Lab 1 - SuperU Overview
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1. Introduction

SuperU is an application that provides lifting guidance and other training information in real-time. The difference between us and our competitors is that we collect data in real time. It also creates a custom tailored workout plan from the user based on the data that is collected from the smart device/wearable. We will be using a Fitbit as our wearable and we will be using their API. By using their API we will be able to track the user data, upload it automatically, and create a routine for the user.

When training competitively in weight lifting it is best to have a trainer to be able to make sure you're performing/training at a progressive rate. It is difficult to train on your own and studies have shown that people who have a trainer usually have a higher one rep per max and those who trained on their own tend to usually plateau later in their training. Another common problem with training alone is that one might overtrain or undertrain. Figure 1 shows how a trainer can impact one's progress through a problem process flow.

Figure 1. Current Problem Process Flow
Another factor that should be taken into account when it comes to training is sleep and a plethora of people don't take this into consideration and this could increase their chances of getting hurt. This can also affect one’s recovery too if you don't get the proper amount of sleep. The CDC says that 1 out of 3 people don't get enough sleep from a day to day basis. It's also common knowledge that it's difficult to train when tired. More info will be provided in Figure 2.

![Figure 2. Further Sleep Research](image)

Research has shown that sleep deprivation can be detrimental to one's health. Some of the side effects are mood swings, loss of motor function, and reduced cognitive performance. This can overall affect one's lift and can cause plateaus in your training.
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Not everyone has access to a trainer, this is where Super U comes into play. Our program will have a learning algorithm that will be tailored towards the users based on their RPE, heart-rate, and other health factors. This will make sure that our client/user will have all the tools needed to reach their overall goals.

2. SuperU Description

The data that will be collected for Super U will be inputed via the user and it will also be based on the data collected from the wearable. Some static information that will be collected is height, weight, resting heart rate, and sleep patterns. The data will be collected during the routine and be updated weekly and monthly. Another important set of data that will be collected is the one rep max. This will be measured with the RPE and heart-rate during each exercise.

The wearable is a crucial aspect of the application without the data collection the app is pointless. The most important fact is that the wearable that is being used must work in tandem with the Fitbit API. This is because we will be using some important features in the API. The wearable will also have to work fluidly with our application so that it can alert the user with information during their routine such as timers, and rep and set counts.

The purpose of SuperU is to grab the data that is inputted by the user and recorded into a server. It will then generate an algorithm. It will then provide a routine for the client/user which will include pictures for each workout. The user will then be able to track their data and progress on their profile page. View our solution in Figure 3.
2.1 Key Product Features and Capabilities

The overall process of our application is very straightforward. Most of the work is already done by the wearable since it collects all the information needed from the user. A routine is then processed through an algorithm through the Fitbit API. After the data is put through that algorithm it is then put into an interpolation algorithm. With this algorithm we will be able to calculate the RPE for the user. After this the data is put into one more algorithm which will then generate the weight you want to lift, number of sets, number of reps, and RPE. This can be shown in Figure 4 and 5.
2.2 Major Components

The diagram in Figure 6 below discusses how important the API is to our program. It shows the process flow and overall shows how it works with the servers and our main application. By following the chart you are able to track the data imputed to a generated workout plan.
2.2.1 Mobile Application

Our platform will be mainly used on a mobile device via a mobile application. In the application the user will input their data and it will be stored onto a server. After this the data is put through two separate algorithms. One is for workouts and the other one is for progress prediction. The app will also allow users to compare each other's progress and predicted process.

2.2.2 Smartwatch Connection and FitBit API

The use of the wearable is important for the data collection for the app. It is important that the wearable have features such as a functional accelerometer and heart rate monitor. These are key data measurements that are taken from the wearable. The only other feature that is important when it comes to the weable is that it can work fluidly with the Super U application. We would like to incorporate features where it makes it easier for the user to view their reps and sets during the workout without looking at their smartphone.

2.2.3 Cloud Server and Server-Side Database

The cloud server plays a pivotal role in our application because this is where we store all of the information that we can gather. Using the server is not difficult because it works directly with the Fitbit API. The user will then be able to input the data and the data is then processed into an algorithm. Through this algorithm workout routine will be generated and the user will be able to track and meet their goals in an efficient manner. View Figure 7 for more information on this.
2.2.4 Testing

Our software development team will implement unit testing during the development of our app. Our application will be written in both Java and Swift. The way we will be implementing unit testing is with JUnit and XCTest. By using JUnit we will be able to inform the test failures quicker and it can be easily modified for the needs of the tester. A more compatible unit testing framework that works well with Swift is XCTest. Using this framework will give us the same benefits that JUnit does.

3. Identification of Case Study

The main demographic of the SuperU applications are powerlifters and weightlifters. This will give the casual/serious weightlifters to keep track of their progress without a trainer.
SuperU will use real-time data and a learning algorithm to give you the same reliable workout routine as a trainer would. Another feature we will have is the option to have a real-life trainer assigned to a given user. The trainer will be able to track the users in real time with their wearable and they can generate routines for the user as well based on the data that is provided to them. The last piece of the puzzle is the stakeholders. The gym owners are the stakeholders in this scenario. They will do this by partnering up with a gym and provide SuperU as a service. With this service trainers will be able to use this app and can easily help out a person with their workout with ease.

**User Roles and Stakeholders**

**Users:**
- **Weightlifter**: Individual that trains to increase their lift.
- **Trainer**: If enabled, analyzes the progress and workout plan generated by the algorithm and is able to modify the workout plan for the weightlifter.

**Stakeholders:**
- **Gyms**: The gym will hire trainers and distribute the application to them.

*Figure 8. User Roles and Stakeholders*

### 4. SuperU Prototype Description

The prototypes that we will be developing will be similar to our final product. The data that we will be using for the prototype will be the users weight, height, and their limitations with
lifting a certain amount of weight. Figure 9 covers the similarities between the prototype and final product.

![Real World Product vs Prototype](image)

**Figure 9. Product vs. Prototype**

### 4.1 Prototype Functional Goals and Objectives

The goal of our prototype is to be able to take in a wide range of data and be able to produce a work out plan for the selected user. In this plan they should be able to provide their current and future goals. We will provide a future that will let the user get into contact with a trainer to give them more information if they wanted to. The trainer will be able to view all the data that has been inputted by the user. This will give the trainer the ability to adjust the users plan if they see a need for it. Our prototype will also be able to work with the Fitbit API. This will give the user a wider range of wearables to choose from. In the final product we will allow backend capabilities that will give us the ability to do maintenance on our databases.
4.1.1 Simulate real-world data

The data set that we will be using will be the one provided by the user. This will give our team a wide range of data to work with because everyone has a different body type. This can range for workouts that involve power lifts to someone who has limitations like asthma for instance. The other data that will be collected consist of your sleep pattern and heart rate.

4.1.2 Produce a simulated routine based on dataset

The data that we will be using will be a fake data set that will help us run a trial test. The data will be run through our algorithm and it will produce a routine for the client. This will all be generated through the fake data set that is provided by our testers. We will double check our work by doing the calculations by hand for the prototype just to make sure we get the right output.

4.2 Prototype Architecture (Hardware/Software)

The hardware that we will be using for the prototype will be a smartphone or any smart device and it will work in tandem with the Fitbit device via the Fitbit API. This will be used during our trial period and it will also be used in our final product. The first run will be with fake data sets while the actual run will include the users data. The program will be developed for android devices using Javascript. The IDE that we will be using is Android Studio. During our trial period we will mainly be focusing on Android, but in our final release we will also be releasing it on IOS. Other software we will be using during this development is Firebase Firestone. Firebase Firestone and Firebase web servers will be our main database and will give our team the ability to have access to their cloud and in app messaging capabilities.
4.3 Prototype and Capabilities

The final product will be very similar to the prototype with a few exceptions of some additional features we might add later down the line. The main purpose of using a wearable to monitor your heart rate during the workout. When you are also sleeping the wearable will keep track of your sleep pattern. Based on all the data that is provided to the app a routine will be generated for the user. You will also be able to get notifications/ alerts that will keep you updated on your progress. This will be incorporated in the form of a workout reminder and will be very useful throughout the week.

4.4 Prototype Development Challenges

The biggest challenge that we will face is the design of the app. It's difficult to come up with a fluid UI from scratch. One of the complications that we have ran into is whether we should incorporate a test harness or not. The next is how we would simulate a test trial. It's difficult to take into account the wide range of body types. We will surely run into some discrepancy if two clients had the same body weight and height but different builds. The biggest problem that we took into consideration was whether or not we needed to use the Fitbit API. This is because we will be limited to a certain range of wearables if we go through with this route. This is why we have taken into consideration making our own API.
5. Glossary

- **Rating of Perceived Exertion (RPE)** - A way of measuring physical activity intensity level based on objective parameters and the person’s experience[1].
- **Rating of Perceived Exertion (RPE)** - A way of measuring physical activity intensity level based on objective parameters and the person’s experience[1].
- **One-Rep Max (1RM)** - The maximum amount of the weight you can lift for a single repetition of a given lift[1].
- **Weightlifter** - One who lifts heavy weights for exercise, muscle strengthening, or athletic competition.
- **Plateau** - State where a lifter fails to improve their 1RM for a long period of time.

6. References


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