

UNIVERSITY OF THE BASQUE COUNTRY

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# Teams strategy for JGOMAS capture-the-flag game

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December 17, 2019

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## 1 Introduction

This report aims to present the methods used to develop a winning strategy for the capture-the-flag game implemented through a multi agent system in the JGOMAS environment. In this game, two teams fight around with two different objectives: the allied team tries to steal the other team's flag, while the axis team focuses on defending the flag they own. For that, three classes or types of agents can be used which can attack with weapons, heal allies and provide supplies (ammo):

- **Soldier:** The agents of this type have the only purpose of being the offensive part of the team. They are equipped with a long range weapon and can attack the enemies to kill them and achieve their purpose.
- **Field ops:** They are both capable of providing ammo for the other agents and also support the team with an extra offensive capacity.
- **Medic:** The supportive role of the team is carried out by them. They provide medic packs that the other agents can take in order to recover health. As the other two types, they are able to shoot the enemies.

In total, four strategies are devised to fulfil the four tasks required to successfully complete the project. In the next sections, the strategies and planning prepared to confront the scenarios adequately will be presented as well as the testing session.

## 2 Friendly fire prevention

The agents shoot exactly straight in front of them, therefore, they sometimes shoot to agents of their own team, which could lead to a potential decease of an agent at the hands of another one of the same team.

As a result, this characteristic has been considered in the behaviour of all the agents and all the associated tasks that we have developed. In particular, we have implemented a strategy that prevents the agents from shooting if there is an ally just in front of them that is not very far.

## 3 Task 1: Allies against default axis

There are seven ally agents in total: three soldiers, two field ops and two medics. The strategy consists in dividing the allies in two teams. The first one, composed of three soldiers, will stroll northeast to enter the base of the axis team from the north entry. The second one, composed of two medics and two field ops, will wait for 57 seconds to give some advantage to the first team. Then, it will proceed to enter the axis team base from the south gate.

When entering into the base, the ally team's members will have an offensive attitude in which they will pursue to kill any of the enemy team's members. There is a priority

when choosing which of the agents should be targeted and followed to kill. Therefore, the allied agents will try to kill first the medic agents to avoid the axis team from recovering wounded units and, after that, they will pursue the enemy agent with the lowest remaining health from the spotted ones. This occurs until no other enemy is spotted, which means that either all are dead or some of them are outside of the field of view of the allied agents.

When one of the allied agents finally arrives and captures the flag, the behaviour of the agents changes abruptly to proceed to withdraw to the base in the shortest span of time as it is possible to achieve. For that purpose, the agents will follow the leader (the one taking the flag from the axis base), who will directly go back to its base, leaving from the south gate in the shortest path possible.

The leader will ignore completely the enemy agents and focus on going back solely to its base. On the contrary, the allies following the leader will detect enemy agents and proceed to eliminate them to prevent the enemies from killing the leader.

## 4 Task 2: Axis against default allies

In order to bring down the enemies efficiently, a special agent of class soldier has been defined. This agent is known as the "commander", which patrols around and informs the other agents about the position of the enemies that it locates. The rest of the agents pay attention to the commander and attack the positions that it specifies. The team composition is of one soldier (the commander), three medics and three field ops.

The commander has a higher recovery threshold given the importance of its position and task to carry out. This means that it will react to HP reduction or ammo consumption earlier than any other among the common agents. Moreover, the patrolling distance when moving from one point to another is reduced for all the axis agents (specially the commander). Therefore, the commander and the other agents have a higher chance of sighting the enemies.

As a mean to increase the efficiency of the agents, they patrol their initial position instead of the flag. With this strategy, the commander and the other agents are capable of pursuing the ally agents twice, since the ally agents will go through the axis base to reach the flag and to go back (the base is in between when entering from the south gate). Thanks to this, the axis team is more likely to take down all the allies, prevent the allies from stealing the flag and, finally, seize victory.

## 5 Task 3: Allies against other team's axis

For this task, all the agents belong to the medic class, whose behaviour has been tweaked to survive as long as possible. In order to do so, the agents automatically release medic packs when their HP goes below the threshold. Moreover, when their HP is low, the maximum priority of the agents is to restore their HP, that is, to go where the medicine has been placed and pick it up. This is done just when they locate a medic pack near them.

The agents are devised to be non-offensive agents, which means that they won't pursue after the axis agents (despite still being capable of shooting). Instead of that, they will accomplish their goals ignoring the enemies and only focusing on the objectives.

The allies are divided in two groups whose specific tasks are geared towards deceiving the axis team in the following manner.

### 5.1 Decoy group

The first group is denominated as "distractors" and their objective is to lure away from the flag the patrolling units of the axis team. It is composed of two medics.

First of all, the agents wait for 37 seconds to let the other allied group move towards the north gate first. Once that time has passed, they enter the enemy base from the south gate. In case their HP goes below a threshold or they get close enough to the flag, they return back to a nearby place to drag the patrolling axis agents out of the path of the other group.

### 5.2 Offensive division group

The second group aims to take advantage of the decoy group's sacrifice in order to steal the flag from the axis team. It is composed of five medics.

Specifically, the agents of this group head towards the north gate to flank the enemy team (which should be following the decoy group deployed in the south gate). Then, they enter the fortress and go for the flag, and once it's taken, they go back to its base with the flag, again leaving from the north gate.

## 6 Task 4: Axis against other team's allies

The entire axis team is formed of field ops agents. In our approach, each of the agents manage their own ammo and save up the time that the communication between them would require. In order to do that, the agents automatically release ammo packs when their ammo goes below the threshold. As a result of that, the axis agents are quick to response to the allies movements and actions, and are seasoned agents on the battlefield.

The agents are devised to have an aggressive behaviour, so they attack whenever they see an enemy. In particular, they attack the enemy agent that has the lowest health among the ones on their field of view. If they run out of ammo, they stop attacking and they return to their patrolling position in order to look for ammo packs.

The axis are divided in two groups whose specific tasks are geared towards killing the agents in the allied team in the following manner.

## 6.1 Sneaky group

The first group is denominated as “sneaky”, and their objective is to flank the enemies and attack them from behind. It is composed of three field ops.

In order to flank the enemies, the patrolling position of the agents has been changed to a hidden corner near the south gate of the fortress, in which the allied agents struggle to detect them when passing through the south gate. When the enemies pass in front of them, the sneaky agents start following the allies in order to kill them from behind without being noticed.

## 6.2 Defending group

The second group aims to patrol the position of the flag in order to detect possible intruders that try to steal it. Just like the other group, they attack and follow the enemies that they spot. It is composed of four field ops.