

The Team Description of YabAII

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Abstract. RoboCupRescue project aims to simulate large urban disasters. In order to minimize damage resulting from disasters, various rescue agents try to accomplish their missions in the disaster space in the simulation system. Ability of an individual agent, however, is utterly insufficient. Agents need to cooperate with other same and different types utilizing as little communication as possible under stringently limited visual sensory information. Our YabAII team solved future work of YabAI in RoboCup-2001 and dealt with some problems issued from the revised rule.

1 Introduction

RoboCupRescue project aims to simulate large urban disasters. Rescue agents such as ambulance teams, police forces, and fire brigades act on the disaster space in the simulation system. Buildings and houses collapse and burn, and roads are blocked in the disaster space. So a number of civilian agents are sacrificed and injured. In order to minimize damage resulting from disasters, these agents have to try to accomplish their missions.

Many agents such as civilians, ambulance teams etc. lived in the disaster space. Soon after the large earthquake, buildings collapse, many civilians are buried in the collapsed buildings, fires propagate, and it becomes difficult for agents to move roads because these are blocked by debris of buildings and something else.

In the disaster space, there are seven types of agents; civilian, ambulance team that rescues injured persons and take them to refuges, fire brigade that extinguishes fires and arrests the spread of fires, police force that repairs blocked roads, ambulance center, fire station, and police office. The number of Say, Tell and Hear commands that can be issued by an agent in one turn is limited. An agent can say or tell up to four messages in a turn, and can hear four messages in a turn. Information amount of messages is measured by the number of sentences involved. When an agent receives hear information from the simulation system, the agent may select whether it hears individual messages or not by checking who is the speaker.

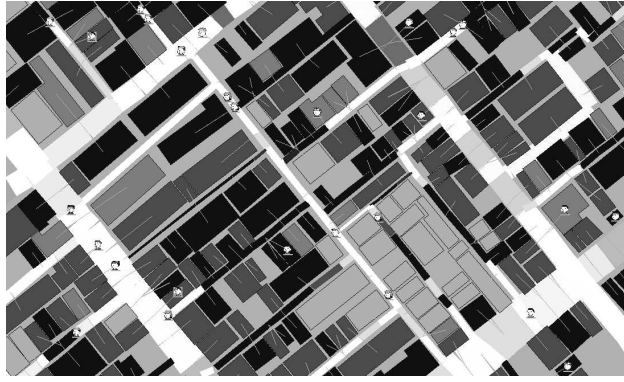


Fig. 1. Disaster space

2 Fundamental abilities

In the previous traffic simulator, agents were not often caught by a traffic jam. The present traffic simulator, however, tends to generate more traffic jams. So agents have to avoid causing a traffic jam as far as possible, and untie it by looking at others if it occurs.

3 Cooperation strategies

3.1 Ambulance Team

Ambulance team agents search for injured persons in a distributed manner, and concentrate to rescue them together with others by using communication. Ambulance team agents can hardly grasp states of all injured persons, because there are many injured persons and they are often appear suddenly, for example, by the spread of a fire. So it is nearly impossible to optimize a rescue plan. Ambulance team agents put a premium on the certainty, and rescue injured persons soon after they decide it is necessary to rescue just now. In order to restrict rescue operation from which little pay-back can be expected, they divide injured persons into four rescuing priorities; “need immediately”, “need”, “no need” and “abandon”.

Under the revised rule, agents have no information about civilians’ initial positions. So ambulance team agents communicate efficiently with other agents and gather information on injured civilians’ positions.

3.2 Fire Brigade

Fire changes its condition rapidly, so it must be especially rapidly coped with. It may not be difficult to extinguish an early fire for even a few fire brigade agents.

On the contrary, it is very difficult even for many to extinguish a late and big fire. Time is valuable very much. It is better that individual fire brigade agent selects fire on its own responsibility, than spending time to communicate with others.

There are four tactical points about fire fighting;

- give early fires a top priority,
- barricade by extinguishing edges of spread of fires,
- concentrate flashing power as far as possible, and
- distribute power as far as possible finally.

It is wasteful that many fire brigade agents extinguish a small-scale fire, and it is ineffective that a small number of agents extinguish a large-scale fire. However, under a situation where fires are scattered, it is a formidable task to balance concentration and distribution of flashing powers.

YabAII becomes possible to distribute fire brigade agents efficiently by estimating the priority of fires based on three criteria; (Fig.2)

- state of the fire, especially burning duration,
- surrounding circumstances of the fire, and
- distance from the agent to the fire.

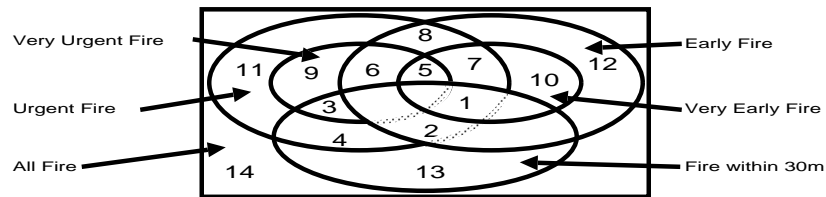


Fig. 2. Priority of fire

Fire brigade agents look at the surrounding circumstance of the fire to estimate whether fire spreading can be blocked by extinguishing it. If extinguishing the fire is useful for blocking of fire spreading, then it is valuable. The value of fire extinguishment is calculated with the numbers of yet unburned buildings, extinguished buildings and fires around the fire. To be specific, the fire around where are many unburned buildings and few fires is valuable to extinguish, that is, urgent. Fire brigade agents should extinguish such urgent fires rapidly, or the fires probably propagate to the surroundings.

Fig.2 shows the priority of fires which is described by a small integer. For example, the first priority, the smallest integer is given to a fire which is very early and located within a radius of 30m from the agent.

3.3 Police Force

Police force agents repair blocked roads through which others need to pass. Other types are often put in a situation that they cannot reach any destinations because routes are cut off. Though they are able to calculate optimal routes, they cannot reach any destinations in such a situation. As previously mentioned, agents must reach their destinations as soon as possible when they need to be there. Activity of police force agents especially affects others'. It is, however, difficult to get a criterion which roads they had better to repair first.

Platoon agents negotiate with each other in advance, that is, police force agents first clear blockade in multilane roads, which are more important than single lane roads in general, and other agents try to pass such roads first. Fire brigade and ambulance team agents can be assured that they will be able to pass blocked roads on where police force agents are clearing and will finish at least a few cycles later.

3.4 Center agents

Center agents only hook up communication with other type center agents, now. Under the revised rule, a center agent can hear messages up to double number of its platoon agents in a turn. So the center agent can play more important role, that is, they can make their choice, and integrate and redistribute gathered information. There remains room for improvement about selection of messages to be spoken or heard.

4 Conclusions

We made several improvements on YabAI team in RoboCup-2001 in order to solve its future work and deal with some problems issued from the revised rule:

- Platoon agents avoid causing a traffic jam as far as possible, and untie it if it occurs.
- Ambulance team agents grasp states and positions of injured persons efficiently.
- Platoon agents move more quickly than YabAI by a so-called locker-room agreement, that is, advance teamwork negotiation.
- Center agents gather more information and integrate it.

References

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 [2001] Takeshi Morimoto: “YabAI source code”, 2001. Accessible from <http://ne.cs.uec.ac.jp/~morimoto/>.