Skillcourt Backend

Andy Martinez & Matthew Santiago

Florida International University

Senior Project

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## Abstract

There is a lot involved with the training of soccer players. The current system for training is primitive usually involving an instructor and a physical field for playing. The primary objective is to produce a new, modern, and system for training soccer players. The system will be a program with features that will assist players for learning the skills required on their own.

Implementing this system is revolutionary to the way avid players train in the sport. With the functionality and portability that SkillCourt offers, the user can create a personalized regimen for improving skills; thus, SkillCourt offers an overall improvement to both the soccer training and playing experience for players.

This document summarizes the functional and nonfunctional requirements for the SkillCourt Backed system, which were established by the project’s clients and mentors, Guomundur Traustason, and Jaime Borras.

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## **Introduction**

SkillCourt Backend provides the user, the player, with a system that can be used to train by means of interacting with it in a one to one manner. Using the illuminating pads and the different combinations of colors provided by the different routines, the players will be able to improve not only their specific skills such as speed, force, accuracy, but also the player will be able to develop a mind-body coordination, which has been proven to be of vital importance during a real life game.

This section introduces the SkillCourt Backend system by first defining the problem it is trying to target, followed by a description of the scope of the system, and a list of the terminology used throughout the document. Lastly, this section presents an overview of the entire document.

### Problem Definition

Traditionally, the way in which a soccer player trains is by interacting with teammates, the coach, and the ball in a training field. This training, however, depends on others, and the coach cannot assess all players at the same time, therefore, performance reviews are not complete. Additionally, for games like Soccer that require a big field, the availability of space is crucial to training, and lack of space to train is a major setback for individual players, as well as lower-budget soccer teams. For these reasons, among others, soccer training can be a very cumbersome feat for the average person to endeavor unaided. Without proper guidance, progression dwindles and a person may not feel obliged to continue.

Additionally, it is essential for players to develop a high body-mind coordination that allows them to move and perform specific techniques without consciously thinking about it. Extensive training is needed to develop such coordination, and brain efficiency.

### Scope of the System

The SkillCourt System will provide athletes and individual players with the ability to train and improve their skills by interacting with it in a one to one manner. The system allows the user to choose from a set of predefined routines to be played in a SkillCourt Room. The users is given the option of modifying certain aspects of these predefined routines by adjusting the timer and number of rounds conditions. The mobile device serves as the connection between the players and the SkillCourt pads so that the user. However, it can also display the player’s performance statistics in order to visualize progress over time. A SkillCourt website has been created as well, so that the player or a coach can access these performance statistics. In the website, the player will be given the option to share these statistics on Facebook. This will allow the user to share his or her performance with friends so that they can also see the progress of the player. The system also provides coaches with the ability to create custom routines and share them with their players so that based on the performance the coach can modify the dynamics of the training.

In addition to the already mentioned abilities of the system, it also has Bluetooth capabilities. It allows the user to locate nearby SkillCourt pads and connect to them and send the chosen routine via Bluetooth. Since the SkillCourt pads are not build yet, the routine will be played on a simulator which has the ability to represent real physical conditions like force when hitting a SkillCourt pad and time between hits. It also keeps track of the points scored by the player and the accuracy.

For future development, the system should be capable of analyzing collected data in order to provide more useful information to the athletes, including predictions based on their progress and also based on the progress of other athletes who are practicing similar skills using similar routines. The system should also start handling more complicated graph problems which deal with pads that are out of reach of the master pad Bluetooth range. The system should also increment the available routines. The system should also allow multiplying.

### Terminology

#### 1.3.1 Acronyms

* **App**: Refers to the SkillCourt application in the mobile device.

#### 1.3.2 Definitions

* **Pad Simulator**: An emulated device which will take the place of SkillCourt pads for testing showcasing purposes. This device will offer all of the features a SkillCourt Pad will offer.
* **SkillCourt**: A system which uses SkillCourt Pads and a player interface for training soccer.
* **SkillCourt Arena**: A 20’x40’ room with SkillCourt Pads on the walls used for soccer training.
* **SkillCourt Pad**: A physical device with a flat surface that can measure and transmit when and how much pressure it received.

### 1.4. Overview of Document

The purpose of this document is to explain the functional and non-functional requirements of the SkillCourt System. The current chapter has served as an introduction to the document, providing the reader with the problem that the system targets to solve, and some terminology. The second chapter, the current system is analyzed, and its limitations are determined, in order to construct a better solution. In the following chapters the proposed system will be explained in a more detailed manner. Chapter 3 describes the Project Plan, starting with a description of the project organization, and the tasks and milestones identified. It concludes with an estimate of the total cost of the proposed system.

Chapter 4 provides a more in depth view of the system, and serves as the main focus of this document, by describing the functional and nonfunctional requirements of the SkillCourt System. In addition, it provides an analysis of the system requirements, including possible scenarios, and the use case model. The static and dynamic models are also included in this section. Chapter 5 serves as a glossary, with all the acronyms and definitions used throughout the document.

Several appendices have been provided as part of Chapter 6. These include a list and description of all the use cases that were completed in this project, and a use case diagram showing the relation between these use cases and the different users. The static and dynamic models are also included in this section, together with the user interface designs, and the diary of meetings. For references used through this document, see Chapter 7, which concludes the Requirements Document.

## **Current System**

The market lacks any non-traditional training system for Soccer players. There are not many companies addressing this problem right now. Companies such as Axon Sports, for example, have tried to develop a training system that improves brain efficiency with games that use the touch technology. However, no customizable, interactive training system is commercially available for users to buy and use.

The traditional system used for training is primitive, usually involving an instructor and a physical field for playing. The limitations of the traditional training system include the lack of one to one interactivity between the coach and each of the players, and the lack of resources for individual players and low budget teams. Additionally, for games like Soccer that require a big field, the availability of space is crucial to training, and lack of space to train is a major setback in many cases, often leading to the inability to train as desired.

The primary objective of the proposed system is to produce a new, and modern, customizable system for training soccer players. The system will be a program with features that will assist players for learning the skills required on their own. Implementing this system is revolutionary to the way avid players train in the sport. With the functionality and portability that SkillCourt offers, the user can create a personalized regimen for improving skills; thus, SkillCourt offers an overall improvement to both the soccer training and playing experience for players.

## **Project Plan**

As part of our project’s development process, we have created a detailed plan to organize our work throughout the semester. By following it, we will be able to keep track of both the project’s progress and our performance according to our requirements. This plan includes our individual roles, the personnel organization, and the hardware and software resources needed. It also includes a description of our tasks, milestones and deliverables.

### Project Organization

This section discusses the roles of all team members as well as the technologies that will be used to develop the SkillCourt system.

#### 3.1.1 Project Personnel Organization

This section lists the main role of each of the 2 team members working on the project.

Figure 1. Project Personnel Organization

### Identification of Tasks, Milestones and Deliverables

Table 1. Description of tasks, milestones, and deliverables

|  |  |  |
| --- | --- | --- |
| Tasks | Start time | End Time |
| 1. Collect User Stories | 01/21/2015 | 01/21/2015 |
| 1. Requirement Analysis | 01/22/2015 | 01/22/2015 |
| 1. Create Product Backlog | 01/23/2015 | 01/22/2015 |
| 1. Setup Development Environment | 01/26/2015 | 01/26/2015 |
| 1. Initial Feasibility Study | 01/27/2015 | 01/27/2015 |
| 1. Initial Project Plan | 01/28/2015 | 01/28/2015 |
| 1. Initial System Design | 01/29/2015 | 01/29/2015 |
| 1. Initial Object Design | 01/30/2015 | 01/30/2015 |
| Milestone: Project Introduction Presentation | 02/02/2015 | 02/02/2015 |
| 1. Finish Account Creation User Story | 02/02/2015 | 02/13/2015 |
| 1. Finish Enter as Guest User Story | 02/02/2015 | 02/13/2015 |
| 1. Finish Login User Story | 02/02/2015 | 02/13/2015 |
| 1. Finish Logout User Story | 02/02/2015 | 02/13/2015 |
| 1. Finish App Interface User Story | 02/02/2015 | 02/13/2015 |
| Milestone: Sprint 1 Meeting with Clients | 02/13/2015 | 02/13/2015 |
| 1. Sprint 1 presentation | 02/16/2015 | 02/27/2015 |
| 1. Finish Account Management User Story | 02/16/2015 | 02/27/2015 |
| 1. Finish Cognitive Skills User Story | 02/16/2015 | 02/27/2015 |
| 1. Finish Connect to Pads User Story | 02/16/2015 | 02/27/2015 |
| 1. Finish Recover Username/Password User Story | 02/16/2015 | 02/27/2015 |
| Milestone: Sprint 2 Meeting with Clients | 02/27/2015 | 02/27/2015 |
| 1. Sprint 2 presentation | 03/02/2015 | 03/20/2015 |
| 1. Finish Login/Logout SkillCourt Website User Story | 03/02/2015 | 03/20/2015 |
| 1. Finish Access Performance Statistics User Story | 03/02/2015 | 03/20/2015 |
| 1. Finish Collect Performance Statistics User Story | 03/02/2015 | 03/20/2015 |
| Milestone: Sprint 3 Meeting with Clients | 03/20/2015 | 03/20/2015 |
| 1. Spring 3 Presentation | 03/23/2015 | 03/23/2015 |
| 1. Finish Access Performance Statistics User Story | 03/23/2015 | 04/03/2015 |
| 1. Finish Collect Performance Statistics User Story | 03/23/2015 | 04/03/2015 |
| 1. Finish Create Account – Coach User Story | 03/23/2015 | 04/03/2015 |
| 1. Finish Logout – Coach User Story | 03/23/2015 | 04/03/2015 |
| 1. Finish Login – Coach User Story | 03/23/2015 | 04/03/2015 |
| 1. Finish Create Custom Chase Routine User Story | 03/23/2015 | 04/03/2015 |
| 1. Finish Start Routine User Story | 03/23/2015 | 04/03/2015 |
| 1. Finish Higher Two Rows Routine User Story | 03/23/2015 | 04/03/2015 |
| 1. Finish Lowest Row Routine User Story | 03/23/2015 | 04/03/2015 |
| 1. Finish Chase Routine User Story | 03/23/2015 | 04/03/2015 |
| Milestone: Sprint 4 Meeting with Clients | 04/03/2015 | 04/03/2015 |
| 1. Spring 4 Presentation | 04/06/2015 | 04/06/2015 |
| 1. Finish Access Performance Statistics User Story | 04/06/2015 | 04/17/2015 |
| 1. Finish Create Player Profile User Story | 04/06/2015 | 04/17/2015 |
| 1. Finish Create Bluetooth connection User Story | 04/06/2015 | 04/17/2015 |
| 1. Finish Share on Social Media User Story | 04/06/2015 | 04/17/2015 |
| 1. Finish Convert Statistics to Visuals User Story | 04/06/2015 | 04/17/2015 |
| 1. Finish Set up New App Visuals User Story | 04/06/2015 | 04/17/2015 |
| 1. Finish Save Performance Statistics User Story | 04/06/2015 | 04/17/2015 |
| 1. Finish Add Game Results Screen User Story | 04/06/2015 | 04/17/2015 |
| Milestone: Sprint 5 Meeting with Clients | 04/17/2015 | 04/17/2015 |
| 1. Spring 5 Presentation | 04/20/2015 | 04/20/2015 |
| 1. Finalize Feasibility Study and Project Plan Document | 04/20/2015 | 04/30/2015 |
| 1. Finalize Design Document | 04/20/2015 | 04/30/2015 |
| 1. Finalize the "Final Document" | 04/20/2015 | 04/30/2015 |
| 1. Develop Your Poster | 04/20/2015 | 04/27/2015 |
| 1. Develop an Introductory Video | 04/20/2015 | 04/30/2015 |
| 1. Develop a User Guide Video | 04/20/2015 | 04/30/2015 |
| 1. Develop a Shortcoming & Wish list Video | 04/20/2015 | 04/30/2015 |
| 1. Develop an Installation & Maintenance Video | 04/20/2015 | 04/30/2015 |
| Milestone: Final Meeting with clients | 05/01/2015 | 05/01/2015 |
| Milestone: Final Presentation and Showcase | 05/01/2015 | 05/01/2015 |

### Cost Estimate

Table 2. Cost Matrix

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Description | Quantity | Cost (each) |
| Human Resources | Team members working on the design, development, and testing processes | 2 | $ 0.00 |
| Hardware Resources | Personal computer | 2 | $ 0.00 |
| Localhost Server to host website | 1 | $ 0.00 |
| Android mobile devices | 1 | $ 0.00 |
| Arduino microcontroller | 2 | $ 27.41 |
| Arduino wireless Bluetooth Transceiver Module | 2 | $ 9.99 |
| Solderless BreadBoard | 2 | $5.50 |
| Software Resources | Software (All open source) | - | $ 0.00 |
| Total |  |  | $ 85.80 |

## Proposed System Requirements

This chapter defines the requirements that will be implemented in the SkillCourt-Backend system. It starts by presenting a description of the system in section 4.1. This description is based on the functional and nonfunctional requirements of the system. Then, section 4.2 follows with an analysis of the listed system requirements.

### Functional Requirements

This section presents the functional requirements of the SkillCourt-Backend system. The requirements have been classified in three groups: “The mobile device”, which includes the requirements having to do with the functions of the application in mobile device, “the webpage”, which includes the requirements having to do with the functions of the webpage, and the SkillCourt Simulator.

#### The mobile device application

* The system shall allow the player to create a new account with new credentials
* **Usability**: User Interface must be easy to follow.
* **Reliability**: With a stable internet connection, the system must be reliable 99% of the time.
* **Performance**: Data must be saved in database within 5 seconds.
* **Supportability**: This functionality must work for any Android device.
* The system shall allow the player to sign in using his or her credentials
* **Usability**: User Interface must be easy to follow.
* **Reliability**: With a stable internet connection, the system must be reliable 99% of the time.
* **Performance**: Data must be checked within 5 seconds.
* **Supportability**: This functionality must work for any Android device.
* The system shall allow the player to enter the application as a guest
* **Usability**: User Interface must be easy to follow.
* **Reliability**: System must work flawlessly 100% of the time.
* **Performance**: App must move to next screen in less than a second
* **Supportability**: This functionality must work for any Android device.
* The system shall allow the player to choose to connect to the pads
* **Usability**: User Interface must be easy to follow.
* **Reliability**: System must work flawlessly 70% of the time and, if failing, alert the user to retry.
* **Performance**: Connection must be established or rejected in less than 10 seconds.
* **Supportability**: This functionality must work for any Android device.
* The system shall allow the player to choose a cognitive skill to practice
* **Usability**: User Interface must be easy to follow.
* **Reliability**: System must work flawlessly 100% of the time.
* **Performance**: List of routine must be displayed in less than ½ seconds.
* **Supportability**: This functionality must work for any Android device.
* The system shall allow the player to play different routines
* **Usability**: User Interface must be easy to follow.
* **Reliability**: System must work flawlessly 70% and, if failing, alert the user to retry.
* **Performance**: Data must be transferred via Bluetooth to the master pad in less than 10 seconds.
* **Supportability**: This functionality must work for any Android device.
* The system shall allow the player to play his custom routine
* **Usability**: User Interface must be easy to follow.
* **Reliability**: System must work flawlessly 70% and, if failing, alert the user to retry.
* **Performance**: Data must be transferred via Bluetooth to the master pad in less than 10 seconds.
* **Supportability**: This functionality must work for any Android device.
* The system shall allow the player to access his/her statistics
* **Usability**: User Interface must be easy to follow.
* **Reliability**: With a stable internet connection the system must be reliable 99% of the time.
* **Performance**: Data must be saved within 5 seconds.
* **Supportability**: This functionality must work for any Android device.

#### The webpage

* The system shall allow the player or coach to create account with new credentials
* **Usability**: User Interface must be easy to follow.
* **Reliability**: System must work flawlessly 99% of the time.
* **Performance**: Data must be saved within 5s seconds.
* **Supportability**: This functionality must work for any browser.
* The system shall allow the player to share his/her performance in social media
* **Usability**: User Interface must be easy to follow.
* **Reliability**: System must work flawlessly 99% of the time.
* **Performance**: Data must be shared within 2 seconds.
* **Supportability**: This functionality must work for any browser.
* The system shall allow the player or coach to sign in using his/her credentials
* **Usability**: User Interface must be easy to follow.
* **Reliability**: System must work flawlessly 99% of the time.
* **Performance**: Data must be saved within 5 seconds.
* **Supportability**: This functionality must work for any browser.

#### The SkillCourt room simulator

* The system shall allow the player to play any of the selected routines
* **Usability**: The illuminating patterns on the simulator must be equivalent to the illuminating patterns on real pads.
* **Reliability**: System must work flawlessly 99% of the time.
* **Performance**: Colors of the pads must be changed instantaneously when it is their turn.
* **Supportability**: This functionality must work on any mac running processing.

### Analysis of System Requirements

This section describes further the functional requirements of the SkillCourt-Backend system. It describes some possible scenarios for some system requirements. Also, it includes different models that help understand the system and its requirements.

#### Scenarios

#### Scenario 1:

Iron Man presses the create account button. Then a screen is shown to Iron Man so that he can enter his username, password and email which must be unique. Iron Man enters unique information: “tonystark”, “GeniusBillionairePlayboyPhilanthropist,” “iamthebest@starkindustries.com” and presses next. An email is sent to Iron Man with a code “28365” in order to make sure that that email actually belongs to the super hero. Also, a new screen on the app appears asking for the code that was sent. He enters the correct code and presses verify. Another screen then requests the first and last name of the user so he types Tony on the first space and Stark on the second one. Then he presses next and another screen appears where the system asks Iron Man the username of his coach and the position he plays so he enters the requested information “nickfiury”, “attacker” and presses next. Then a new screen appears alerting Iron Man that he already has an account in SkillCourt.

#### Scenario 2:

Andy presses the log in button and types his correct username and password “andy1”, “123” then presses login and the system moves to the Home Screen.

#### Scenario 3:

Matthew is on the home screen and he wants to logout so he presses the icon showing an open door on the top right corner and the app moves to the welcome screen.

#### Scenario 4:

Jaime wants to enter as a guest because he does not want to reveal any information about himself so he presses “enter as a guest”. He realizes that the system shows him a message alerting him that as a guest his performance data will not be recorded.

#### Scenario 5:

Gummi wants to see how well he has been performing so far, so in the home screen, he presses access performance statistics. A new screen is shown to him with his best performances metrics. Then he presses his best force and a line graph is shown to him with performance number in the x-axis and force measurements in the y –axis.

#### Scenario 6:

The Incredible Hulk wants to play a chase routine in a SkillCourt room so he first presses select pad and a list of available Bluetooth devices is displayed. He selects one called “Pad1”. So “Pad1” assumes the role of a master pad. He then goes to play and selects to play 3 rounds of chase routine and then presses play. Then the app sends the routine to master pad “Pad1” and the pads start illuminating so that the Incredible Hulk can start hitting the pads (or smashing them).

#### Scenario 7:

Daniela wants to share her performance so far in Facebook so she accesses the SkillCourt website and enters her username “daniela1” and password “12345” then she clicks “my stats” and then the system shows her a new screen which contains a share in Facebook icon so she clicks it and her performance get published in Facebook.

#### Use case model

This UML diagram, see Appendix B, shows all the Use Cases that were implemented so far in the SkillCourt system. Its objective is to make easier the understanding of the current functionalities that the system is providing and to explain the associations between the different actors and the use cases

#### Static model

This diagram represents the classes that are needed in order implement the current SkillCourt System and how they are related to each other. It was developed using UML so that future Senior Project students can follow it to have a better understanding of the system (Refer to Appendix C).

#### Dynamic model

These diagrams shows the interaction between the users and the different components of the system. It was developed in UML and its objective is to make easier the understanding of the interaction between SkillCourt System and the user (Refer to appendix D).

## Glossary

### 5.1 Acronyms

* **App**: Refers to the SkillCourt application in the mobile device.

### 5.2 Definitions

* **Pad Simulator**: An emulated device which will take the place of SkillCourt pads for testing showcasing purposes. This device will offer all of the features a SkillCourt Pad will offer.
* **SkillCourt**: A system which uses SkillCourt Pads and a player interface for training soccer.
* **SkillCourt Arena**: A 20’x40’ room with SkillCourt Pads on the walls used for soccer training.
* **SkillCourt Pad**: A physical device with a flat surface that can measure and transmit when and how much pressure it received.

## Appendix

### Appendix A – Complete use cases

#### The mobile device application:

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend # 108 | |
| **Name:** | Cognitive Skills | |
| **Details:** |  | |
| **Actors:** | Players | |
| **Pre-Conditions**: | |
| **Description**:   * As a soccer player I want to be able to select the cognitive skill that I want to practice so that I can improve my abilities in that specific area.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #109 | |
| **Name:** | Access Performance Statistics | |
| **Details:** | This use case will allow the user to access his statistics | |
| **Actors:** | Player | |
| **Pre-Conditions**:   * Player has logged in with his credentials | |
| **Description**:   * As a player I want to be able to access the statistics of my performances so that I can isolate weaknesses and see my improvements to focus in the areas of training that I need the most.   **Steps:**   * Use case begins when the user presses the “Statistics” button * The use case ends when the system accesses and displays the player’s statistics | |
| **Post-Conditions**:   * A window with the user’s statistics data is displayed | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #111 | |
| **Name:** | Create Custom Chase Routine | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player I want to be able to customize my own routines so that I can perform routines that are not already predetermined     **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #112 | |
| **Name:** | Account Creation | |
| **Details:** | This use case allows the players to create their SkillCourt accounts using their credentials | |
| **Actors:** | Player | |
| **Pre-Conditions**:   * Player has entered the application in the mobile device | |
| **Description**:   * As a player, I want to be able to create an account so that I can log in and log out.   **Steps:**   * Use case begins when user presses the “Create Account” button * The system should provide the user with a form to be filled, which includes name, username, email address, password, date of birth, and coach username (optional). * The user should fill out the provided form and press “Submit” * System should record the user’s information in the database and increment the number of members by 1 * The use case ends when the system provides the user with a confirmation of the new account creation. | |
| **Post-Conditions**:   * The user information must be stored in the database | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #124 | |
| **Name:** | Share on Social Media | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #141 | |
| **Name:** | Enter Application as Guest | |
| **Details:** | This use case will allow the user to enter the application as a guest without logging in to a account | |
| **Actors:** | Player | |
| **Pre-Conditions:**   * Player has entered the application in the mobile device | |
| |  | | --- | | **Description**:   * As a player, I want to be able to enter the application as a guest so that I can play without having to enter my credentials.   **Steps:**   * Use case begins when user presses the “Log in as Guest” button * The system should show a warning saying that if the user enters as a guest, his performance will not be recorded, and present two options: “Accept”, “Go back” * The user presses “Accept” * The use case ends when the system displays the Guest Home View. | | |
| **Post-Conditions**:   * The system is aware that the user is a guest and is ready to handle it as such | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #142 | |
| **Name:** | Connect to Pads | |
| **Details:** | This use case allows the player to find pads that are closed to him and connect to them via Bluetooth. | |
| **Actors:** | Player | |
| **Pre-Conditions**:   * The player has already logged into the account or entered as a guest | |
| **Description**:   * As a player I want my application to connect to the pads so that I can send information to the pads regarding what routine to play.   **Steps:**   * Use case begins when user presses the search for pads button. * The system will display a list of possible pads. * The user will select the pad he wants to connect to. * The use case ends when the system uses the Bluetooth address to establish a connection. | |
| **Post-Conditions**:   * The system has all the information needed from the pad in order to start to transfer data. | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #143 | |
| **Name:** | Log in | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #144 | |
| **Name:** | Log out | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #145 | |
| **Name:** | Collect Performance Statistics | |
| **Details:** | This use case will allow the user to have his performance statistics stored. | |
| **Actors:** | Player | |
| **Pre-Conditions**:   * The user is already connected to a set of pads | |
| **Description**:   * As a player I want to be able to record my performance statistics so that they are stored.   **Steps:**   * Use case begins when the user chooses the routine he wants to play * The Android application will use the name of the routine to get the routine’s specifications from the database and will transmit every step to the pads * The pads will receive the routine and will start illuminating the corresponding lights * The user will hit the illuminated pads * The pads will send information about the user’s hits to the Android application * The Android application will store the information provided by the pads in the database * The use case ends when the pads inform the Android application that the time for the entire routine has expired | |
| **Post-Conditions**:   * All performances of the player are stored in the database | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #150 | |
| **Name:** | App Interface | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #192 | |
| **Name:** | Account Management | |
| **Details:** | This use case allows the player to change his account information after his account has been created | |
| **Actors:** | Player | |
| **Pre-Conditions**:   * The player has already created an account and is logged into said account | |
| **Description**:   * As a user I want to be able to modify my account information so that I can make changes and updates as needed   **Steps:**   * Use case begins when user presses the edit account button. * The system will display the user’s account information * The user will press edit Information * The system will allow the user to modify his information * The user will change the information he wants to change and press done * The use case ends when the system moves to User’s profile view. | |
| **Post-Conditions**:   * The user’s new account settings will be properly changed in the database | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #197 | |
| **Name:** | Recover Username/Password | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #264 | |
| **Name:** | Start Routine | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #273 | |
| **Name:** | Higher Two Rows | |
| **Details:** | This use case allows the player to play the higher two rows routine in the simulator | |
| **Actors:** | Player | |
| **Pre-Conditions**:   * Connection between mobile device and pads has been established * The user has selected to play the higher two rows game, and has selected which level and number of rounds will be played. | |
| **Description**:   * As a player, I want to practice elevating the ball and also my reaction time to the visual cues   **Steps:**   * Use case begins when the master pad receives a command from the mobile device to start this specific routine. * The simulator will verify if the setup of the room is appropriate for the specified routine. * The entire room with start a count of 10 seconds to allow player to position himself. * Pads for this routine will start illuminating with the correct colors to expect the player’s hit. * The use case ends when the simulator starts playing the routine | |
| **Post-Conditions**:   * The user is capable of playing the routine | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend # 274 | |
| **Name:** | Lowest Row Routine | |
| **Details:** | This use case allows the player to play the lowest row routine in the simulator | |
| **Actors:** | Player | |
| **Pre-Conditions**:   * Connection between mobile device and pads has been established * The user has selected to play the lowest rows game, and has selected which level and number of rounds will be played. | |
| **Description**:   * As a player I want to be able to practice my skills with reaction time   **Steps:**   * Use case begins when the master pad receives a command from the mobile device to start this specific routine. * The simulator will verify if the setup of the room is appropriate for the specified routine. * The entire room with start a count of 10 seconds to allow player to position himself. * Pads for this routine will start illuminating with the correct colors to expect the player’s hit. * The use case ends when the simulator starts playing the routine | |
| **Post-Conditions**:   * The user is capable of playing the routine | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #340 | |
| **Name:** | Chase Routine | |
| **Details:** | This use case allows the player to play the chase routine in the simulator | |
| **Actors:** | Player | |
| **Pre-Conditions**:   * Connection between mobile device and pads has been established * The user has selected to play the chase routine, and has selected which level and number of rounds will be played. | |
| **Description**:   * As a player, I want to play a chase routine so that I can practice my coordination with the ball   **Steps:**   * Use case begins when the master pad receives a command from the mobile device to start this specific routine. * The simulator will verify if the setup of the room is appropriate for the specified routine. * The entire room with start a count of 10 seconds to allow player to position himself. * Pads for this routine will start illuminating with the correct colors to expect the player’s hit. * The use case ends when the simulator starts playing the routine | |
| **Post-Conditions**:   * The user is capable of playing the routine | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #392 | |
| **Name:** | Create Player Profile | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #393 | |
| **Name:** | Create Bluetooth Data Transfer between App and Simulator | |
| **Details:** | This use case allows the player to establish a Bluetooth data transfer between the master pad and the mobile device. | |
| **Actors:** | Player | |
| **Pre-Conditions**:   * The user should have already logged in or entered the application as a guest. | |
| **Description**:   * As a player, I want to be able to send and receive information to and from the pads via Bluetooth so that I can play and receive my performance statistics.   **Steps:**   * Use case begins when the user presses “Play.” * The mobile device sends the routine to the master pad * The use case ends when the master pad receives the routine | |
| **Post-Conditions**:   * The master pad has the necessary data to know the specifications of the routine to be played. | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #394 | |
| **Name:** | Create Custom Lowest Row | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #395 | |
| **Name:** | Create Custom Higher Two Rows | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #396 | |
| **Name:** | Convert Statistics to Visuals | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #412 | |
| **Name:** | Set New App Visuals (look and feel) | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #426 | |
| **Name:** | Add Game Results Screen | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a player, I want to be able to.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

#### The webpage

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #134 | |
| **Name:** | Login/Logout – SkillCourt Website | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a user I want to be able to access my SkillCourt data on the web so that I can access my SkillCourt account from the comfort of my computer   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #337 | |
| **Name:** | Logout – Coach | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a coach, I want to be able to log out of my account so that I can keep my account secure and allow others to log in.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #338 | |
| **Name:** | Create Account – Coach | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a coach, I want to be able to log in to out of the SkillCourt website so that I can get access to my account.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

|  |  |  |
| --- | --- | --- |
| **Use case ID:** | SkillCourt-Backend #339 | |
| **Name:** | Login – Coach | |
| **Details:** |  | |
| **Actors:** |  | |
| **Pre-Conditions**: | |
| **Description**:   * As a coach, I want to be able to log in to out of the SkillCourt website so that I can get access to my account.   **Steps:**   * Use case begins when * The use case ends when | |
| **Post-Conditions**: | |

### Appendix B – Use case diagram using UML

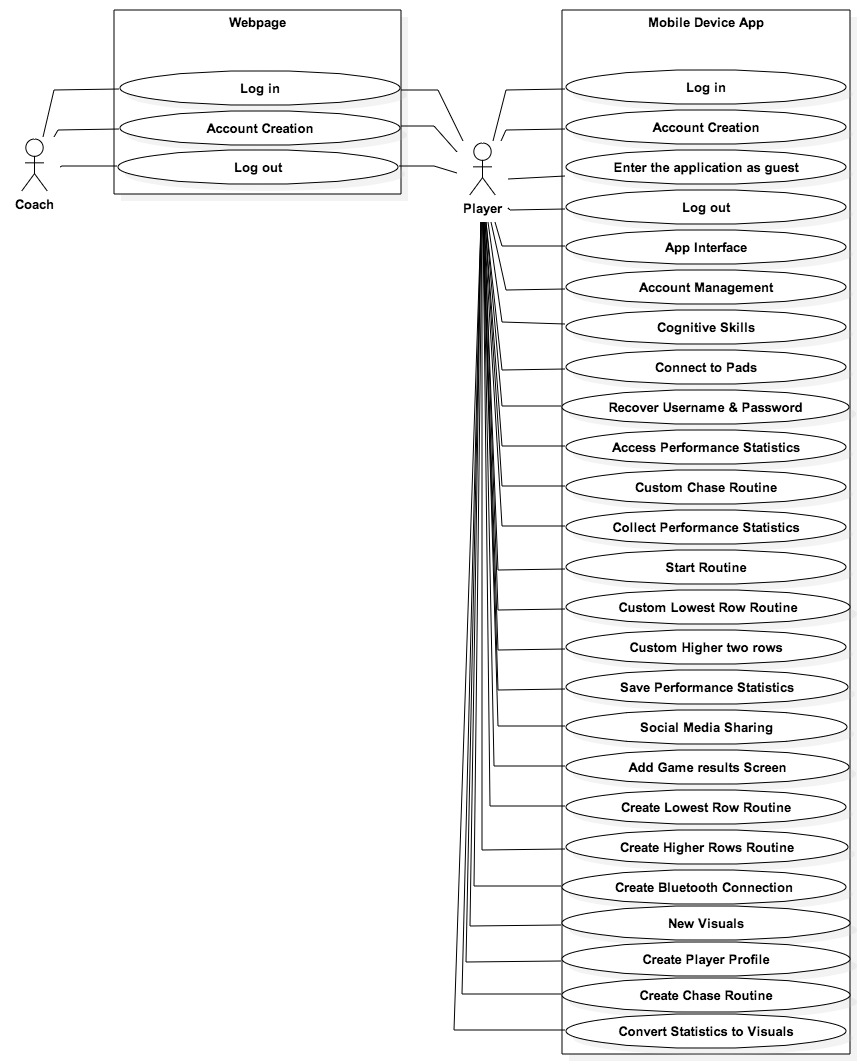


Figure . Use Case Diagram

### Appendix C – Static UML diagram

Figure Class Diagram

### Appendix D – Dynamic UML diagrams

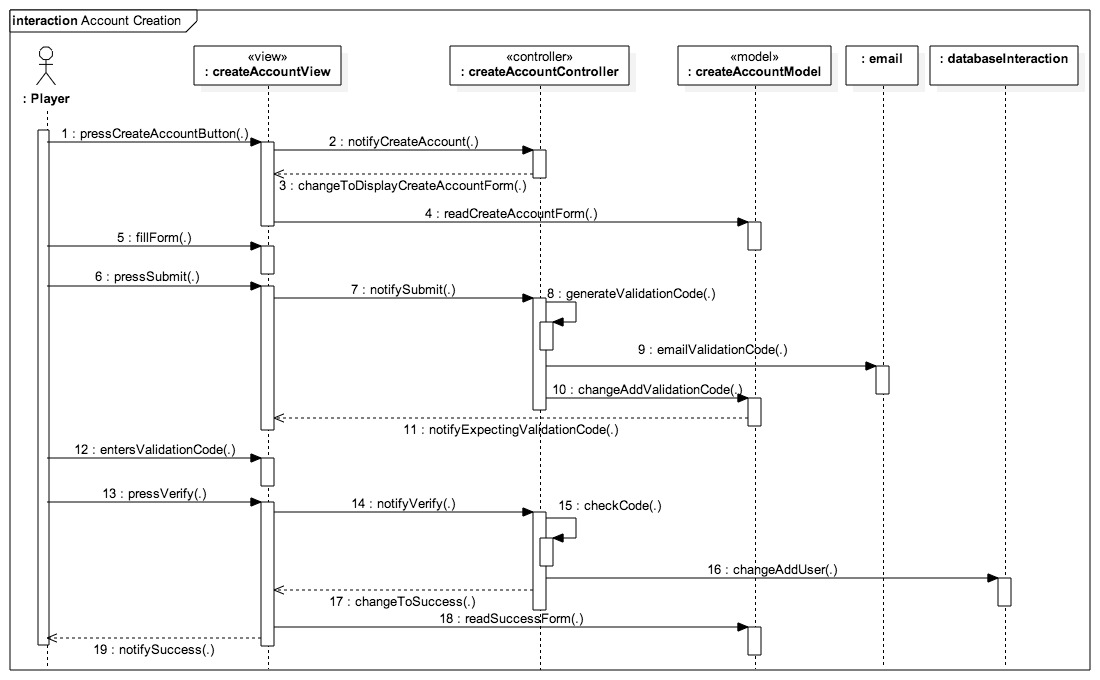


Figure Account Creation Sequence Diagram

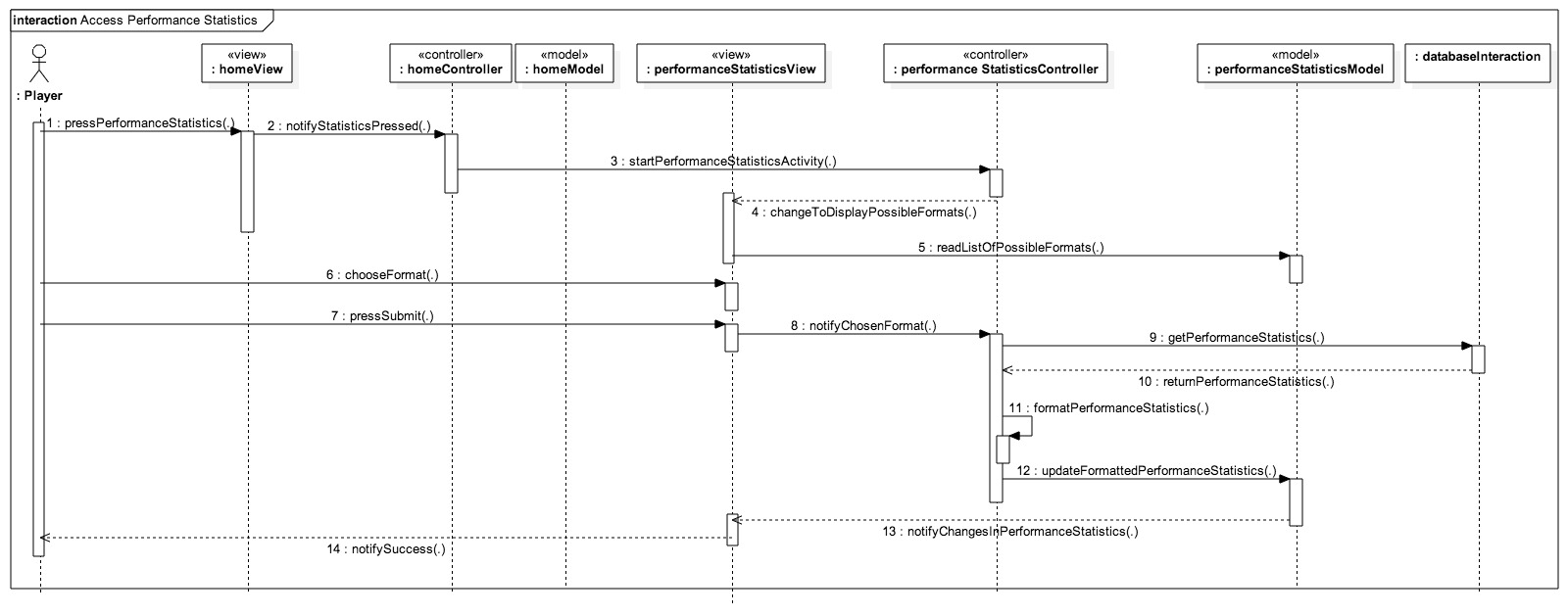
****

Figure Access Player Statistics Sequence Diagram

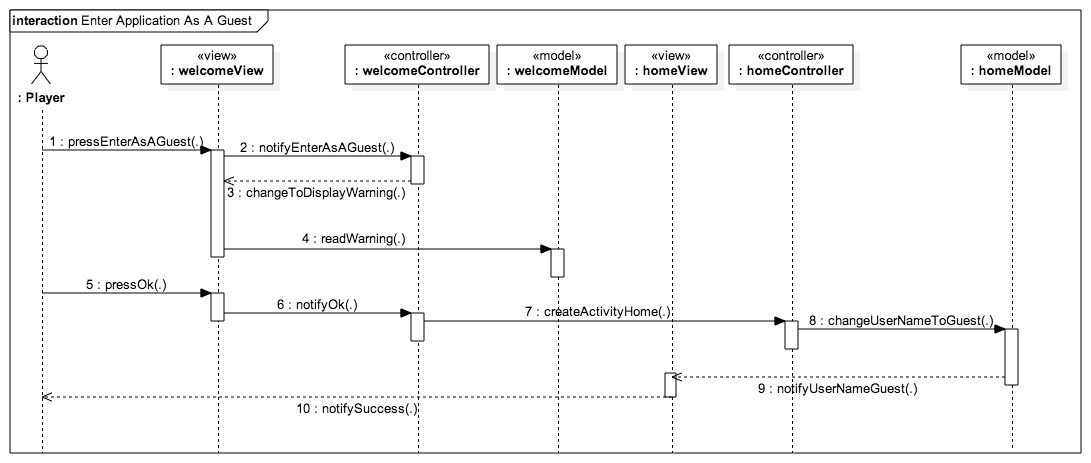


Figure Enter Application as A Guest Sequence Diagram

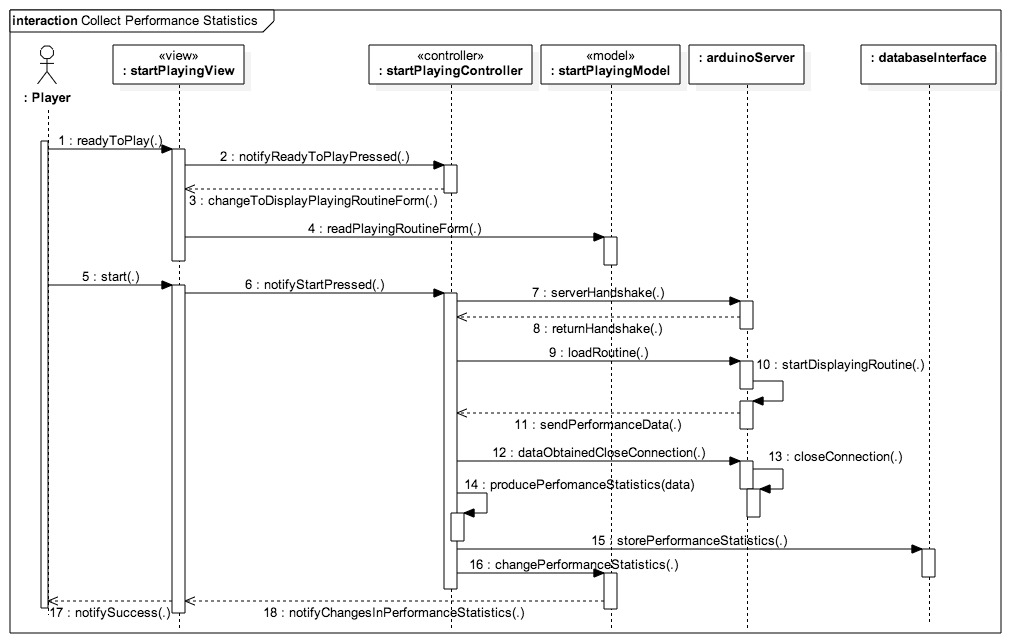


Figure Collect Performance Statistics Sequence Diagram

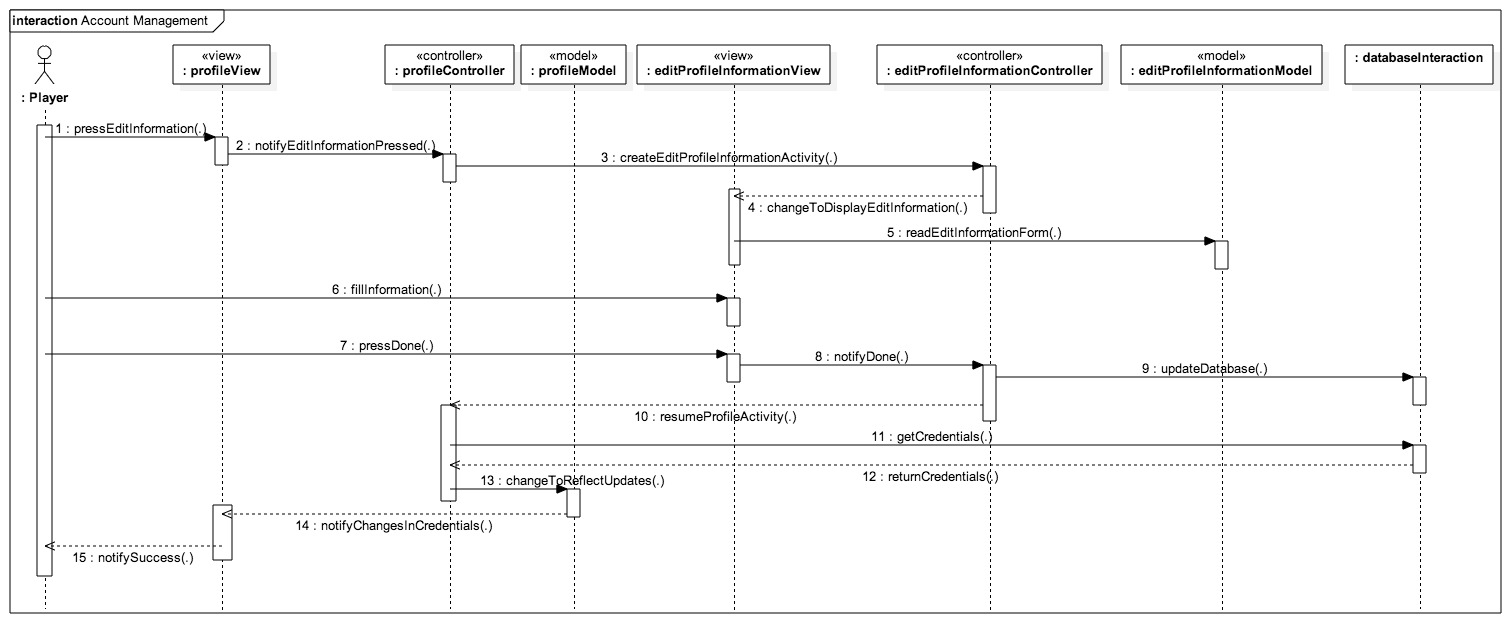


Figure Account Management Sequence Diagram

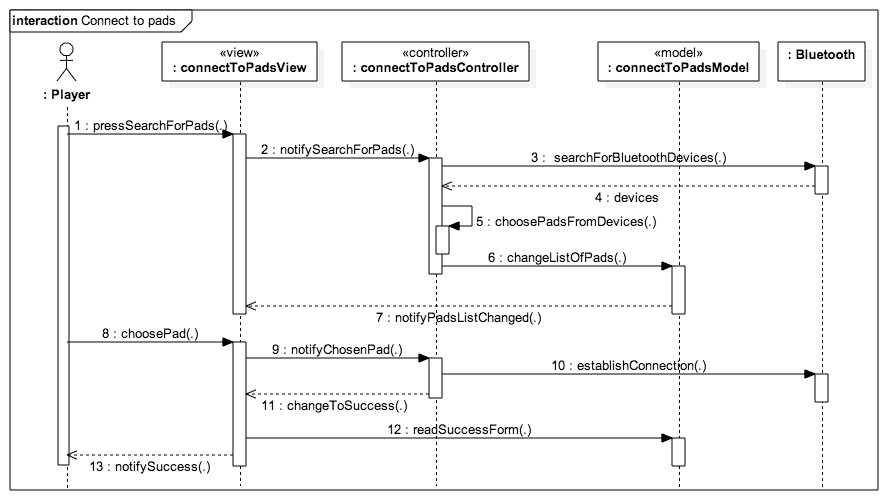


Figure Connect to Pads

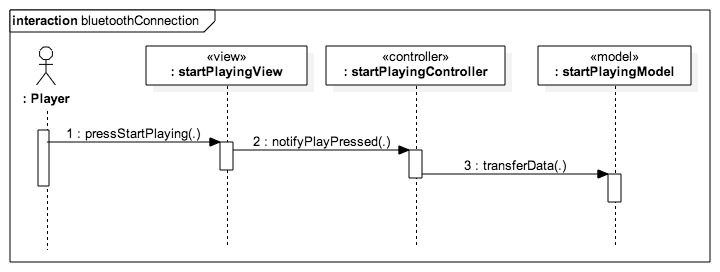


Figure Bluetooth Connection Sequence Diagram

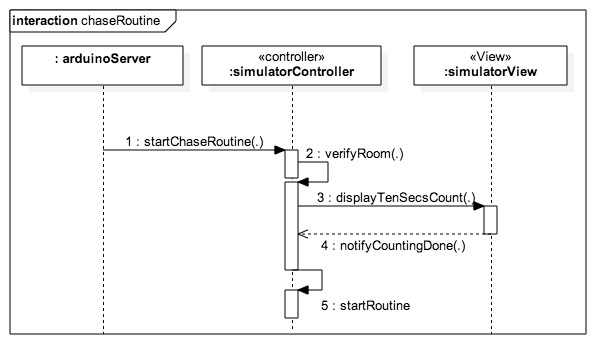


Figure Chase Routine Sequence Diagram

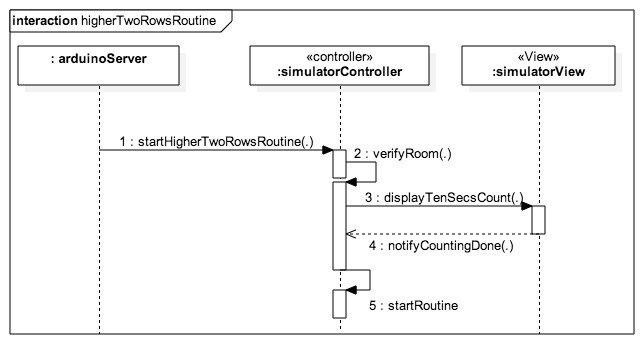


Figure Higher Two Rows Routine Sequence Diagram

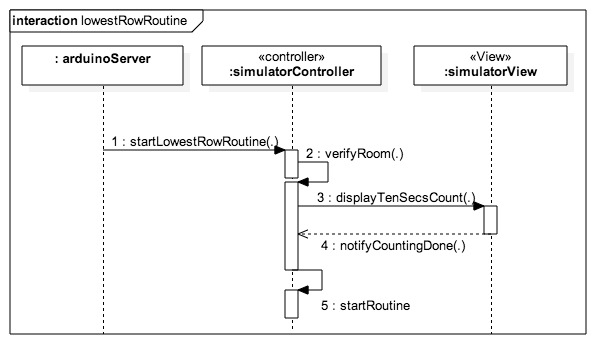


Figure Lowest Row Routine Sequence Diagram

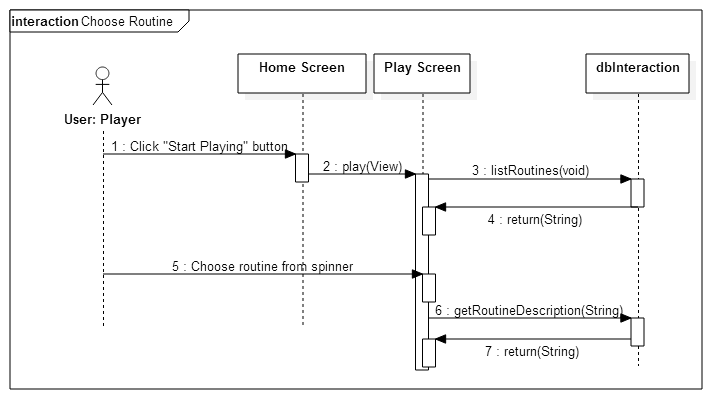


Figure Choose Routine Sequence Diagram

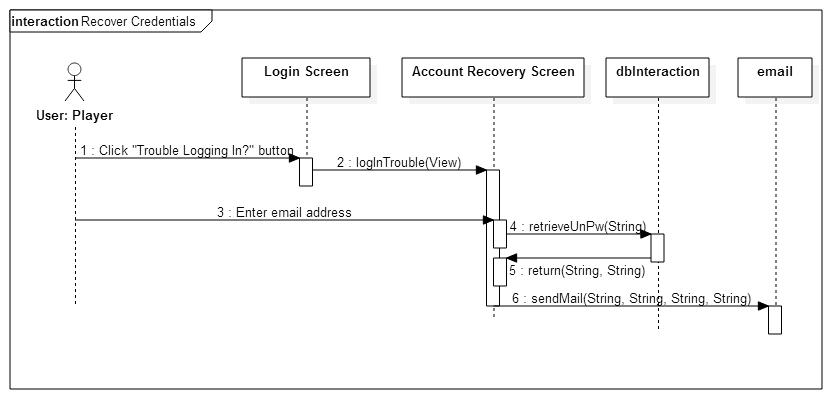


Figure Recover Credentials Sequence Diagram

### Appendix E – User interface designs

#### 6.4.1 The Mobile Device Application

|  |  |
| --- | --- |
| C:\Users\Andy\AppData\Local\Microsoft\Windows\INetCache\Content.Word\Screenshot_2015-04-25-00-10-39.png  Figure Welcome View | C:\Users\Andy\AppData\Local\Microsoft\Windows\INetCache\Content.Word\Screenshot_2015-04-25-00-10-49.png  Figure Create Account View |
| Figure Enter as a Guest Warning View | Figure Login View |

|  |  |
| --- | --- |
| Figure Home View | Figure Bluetooth Permission Request View |
| Figure Scanning for Bluetooth Devices View | Figure Select Routine View |

|  |  |
| --- | --- |
| Figure Performance Metrics View | Figure Display Performance Statistics View Option 1 |
| Figure Display Performance Statistics View Option 2 |  |

#### 6.4.2 The Simulator

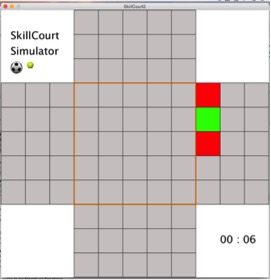


Figure Sample View of Simulator Playing Routine

#### 6.4.3 The Webpage



Figure SkillCourt Website Login Page View

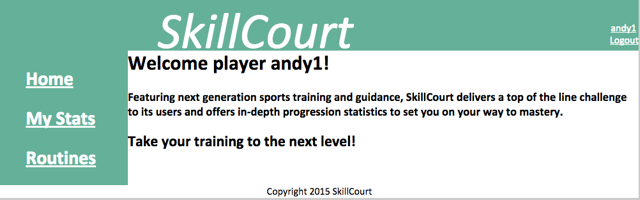


Figure SkillCourt Website’s Welcome View

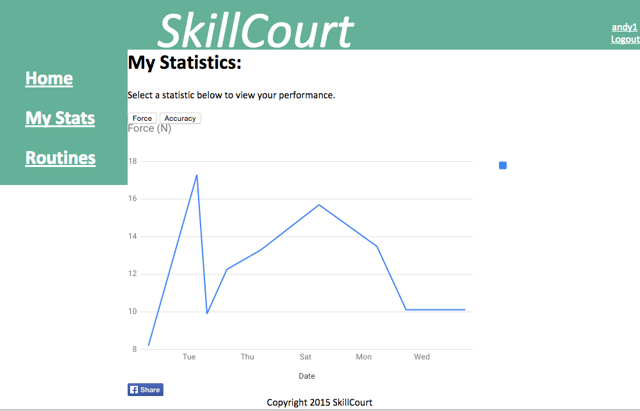


Figure View Statistics and Share in Facebook Page

### Appendix F - Diary of Meetings and tasks

1. **Meeting 1:**

Monday 1/19/15

@8:57pm

Meeting on Mingle starts

In attendance: Andy Martinez, Matthew Santiago

@9:08pm

Arranging possible meeting times for Requirements Elicitation:

* Tuesday 1/20 9:00 pm
* Wednesday 1/21 before 2:00 pm
* Wednesday 1/21 after 7:30 pm

@9:23pm

Chose for Andy Martinez to be Scrum Master for the first sprint

@9:28pm

Sent message to @Product Owner for their preferred meeting time:

* Awaiting reply…
* **1/20 @10:43am** Reply Received, Meeting Tuesday 1/20 at 9:00 pm confirmed

@9:33pm

Meeting Dismissed

1. **Meeting 2:**

Tuesday 1/20/15

@9:00 pm

Conference Call Started

In attendance: Matthew Santiago, Andy Martinez, Jaime Borras, Gummi

@9:02 pm

Introductions

@9:12 pm

Stories:

1. Skill development (accuracy, speed, intensity)
   1. User chooses skill to train from Android App
   2. Measure pressure, time
   3. 3 colors red blue green
   4. Change to red when underperforming
   5. Ball should take 5 seconds to hit the pad, turn red if user takes too long
2. Tracking and analysis
   1. accuracy, speed, intensity, reaction time
3. Single Player/2 Player
   1. Social Media Connection
4. Mapping a game
   1. Pad light up, hit pad with ball in proper time, another pad lights up, hit with ball in proper time, continue until you make goal (certain number of successful iterations)
   2. Beginner, Intermediate, and advanced levels
5. Simulator (simulate a pad)
   1. Android application?
6. (Backend look at particular game (real game) and simulate a player or play within that game)

@9:32 pm

Set meeting with Gummi on 1/21 at 11:00 am in GL 693

@9:38 pm

Meeting Dismissed

1. **Meeting 3:**

Thursday 1/22/15

@9:00

Conference Call start

In attendance: Andy Martinez, Matthew Santiago, Jaime Borras

@9:07

Review stories

Predetermined Routines:

* Separate Goal Simulation into its own story

Performance Statistics:

* Add statistics about specific game

Competition Mode:

* Separation of social media into a new story is good
* Have different routines for single and multiplayer

Custom User Routine:

Pads Simulator:

Real Game Simulation:

Social Media Sharing:

Website:

* (Differentiate between coach and player?)
* Webpage access

@9:46

Meeting Dismissed

1. **Meeting 4:**

Tuesday 1/27/15

@ 6:30 pm

Meeting starts

In attendance: Jaime Borras, Andy Martinez, Matthew Santiago

**Github upload schedule:**

Matthew upload from 10:00pm - 10:59pm

Andy upload from 11:00pm - 11:59pm

**Weekly in-person meeting:**

Thursday between 2:00pm - 6:00pm to prepare for weekly meetings with project owners

**Coding standards**

Comment Convention:

/\*\*

\* Comment goes here

\* and here

\*/

fun()

{

random code

}

**Indentation:**

1 tab per pair of curly braces

**Variable names:**

private \_variableName

public variableName

**Reports:**

**Matthew:** Feasibility report & Initial System Design

**Andy:**  Project Plan & Initial Object Design

**Read up on:**

Android Bluetooth library

Java Databases

1. **Meeting 5:**

Tuesday 1/30/15

@ 4:00 pm

Conference Call starts

In attendance: Jaime Borras, Andy Martinez, Matthew Santiago, Gummy

* Review stories
* Decide which stories to assign to sprint 1

@ 5:00pm

Meeting Dismissed

1. **Meeting 6:**

Thursday 2/13/15

Start @ 3:15

In attendance: Andy, Matthew, Jaime, Gummi (Remote)

* Summary of current state of the app
* Add administrator view
* Coach: Should a coach have access to SkillCourt Web and Mobile, or just website?
* Demonstrated create account and log-in features
* Finish for sprint 1:
  + Option for forgot username/password (email library)
  + Verify email address
  + Password restrictions
* Sprint 2 will include the 2 most crucial stories for continuing development:
  + Cognitive Skills -> This will require a lot of input from Gummi
  + Connect to Pads: App to pad simulator functionality
* Near end of development :
  + Ask about life of server post-class, and possibly move database to a more permanent server
  + Look into adding app to Google Play store

End at 4:00

1. **Meeting 7:**

Thursday 2/16/15

@10:00am

Meeting starts

In attendance: Andy Martinez, Matthew Santiago

* Retrospective Meeting
  + Decided what works best, and what we should do more often
* Deciding what tasks to assign to each user story, what the steps are, and how to organize them.

1. **Meeting 8:**

Thursday 3/02/15

@10:00am

Meeting starts

In attendance: Andy Martinez, Matthew Santiago

* Retrospective Meeting
  + Decided what works best, and what we should do more often
* Deciding what tasks to assign to each user story, what the steps are, and how to organize them.

1. **Meeting 9:**

Thursday 3/20/15

@10:00am

Meeting at Green Library starts

In attendance: Andy Martinez, Matthew Santiago, Jaime Borras, Gummy

* Review stories from Sprint
  + All stories were approved
  + No specific comments

1. **Meeting 10:**

Thursday 3/23/15

@10:00am

Meeting starts

In attendance: Andy Martinez, Matthew Santiago

* Retrospective Meeting
  + Decided what works best, and what we should do more often
* Deciding what tasks to assign to each user story, what the steps are, and how to organize them.

1. **Meeting 11:**

Thursday 4/03/15

@10:00am

Meeting at Green Library starts

In attendance: Andy Martinez, Matthew Santiago, Jaime Borras, Gummy

* Review stories from Sprint
  + All stories were approved
  + No specific comments

1. **Meeting 12:**

Thursday 4/06/15

@10:00am

Meeting starts

In attendance: Andy Martinez, Matthew Santiago

* Retrospective Meeting
  + Decided what works best, and what we should do more often
* Deciding what tasks to assign to each user story, what the steps are, and how to organize them.

1. **Meeting 13:**

Thursday 4/13/15

@10:00am

Meeting at Green Library starts

In attendance: Andy Martinez, Matthew Santiago, Jaime Borras, Gummy

1- Must complete the return sequence from the Simulator to the mobile App. This allows the transfer of the Simulator data to the App and hence to the database and the online web browser...........Andy

2- Simulator must send the finish play variable and reset the App. This is necessary to avoid the manual resets at the end of every simulation.................Andy

3- Mobile App must allow the user to select the different levels for the Simulator i.e. Novice/Intermediate/Advance. It was hardwired for today's demonstration of "Chase".........Matt

4- Add to mobile App the selection for Time based or Sequence or Round based simulation............Matt

5- We agreed in the "Outcome" screen to show the following for all games:

- Score\_\_\_\_\_\_\_\_\_

- Time Played\_\_\_\_\_\_\_

- Number of Rounds\_\_\_\_\_\_\_

- Accuracy = (# of Rounds/# of Shots)X100

- Reaction Time\_\_\_\_\_\_ sec.

- Avg. Force\_\_\_\_\_\_\_\_\_ Newtons

6- Status Matrix

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Original Game Name** | **New Game Name** | **Existing Constraints** | **Simulator** | **Web App** | **Comments** |
| Chase Sequenced | Chase Me | 3 or 4 walls | X |  | Bottom Row Only |
| Chase Time Based | Chase Me if you can | 3 or 4 walls | X |  | Bottom Row Only |
|  |  |  |  |  |  |
| Top 2 Rows Seq. | Fly Me | Min. of 4 pads | X |  |  |
| Top 2 Rows Time | Fly Me if you can | Min. of 4 pads | X |  |  |
|  |  |  |  |  |  |
| Ground Chase Seq. | Drive To Chase Me |  |  |  |  |
| Ground Chase Time | Drive To Chase Me   if you can |  |  |  |  |
| Ground 2 top rows Seq. | Drive To Fly Me |  |  |  |  |
| Ground 2 top rows Time | Drive To Fly Me     if you can |  |  |  |  |
|  |  |  |  |  |  |
| X = Available as of 4/13/15 | |  |  |  |  |

7- In addition, the following User Stories are planned to be completed at the end of Sprint 5:

    a- Access Performance Statistics:

        Best Performances: Score\_\_\_\_\_

                                     Reaction Time\_\_\_\_\_

                                     Accuracy\_\_\_\_\_\_\_

                                     Avg. Force\_\_\_\_\_\_\_

      - Average:                Score\_\_\_\_\_

                                     Reaction Time\_\_\_\_\_

                                     Accuracy\_\_\_\_\_\_\_

                                     Avg. Force\_\_\_\_\_\_\_

Gummi will work on an equation to place a weighting factor on these parameters to be included if there is time.

     b- Share Outcomes on Social Media

1. **Meeting 15:**

Thursday 4/17/15

@10:00am

Meeting at Green Library starts

In attendance: Andy Martinez, Matthew Santiago, Jaime Borras, Gummy

Jaime: All items outlined on the April 13, 2015 meeting minutes were completed, and the UI was very nicely improved

We proceeded to test the Android Mobile App connected to the PC Simulator via Bluetooth (BT) and the Arduino board which was serially connected to the laptop. For proper PC Simulator functionality there needs to be a double click on the same pad to record the force of the striking force simulation.

New Issues Observed .........................................and the follow up actions:

1- Database showed zero for accuracy during Analytics............................................Matt to investigate

2- The Rounds statistics is really the number of "shots on target"........................Matt to change it to "Targets Hit" or similar

3- Add the proper UI background to Analytics..............................................................Matt to update

4- Play again did not disconnected Bluetooth........................................................Fixed during meeting

5- Display of Statistics do not distinguished between classes of data i.e. N/I/A.................Andy to fix

6- Change default to Rounds selection rather than Time................................................Matt to do

7- While playing Time base, there should be some sort of animation to show game is active...........Future

8- The Back Button is not programmed to go back.........................................................Future

9- Initial connection time from App to BT/Arduino/PC Simulator is very random.................Future Investigation

10- During initial connection time there should be a progress bar......................................Future

Other Actions:

1- Andy to order two sets of Arduino boards, Bluetooth modules and small assembly breadboard for Gummi and Jaime to test next Monday, April 27.  Andy to send total cost so that we can bring a check.

2- Matt to package Android App with final App version and send APK prior to Monday's meeting.

3- PC Simulator stand-alone version was discussed to be implemented in the future.

4- We also discussed Andy and Matt's desire to continue optimizing SkillCourt during the Summer.

5- After Graduation, Andy and Matt to proposed potential Summer tasks for discussion.

6- Andy and Matt to propose Restaurant for Graduation/Thank you dinner sponsored by SkillCourt.

Post Meeting Observations for Future:

1- PC Simulator should return the ball to the middle of the court after every strike.

1. **Meeting 15:**

Thursday 4/20/15

@10:00am

Meeting starts

In attendance: Andy Martinez, Matthew Santiago

* Retrospective Meeting
  + Decided what works best, and what we should do more often
* Deciding what tasks to assign to each user story, what the steps are, and how to organize them.

## References

### 7.1 For website:

* [http://www.w3schools.com](http://www.w3schools.com/)

### 7.2 For App:

* <https://developer.android.com/training/basics/firstapp/index.html>
* [http://www.android-graphview.org](http://www.android-graphview.org/)

### 7.3 For Simulator:

* [https://processing.org](https://processing.org/)
* <http://www.soccerballworld.com/Physics.htm>

### 7.4 For MasterPad (microcontroller):

* <http://www.arduino.cc/en/Guide/HomePage>