RoboCupJunior Soccer Simulation 2021 Team Description Paper TFA 406

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Abstract

In the RoboCupJunior Soccer Simulation, the goal is to score more points than the opponents. Our robots achieve this goal by focusing more on the offense strategies and utilizing the most out of the robots. This paper describes the main features and strategies developed by the TFA 406 Team from the TFA Academy.

1. Introduction

a. **Team**
   i. The TFA Junior Robotics Team is a team from Vancouver, BC, Canada. The team has participated in RoboCupJunior Rescue League multiple times.
   ii. Leo is responsible for coding, and Grace is responsible for strategy and analyzing.

b. Main features
   i. The most important strategies of our robot include dynamic role assignment, positioning before ball LoP, and pushing along the wall beside opponent's goal.
   ii. Another critical feature in our development process is the TFA Robot Monitor, made by our lab, which is a visualization tool for the soccer simulation that let us see the data visually while the game is running.

2. Robot and Results

c. Dynamic role assignment
   i. Since we have three robots for each team, it is wise to utilize each robot as much as possible. Instead of assigning specific role to the robots, we assign different roles to our robots depending on the situation.
   ii. First, the closest robot to the ball will be assigned to follow the ball. This means that the robot following the ball is always the closest one to the ball, and therefore, reducing the time to get to the ball.
   iii. Then, for the other two robots, we check several conditions. We first separate the field into three equally divided sections (see Fig. 1), and we check which section

the ball is in. When the ball is in the front section, one of the remaining robots will go to the attacking position (see Fig. 2). The other robot will keep a distance behind the ball to catch it if the closest robot to the ball loses it. When the ball is in the middle section, the robot that is second closest to the ball will follow it. This is meant to push the ball to the front section because opponent's robots may be blocking it. The other robot will keep a distance behind the ball for the same reason as the robot in the front section. When the ball is in the back section, the robot second closest to the ball will go to the goalie side position and the other robot will go to the goalie center position (see Fig. 3).

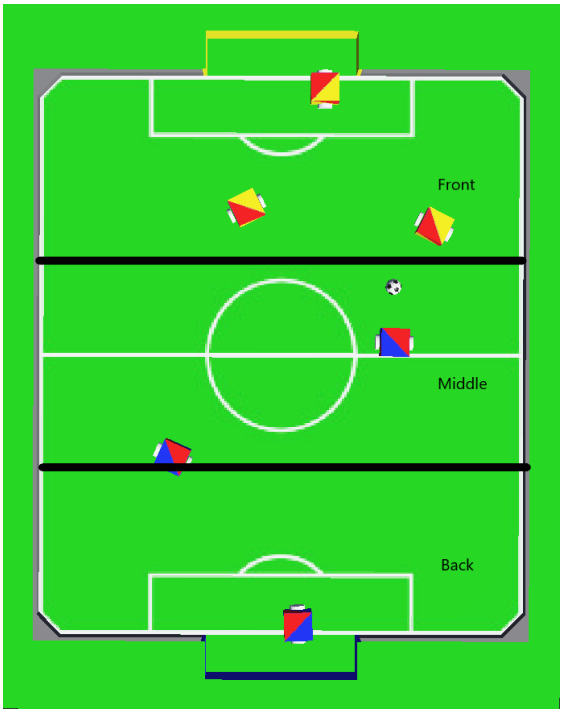

Fig. 1: three equally divided sections of the field

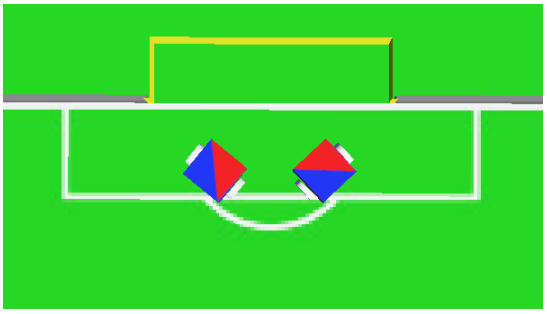

Fig. 2: the attacking position will be one of them depending on which side the ball is on

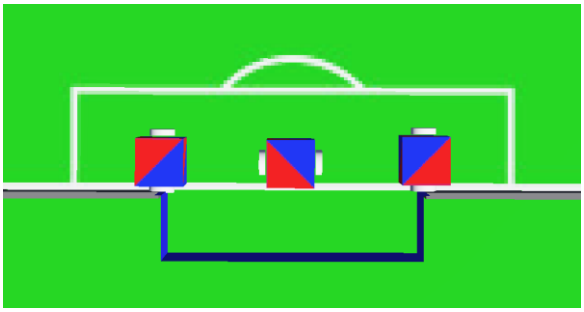

Fig. 3: the goalie side position will be one of the positions on the side and the goalie center position is the one in the middle

d. Positioning before ball LoP

i. We noticed that ball lack of progress is one of the easiest ways to score a goal in the simulation. This is due to the fact that when ball resets, it is often far away from the majority of the robots, causing the defense robots to take longer time than usual to get back to their goal.

ii. That being said, we decided to move the robots to some of the neutral spots when we detect that the ball is going to reset. Specifically, one robot is going back to in front of the goalie center position, so wherever the ball resets to, the opponent's robots will not score easily. The other robot will go to its closest neutral spot.

e. Pushing along the wall beside opponent's goal

i. Another thing that we noticed is that during a game, the ball is more likely to be on the edges of the field because it is squeezed by two robots from different teams when robots get close to each other. In addition, since each robot has the same amount of force, two robots pushing toward the same direction can be really hard to stop with only one robot.

ii. Therefore, when the ball gets near the wall beside opponent's goal, the robot that stays behind the ball will try to help the closest robot to the ball to push it along the wall and eventually scoring (Fig. 4).

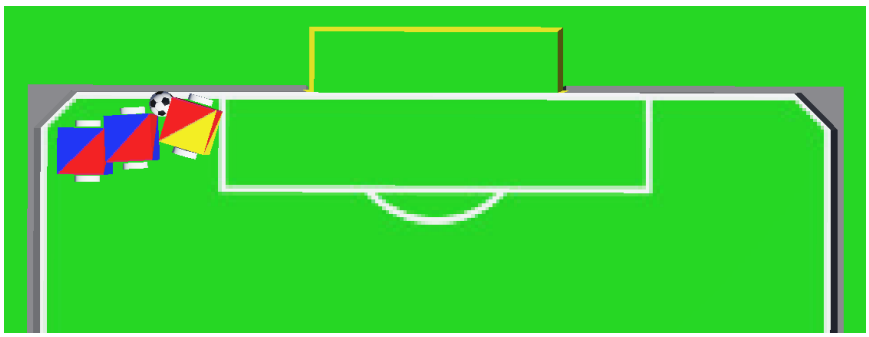

Fig. 4: example of two robots pushing along the wall beside opponent's goal

f. Visualization

i. We used the TFA Robot Monitor to test and see the data of the simulation. With this tool, we can see the previous positions of the robots and the ball. We can also replay the match to review critical moments. Additionally, we can send custom data to the monitor. For instance, we can send the predicted ball position to the monitor to accurately track whether or not we have predicted the correct position of the ball.

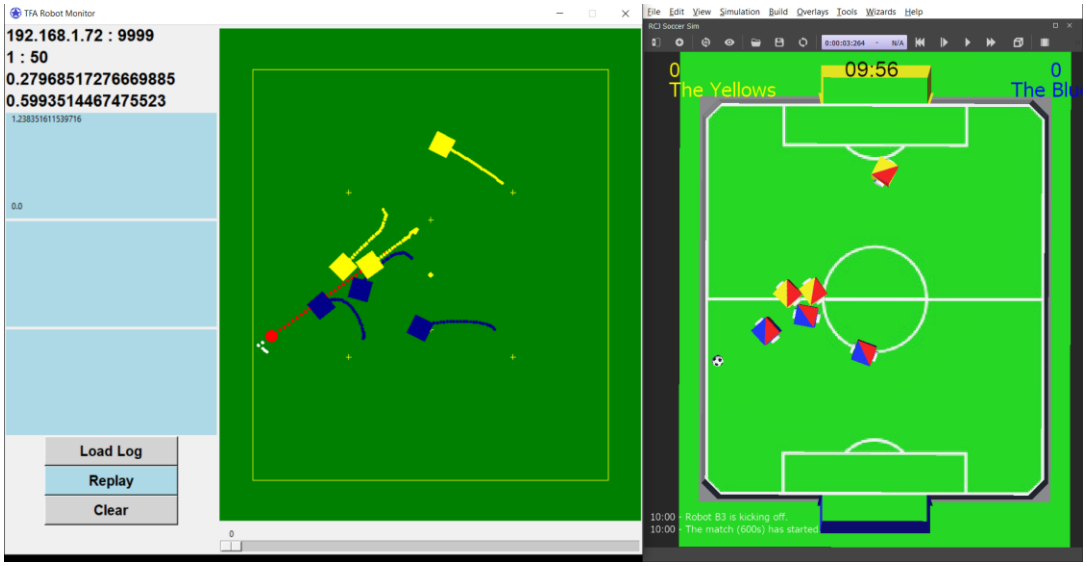

Fig. 5: TFA Robot Monitor on the left with soccer simulation on the right. The red dot in the monitor represents the ball, and the white dots represent the predicted ball position for robot B1

3. Conclusion

g. Through the development process, one thing that we found really helpful is by imagining the simulation as a real soccer game and think about what the players on the field will do under different circumstances.
h. In the future, we would like to incorporate dynamic weighing into our program, meaning that the robot may choose to do a task out of several tasks based on a weight.

Appendix

TFA Academy Website: https://tfacademy.ca/

TFA Junior Robotics Website: https://rcj.tfacademy.ca/

TFA Junior Robotics YouTube: https://www.youtube.com/channel/UCAXm5clAvmlfQ3CpkDJYwMg