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TDT4280 - Exercise 2

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Academic year 2011 - 2012

Chapter 1

Planning

1.1 Theorical Questions

1.1.1 Think of at least three goals and corresponding plans for a robocode agent. Explain these plans, and how might an agent decide what plan to follow.

- **Kill Opponent**
  In a game without team, the main goal of the agent is to destroy the other agents.
  The plan followed by the agent is:

  1. Find opponents
  2. Move towards this opponent
  3. Aim at this opponent
  4. Shoot at this opponent

  Each of these actions can be seen as subgoals of the agent. The agent should follow this goal at all time if it is not part of a team and if there are no other goals more critical at the moment.(e.g. Stay alive)

- **Stay alive**
  Another important goal of the agent is to stay alive. This goal could change the strategy of the agent when its energy is low for example.
  The plan followed by the agent could be:

  – Find opponent
  – Move away from the opponent
  – Shoot from far away only

- **Protect the leader**
  This goal would be followed only in a game involving several teams. In this case, we could imagine that the agents have to protect the leader when its energy is low.
  The plan followed by the agent could be:

  – Move toward the leader
  – Choose a position in order for the team to surround the leader
  – Stop moving
  – Aim and Shoot at the opponents outside the circle formed by your team

1.1.2 Discuss overcommitting (i.e. sticking to a certain plan for too long). When, why and how this problem can be solved?

An agent has commitment to both ends (the state of affairs) and means ("how" the agent will achieve its goal). To avoid overcommitment, an agent must have the possibility to replan if the initial plan goes wrong. However, this is not enough because the agent is still overcommited to its intentions. It never stops to consider if its intentions are appropriate or not. The agent must also have the ability to determine if its intentions have succeeded or are impossible. Finally, the agent must have the ability to reconsider its intentions after executing every action of the plan or after realizing the plan was successfully achieved or was impossible to achieve.

Chapter 2

Communication

2.1 Theorical Questions

2.1.1 Describe in your own words the FIPA agent communication language, and your choice of performatives used in the programming exercise.

The syntax of FIPA ACL is very similar to KQML. It uses a set of 20 performatives which can be divided in different classes:

1. Passing information
2. Requesting information
3. Negotiation
4. Performing actions
5. Error handling

SL (Semantic language) is the language that was used to define the semantic of FIPA ACL. SL is based on the representation of beliefs, desires and uncertain beliefs of agents. The feasibility condition represents the constraint that the sender must satisfy in order to conform to FIPA ACL. These constraints are mappings between the semantic of FIPA and the formulas in SL. There is another important concept which is the rational effect of the action. This can be seen as the purpose of the message but cannot be guaranteed.

Choice of performatives:

1. **Inform:** this performative is used to send messages with the type of the agent as content. This message is sent each time the radar has scanned a bot.
2. **Not-understood:** is used in case the message was not understood and has to be sent again.

2.1.2 Explain why ontologies are useful.

The goal of an ontology is to give a common terminology within a domain between several agents. When the agents have been designed by different programmers or companies, problems of compatibility between agents can arise. If the agents don't agree on certain terms, they cannot collaborate to achieve their goals. For example, the semantic web uses ontology to ensure that

different agents located on the web can interact with each other and provide the best answer possible to each request of the end user. The browser could be the user's agent which will have to negociate with a company's agent to find a trip according to the user's preferences. Another important feature of ontology is that it adds meaning to the information and this allow agents not only to display this information but also to process it in a very efficient way.

Chapter 3

Working Together and Negotiation

3.1 Theorical Questions

3.1.1 Explain the FIPA Contract Net Protocol.

The FIPA Contract Net Protocol is a task-sharing protocol for task allocation.
The contract net includes five stages:

- Recognition
- Announcement
- Bidding
- Awarding
- Expediting

In the first stage, the agent must recognize the problem. Then, it sends messages to the other agents to announce the problem. This is often done via a "call for proposal" to the other agents. The agents that received the announcement and can comply with the condition of the cfp send a bid which is basically the proposal they can offer to the demanding agent. In the awarding phase, the demanding agent has to choose between the different proposals sent by the other agent according to some criterias (e.g. the cheapest). It will send a message to the successful contractor of the call. Eventually, the last phase involves the successful contractor which has to execute the task.

3.1.2 Read the programming task below and describe your agent's strategy for negotiating with other agents.

The strategy is very simple, the master broadcast a message to all agents around it and chooses the cheapest bid available.

3.1.3 Elaborate on the advantages and disadvantages of the different auction types mentioned in chapter 14.2.

- English auction
  - Advantages
    In the English auction, the bidders have information about the market and can adapt their bid in consequence. Bidders will know directly if they have won or not and what was the winning price.
  - Disadvantages
    The problem is that some bidders will raise over their limit in this kind of auction. It is more likely that a bidder will pay much more money in this kind of auction than in a sealed bid auction because the other can react to each bid. Finally, English auction is a slow kind of auction because many bids can take place.
- Dutch auction
  - Advantages
    This type of auction is convenient when it is important to auction goods quickly, since a sale never requires more than one bid. As the English auction, all information about the market is available to bidders. Finally, you pay what you wanted to pay.
  - Disadvantages
    Knowing all information about the market is also a disadvantage because others will know what you bid.
- First-price sealed bid auction
  - Advantages
    As the bid is sealed, noone is able to react to a bid. You just have to bid enough to make sure the good will be yours without having to fear for a crazy bidders going overboard. If you win, you pay the price that you wanted. Another advantage is that nobody will know what your bid was except for the winner sometimes. Therefore other people cannot analyse your strategy and know your limit. Eventually, it is a quick kind of auction because only one bid is allowed.
  - Disadvantages
    In this case, the bidders will probably bid a lower price for the good than their valuation of it since they have no information about the other bidders' bid. However, the bidders cannot start with a low price to see the reaction of the other bidders.
- The Amsterdam auction
  - Advantages
    The seller of the good will get the maximum price for it. In fact, the crowd will increase the bid until only two bidders remain. In the English auction the bidding would stop and the highest bid would win but in this case a Dutch auction start between the two last bidders. This last round will raise the price of the highest bid again making it very profitable for the seller. This auction type also gives advantages to weaker bidders to promote competition.
  - Disadvantages
    On the contrary, this is very disadvantageous for the bidders which will have to pay more than they intended to win the good.

- Vickrey auction
  - Advantages
    People tend to bid what the price that they evaluate for the good if there is enough bidders because the winning bidder does not affect the price they will pay.
  - Disadvantages
    Vickrey auction is vulnerable to bidder collusion. If the bidder evaluate the good together, they can lower its price. It is also vulnerable to shill bidding. A bidder with two accounts can use one to keep the winning position and the other to bid the real price he wants to pay.