MultiAgent System Modelling Using JADEX

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Abstract

The agent is something that is capable of sensing its environment through sensors and react to that environment through *effectors*. *Multiagent system* is a system whereby a number of agents perform a number of tasks to achieve common goals. The agents in *multiagent system* can interact with each other either directly *(direct*, through communication and negotiation) or indirectly *(indirect*, interact through their environment). JADEX is an *agent-oriented reasoning engine* to write the relationship between agents using XML and Java programming language. So Jadex can display a simple approach to the relationship between the agent for some tasks. By using JADEX to simulate how agents communicate with each other cooperatively and competitively. In this study simulate an example case of the mining process energy sources. With the results of a comparative analysis of the benefits of work and production expenses. Where there are several agents that cooperate with each other and there is an agent that acts as an *obstacle* (barrier). From the results of this study can be considered for a mining company to simulate those things into consideration when will perform the mining process.

Keywords: agent, *multiagent*, JADEX, Java

1. Introduction

Agent technology has become one of the subject of discussion and research is much talked about in science today. Starting from the use of robotics technology and mimic the functions of the behavior of living things to the modeling of human social interactions in computer simulations.

The agent is something that is capable of sensing its environment through sensors and react to that environment through *effectors* **[1].** Basically, an agent is *autonomous*, since agents operate without

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direct intervention by humans or others and can control the action and the condition itself against its environment. Multiagent system is a system where some agents do a number of tasks to achieve common goals **[2].** Agents in *multi-agent system* can interact with each other either directly *(direct*, through communication and negotiation) or indirectly *(indirect*, interact through their environment).

In this study the development of an agent using a *tool* Jadex. Jadex is an *agent-oriented reasoning engine* to write the relationship between agents using XML and Java programming language. So Jadex can display a simple approach to the relationship between the agent for some tasks. By using *Jadex Control Centre* (JCC) displays all *runtime tools* that can be accessed and used in accordance with their respective functions.

2. Simulation Scenario

In this study we create a scenario simulation *game* about agents Lithium Ore miner. There are some agents that exist in this story, such as *Homebase, Alien, Sentry, Production* and *Carrier.*

In this simulation we analyze the outline of a mining process that requires many resources, among others, who can we describe here in simple form on the stage of the process of looking for sources of ore, producing and transporting the result. It describes a simple simulation of how a process of mining new energy sources *(ore)* which was initially all agents can be simulated for the detection of the source of ore mines, each agent will communicate with one another to report on its search results to the agency Sentry, which in this case This serves to determine the large amount of ore that can be explored and opened the mining points are to be explored further by the production agent.

For agents who have the mining function will start the process of working from a *base camp* or named as a *home base* here. *Sentry* agent, *production*, and the *carrier* will begin its work by the time set by the *home base.* After the allotted time expires, then all the agent will return to *home base.*

Figure 1 shows the process flow diagram of ore mining. We add an agent that is named *Alien*, this agent has a capability similar to the *Sentry*, but its the opposite of the *Sentry*. The purpose of this agency is to describe an obstacle or problems that may occur in the mining process is simple. This agent has the ability to remove the sign *(mark)*, which means the point of the mine can not be explored again.

3. Experiment

After doing this miner agent simulation, we did some experiments by replacing some variables to determine the optimal configuration taking into account several aspects. In this experimental configuration we are doing just the addition of the agent (Table 1), so other factors such as the *obstacle, vision sensor, speed* and capacity *Carrier* everything fixed.

In Table 2 indicated several variables *(speed, vision*, number of agents) that will be simulated in normal conditions. Variable *speed* and *vision* are fixed, while the number of agents will vary. Variable *speed* is a variable speed which is owned by each agent to be able to reach each target operation, this variable will be different for each agent but in this simulation is that it has constant *speed* variable. For the vision variables is assumed as a sensor to detect the target variable mining

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which is well worth the stay. Initial conditions assumed an ore valued at Rp. 5,- the number of existing ore mining in the area totaling 500 units and exploration of the simulation time is 90 seconds. Within 90 seconds of each agent will work each according to its function and will return to *home base*.

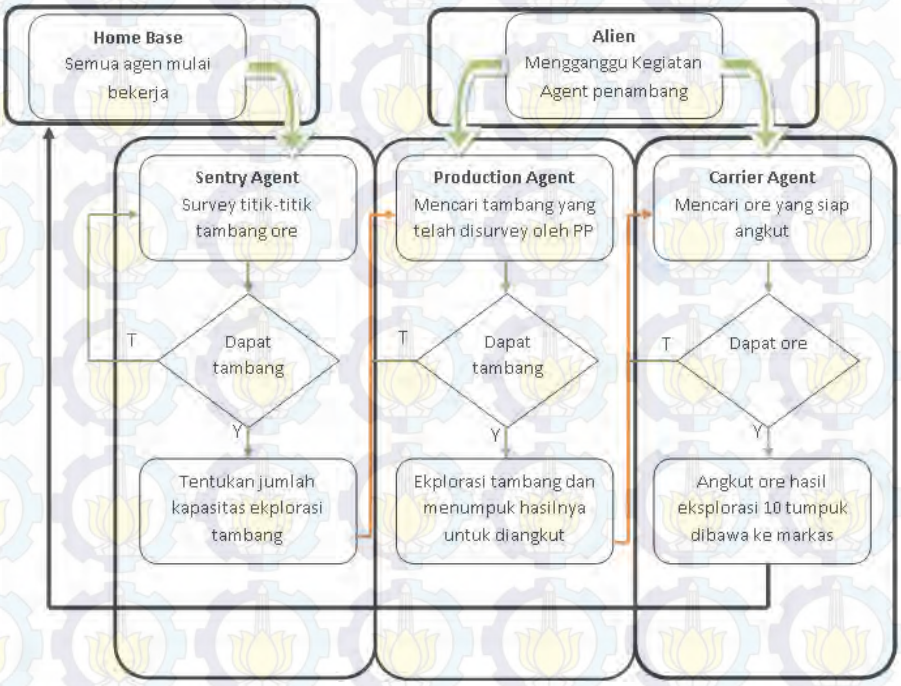

Figure 1. Mining process flow diagram

After determining the variables that are fixed and variable, then obtained a result as shown in Fig. 2.

Table 1 Assumptions Agent per unit

Agent Type	***Speed***	***Vision***	**Price (Rp)**
Sentry	5	0.1	50
Production	10	0:05	35
Carry	15	0:05	15

In this experiment, we conducted additional amount of carrier agent *(carrier)* in each section. We divide the experiments each agent into 3 major parts, where in each section we perform the experiment 10 times and write the result as shown in Figure 2.

It appears that in table 2 with the normal condition of all agents amounted to 1 pc comparison of results obtained between the cost *(cost)* incurred by the amount of ore obtained. Of the total ore are placed at all points of fruit ore amounting to 500 targets, the results obtained from this process, the carrier agent can perform an average of transporting ore are 36.8% or roughly about 184 pieces ore. These results will be compared with our subsequent experiment with the addition of different agents.

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Table 2 Experiment 1 (Normal Condition)

Tipe Agen	*Speed*			Vision			Jumlah Agent		
	A	B	C	A	B	C	A	B	C
Sentry	5	5	5	0.1	0.1	0.1	1	1	1
Production	10	10	10	0.05	0.05	0.05	1	1	1
Carry	15	15	15	0.05	0.05	0.05	1	2	3
Alien (obstacle)	5	5	5	0.05	0.05	0.05	1	1	1

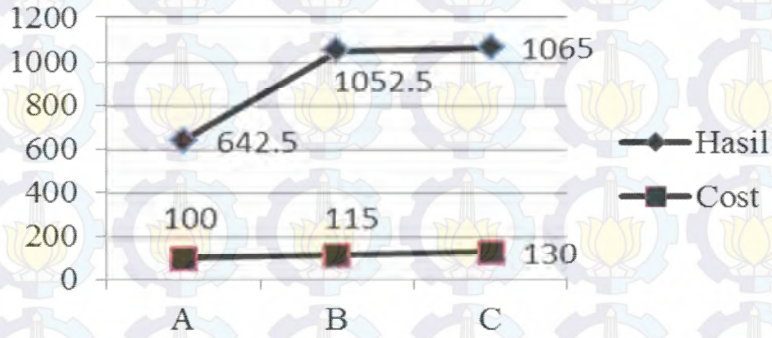

Figure 2: On Production Cost Comparison Graph Results

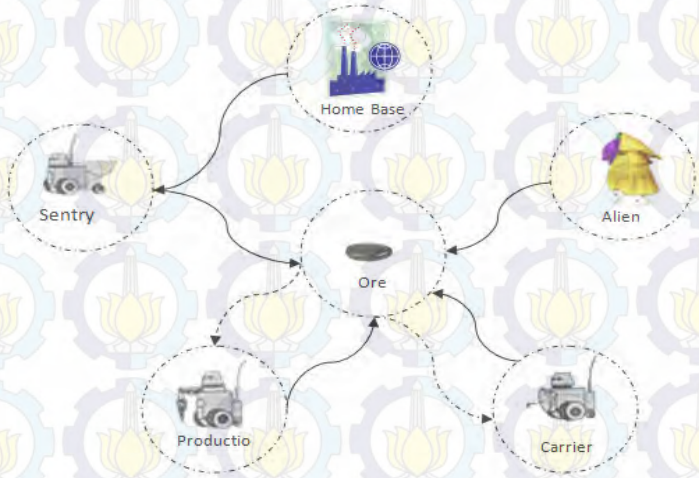

Figure 3: An example of JADEX Simulation Program

4. Conclusion

From the simulation *multiagent systems* we have done in this case take the example of energy mining process simulation can be drawn a conclusion that by adding one of the fleet (agent) miners will lead ore mining products increased, but the increase was also accompanied by an increase in total *cost* of expended by the miners to fulfill the request. Comparison between the total *cost*

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incurred and the amount of ore produced significant is 1:5. With the addition of an alien agent (in character as a barrier, *obstacle)* will result in decrease in the number of mining ore and this has become one of the factors to be considered. However, if the agent is removed will be obtained a very ideal conditions (without obstructions) and almost all sources of ore being mined successfully collected.

Future Work:

This experiment can still be done by making changes in *vision* sensors, *speed* of each agent, communication systems, the addition of *(alien)* as an *obstacle* and a combination of *production* of each agent, *carrier* and *Sentry* to enable maximum results with minimum operational costs down possible.

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