

Useful and Effectiveness of Multi-Agent System

Moe Myint Myint

University of Computer Studies, Hpa-An, Kayin State, Myanmar

How to cite this paper: Moe Myint Myint "Useful and Effectiveness of Multi-Agent System" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-3, April 2019, pp.671-673, URL: <http://www.ijtsrd.com/papers/ijtsrd23036.pdf>



Copyright © 2019 by author(s) and International Journal of Trend in Scientific Research and Development Journal. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<http://creativecommons.org/licenses/by/4.0>)



1. INTRODUCTION

The aim of multi-agent systems is to know how independent processes can be coordinated. An agent is an autonomous computerized entity like a computer program or a robot because it has the capacity to adapt when its environment changes. A multi-agent system is made up of a set of several agents that exist at the same time, share common resources and communicate with each other at different or same time. The key issue in multi-agent systems is to formalize the cooperation between agents. Multi-agent systems can be applied to artificial intelligence. They simplify problem-solving by dividing the necessary knowledge into subunits to which an independent intelligent agent is associated and by coordinating the agents' activity. In this way, we refer to distributed artificial intelligence. Intelligent multi-agent systems can be created by programming languages to develop autonomous agent systems. Consensus problem is to design appropriate control input based on local information that enables all agents to reach an agreement on consistent quantity of interest. There are a lot of consensus with switching topologies were considered, such as asynchronous consensus, time limit consensus, stochastic consensus, group consensus, sampled-date based consensus and so on. This problem is usually termed consensus or synchronization problem. Aim of this paper is to effectiveness role of multi-agents systems, used in information technology field. It is structured as follows. Section 2 introduces reader to the objectives of MAS. Section 3 presents the methodology of MAS. Respectively, section 4 presents proposed system using JADE. Finally, conclusion is presented in section 5.

ABSTRACT

A multi-agent system (MAS or self cooperating system) is a computerized system organized of multiple interacting intelligent agents. The problems that are difficult to solve for an individual agent or a monolithic system can be solved by multi-agent system easily. MAS is a loosely coupled of software agents' network that interact to solve problems that are beyond the individual capacities or knowledge of each software agent. Distributed systems with a group of intelligent agents that communicate with other agents to achieve goals are directed by their masters. MAS group aims to develop new theory and computational models of higher-order social cognition between people and computer systems by producing their abilities to reason about one another automatically. More specifically, multi-agent control systems are fundamental parts of a wide range of safety-critical engineering systems, and are commonly found in aerospace, traffic control, chemical process, power generation and distribution, flexible manufacturing, chemical processes, power generation and distribution, flexible manufacturing, robotic system design and self-assembly structures.

KEYWORDS: Multi-agent system (MAS), Consensus, JADE platform, Continuous time subsystem, discrete time subsystem

2. Objectives

There is a lot of progressing in AI, hardware, and sensor technologies have been achieved by the MAS community, resulting in agent technologies that are applied successfully to real-world industrial problems. There are two consensus problems, one is a leader-follower case and the other is a non-leader case. Many researches are considered to handle consensus between agents consistently. So by using multi-agent systems, certain global agreements can be achieved through sensing, exchange of information using communication, computation and their control. In the cooperative control consensus, agents share their information with each other. This information may lead to achieve common group's goal, relative position information or common control algorithms. Handling consensus problems in MAS is not only to improve synchronizing between agents but also to reach group objectives without time delay.

3. Methodology

The consensus and interactive consistency problems are important aspects. In this study, the consensus problem is addressed. A consensus protocol is a communication rule that specifies the exchange of information within between agents in networks and all its nearby neighbors. If the information exchange among agents allows continuous or the bandwidth of communication is significantly large, then the information state is used to model differential equation. Similarly, if the information exchange data arrive in discrete packets, then difference equation is used to model information state of each agent. The three major areas that

have been covered under consensus network are consensus algorithm, network topology and convergence rate.[1]

Typical multi-agent platforms, frameworks, and simulators developed by different academic and industrial groups are compared. A notable feature of most platforms is the open source and non-proprietary nature that allows free distribution and development. For example, JADE benefits greatly from its pure design using Java, which is cross-platform with respect to the associated Java virtual machine (JVM). Applications developed using JADE can run on multiple operation systems without modification. Therefore, it becomes one of the most widely used platforms for research purpose. Furthermore, programmers usually intend to use tools that support programming languages with which they are familiar and are easy to use, regardless of characteristics of the problem and model. For instance, agent-oriented programming languages are not a preferred option for new developers due to its lower level of abstraction.

4. Proposed System

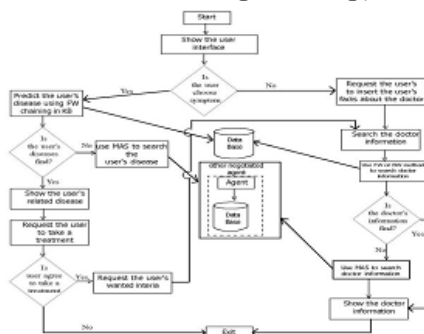
There are three different medical centers located in different areas. Each medical center has its own agent. Each agent has been created in web to pay medical services and doctor information to the end user. Each agent has its own knowledge to decide the user's syndrome. They are negotiated with each other not only when the user's desired doctor doesn't exist in the user's requested agent but also when the syndrome according with the related user's choice symptoms doesn't search in the requested agent. When a user chooses one of the agents, the user can work with its requested agent until to complete its goal.



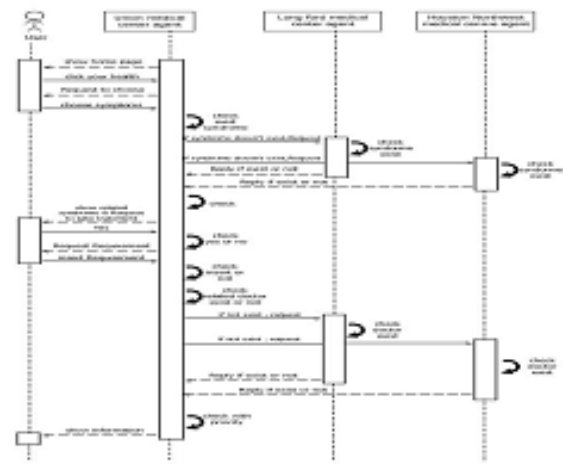
Database design in each agent



Agents' interaction between agents using JADE platform



System Flow Diagram for medical multi-agents system created by JADE



Sequence diagram for agents/user interaction

Firstly, Agent one accepts the user's symptoms. Then agent one predicts the disease using Forward chaining method but the related disease is not find in its database or knowledge repository. Agent one sends the user's symptoms to agent two using EJB and JADE techniques for completing the user's goals. Agent two searches the user's related disease and replies to agent one using EJB and JADE techniques.

When doctor information is not find in agent one, it sends syndrome to agent two to find doctors' information that pay a good treatment in this disease (specialty). Agent two searches doctors' information using backward chaining method in its database or knowledge repository. When agent two finds doctors' information, it sends results to agent one using EJB and JADE techniques.

4.1. System Modeling Base-on Time

In this subsection, the multi-agent system which is composed of a continuous time subsystem

$$x_i(t) = u_i(t), i \in \mathbb{N}, (2)$$

and a Discrete time subsystem

$$x_i(t+1) = x_i(t) + u_i(t), i \in \mathbb{N}, (2)$$

where $x_i \in \mathbb{R}$ and $u_i \in \mathbb{R}$ are the position and control input of agent i , respectively.

The starting condition is $x_i(0) = x_{i0}$. Let $x(0) = [x_{10}, x_{20}, \dots, x_{n0}]^T$.

The network, with fixed undirected graph, fixed directed graph and switching topologies, will consider the consensus problem of switched multi-agent system. So, we can control the consensus problems between agents with linear protocol [2].

5. Conclusion

Agents' using in engineering leads us:

Agents can exit with different names and several actions in many systems. Vice versa, there are agents with the same name but different functions. The existence of an agent in a decentralized system excludes its operation at a centralized architecture. The design stage includes fewer agents than manufacturing stage [3]. This is unpredictable since the design of mechanical parts is not so much automated and also, design data are incomplete, ambiguous and unorganized. A lot of multi-agent systems are characterized by agents' types, since some agents have more profits and

responsibilities in a system. MASs' software development process requires technical support from the selected platform. It is pointed to which documentation and interface are user-friendly. The efficiency of agents can be significantly enhanced if good software development kit (SDK) is provided. Once a MAS is deployed, maintenance becomes a long-term issue concerning the complex environment and geographically widely distributed nodes because of MAS base on cooperation and coordination. Specialized and professional services on maintaining distributed hardware devices, agents' communication control protocol and software components are critical in future.

References

- [1] Muhammad Majid Gulzar 1,* ID , Syed Tahir Hussain Rizvi 2,* ID , Muhammad Yaqoob Javed 3, Umer Munir 1 and Haleema Asif 1, "Multi-Agent Cooperative Control Consensus: A Comparative Review"
- [2] Yuanshi Zheng a, Jingying Ma a, Long Wang b,*, "Consensus of switched multi-agent systems"
- [3] Georgios Andreadis*, Paraskevi Klazogloub, Kyriaki Niotakib, Konstantin-Dionysios Bouzakisa, "Classification and Review of Multi-Agents Systems in the Manufacturing Section"
- [4] R. P. AGAEV1, P. Y. CHEBOTAREV1, "TWO MODELS OF LATENT CONSENSUS IN MULTI-AGENT SYSTEMS"
- [5] Lantao Xing, Changyun Wen, *Fellow, IEEE*, Fanghong Guo, Zhitao Liu, and Hongye Su, "Event-Based Consensus for Linear Multiagent Systems Without Continuous Communication"

