International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)
ISSN: 0976-1353 Volume 26 Issue 5 – AUGUST 2019.

Multi-agent Based on Hospital Selection System

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Abstract—This paper proposes collaborative multi-agent systems for best selection of Hospital information. A multi-agent system framework is discussed to support Patients by using agent. Today, multi-agent system is currently popular in computer science communities. A multi-agent system is a loosely coupled network of problem-solving entities (agents) that work together to find answers to problems that are beyond the individual capabilities or knowledge of each entity (agent). This paper present the best selection of Hospitals information Medical developed countries based on multi-agent system Firstly, the required parameters for the system are accepted and then the hospitals information associated with the desired results are obtained. It includes a master agent also act as an interface agent and the other slave agents. The required information is received by master agent and it then suggests the best and the further suitable hospitals information and optimal agent to user. Consequently, the results depended on incoming information are searched by slave agents and reply the result. This system is constructed based on the multi-agent technology and making for the best used of the user who want to know the hospitals information.

***Index Terms*— Multi-agent, expected utility and Optimal agent**

I. . INTRODUCTION

In educational situation, the autonomy of an agent means the ability to perform independently a task assigned to the agent by a person or other software. Agents promote interaction between a human and computer for the delivery of information, and interaction among human users for high-level achievements. Another advantage of agents in education is that they can provide a learning environment customized to individuals a unified learning environment that integrate between local and remote resources, and a mechanism for users to concentrate on knowledge provided by the agents Agents are capable of flexible (reactive, proactive, social ability) behavior.

Multi-agent system is a relatively new subfield of computer science. This system is composed of multiple interacting agents. Multi-agent is an outgrowth of distributed artificial intelligence community. It is a large scale system which contains a lot of agents with different goal, concept and structure. From the viewpoint of control, Multi-agent System (MAS) architectures can be categorized into centralized, distributed, and hybrid architectures. The centralized multi-agent architectures share many of limitations of master-slave architectures. The distributed architectures are much more complex because of complicated information control. The hybrid architectures combine the advantages of these two types of architectures [1, 3, 5].

Nowadays, there are many people who interested to know abroad in various hospitals information not just because they provide very good treatment but also the opportunities provided by them to explore a selection is notable. Due to the quality of treatment supported by hospitals in different countries, many patients are trying to know and make the best selection in the deceases they are suffered. There are various international hospitals that are now providing opportunities for various patients belong to different countries to treat [7]. The objectives of the present research are: (1) to investigate different algorithms for centralized and distributed decision-making; (2) to take advantage of multi-agent technology for supporting best selection of hospital information.

This paper present the best hospital information searching system based on multi-agent technology and the selection of optimal agent based on expected utility. This paper is organized as follows: section 2 is described classification of agent related with master and slave agent, Interface agent, and etc. Section 3 describes Multiagent system and some agent properties. Function of agent, system design and algorithm are presented in section 4. Finally, we conclude the paper in section 5.

II. . CLASSIFICATION OF AN AGENT

Agent can be classified by the type of the agent, by the technology used to implement the agent, or by the application domain itself. In Figure 1, difference agents are as follows:

(1) collaborative agent have to negotiate in order to reach mutually acceptable agreements on some matters, general characteristics of these agents include autonomy, social ability, responsiveness and proactiveness;
(2) interface agent is a personal assistant who is collaborating with the user in the same work environment;
(3) mobile agent their ability to move around some network;

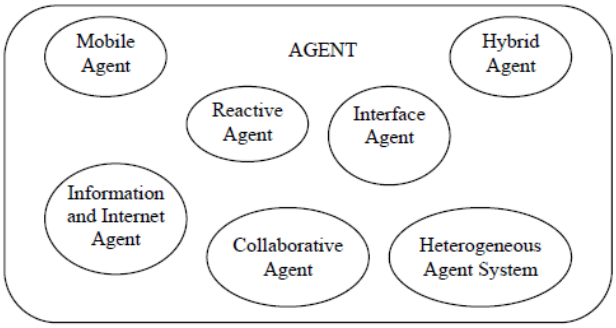

Figure 1 Classification of agents

(4) information and internet agent perform the role of managing, manipulating or collating information from many distributed sources; essentially, they help manage the vast amount of information in wide area networks like the internet;
(5) reactive agent shows a reaction or response to the user, which should not wait to be told what to do next;
(6) hybrid agent refer to those whose constitution is a combination of two or more agent philosophies within a singular agent;
(7) heterogeneous agent system contain one or more hybrid agents which belong to two or more different agent classes [1, 3, 5].

III. Multi-Agent System

A. Interface Agents

Interface agents in Figure 2 emphasise autonomy and learning in order to perform tasks for their owners. Pattie Maes, a key proponent of this class of agents, points out that the key metaphor underlying interfaces agents is that of a personal assistant who is collaborating with the user in the same work environment. Note the subtle emphasis and distinction between collaborating with the user and collaborating with other agents as is the case with collaborative agents. Collaborating with a user may not require an explicit agent communication language as one required when collaborating with other agents [6].

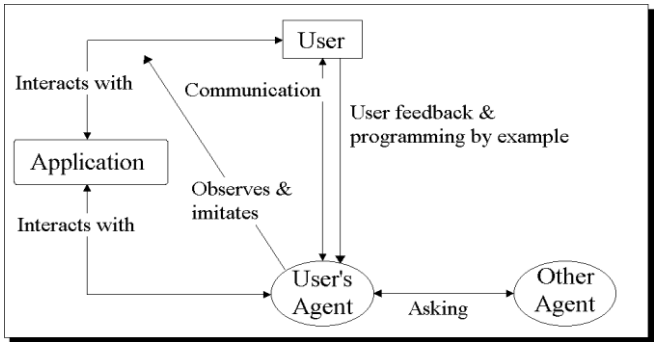

Figure 2 Interface Agents Process

B. Information/Internet Agents

Information agents have come about because of the sheer demand for tools to help us manage the explosive growth of information we are experiencing currently, and which we will continue to experience henceforth. Information agents perform the role of managing, manipulating or collating information from many distributed sources [6].

I. Functionality and Representation of Agent System

The proposed system is the best hospital information selection based on multi-agent technology. This system involves the access to the databases representing the hospital data for medical developed countries. This system includes a master agent also act as an interface agent and slave agents representing the countries.

The action of the master agent is that it can also act as an interface agent. It receives the user inputs and it can distribute the accepted inputs into other slave agents. Master agent also performs the action such as when the results from the slave agents are received, it can suggest the best and the further university information and the optimal agent to user.

The action of the slave agent is that it can accept the distributed request and then it can search the university information from their related database. After searching the information, this information is responded to the master agent.

At this proposed system, agents can interact with each other to accomplish their desired result in the shortest time. As the enhancement of technology in the field of agent, interacting takes the main part to accomplish the tasks rapidly. In the proposed system, a single master agent also acts as interface agent makes the tasks allocation to the slave agents. The master-slave relationship has two types of interaction. Firstly, a single master agent sends the request to slave agents. Secondly, more complicated relation, a master agent sends the request to the slave agents, and then sends again to the lower level slave agents. The slave agents that send again the request become the master agent [3]. The proposed system used simple master-slave interaction.

C. Master agent also act as Interface agent

Master agent also act as interface agent is responsible for interacting with the user for accepting the user request, distribute this request to slave agents and can accept the reply from slave agents. Then, display the best and the other output results and the optimal agent by using the proposed best selection algorithm to user. Figure 3 shows the master agent's operation and communication with other slave agents.

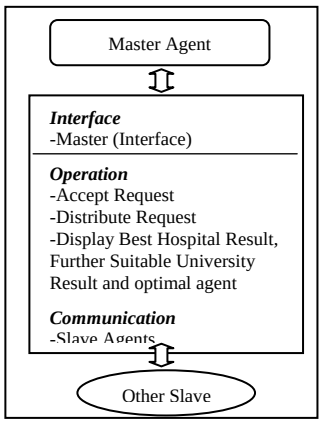

Figure 3 Master Agent

D.Slave Agent

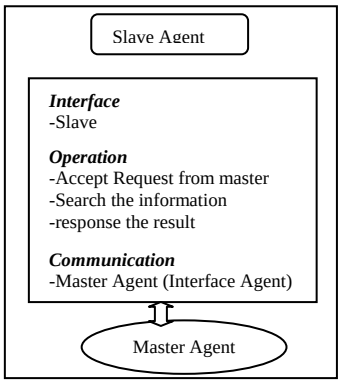

Figure 4 Slave Agent

These agents accept the request distributed from master agent and each of the slave agent searches the hospital information from their associated database according to the requests. After searching the information, each of the slave agents replied the searching results to master agent. Slave agent's operation and the communication to master agent are shown in figure 4.

E. Selecting Optimal Agent

The optimal agent is the agent that making things to achieve their wanting by choosing with maximal expected utility. There are different optimal agents exactly when there are actions with equal expected utility. This agent will maximize its expected utility whatever the current state. The optimal agent Ag_{opt} [4, 8] from agents (AG) is chosen with the maximum expected utility (EU) according to the equation (1). By the selection of optimal agent, the system can get the most appropriate universities information. The expected utility (EU) of the agents [4, 8] is calculated with the equation (2). Where, u(r) is the utility function for run (r), P is the probability of run for the agent (Ag) in the environment (Env). The probability of the agent for successive run is described in equation (3). u (r) is the utility function for description of agent ability can be seeing in equation (4).

$$Ag_{opt} = \arg\max_{Ag \in AG} EU(Ag, Env) \quad (1)$$

$$EU(Ag, Env) = \sum_{r \in R(Ag, Env)} u(r) P(Ag, Env) \quad (2)$$

$$\sum_{r \in R(Ag, Env)} P(r \setminus Ag, Env) = 1 \quad (3)$$

$$u(r) = \frac{\text{no of rows found that satisfied all of the inputs in r}}{\text{no of rows that have to find in r}} \quad (4)$$

Assigning the environment (Env) is described in equation (5). A symbol E is the set of states; $\in_0$ is the starting states of each agent and τ is the state transformer function for the action of each agent α. As this proposed system, includes four inputs such as treatment, disease of subject, level and finance. The probability can get according to the reach state [4, 8].

Environment, $Env = < E, e_0, \tau >$ (5)

Example variable are:

Let w = Treatment, x = Disease, y = Level and z = Finance.
Treatment =checkup, operation, etc.

Disease = Liver, Kidney, Bone, etc.
Level = Ordinary, Important, Normal, etc.
Finance = FOC, expense

F. Algorithm for Master Agent

```
Begin
    Accept Treatment, Disease group, Disease type and Finance;
    Sent data to Slave Agents;
    Receive result hospitals information from Slave Agents;
    If (Treatment, Disease group, Level, Finance from Slaves match user inputs);
        Store the result hospitals information to Temp1 table;
        Display the hospital information from Temp1 table;
     Else If (Treatment, Disease group and Level from Slaves match user inputs but not match Finance)
        Store the result Hospitals information to Temp2 table;
     Else
        Not store to any table;
    End If
    If (user request = "Optimal Agent")
        Calculate the expected utility for the selection of Optimal Agent;
        Display the Optimal Agent and the best universities information of the Optimal Agent;
    End If
    If (user request = "Further Suitable Result")
        Display the hospitals information from Temp2 table;
        If (user request = "Optimal Agent")
            Calculate the expected utility for Optimal Agent;
            Display the hospitals information of the Optimal Agent;
        End If
        If (user request = "Further Suitable Result")
            Display the hospitals information from Temp1 table;
        End If
    End If
End
```

G.Algorithm for Slave Agent

```
Begin
    Accept Treatment, Disease group, Level and Finance from Master Agent;
    If (Treatment or Disease group or Level or Finance matches Master Agent data);
        Store the hospitals information to Temp table;
        Reply Hospitals Information from Temp table to Master Agent;
    End If
End
```

H.Implementation Results

In this system, the user firstly enters the desire Treatment, Disease group, Level and Finance. Then, the master agent also acts as an interface agent distributes the accepted inputs

to slave agents representing each of the countries. All of the slave agents search the result information from their databases and responded the finding results to master agent. Master agent describes the best and further suitable information by using master agent algorithm and calculates the utility and expected utility model. Then, the optimal agent is selected by the optimal agent formulation. By selecting optimal agent can get the more suitable universities that match with the user inputs. Finally, the hospitals information of the optimal agent is display as the result to user.

I. Database Table

The proposed system uses as Country_db, databases and Information_db representing medical developed countries.

Each of the databases of the proposed system uses the following tables:

1. Hospital Table
2. Rank Table
3. Specialist Table
4. Finance Table
5. Information Table

IV. CONCLUSION

People are currently surrounded by technology which tries to increase our quality of life and facilitate our daily activities. However, there are situations where technology is difficult to handle or people are lack of knowledge to use it. Nowadays, there are many people who wanted to know abroad in various hospitals in different countries to make the best treatment in the disease they need into.

By using the proposed system, the user can get the suggested hospitals information in the shortest time. This system is constructed for the hospitals of medical developed countries. The proposed system shows the interaction of master and slave agents in the multi-agent system. This system can search the best suitable hospitals information according to the user preference and based on the selection of optimal agent. This system also provides the concepts of the utility and expected utility model to select the optimal agent.

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