

Design Document

Indoor Football Strategy Simulation

Iteration 2



Development team

Alex Lievense
Dinh Thanh Nguyen
Kheir Almosally
Thi Thu Thao Nguyen
Tsvetelina Chantalieva
Viet Hai Nguyen

Reviewed by

Stan van Hartingsveldt

Last updated: November 23, 2018

Overview

A high level summary that every engineer at the company should understand and use to decide if it's useful for them to read the rest of the doc. It should be 3 paragraphs max.

You are reading the design document for the second iteration of the development of an indoor football strategy simulation. This document contains the following sections:

[Context](#)

[Goal](#)

[Milestones](#)

[Current Solution](#)

[Proposed Solution](#)

[Improved strategy management](#)

[Area of Influence](#)

[Advanced AI Features](#)

[More realistic simulations by adding a time aspect](#)

[Results of a simulation](#)

[Resize the simulation](#)

[UML Diagrams](#)

After reading this document you should have a clear idea of why we are developing this simulation and what we will do in the next iteration.

1.Context

SIM Software Inc. is a fast growing company aiming at innovative solutions for simulation problems. In the last few years, SIM software has focused on traffic simulation software. SIM Software Inc. would like to extend its expertise to cover a broader area of simulation software. The project team is in charge of developing an indoor football strategy simulation for SIM.

This project will help SIM Software to grow horizontally as a business by delivering simulation software for a totally different group of customers. The project will be completed by February, 2019.

The development phase of the product is divided into three iterations. During the first iteration the project team developed a simple simulation where football players are able to chase the ball and goalkeepers are able to keep the ball out of their goal. During the second iteration the team will enhance this simulation by adding new features to the simulation and enhancing the AI of the players.

2.Goal

Our goal for the second iteration of the project:

Improve the simulation by enhancing the strategy section, adding new features to the AI of the football players and making the football matches more realistic by adding a time aspect to it. We want to achieve more realistic outcomes of the simulations by implementing these new features.

3.Milestones

Start Date: *November 26, 2018*

Milestone	Description	Deadline
Milestone 1	Enhanced strategies by adding custom formations	November 30, 2018
Milestone 2	Add a time aspect to the simulation	November 30, 2018
Milestone 3	Players can pass a ball	December 7, 2018
Milestone 4	Strategies have AOI features	December 7, 2018
Milestone 5	Players can kick the ball towards the goal	December 14, 2018
Milestone 6	More realistic simulation by adding events	December 14, 2018
Milestone 7	Translate strategies to the simulation	December 14, 2018
Milestone 8	Display results and add option to export them	December 14, 2018

4. Current Solution

At the end of the first iteration the project team had created a working simulation with the following features:

- Strategy management section where the user can choose a formation from a fixed list of formations.
- User can select a formation for the home team and the away team and start the simulation.
- During the simulation:
 - Players can chase the ball.
 - Goalkeepers move between the posts of their goal and bounce the ball back into the field if it reaches the goal.

User story

When starting the application the first thing that the user can see is the home form from which a strategy and a formation can be picked. In this form the user is able to pick a strategy for the home team and a strategy for the away team. Also the alteration of a strategy is possible. Meaning if the user wants to add or delete a strategy that is possible too. That is done in another form called “Strategies”.

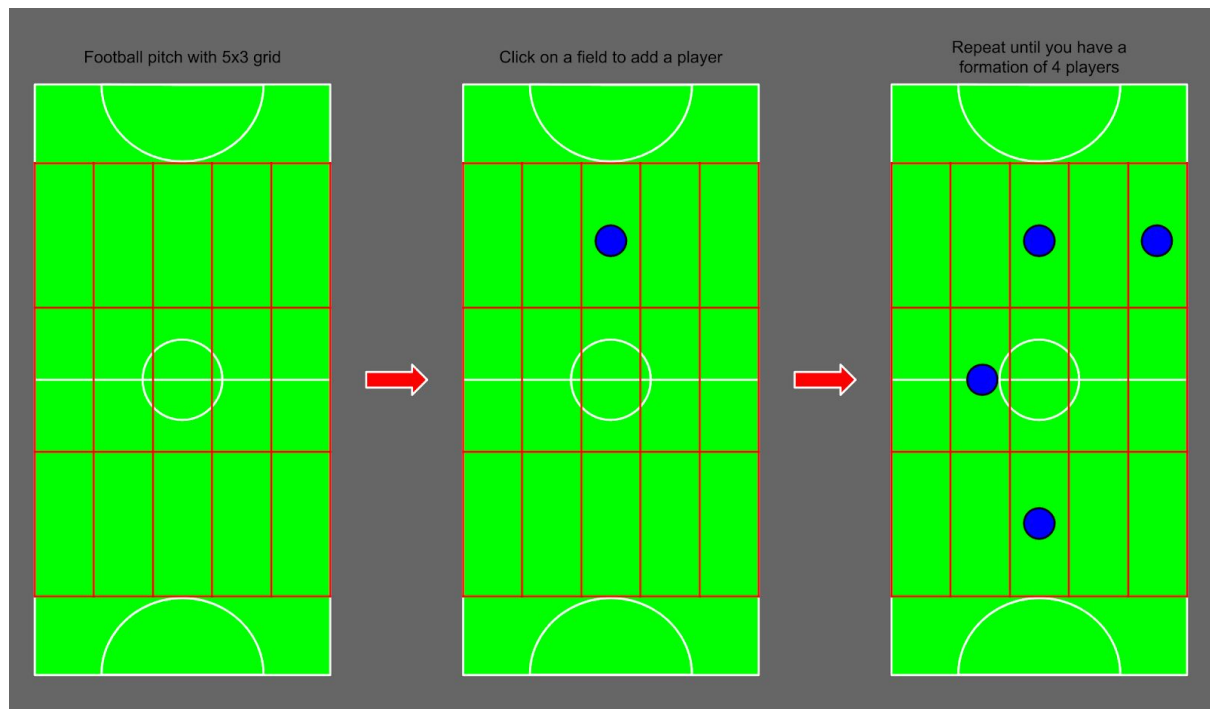
The next step is to simply press the “Start simulation” button in the right corner of the form. From that moment a new form with the simulation in motion is being loaded. In this form the user can see the simulation and also has some other options. For this iteration the only implemented option is “Stop simulation” which stops the simulation. The simulation itself shows the players that chase the ball and the goalkeepers of both teams.

5. Proposed Solution

In the section milestones we already presented the things we want to accomplish during this second sprint. In this section we will present them in more detail.

Improved strategy management

- Custom formations:
 - The field will contain a grid of 3 rows and 5 columns.
 - You can select the default position of a player by entering clicking on that area in the grid.
 - No more than 4 players can be added.
 - You can remove a player from a position by clicking again on the existing player.
 - Demonstration:

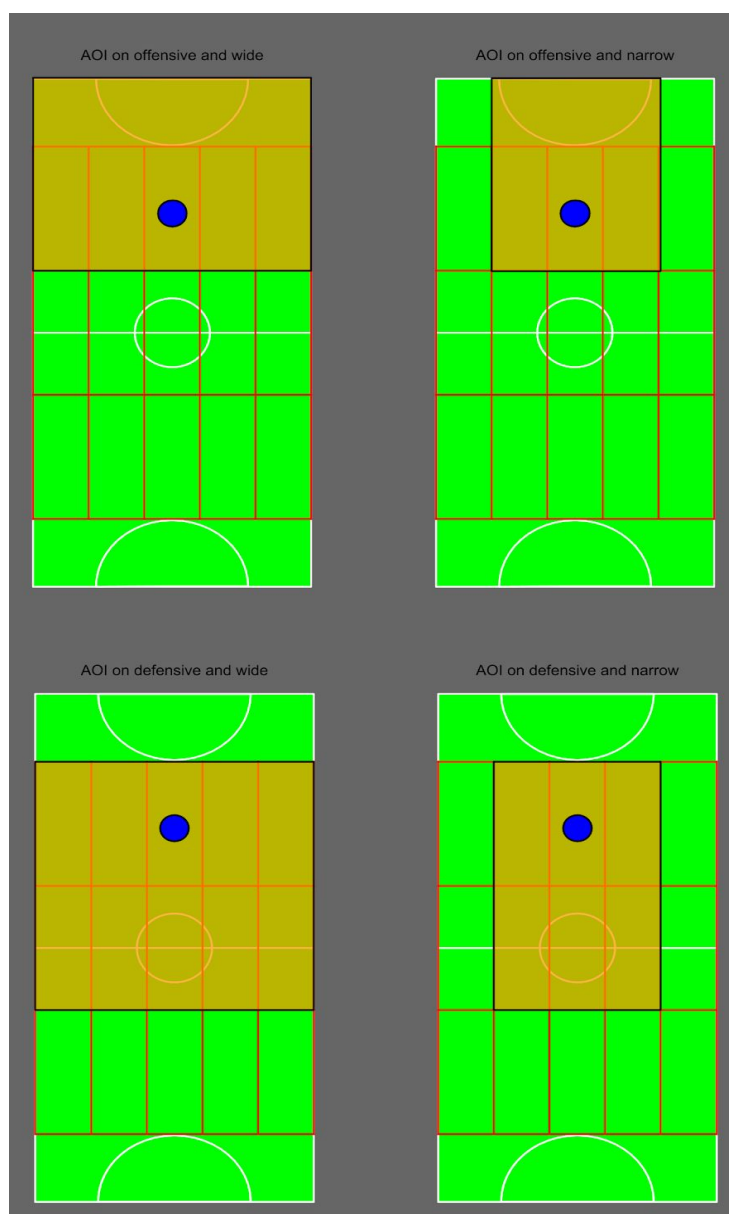


- More advanced strategies, more advanced than iteration 1:
 - The user can select a custom formation in the way explained above.
 - The user can specify offensive and defensive playing style.
 - The user can specify wide or narrow playing style.
 - Man marking will NOT be part of the strategy in this iteration.

Area of Influence

Each position on the field gets an assigned area of influence (AOI). This AOI restricts the players movement, such that the chosen formation will be maintained during the simulation and the player won't all run to the same location.

- Every position has a predefined Area Of Influence (AOI from now on). This AOI can not be set by the user.
- This AOI differs based on the state of the team (offensive/defensive) and the width of the playing style (narrow/wide).
- Demonstration with the center forward position:

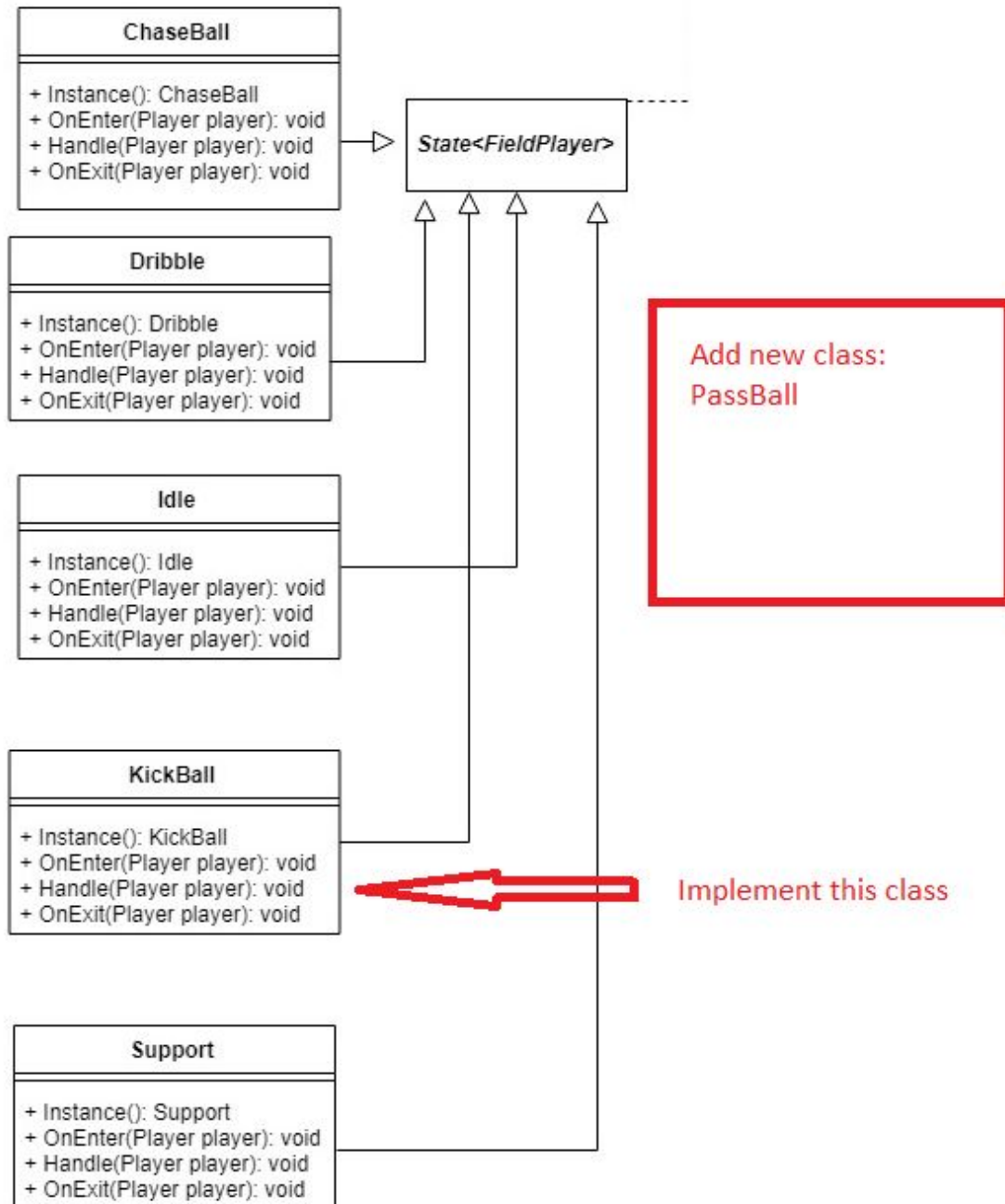


The AOI has to be translated to coordinates on the field on a running simulation.

Advanced AI Features

- A player should be able to decide to pass the ball to a fellow player.
- A player should be able to decide to kick the ball towards the goal.

These features can be implemented by implementing existing state class “KickBall” and creating a new state class “PassBall”:



More realistic simulations by adding a time aspect

- Add a time limit to the simulation
- Show current time during a simulation
- Add events to the simulation (goal, kick-off, start, half-time, end)

Results of a simulation

- Show the outcome of a simulation after it has ended.
- Provide the option to export the results either in a PDF or CSV format.

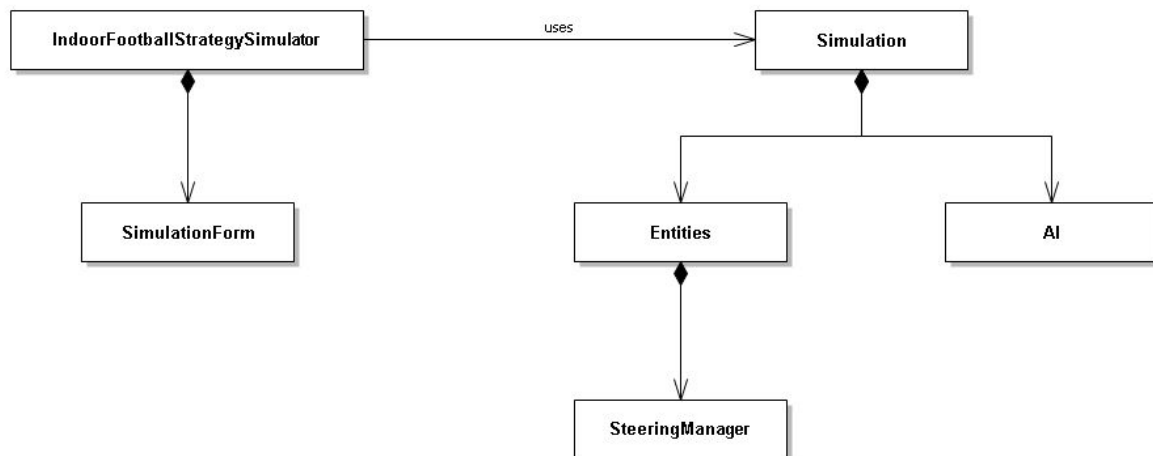
Resize the simulation

- Scale the simulation down so that it also fits on smaller laptop screens.

UML Diagrams

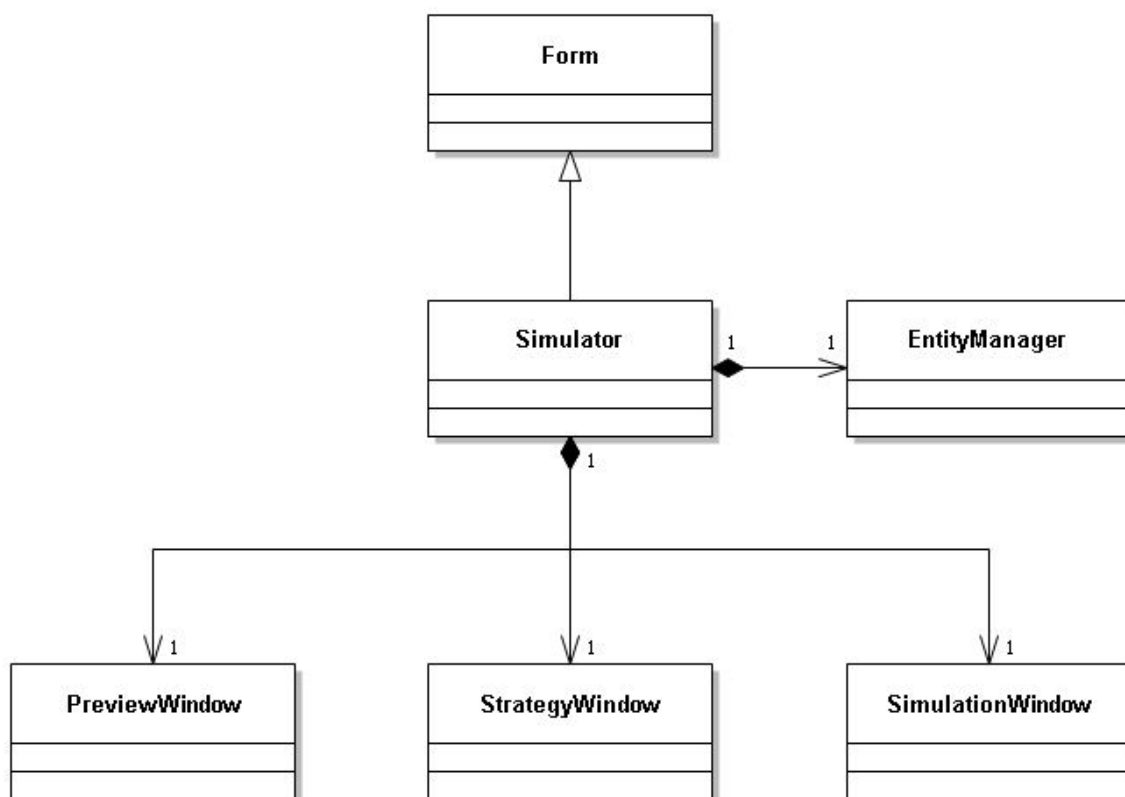
1. Namespace diagram

There are two namespaces: IndoorFootballStrategySimulator and Simulation. The simulation namespace contains all the entities, the physics and the AI:



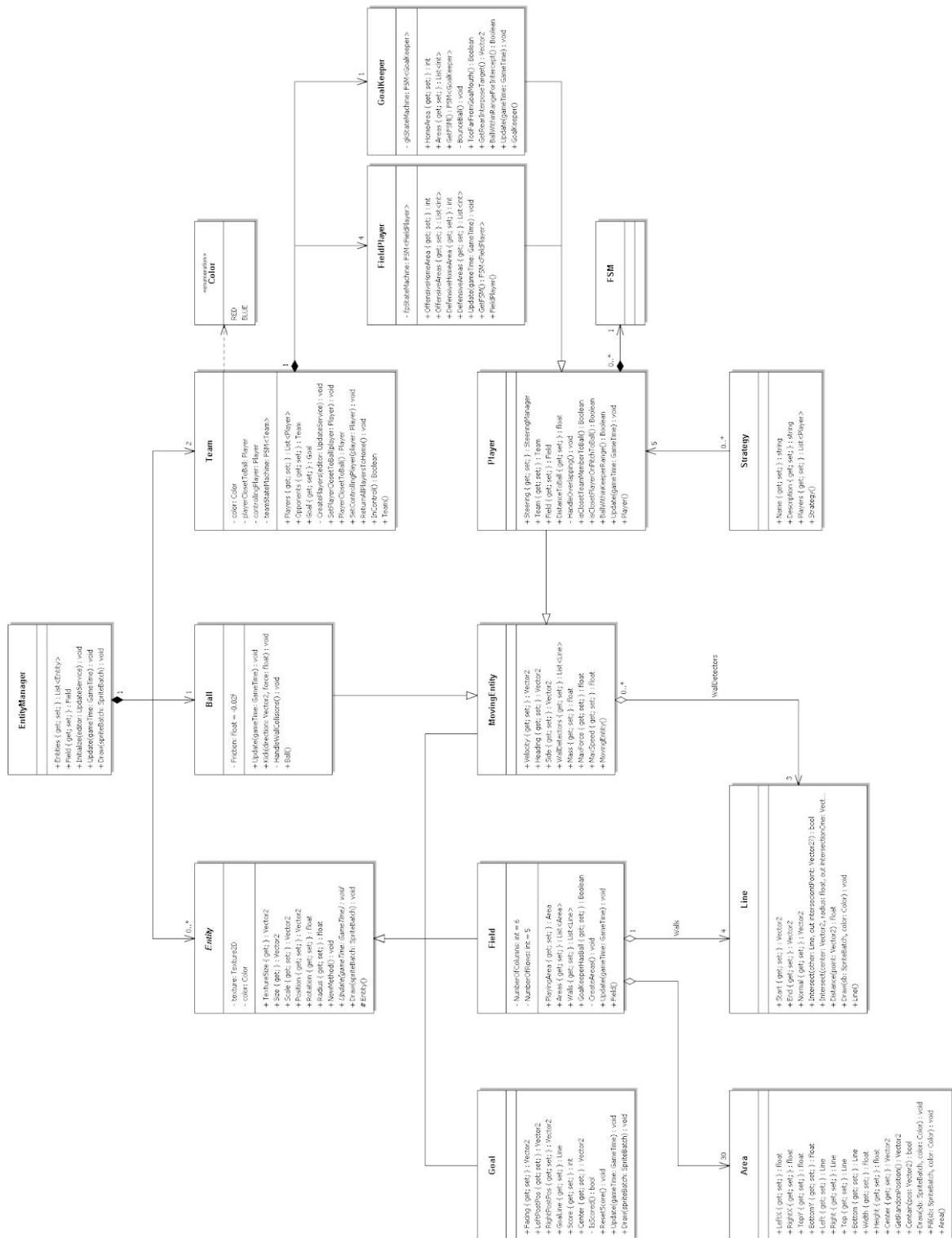
2. IndoorFootballStrategySimulator

This namespace contains the forms to display the simulation:

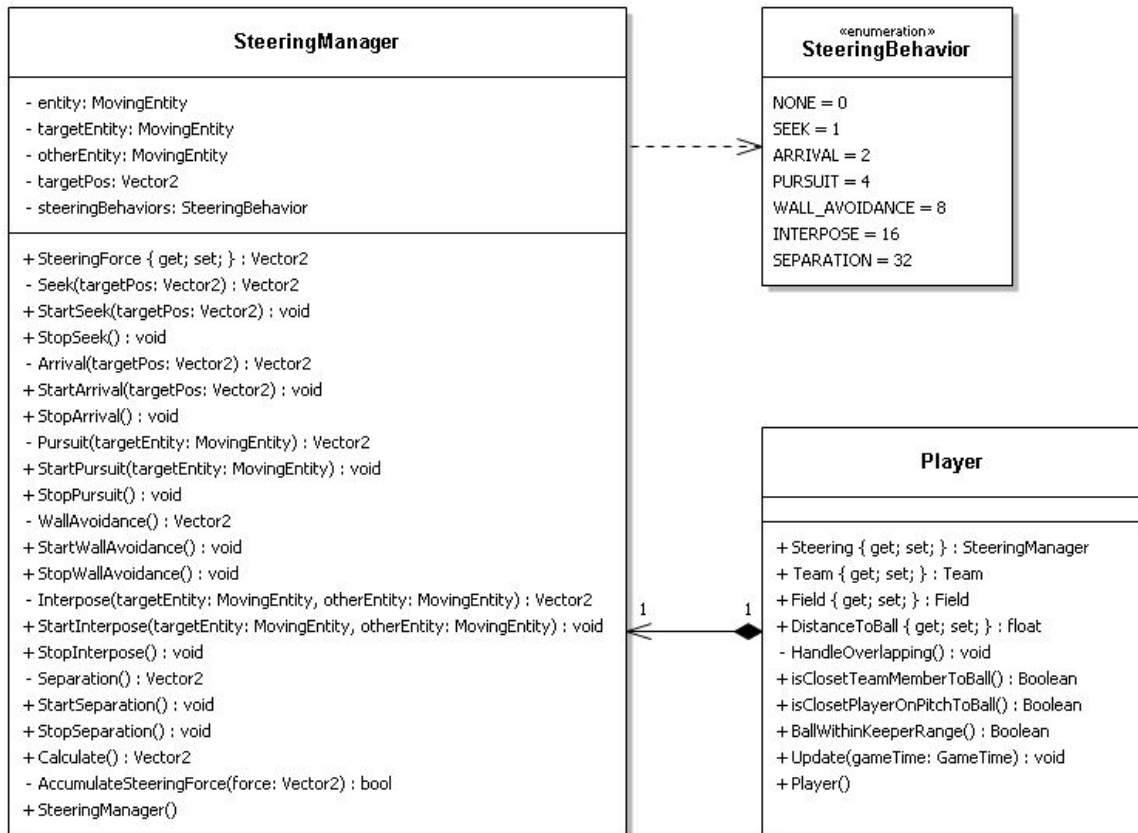


3. Entities

All the entities with their subclasses:



4. Steering behavior



5. AI

