Rescue Agents Practical Handout 1

COURSEWORK DETAILS			
C/W NUMBER	1st	**CONTRIBUTION**	15 % of the module final mark
C/W TITLE	Rescue Agents		
C/W TYPE	Individual Practical		

LEARNING OUTCOMES
Upon completion of this piece of coursework, a student will be able to: ▪ understand in depth the reactive agent architecture, its advantages and disadvantages ▪ design a simple reactive agent to perform a task ▪ build a simple prototype of a reactive agent system on a multi-agent simulation platform (NetLogo) ▪ evaluate the design choices made based on simulation results.

ASSESSMENT CRITERIA	
▪ Correctness, originality and justification of the proposed agent architectures	45%
▪ Implementation and code documentation	30%
▪ Analysis and presentation of experimental results	15%
▪ Presentation of the report (clarity, structure)	10%

DETAILED DESCRIPTION

Rescue Agents

Rescuing civilians in disaster situations is a difficult problem that attracted a lot of attention in the recent years. Intelligent autonomous robotic agents can be a valuable tool in such situations, since they can help to locate and rescue victims of disasters quite efficiently. The rescue procedure is rather simple. A rescue unit locates the civilian (victim) in need. Since in most of the cases, the victim requires immediate attention and help, the *rescue unit* provides oxygen and water to the victims, so that they can be sustained in life until transportation arrives.
Thus the rescue team consists of rescue-unit agents that are autonomous vehicles that can move around the disaster area, locate (detect) any civilians in danger (victims) and temporarily rescue them. A base exists, installed in a central location, that provides refuelling and renewal of medical supplies (oxygen, water, etc) services.
An example disaster area with the agents operating is shown in the figure below (Figure 1).

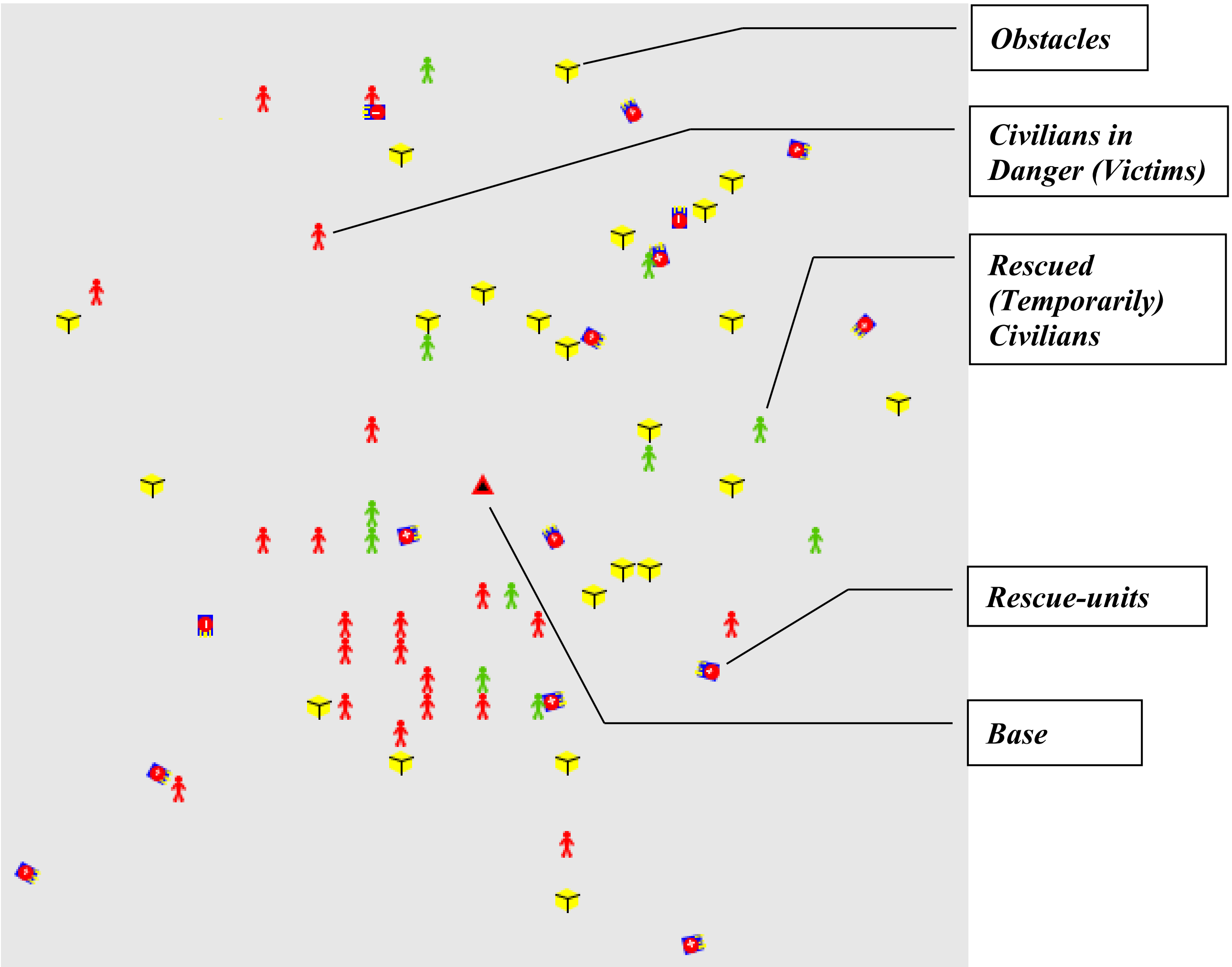

Figure 1: Agents rescuing civilians in a disaster scenario

Rescue units have a very limited set of sensors. The latter includes:

- a sensor for detecting civilians in danger, that operates at a very close range (*detect-civilian NetLogo reporter*)
- a sensor that notifies the agent that another agent or an obstacle is near by (*detect-obstacle NetLogo reporter*). Obviously this sensor is used to avoid collisions.
- a sensor that detects whether the agent is current at the base (*at-base NetLogo reporter*)

- a sensor to detect that the fuel levels are low (*fuel-low NetLogo reporter)*
- a sensor that detects that supplies (oxygen, etc) are finished (*supplies-finished NetLogo reporter)*

Rescue-unit agents:

- Can move on the floor in order search for victims (civilians) (*move-randomly NetLogo procedure*). Each time the agent move it consumes one unit of fuel.
- Can avoid obstacles (*avoid-obstacle NetLogo procedure*)
- Are able to provide immediate attention to victims, (*rescue-civilian NetLogo procedure*). Each time the agent provides assistance, one unit of supplies is consumed.
- Renew supplies and refuel (*load-supplies and refuel NetLogo procedures)*
- Move towards the base if needed (*move-towards-base NetLogo procedure).*This is feasible since the base transmits a signal that the rescue unit agents can follow.

All agents operate in the same environment (disaster area). The resulting system's efficiency is measured in terms of total distance travelled by the rescue agents and time required to complete the task (temporarily save all civilians). Obviously a well designed system should minimise both measures.

Part of the agent system described above has been implemented as a model in the NetLogo platform, (as shown in Figure 1) and the code of the model is provided through the web page of the course. The model includes procedures and reporters that implementing sensors, as well as running the experiment with a varying number of agents. The code provided also positions all agents on the grid.

1) Propose and describe in detail a reactive agent architecture that can be employed to model rescue unit agents, given their limited set of sensors. Justify your answer.

2) Implement the architecture you propose in NetLogo and run a set of experiments to demonstrate the viability of your model, i.e. that it temporarily rescues all victims. Your experiments should include a varying number of agents.

3) Someone could argue that the higher number of rescue-units available the more efficient the system would be, both in terms of total cost and time efficiency. What is your opinion? Support your answer by performing a set of experiments on the given model for a varying number of agents.

4) Propose improvements to the above agent system that could increase its efficiency, bearing in mind that the rescue units can have a limited range of sensors. Your proposals should include both the design (architecture) of the agent, its implementation in NetLogo as well as experimental data that prove its efficiency. Any improvements are acceptable, as long as they follow the reactive architecture. Be imaginative!

5) Discuss the advantages and disadvantages of the reactive agent approach to the specific problem. Briefly describe other "real-world" situations in which the above agent architecture could be used without modifications tasks.

SUBMISSION
Students are expected to submit: ▪ A written report that contains • Appropriate answers to all the questions that appear above. • Descriptions of the experiments carried out and experimental results. • A printout of the code implemented, **highlighting in BOLD** the changes made to the code given. • References ▪ A floppy disc containing the documented NetLogo code. In all cases the results obtained by the submitted code should match those appearing in the report.