

Software Engineering Project Report



Documentation for Software system development on Training Simulator for Soccer Players

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Table of Contents	2
How to Use This Document	2
List of Figures	9
List of Tables	10
I Project Description	12
1 Project Overview	12
2 The Purpose of the Project	12
2a The User Business or Background of the Project Effort	12
2b Goals of the Project	12
2c Measurement	13
3 The Scope of the Work	14
3a The Current Situation	14
3b The Context of the Work	14
3c Work Partitioning.....	17
3d Competing Products	19
4 The Scope of the Product	19
4a Scenario Diagram(s)	20
4b Product Scenario List	20
4c Individual Product Scenarios	20
5 Stakeholders	21
5a The Client.....	21
5b The Customer	21
5c Hands-On Users of the Product	22
5d Maintenance Users and Service Technicians	23
5e Other Stakeholders	23
5f User Participation.....	24
5g Priorities Assigned to Users	25
6 Mandated Constraints	26
6a Solution Constraints	26

6b Implementation Environment of the Current System	27
6c Partner or Collaborative Applications	28
6d Off-the-Shelf Software	29
6e Anticipated Workplace Environment	30
6f Schedule Constraints	31
6g Budget Constraints	32
7 Naming Conventions and Definitions	32
7a Definitions of Key Terms	32
7b UML and Other Notation Used in This Document	33
7c Data Dictionary for Any Included Models	34
8 Relevant Facts and Assumptions	35
8a Facts	35
8b Assumptions	35
VII References / Bibliography	80

I Project Description

1 Project Overview

This development project is about creating a system software that will provide an innovative training system for soccer players. The system reproduces a real situation or a cognitive process designed to boost its users' capabilities. The system consists of a 4-sided physical box that encloses an artificial pitch. Once activated, the simulator fires in balls to a waiting player, who is then directed to settle and pass that ball into a specific quadrant of the box, dribble around physical obstacles, shoot at virtual goalkeepers, etc. The system relies on an LED wall and automated 'ball boy', using fully-customisable system software to analyse performance and allow players to work on their skills. The software will have the ability to interact with existing databases and manage training sessions. Each player has their own system profile for training, enabling them to track details about their session and generate reports. This will allow developing and improving the players' responsiveness, accuracy, speed and 360° vision in a system of individualised training within specific exercises.

Also, in conjunction to control-panel model, the power of virtual reality is incorporated to get insights about the gameplay of each player during the actual games he has played in past via using data from in-stadium cameras and other tracking systems. This will create a VR replay of the entire soccer match which can be seen using hardwares like Oculus, etc. Players (Wearers) can use simple controls to fast-forward to specific points of the game. Also, the player can switch to the perspective as a team-mate and see what he saw at the given moment.

2 The Purpose of the Project

2a The User Business or Background of the Project Effort

The product will be installed in the training facility center of professional soccer academy or soccer clubs. The client wants to get better training simulation for his team players which will enable to practice soccer drills in an indoor replicated physical environment which can be used in all weather conditions.

The virtual reality aspect of system can be used during pre-game or post-game team talks sessions for strategy building and analysing the gameplay of past matches played and learn to do better in upcoming games.

The main motivation behind developing this simulator is to provide almost similar experience to the players while training which they would be facing while playing real soccer games. Also, this training simulation can be used to analyse the overall aspects of past games played by a particular player. This helps them to avoid those mistakes in future to avoid injury or maybe to increase their overall efficiency in actual live games.

The user of the system will be a soccer player or a goalkeeper who is trying to train harder to get better and stronger for his/her future games. Getting better training simulation will help them to learn new techniques and improvise on the existing techniques. The statistical reports generated by the system about their individual profiles will track the performance measures of various aspects of their gameplay. Training the right way before games is a very critical aspect for a sportsperson as it will help reduce injuries and improve the overall efficiency of a player during the actual games.

2b Goals of the Project

We want to develop a realistic as well as an entertaining soccer simulator. The system developed will be more than just a typical Video Game simulation and give the players more thorough training. The system aims to evaluate and improve player's reaction times specifically goalkeepers, and simultaneously collect a variety of performance measures as digitised data that can be utilized in analyzing everything from player positioning to injury recovery.

This product will be used for training both professionals and beginner soccer players. For professional soccer players, their usage is two-fold. The coach can customize the features of software system simulator as required according to the needs of the individual player. During one-on-one sessions, a coach can focus only on certain players for that particular time. Using our system, multiple players can undergo specialized training at the same time. This results in more practice for each player in the same amount of time. Also, practicing risky maneuvers in a controlled in-doors environment is better than practicing them on a field where accidents can occur that can drag in other players and injure both.

A beginner soccer player can also avail the training of a professional coach using the simulator. While the player may not have a coach to teach them personally or have a specialized training regime like a professional would, certain tricks and maneuvers can be taught in a better way. A beginner would have generic in-built training sessions developed by professional coaches that would help them develop faster than individual training or local coaches would. Learning dribbling tricks or overhead passes in a controlled environment would reduce training induced injuries so as to facilitate faster learning.

Both professional players and beginners would be able to see past games. For professional players, this would enable them to analyse strategies of their opponents as well as self-criticize their own games. For beginners, this would enable them to develop a sense of the game-play in

soccer and inspire them to avail to greater heights.

2c Measurement

The goal of the system is to improve the overall efficiency of the soccer player or a goalkeeper and that can be best measured by key traits of the player and some performance measures such as the average velocity of the shots taken during the session, the number of goals scored/saved, the scoring/conceding percentage, controlling ball with varying speeds, reaction time in seconds, accuracy of passes and shots taken, consistency, etc. The goal is said to be fulfilled if it helps to develop the individual performance of the player in terms of the capacity of reaction, the precision and consequently enhancing their decision capacity and technical execution.

3 The Scope of the Work

The product is designed for clients who have well established soccer academies and for the professional soccer clubs. The end users of this system will be soccer coach, team management staff and the players.

3a The Current Situation

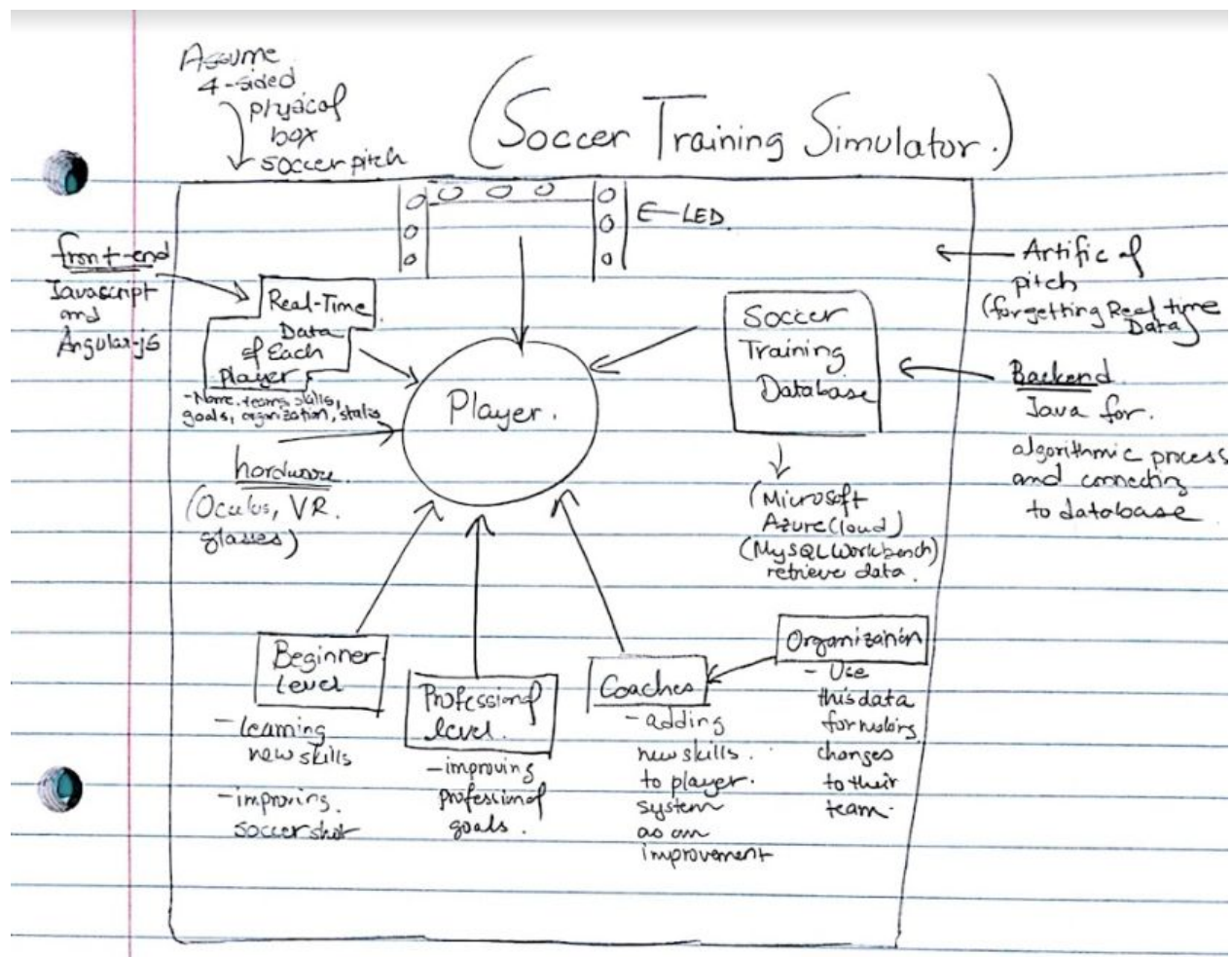
Currently, potential clients develop their individual skills by training on the field as a team. Sportspersons need to be careful during practices for team games as there is always a greater chance for injuries. During practice, one or multiple players may get injured and this stalls the development of the team as a whole. For injuries incurred during practicing individual maneuvers, it stalls the growth of the players and decreases the practice time of the player. Also, the weather conditions throughout the year are not benign enough to continue playing outdoors and this might affect the practicing period for players.

The introduction of this computerized system will allow players to accurately measure their skills and track their growth, much like biometric sensors allow many to track their fitness data in devices like Fitbits. The users will also be able to create scenarios that facilitate the practice of skills in novel ways that can not be achieved conventionally. A safe and secure in-door training environment will decrease practice related injuries and increase skill growth of the player and allow them to practice anytime of the year irrespective of the outdoor weather conditions.

3b The Context of the Work

To build the product we need both software and hardware components for example whenever are retrieve data of a specific player and keeping track of their personal skills we will be using MySQL Workbench, Microsoft Azure for collecting the data and Java is the backend programming language in terms of the algorithmic process and connecting to the database. For front-end we will be using Javascript and Angular.js for rendering the data of each player with their name, skills, team, goals, and achievements from the system.

The subjects that matters for the soccer training simulator our the professional and beginner players, coaches, and teams from different organizations. Each subject is an entity in the soccer training database system. We are collecting real-time data of each player based on the sensors when they are playing in the 4-sided physical box that encloses an artificial soccer pitch. Since we are collecting real time data it is useful for coaches for making changes in team, beginner and professional players can set their goals higher based on their data.



In terms of the future considerations for soccer simulator we need to research on the sensor that

are used on the artificial soccer pitch to collect the real time data of each personal player. If there are multiple group of people playing on that artificial soccer pitch is there collision in terms of retrieve data of each player playing on the soccer pitch. This is something to consider will working on the soccer training simulator.

3c Work Partitioning

Business Event List

Event Name	Input and Output	Summary
Coach create drills for players	Inputs for the ball speed, trajectory and speed (in) Ball gets fired from the walls accordingly (out)	Coach customises drills for players like long balls, trajectory, speed, etc
Technicians and Analysts fetch statistics from the simulator software and analyse the player's performance	Performance measures (in) Sports Science Reports (out)	Tracking overall improvement of a player
Player shoots/passes ball to the physical LED wall	Target detection on LED wall (in) Performance measure reports generated by system (out)	Target is detected on the wall and generates accuracy reports for each training session and particular drills
Ball recovery	Conveyor belt input parameters (in)	Automated 'ballboy' with balancing software to deliver the balls accordingly with the needs of the system (training session)
Software fetches reports from existing databases	Database systems (out)	Past sessions' reports
VR hardware gets footages from in-stadium cameras	Video recordings(in)	Getting input for VR
Data is collected by software via cameras and sensors present in the physical box	Detection of targets(in)	Digitising physical movements happening in the box.
Canons fire balls to the players according to the customization of software	Ball delivery positioning (in)	Ball launchers - full control and feedback, speed upto 100mph, ball spin, etc
Video recording HD	Dynamic report generation (out)	History records and dynamic reports

3d Competing Products

The soccer simulator game such as FIFA and Pro Evolution soccer. Let's take FIFA soccer game as the explanation of the product. FIFA soccer video game can help players pick up the intricacies of the sport at a young age. By the time they are six years old, a lot of children are already aware of wingers, defensive midfielders and the key attributes that make the best players the best.

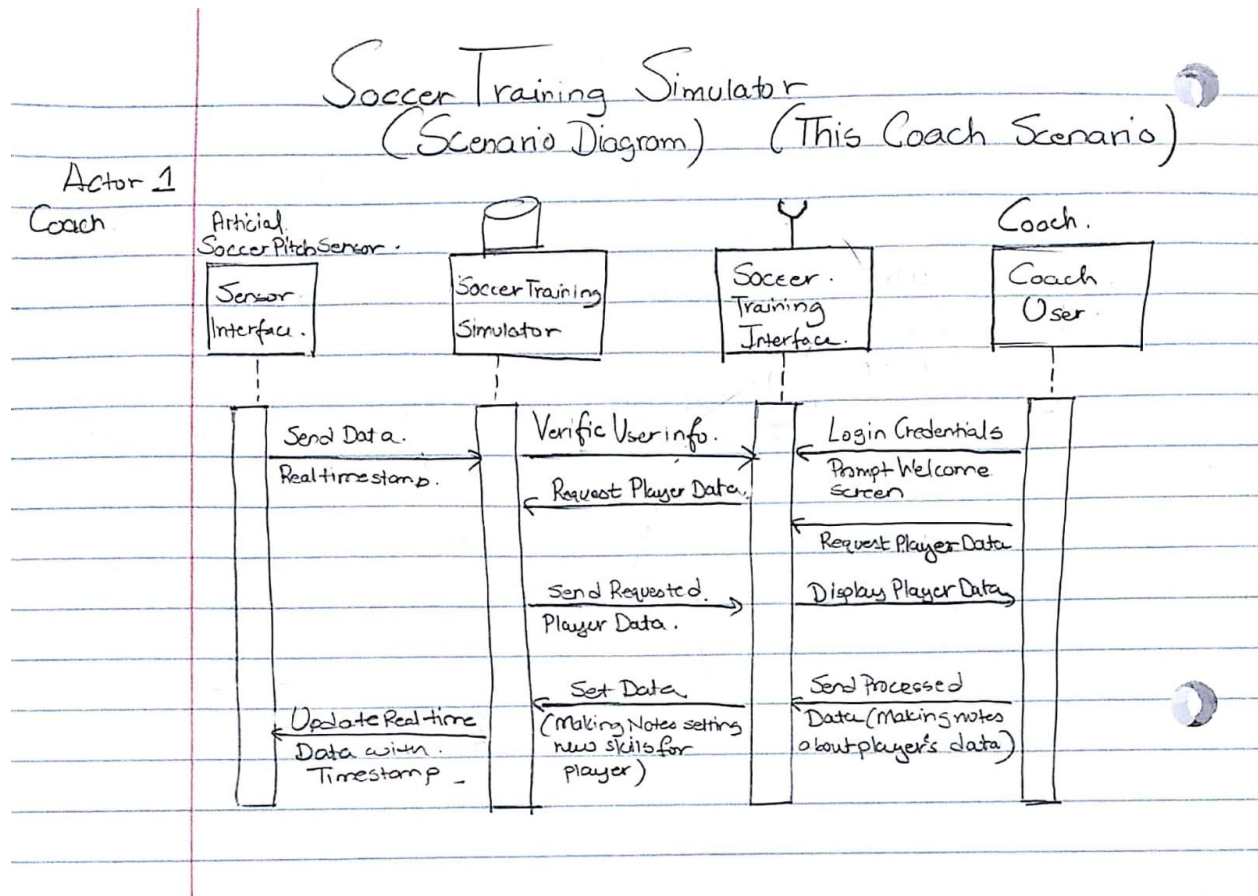
Even though FIFA is the best simulated game on mobile or PC it still a video game where the person is not physically playing the game. Basically, FIFA and PES (Pro Evolution Soccer) games are not compatible using Augmented or Virtual Reality device. The person does not have real-world experience playing these game.

This is where our product Soccer Training Simulator comes in which covers all the flaws or deficiencies existing products have for instance our product's system relies on an LED wall and automated 'ball boy', uses fully-customisable system software to analyse performance and allow players to work on their skills. The software will have the ability to interact with existing databases and manage training sessions. Each player has their own system profile for training enabling them to track details about their session and generate reports. This is the best product for people who are new to soccer, want to practice on their soccer skills, and have some physical activity going on during the weekend rather playing the FIFA games remotely on their PC or laptops.

4 The Scope of the Product

4a Scenario Diagram(s)

Scenario diagram for user 'Coach'



4b Product Scenario List

There are 2 main scenario for our system based on the types of users and the system function they avail.

First scenario, called 'coach', is for user coach. The main function of a coach is to develop training schedules specifically designed for the improvement of each individual player. A coach also analyzes past game play and makes notes for its strength and weaknesses.

The second scenario, called 'player', is for user player. It has 3 sub-scenarios based on the system function they avail. A player can choose to (a) either look at past practice sessions or gameplays, (b) continue a past training session or (c) begin a new training session.

4c Individual Product Scenarios

The two users of our system would be the coach and the player. Scenarios for both are as given below:

Coach:

The coach will login to the system using his credentials.

After the welcome screen, the system will show him the list of players under his purview. For each player, the current statistics, training schedule and desired improvement after the training schedule are given. A progress bar showing distance between current statistics and desired statistics is also given.

The coach can modify the training schedule for each player according to various stages of improvement and rate of improvement.

The coach can also view various past games and make note of game play strategies and their success and failure rates.

After all modifications are completed and notes are stored in the database, the coach will log out.

Player:

The player will login to the system using his credentials.

After the welcome screen, the current statistics, training schedule and desired improvement after the training schedule are given. A progress bar showing distance between current statistics and desired statistics is also given.

A player can send a notice to the coach for any desired changes in the training schedule or any additions/updates in maneuvers he wants to learn.

A player can then chose to either look at past practice sessions or gameplays, continue a past training session or begin a new training session.

If the player chooses to look at past practice sessions or gameplays, then he can utilize the LED display as a screen or use VR head gear for a full 3D experience to analyze past performances.

If the player chooses to continue a past training session, then the previous progress bar is shown and the player can resume the paused training session or reset it and start that particular session from the beginning.

If the player chooses to begin a new training session, then a list of all available training sessions will be displayed to him. He will choose one of those and start the training. He can either finish the session in one go or pause the session and continue it later on if he has to take a break for any

reason.

After the session is over, the player will be shown the progress made during this session by displaying his worst and best scores achieved during the session and those scores will be compared to his past worst and best scores in all sessions.

The progress bar showing distance between current statistics and desired statistics is updated according to the worst and best scores achieved in the latest sessions.

After the session is completed, the player will log out.

5 Stakeholders

5a The Client

The client is a professional soccer team and beginner players who are trying to improve their soccer skills.

5b The Customer

The customers are professional soccer teams, and beginner soccer player who are trying to learn soccer as the new sports and improve their skills.

5c Hands-On Users of the Product

The actually users will be coaches and players. Coaches will be able to design their own training scenarios, and players will be able to play out the scenarios on the field and with the VR headset.

5d Maintenance Users and Service Technicians

Maintenance will be the responsibility of the maintenance department of the given soccer team. New specialized technicians may be necessary to upkeep the components.

5e Other Stakeholders

Other potential stakeholders are universities with soccer teams.

5f User Participation

It may be necessary to bring users in to test the functionality of the features. They could give valuable feedback on the details.

5g Priorities Assigned to Users

Key Users: Players, the system must be optimized for their use so that they will see the results in their playing. A team will not want to pay for this product if it has no effect on their players and does not lead to more wins.

Secondary Users: Coaches, they are also important to the team's success, but ultimately the players will be using most of the product's features and they are the ones that need to improve.

Unimportant Users: Any other users would be considered unauthorized: the intended use is for professional teams.

6 Mandated Constraints

6a Solution Constraints

Description: The product must allow teams to practice in all weather conditions.

Rationale: Allowing teams to practice year round is a primary marketing point.

Fit criterion: The environment must be completely enclosed and unaffected by the outside.

Description: The product must replace FIFA games during training.

Rationale: One of the main goals of the project is to create a better tool for strategic training.

Fit criterion: 70% of coaches testing the system must say they would like to use it as a replacement.

6b Implementation Environment of the Current System

This system is its own environment, so all of these considerations are included in the design.

6c Partner or Collaborative Applications

The system's strategic learning capacity must take the role of FIFA in training and must be similar and intuitive to use for the coaches and players. The team's use of FIFA should be studied and used as a model for development of the strategy system. Partnership is also an option to explore.

6d Off-the-Shelf Software

We will need a VR gear like hardware like Oculus, etc. Players (Wearers) to view replay of the entire soccer match. We can use simple controls to fast-forward to specific points of the game.

The power of virtual reality is incorporated to get insights about the gameplay of each player during the actual games he has played in past via using data from in-stadium cameras and other tracking systems. Also, the player can switch to the perspective as a team-mate and see what he saw at the given moment.

6e Anticipated Workplace Environment

The finished product is its own working in-door environment, so these concerns are completely encapsulated in the design work.

6f Schedule Constraints

This product should be completed before a soccer season, to give teams time to adjust their training regiment and make full use of it. Completion during the soccer season makes it less likely that teams will buy it at that time.

6g Budget Constraints

We have estimated a budget of 20 million USD is needed for development of this project.

7 Naming Conventions and Definitions

7a Definitions of Key Terms

Teams- professional soccer teams such as those in FIFA or similar.

7b UML and Other Notation Used in This Document

No UML diagrams have been used in this document. Only various diagrams that show desired design and working of the finished product have been used.

7c Data Dictionary for Any Included Models

No data dictionary needed.

8 Relevant Facts and Assumptions

8a Facts

The LED display necessary for the enclosed training area has to have a display of at least 1080p.

8b Assumptions

We assume teams are willing to invest in an expansion to their facility to house our system.

VII References / Bibliography

N/A