PiSonal Trainer: Weight Lifting Performance Tracker

Software Requirements Specification Version 0

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Revision History

Date	Primary Author	Comment
04/01/2017	Birunthaa Umamahesan	Final editing and proofreading for revision 1
10/12/2016	Micaela Estabillo	Final editing and proofreading for revision 0
10/12/2016	Birunthaa Umamahesan	Update project drivers and project constraints
10/12/2016	Simarpreet Singh	Update functional requirements
10/11/2016	Micaela Estabillo	Adding non-functional requirements
10/7/2016	Micaela Estabillo	Initial skeleton version

Table 1: Revision history

1 Project Drivers

1.1 The Purpose of the Project

1.1.1 The Background of the Project Effort

There are many fitness-tracking apps that people use to track their daily fitness routine and dieting habits. However, the available fitness apps and wearables only go as far as keeping track of heartbeat, calories and steps. This may be sufficient for cardiovascular exercises but when it comes to muscle training, it is still common for people to use the traditional method of logging their progress in a book (i.e., a user might log their workout to keep track of the weights they are lifting to evaluate performance). Using this method requires the person to take note of the weight used, the number of repetitions and the sets completed. To date, there is no application that automatically calculates and summarizes a user's personal record for a specific muscle-training machine, and everyone must make note of their performance after they have completed their workout.

1.1.2 Goals of the Project

We are going to device a tool that integrates and reports a user's performance on a training machine to a smartphone application. We want to enhance the user's training experience by eliminating the need to manually record their performance.

1.2 The Stakeholders

1.2.1 The Client

The prospective clients for this application will be gym owners or managers who would like to incorporate its functionality into their gym to enhance user experience, and to encourage more clients to sign up for their gym.

1.2.2 The Customer

The PiSonal trainer is designed for gym members, specifically for users who undergo muscle training using weights. It provides gym members the ability to train using weighted equipment without the need to manually track their performance.

1.2.3 Other Stakeholders

Other stakeholders of this project include:

- Project supervisor - Dr. Christopher Anand
- Developers and testers – Simarpreet Singh, Micaela Estabillo, Birunthaa Umamahesan
- Beta testers
- Prospective gym owners or managers

1.2.4 The Hands-On Users of the Product

1. **Gym members/clients**
    - *Priority*: Key users
    - *User Role*: These users will use the product to perform their workout in view of the camera, use the application to send their performance results to the server, and then view their workout summary using their mobile phone application.

- *Subject Matter Experience*: These users can be categorized as novice, as they do not need prior knowledge of the machines and equipment. The user may be a new trainee at the gym but their fitness routine would not be impacted.
- *Technological Experience*: The technological experience of the gym members can also be considered novice. The application will require initial training for setting-up the system and performing the routine in front of the application's camera. There would be no further training required.
- *Other user characteristics*: There are some essential characteristics that the user should have in order to successfully use this application:
  - Should have a smartphone with internet connection
  - Fundamental understanding of how to use a smartphone application

2. **Gym Trainers and Managers**

- *Priority*: Key users
- *User Role*: These users will use the application to see how well it fits into their business scheme. They will also scope the product with future features and enhancements.
- *Subject Matter Experience*: These users can be categorized as masters, as they have complete understanding of the functionality of the machines and equipment in the gym.
- *Technological Experience*: The technological experience of this user can be considered masters. They will be required to know how to function the PiSonal trainers within the gym so they can help support the gym members if required. The only knowledge required would be the initial setup of the system to start training.
- *Other user characteristics*: There are some essential characteristics that the user should have in order to successfully use this application:
  - Should have a smartphone with internet connection
  - Fundamental understanding of how to use a smartphone application.

3. **Developers and Testers**

- *Priority*: Secondary users
- *User Role*: These users will develop the application and perform end-to-end system testing. The developers and testers will verify that each use-case and feature in the application works as per the requirement needs.
- *Subject Matter Experience*: They will have complete knowledge of the business needs and requirements, hence they will be considered masters of this subject.
- *Technological Experience*: They will be the masters in technological experience. They will know the code structure of the application thoroughly. Also, they will have complete understanding on the application's infrastructure and other technologies used in the application.
- *Other user characteristics*:
  - Advanced knowledge of the code base
  - Advanced knowledge of Android and iOS framework
  - Assess applications performance and functionality from an engineering perspective
  - Complete knowledge of all the use-cases and expected outcomes of the application

2 Project Constraints

2.1 Mandated Constraints

2.1.1 Solution Constraints

Constraint #: 1

Description: The user activate the camera to recognize the weight

Rationale: The user can select the "log using camera" option in the application to trigger the camera to turn on and detect the weight.

Fit Criterion: Must be approved by tester and developer. They must confirm that the camera gets activated once user selects the "log using camera" option.

Constraint #: 2

Description: The data from user's routine must be sent back and stored

Rationale: The end results of the users training session must be stored to the backend database so the user can retrieve it when required

Fit Criterion: Developers and testers must approve the application. Thorough testing will be done on both platforms.

Constraint #: 3

Description: The application must run on iOS or Android operating system

Rationale: To accomodate both iOS and Android smartphone users

Fit Criterion: Developers and testers must approve the application. Thorough testing will be done on both platforms.

2.1.2 Implementation Environment of the Current System

N/A

2.1.3 Off-the-Shelf Software

OpenCV-Python OpenCV-Python is a library used for solving computer vision problems. This library provides a ready-to-use API for image processing algorithms. The PiSonal Trainer camera will leverage this techonology to write specific algorithms to track the motion of the gym equipment.

React Native React Native is a framework for building cross-platform mobile applications. Using this framework requires the developer to only write code once while being able to build the application for both Android and iOS. React Native code is written in Javascript. The use of this techonology is essential to building the PiSonal Trainer application for the majority of mobile phone users.

2.1.4 Anticipated Workplace Environment

The users will be using this application in a gym, where it is typically loud and distracting. Hence, the UI of the application will be designed such that there will be minimal need to read in order to understand. Specifically, the UI will have pictures and graphs with less text so that it is simple and straightforward design. This will make the application user-friendly and simple to use.

2.1.5 Schedule Constraints

The final deadline for the project is April 5th, 2017. The detailed deliverables and their respective deadlines are listed in the following table.

Deliverable	**Date**
Requirements Document Revision 0	October 12th, 2016
Proof of Concept Plan	October 26th, 2016
Test Plan Revision 0	November 2nd, 2016
Proof of Concept Demonstration	November 21st-25th, 2016
Design Document Revision 0	January 11th, 2017
Demonstration Revision 0	February 13th-17th, 2017
User's Guide Revision 0	March 1st, 2017
Test Report Revision 0	March 22nd, 2017
Final Demonstration Revision 1	Mid-April 2017
Final Documentation Revision 1	April 5th, 2017

Table 2: Project Timeline

3 Functional Requirements

3.1 The Scope of the Work

3.1.1 The Current Situation

There is currently no existing software that tracks muscle training. A system that integrates with gyms and its members' devices is needed in order to track muscle training workouts as they happen. This system will use a camera that is capable of image processing and detecting a user's performance, and an iOS/Android mobile application that can display statistics from the collected data. The mobile application will include data storage, workout history, and a Quadratic Residue code scanner for gym equipment.

3.1.2 The Context of the Work

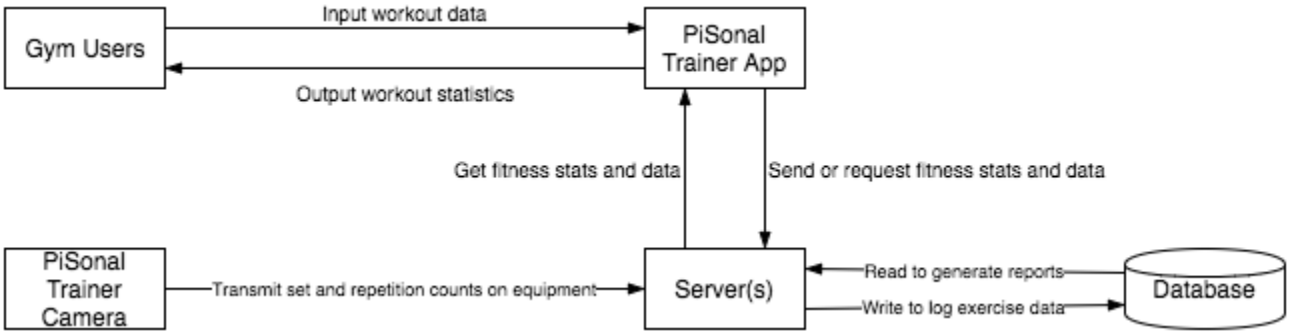

Figure 1: Context of the Work

3.2 Business Data Model and Data Dictionary

3.2.1 Business Data Model

N/A

3.2.2 Data Dictionary

Name	**Content**	**Type**
User	User Identifier	Class
Exercise	Exercise Identifier	Class
Equipment	Equipment Identifier	Class
Weight	Weight Identifier	Class
Station	Station Identifier	Class
User Identifier	Username and Password	Attribute/Element
Exercise Identifier	Exercise name, Muscle groups, Equipment assigned	Attribute/Element
Equipment Identifier	Equipment type, Station assigned	Attribute/Element
Station Identifier	Camera assigned	Attribute/Element

Table 3: Data Dictionary

3.3 The Scope of the Product

3.3.1 Product Boundary

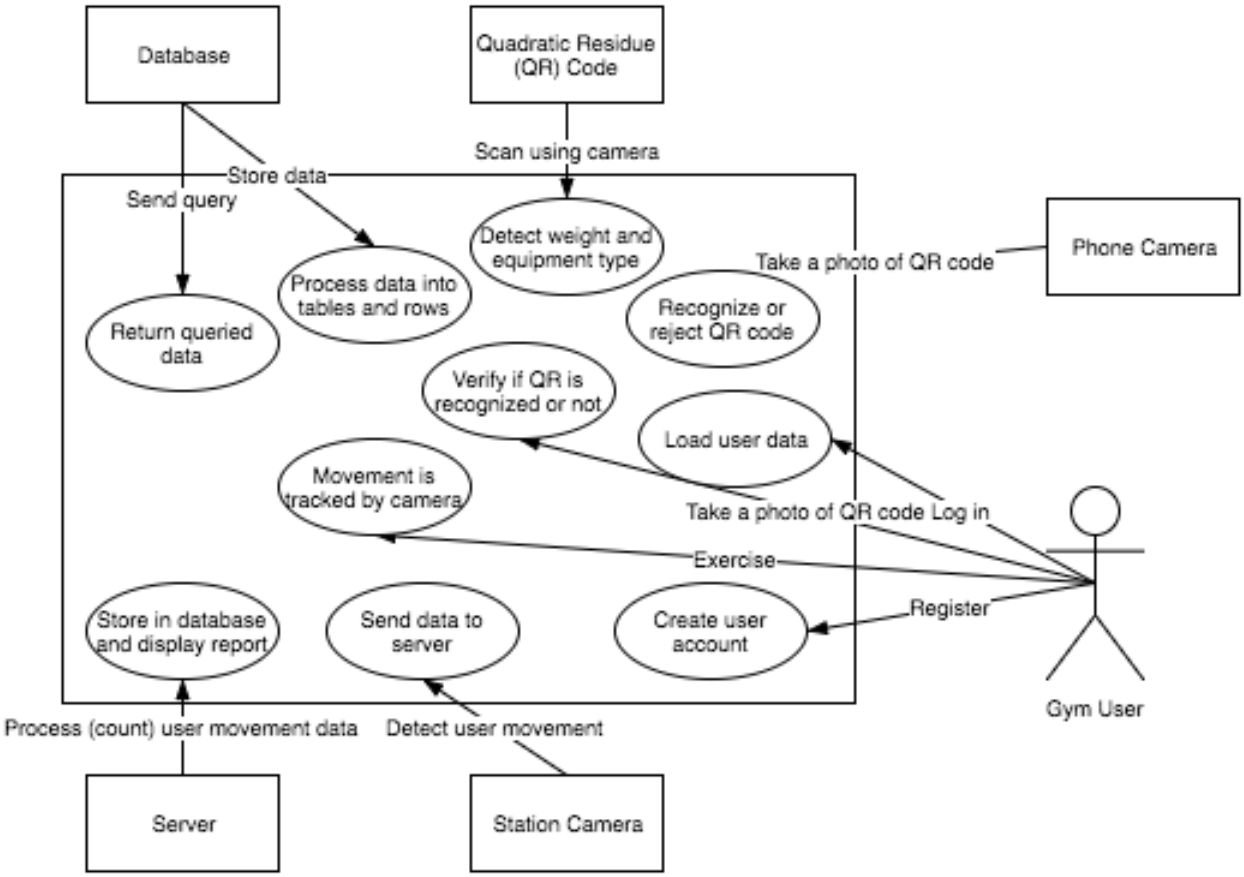

Figure 2: Product Boundary

3.3.2 Product Use Case Table

PUC No	PUC Name	Actor/s	Input & Output
1	Register for an account	User	Mobile phone (in)
2	Log in to an account	User	Mobile phone (in)
3	View fitness statistics	User	Mobile phone (out)
4	Log workout	User	Mobile phone (in)

Table 4: Product Use Case (PUC) Summary Table

3.4 Functional Requirements

Requirement #: 1 **Event/Use Case**: 1 **Priority**: High

Description: The product's mobile application shall require a user to first register an account before using the service

Rationale: To identify user within the application

Fit Criterion: Product's mobile application shall have have a "Create an Account" button which will present a screen containing a registration form when clicked. The user can submit the form using a username, a password and an email address.

Requirement #: 2 **Event/Use Case**: 1 **Priority**: Medium

Description: The product's mobile application shall provide popup error messages

Rationale: To let the user know that their actions were unexpected and the application did not accept it.

Fit Criterion: The application shall show an error message when (1) the user enters a wrong username or password when trying to login and (2) the user tries to scan a Quadratic Residue code that is not recognized by the system, or (3) the user tries to register using an email or username that already exists in the database.

Requirement #: 3 **Event/Use Case**: 3 **Priority**: High

Description: The product's mobile application shall display the fitness statistics through visual graphs

Rationale: To summarize a user's workout history

Fit Criterion: Once logged in, the user sees different types of graphs on the dashboard. Pie graphs shows the percentage of muscle groups the user has worked out in the past.

Requirement #: 4 **Event/Use Case**: 4 **Priority**: High

Description: The product's camera shall track the motion of the gym equipment

Rationale: To infer the user's movement and muscle engagement

Fit Criterion: The position of the gym equipment at any point after scanning the Quadratic Residue code shall be known to the application by using computer vision and image processing algorithms.

Requirement #: 5 **Event/Use Case**: 4, 3 **Priority**: High

Description: The product shall be able to store data about the user's exercises (sets, repetitions and weight) into the database

Rationale: To enable processing and retrieval by the server and mobile application

Fit Criterion: Backend processes shall be able to add a user's sets, repetitions and weight into the database.

Requirement #: 6 **Event/Use Case**: 4, 3 **Priority**: High

Description: The product shall be able to calculate a user's workout information using data from the camera

Rationale: To present workout reports to the user

Fit Criterion: Backend processes shall be able to calculate workout statistics for the user by inferring sets, repetitions and weight from the movement tracked by the camera.

4 Non-functional Requirements

4.1 Look and Feel Requirements

4.1.1 Appearance Requirements

Requirement #: 1 **Event/Use Case**: 3 **Priority**: Low
Description: The mobile app shall have minimal textual content on each screen
Rationale: To make navigation and easier
Fit Criterion: The product shall enable the user to workout and then view their statistics by only tapping buttons on the screen instead of typing values such as weight, repetitions or sets.

Requirement #: 3 **Event/Use Case**: 2 **Priority**: Medium
Description: The cameras shall be non-obtrusive
Rationale: To blend in with the environment
Fit Criterion: The gym owners or managers shall agree that the presence of cameras does not negatively affect the aesthetic of their gym.

4.1.2 Style Requirements

Requirement #: 2 **Event/Use Case**: 3, 4 **Priority**: Medium
Description: The mobile application shall appear simple to use
Rationale: To reduce the amount of time that users need to record their workout statistics
Fit Criterion: The time it takes for a user log into the application, start the camera and work out shall be less than the time it takes for them to write down their workout type, sets, repetitions and weights.

4.2 Usability and Humanity Requirements

4.2.1 Personalization and Internalization Requirements

Requirement #: 1 **Event/Use Case**: 2, 3 **Priority**: Medium
Description: The product shall become the user's preferred tracking method after the trial period
Rationale: To automate tracking workout progress
Fit Criterion: After a trial period of one week, the user shall agree that they would rather use this product than manually track their muscle training progress.

4.2.2 Learning Requirements

Requirement #: 2 **Event/Use Case**: 1, 2, 3 **Priority**: Medium
Description: The product shall be easy to learn by users who have never tracked their workouts
Rationale: To show that this product is easily learned and intuitive
Fit Criterion: After a trial period of one week, the rate of errors that the user makes while using the application shall decrease to at most 10%.

Requirement #: 3 **Event/Use Case**: 2, 3 **Priority**: Medium
Description: The product shall be easy to learn by users who have used other methods to track their workouts
Rationale: To make the transition to this product easier
Fit Criterion: After a trial period of one week, the rate of errors that the user makes while using the application shall decrease to at most 5%.

4.3 Performance Requirements

4.3.1 Capacity Requirements

Requirement #: 1 **Event/Use Case**: 1, 3, 4, 5 **Priority**: Medium
Description: The mobile application shall be concurrently used by multiple users on their devices
Rationale: To enable multiple users to monitor their workouts at the same time
Fit Criterion: The application's output shall not be affected by the number of users currently using it.

4.3.2 Scalability or Extensibility Requirements

Requirement #: 2 **Event/Use Case**: 2 **Priority**: High
Description: Each camera shall be able to track at least one user at any time
Rationale: To associate each user to their corresponding movement
Fit Criterion: The camera shall give an accurate count of moving objects in the screen (at least one when there is someone working out).

4.4 Operational and Environmental Requirements

4.4.1 Expected Physical Environment

Requirement #: 1 **Event/Use Case**: 1, 2 **Priority**: High
Description: The product shall be used in a well-lit environment
Rationale: To enable the cameras to see their subjects
Fit Criterion: The gym shall have enough lighting such that objects in the video can be tracked and Quadratic Residue codes can be scanned.

Requirement #: 4 **Event/Use Case**: 3, 4, 5 **Priority**: Medium
Description: The mobile device shall have access to the internet
Rationale: To send and receive data from the server and the database
Fit Criterion: The mobile device shall be able to send at least one message through an internet connection.

4.5 Maintainability and Support Requirements

4.5.1 Maintenance Requirements

Requirement #: 1 **Event/Use Case**: 2 **Priority**: High
Description: Gym employees such as trainees or managers shall be responsible for making sure the cameras work
Rationale: To enable the movement-tracking camera through connecting it to power and to the network
Fit Criterion: The camera shall be able to transmit data over the internet.

4.5.2 Adaptability Requirements

Requirement #: 2 **Event/Use Case**: 1, 3, 4, 5 **Priority**: Medium
Description: The mobile application shall be easily portable from Android to iOS
Rationale: To make the product available to most mobile phone users
Fit Criterion: The application shall be developed and tested for both Android and iOS

4.6 Security Requirements

4.6.1 Access Requirements

Requirement #: 1 **Event/Use Case**: 1, 3, 5 **Priority**: Low
Description: The product shall notify customers of changes to its information policies
Rationale: To make sure that the user knows how their data is protected
Fit Criterion: The product shall use a popup that appears upon opening the application after the User Agreement Policy changes. This popup shall prevent the user from accessing the its functions unless they read and accept the User Agreement Policy.

4.6.2 Integrity Requirements

Requirement #: 2 **Event/Use Case**: 2 **Priority**: Medium
Description: The product shall not store videos or images of users' workouts in any form
Rationale: To protect the privacy of users
Fit Criterion: The image processing algorithms shall be directly applied to captured images in the camera feed, thereby storing no videos in the database.

4.6.3 Privacy Requirements

Requirement #: 3 **Event/Use Case**: 3, 5 **Priority**: High
Description: Users shall only be able to view workout data that pertains to them
Rationale: To protect the privacy of other users
Fit Criterion: The product shall allow the user to only view their own workout statistics.

Requirement #: 5 **Event/Use Case**: 2 **Priority**: High
Description: Users shall be informed that a camera will be tracking their movement during their workouts
Rationale: To let users know that their image is being scanned and that their data is sent over a network
Fit Criterion: There shall be a separate agreement clause in which the user will verify they consent to being photographed in order to use the product.

4.7 Cultural Requirements

N/A

4.8 Legal Requirements

N/A

5 Project Issues

5.1 Open Issues

Our implementation consists of creating an entirely new product for fitness training applications. There have previously been no significant efforts to implement this functionality, wherein image recognition is utilised to automatically record a user's performance. There are also no open issues outside of implementing this product.

5.2 Off-the-Shelf Solutions

N/A

5.3 New Problems

Our contribution is completely new; there are no products currently in the market that implement the same functionality. Hence, there are no new problems to consider.

5.4 Tasks

- Propose design solution to the project supervisor
- Implement the solution and provide the source code to the project supervisor for review
- Update design to incorporate suggestions and merge changes to main PiSonal trainer repository once tasks have been successfully completed

5.5 Migration to the New Product

N/A

5.6 Risks

As this is a new product, there are no risks that can impact the project in terms of old code. All the tests will be based on the new requirements and desired product functionality.

5.7 Costs

There are no costs involved in the implementation of PiSonal trainer. All the technology to be used is open source; hence there are no expenses incurred.

5.8 User Documentation and Training

User documentation will accompany a brief explanation concerning how PiSonal trainer works and how users can use it to enhance their training experience. PiSonal trainer requires minimal input from the user. However each input will be explained through a step-by-step tutorial to help setup the application. The User Documentation will include several visuals to help the user comprehend what the application's interface should look like from beginning to end.

5.9 Waiting Room

Our project consists of implementing a new application. There are no other features that have been out of scope for this project as our requirements have been scoped to satisfy the main needs for the initial release.