LuckyStar

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FY, BN, SQ, KC, KC, DC, JT, JT, CT, CT, TT: Ngee Ann Polytechnic

Abstract. *The small-size league robotic soccer game is played between two teams of 5 robots each on a table-tennis size field. Just like real human soccer, each team of robots played cooperatively in order to score as many goals as possible. This paper describes LuckStar, the team that we have developed for the pacific-Rim RoboCup-98 competition, held in November 1998, in Singapore.*

1 Introduction

Our project team was formed in May 1998. With six months to go before the November competition, we were hard pressed for time. So we borrowed ideas from the many papers published by the experienced research group. In particular, we referred heavily to a team description paper [1] from CMU. In this paper, we briefly describes our system and then some of our game tactics.

2 System Description

We employed global vision as this is the simplest and most effective method. The five robot players are basically the same except that the goalkeeper is longer compared to the rest for obvious reason. Two cameras are used, with each mounted on top of each half of the field. The cameras' outputs are fed to two Cognachrome vision systems. The vision systems outputs are transmitted to the host PC via two RS232 ports. The host computer computes the next move for each robot. The outputs are sent to the robots via a Radiometrix RF transceiver.

3 Vision system

Two Newton Research Labs Cognachrome vision systems are used to recognise the color markers on the robots and the orange ball. Thee Cognachrome

Figure 1:

resolution is approximately 200x250 which is insufficient to cover the whole field reliably. Hence two cameras are required. The Cognachrome can track 3 different colors at any one time. We used one colour for the ball, one for our own robots and one for the opponent robots. For our own robots, we used two same colour patches of different size. This helps to identify the head, and hence the orientation of the robot.

4 Robot Motion Control

The movement of the robot is controlled by manipulating the motors speeds. Each robot is driven by two DC-motors in a wheel-chair configuration. The robot speed is the sum of its translation speed and the rotation speed. By

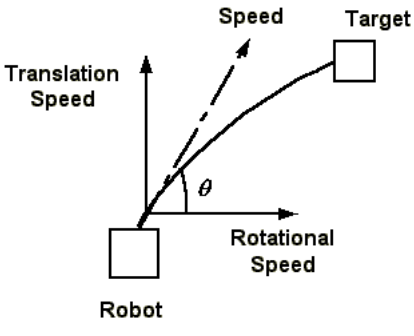
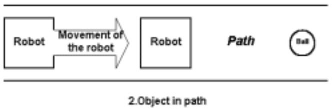


Figure 2:



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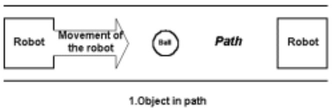


Figure 4:

controlling adjusting the composition of translation and rotation speed [1], we can make the robot move towards a target. This forms the basis of all robot movements.

5 Obstacle Detection and Avoidance

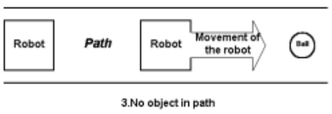
A simple object detection technique was implemented to detect for an obstacle. An area along the path of the particular robot is calculated based on the current position and orientation of the robot, any objects coordinates besides the balls coordinates covered by the computed area is taken as an obstacle of the robot.

Any objects in path before the ball will be taken as an obstacle, and the adjustment of the movement of the particular robot is needed. The path to go around the obstacle will be calculated based on the coordinates of the particular robot, ball and detected opponent or teammate.

6 Strategy

6.1 Attackers

Two of the robots are designated as attackers. These attackers will only response when the ball is within the opponent half of the field. At any one time, only one attacker will be actively striking, clearing, chasing or passing the ball. The other attacker will go to its pre-programmed position waiting for the ball at the best striking angle. Each attacker is responsible for its own area.



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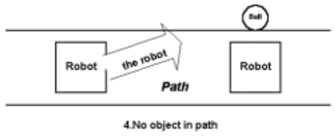

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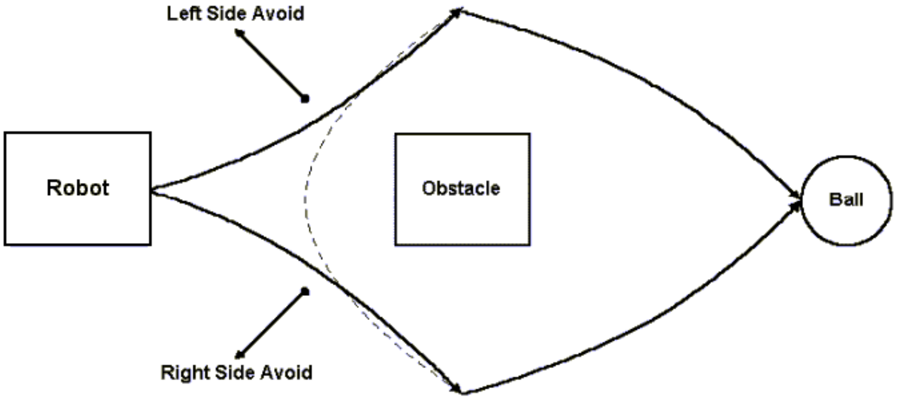

Figure 7:

6.2 Defenders

Basically, the responsibilities of defenders are to block the ball from entering to the defence zone of the goalkeeper and passing the ball back to the attackers. Two robots are programmed to perform the task of defending. Once the ball enters our half of the field, the defenders are activated. The following factors are used to decide which robot shall handle the ball.

1. Distance between defender and ball.

2. Presence of obstacle in path towards ball.

6.3 Goalkeeper

The job of the goalkeeper is to block and clear the ball from the defense zone. When the ball is at attacking half-field side, the goalkeeper will move to the centre. It only responses when the ball is in the defence half-field

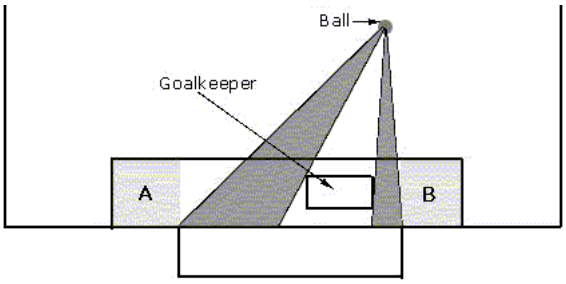

Figure 8:

side. By using the angle offset, the goalkeeper will position itself so that it minimizes the largest area of unobstructed goal area, which is shown in the figure below. Note that the area on the right is slightly smaller (exaggerated in the diagram) that the area on the left. This is because the ball distance to the right opening is shorter and hence the right side needs to be protected more. The speed of the ball is also monitored. When it is above certain critical speed and towards the goal, the goalkeeper will move towards the predicted goal position. When the ball moves into region A or B, the goalkeeper will hit the ball out of that region.

7 Conclusion

From the Pacific-Rim RoboCup-98 competition, we noticed that almost all teams were having problems with their vision system. The host computer would lose track of the robots as the game progressed. This is also our main problem right now and we hope to be able to address this problem by RoboCup-99 competition.

8 Bibliography

[1] Manuela Veloso, Peter Stone, Kwun Han, and Sorin Achim. The CMUnited-97 small robot team. In *Proceedings of the First International Workshop on RoboCup*, Nagoyo, Japan, August 1997