

RoboCup Rescue 2017– Agent Simulation League Team Description Paper MRL (Iran)

Peyman Ardestani, Mahdi Taherian, Parham MohammadAliZadeh, Erfan Jazeb
Nikoo

¹ Mechatronics Research Laboratory, Syntech, Islamic Azad University, Qazvin
branch, Qazvin, Iran
{peyman.ardestani, Mahdi.tn, [prhmma](mailto:prhmma@gmail.com)}@gmail.com

Abstract. in this paper we introduce recent works of QIAU rescue simulation team, MRL, to participate in the international RoboCup contest 2017. Considering new changes in code structures based on agent development framework, ADF, we intend to put our previous works to this new framework. These contributions include parts of the code for police and firefighter agents and changing path planning model. Some of this changes were done in last year's technical challenge and some of them are new.

Keywords: RoboCup, Rescue Simulation, Agent Development Framework

1 Introduction

Last year our team, MRL, awarded first place in rescue agent simulation league, but due to structural changes and obligations to use ADF, we decided to use just some parts our previous codes in new framework to commit in 2017 tournament. These changes are those which used in technical challenge 2016 that includes path planning algorithm and few changes in ambulance agent. This change affects moving ambulance agent and amount of time that it takes the agent to do its works. Other changes are made for 2017 tournament, including road clearing in police forces. Police agent in this new development tries to clear the roads in such way that blockades are not serrated. Most of these changes come from our older codes since 2014 to 2016 and you can see them in [1, 2, 3]. In this paper, first, we discuss ADF and its relating portions that could be altered or developed. Next, we explain clustering that is done the same for all the agents. Then, a brief description of path planning is described. In the last 3 sections, we discuss ambulance agents and police forces respectively.

2 ADF Structure

Last year our team, MRL, awarded first place in rescue agent simulation league, but due to structural changes and obligations to use ADF, we decided to use just some parts our previous codes in new framework to commit in 2017 tournament. These changes are those which used in technical challenge 2016 that includes path planning algorithm and few changes in ambulance agent. This change affects moving ambulance agent and amount of time that it takes the agent to do its works. Other changes are made for 2017 tournament, including road clearing in police forces. Police agent in this new development tries to clear the roads in such way that blockades are not serrated. Most of these changes come from our older codes since 2014 to 2016 and you can see them in [1, 2, 3]. In this paper, first, we discuss ADF and its relating portions that could be altered or developed. Next, we explain clustering that is done the same for all the agents. Then, a brief description of path planning is described. In the last 3 sections, we discuss ambulance agents, police and firefighters respectively.

3 Assignment

In big multi-agent environments, one of the methods for splitting the task is to split the environment into some different separate environments. This can be done through clustering. To do so and allocate agents we use K-means algorithm [5]. This algorithm is implemented in the algorithms section but we have applied some slight changes to its structures to fit our needs. What we do here is based on the number of ready to work ambulances that we are sure are safe and sound.

We try to minimize the rate cost per work all the way to acquire the maximum effectiveness. To get to this purpose we should minimize the sum of costs of the agents this maximizes the remaining time in the simulation. In our implementation “Work” is related to the distance traveled by an agent and is shown as a 2D matrix of agents to the center of clusters. We solve this 2D matrix using Hungarian algorithm [6]. Both methods are implemented in the algorithm sections.

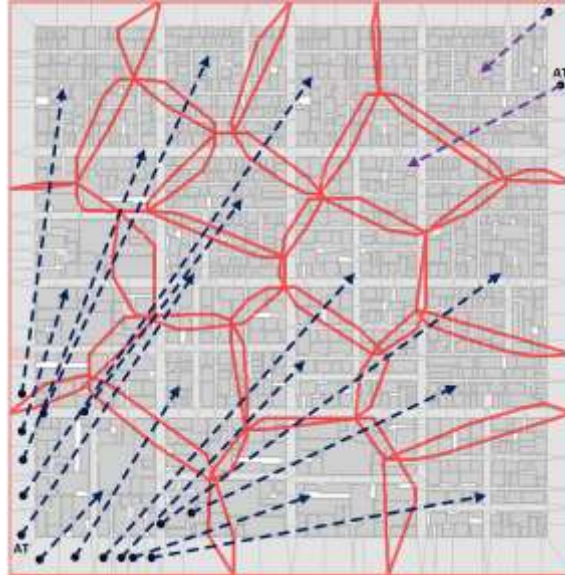


Fig. 1. This figure shows how agents (i.e. ATs) assigned to their clusters.

4 Path Planning

Navigation is one of the most important processes of the agents. With respect to the existence of the blockades, in case the navigation won't work properly it can cause a huge time waste. To avoid this problem, we use algorithms such as A* [7] to find the best path. We have implemented new graph based on area passable edges and available blockades.

Our A* algorithm respects these passable and blocked nodes to finding shortest reachable route, if available.

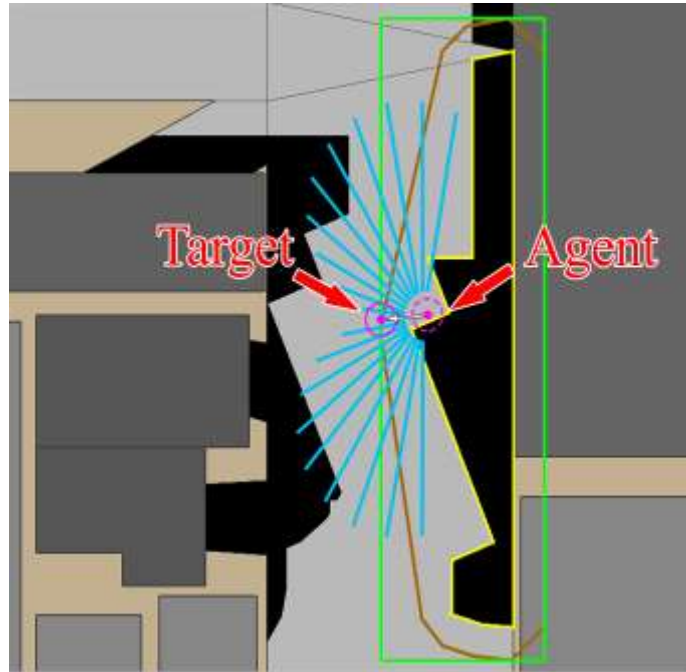


Fig. 2. when an agent stocks in a blockade, it ca get out of the blockade using guide row (the blue ones) which cross blockade outer bound (a resized polygon of the blockade), this method gives us a point and guarantees that this location has no blockade.

5 Ambulance Team

The ambulance team is responsible for rescuing civilians. Choosing which civilian should be rescued at the time, the number of ambulances needed in the operation affects the performance, and the number of civilians rescued. Our strategy to do so is that each agent is dedicated to a cluster in the pre-compute step. Next, if anyone who is injured is in the path generated by path planner, the nearest injured civilian is then passed to the agent as the target. Then after the termination, the target detector can choose between traveling to its cluster and selecting a new target. The performance logic of the ambulance is shown in the following figure.

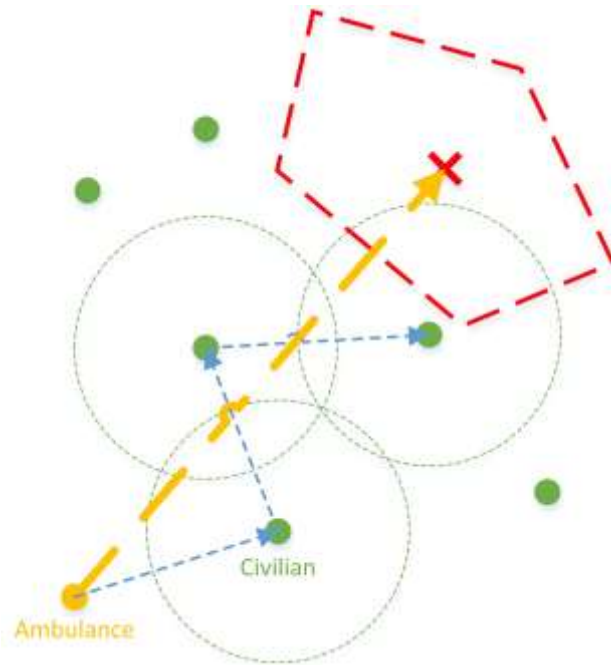


Fig. 3. ambulance team agents use the sticky move method, this way they can move to their clusters and in those ways they can rescue any civilian nearer than the threshold distancePolice Force

6 Police Force

The Clear model presented for the police agent in the ADF, clears any agent in its path. But with respect to the huge cost of fully clearing the path, we decided to change this with a new approach. The new approach indicates that the clearing operation is only done in a direct path. Calculations to make sure that the cleared path is as close as possible to the center of the road and has slight turning degree is done in police command executor section. The path processed in the recent technical reports is described as road guideline and its performance is shown in the following figure.

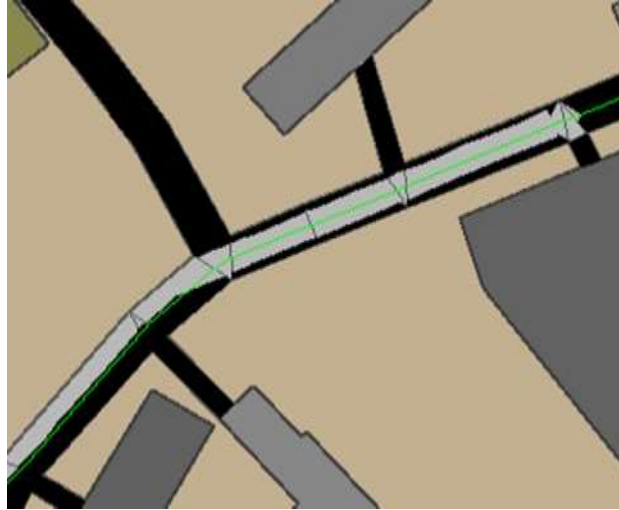


Fig. 4. a guideline help police force agents to clear a road smother and prevent to create jagged blockades in a long straight path

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