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Selection of Contractor Agent in E-Commerce Based on Cognitive Parameters

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ABSTRACT

Multi agent system (MAS) model has been extensively used in the different tasks of E-Commerce such as customer relation management (CRM), negotiation and brokering. We have our objective in this paper to evaluate contractor agent's various cognitive parameters like capability, trust, and desire for selection of the best contractor agent . The selection of the best contractor agent from ordering queue, it helps for negotiation strategies to find out most profitable proposal by which both contractee and selected contractor can get profit. In this work we have provided a logical cognitive model.

Keywords- Multi-Agent; Negotiation; Desire, Trust, B2B, E-Commerce agents.

I. INTRODUCTION

E-Commerce is the movement of business onto the World Wide Web (WWW). This movement has been broken up into two main sectors: business-to-business (B2B) and business-to-customer (B2C). An agent is a software program that acts flexibly on behalf of its owner to achieve particular objectives [1]. Contractee agent gives instructions to its agent to fulfill his all needs. An agent must be a good listener, analyzer and cooperative in nature; as well as has the quality of good coordination, good communication and negotiation with other agents [2]. Hence the software agent should be autonomous, reactive and proactive. We will describe the application of cognitive parameters based agent selection for negotiation in the purchase domain in a cooperative system. In this domain the buyer agent has a set of seller agent fulfill the buyer agent's requirements and set of seller agent fulfill the buyer agent's requirements through cooperative negotiation mechanism. We will further describe customer orientation based Multi-agent system in negotiation process. The customer orientation is of three type domains: profit centric, customer understanding, and customer relationship for selecting the most profitable buyer agent for potential seller agent. Further we have made a study to determine the rules, importance of the cognitive and business parameters such as preference, commitment, intention, desire, price, payment mode, quantity and quality and address mode etc Our approach focuses on the problem description and the basic definition of different types of agents. In this part, we define "Agent Model" in 2-stages: (1) need identification, (2) brokering (product brokering and merchant brokering). We first describe our models. The major parts of the flow charts that implement the model and result are described also. Finally conclusions of the work are described.

II. PROBLEM DESCRIPTION

The proposed model consists of two stages of CBB (Consumer Buying Behavior) model of B2C E-Commerce

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[3]. These stages are: need identification, contractor selection and negotiation. In this model there are four types of agents with their different functionalities. Contractee Agent (Contractee) is the agent who needs to buy some tasks from another agent. Contractor Agent (Contractor) is the agent who sells tasks to the contractee. Broker Agent (Broker) is the agent who acts as a mediator between contractee and contractor. He identifies the need of the contractee agent and then selects the best contractor agent by evaluating the profile of the various contractor agents and finally negotiates between contractee and contractor agent. Feedback Agent is the agent, who keeps all responses of contractors and contractees which are itself given by contractees and contractors and gives feedback information to broker if contractee is not satisfied the service of contractor, as well as it also warns to contractor and contractee if any problem occurred in between their relationships.

III. PROPOSED APPROACH

Our proposed approach consists of two logical models and an interaction model. The logical models are Cognitive model and negotiation model.

3.1 Cognitive Model

The performance, desire, intention, capability, commitment, trusts contractor agent has been computed on the basis of cognitive computational method**.** Performance, capability, intention, desire, preference, commitment are multiple attribute functions of the tasks that was completed or purchased in best, fair or defective categories.[4]. Each contractor agent can do several types of tasks. In order to accomplish this task, the agent needs to negotiate with another agent about the appropriate time and approach to execute this task, so that the combined utility can be increased. This approach uses two mathematical models for compute the index of negotiation, and utility. The negotiation approach is based on the cooperative negotiation mechanism. The contractee agent first evaluates the index of negotiation value, trust, and intention and other various cognitive function and social states of the various contractor agents and then selects that contractor's bid for negotiation that has better index of negotiation value. The level of trust is determined by the degree of initial success of the agent experience. Cognitive parameters of contractor agents help to select best contractor agent.

The above points are expressed in terms of logical parameters as follows: [5]

a) The performance is calculated on the basis of number of tasks that are completed in best category, numbers of tasks that are completed in fair best category, number of tasks that are completed in defective category by the contractor agent. Hence, the performance of *i*th agent for *j*th tasks is

$$\boldsymbol{P}_i^j \equiv \left\langle \boldsymbol{T}_i^{j,bs}, \boldsymbol{T}_i^{j,fs}, \sim \boldsymbol{T}_i^{j,ds} \right\rangle$$

Where, $\boldsymbol{P}_i^j$ is the performance of *i*th contractor for *j*th task, $\boldsymbol{T}_i^{j,bs}$ is the *j*th type best tasks that was completed by ith agent, $\boldsymbol{T}_i^{j,fs}$ is *j*th type fair tasks that was completed by ith agent, $\boldsymbol{T}_i^{j,ds}$ is the defective tasks that was completed by *i* th agent.

b) The capability is computed on the basis of performance and total number of tasks completed Where, $(Capability)_i$ is the capability of the *i*th agent; the capability shows the how much tasks can be completed handled by a particular contractor agent. Hence, the capability of *i*th agent is:

$$(\boldsymbol{Capability})_i \equiv \left\langle \sum_{j=1}^{n} \boldsymbol{P}_i^j \right\rangle$$

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Where, $(Capability)_i$ is the capability of *i*th agent for performance of *j*th tasks, P_j^i is the performance of *i*th contractor for selection of *j*th task.

c) Desires denote states that agent wish to do the task which is based upon the performance of *i*th agent for *j*th tasks. Hence, desire of *i*th agent is :

$$(Desire)_i \equiv \left\langle \sum_{jp=1} T_i^{jp,bs}, \sum_{jp=1} T_i^{jp,fs}, \sum_{jp=1} T_i^{jp,ds} \right\rangle$$

Where, $(Desire)_i$ is the desire of the *i*th contractor, $T_i^{jp,bs}$ is the number of selected tasks types best completed tasks by *i*th agent, $T_i^{jp,fs}$ is number of selected tasks types fair completed tasks by *i*th agent, $T_i^{jp,ds}$ is the number of selected tasks types defective completed tasks by *i*th agent.

d) The intention computed on the basis of choice (desire) and preference and performance of *i*th agent. Hence, intention of *i*th agent is:

$$(Intention)_i \equiv \left\langle (Desire)_i, \sum_{j=1} P_i^j \right\rangle$$

e) Commitment is computed on the basis of intention and capability of *i*th contractor agent. Hence, Commitment of *i*th agent is:

$$(Commitment)_i \equiv \langle (Intention)_i, (Capability)_i \rangle$$

f) The Trust is computed on the basis of commitment and capability of an agent. Hence,

Trust of *i*th agent for contractee agent is:

$$(Trust)_i \equiv \langle (Commitment)_i, (Capability)_i \rangle$$

3.2 Qualitative composition rules

The composition of qualitative variables L, M, H is based upon the following rules [6]:

- Rule 1: If two variables are equal then the composition amounts to the same either variable level such as L $\oplus$ L=L, M $\oplus$ M=M, H $\oplus$ H=H
- Rule 2: If two qualitative variables are unequal then the composition amounts to the greater level of the variable: $L \oplus M = M, L \oplus H = H, M \oplus H = H$
- Rule 3: If the two qualitative variables differ by two levels then the composition level is the average level between the two levels. Such as H $\oplus$ L=M
- Rule 4: If any negation value of qualitative variables comes then it converts into:

~H = L , ~L = H , ~M = M

IV. IMPLEMENTATION & RESULT

The flow-chart 1 (Fig. 1) is used for computing the Selection of maximum trust contractor agent. According to flow-chart 1, numerical value of trust for five agents fall in L, L, M, H, H. Using these searching technique, broker agent finds that agent name list whose trust value is high. Ag4 and Ag5 has high trust logical value among all given agents. Now, broker agent search out that which agent has highest logical value for all available cognitive parameters, broker finds that Ag5 has all cognitive parameters in high logical range. Thus, Ag5 will be selected for best contractor agent for negotiating with contractee agent.

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In our experiment, output result shows that the agent Ag5 has maximum trust as per Figure. 2. So contractee agent selects agent Ag5 for negotiation.

The experiment has been shown number of communications between contractee and various contractor agents through broker agent and achieves maximum trust for contractor agent Ag5. Ag5 can effectively satisfy the contractee's need (as shown in Figure. 3).

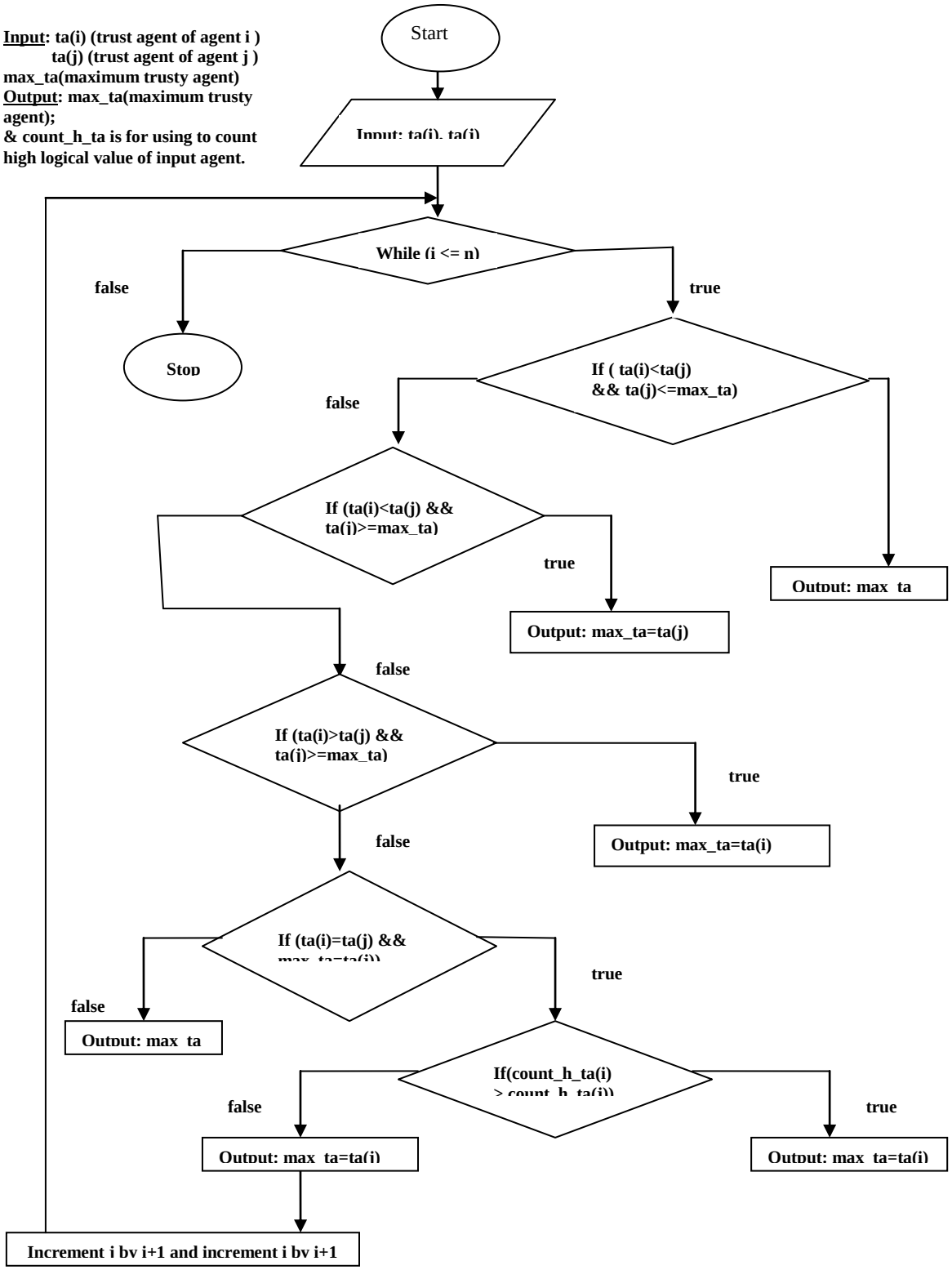

Figure.1. Selection of Maximum Trust Contractor Agent

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NameOfAgent	Performance	Desire	Intention	Capability	Commitment	Trust
Ag1	L	L	L	L	L	L
Ag2	L	L	L	L	L	L
Ag3	M	M	M	M	M	M
Ag4	M	H	H	M	H	H
Ag5	H	H	H	H	H	H

Figure. 2. Output Of Selection Of Maximum Trust Contractor Agent

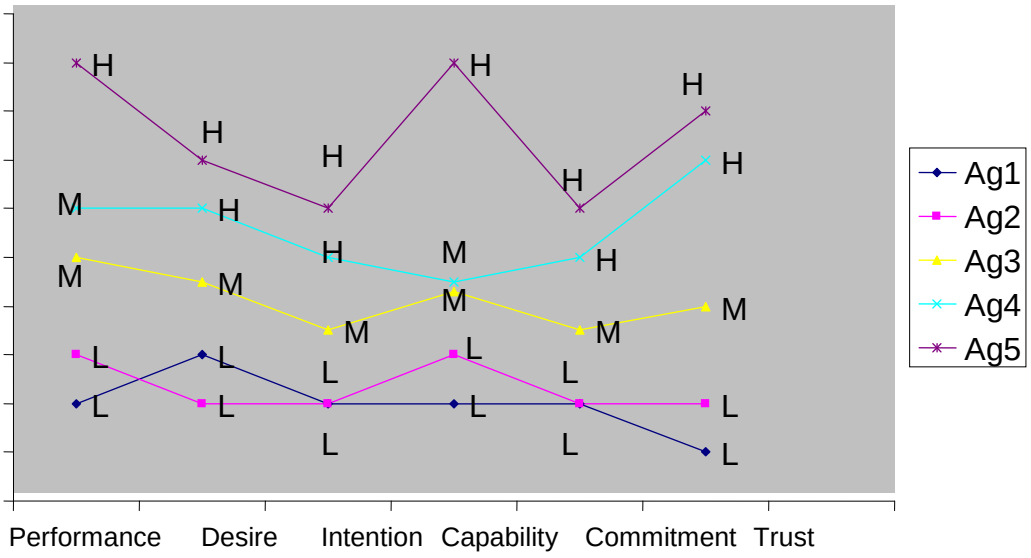

Figure 3. Graph for Selection of Maximum Trust Contractor Agent

V. CONCLUSION

We propose the agent selection for negotiation method in the purchase domain. We first examined a search for the highest trusty contractor agent as a mechanism to find a compromise between the histories of different contractors. This mechanism helps to evaluate a good solution for fulfilling the requirements.

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