OXSY 2023 Team Description

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Abstract. Oxsy team has been founded in July 2002 as a graduation project of one student, Sebastian Marian, in the field of Multi-Agent Systems [1], at the Department of Computer Science of Lucian Blaga University (Sibiu - Romania). After graduation he continued the work on this project and eventually Oxsy team was born. As we started from scratch, our ideas, concepts and beliefs, have been implemented year by year, and today, we are happy to see our evolution, as our team was growing in these years, more than we expected from the beginning. If we will qualify for this year competition, we will reach at the 19h consecutive participation, in RoboCup [4] Soccer Simulation League.

Keywords: RoboCup, 2D Soccer Simulation, AI, Multi-agent Systems, Neural Network.

1 Introduction

In July 2003 at RoboCup [4] competition, which was held in Padua - Italy, we won the first round and for us it was a good surprise for first year of participation. Then, in the next year, we participated in Lisbon - Portugal for the second time, and again we obtained a good result (the 11th place). In 2005 in Osaka – Japan, we participated for the third time and finally we entered in the first 8 teams of Soccer Simulation League, as we won (the 8th place). In 2006 the competition was held in Bremen – Germany and we won (the 7th place). In 2007 we went to Atlanta – Georgia (U.S.A), where we obtained (the 5th place), the same result has been achieved in 2008 in Suzhou – China. Finally, in 2009 in Graz, we entered in the first 3 teams in the Soccer Simulation League, as we won (the 3rd place), the same result has been achieved in 2010 in Singapore. In 2011 we came back from Istanbul - Turkey with (4th place). In 2012 we were in Mexico City, where we had a bad experience as we made some major changes in our defensive system and in our team strategy as well, changes which were not very well balanced with all other characteristics of our team. Thus we didn't manage to qualify for finals, from the second round groups. In 2013 we came back in top, as we won (the 6th place) in Eindhoven – Netherlands. In 2014 the competition was held in Joao Pessoa – Brazil, and we stepped on the stage for the third time in our participation history, as we won (the 3rd place) again. In 2015 we won the (4th place), as we played the semifinals in Hefei – China. In 2016 the competition was held in Leipzig – Germany, we missed the semifinals and we came back with (5th place). In

2017 we came back from Nagoya with (3rd place) for the fourth time in our participation history. In 2018 the competition was held in Montreal – Canada and we won the (4th place) as we played in the semifinals. In 2019, unfortunately, our team missed the competition which was held in Sydney – Australia. In 2020 the competition has been postponed for 2021, when it has been held online due to pandemic situation. Our team won the (6th place) this time. Last year the competition was held in Bangkok - Thailand and our team has been entered again in the square of aces as we won the (4th place). This year the competition will be held in Bordeaux - France. As we already have a very good experience in 2D Soccer Simulation League, we hope that our new ideas and improvements will be reflected in the competition, where we will also test other tactical pieces developed.

2 Improving the Offensive Phase

The objective of the offensive phase is to score. So, the necessary sub-phases which lead to scoring are:

- Refraining from losing the ball (avoid risky moves in the defensive area).
- Tacking the ball forward towards the opponents' goal.
- Getting the ball to a teammate who is free from his opponent's marking.
- Shooting effectively.

Statistical analysis has determined that 65% of goals are scored in dynamic play, while 35% are scored in, or following, dead ball situations. Analysis of goals which result from dynamic play shows that the fewer the number of passes, and the shorter the duration of the attack, the more likely the chances of scoring. Therefore, the offensive team should optimize its time on offense, taking advantage of its players' movements, and passing, receiving and shooting skills, to take actions in a quick and decisive way. This was our philosophy of playing soccer, from the very first beginning of our participating in 2D Soccer Simulation League. On offense, the player with the ball can either kick it (pass it or shoot) or dribble it (also dribbling past an opponent), while his teammates are moving without the ball. The roles of the players with and without the ball are the following:

- Increasing ball possession through accurate kick ball decision.
- Reacting before events occur.
- Moving without the ball.
- Creating more spaces behind opponent's defense line.
- Receiving the ball in most advantageous positions.

2.1 Increasing ball possession through accurate kick ball decision

Having a good world model of the opponent's players position, when our team controls the ball, is very important if we want to take a good decision. Generally, not only in soccer, teams that have a better possession of the ball, have more chances to score. In addition, opponents will run all the time to regain possession of the ball, to cover spaces and so on. In fact they will have much less situations to score against one team

which has the ball possession most of the time. To achieve a better world model of our opponent, we implemented the following steps:

- Creating a player map's positions, since last trustable known position, which was obtained through "see" or "hear" message.
- Adjusting the player map's positions through "see" messages, received in meantime, which prove that player can't be in certain places.
- Reshaping the player map's positions after a clearly pattern of moving which has observed in most of the cases.

2.2 Reacting before events occur

The basic idea of this method is that the agent, must react like in real soccer, when two or many players collaborate to create a particularly phase of defense or attack, like when they are one brain. This automatism for the real soccer players has been created not over the night, but after a lot of trainings and therefore it seems to work naturally for somebody who watches from outside. On the other hand, in our world of simulation these things are not so easy. One of the simplest examples of something that we call "reacting before events occur" is the so called "give-and-go" (Fig. 1). In this case a player will pass to another teammate and then he will run in some free spaces, or in one clearly direction, to receive the "future" pass of the player that received his first pass. So, this implies that he has to anticipate the "future" pass and has to react before event occurs. Of course that it is very important that the player who makes the final pass to have a good timing as well.

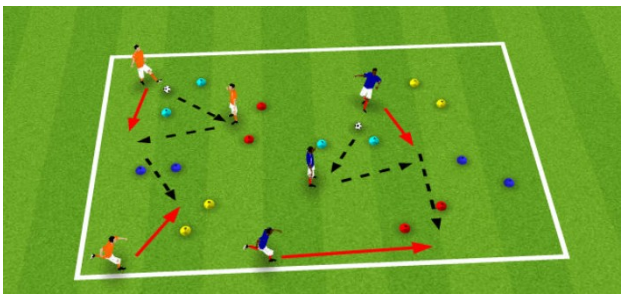

Fig. 1. Give-and-go examples

2.3 Moving without the ball

We will now consider how to organize the movement of two offensive teammates, one belonging to the "attack" line and the other a neighboring "attack" player or belonging to the "midfield" line.

- Both forwards go towards the teammate with the ball.
- Both forwards move forward in depth.
- One forward goes towards the ball while the other attacks in depth.

Possible combinations of movements of two forwards:

In figure 2A, we can see the situation when both forwards go towards the ball. The player with the ball can either pass it to the near assisting player and make himself available for a combination (one-two) or, as shown in the figure, pass it to the far forward that can then make a deep pass to the other forward or a back pass.

In figure 2B, both attackers go forward in depth. The near attacker carries out a crescent-shaped movement in order to receive the ball. The assisting attacker, who is further away, cuts diagonally into the space vacated by his teammate's movement.

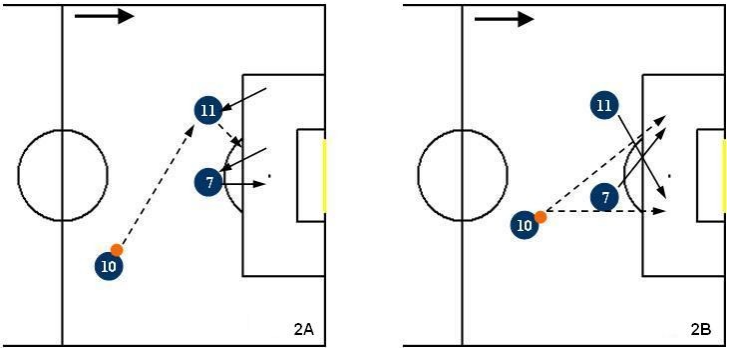

Fig. 2. Both forwards towards the ball or in depth

In figure 3A, the two attackers go forward in depth, without crisscrossing and then cut in the same direction.

In figure 3B, the near forward goes towards the ball, while the far forward attacks in depth. The player with the ball can either make a "one-two" pass to the near forward coming towards him, or he can make a deep pass to the far forward who is cutting into the space created by the movement of the near forward.

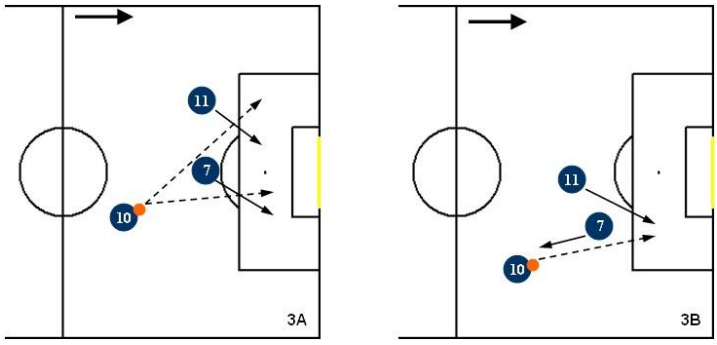

Fig. 3. Both forwards in depth or in opposite movements

Possible combinations of movements of a forward and a midfielder:

- Both players attack in depth.
- The forward goes towards the ball while the midfielder goes forward in depth.

In figure 4A, both assisting players attack in depth, enabling their teammate with the ball to have two passing options.

In figure 4B, the forward comes towards the ball, thus creating space for the midfielder's deep cut-in. The teammate with the ball can either make a pass to the penetrating midfielder or carry out a combination with the forward coming towards him.

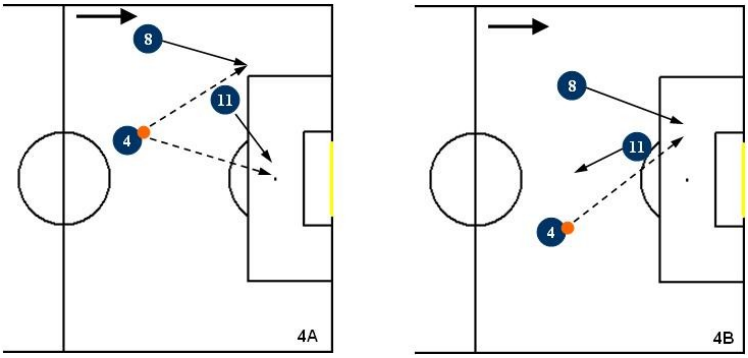

Fig. 4. Both players in depth or players in opposite movements

2.4 Creating more spaces behind opponent's defense line

All the 2D Soccer Simulation teams could be grouped in three different types of defending approach. First group of teams is defending using pressing (marking one at one) in certainly zone, specially in theirs own third. The second group is defending in zone, without very strictly marking. The last group of teams is defending using pressing (marking one at one) almost all the time on the whole field. As we are interested how to create more spaces in theirs own third, behind the opponent defense line, we will underscore the roles of the players involved in the offensive phase, who do not control the ball as could be seen in figure 5.

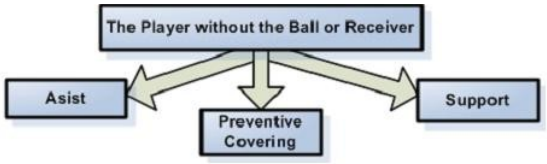

Fig. 5. The role of the players involved in the offensive phase.

- **Preventive Covering**

The offensive players who remain positioned between the opponent's offensive line and the opponent's goal, so as to become an obstacle to the opponent's action if they gain possession of the ball starting an attack, are said to be in preventive covering. All the players on offense, who remain positioned behind the line of the ball, are considered to be in "preventive covering".

- **Support**

An offensive player who makes himself available for a back pass or a horizontal pass is referred to as a "supporting player". The supporting player can be termed as "back support" when he is behind the teammate with the ball. When the supporting player is along the same line as the teammate who has the ball, his support is referred as "encompassing" because he can receive the ball either some steps forward or some steps backward, depending on the game situation.

- **Assist**

An offensive player, who helps to take the ball towards the opposing goal by making himself available for a pass forward, is referred to as an "assisting player". He can receive the ball in two ways: either with the opponent at his back or by unmarking himself. He has the opponent at his back when he comes towards the ball or when he cuts towards the corner flag. He tries to receive the ball unmarked when he cuts towards the opposing goal or when he penetrates to receive the pass from his teammate.

2.5 Receiving the ball in most advantageous positions

Passing the ball is fundamental to taking the ball towards the opponent's goal. Effective passing requires good timing between the player passing the ball and the teammate receiving it. The receiver should make himself available for the pass and get towards the point where he wants to receive the ball with good timing, thus carrying out a movement which makes it difficult for the defense to anticipate him. (See figures 6 - 11).

The offensive player could receive the ball in one of the following situations:

- "Over" the opponent, and the ball is passed forward, this is referred to as "depth"
- "Over" the opponent, and the ball is passed backward, this is termed "penetration"
- "Under" the opponent, and the ball is passed forward, this is termed "meeting"
- "Under" the opponent, and the ball is passed backward, this is termed "back pass"
- "Under" the opponent, while passing the ball along the same line, this is termed "encompassing movement".

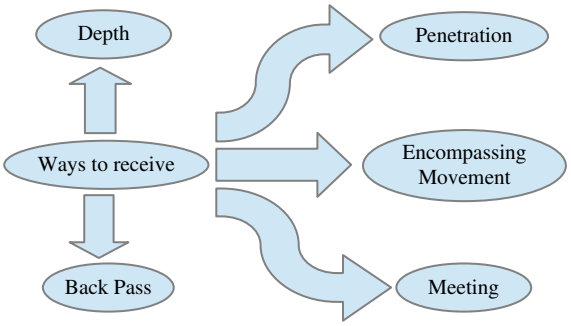

Fig. 6. The receiving player's options.

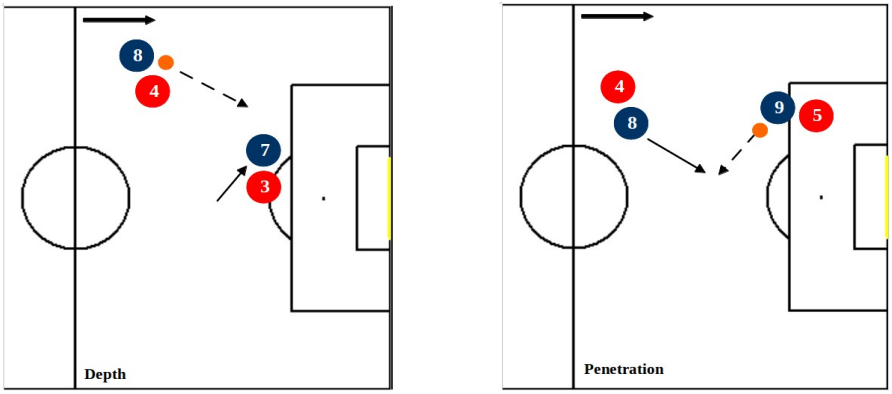

Fig. 7-8. Depth and penetration receiving.

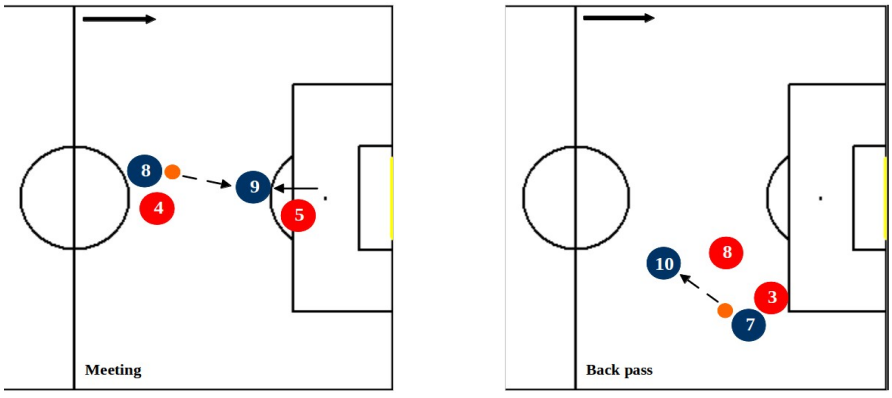

Fig. 9-10. Meeting and back pass receiving.

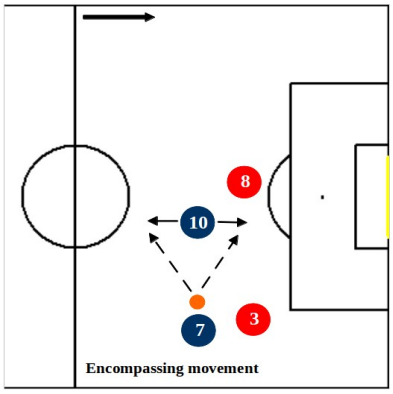

Fig. 11. Encompassing movement pass receiving.

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