



# RoboCup Junior Soccer Simulation Team Description Paper (TDP)

RoboCup Worldwide 2021

**Team name : NOVA**

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## **Preface**

This Description Paper is going to take a quick look on NOVA's algorithms and the way robots play in Robocup Junior Soccer Simulation 2021. The attention of this paper is our current focus on Attack and goal keeper. Virtual Robots is an environments that a combination of state of the art algorithms of Robotics fields are needed to deal with its challenges. In the following we describe our approach for the main challenges such as scoring goal , following the ball , defending our goal and etc.

**Keywords:** Robocup Junior Soccer Simulation 2021 -

## **Introduction**

Our team is well known in light-weight Robocup Junior soccer competitions but unfortunately because of Corona virus and cancelation of last year's competition we couldn't participate , so this year although all problems we thought that we could use this great opportunity to participate in this online simulation competition. Our recent achievement was third place in Junior soccer Simulation IranOpen 2021 and also our previous team RASAA, scored second place in soccer light-weight Robocup 2018 and became first place in soccer light weight Iranopen 2018.

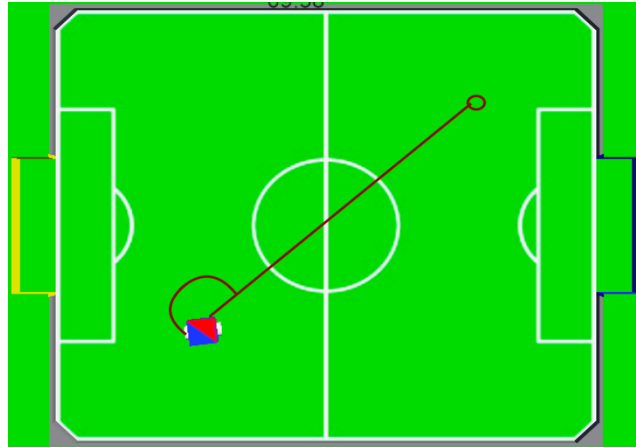
### **First of all,**

We defined three tasks for our robots which contains: Attacker , Defender and Midfielder. Our algorithm is based on task changing.

## 1- Move

### 1.1- Move a Robot to a certain point

For moving to a point in field we use PID controller. A **PID controller** is an instrument used in industrial **control** applications to regulate temperature, flow, pressure, speed and other process variables. So at the first we would set a MAX speed , get the difference between the zero angle of robot and coordinates of the desired point and multiply by a factor of  $K_p$ . Finally We put it on the engines.



## 2- Attacker

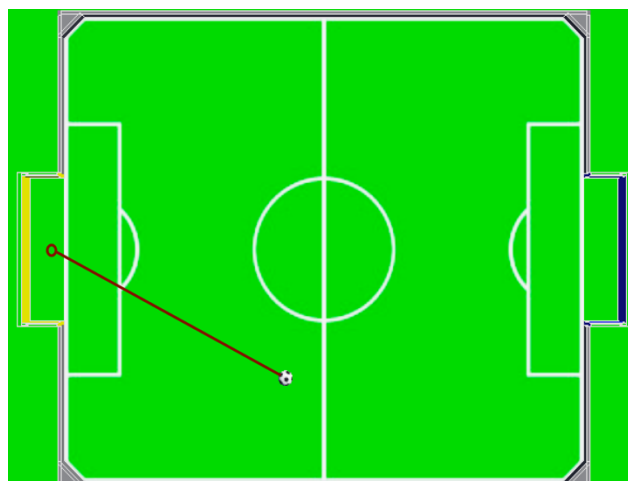
### 2.1 – When does the robot decide to be an attacker?

We always calculate distance of robots from the ball and the robot with the shortest distance is selected as the attacker.

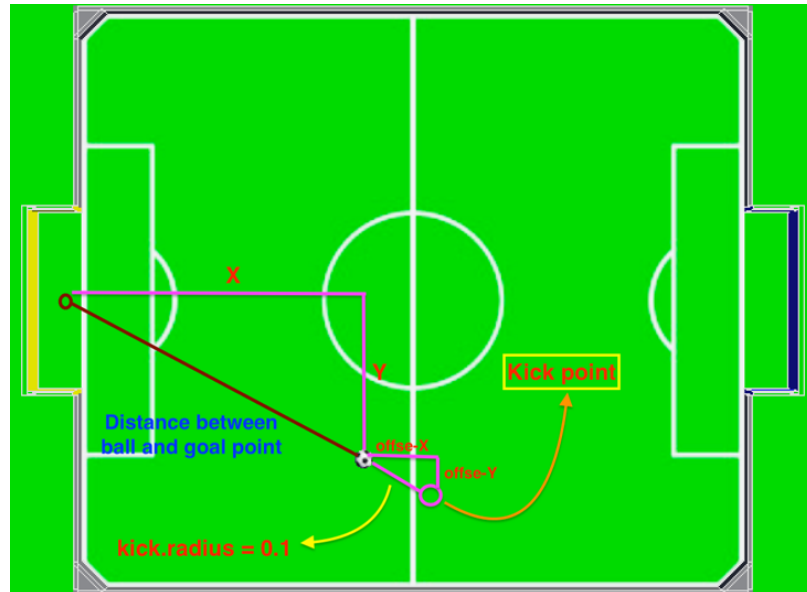
### 2.2 - kicking the ball

For kicking the ball we decided to move to a point behind the ball, so at first we have to find X and Y coordinates of this point by following these steps:

#### 2.2.1- Find the distance between ball and a point on goal



### 2.2.2 - Find X and Y coordinates of Kick-point



### 2.2.3 – Move to the Kick-point

### 2.2.4 – Kick the ball

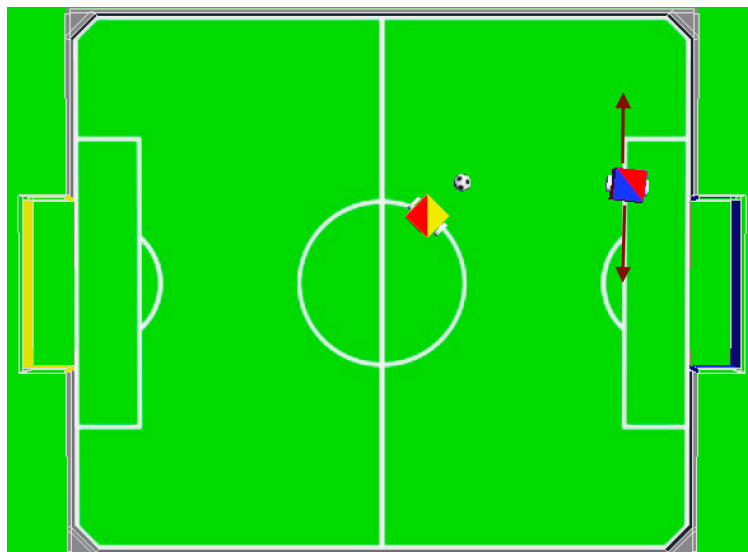
when our robot arrived at Kick-point, it would try to score a goal.

## 3- Defender

In early seconds of game, the robot with the furthest distance with the ball goes for the defender task and it would be its default task till end of the game.

### 3.2 – Goalkeeper

When the competition starts, where ever the robot is, it goes to the point ( $x = 0.7$ ,  $y = \text{ball's } y$ ) and it moves on a straight line. There is a parallel line to our goal next to the penalty area that the defender moves on that line at the whole time and sets its Y-coordinate with the ball's Y-coordinate .

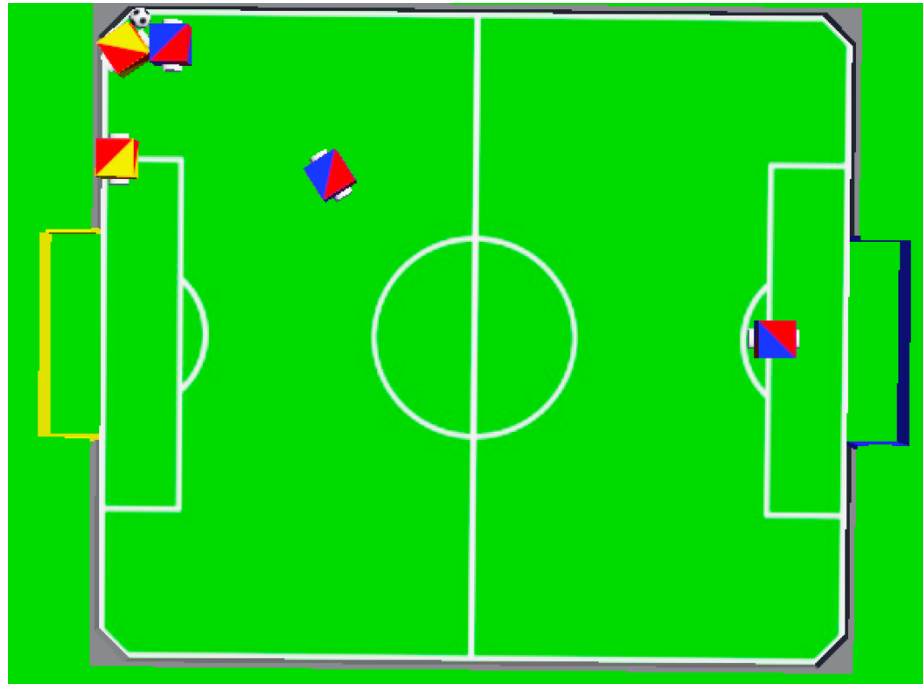


### 3.3 – Lack of progress

When the ball is going to be stuck (lack of progress), there would be two situations for the robot:

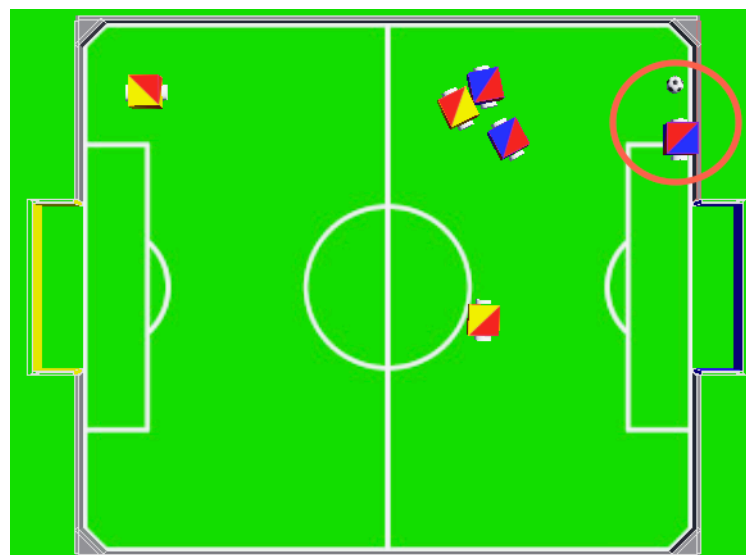
First situation is when ball is in rival's field, our defender which is free goes to center of penalty area.

Second situation would be when the ball is in our field, in this situation the defender stays wherever it is.



### 3.4 – Corner defense

While the ball is in distance between penalty area and corner area, the robot goes to the final Y-coordinate of Penalty area, it would make a 90 degree turns and hits itself to the wall. Actually, it stays in a stable situation that completely stops the ball, so it would concede the lowest number of goals.



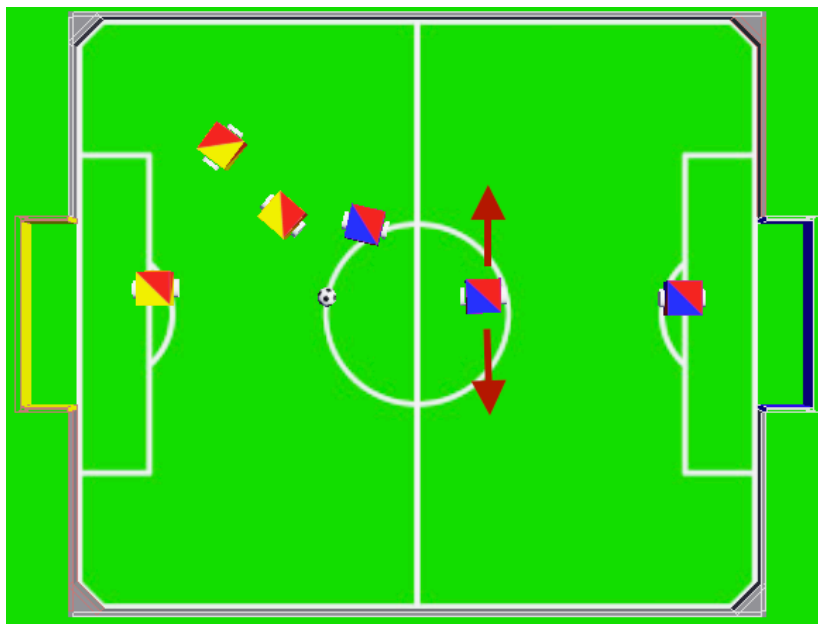
## 4- Midfielder

In beginning of the match after the defender distinguished, the robot which is further then other robot is selected as midfielder.

\* We always calculate the distance of the robots from the ball, so the task of attacker and midfielder can be changed anytime at the hole game.

### 4.1 – How it works?

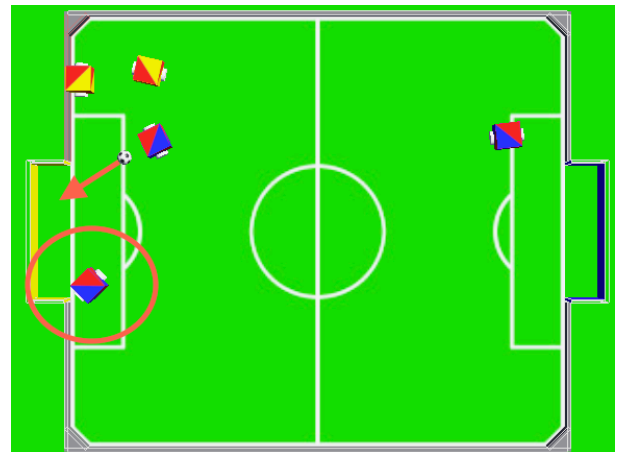
Midfielder sets its algorithm due to the ball's position. When the ball is in our field it would try to shoot the ball in rival's field and direct it to the rival's gate by going behind the ball like attacker. Whenever the ball is in rival's field, imagine a parallel line near the center line of filed, our robot sets its Y-coordination with ball's Y-coordination exactly like the defender to be ready for the time that ball enters to our field.



## 4.2 – Ball pass in rival's field

Whenever distance of the attacker and ball toward rival's gate both became less than 0.2, the midfielder moves to a point near rival's gate after that it would wait for attacker to navigate ball toward rival's gate. (this algorithm is a great solution for the time attacker shoots to the goal but it couldn't score)

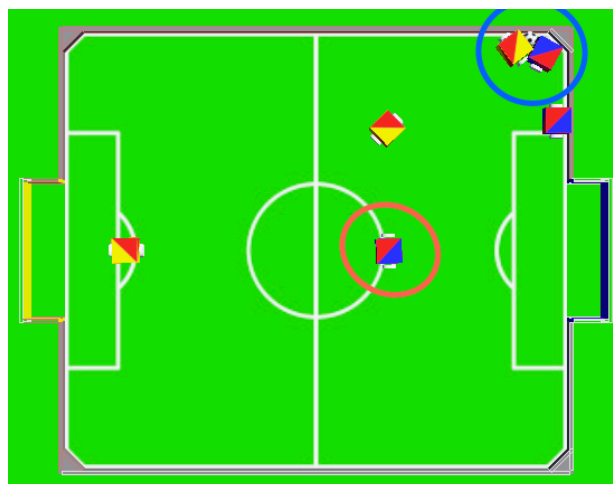
Although if the ball skips the goal, the midfielder should stay there and increase the opportunity of scoring.



## 4.3 – Lack of progress

When the ball is going to be stuck, the midfielder which is further than attacker, it should go for lack of progress.

If "lack of progress" happens in our field the midfielder will go to the perimeter of the middle circle of the field.

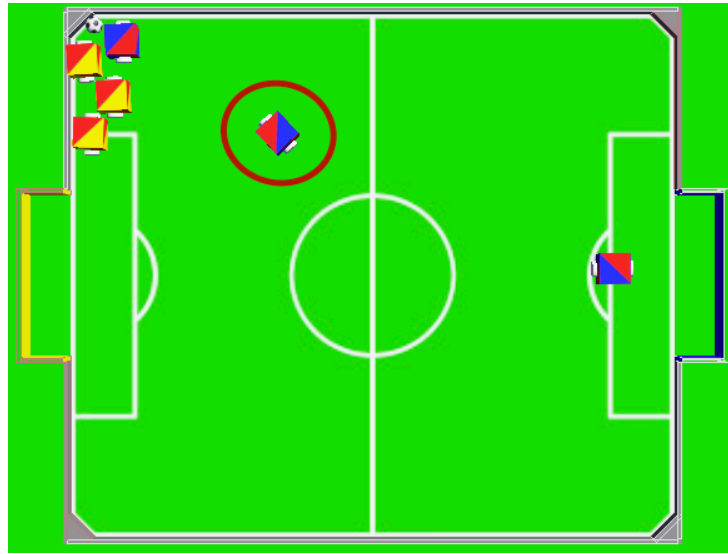


When that happens in rival's field, we would prefer to go to a point which higher possibility of setting the ball is.

Consequently, the robot goes to the position of the neutral point which  $Y$  is lower than zero and it's in rival's field.

- blue team:  $(x = -0.3, y = -0.3)$
- yellow team:  $(x = 0.3, y = -0.3)$

And then it sets its angle to the side of the rival's goal.



## 5- References

-What is a PID Controller? : [www.omega.co.uk](http://www.omega.co.uk)

