Fast and Smart RCJ Soccer Simulation 2021

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Abstract. in this paper, "fast and smart" team' has been introduced ,in brief. Also, we investigated the ideas and algorithms which were applied in our simulation. for instant, robot motion and goalkeeper's positioning. In addition, coding for empty space was explained. Finally, we expressed our experience and learnings throughout robocup tournaments and our future plans as well.

Keywords: Robocup,simulation,junior Soccer,Webots

1   Introduction

Fast and smart" was founded in 2010. At first, the team participated in Iranopen 2011 junior soccer lightweight competition with excellent records and won first prize. After that, wining the first place was repeated in iranopen 2012 and 2015 competitions. Also, our team took first, second and third place in robocup Mexico 2012, turkey 2011 and china 2015 ,respectively. the team is currently preparing for RCJ Soccer Simulation league. Three student as fast & smart' members collaborate on coding and algorithm determination. in this year, we experienced different environments because of covid-19 pandemic.   All competitions were cancelled and we decided to adopt ourself with new circumstance. So, we studied python programming language and improved simulating soccer robot with python and also we learned more about webots

or coding and editing of program, visual studio code was used to order codes in a fast manner. In the following, we investigated the results of our works :

2 motion function for robot

As you know, motion function command the robot to move. At the first, motion ability of robot should be introduced. This robot includes two motor and the connected wheels which have less motion abilities than common soccer robots. It is the reason for us to be more cautious than applying real world algorithms. For controlling of robot, each motors should be controlled separately which leads to change in velocity and direction of robot's motion.

But how do we expect the robot's movement?
•Move at the fastest speed
•The most accuracy in reaching the desired point
•Minimum possible L.O.P

To achieve these goals, we examined several scenarios:
1. In case of deflection , the motors rotate to minimize deflection
2 .Only if the deflection exceeds the specified limit, the motors will reverse
3 .Under no circumstances should the motors be inverted from each other.
The results in the third condition were more optimal for high accuracy and   speed, and we based our robot movement pattern on it.

3 Goalkeeper robot algorithm:

The goalkeeper robot is the same as the center of the field. In the figure below, we see the robot positioning algorithm by looking at the videos and simulations of the role of the goalkeeper and a defensive arrangement. To protect the goal , at least one robot needs to be present near its own goal that can move dynamically. Block the movement of the ball Due to the robot's ability to move the ball linearly to better control the ball, the goalkeeper robot rotates and shifts 90 degrees relative to other robots on the ground and determines its position on the ground Always make the angle of the ball with the center of the goal at an angle of ten
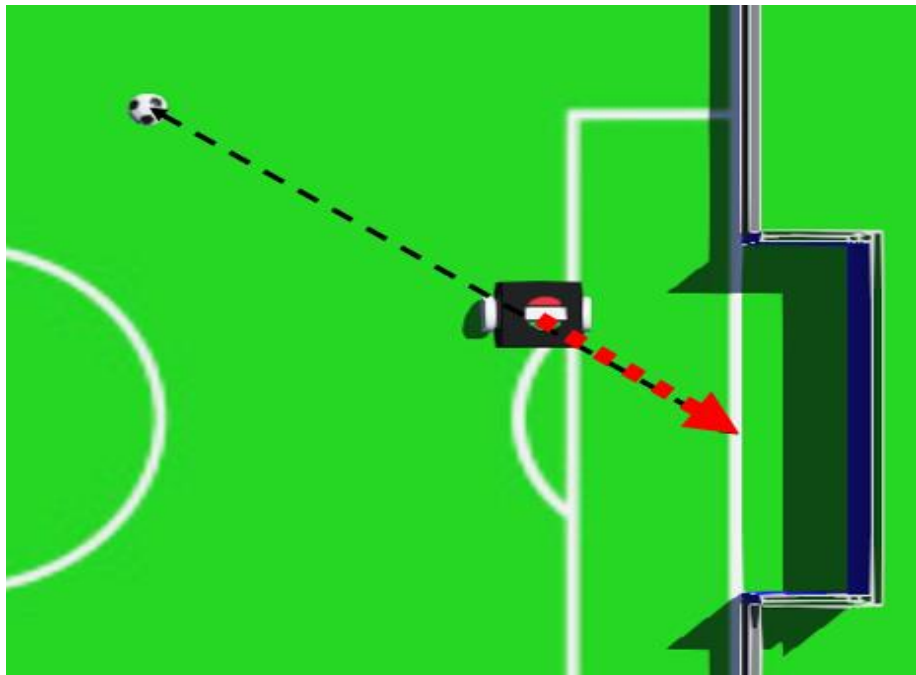
4 Algorithm for detecting empty space from own player

At times of the game, the robot needs to move to a predetermined point to get the best position to start the game, the robot must make sure that this position is not occupied by the team robot before moving to these points, for this We have prepared a function that, it receives the desired position and measures the distance between two teammates robots with that point and returns the value True if it is larger than the specified number and returns the value False if it is less. You can see the desired codes below:

```python
def is_empty(self,pos,team_side,reng,data):

    if team_side==0 :

        if self.name=='B1':
            if self.get_dis(data['B2'],pos)<= reng :
                return False
            if self.get_dis(data['B3'],pos)<= reng :
                return False
        if self.name=='B2':
            if self.get_dis(data['B1'],pos)<= reng :
                return False
            if self.get_dis(data['B3'],pos)<= reng :
                return False
        if self.name=='B3':
            if self.get_dis(data['B2'],pos)<= reng :
                return False
            if self.get_dis(data['B1'],pos)<= reng :
                return False
    else:
        if self.name=='Y1':
            if self.get_dis(data['Y2'],pos)<= reng :
                return False
            if self.get_dis(data['Y3'],pos)<= reng :
                return False
        if self.name=='Y2':
            if self.get_dis(data['Y1'],pos)<= reng :
                return False
            if self.get_dis(data['Y3'],pos)<= reng :
                return False
        if self.name=='Y3':
            if self.get_dis(data['Y2'],pos)<= reng :
                return False
            if self.get_dis(data['Y1'],pos)<= reng :
                return False
    return True
```

5 Achievements

The ability to code in Python and the ability to simulate what we have in mind without having to actually build it is a great experience we have gained. Combine math and coding to come up with new solutions that can improve robot performance and team results.Team work and dividing tasks and holding various meetings and discussions to get the best solution to problems such as determining a better algorithm for attacking and defending the advantages of this new project.

6 Future Works

For the future, we are thinking about using artificial intelligence and learning machine for simulation and we want to evaluate its performance compared to the current method and of course gain new experience

7   References

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