Multiple Character-Agents Interface: An Information Integration Platform Where Multiple Agents and Human User Collaborate

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ABSTRACT

We propose the Multiple Character-Agents Interface (MCI) as an information integration platform where multiple animated life-like characters interact with each other and with the user to retrieve and integrate information from the Internet. The MCI makes the process open to the user and allows him/her to collaborate with the character-agents. We implemented the MCI as a multi-agent system in which information agents distributed over the Internet are integrated, then we developed a prototype called Venus and Mars, which is a cooperative cooking recipe search engine consisting of three character-agents that collaborate with the user to locate cooking recipe pages.

Categories and Subject Descriptors

H.5.3 [**Information Interfaces and Presentation**]: Group and Organization Interfaces—*collaborative computing, Web-based interaction, character agent*; H.3.3 [**Information Storage and Retrieval**]: Information Search and Retrieval—*search process*

General Terms

Multiple character-agents

Keywords

animated character, interface agent, information agent, information retrieval, information integration

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1. INTRODUCTION

World Wide Web can be viewed as an open information system on the Internet from two viewpoints. Firstly, it is open to information providers. Once an information provider installs and starts a Web server on a computer connected to the Internet, he/she can immediately disseminate information toward the world. On the other hand, it is not easy to retrieve and integrate information from the Web because related information tends to be scattered among a number of sites. Various search engines, information integration systems [2] and information agents [3] have been developed to deal with the problem.

Secondly, the Web is open to information users. The Internet is spreading into our society deeply and it becomes one of social infrastructures which support our daily life. The range of users is spreading from computer experts to novice users such as children or elderly people. At present, Web browsers are a most widely used tool to get access to the Web, but in the future, more user-friendly tools or interfaces, which even novice users can easily handle, are expected. To this end, various life-like character agents [1] have been developed and some character agents such as developed by Extempo have been ready for e-commerce. These agents can chat with the user in natural language such as English or Japanese and help him/her navigate the Web with gestures.

Conventionally, each of the above two approaches has been discussed as an individual research topic. In this paper, we rather integrate these approaches into a single platform called the Multiple Character-agents Interface (MCI) where multiple information agents, each of which has a character interface, interact with each other and the user. On the MCI, the information agents can collaborate with each other for retrieving and integrating information to meet the user's demands and the user also can interact with the agents to improve their behaviors or to change the team of agents in a flexible manner.

2. MULTIPLE CHARACTER-AGENTS INTERFACE

We show the components of the Multiple Character-agents Interface (MCI) in Figure 1. We here presume that an information agent consists of a body part and a header part.

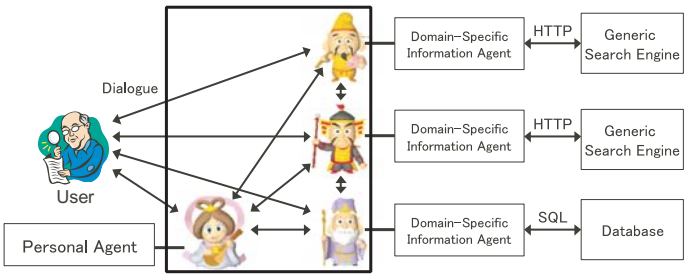

Figure 1: Multiple Character-agents Interface.

The body part of agent resides in an individual server which is distributed over the Internet, and works as an information gathering engine that retrieves domain-specific information by using a search engine or a database. A personal agent in Figure 1 is also regarded as a special-purpose information agent though it resides in the user's machine and handles and stores the user's profile for assisting his/her information retrieval task.

The header part of agent is embodied by using an animated life-like character interface such as the MS-Agent platform. The user can get access to the agent by clicking it and giving a message. The agent can respond to the message by talking with a gesture.

When the user invokes an information agent, the character agent (header part) is loaded into the MCI on a client machine of the user. The character agent can interact not only with the user but also with other character agents which have been loaded on the MCI. Collaborative actions among information agents for retrieving and integrating information are performed by character agents on the MCI and displayed to the user.

The advantages of the MCI are summarized as follows.

- It provides a friendly interface between the user and information sources.
- Agents work in collaboration to assist the user in retrieving and integrating information. By showing the collaborative process of information retrieval and integration to the user, he/she can intuitively understand what happens in the system. Furthermore, he/she can change or modify agents in progress according to the task or his/her preference.
- The user can flexibly build a team of agents for integrating information by choosing his favorite agents.
- Some agents are proactive in a way that they can suggest proper keywords for information retrieval.
- By interacting with the user, some agents can discover his preferences and can use it for assisting his/her future information retrieval tasks.

3. VENUS AND MARS: A COOPERATIVE SEARCH ENGINE FOR COOKING RECIPE

Venus and Mars (VandM) is a cooperative search engine in which three character-agents; Kon-san, Cho-san, and Pekko, work cooperatively to search for cooking recipe pages.

Kon-san is the information agent that locates Web pages about cooking recipe. He can accept a Japanese utterance that include keywords about recipe, such as "I would like to eat a pork dish," as a query. He extracts one or more keywords about recipe ("pork") from the utterance and submits the keyword(s), with keyword spices[4] for the recipe domain, to a general-purpose search engine. He receives search results from the search engine and shows them to the user through the Web browser. In case he receives too many results, he automatically asks for additional keywords about seasoning or type of recipe (Western, Japanese, Chinese, and so on) to reduce the number of results. To the response from the user, he resubmits a query with corresponding keyword spices about seasoning to the search engine.

Cho-san is another type of information agent that has knowledge about cooking ingredients and health in his local database. Responding to an utterance that includes keywords related to cooking ingredients or health, he utters a comment about the relations between cooking ingredients and health, such as "Leeks are good for colds." As an example of collaborations among agents, Cho-san can assists Kon-san. When Kon-san cannot answer the request "I want a recipe that is good for recovering from a cold." because he has no knowledge about health, Cho-san can make a comment "Leeks are good for colds." Kon-san takes the comment as a clue to initiate a new search with the keyword "leek." This type of collaboration shows a potential of VandM for realizing various type of information search by adding agents to the team.

Pekko is the personal agent; she initially appears on the client machine and calls other agents. She then monitors the user's utterances. When needed, she suggests some search keywords on behalf of the user referring to the history of user's utterances. For example, if the user expresses a preference about seasoning when asked by Kon-san, Pekko stores it in her local database and expresses it on behalf of the user at the same situation in the future. As another example of collaborations among agents, Pekko assists Kon-san in reducing the number of search results. When Kon-san asks for a tip on seasoning, Pekko can answer "I know Kitamura-san likes Japanese food." by referring to the interaction history of user. If the user does not like Pekko's suggestion, he/she can correct Pekko's utterance by indicating his/her true preference directly to Kon-san through the dialogue box. Pekko recognizes this correction and updates the user's preferences stored in her local database. Monitoring interactions between agents and the user, Pekko learns the user's preference.

4. REFERENCES

[1] Cassell, J., Sullivan, J., Prevost, S., Churchill, E. (eds.): Embodied Conversational Agents. The MIT Press (2000)

[2] Hearst, M.A.: Information Integration. IEEE Intelligent Systems **13**(5) (1998) 12–24

[3] Klusch, M.: Information Agent Technology for the Internet: A Survey. Journal on Data and Knowledge Engineering, **36**(3) (2001)

[4] Oyama, S., Kokubo, T., Yamada, T., Kitamura, Y., Ishida, T.: Keyword Spices: A New Method for Building Domain-Specific Web Search Engines. In Proceedings 17th International Joint Conference on Artificial Intelligence (2001) 1457–1463