

# RoboCupRescue 2015 – Rescue Simulation League

## Team Description

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**Abstract:**This paper mainly puts forward the partition map, channel allocation, fire simulation and analysis of the fire, and the three Agent handle their tasks, to achieve efficient use of channel messages, find the fire quickly, stop the fire spreading, the purpose of reducing casualties and property losses.

**Keywords:**Partition,Channel allocation, Fire simulator,Fire Simulator ,Agent

## 1.Introduction

Rescue robot simulation is to simulate that when the real world city disaster occurs, we should adopt what kind of strategy to minimize casualties and property losses. Various disasters which may happen in the city are simulated by servers. Three Agents are used to collect and deal with the information. Then tasks are distributed to the corresponding Agents by the reasonable programming we made it to make Agents properly cooperate. Agents carry out emergent help so that the casualties and property losses reach a minimum value. By attending this game, we can use the knowledge to practice such as in artificial intelligence, algorithm design, data acquisition and information processing, etc.

## 2.Channel

Channel is the core of the system, it should be allocated properly to ensure all agents can communicate with each other, and coordinate work to rescue effective. When disaster happens, the communication resources are very limited,what we need to do is to get the maximum amount of information with the minimum data transmission.

- Data Compression

Official API use array of byte, the information that we need to transfer is large integer,String or char type.However, byte: between -128 to 127, in order to make full use of channel resources, we use “Data-Compression” algorithm to compress and process data .

- Data redundancy

To avoid the same message is repeatedly transmitted, reducing the efficiency of the channel using, we propose a method to transmit message effective,by making the same message be transmitted only limited times within a certain period of transmitting.

- Channel allocation

Since the channel bandwidth is limited, we put adopt the proposal that assign different bandwidth for different Agent. Fire-brigade is most important in the disaster environment, so we give it a maximum bandwidth and give the rest to policeForce and ambulanceTeam.

- No channel

Some maps have no channel, namely the lack of communication environment. We use a different way to spread the message, which make agents exchange message face to face.For example: When the ambulance-Team found the building on fire, this message will be transmitted in form of speaking. When Fire-brigade received, the message is to stop transmission. (In order to achieve real-time performance and reliability of the message transmission, to avoid outdated information is sending out ,the same message will only transmitted 10 times, more than 10 times ,the messages will be stopped spreading).

### 3.Partition

Our project takes the distributed control scheme, in order to avoid the agents to be a massive cluster, we adopts the stragegy that the whole map divided to make the agents work more reasonably and coordinatngly.

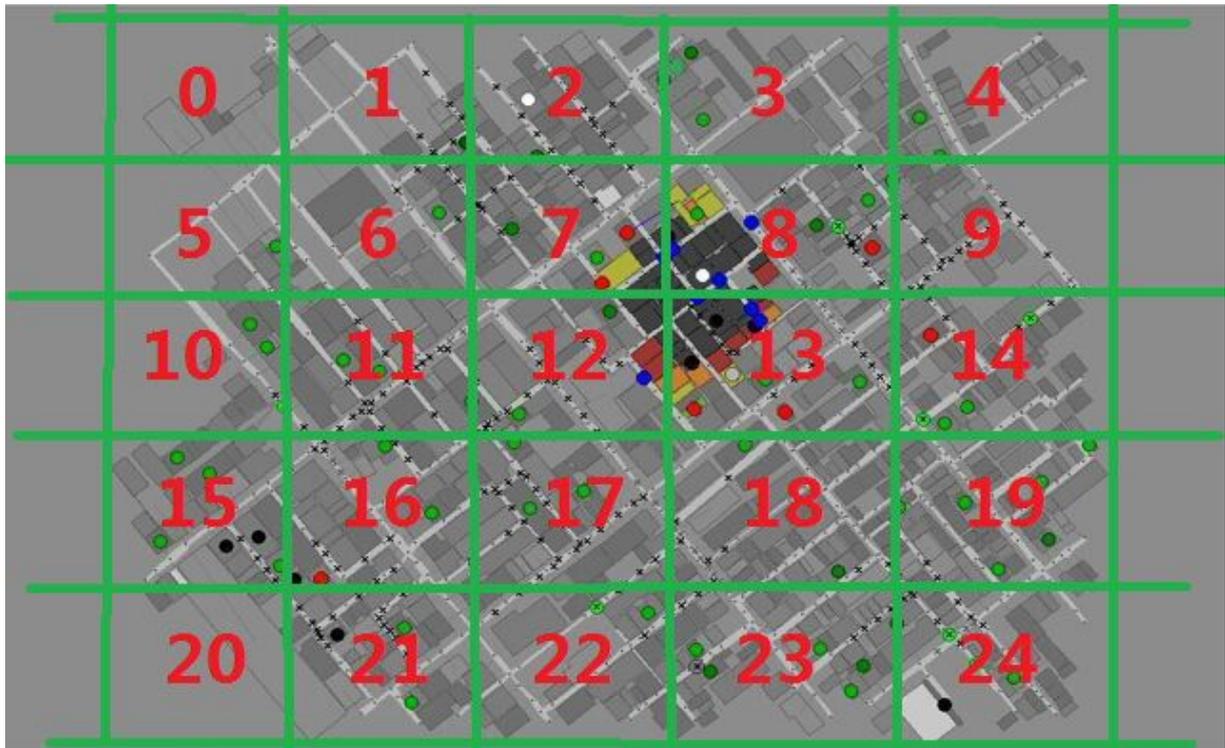
- Initialization

When system initializing, according to the size of the map and number of each Agent, the map is cut according to the form of a rectangular, precisely the map is divided into several small rectangular.

- Dynamic Partitioning

As the game progresses, in the disaster locale, some areas could be completely destroyed, they are divided into dead partition at this time. Meanwhile we should cut these

areas from the effective partition to avoid Agents doing invalid work.



**Fig. 1 Partition**

#### **4.Fire Simulator**

We can predict the places which may be on fire according to observe the change of the temperature,directions of the wind and other elements on the map.To reach the goal of finding the fire on time as well as putting it out quickly,the agent will intensify their patrol on the burning building.

#### **5.Fire Controller**

As soon as finding the building on fire, the agent will deal with it by three steps. First, the agent will send the location information of the burning building to the Fire Controller. Secondly, the Fire Controller will simulate and present the range of the fire. At last, the Fire Controller will provide the reference for how to put out the fire on the basis of the wind-direction and the change of temperature.

#### **6.Fire Brigade**

Fire-brigade's main task is to control the fire behavior, and the aim is to try its best to put the fire out.This contains two strategies.

- How to find the building on fire

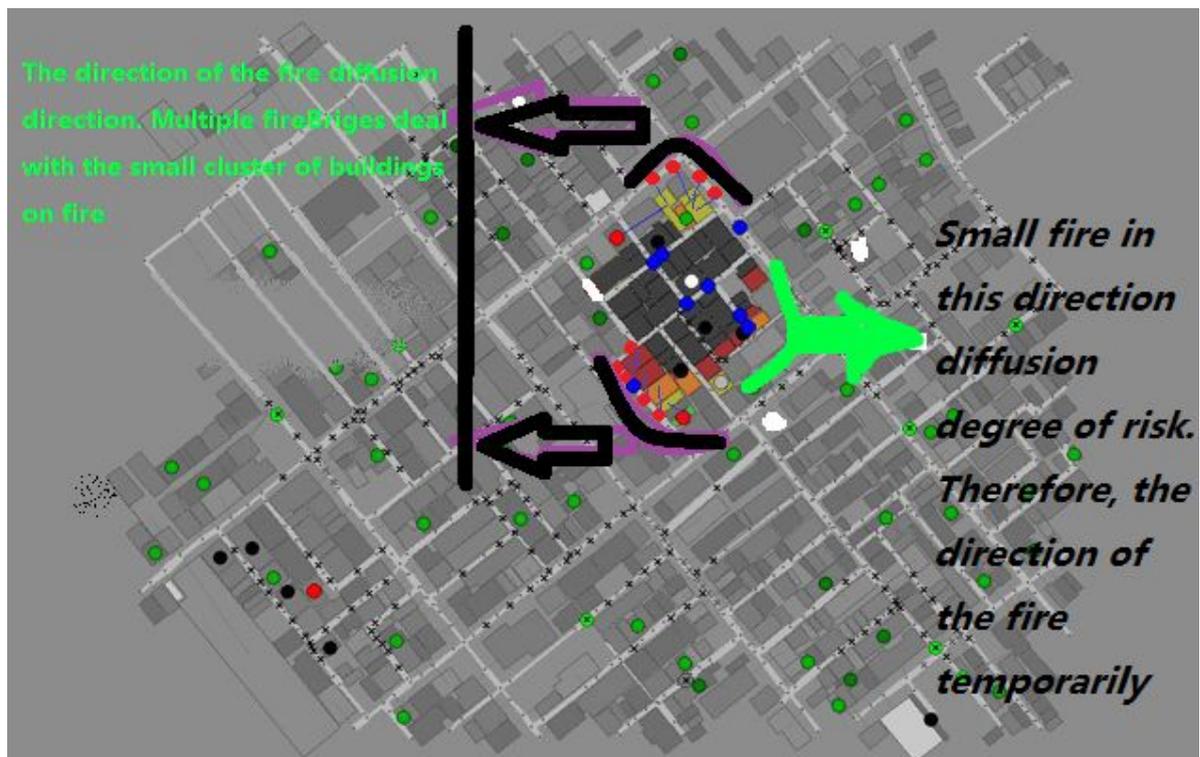
We can find the location of the burning buildings by patrol and the channel information.The

main way of patrol is partitioned patrol, and then we can use the fire simulator's forecast to monitoring some risk areas.

- How to deal with the fire building

Using the fire simulator to analyze where the fire will expand,then let the firemen hurry to the source of the fire,lastly,use the cluster-type method to prevent the fire from spreading further.The meanings of fire brigade's cluster are as follows:

At the appropriate time, the top priority of extinguishing target is that all firefighters put out the minimum the scope of the building on fire,so that a plurality of fire-brigades will be concentrated on the area.



**Fig.2 Cluster**

In order to slow down the fire's spread.if it is found that the fire is out of control,it is needed to use the pre-watering strategy in the area of where the fire spread.

The strategies use to choose add-water place are as follows:

In sim world, fire-brigade can add water in Refuge and Hydrant.In Refuge, fire-brigades could add water fast in the same time, but in Hydrant, only one fire-brigade is permitted to add water in a period, and lower than in Refuge.

The strategy is that fire-brigade could select a place it reach and add water in the shortest period.

## **7.Police Force**

1.The police optimization strategy is to make the police in the middle of the road, use this strategy road block can be cleared fast and clear.

2.The polices clear the road block around ,and move to mission area step by step clear the road block around.If there are road blocks about the polices,the polices must clear the blocks that they trapped by to save themselves.

3. Clear the situation of agent trapped,that is to clear the blocks of buildings where residents get trapped.

4.Generally,shelters own the highest priority, the id of shelters must be added to task list once in a while, that is all the strategy.Police agent still got some parts need to be optimized,that have something to do with the constraint of frame.

### **8.Ambulance Team**

In order to improve the overall efficiency, the core idea of AT is to save more people in the shortest possible time.

#### ●Reduce waste time on the road

In the whole map, only the Refuge is absolutely safe.The civilian will be returned to Refuge after them have been rescued by AT.So the preference strategy for rescue is that AT will save the civilian who are closer Refuge.

#### ●AT(Ambulance Team)modest cluster

During the process of rescue, it could happen that the civilian almost dead after it is rescued by AT.At this time,the rescue operation is failed once the civilian is dead.That will waste so much time of AT's working.So we need to allocate the number of AT properly according to the time of rescue a civilian.

#### ●AT Rescue plan

As the end of game grew nearer, we will concentrate AT's force to refuge civilian from the close to the distance and a number of AT to save a civilian at the same time.To avoid failing in the rescue, we will try our best to rescue more civilian in the last time.

### **9.References**

- 一、 RoboCup TDP ZJUBase 2014.
- 二、 RoboCup rescue website. <http://roborescue.sourceforge.net/>.
- 三、 Huang Zhouong, Guan Daqi, Shi Fabin. SEU\_Jolly 2012 Team Description.