

# Home Electricity Decoration By Using The Contract Net Protocol

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## Abstract

*Nowadays, people become interested in home electricity decoration for the modern living. So, people negotiate with agents for the design, quality and cost of the user's want. In this system, the homeowners can find the best contractor to decorate the electricity at a given time, quality and cost availability. The basis of contract net protocol(CNET) is a formal model for making announcing, bidding, awarding decision based on marginal cost calculation. Modern CNET allows for autonomous agents and has the primary benefit that is a global optimum can be ensured.*

## 1. Introduction

Today, the number of electrical decoration group is increasing quickly. The more decoration group, the more different to user to choose one that satisfies the desires.

The emergence of new technology such as multi-agent system can solve above the problem. Multi-agent system is one in which groups of agents communicate, coordinate, and negotiate with each other in order to achieve a particular purpose. In multi-agent system, each agent owns its ability, knowledge, and information for giving the appropriate solution of the

user's problem. One agent may provide a solution to user but it cannot be granted. Thus, agent needs to communicate and negotiate with each other to provide the better solution. In this system, multi-agent technology is used to solve the users' home electrical decoration problem.

In order to provide the best decoration group, the agent communicates and negotiates with each other. In the cases of agent communication and negotiation, Contract Net (CNET) protocol is used. The CNET protocol includes two agents, Manager agent and Contractor agent. Manager takes the user's problem and starts a negotiation process by sending Agent Communication Language (ACL) to one or more contractor agents. Each contractor agent evaluates its capability to respond the received announcement. If so, the agent sends a bid to indicate the proposed task can perform by it. Otherwise, the agent also sends a bid indicating the proposed task cannot perform. Upon

the receiving bids, Manager Agent makes a bid evaluation for choosing the most appropriate bids with the user's needs. Then, the agent sends the award message to the successful bidder and also sends cancel message to the remaining bid senders.

## **2. Literature Review**

The word agent derives from the Latin word for actor, meaning a person who acts on behalf of another. In different languages, the notion of agent is used with different meanings. In English-speaking countries, for example, the word agent is often used in a more general context, whereas in German-speaking countries an agent mostly works for the secret service. Usually, a real estate agent is employed to aid in renting or buying a house, and a travel agent is visited to aid in planning a vacation. In physical science, an agent can be an active substance that causes a reaction. Other sciences also use the term agent. For example, in legal sciences an agent provocateur is a person hired to incite suspected persons to commit some illegal action that will make them liable for punishment.

In the computer science, the term agent has been used since the mid-1970s. It

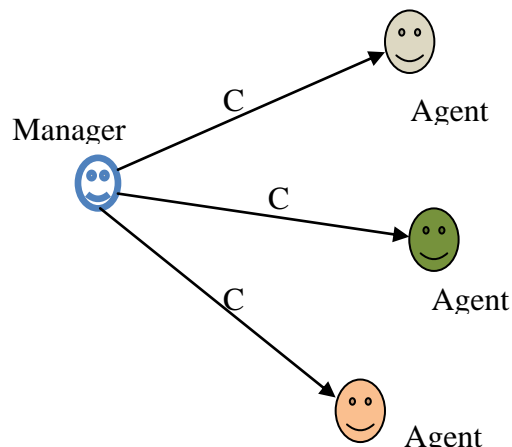
was introduced to the area of artificial intelligence. Nowadays, the term agent has (unfortunately) become a buzzword to signal innovative system characteristics. For example, some electronic mail clients are called mail agents, although they do nothing aside from the usual task of delivering and collecting emails from your mailbox.

## **3. Agent Communication**

This system develops an electrical decoration system based on multi-agent technology. In this system, agents communicate and negotiate each others in order to achieve the user's desires relating with the electrical decoration groups. In the case of negotiation, FIPA contract net interaction protocol is applied. This chapter discusses the process of the interaction between agents in detail.

This system defines two types of agent. One of them is Manager agent who performs two tasks, such as interacting with both user and other agents. Another one is Participant agents which representing the decoration groups. This kind of agent performs the decoration tasks for the user's house. Manager agent communicates with all participants in order to perform the user's request task

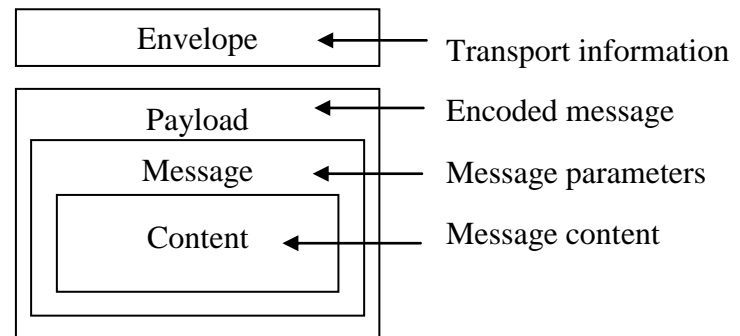
(decoration task). This section describes how the Manager agent starts the negotiation with three participant agents by sending message as a task announcement. In task announcement process, manager agent waits for the user's request. The Manager agent sends CFP messages to the participant agent (Agent1) by giving the user's personal information, such as user name, national registration number, address, contact number, and optional email address, and the rooms' information and decoration style.



**Figure 1(a). Task Announcements between Manager Agent and Participant Agent**

The FIPA Agent Communication Language (FIPA-ACL), like KQML, is based on speech act theory: messages are actions, or communicative acts, as the messages are intended to perform some action by virtue of being sent [11]. The message

format of FIPA-ACL [1] is shown in Figure 3.4.

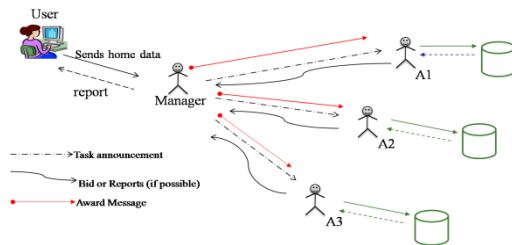


**Figure 1(b). FIPA Message Structure**

A FIPA-ACL message structure contains a set of one or more parameters. Precisely which parameters are needed for effective agent communication will vary according to the situation; the only parameter that is mandatory in all ACL messages is the per formative, although it is expected that most ACL message will also contain sender, receiver and content parameters. The FIPA-ACL message parameters are shown in Table 3.1 without regard to specific encodings. FIPA defines three specific encodings: String (EBNF notation), XML and Bit-Efficient. User-defined message parameters may also be included by preceding the parameter name with the string 'X'.

#### 4. Design and Implementation of the System

This system develops a home electrical decoration system based on multi-agent technology. This system involves one Manager agent and three participant agents. Both agents communicate and negotiate over FIPA Contract Net Interaction Protocol. When the user wants to find the appropriate decoration groups, the user fills up the required information and then sends them to the Manager agent.



**Figure 2. Overview Diagram of the System**

Participant agent works as a decoration group in this system. Participant agent waits for the task announcement message when the agent is created. When the agent receives the message, the agent checks itself whether the agent can perform the announcement task. In other words, the agent checks the maximum job of the current month. If the Participant agent reaches maximum job, the agent sends the bid indicating the agent cannot perform the announcement task now. If not, the agent extracts the information from the message. The agent then searches the appropriate decoration design and cost for each the room in the message using bidding algorithm. After computing and designing, the agent sends the bid which includes the

general decorate information for the user's house, the cost of installation materials, labour charges, total cost, and also includes the discount rate. If the participant agent receives the award message, the agent stores the user's personal information and also records the agreement information such as the agreement date, the detailed decorate information and so on.

This system develops a multi-agent based on home electricity decoration system. This system provides the decorate information for each user's room type and its length. The user can find the user's satisfied decoration group by giving some information. First, the user fills up the user personal information, such as name of the user, national registration number (NRC No), the address of the user's house, the phone number to contact with the user, and optionally e-mail address of the user.

## 5. Limitations and Further Extension

This system only provides the mutual agreement. The rest portions (such as prepaying the charges) of the decoration system are not implemented in this system. This system can only provide the information of the room with fixed length which means that this is not considered on the construction design of the house.

This system is implemented as a standalone application by using J2SE

(Java Standard Edition) and JADE. Thus, this system can be extended as a web application by using J2EE (Java Enterprise Edition) and JADE. In this system, the agents communicate with each other by using FIPA as a communication language. In this portion, instance of FIPA, KQML can be applied. Multi-agent technology can be used to develop the system for other applications such as home decoration and estate agency.

## 6. Conclusions

This system develops electrical decoration system based on multi-agent system. In the multi-agent system, there are two types of agents; manager agent and participant agents in any interaction protocol. In this system, FIPA Contract Net Interaction Protocol is applied in order to communicate and negotiate between manager agent and participant agents (decoration groups). When the user gives the requirements, the manager agent accepts this and sends part of this message to the participant agents. If the participant agents reply bids, the manager agent chooses the best information for the user by using Manhattan distance method. This means that the manager agent acts as a personal assistance in the application

area. So, the users save their time and efforts in order to find the appropriate decoration groups.

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