PERSONAL ASSISTANT: REPRESENTING DIFFERENT INDUSTRIAL DESIGN STAKEHOLDERS BY MULTI-AGENTS

The Case of Company ASUS

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Abstract. To deal with complex communication problems, requires both a web-based collaborative system and a multi-agent system (MAS) integrated with knowledge management architecture. Agents have been acknowledged as a promising approach through the metaphor that an agent can act as a personal assistant. In this paper we proposes an approach to develop personal assistant agents, each of which can represent a different stakeholder and load different domain knowledge inside. To demonstrate our proposed concepts, we focus on a prototype system for notebook design for the company ASUS, a leading notebook manufacturer based in Taiwan.

1. INTRODUCTION

In business and engineering, new product development is the complete process of bringing a new product to market (Wikipedia, 2006). A development project usually involves diverse team members such as sales manager, project manager, industrial designer, and mechanical, electrical, and layout engineers. Different stakeholders require different views of the system, while they also need to be able to communicate with each other using common models and languages (Johannesson and Perjons, 2001). According to Burdman (1999), however, there are 11 factors that cause poor communications, and Lu and Lee (2005) selects 6 factors our of the 11 factors that can be solved by computer supported systems: (1) people have backgrounds in different disciplines; (2) a lack of mutual understanding of terminology; (3) ineffective meetings; (4) proximity; (5) fear; and (6) lack of a good communication structure/system. In addition, the sharing of real-time information and updating information can also pose difficulties.

To deal with such complex communication problems, requires both a web-based collaborative system to communicate and share information immediately, and a multi-agent system (MAS) integrated with knowledge warehouse (KW) architecture to possess different levels of competence at performing a particular task. Agents have been acknowledged as a promising approach through the metaphor that an agent can act as a personal assistant. The agent acquires its competence by learning from the user as well as from agents assisting other users (Pattie, 1994).

In this paper we proposes an approach to develop personal assistant agents, each of which can represent a different stakeholder and load different domain knowledge inside. The personal assistant can help stakeholders to solve their communication problems by representing stakeholder themselves, capturing their experts and taking the proper actions. For our particular system, the objective is to integrate the multi-agents that represent different stakeholders to simulate the communication and collaboration in the real world. To demonstrate our proposed concepts, we focus on a prototype system for notebook design for the company ASUS, a leading notebook manufacturer based in Taiwan.

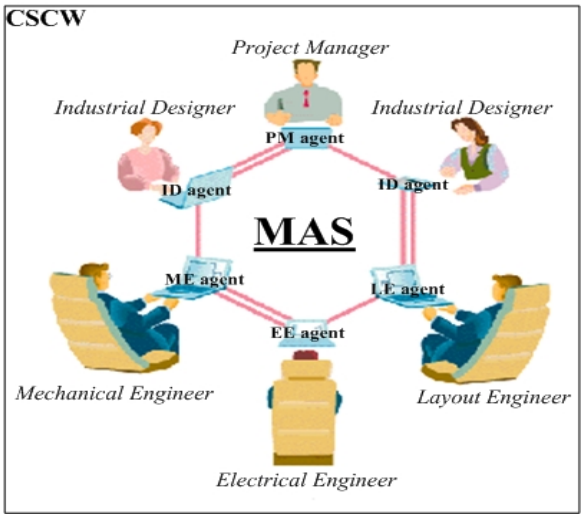

Figure 1 Multi-agents representing different stakeholders

2. BACKGROUND

2.1 KNOWLEDGE MANAGEMENT FOR AGENT KNOWLDEGE BASE

Knowledge management (KM) methods that help to move knowledge include (1) face-to-face communication methods; (2) computer-based communication methods; (3) storage-and-retrieval using computer systems; and (4) knowledge-Based Systems. In addition to the codification of explicit knowledge, some KM authors have proposed methods for categorizing tacit knowledge within the organization. One of the techniques is to create a knowledge map (i.e., a knowledge "Yellow Pages"), which identifies the experts and their field of expertise within the organization. To increase the level of trust in the users of the knowledge map, the inclusion of pictures or videos of the expert has been recommended (Davenport and Prusak, 1998).

Knowledge map is a method designed not only to elicit information complexity that the decision makers faced, but also to combine the probabilities associated with each factor to obtain a final probability (Browne et al., 1997).

2.2 AUTONOMOUS AGENT IN CSCW BASED ON MULTI-AGENT SYSTEMS

A CSCW system based on agent uses a substantiation group of four units' description: agent, goals, knowledge base, and relations. To date, there are several commercial software to develop agents in the market. It supports one platform to loads knowledge-base and displays an animated character that you can interact with through text-based conversation. Content within a knowledgebase rule allows character to open desktop applications, and perform various animations. It also provides editor function is used to create custom knowledge-bases and simply interface allows you to create rules which contain inputs and outputs. Inputs can utilize files to help make scripting a breeze and outputs can contain special tags which can open and run applications, as well as animate it in many ways (Verbot-Wiki, 2006).

3. Methodology

3.1 INTERVIEW WITH ASUS STAFFS AND ESTABLISHMENT THE KW

In this paper we chose one notebook development process within ASUS for which to collect qualitative data by interviewing different stakeholders such as the manger, designer, and engineer (Figure 2). Interviewing not only provided qualitative data for this paper but also demonstrated the way in which the proposed system can operate in the real world.

Stakeholder	Task Description	Expect System Support
SM	1.Analyze marketing information 2.To decide development target 3.To communicate with PM 4.Decision making for marketing section	1.Communication platform 2.Decision making support
PM	1.To decide target with SM 2.To accept design information 3.Make schedule and hold schedule 4.Decision making between into two section 5.To communicate with other department 6.R&D knowledge management	1.Communication platform 2.Schedule arrangement 3.If schedule delay then to figure the time and to arrange new schedule 4.Decision making support 5.To choose development team member
ID	1.To accept development target 2.Survey any image related to target 3.Sketching 2D notebook appearance	1.Image explorer (case-base database) 2.Forward data to ME 3.Communication platform
ME	1.To accept 2D image from ID (include notebook length, wide, depth) 2.To make 3D notebook model 3.To arrange connector 4.To arrange electronic device	1.Combine PRO-E software to make 3D model 2.The system can automatic to match the case and give suggestion 3.Communication platform
EE	1.To accept information from ME 2.To implement electronic component 3.To communicate with ME and LE	1.The system can automatic to match the electronic component 2.Communication platform
LE	1.To accept information from ME and EE 2.To arrange electronic circuitry	1.The system can automatic to match the electronic circuitry case 2.Communication platform

Figure 2 Results of interview

The detailed process flow for notebook development within ASUS can be found in Lee and Liu (2006). On the basis of the information, we have made knowledge map (Figure 3) to represent knowledge of whole stakeholders in ASUS and to support multi-agent knowledge base resource.

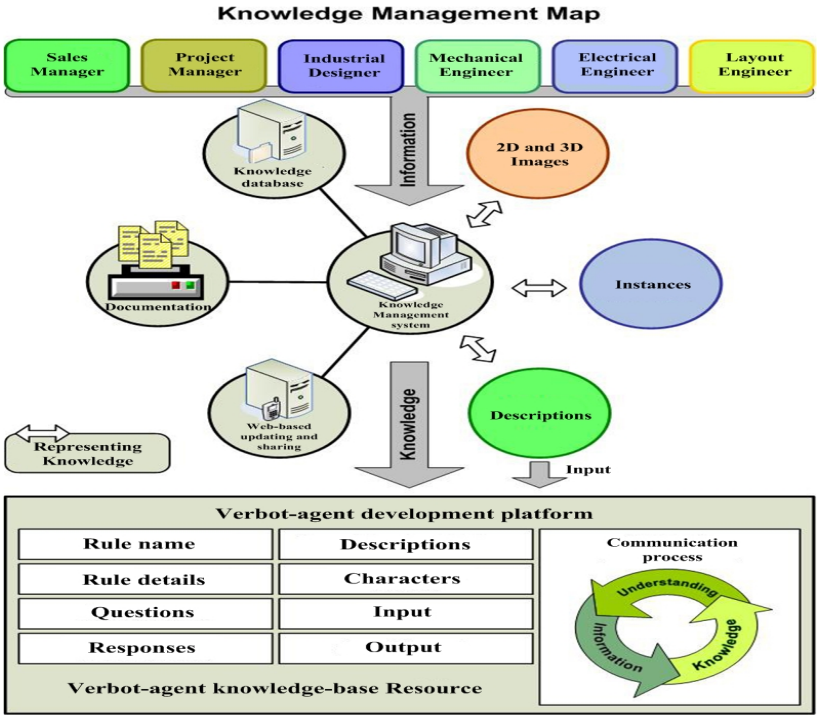

Figure 3 Knowledge Map to connect multi-agent platform

3.2 ESTABLISHMENT OF DIFFERENT AGENTS IN MULTI-AGENT SYSTEM

Using the MAS, the stakeholder can communicate with others or the core system via the collaboration of agents. We defined and established several agents to help with different stakeholders in the MAS framework (Figure 4).

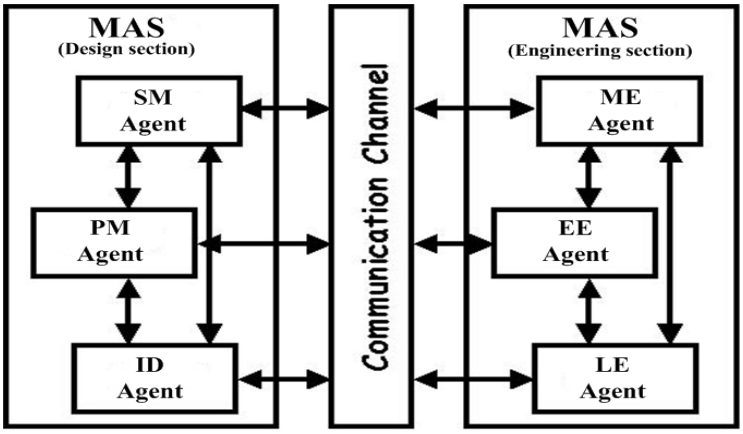

Figure 4 MAS framework

4. Prototype Implementation

The system proposed in this paper uses Jsp as a web-based development language. In agent part we use Verbot-agent (Verbal-Robot), a commercial

software to develop agents. The Verbot is a popular chatterbot program and artificial intelligence (AI) Software Development Kit (SDK) for the Windows platform and for the web (Verbot-Wiki, 2006). We also made a widget for stakeholders to control information updating. The database uses MySql to implement knowledge management platform. Figure 5 shows the architecture of our system.

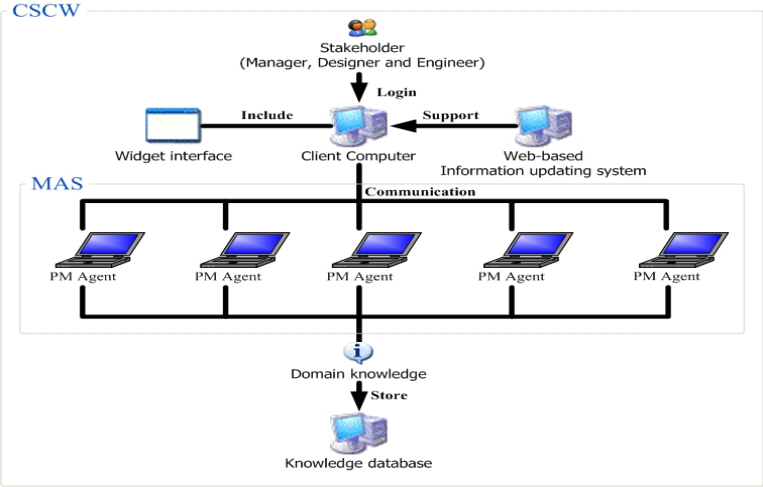

Figure 5 The system framework

When users login to the system, the system will show a customized Verbot-agent and widget interface according to the user's role. Because different stakeholders have different domain knowledge depending on the roles of the each stakeholder, the system only shows information that is important for the individual stakeholder. The example interface for the project manager is shown in Figure 6.

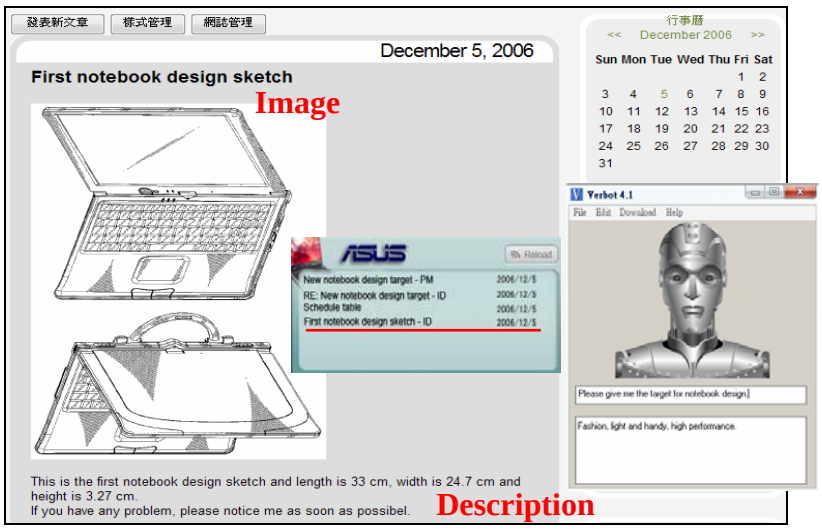

Figure 6 Verbot-agent and widget communication tool interface

The project manager can communication with the Verbot-agent through text-based conversation. The agent will accord to your question and find appropriate responses based on the knowledge base to help make a decision.

Then the project manager can directly connect to web-based information management platform or via widget tool. The information management platform allows different stakeholders to update their current work through image or description. The widget tool can update current news information immediately. It is convenient for stakeholder to control project easily and reduce problem load of the system.

5. Conclusion

In this paper, we developed a multi-agent system to represent different stakeholders. The Verbot-agent system and widget tool can link information updating to platform immediately to support communication and the sharing of knowledge among different stakeholders, as well as provide data for the project manager to analyze, consider, and decide upon over the entire development process. We expect that our proposed concept can solve several communication problems in product development process via improved communication, collaboration and distribution of multiple information sets to each of the stakeholders within the design team.

In the future the system can be extended as follows: the same knowledge using different representation to support varied skill for different stakeholders when they communication; to support for multi-file formats to make communication more convenient and enhance the sharing of information; apply system to the real world and to record users' behavior within the server to acquire considerable data concerning cooperative work; such data is useful for research into collaboration design in academia, business and architectural design; to modify agent's interface as real stakeholders' face let stakeholders feel reality.

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