

# A Group Forming and Clustering Approach for Rescue Agents

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**Abstract.** We implemented cooperation model (that the agent get his act together with other agents) and a group forming algorithm for our rescue agents. And we adopted idea that some adjacent burning buildings are recognized a cluster. Therefore, our rescue agents can behave efficiently.

## 1 Introduction

When we develop rescue agents for large scale disaster, there are following problems.

- The difficulty of problems is changing.
- We must solve this problem in short time.
- Some problems occur concurrently.
- A problem which a single agent can't solve occurs.
- The number of agents for solving a problem is not fixed.

In order to solve these problems, our team, NITRescue03, introduce cooperation model(that the agent get his act together with other agents) and a group forming algorithm, and implemented them to fire brigades.

We think of adjacent burning buildings as a "cluster". Our agents can extinguish more building by using this cluster.

Through following sections, we explain the following two points.

1. A cooperative agent approach by using a group forming approach.
2. A clustering approach for burning building.

## 2 A cooperative agent model by using a group forming approach

A flow of agent's behavior is shown in Figure 1. An agent looks for a task, which is to solve a problem (for example extinguishing fire, recovering unavailable roads and so on), with the highest priority. The priority of a task is decided according to the the number of agents which solve the problem and the distance from the agent to the place where the problem is occurred. When the agent recognizes the problem to solve cooperatively, the agent decides to form a group. We call solving such a problem a "cooperative task". The agent forms a group for a cooperative task through the following 4 steps.

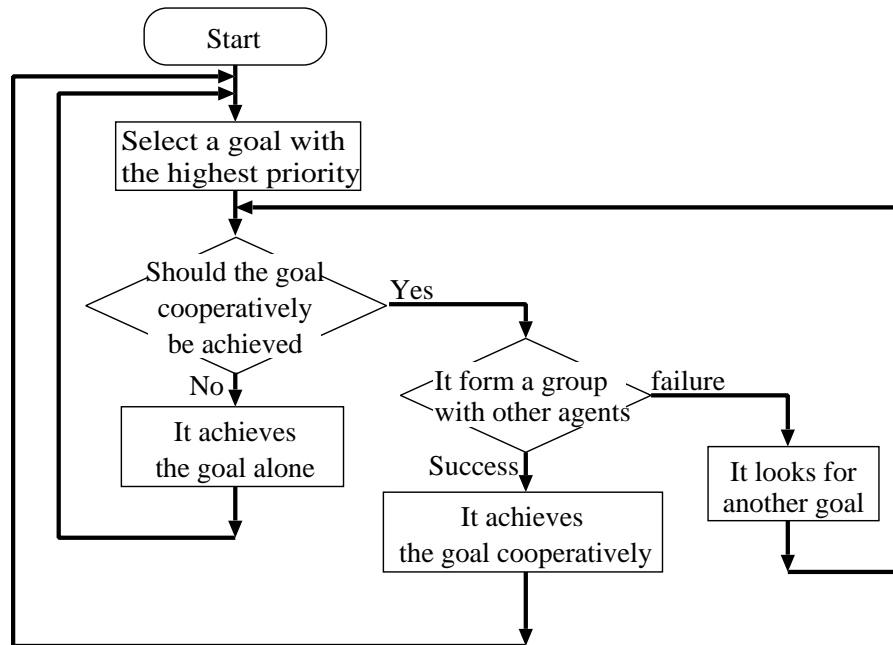


Fig. 1. A flow of agent's behaviors

**Step1.** When the agent recognizes a task as a cooperative task, the agent sends a request message to form a group. This agent is called a "leader agent".

**Step2.** Every agent decides whether they accept the request or not. The agent which accept the request sends an acknowledgment message. This agent is called a "member agent". Each agent has its priority, and our agent avoids conflicts of group forming requests by using the agent's priority. As the result, our agent can select only one leader agent for a cooperative task.

**Step3.** When the leader agent receives the acknowledgment messages, the leader agent decide whether it can solve the problem by cooperating with these members or not. If the leader agent decides that the problem can be solved cooperatively, the leader agent send a group forming message to member agents. If the leader agent decides that it can not, the leader agent sends a failure message.

**Step4.** When the member agents receive the group forming message, they select the task of the leader agent as own task. Then they solve the problem with the leader agent cooperatively.

Agents dissolve the group in the following cases.

- They completed to solve the problem.
- It becomes impossible for agents to solve the problem.

### 3 A Clustering Approach for Burning Buildings

Agents who extinguish fire get the information of each burning buildings. At this time, agents can also aiming at a one burning building. However, this method has weak point like following example.

For example, we suppose that these are two burning buildings joined each other, and we call them "set A". Their adjacent buildings are not burning, and a detached building is burning. At first, agents fight fire to one burning building of set A. Next, agents work to detached burning building before agents fight fire to another building of set A. As a result, fire spread widely in set A. That is to say, agents should extinguish fire to the all part of set A before agents work to other buildings, or there is no effect of extinguishing fire. Therefore, agents must recognize "set A" as a large fire. It is a cluster.

We introduce the concept of cluster for NITRescue03.

### 4 Conclusion

We implemented above concepts for our rescue agents. our agent can behave efficiently by introducing these concepts. It is the future work that we consider the clustering method using learning to do the clustering work, faster.

### References

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