A Design of Agents for the Disaster Simulator on RoboCup-Rescue

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Abstract. In a Multi-Agent System, it is important that an agent co-operate with the others appropriately. In our rescue agent team "NI-TRescue", each agent acts in cooperation with other kind of agent by using limited communication facility. Therefore they aim at coping with complicated disaster circumstances of Rescue simulator.

1 Introduction

In Robocup-Rescue simulation[1], agents act in order to minimize the damage of disaster. For example, fire fighting party(Fire Brigade) extinguish a burning building, and Ambulance Team saves a buried people by building collapse and injured people. However, as real disaster, there is limit to solve a situation by power of an individual agent. Therefore it is important an agent cooperates with other agent. In addition, it considers comparing with a Rescue simulation and a Soccer simulation[2]. In a Rescue simulation, the agent of two or more kinds exists in that environment. Therefore cooperation with a different kind agent is important same as cooperation with a same kinds agent.

In NITRescue, we implement cooperative activity between similar agents to fire brigade in order to extinguish a fire of a burning building more effectively. In addition, in order to cope with the circumstances that more than one element such as road confinement or collapse of a building was related with each other complicatedly, agent communicate with heterogeneous agent.

2 Cooperative Activity

2.1 Cooperative Activity of Homogeneous Agent

In Rescue Simulation, goal of an agent minimizes spread of a fire that occurred by a disaster, and it is to save a lot of human life as much as possible. However, power of single agent is limited. For example, we think about fire extinguishing activity of a fire brigade agent. It is difficult on a Rescue simulation for only one agent's power to extinguish a fire of a building. Also, this can say the same things also as fire-extinguishing activities in the real world.

Fire Brigade agent of NITRescue extinguishes a fire of a building in coopera-
tion with a nearby fire brigade agent with using communication. We can use two
different communication methods in rescue simulation. The first is "say" that
communication range is limited (equivalent to communication of natural voice),
and the other one is "tell" that communication range is unlimited (equivalent to
communication method to use radio). When there is other fire brigade near it,
fire brigade transmits information of the building which oneself extinguishes a
fire with using "say" to that fire brigade. If the agent which received a message
of the information does not extinguish a fire, they help extinguishing activity
of the agent that sent the information. On the other hand, when that agent
is extinguishing a fire, that agent judges which building can extinguish a fire
effectively after having considered distance to a building and scale of a building.

Fire brigade extinguishes a fire of many buildings by extinguishing a fire of
each building quickly.

2.2   Cooperative Activity of Heterogeneous Agent

In a RoboCup-Rescue simulation, in addition to the movable agent such as fire
brigade, ambulance team and police force, there is headquarters agent having
role to control an agent of each kind (Fire Station, Ambulance Center, Police
Office). In a NITRescue team, these agents support action of a movable agent
by undertaking communication of message between each kind of agent. In a rule
of RoboCup-Rescue simulation[3], the number of message which each agent can
receive in one simulation step is limited. Therefore it is impossible to receive
every message from every agent.

In order to solve this problem, headquarters agent and a move agent of NI-
TRescue limit the partner that each agent receives a message, like figure 1. By
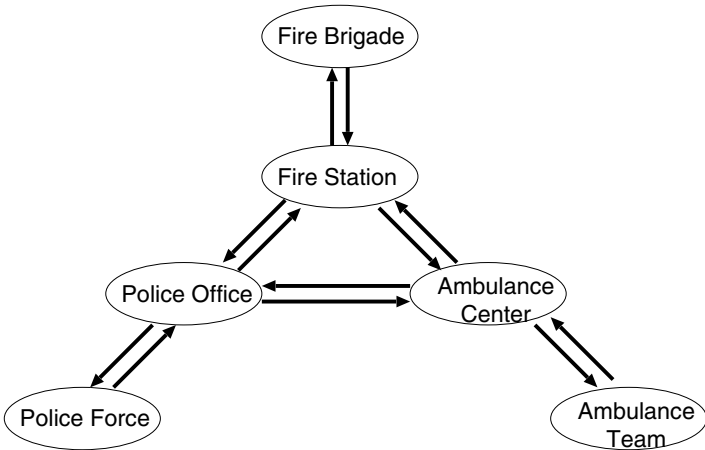

Fig. 1. Network Diagram of Rescue agent

using this method, an agent can do effective communication in limit of severe message.

As an example, we think message communication between fire brigade and police force. There is road confinement by disaster in Rescue simulator. Therefore there is a case that fire fighting party cannot arrive at a destination by road confinement and cannot act at all. In this case, fire brigade aims at a breakthrough of circumstances by sending in a relief request to the police force. Fire brigade can send in a direct relief request to the police party, but in such a case the police force needs to be prepared to always hear a message of fire brigade. In a fire brigade's message, the message which is not related to a police force at all is also contained. If the police force receives every message of fire brigade, it becomes difficult that the police force receives even a necessary message by limit of severe message. In order to solve this problem, based on network as figure 1, each agent transmits a message with the following procedure(figure 2).
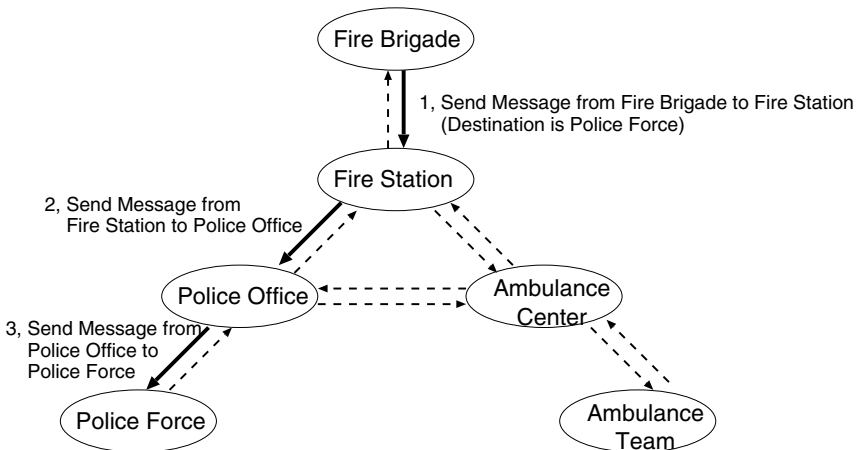

Fig. 2. Flow of Sending Message from Fire Brigade to Police Force

1. Fire brigade transmits the message whose transmission address is a police force to a fire station.
2. A fire station forwards the received message to a police station after having checked destination.
3. If the message which police station received from a fire station is addressed to the police force, a police office forwards the message to the police force.
4. If it is message from a police office, the police force checks contents.
5. The police force acts on the basis of contents of received message.

Based on such a procedure, fire brigade communicates with the police force. And an agent cooperates with heterogeneous agent in complicated disaster circumstances

And there is a limit in the capability of ambulance team which finds people who have been buried in a rescue simulation. In NITRescue, when police force and fire brigade found a buried person, they transmit the information with the same procedure to ambulance team. Therefore, in difficult situation, an agent aims at lessening damage of disaster by cooperating with other agents.

3   Conclusion

We designed the agent in the rescue simulation in which agent of more than one kind exists. In addition, in order to cope with restriction of the severe communication in the game rule of a rescue simulation, we developed the communication network which can communicate effectively among the agents of a different kind. However, it is mentioned that a headquarters agent's amount of communications increases and a bottleneck arises as a problem of the built network. Since the map of 1/10 scale is used, there is no problem in the present game. However,since the number of agents will increase if the scale of a map will become large from now on, it is a future work to solve this problem.

Acknowledgment

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