Hinomiyagura's Goals

Tomoichi Takahashi[1], Hironori Takahahsi[1], and Takayasu Suzuki[1]

Meijo University, Faculty of Science and Technology
1-501 Shiogamaguchi, Tenpaku-ku, Nagoya, 468-8502, Japan
ttaka@ccmfs.meijo-u.ac.jp

Abstract. Hinomiyagura aims to develop simulation environments that will be used before disasters of local governments. For a start, map generators are being prepared and rescue policies dependent on positions are implemented.

1 Introduction

Robocup Rescue simulation provides a good research platform and serves a purpose to rescue activities at disaster situations [1]. Activities of our community have been promoting them and it has made clear that rescue simulation are assumed to be used for various purposes. The purposes vary with stages of disasters, for example, simulators are used to check disaster prevention plan before disasters. And during disaster they also will be used to predict disaster situation and to design a disaster-resistant urban after disaster.

Our team name "Hinomiyagura" comes from traditional Japanese fire tower (Fig. 1). The tower has been used since middle of 15 century and been used to lookout tower for fires. When persons in the tower detect fire, they ring a bell repeatedly to alarm people. The system becomes obsolete at present, however, its principle - early detection and swift announcement - still survives. Hinomiyagura targets at implementing its principle and check disaster prevention plans of local governments.

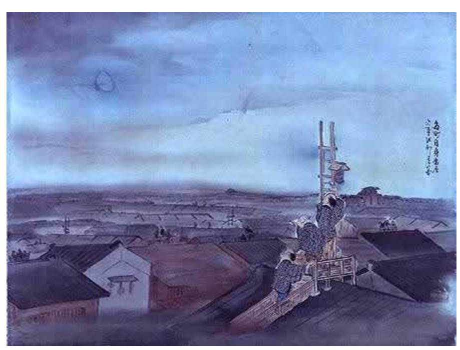

Fig. 1. Hinomiyagura in Hiroshige's (1797-1858) block print

2 Maps generation from Open Source data

Geographic Information System (GIS) data is an important component not only of Rescue simulation system but also in other application fields. The variety of GIS applications sets up a situation that there are many application specific record formats. Geographical Survey Institute (GSI) of Japan designed an application schema for spatial data, and XML format data were created.[2] The XML maps are 25,000 scale. They cover cities and towns across Japan and are available from the Internet.

Fig. 2 shows road network and locations of public utilities of Tenpaku-ku that our university locates. The area is $21.61km^2$ and the converted map has 4,005 nodes and 6,028 roads. Table 2 shows specifications of maps that are used at RoboCup competitions and Nagata and Tenpaku of GSI 25000 XML maps. The size of real maps are larger than that of our community is using. At present, it can be handled with JGISEdit [3]. Our team is preparing map generation tools that add data necessary for RoboCup Rescue simulation. The data are not included in Open Source data.

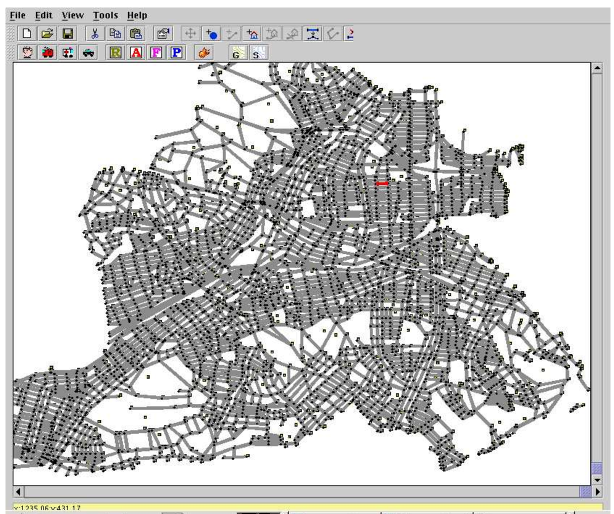

Fig. 2. RoboCupResuce Map created from GSI 25000 Map

3 Hinomiyagura Agent's policy

Rescue agents plan to rescue victims as effectively as possible. Operation costs and rescue benefits are parameters of rescue action planning. In cost evaluation,

Table 1. Maps

	RoboCupRescue			GSI 25000	
	Kobe10	Vc1	Foligno	Nagata (Kobe)	Tenpaku (Nagoya)
node	765	531	1369	1284	4005
roads	820	622	1480	1818	6028
area(km^2)	0.25	0.29	0.74	11.48	21.61

Ambulance agent are though to have different structures than other rescue Fire-brigade and Police agents. The latter's evaluations are scored based on bilateral relation between rescuers and disaster sites. A simple standard is to go disaster sites with minimum cost, e.g. to the nearest site, so that rescue agent can start it operations as fast as possible. It is stated as follows:

- rescuer$_i$'s rescue policy: go to site$_j$ such as $\min d_i^j$ and rescue,
- rescue policy of a team as a whole:
  assign rescuer$_i$ to go to site$_j$ such that $\min_{i,j} \sum d_i^j$,

where d_i^j is distance between rescuer$_i$ and disaster site$_j$.

On the other, ambulance agent's policies are measured from trilateral relation between rescuers, disaster sites and refuges, because they go to refuges after loading victims. Their standard is described with d_i^j and e_j^k where e_j^k is distance between victim$_j$ and refuge$_k$.

- ambulance agent$_i$'s policy:
  go to site$_j$ and take victim to refuge$_k$ such that $\min_j d_i^j + e_j^k$ and rescue,
- ambulance center's policy:
  assign agent$_i$ to take victim$_j$ to refuge$_k$ such that $\min_{i,j,k} \sum d_i^j + e_j^k$.

Solid lines and dashed lines in Fig .3 represent d_i^j and e_j^k respectively. It is clear that ambulance agents can carry a victim to a refuge(Rf) faster by going to site$_3$ than to site$_1$. Actually, d_i^j is not so a simple metric as the Fig .3 shows in real

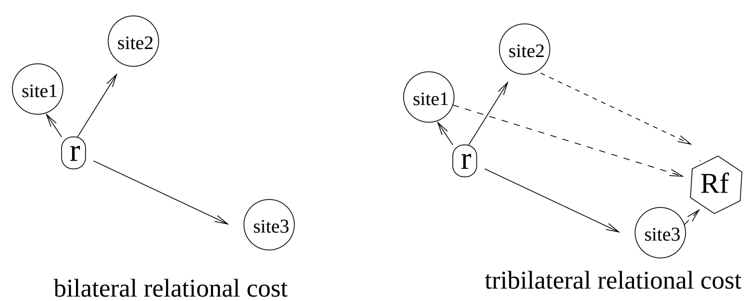

Fig. 3. Selection policy based on locations

situations, Hinomiyagura Ambulance agents are being developed to adjust the metric to real ones. Rescue center agents collect information on local geography from all rescue agents and round up them with reducing contradictions among them to rescue platoon agents. The strategy seems not to work well at RoboCup competition field size. Because the sizes are small that rescue agents can manage GIS data together.

4 Conclusion

Our team aims to develop simulation environments that will be used before disasters. For a start, map generators are being prepared and rescue policies dependent on positions are implemented. It is planned to check vulnerable areas of a city to disasters by running simulations over various cities.

Hinomiyagura has been programmed based on YowAI's code and YabAI package, we would like to express thanks YowAI team [4].

References

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