also fail to accurately track these parameters. Such data could be used to formulate decisions and allow lifters to take the best plan of action to most effectively and efficiently increase their lift. Finally, weight trainers often make non-optimal decisions in the context of workout which serves to cause the lifter to enter a plateau.

**Current Problem Process Flow**

![Current Problem Process Flow Diagram]

**Figure 2: Current Problem Process Flow**

1.3 Solution Description

A solution to these problems would include a way to make trainers aware of critical factors affecting their progress. However, even if trainers were aware of these factors, they would need a way to track them over time. A solution to this would entail a way for them to track their data and visualize it. Weightlifters would also need
assistance making decisions from the data in order to ensure they take the best actions from their current physical state. The final component required would be a way to generate workout plans for the user based on their training data history.

1.4 Solution - SuperU

SuperU is a mobile phone application that will highlight critical factors the users should consider when looking to increase their lift. Furthermore, SuperU will provide a powerful interface for users to track their training data and visualize it. Lastly, SuperU will use machine learning algorithms and other intelligent algorithms to tailor customized workout plans for the user which will be based on modern body-building research.

![Current Solution Process Flow](image)

*Figure 3: Current Solution Process Flow*

2. SuperU Product Description
Users will make an account similar to most applications, where they will answer a basic questionnaire that serves to establish what lifts that user will be looking to increase. Furthermore, the user will be baselined for a week in order to build up a sufficient amount of data for the workout plan algorithm to work properly. From there, users will wear a FitBit compatible smartwatch of which will track critical parameters such as sleep, heart rate, RPE, etc. The application will use data collected to generate workout plans for the user. The application will be available on Android initially but will be ported over to IOS devices. The goals and objectives of SuperU will include:

- Allow users to visualize and see tracked data.
- Create data profiles for users to allow for user data collection overtime
- Use Smartwatches to increase the amount of relevant data that could be used to make decisions.
- Hardware necessary (accelerometer/motion detection, heart rate monitor)
- Process data into proper routine algorithms

2.1 Key Product Features and Capabilities

The key product features and capabilities include the mobile SuperU client application, Firebase cloud architecture, the FitBit API and Firebase administrative functions. These features will allow for SuperU to function.

2.1.1 Mobile Client Application

The mobile application will have two major parts, one for weight lifters and one for trainers. Lifters will have the ability to visualize their progress and view their data history. Users will also be able to receive custom tailored workout plans generated by the workout plan generator component of the application. The workout plan generator will be comprised of several algorithms required to generate plans the lifter and will include:
- RPE generating algorithm using tracked parameters such as sleep, previous RPE, soreness, Previous 1RM.

- Daily workout generator (selects exercise, # of set per exercise, # of reps per set, and rest time between sets)

- A weekly schedule generator will use tracked parameters such as sleep, previous RPE soreness, previous 1RM to determine when the lifter lifts next.

The trainer will have access to the clients data for visualization purposes and will be able modify clients’ workout plans how they see fit.

Figure 4: Generating Workout plan
2.1.2 Cloud Architecture

The cloud architecture exists as a set of Firebase services of which include:

- Firestore - will serve as the primary database for user’s workout data.
- Functions - Will be where cloud code such as FitBit API calls will be made
- In-App-Messaging - is the Firebase feature that will allow SuperU to message its users through administrative roles.
2.1.3 FitBit/SmartWatch API

The FitBit API will serve as the interface for SuperU to access the users’ third-party smartwatch data. The FitBit mobile app will be able to pair with a user’s smartwatch. The smart watch will serve to capture large amounts of heart rate data and accelerometer data which can then be analyzed to understand how users are lifting and track progress in realtime.

2.1.4 Administrator Roles

SuperU administrative roles will allow for the maintenance and upkeep of the platform. Admin tasks will include actions such as adding or removing users, database repair or data migrations, and platform performance monitoring.

2.2 Major Components
The major components of SuperU can be broken down into Hardware and Software respectively. The hardware components include:

- Smartphone
- Smartwatch
- Google servers that host our Firebase instances

The software components of SuperU include:

- Android Studio IDE with Java
- Xcode with Swift (later on)
- FitBit API service
- Firebase Services
  - Firebase authentication
Lab 1 - SuperU Overview
Lab 1 - Draft

○ Firebase Firestore
○ Firebase Functions
○ Firebase In-App-Messaging

● Testing
  ○ JUnit
  ○ XCTest

● Local Database
  ○ SQLite

3. Identification of Case Study

3.1 Who is the product for?

The primary target audience for SuperU includes:

● Weightlifters
● Powerlifters
● Bodybuilders
● Personal trainers

3.2 What will it be used for?

The product will be used to allow for lifters to increase 1RM for a selected set of exercises.

3.3 Who else might this benefit?

Other possible individuals who might benefit from SuperU include:

● Non-athletes who are meeting job strength requirements
● Athletes for other sports who might benefit from strength training
● Trainers who want to track and visualize client data
• Data could by fitness industry to make calculated business decisions

4. Glossary

a. **Rating of Perceived Exertion (RPE)** - A way of measuring physical activity intensity level based on objective parameters and the person's experience[1].

b. **One-Rep Max (1RM)** - The maximum amount of the weight you can lift for a single repetition of a given lift[1].

c. **Weightlifter** - One who lifts heavy weights for exercise, muscle strengthening, or athletic competition.

d. **Plateau** - State where a lifter fails to improve their 1RM.

5. References


