Get Fit Right Project Report

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I Project Description

The *Get Fit Right* is a technology which utilizes motion capture to analyze the movements of a user while performing an exercise. *Get Fit Right* has two modes. A smart phone only mode which relies on the phones camera to track the user and give feedback. The second mode utilizes special body suits with built in sensors to connect to the phone and give more accurate data regarding the user. The second mode uses the data from the body suit and the smart phone to provide feedback. If a user is only lacking form, then the application will be able to advise them on what they're doing wrong. If the error lies in a stiffness within the body, or lack of mobility, then the application will also be able to spot that and advise the user a plan to increase mobility in the problem area. The purpose of the device in general is to provide feedback to a user on the based on their movement to improve performance, increase mobility, and keep them safe during the duration of the exercise.

1 Project Overview

The use of improper form during many of the more complex exercises – Deadlift, Squat, Snatch – can lead to injury. The goal of our simulator is taking a user through the exercise in a safe, comfortable environment where the risk of injury is as minimized as possible.

2 The Purpose of the Project

This project is being done to combat a variety of problems, such as injury prevention, and to improve performance.

2a The User Business or Background of the Project Effort

We are working with Nike, which is an athletic apparel and equipment business, in order to develop the Get Fit Sim application. The application suits, which users will be able to wear, will be developed by them as well. The application was made with the intention of mitigating the amount of injury created in the gym. Nike sells products which are meant to improve an athlete's performance. The creation of this application will allow Nike to sell shirts and pants that are meant to be captured by our motion capture software. The user will be able to utilize that product in the gym and receive accurate useful feedback on their weightlifting activity and improve because of it. Not only do we aim to battle injury and improve performance, but we wish to make an application readily to anyone who wishes to improve their technique. Therefore, we made the motion capture technology to work with just an ordinary smartphone. There is a plethora of terrible advice floating around in the wellness community, and most everyone knows of someone (or is that someone) who deals with gym anxiety because they don't know if they're doing something right. For this reason, we wanted to put that power in the hand of our users, and make precise, useful information readily available to anyone who wants to make a difference in their health.

2b Goals of the Project

Our client, Nike, has just as much to benefit from their involvement in our technology as the users will. Our technology utilizes a smartphone for our motion capture technology, however, it also utilizes specialized shirts and pants that are created by our Client. The cost of a new workout outfit is far less than that of a personal trainer. The product is being made in order be the premiere choice for a user of any kind looking to improve their physique, or performance. We want to be able to give instant feedback to any user who utilizes our application. It should be intuitive, easy to use, and provide real usable advice.

2c Measurement

Our app will have the ability for users to enter the height, weight, and test for flexibility. Upon the first use of our application, the Get Fit Sim will administer a test in order to track where our users starting point is. Upon utilizing the application, one will be able to check in on their progress since every time they use it, data is collected. Improvements are measured and displayed in an easy depict visual representation. Once users see the results, we will be able to measure the success of the apps by the frequency that they use it, and by the reviews they leave on the IOS/Android respective app stores.

3 The Scope of the Work

An application that allows people with any type of workout experience to correctly and safely workout by notifying them when performing an exercise incorrectly.

3a The Current Situation

There are already lots of fitness apps out there for people to use to help them get fit and stay healthy. From running apps that track your time per mile to apps that track how much water you drink or food you eat. The current issue with this apps is that they don’t alert the user when they are working out incorrectly, leading to unsafe workouts, resulting in unwarranted injuries when working out.

Our solution consists of an application that uses a client’s camera to track posture when working out and alerting them when their posture is incorrect thus avoiding unsafe workouts. By improving user experience when working out it allows our clients to work out without worrying about technique and focus on what really matters about working out, getting healthy. 3b

3b The Context of the Work

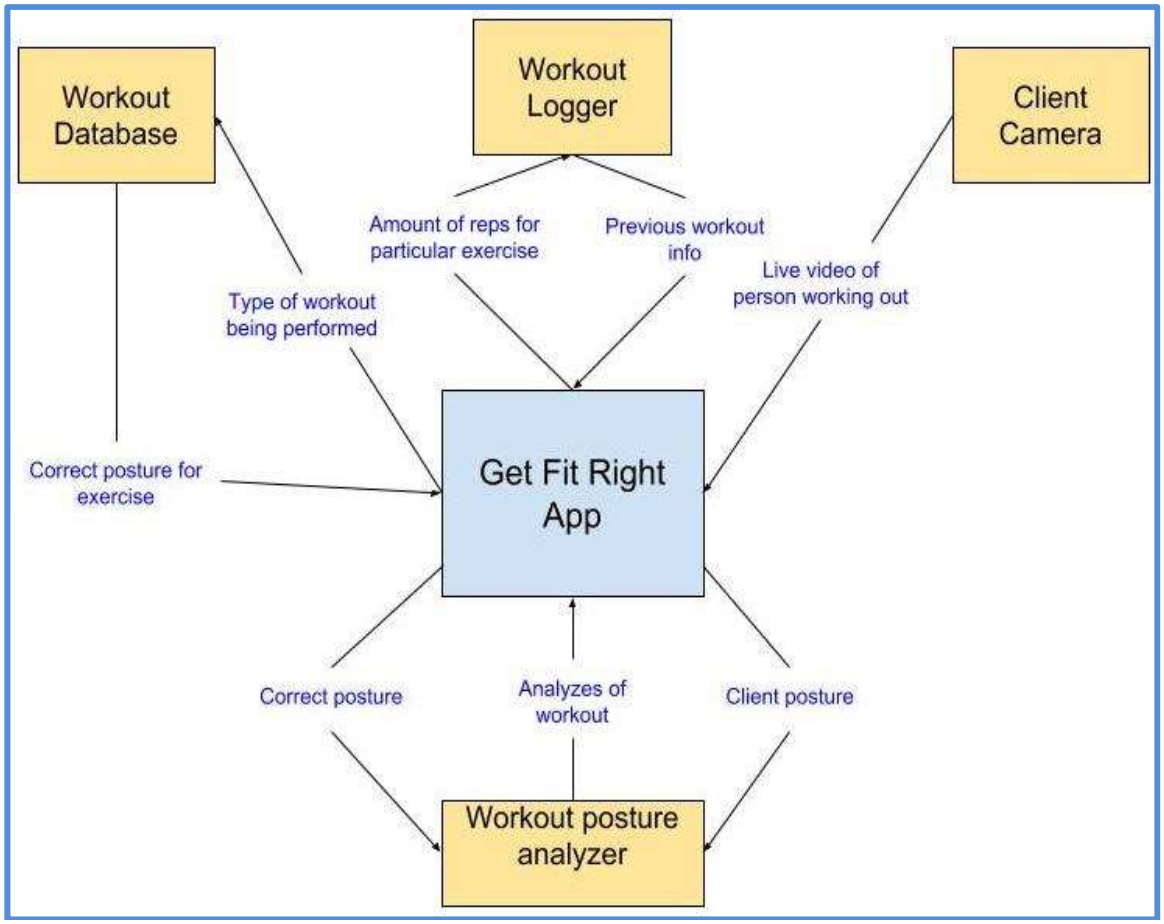


Figure 1 - Context of Work

3c Work Partitioning

Event Name	Input and Output	Summary
Workout database determining type of workout	Type of workout (out)	Sends the type of workout so to be able to receive the posture of the exercise.
Workout database knowing the workout	Posture Info (in)	Sends the information for the type of posture needed for that exercise.
Client camera video	Live video of workout (in)	Video received from camera that will be used to determine if posture is correct.

Posture video analyzer	Posture info and live video of workout (out)	Receives both the correct posture info and the live video of the workout that will be compared to inform the user if his/her posture is correct.
Posture video analyzer result	Update of workout (in)	Update to the app that will notify the user if posture is correct in live time based on results from the analyzer.
Exercise logger	Exercise Info (out)	Sends the amount of exercise and other data gathered the user did to cloud storage system so that user can access data from any of his/her devices.
Exercise history	Exercise Info (In)	Retrieves the previous workout sessions info so that user sees progression over time.

3d Competing Products

There are currently many applications available to help people get into shape and teach them new exercises, but none of them notify the user if they are correctly performing their workout. The current selection of applications offer the user no notifications in real time to inform them if they are correctly performing the exercise, thus putting people in danger of needless injuries. Most of these applications just offer videos or images of the workout to the user, completely ignoring people's safety when performing new exercises by offering live feedback to the user based on their posture.

4 The Scope of the Product

The main idea behind this product is to be able to tell a user if the workout that he or she is performing is being done correctly. This is done using a person's smartphone and capturing video of them working out and instantly notifying them if they are doing their workout using good or bad technique. Also included in the application will be a workout logger that helps the user lookup previous workout and what type of exercises were performed that day and other valuable information like the amount of repetitions and if the workout was done using the correct posture and technique.

4a Scenario Diagram(s)

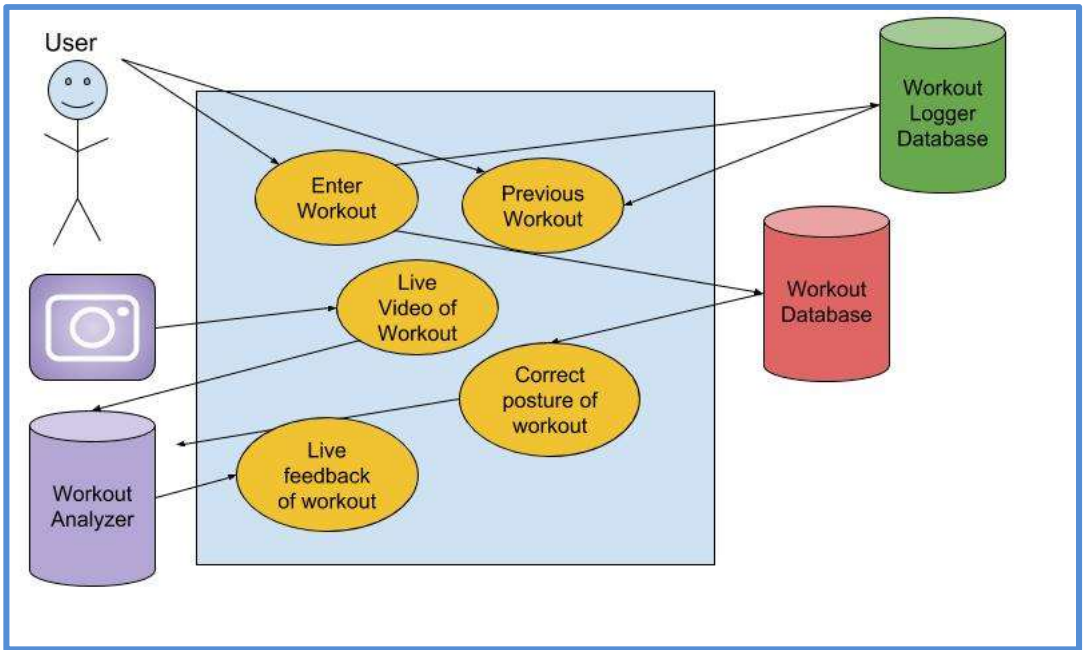


Figure 2 - Project Scenario

4b Product Scenario List

1. Initial Startup
2. Starting a workout
    a. Using Smartphone camera
    b. Live feedback of workout
3. Looking at previous workouts

4c Individual Product Scenarios

1. **Initial Startup:** John decides to run Get Fit Right app on his smartphone. He has received as a gift for his birthday a set of weights, problem is that he doesn't know if he is correctly performing his workouts. So when he opens the application for the first time John is asked to input his current vitals and measurements. After he enters his information he is given the option to start a workout or to look at previous workouts.

2. **Starting a workout:** John decides to start a workout so on his smartphone he selects this option. By doing so John will receive notifications on his phones screen in real time as he works out displaying whether he is correctly performing the workout based on his posture and comparing it to the correct posture. John also places his phone in at an angle that records his workout for the analytical part.

a. **Using Camera:** By using his camera John is recording his workout and its being analyzed in real time using machine learning on the local device and it will notify him if the workout is done correctly.

b. **Receiving Feedback:** John has completed a set of repetitions for a barbell squat. He looks at his phone and proceeds to hit the "DONE" button. The app then takes a second to process all of the data, and then displays a list of analyses of John's set. After John sees the analyses, the app then creates recommendations based on John's performance. The app recognizes that John's form quickly turned bad after rep 4 out of 8, therefore the app recommends John to use a lighter weight for the next set in order to avoid injury. John presses "CONTINUE" on the app and moves on to the next set to use tos the s

3. **Looking at previous workouts:** John doesn't feel like working out today, but instead wants to reminisce about last Tuesday's workout. He wants to see how many squats he performed. Along with how many squats he did John can also see how much weight he squatted that day along with data that shows if John performed his workout correctly based on the analysis that was done that day.

    a. **Retrieving Data:** John decides to use his computer one day because his phone broke to view last weeks workout data and is able to because his data was sent to the cloud so that he can access it from any of his devices and doesn't have to worry about it getting lost which makes John very happy since he can show his workouts to other people from anywhere in the world on any device connected to the internet.

5 Stakeholders

5a The Client

The client is Nike Incorporated, a multinational corporation that is a leader in the design, development, and manufacturing of footwear, apparel, equipment, accessories, and services.

5b The Customer

The intended purchasers of this product are professional sports teams, gym owners, and personal trainers. Any individual who helps others improve their fitness is a potential customer.

5c Hands-On Users of the Product

Professional Athletes: Athletes will use this app to improve their overall performance. From tracking a throw from the quarterback to the swing of a power hitter, the app will provide feedback on the essential skillsets of an athlete in any sport. Professional athletes are already at a master level in their fields, but this will allow them to further

practice their "textbook" skills, so that they can make "textbook" plays. Athletes already use high tech technology for their training, and this will be a perfect add-on to their training options. Since their technological experience is already at a master level, using any kind of new technology will be a breeze. Apart from improving their in-game skills, athletes can also use this to assist with their weight training and agility workouts.

Gym Goers: There are varying levels of gym goers. There are fitness buffs, who walk around the gym with their duffel bags and their protein shakes to take before, during, and after their workouts. Their knowledge of fitness and exercise ranges from a journeyman to a master level. These types of people are looking for that something extra to make them lose that one percent of body fat or make them hit their next PR (persona record). The other subgroup are the regular gym members. Their knowledge of fitness and exercise ranges from novice to journeyman. Gym goers would use this app to ensure they are performing the exercises with proper form and repetitions. The technological experience of this group varies from novice to master. The older gym goers tend to be novices, while the younger gym goers tend to be masters.

5d Maintenance Users and Service Technicians

There would be a team of software developers that maintain and update the app, add new features, and resolve bugs that are discovered by the users. Another team would be required to service the hardware aspects of this product. The hardware team would make changes and create new designs of the clothing pieces, as well as troubleshoot any issues that arise in either connectivity or usability of the product. Ideally, there would be an employee at every Nike store who was trained to help with issues regarding this product.

5e Other Stakeholders

Patent lawyers: Lawyers will ensure that others do not steal our ideas and products. They will follow all rules and regulations and prevent the company from intellectual property infringement.

Fitness Professionals: Provide data for our exercise database. Give us baselines on how to perform a certain exercise. These can include coaches, trainers, doctors, and scientists.

Google Fit, MyFitnessPal: Current popular fitness apps that would need to add new features to keep up with *Get Fit Right*. These apps only cover limited amount of our features and tend to serve the same audience.

Adidas, Under Armour: These companies would need to create a similar app to keep up with Nike which is one of their main competitors. Adidas recently lost its NBA contracts to Nike. To avoid further losses in business these companies would need to invent new products.

5f User Participation

Professional Athletes: Athletes can suggest different actions and maneuvers that they would like special training on. Preferably specific skills that can't be assessed manually.

Gym Goers: Gym goers can test out the preliminary versions of the UI to give feedback and suggestions to the developers to create a better UI for when the product launches.

5g Priorities Assigned to Users.

Key Users: Gym Goers (80% of users) – Gym goers will be the primary users of this app. These are the users that need the most feedback on their exercises as a lot of these users are in the novice to journeyman level of expertise on the topic.

Secondary Users: Professional Athletes (20% of users) – Athletes don't require the same level of assistance and feedback as gym goers do. Their use for this app is more of an additional tool to improve and track their performance. This app won't be their primary tool for improvement, so it is better to spend more time developing towards the gym goers.

6 Mandated Constraints

This section describes constraints on the design of the product. These constraints have been mandated by the client at the beginning of the project before the full set of requirements had been determined and are set in stone. Any other solution that does not follow these constraints are unacceptable.

6a Solution Constraints

Description: The software of the product shall be available on the Apple App Store and the Google Play Store.

Rationale: The client wants as many customers as possible to be able to use the base version of the application without having to purchase additional hardware.

Fit Criterion: The product shall be compliant with Apple and Google guidelines and requirements in order to be available on each respective app store.

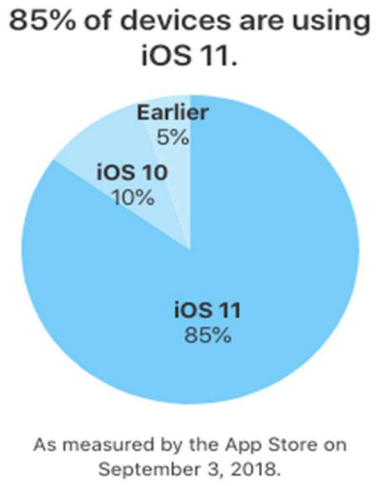
Description: The software of the product shall be downloadable on a minimum of 85% devices for each respective app store.

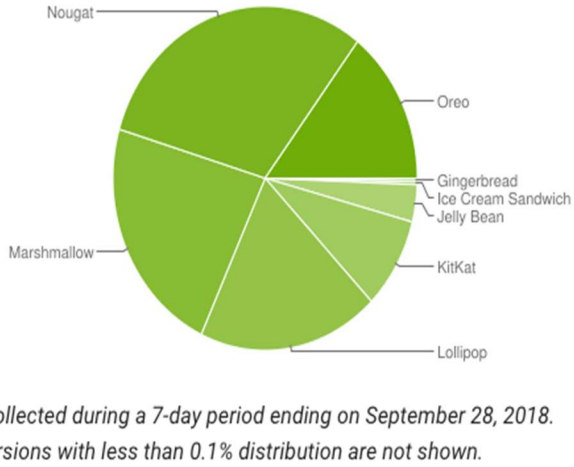
Rationale: The client does not want to limit its user base simply on what version of iOS/Android OS the customer's device is running.

Fit Criterion: Percentage distribution of devices and operating system versions can be found on Google's and Apple's distribution dashboards:

Apple: https://developer.apple.com/support/app-store/

Google: https://developer.android.com/about/dashboards/





Description: The wearable technology available in the advanced system must be compliant with United States clothing guidelines and regulations.

Rationale: The advanced system of the product will only be sold within the United States; therefore, it must follow guidelines set by the government.

Fit Criterion: Must follow all regulatory guidelines through the Federal Trade Commission under the Textile and Wool Acts.

6b Implementation Environment of the Current System

The iOS version of the application must be developed using Swift and not Objective-C.

Swift is given preference over Objective-C due to the fact that the latter is an outdated technology that is more is more prone to error than the former.

The Android version of the application must be developed using Java and not Kotlin.

Java is given preference over Kotlin due to the fact that the former is a very well-known language throughout the world as compared to the latter. According to the client, Kotlin is too young of a language to be used in an enterprise application.

6c Partner or Collaborative Applications

External applications with which this product must be compatible with include the Apple Health app and the Google Fit app.

These are the applications that are maintained by the owners of the operating system the product will be supported on, therefore there is a greater chance that the user utilizes these applications.

The product must be able to read in user data from these apps, but also be able to update the data by writing to these apps. This has been mandated to allow the user to easily monitor and track his/her progress in parallel with any other third-party application that is also compatible with Apple Health and Google Fit.

6d Off-the-Shelf Software

The product must implement Adobe Acrobat Reader.

This is required to print an editable PDF of the user's data and progress through the most commonly accepted means of distribution.

Adobe Acrobat Reader is a free software tool used to read PDF documents. Files are handled differently depending on the operating system, and the client does not want to alienate a certain population of customers simply on the operating system he/she prefers. This also allows the customer to share necessary data easily with his/her trainer or primary care physician without worry since PDFs and Adobe Acrobat Reader are not reliant on a license, like Microsoft Word and Excel are.

6e Anticipated Workplace Environment

The general description of the workplace is an open floor environment that allows the user to easily and freely perform the desired exercise within adequate range of the sensory camera. Environments include, but are not limited to recreational and professional gyms, physical therapy offices, and any environment that is deemed safe for the pursuant activity.

The workplace is noisy; therefore, notifications must be visible and audible at a high enough frequency to be seen and heard.

The workplace is large; therefore, the application must be able to accurately measure distance from the user.

The workplace is potentially dangerous; therefore, the application must not distract the user from being aware of his/her surroundings.

The workplace is fast paced; therefore, the application must be able to track and distinguish the user and his/her equipment from others.

6f Schedule Constraints

A working demo of the application must be presented to the client every 3 months to show what progress has been made, and whether certain functionality must take precedence over others.

The final release of the applications on the App/Play Stores and the release of the apparel has been planned for the end of 2020 to meet the needs of the client.

Once the apps have been released, frequent updates to the applications must take place to fix bugs and optimize the applications on future operating system upgrades.

6g Budget Constraints

The client has proposed $100,000 to successfully create the applications for iOS and Android, and another $100,000 to successfully create the apparel that will be used for the advanced system of the application.

Based off estimates from http://howmuchtomakeanapp.com/ this budget is very realistic to build this product.

Factors that have been considered for the budget constraints include developer and designer salaries, infrastructure costs for the machine learning database, and warehouse rent and employee maintenance for the apparel.

7 Naming Conventions and Definitions

7a Definitions of Key Terms.

Below is the list of some of the most important words which include acronyms and abbreviations. See the glossary at the end of the document for a complete list.

"Textbook" – When something is executed perfectly it can be described using this word.

PR – Personal records. Common uses is when an individual reaches a new weight on a lift or a runner completes a race beating their own personal record.

Other important keywords will be added as necessary.

7b UML and Other Notation Used in This Document

This document generally follows the Version 2.0 OMG UML standard, as described by Fowler in [4]. Any exceptions are noted where used.

7c Data Dictionary for Any Included Models

All data would be stored in tables in the back-end database.

Table 1: User Profile Data

Fields: Name, Age, Sex, Date of Birth, Weight, Height. Activity Level (On a scale of 1-4 how active is a user)

Table 2: User History Data

Fields: Activity, Duration, Reps (If applicable), Sets (If applicable), Accuracy (Percentage of how accurate the activity of performed), Suggestions (Future actions suggested to the user)

Table 3: Exercise Data

Fields: Name (Name of exercise), Category (Under what general category does this exercise lie), User type (Which user is this meant for), Suggestions (List of suggestions for this exercise), Accuracy Info (Evaluation metrics for this exercise)

Other tables will be added as necessary.

8 Relevant Facts and Assumptions

8a Facts

iOS code written in Swift must be in Xcode and Xcode is only available on Mac OS.

Android code written in Java must be in Android Studio and Android Studio is available on all platforms.

Android applications use Material Design, while iOS applications use Human Interface Design.

Every smart phone camera has a different number of front-facing megapixels. smart

Men and women sizes are labeled differently.

8b Assumptions

Cotton is the best well-rounded material to use when making clothes.

The user already owns an iOS or an Android OS device.

Certain open-source machine learning APIs are already available to integrate and expand upon within this application

User data is readily available through the Apple Health app or the Google Fit app.

Monetary resource disbursements are released at the end of every demo update with the client.

The product cannot move on to the next stage after a demo update if functionality or aesthetic implementation does not please the client.

II Requirements

9 Product Use Cases

9a Use Case Diagrams

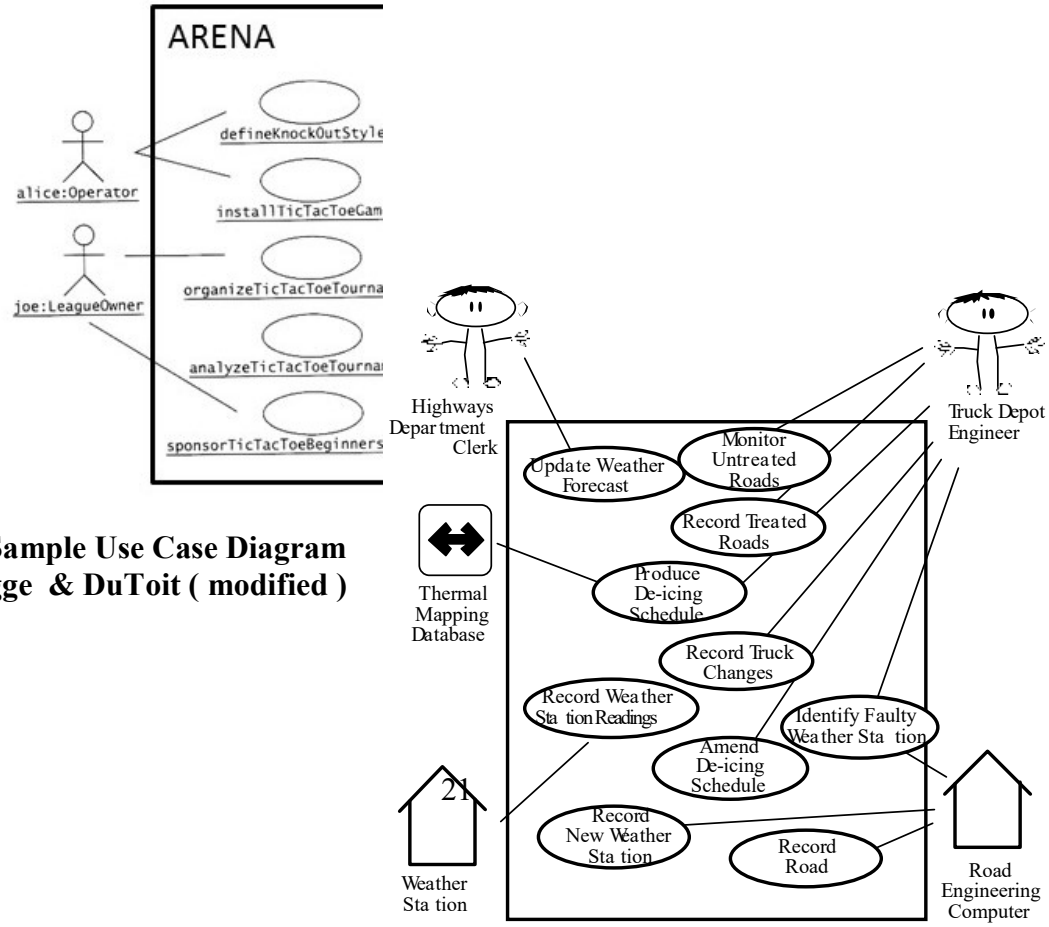


Figure 3 - Sample Use Case Diagram from Bruegge & DuToit (modified)