TH-SP Field Rangers

Wang Lei [1]

Sng Hong Lian [2]

1 The State Key Laboratory of Intelligent Technology & Systems,
Department of Computer science & technology,
Tsinghua University, China
Wangl01@mails.tsinghua.edu.cn
2 Advanced Intelligent and Control Centre
School of Electrical and Electronics Engineering
Singapore Polytechnic
Snghl@sp.edu.sg

Abstract. This paper describes TH-SP Field Rangers, the RoboCup small size league team that we are preparing for the Padua 2003 competition.

1 Introduction

In the past, Field Rangers is a RoboCup small size league team put up by Singapore Polytechnic. The team has a long history in SSL. This year, we decided to jointly participate as a team made up of a collaboration between Tsinghua University, China and Singapore Polytechnic. The team name is modified to TH-SP Field Rangers.

In robot soccer game, it includes many technologies of different fields such as vision, tracking, strategy planning, behavioral algorithms, motion control or special robot hardwares. Even though fast speed and accurate motion control are crucial in most competitive games; we prefer to emphasize on good strategy planning algorithms. In this paper, I shall mainly describe a new strategy algorithm we adopted

2 System Description

Like many other teams, we use a global-vision-based system. The host computer processes and derives the vision data and computes all the intelligence for control actions of all robots. In every sample, it sends out commands to all robots, which are the robots' translation and rotation speeds via a RF transmitter.

3 Robot

We have just completed our new omni-direction drive robots, which are basically of the same design as our previous robots including dribbling bar and kicking mechanism. There are some other minor changes to the electronic and mechanical design in order to make the robots more reliable. The robots are barely completed and we shall wait and see whether these robots can be commissioned on time for the Padua 2003 competition., else we will stick to the differential-wheel drive robots due to their simplicity.

4 Strategy algorithms—the Methods of Dynamic Alliance

We use new strategy algorithms called the methods of dynamic alliance, as inspired by virtual enterprise alliance in manufacturing technologies. We apply the algorithms onto the host computer. The software structure comprises of a controlling architecture and four tandem algorithms.

4.1 Controlling architecture

Our robots cannot be a fully autonomous entity based on global-vision system, so it must depend on a host computer computation to process the vision data and intelligent decision-making. We design a controlling architecture to obtain distributed multi-robot system by combining both software and hardware aspects.

The host computer executes five independent programs, which corresponds to a team of five robots. It also runs another service program, which accomplishes three tasks. The first task is to process vision data and compute all robots' locations and directions. This information is made available to all the five robot's programs. The second task is to poll the COM port, which is connected to the referee box and pass the referee's instructions to these five programs. The third task is to collate the commands for all robots' translation and rotation speeds from these five programs and send to the RF transmitter for onward transmission.

When the game starts, five robots vote for one robot as the chief of alliance, base on some rules such as the nearest robot from ball etc. Then, the chief of alliance decide the plan of cooperation and decompose it into tasks executable. Secondly, the chief of alliance robot select the collaborator robot that can fulfill some task and assign the role to it. Finally, all participants of this dynamic alliance co-operate with each other according to the strategy. When task is accomplished or aborted, the alliance is dismissed, and the five robots collaborate and vote for next alliance.

We call the above-mentioned controlling architecture as dynamic hybrid controlling architecture. The methods of dynamic alliance are based on four tandem algorithms.

4.2 Four tandem algorithms

1. **The algorithm for voting for the chief of dynamic alliance**. We apply a set of fuzzy rules to select a robot (the corresponding program on host computer actually) to administer the dynamic alliance.
2. **The algorithm for the chief robot to decide the co-operation plan**. We design a set of tactics, which are the blue prints available. The chief robot will select one of them. The chief robot may modify it if necessary.
3. **The algorithm for the chief robot to decompose the co-operation plan**. The plan must be divided into several tasks that can be executed by robots. For example: if the plan is a pass between two robots. This can be decomposed into two separate tasks; namely, a task for one robot to move to a appropriate position and face a particular direction while the other robot holding the ball is preparing to kick the ball to it. The chief robot solves the decompositions.
4. **The algorithm for the chief robot to select partners**. Every special task must be assign to the most appropriate partner to carry out. We design a power matrix to help the chief robot implements the role assignment.

It is a bottom-up process and from free-state to alliance while the opposite process is that the chief leads other robots to finish a plan. Those are methods of dynamic alliance.

5 Conclusion

So far, I have briefly introduced our algorithms used in the strategy. We attempt to apply distributed control methods for multi-robot system on a centralized controlling test bed. We have not completely accomplish our work but we have the confidence to succeed.

6 Acknowledgement

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References

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