# Footballer and Football Simulation Markup Language and related Simulation Software Development

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***Abstract* – *In this paper we introduce our idea about how to create a virtual reality system, wherein the football teams, or in our terminology, the avatars of the football players can play a high number of football matches. Based on our former experience in mobile soccer gaming we suggest developing an appropriate markup language to describe the football players, the coaches and the matches themselves. We review our experience in question and in present work the targets shall be set by suggesting the development of the Football(er) Simulation Markup Language.***

***Keywords:* *virtual reality, simulation of football, XML-based modeling, Java ME, Football World Cup.***

## I. INTRODUCTION

There are several papers in literature discussing the relationship between sport and science. We focus especially on the relationship between football (soccer) and simulation of football. For example [1] has already described a method that also seems useful for the purpose of simulation. But we would like not only to describe football matches but we would also like to generate them. We have a dream that based on the observation of players we will be able to build such virtual players with whom we can simulate a high number of football matches. Under these simulations, we would like to obtain information for developing future team tactics. It is a very interesting question whether behaviors observed in reality can be observed during these simulations. This question is also of great importance from the point of view of usability.

### *A. The idea*

The players in the football pitch with or without the ball are in decision making situations. For example, they must decide in which corner he or she should shoot the penalty kick? In which direction does he or she perform a given feint? Does he or she usually try to shoot after a dribble inside the penalty area? **The avatar is a collection of information which in turn enabled us to give whatever probability answer to such questions**. The open structure of avatar files will be defined in Relax NG and in compliance with this, the data of avatars will be collected and maintained in this new XML format called **F**ootball(**er**) **S**imulation **M**arkup **L**anguage, or briefly FerSML. The work of building of avatar files is closely connected with the football clubs and theirs footballers and coaches. But it is interesting to note that valuable information may be gathered by fans with particular stress on the players of the opposing team.

If avatar files of players and head coaches of the two teams are already available then the simulations could be run. The structure of avatar XML files must be developed together with the corresponding simulation software. It is indispensable for the success of such planned simulations. The FerSML project [2] in SourceForge has been established by us to support this purpose.

### *B. Observing of football game and players*

There are, to date, two fundamental techniques to observe the behavior and properties of players in the football field, the video processing-based method and the GPS-based method.

1) In the former case we may mention that there are several companies that are specialized in this type of observing. Some of such companies are listed in summary work [3].
2) In the latest method a GPS device is worn by the player. For example, it can be seen well in a photo of the article [4]. But it is important to note that players must not wear these devices in the match by FIFA's rulebook [7]. For example, we may read about the experiences of using GPS tools generally in [5] and [6].

In addition, we plan to use **questionnaires** with pictures to gather further decision making information from the players and coaches.

## II. OUR PREVIOUS WORK

### *A. Eurosmobil's soccer simulation*

We have already written some mobile soccer simulations for Eurosmobil games. The Eurosmobil is the author's own small family company specializing in mobile game development based on Java ME platform. It has been presented only in the Hungarian mobile game market since 2003. In January 2010, Eurosmobil opened source of some pieces of their game software

including the soccer games. These games were opened within the framework of the author's PhD Thesis entitled "Mobile Game Design and Development" [8] in the University of Debrecen. We are going to use the opened games in education of programming, our conception was presented at the conference ICAI 2010 - 8th International Conference on Applied Informatics [9] and submitted to Teaching Mathematics and Computer Science [10]. The game which contains the simulation in question is released in SourceForge portal under the project name "Jávácska One / Focijáték Neked NYFK, Soccer Game 4u OSE" [11] and it is also released in the author's homepage [12]. This project is licensed with GNU GPL v3, and it can be downloaded in only source as a Maven project. We are using the j2me-maven-plugin of pyx4me [13] in pom.xml of project, so it is usually enough to enter the command "mvn package" to produce the files that may be uploaded to the mobile phone.

## III. OUR EXPERIENCE IN MOBILE GAMING

### A. *The "Soccer Game 4u OSE" game*

According to our terminology introduced in [14] and also presented briefly in [10] **the experience of playing football is encoded by the game** called "Soccer Game 4u OSE". This game is a MIDP 2.0 / CLDC 1.0 application that also uses JSR 135 Mobile Media API. The user interface of the game, shown in from Fig. 1 to Fig. 9, has 2.5D appearance. In the game there are some functions for football fans, for example, you can rename the footballers and you can take a photo with the built-in camera of the footballers. In the simulation, for example, you may choose from the possible formations 3-3-3, 3-4-2, 4-3-2 and 2-3-4 at any time (the Fig. 2. and Fig. 3. show two-two opposing play systems), you may kick corners (Fig. 4. and Fig. 5.) and where appropriate you may fence a penalty duel (Fig. 6. and Fig. 7.). The game lasts from the quarters to the final and a match lasts 10 minutes. There are eight teams (Hungary, France, Germany, Brazil, England, USA, Sweden and Italy) in the Football World Cup, a team consists of nine field players numbered from 0 to 7 and a goalkeeper numbered by 0. The usage of the game is based on mobile phone buttons. Every hard keys from 0 to 9 on the phone represents a footballer in the user's own team. If the user presses the i-th numerical button, then the one of the following main options will be applied.

1) If the j-th player of the own team possesses the ball, then the j-th player passes the ball to the i-th player. One such situation is shown in Fig. 1, where "German 2"passes the ball to player "German 1".
2) Otherwise, if the j-th player of the opposite team possesses the ball, then the i-th player attacks the opposite player who possesses the ball.

### B. *The simulations*

The players in simulation are described by only three properties: ball technique, football sense and quickness. To be more precise, in the program there is no Player object or class, we simply use native Java arrays for the determination of attributes of a footballer.

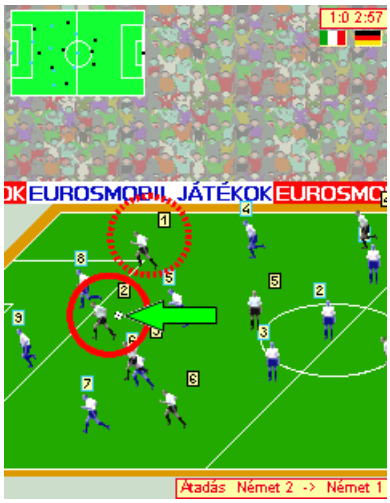


Fig. 1. "German 2" passes the ball to player "German 1".


Fig.2. The 3-3-3 vs. 4-3-3 formation


Fig. 3. The 4-3-2 vs. 4-3-2 formation.


Fig. 4. An England corner in the Brasil v. England match.


Fig. 5. An England corner in the Germany v. England match.


Fig. 6. A penalty duel in the Germany v. USA match.

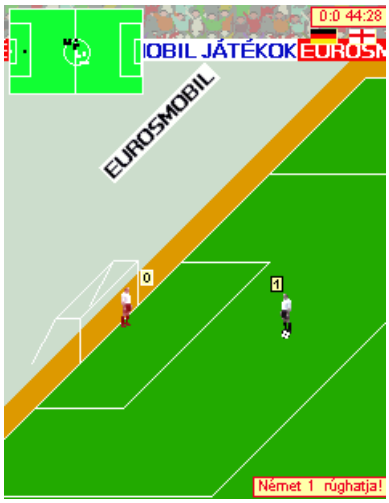


Fig. 7. A penalty duel in the Germany v. England match.

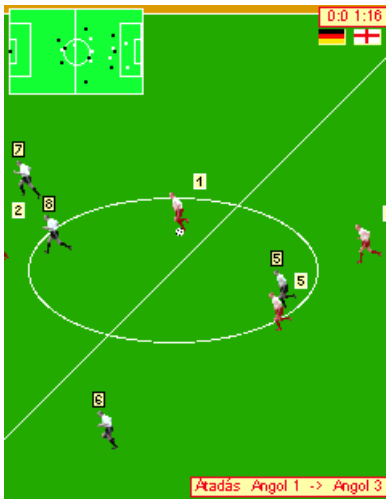


Fig. 8. Field play.

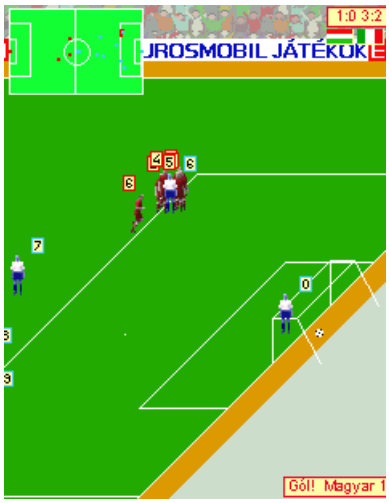


Fig. 9. Hungarian goal joy in Hungary v. France.

It is unusual in object oriented programming, but it is usual in real practice of programming in mobile Java.

The concrete behavior of any individual player is determined by these three mentioned properties. The simulation is basically controlled by the moving of the ball, which may be in a number of states according to the present reality of the world of the game. For example it may be a state called POSSESSED when the ball is possessed by a player. The rhythm of the behavior of teams and the footballers is based on the ten opposing formations.

The experiences collected during the development, testing and using of this mobile simulation so far have been encouraging that we should develop it further.

## IV. THE SOFTWARE REQUIRING DEVELOPMENT

In framework of the planned project FerSML we are going to develop the following strongly connected two main components: the structure of the avatar XML files and the corresponding simulation software. Currently, we are working on PC or mainframe in the Java SE environment. But it is important to note that involving football coaches and professionals is essential for successfully completing these tasks. It will be demonstrated by the following code snippets from the planning XML files.

### *A. The avatar of the footballers*

The properties of a footballer will be described in an XML file called Footballer.avatar.xml.

```
<?xml version="1.0" encoding="UTF-8"?>
<avatar>
 ...
  <person>
    <name>Mátyás Bendegúz Bátfai</name>
    <age>21</age>
    <height>186</height>
    <weight>75</weight>
    <dominant_foot>both</dominant_foot>
    <usual_position>
      attacking midfielder
    </usual_position>
    <actual_position>
      left winger
    </actual_position>
    <playmaker />
    ...
  </person>
  ...
  <skills>
    <football_sense>97</football_sense>
    <ball_technique>92</ball_technique>
    <quickness>87</quickness>
    ...
  </skills>
  ...
  <gaining_the_ball>
    <in_midfield>
      <probability distance_of_ball="0.5">
        0.89
      </probability>
      <probability distance_of_ball="0.6">
        0.84
      </probability>
      <probability distance_of_ball="0.7">
        0.47
      </probability>
      ...
    </in_midfield>
    ...
  </gaining_the_ball>
...
  </avatar>
```

### *B. The avatar of the coaches*

The coach's decisions and requests will be described in an XML file called Coach.avatar.xml.

```
<?xml version="1.0" encoding="UTF-8"?>
<coach>
 ...
  <tactics>
    ...
    <play_system>
      ...
      <formation name="Hungarian sytle" >
        <player_position player_id="0">
          <coord_x>10</coord_x>
          <coord_y>320</coord_y>
        </player_position>
        <player_position player_id="1">
          <coord_x>845</coord_x>
          <coord_y>470</coord_y>
        </player_position>
        ...
      </formation>
     ...
    </play_system>
    ...
  </tactics>
 ...
</coach>
```

In case of mentioned Hungarian style, the initial positions of the players are described by the tags coord_x and coord_y, the values of these properties, for example, can be determined from the book [15].

### *C. The avatar of the simulations*

The control of the simulation will be described in an XML file called Simulation.avatar.xml.

```
<?xml version="1.0" encoding="UTF-8"?>
<simulation>
 ...
  <impact_of_skills>
    ...
    <dribbling>
      <factor name="ball technique"
      percent="30" />
      <factor name="quickness"
      percent="20" />
      ...
    </dribbling>
    <shielding>
      <factor name="football sense"
      percent="30" />
      <factor name="ball technique"
      percent="30" />
      <factor name="quickness"
      percent="20" />
      ...
    </shielding>
    <tackling>
      <factor name="ball technique"
      percent="20" />
      <factor name="quickness"
```

```
      percent="30" />
      ...
    </tackling>
   ...
  </impact_of_skills>
...
  </simulation>
```

## V. CONCLUSIONS

In this article we started to develop a simulation platform to model the magic world of real football. This ambitious goal may legitimately raise the question of how the developed models will be verified. In light of the former results [3, 16, 17] this can be done for example as follows: the distributions of observed phenomena (like number of scores, goals, wins, defeats, draws, absences, injuries, and so on.) in the simulated and real world have to be equal.

### *A. Future Work*

We believe this article will be the starting of a pioneer work that introduces the usage of XML in the simulation of "real" football. The progress of the project will be monitored at URL [2].

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## REFERENCES

[1] Brillinger, David R. "A Potential Function Approach to the Flow of Play in Soccer," Journal of Quantitative Analysis in Sports: Vol. 3: Iss. 1, Article 3., DOI: 10.2202/1559-0410.1048, http://www.stat.berkeley.edu/~brill/Papers/jqas.pdf, 2007.

[2] N. Bátfai "Football(er) Simulation Markup Language", https://sourceforge.net/projects/footballerml, (webpage), 2010.

[3] Brillinger, David R." Soccer/World Football", Technical Reports (Preprints), http://www.stat.berkeley.edu/tech-reports/777.pdf, July 2009.

[4] J. Pino, R. Martinez-Santos, M. Isabel Moreno and C. Padilla "Automatic analysis of football games using GPS on real time" Journal of Sports Science and Medicine Suppl. 10, 6-11, (VI-th World Congress on Science and Football) http://www.realtrackfutbol.com/pdf/384_full_text.pdf, 2007.

[5] Ben Wisbey, Paul G. Montgomery, David B. Pyne, Ben Rattray, "Quantifying movement demands of AFL football using GPS tracking", Journal of Science and Medicine in Sport, In Press, Corrected Proof, ISSN 1440-2440, DOI: 10.1016/j.jsams.2009.09.002., November 2009.

[6] Jose C. Barbero-Alvarez, Aaron Coutts, Juan Granda, Veronica Barbero-Alvarez, Carlo Castagna, "The validity and reliability of a global positioning satellite system device to assess speed and repeated sprint ability (RSA) in athletes", Journal of Science and Medicine in Sport, Volume 13, Issue 2, Pages 232-235, ISSN 1440-2440, DOI: 10.1016/j.jsams.2009.02.005., March 2010.

[7] Federation Internationale de Football Association "Laws of the Game", FIFA-Strasse 20, P.O. Box 8044 Zurich, Switzerland, http://www.fifa.com/worldfootball/lawsofthegame.html, February 2009.

[8] N. Bátfai. "Mobiltelefonos játékok tervezése és fejlesztése" (Mobile game design and development, hungarian). PhD Dissertation and Thesis, http://www.inf.unideb.hu/~nbatfai/phd, 2010.

[9] N. Bátfai. "Open source mobile games for education", 8th International Conference on Applied Informatics, http://www.inf.unideb.hu/~nbatfai/opensource/ICAI_OpenSourceMobileGamesForEdu.pdf, (conference lecture), 2010.

[10] N. Bátfai, E. Bátfai, and I. Pšenáková. "Open source mobile games to revolutionize education of programming", Teaching Mathematics and Computer Science, (submitted), 2010.

[11] N. Bátfai Jávácska ONE, http://sourceforge.net/projects/javacska, (webpage), 2010.

[12] N. Bátfai "Focijáték Neked NYFK, Soccer Game 4u OSE", http://www.inf.unideb.hu/~nbatfai/opensource/FocijatekNekedNYFK-SoccerGame4uOSE, (webpage), 2010.

[13] j2me-maven-plugin, http://pyx4me.com/pyx4me-maven-plugins/j2me-maven-plugin, (webpage), 2010.

[14] N. Bátfai and E. Bátfai. "A mobil játékfejlesztés elméleti és gyakorlati momentumai" (theoretic and practical issues in m-game development, hungarian). Híradástechnika, 5, http://www.hiradastechnika.hu/data/upload/file/2005/2005_5/HT_0505-7.pdf, 2005.

[15] Bjorn Ekblom (editor) "Football (Soccer) Handbook of Sports Medicine and Science" Blackwell Scientific Publications, Oxford, ISBN 0 632 03328 2, (1994).

[16] Ruud H. Koning, Michael Koolhaas, Gusta Renes, Geert Ridder, "A simulation model for football championships", European Journal of Operational Research, Volume 148, Issue 2, Sport and Computers, Pages 268-276, ISSN 0377-2217, DOI: 10.1016/S0377-2217(02)00683-5., July 2003.

[17] Les Parry, Barry Drust, "Is injury the major cause of elite soccer players being unavailable to train and play during the competitive season?", Physical Therapy in Sport, Volume 7, Issue 2, Pages 58-64, ISSN 1466-853X, DOI: 10.1016/j.ptsp.2006.03.003., May 2006.