

# FCP\_GPR\_2016 Team Description Paper: Advances in using Setplays for simulated soccer teams.

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**Abstract.** FCP\_GPR\_2016 continues the effort of evaluating the use of pre-defined setplays in simulated soccer. The team brings together effort of an international team of researchers of two countries: Brazil and Portugal. The GPR2D Team is from the Federal University of Technology – UTFPR, formerly having participations of UNIOESTE and UFSC, two other universities from Brazil). GPR2D is participating in competitions since 2009, having won the Brazilian 2D competition in 2011. FCPortugal have been participating in Robocup since 1999 (being the 2000 world champion in the 2D simulation category, is the result of joining forces of three Portuguese universities: Aveiro, Minho and Porto). Since 2014, the teams from both countries and research teams have joined forces and formed FCP\_GPR, also releasing a complete set of tools to integrate setplays to soccer playing agents as free software (see SourceForge.net projects: [fcportugalssetplays](#) for the C++ Setplay Library, [fcportugalSPanner](#) for a Graphical Interface to design Setplays, and [fcportugalssetplaysagent2d](#) for a complete example of 2D simulation agent). This TDP presents the latest attempts to apply setplays to robotic soccer teams.

**Keywords:** Simulated Robot Soccer, Coordinated Behaviour, Setplays.

## 1 - Introduction

FCP\_GPR\_2016 2D soccer simulation team is the result of joining forces between FCPortugal [1] and GPR-2D [2]. FCPortugal is a research initiative from the Portuguese research centers at the universities of Minho (DSI - Information Systems Department), Aveiro (IEETA – Institute of Electrical Engineering and Telematics), and Porto (LIACC - Artificial Intelligence and Computer Science Lab). This team of researchers participate in Robocup since 1999, in various categories (Rescue, 2D and 3D soccer simulation, Small Size, Standard Platform and Medium Size League). Among other research goals, these institutes are developing techniques and tools for machine learning, control, coordination and cooperation among agents, with application to various competitive and collaborative tasks, among then the RoboCup Soccer and Rescue leagues. FCPortugal was the 2000 world champion in the 2D

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simulation category. GPR-2D is the Robotics Research Group simulation soccer team from UTFPR (Federal University of Technology – Paraná – Brazil). Together with other research groups from other universities of the south of Brazil (Federal University of Santa Catarina - UFSC and State University of West Paraná - UNIOESTE) this team has participated in robotic soccer competitions since 2009, in various categories. After winning the Brazilian national competition in 2011 in the simulated competition, the team started its participation in Robocup in 2012(Mexico). Among its research objectives are the use of adaptive intelligent approaches to provide simulated and real robots with capabilities to cope with complex scenarios, applied to simulated soccer (2D and 3D) and real robots (Small Size league, and more recently to Robocup@Home).

Since 2013, the Brazilian and Portuguese groups joined some of their research efforts, creating the FCP\_GPR\_2D team for Robocup 2014, that also participated in Robocup 2015. This 2D simulation team joined the ongoing effort of predefined cooperation among agents, and a complete set of tool to specify and execute setplays have been proposed and made public, as free software [6]<sup>1</sup>. This is result of an ongoing research project from FCPortugal [2] [3] [4] [5], with help from the GPR team[1]. This paper briefly presents the set of setplay tools, (the Setplay Framework, that is a collection of C++ classes, the SPlanner graphical specification tool, and an example team, based on Agent2D), in section 2. Section 3 presents some results of experiments, regarding the participation of FCP\_GPR\_2016 in Robocup this year.

## 2. Setplays, and their use Robocup Soccer

Setplays are predefined plans, usually rehearsed and used in various sports (such as football and soccer<sup>2</sup>). The main objective is to execute a previously planned sequence of plays (passes, dribbles, shoots), obtaining some advantage (usually a goal). Setplays start from situations such as faults, corner kicks, and other situations, that usually occur close to the adversary goal area. The Setplay Framework is composed of three tools: 1) a high-level, XML based, specification language for soccer Setplays [3]; A graphical Strategy Planner – SPlanner –, that allows the composition of setplay using a graphical interface [7] (see Figure 1); and finally, 3) a complete example team for 2D soccer simulation, based on Agent2D 3.1.1 [9] that can be used by anyone interested in provide its team with Setplay capabilities [6]. These technologies have been successfully applied to at least 3 different Robocup soccer leagues: 2D and 3D simulation, as well as Middle Size League [8].

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<sup>1</sup> See “<http://www.sourceforge.net/projects/fcportugalssetplays>” for the C++ Setplay Library, “<http://www.sourceforge.net/projects/fcportugalSPlanner>” for a Graphical Interface to design Setplays, and “<http://www.sourceforge.net/projects/fcportugalssetplaysagent2d>” for a complete example of a 2D simulation agent.

<sup>2</sup> See “<http://dictionary.reference.com/browse/set-play>” for a definition of setplays.



**Fig. 1** - Setplay definition tool - SPLanner - and example of Setplay steps (bottom).

Figure 2 presents an example of the XML-like specification file that represents the sequences of actions, graphically designed with the SPLanner tool. In order to anyone interested to integrate the setplay capability to its team, the following steps should be taken:

- download and compile the Setplay C++ Library from sourceforge.net (fcportugalsetplays);
- download and compile the SPLanner tool (project fcportugalplanner);
- execute SPLanner (binary file AllSetPlay inside folder AllSetPlay);
- graphically design a setplay (choosing the “File->New->Setplay” from the main menu); the setplay can be started in any “stopped-ball” situation such as: kickoff, throw in, direct or indirect free kick, corner kick, goal kick or keeper catch (although possible to create “play on” setplays, that are setplays initializing in a situation in which the ball is in movement, this kind of setplay is not yet supported in the current version of the library);
- after the design is finished, it should be exported (Option File->Export Setplay); prior to exporting a setplay to a configuration(.conf) file, it is important to define all its parameters (waiting time for each sub-play, specially the starting one, so that all the players participating can be chosen by the library, and have time to position themselves for the start of the coordinated play); another important parameter is the number of the setplay, since various setplays can be concatenated posteriorly, but only if their number is different among themselves; and the name of the setplay, that should match the name of the exported .conf file; any configuration file exported is human-readable, such as the fragment presented in Figure 2;

- if your team is based on Agent2D 3.1.1, please download the example team *fcportugalsetplaysagent2d* from sourceforge, and integrate the code with your own source code; if your team has another structure, you will have to integrate it with the Setplay C++ Library, following the instructions presented in [6]; the integration have much to do with sensing the environment (ball position, mode of play, player position, among other data that can be directly obtained from the simulator itself); there are two important alterations in the cycle of your player: the player have to implement communication capabilities to the simulator, in order to allow the Setplay framework to be started and coordinate through “say” commands, and in every cycle of decision-making, the player has to call the framework to evaluate if the current situation allows for the begin of execution of any coordinated behavior defined by a setplay;

```
(setplay :name CornerKick1 :id 1 :invertible true
:players (list (Player P6) (Player P7) (Player P8) )
:steps
(seq
(step
:id 0 :waitTime 25 :abortTime 59
:participants
(list
(at (Player P6) (pt :x 52 :y -34))
(at (Player P7) (pt :x 40 :y -28))
(at (Player P8) (pt :x 31 :y -21))
)
:condition (and (playm ck_our) (bpos :region (regNamed :name left)))
:leadPlayer (Player P6)
:transitions
(list (nextStep :id 1
:condition (canPassPl :from (Player P6) :to (Player P7) )
:directives (list
(do :players(list (Player P6) )
:actions(btto:player(Player P7)) )
(do :players(list (Player P7) )
:actions(intercept ) )
(do :players(list (Player P8) )
:actions(pos :region (pt :x 41 :y -12)) )
)
)
).....
)
```

**Fig. 2** – Initial section of the exported “CornerKick1.conf” XML-like file

- finally, you must inform each player, during its initialization, which are the setplays passive of execution; this is done by renaming the configuration file generated in Splanner (that are usually exported to the folder “AllSetPlay/setPlayGUI/tests”) to “setplay.conf”, and putting it inside the execution folder of your team (src folder in the case of Agent2D based teams); if you want the team to execute more than one kind of setplay, such as one setplay for corner kick, and one for throw-in, all you have to do is concatenate all the .conf files in a single “setplay.conf” file, provided that no two setplays have the same id number).

### 3 – Preliminary Results and Discussion

FCP\_GPR is in a continuing effort to use together the Setplay Framework (C++ Library, SPLanner Graphical Tool, and the example team) in order to evaluate the advances provided by the use of setplays in robotic soccer. In simulations against Agent2D 3.1.1, the results where of more than 90% of winning, after 100 simulated games. Against last year's third place, Gliders [11], the team obtained 50% of wins (won 10 in 20 simulations, scoring 21 and taking 25 goals). In matches against HELIOS2015, runner-up in Robocup 2015, the team had much worst results, loosing all 20 games, scoring only 2 goals, and taking an average of 3 goals per game. Against WrightEagle, 2015 champion, incongruently, the performance was a little better, with

2 wins in 20 games (10%), and with 5 matches being decided in penalty shoot-outs after draw during both normal time and overtime (but in all 5 matches, WrightEagle won the game). FCP\_GPR scored 12 goals against WrightEagle, but took 39. It is expected that, with continuing effort in designing new setplays, it would be possible for FCP\_GPR\_2016 to reach the top 8 this year.

## Acknowledgements

The first author would like to thank CAPES. We would also like to acknowledge the Robocup community for its support, specially team Helios [9] for the excellent contributions to the community and source releases that is the base for our team.

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