AN INTRODUCTION TO ROBOTIC MULTI AGENT SYSTEMS

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ABSTRACT

This paper gives a deeper look at the robotic Multi Agent System. Multi Agent System gained widespread identification in the mid 1990's and it has achieved interests internationally also. Internet has become the main medium for the open distributed systems which has stimulated the growth of agents as a software prototype. Multi agent systems seem to serve as a personification for deducing and constituting an ample range of artificial social systems. The scope of multi agent system is not limited to single domain but it finds applications in many different fields. The work highlights about the agents in M.A.S, the environment which is suitable for their working and the problems that are faced by the agents and how to cure them efficiently.

1. INTRODUCTION

Multi Agent System (M.A.S.) is basically a system which is computerised constituting numerous interacting perceptive agents with in an event. Multi Agent System is more often used to deal with complex problems that are generally difficult for a single agent to solve. Multi Agent System finds applications in engineering and technology. Online trading and disaster response are some of the interesting fields where M.A.S. research delivers positive results.

Agents can be of numerous types like Passive Agents i.e. agents which do not have a set goal, Active Agents i.e. agents with a defined goal and Cognitive Agents i.e. agents which are mainly designed to deal with manipulative and complex problems [1].

Agents work in various environments namely:

1. Virtual Environment
2. Discrete Environment
3. Continuous Environment

Agents in Multi Agent System possess many vital characteristics like they are independent, have local views and finds application in the process of decentralization [2]. Two of the most important capabilities are:

1. They are autonomous i.e. they are free to decide for themselves what course of action they need to follow which in turn will take them further towards there design objectives.

2. Agents are prone to interact with other involving agents in their environment by exchange of the information coordinate with each other and similar kinds of activities.

2. RELATED WORK

Much of the work has been done previously related to multi agent system. Some of the study has been discussed further. Tucker Balch and Ronald C. Arkin in their paper entitled "Communication in reactive multi agent reactive system" have stated that how communication in robotic societies is vital for investigation point of view and has been done through experiments with both simulated and real robots.

Mathijs de Weerdt and Brad Cement in there paper "Introduction to planning in multi agent system" have studied about the problems that are faced by the multi agent systems and what ways must be followed to improve the execution of M.A.S.

Nilanjan Chakraborty and Katia Sycara in there research namely "Reconfiguration algorithms for mobile robotic networks" explored different algorithms to judge the functioning of robots. They worked on two algorithms to be precise i.e. incremental algorithm and centralized algorithm and results for both the algorithms are compared out of which incremental algorithm is founded better than centralized algorithm.

Rajkumar Muthusamy et all in their research entitled "Task Specific Cooperative Grasp Planning for Decentralized Multi-Robot Systems" have developed task specific cooperative grasp planning approaches which advances the present state of art in decentralized manipulation systems by making manipulation quality better.

3. PROBLEMS IN PLANNING MULTI AGENT SYSTEM

Agents have the power of making decisions based on their actions. This allows agents to be further divided into reactive agents who takes decision of next level on the basis of current scenario and planning agents who have the power of predicting future circumstances. This can be explained by an example of traveling from one point A to point B. A reactive agent might use instruments to devise a suitable route while planning agent might take the help from the diagrammatic representation showing rivers, cities and towns [3]. There may be situations where agent may react independently to a circumstance i.e. not sharing any resources or at times they may relate strongly with each other and take decisions unanimously.

To overcome problems related with planning M.A.S. there must be proper coordination , looking deeper into the limitations , studying them in distributed environment, making decisions that are favorable for all the agents interacting in a system, there individual preferences , efficient communication and other information that is required for the proper planning.
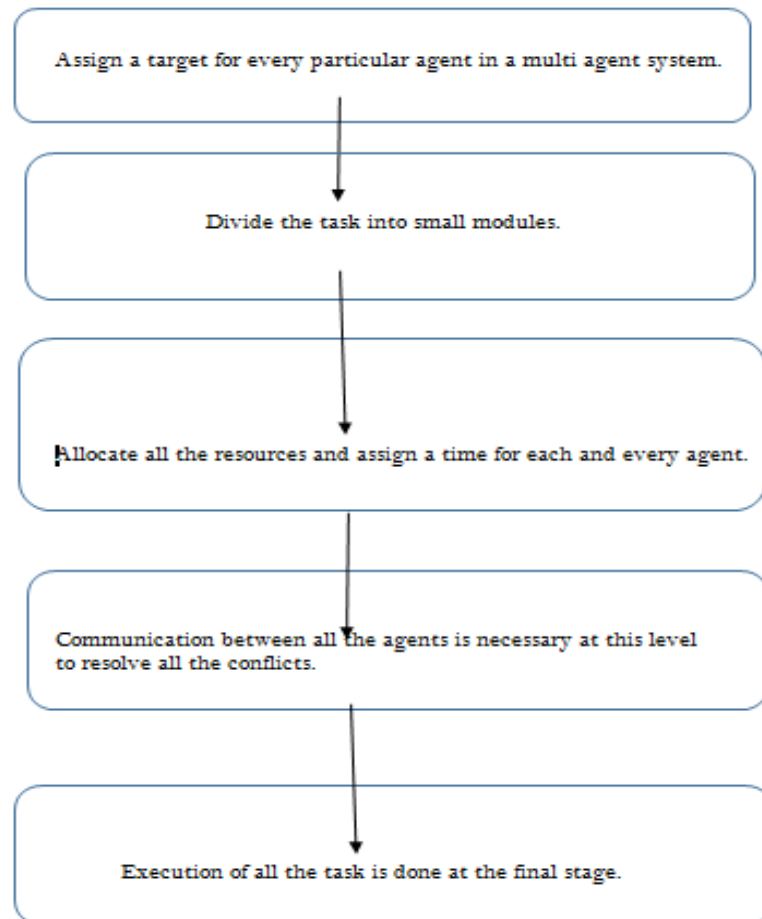
Figure-1. Procedure that can be adopted to solve the problems in planning M.A.S.
Source: Robot Application System-The complete Reference

4. ROBOTIC MULTI AGENT SYSTEMS

In the field of robotic multi agent system, mobile robotic networks having communication characteristics have gained popularity owing to their lurking utilization in operations related with searching ,rescuing and monitoring of environment [4]. Mobile robotic network can also be used in terrestrial exploration. In mobile robotic network it is essential that all the robots stay connected with the network for communication purposes and changing of the positions according to the circumstances.

5. NETWORK CONNECTIVITY IN ROBOTIC MAS

For communication between robots in a network connectivity between team members must be reliable. To complete a task, it is vital for the robots to move in their environment to maintain the probity within the network. To know the routes distributed approach can be followed. Communication variables communicate with the distributed controllers and thus a multi-robot network can be established [5].

6. WIRELESS COMMUNICATION IN MAS

In distributed multi-robot algorithms the role of wireless communication is important which often crashes owing to various factors like environment, signal problem or robots extending beyond wireless devices. Sharing of information is important in various applications and algorithms related with control and estimation. Communication model in a robot can be considered as a graph with nodes and edges where each robot serve as a robot and links necessary for communication serve as edges [1].

The robots main task remains to communicate the changes in individual robots in their behaviour, propinquity and other affecting factors with other peers to obtain a coordinated objective. There are various kinds of approaches that are followed for multi-robotic applications. Decentralized approach is considered to be most suitable for in which manipulations in radio signal strength can be used to locate movements of individual robots [2].

7. DECENTRALIZED APPROACH IN MAS

Grasp planning is one of the recent technique which has gained importance in multi-robotic systems. This technique is generally studied in a centralized environment in which all peer robots are acquainted with the common information about the overall system. Sequential planning is preferred over decentralized planning when related with task specific multi robot grasp as in decentralized approach each robot plans its own actions without any previous information about other robots whereas in sequential approach each agent waits for the previous robot to complete its task and then only it proceeds with its own work.

More specifically, in decentralized multi-robot grasp system (DMRGS) robots are not aware about the incarnation of the other involved robots. They are able to track other robots details only by seeing visually. Many decentralized approaches can be studied further such as Decentralized Independent Approach and Decentralized Average Approach to name a few [6].

8. CONCLUSION

This paper provides the researchers the information about the multi-robot systems and how the agents must work with their peers in a network. This paper highlights that Multi Robotic Systems have gained popularity in robotics due to their increased potential when compared to single robots. It is an initiative for all the beginners to be acquainted about recent topic in Artificial Intelligence which is gaining popularity nowadays.

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