

Imagine Cup Project Blueprint Challenge Games

Team Name	UnrealCup
Country	Germany
Project Name	UnrealCup
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Figure 1: First prototype

Concept

Our project UnrealCup is a quite different approach to computer soccer games. Instead of controlling your team directly, you can give each player a certain pattern which describes how the player will act. As in real soccer there are 11 players competing in two teams against each other. Regular soccer rules are upheld by the game and the players are penalized if they break the rules. The penalties depend on the game situation and are similar to real soccer. The rules contain the basic soccer rules like offside and throw-ins as well as physical rules which, for example, prevent players from sprinting all the time.

The players are able to communicate with each other by talking and listening.

The game features a 3D playing field and animated players. The movement of the ball is computed by using the game engine's physic engine. The game is available for PC and Xbox One.

There are three approaches for creating your own player intelligence, each targeting a different user group, depending on their programming skills:

Macro recording

If you never have encountered programming before this is the first step for you. In this editor you can move your players yourself and record patterns for certain situations by taking control of one player while the simulation is running.

This way you can control how your players behaves without knowing the logic running in the background.

After creating a macro recording you can use it in the game or edit it in the graphical editor. If you are not satisfied with the achieved result you can enhance it even further by directly editing the file.

Graphical Editor

If you already have knowledge in programming languages you can use a graphical editor to define your own logic. In this editor you can create your logic by dragging predefined parts together. This way you can create complex decision trees or loops without actually coding a single line.

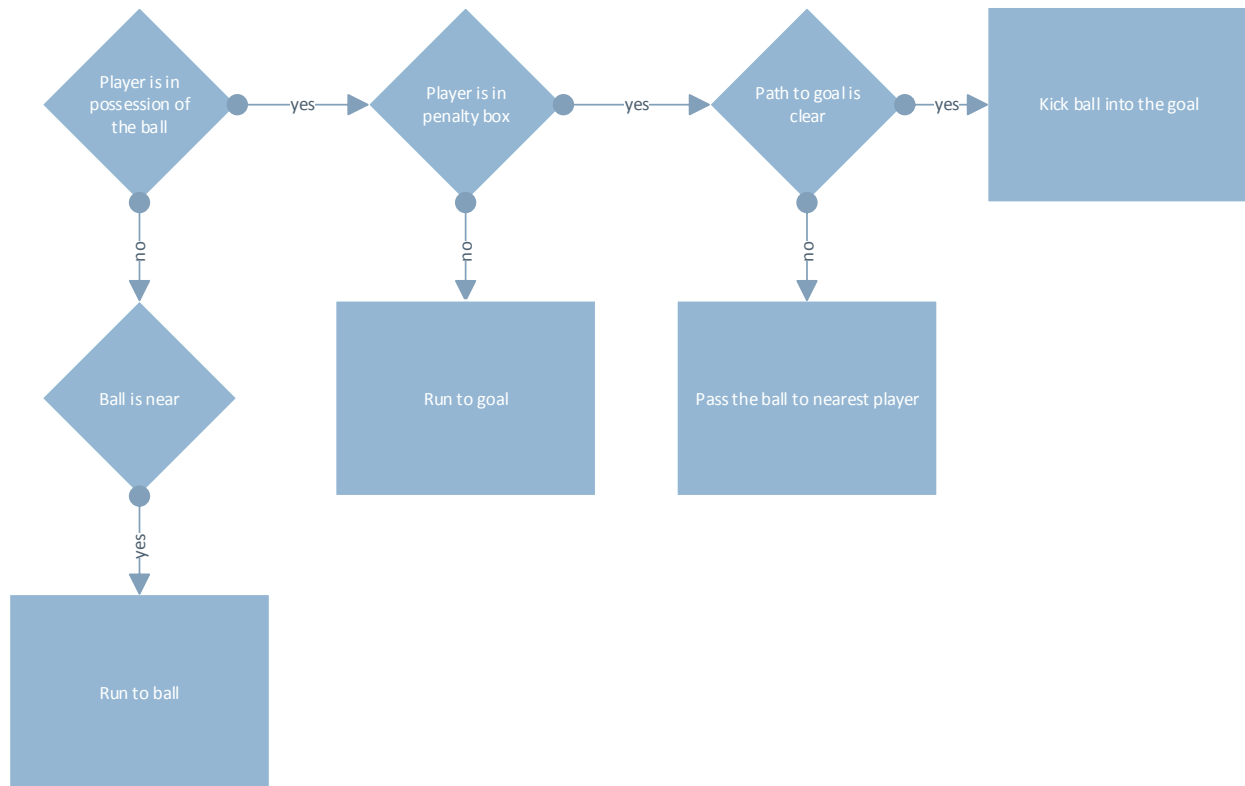


Figure 2: Example of graphical logic code

This approach is best suited for users who already have certain knowledge of how logic programming works, but are not capable of coding their own logic. Since this Editor is all about drag and drop a version for windows tablets would be possible.

Coding

The coding approach is for all hardcore users, who might feel limited by the previously mentioned tools. You can create your own logic files by editing the outcome of the previous tools or even create it from scratch. For this purpose you have to use the scripting language LUA¹. There is an additional library added to the basic LUA functions to perform actions like “move” or “turn” a player. This library contains all the functions that can be used for the AI creation. All possible actions are documented and explained with sample codes.

The game’s main focus is, not to create a purely recreational game, but to create a game which helps the players to learn logic and programming in a fun way.

¹ <http://www.lua.org/about.html>

Target Audience

Our main audience is separated into two groups. But also persons who do not completely fit into one of the following groups may be interested in the game.

The first group is made up of students from High schools or Universities. This group will be our major audience. Teachers can use UnrealCup as part of their lessons, for example as an introduction to show how simple logic affects the behavior of the soccer players. The students can also compete against each other and therefore will be encouraged to further improve their skills. For an example of this audience you can look at the persona “John Smartman”.

The second target group consists of gamers who like to play strategy games. This group will not be as large as the afore mentioned group. This group is made up of people who want to create the perfect team, which competes only with the best. This group features people roughly in their mid-20s who are willing to spend a lot of time to create the best team possible. They will not stop after just using the graphical editor to make their team, but they will use all the possibilities available, even if they have to learn something new. An example of this group is “Jack Hardcore”, who is mentioned in the personas chapter.

Personas

Introduction

The following two chapters aim at giving examples for possible users of our software.

John Smartman

A typical user for our project is John Smartman, he is a 16 year old sixth former at a German school. He likes to work with computers and has even tried to write some computer program before. He has decided to go to a special school with computer science as his main subject. In one of his first Computer Science courses his teacher wants to explain the logic of computer programs. For this purpose the teacher uses UnrealCup to show the basics of computer logic. He explains how the decisions of the robots are defined by logic in their AI. John was so fascinated by this, he downloaded UnrealCup to his own computer and took a closer look at it. After a few days playing with the editor he began to program his own AI. While working with UnrealCup he became fascinated by software development and decided to study Computer Science.

Jack Hardcore

The second typical person is Jack Hardcore, he is quite the opposite of John. He is a 20 year old student and likes to play computer games. He is a perfectionist in his gaming, he does not quit before he gets the best solution for a problem or win the game with the highest possible score. After he discovers UnrealCup he tries to create a very good AI in the editor but he does not win against all the competitors. So he needs to get a better AI. The only possibility is to program it on his own. So he learns how to do that. As he worked on the AI he begins to like programming software. He tries to write his own little games. That is how he became an independent game developer.

Game Mechanics

The simulator

The main part of the game is the simulator. The simulator loads the specified teams and let them compete against each other. To make sure everything is fair, the simulator checks the common soccer rules². Every player is controlled by its own LUA script which is assigned over a XML file. The XML configuration file also contains the information about the line-up of the players. The LUA script which contains the player's intelligence is created by the user using the editor.

After all the prerequisites are fulfilled, the simulator starts the match execution by creating a new thread for each player. To make sure one of the AIs is not able to take all the CPUs power, the simulator schedules the AI threads. There are also threads created for the 3D simulation which shows the players while they are playing the game, our first prototype is captured in figure 1.

In the recording mode there is a way to control a player by user input to capture a macro recording. It is possible to add these macros directly to the LUA scripts or to use them as component in the editor.

The Editor

The cross platform editor is based on HTML5 and JavaScript. It is optimized for usage with computers or tablets. The editor is a graphic based development system without the need to write any line of code. This editor is mostly operated by using drag and drop. The idea is to connect different macro functions and logic controls with simple mouse clicks. This way the user can create very simply different approaches for his AI. An example is shown in figure 2.

These generated AIs are saved as LUA scripts and can be loaded into the simulator.

Top User Stories

AI Editor

As a user of the UnrealCup program, I want to have the possibility to create an AI team without having to learn a programming language. The creation of the team should be simple and easy to understand.

We plan to fulfill this requirement by implementing the drag-and-drop editor or the macro recorder mentioned in earlier chapters. Those software components will allow users who are unexperienced in programming and logic to create their own AI.

A serious simulation

I want the game to realistically simulate a soccer game. This includes good graphics as well as actual soccer rules.

By using the unreal engine³, the graphic and the physics of the game will look pretty realistic, and one of our main goals is to implement the soccer rules in detail.

² http://www.fifa.com/mm/document/footballdevelopment/refereeing/02/36/01/11/27_06_2014_new--lawsofthegameweben_neutral.pdf

³ <https://www.unrealengine.com>

Great AI players

I want to create brilliant AI teams. I do not like to be restricted by the possibilities given by the editor.

We will make it possible for experienced users to program their own AI by making the LUA interface accessible for the users.

Competitive gameplay

I want to challenge my friends and play against their AI teams. Also, I would like to be able to receive other AI players and adapt them so they fit into my team.

The files that store the intelligence of the team can easily be exchanged and used in your own game. This way, the user is able to challenge other teams with his own AI or change an existing AI to match his desires.

Competition

RoboCup

The main competitor to our game is called RoboCup. RoboCup offers the possibility to create AI teams on 2D or 3D basis, or using robots for a real life simulation. The real-life simulation isn't a real competitor to our project, because a huge part of creating a robotic soccer team is building the actual robots, and the participants most likely won't be satisfied with controlling computer-simulated teams.

Many users might experience difficulties getting into the RoboCup simulation technology, because the program requires a lot more programming experience than our game.

Our tool tackles this problem by providing a graphical editor which reduces the required experience greatly.

Another problem of the RoboCup software is that it can only be used on a PC, and it is created to run under Linux, although it is possible to install the game on Windows with increased effort.

The game we are planning will be playable on Windows and Xbox, the graphical editor could also be used on Windows tablets.

Another advantage of our program is the newer engine which enhances the graphic and physics of the game.

FIFA / PES

Our game does not directly address the same targets as soccer games like FIFA or PES, yet those games might share a small target group with our program.

The main difference is that our game is not an active game, the AI is created before the match simulation starts.

This leads to the conclusion that classical soccer games are not a real competitor for our project.

Business Model

With UnrealCup we plan to establish a new platform to help people get started with programming and understanding artificial intelligence.

Therefore we want to distribute UnrealCup for free. This helps to spread the platform among educational institutions like Universities or Schools. These educational institutions can use UnrealCup in their lessons to draw the pupils' attention to the field of artificial intelligence. This part of computer science is already very important and will become even more important in the future because it provides new ways of solving problems which seem unsolvable from today's point of view. UnrealCup provides a playful way of getting in touch with artificial intelligence.

Also students and other people will have the possibility to use UnrealCup to play and develop artificial intelligence.

But developing UnrealCup and supporting the platform in future requires money. Therefore we plan to display advertisements on the banners around the soccer field and show short video clips during the half-time break. The advertisements are included into the game environment and in this way they do not disturb the gameplay in a negative way. By placing these advertisements we can earn the money that is necessary for the development and future support.

In addition to the advertisements we plan a marketplace in which the user can buy items like better animations or new skins for the players. Those items are optional and do not affect the gameplay itself. They only enhance the game in an optical way.

Core Technologies

Unreal Engine 4

One of our core technologies is Unreal Engine 4: The engine allows us to create a game with real physics experience and attractive graphics without coding everything from scratch. One big advantage of the Unreal Engine is that it is free to use for students, so we can work with a professional environment to develop our game.

As a framework Unreal Engine 4 already provides physics calculations for game objects and their interactions. It also provides lots of basic functions which can be altered or expanded to fit the needs of UnrealCup.

By using Unreal Engine 4 UnrealCup can be played on different platforms such as Windows or Linux computers, as well as the Xbox One. In the future, Unreal Engine 4 will also be supported by mobile platforms such as Windows Phone or Android.

The simulation is currently in development using Unreal Engine 4. For more flexibility the players' intelligence is programmed in LUA scripts. Therefore we have to include an interface between the Unreal Engine and the LUA scripting.

LUA scripting

LUA scripts are used to program the intelligence for the players. Every player has its own script containing logic that allows individual behavior for each player and position in the field.

The reasons for using LUA script are that LUA script is platform independent and as a scripting language it provides flexibility in programming the player's intelligence. There is no need for compiling the scripts. Also LUA script can be extended with special functions to control the player in the simulation and functions that deliver information from the simulation into the script. Another benefit of LUA script is

that there are no license problems. (MIT license)

Compared to other scripting languages LUA script is easy to implement and allows to call C++ functions.

The LUA code is quite small and the execution speed of LUA script is very good.

HTML/Java Script

For editing the player's intelligence we use HTML and Java Script. The editor provides multiple options for editing the player's intelligence.

With HTML and Java Script platform independence is guaranteed.

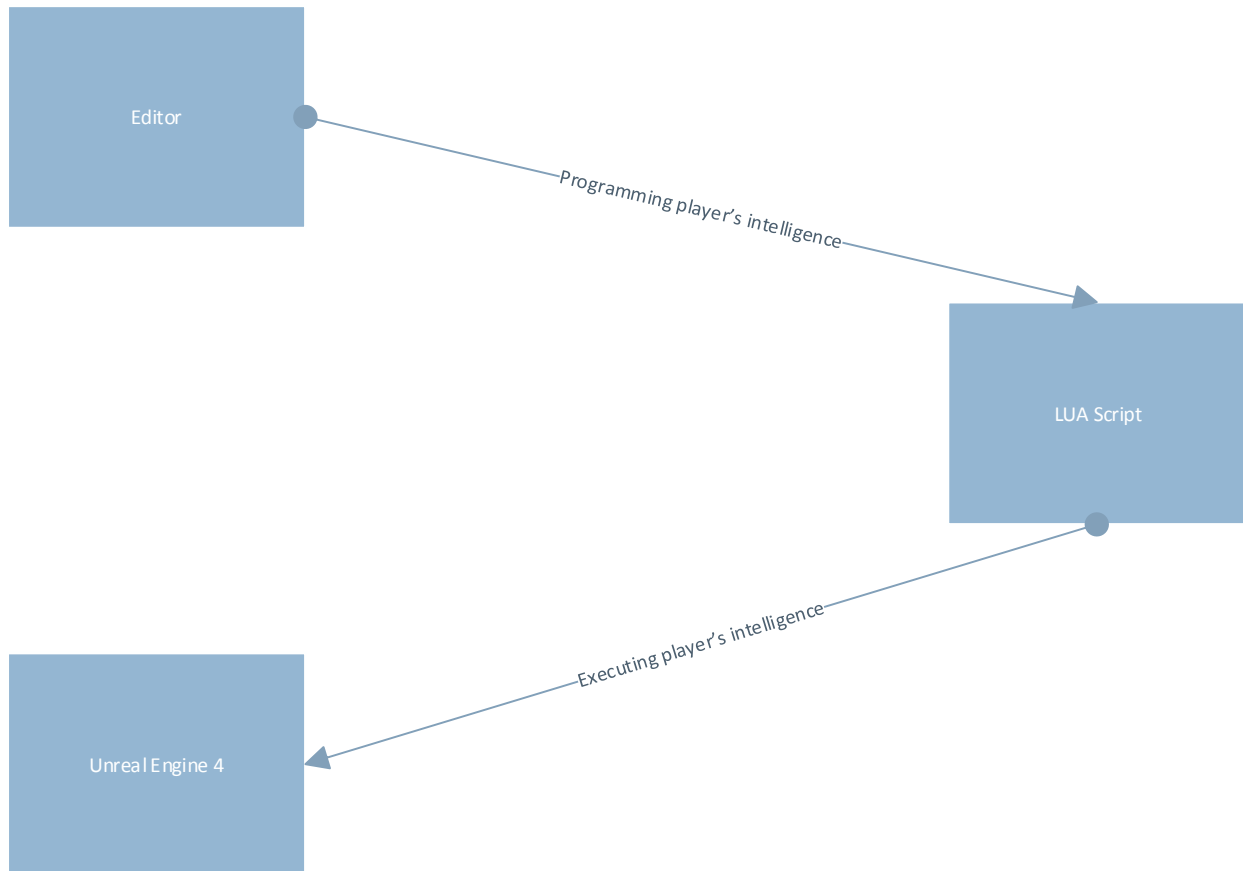


Figure 3: Architecture overview