

Personalized Digital Library System using Mobile Multi Agents

Young Im Cho*, Sung Jae Lee**, You Shin Kim**

*Department of Computer Science, Pyongtaek University

**Department of Electronic Engineering, Pusan National University

e-mail : yicho@ptuniv.ac.kr

Tel : 031-659-8342

Abstract

In this paper, we propose a new framework based on negotiatory mobile multi agent system, and implement a mobile multi agent environment based on DECAF(Distributed Environment-Centered Agent Framework) which is one of the distributed agent development toolkit so as to implement a new PDS(Personal Digital Library System). The new framework has some optimality and higher performance in distributed environments.

I. INTRODUCTION

Recent developments of internet and network technologies evoke the technical change of data processing from a conventional centralized and local processing system to the distributed processing one. The researched of this network and various approaches have been studied to efficiently manage mutual operations in such network environments.

Many researchers for efficient work managements using agent systems have been actively carried out in the environment of distributed processing. An agent system has some

characteristics as follows: multi agents in the distributed environments promote efficiency by solving one problem through cooperation, each agent manages it by dividing a common work into number of agents or each agent manages it independently, and then solve the problems by analyzing the results. In addition, it has some advantages that intelligent agents reflecting the tendency of users make no limitation of movement in network and remarkably decrease the network traffic[1].

In this paper, we propose a new framework based on negotiatory mobile multi agent system, and implement a mobile multi agent environment based on DECAF(Distributed Environment-Centered Agent Framework)[2] which is one of the distributed agent development toolkit so as to implement a new PDS(Personal Digital Library System). The new framework is a hybrid system of a mobile and a distributed system so as to have some optimality in distributed environments, and makes it effectively operate by the propose of a new negotiatory algorithm and a new scheduling algorithm. To do that, we analysis the tendency of clients using neural networks by improved client-server system, and make a system have modular parts.

II. MULTI AGENT SYSTEM

2.1 DECAF

DECAF(Distributed Environment Centered Agent Framework) is a framework to design some intelligent agents[2]. DECAF is a kind of operating system including agent communication, planning, scheduling, monitoring, coordination, diagnosis, and learning among agents. DECAF makes a socket program by itself, and presents some building blocks which format the messages and communicate between agents. Therefore, users or programmers can produce agents without having some knowledge about API approaches. Also, users or programmers don't need to make communication codes directly to communicate among agents. DECAF produce a KQML protocol automatically which sends messages and searches other agents and interacts between agents. Figure 1. shows the DECAF structure.

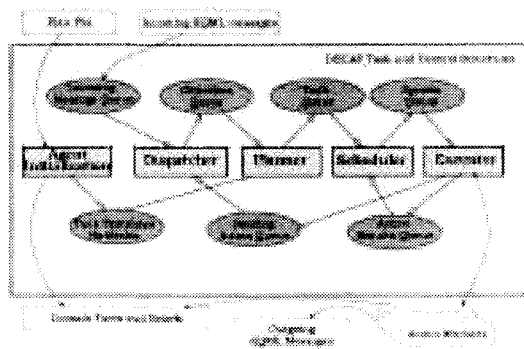


Figure 1. DECAF Structure

Agent systems have been developed using various languages and platforms, and are classified into so many types by purpose.

In DECAF, many agent's tasks are divided by GPGP and TAEMS algorithms.

2.2 Voyager

Voyager is a distributed mobile agent's platform for developing agent's applications, whereas DECAF is a non-mobile agent's platform. Voyager is an interactive framework with Java programming.. Also, Voyager can be activated any Java classes in remote sites, and make use of network bandwidths effectively.

2.3 GPGP

GPGP(Generalized Partial Global Planning) is for improving of PGP which acts as a coordination algorithm of multi agents[3]. The first advantage of GPGP is to reduce the systems overhead which is occurred by interactive overlapping among agents. And the second advantage of GPGP is not to fall into some specific domain areas. Therefore, GPGP can make heterogeneous multi agents system having different functions.

2.4 TAEMS

User's requirements can be decomposed by GPGP, and be structured by TAEMS(Task Analysis Environment Modeling and Simulation)[4]. Figure 2 shows the TAEMS task structure. The root task can be decomposed into subtasks, and the subtasks can be decomposed into methods. The leaf node acts as a method which means actually acted elements.

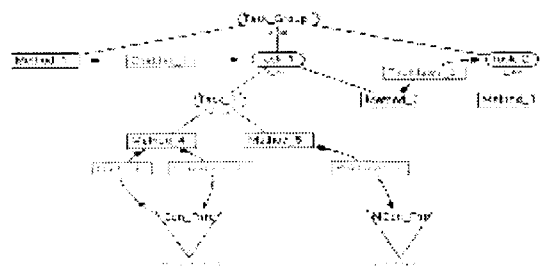


Figure 2. TAEMS Task Structure

2.5 Digital Library

A digital library serves so many information via on-line[5,6]. The advantages of digital libraries are user friendly, on-site service and accessibility. However, in case of not having standardized platform, the search of heterogeneous information from digital library may be hard as well as impossible. If it doesn't have user's information, the unnecessary information may be searched from digital library.

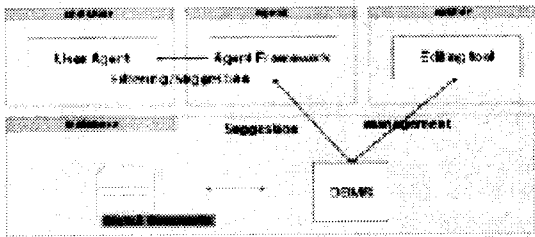


Figure 3. Agent based Digital Library

Figure 3. shows the concept of an agent based digital library which is proposed in this paper. This is based on the proposed mobile multi agent framework so as to search concurrently many servers using multi agents. Also user's profile can be produce into database in this system.

III. NEGOTIATORY MOBILE AGENT BASED PERSONAL DIGITAL LIBRARY SYSTEM

3.1 System Structure

The proposed system is Personalized Digital library System(PDS) based on the proposed multi mobile agents. The system combines mobile system and distributed processing system to make optimization of behaviors in distributed environments. To be a distributed environment, DECAF is used, and to make it activated in a mobile framework, Voyager is used here.

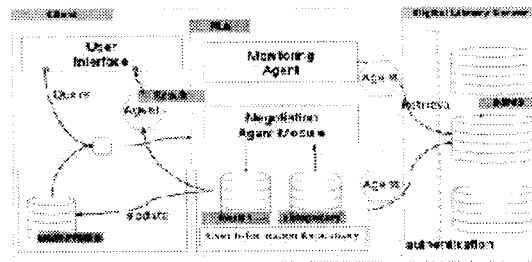


Figure 4. System Structure

The PDS is composed of two parts: client group, server group. The client group is composed of three modules. First, a user interface module let users make use of library as well as control. Second, a user profile control module learns user's preferences by neural network (SOM[7]), and makes database. Third, a PLA(Personal library Agent) module makes multi agents in real time, and searches information from library according to user's profile, and stores the searched results into database.

3.2 PLA(Personal Library Agent)

As shown in Figure 4, PLA has two modules and two databases. The monitoring agent module is composed of Voyager and DECAF, and monitors agent's movements and controls their executions. When the user's requirements are transferred to the PLA, the monitoring agent module checks whether the servers are available or not. After that, it makes some agents, and passes them to the servers. The searched results are saved to a temporary repository. They are filtered by negotiation agents, and the final results are saved to the result repository.

3.3 Construction of User's Profile

The construction of the initial user's profiles is constructed by user's first input information. According to the user's searched results, PDS

endows user's keywords to weight values, and updates user's profile information by SOM (self organizing map) network in real time[7].

User interface is composed of four windows. The user's window is for entering user's information and for recalling user's profiles from databases. The monitoring window is for checking agent's activities. The remote windows is for representing the final results, and finally the local windows is for representing the constructed locally user's computer hard disk information.

IV. SIMULATION RESULTS

We simulated according to the simulation scenario as shown in Figure 5.

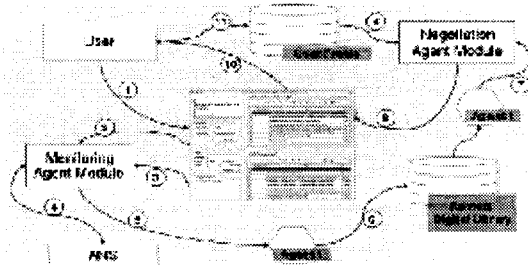


Figure 5. PDS Simulation Scenario

The simulated results are shown in Figure 6: The retrieval times between the proposed PDS and the traditional client/server model. As time passed, PDS is higher retrieval time as well as much safely search than C/S model. As a results, as the number of servers increased, the retrieval time in decreased in PDS.

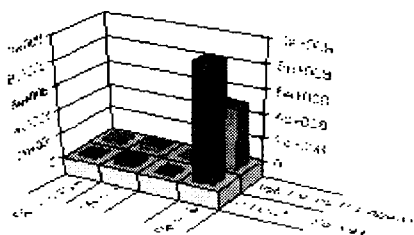


Figure 6. Simulation Results

V. CONCLUSIONS

In this paper, we proposed a Personal Digital Library system. PDS designed based on mobile multi agents using Voyager and DECAF agent framework.

We are simulating of the PDS system, and we can conclude that the performance and user's satisfaction of this system is higher than any other information search systems as of now.

In the future, we have to compensate PDS, and activated in real world.

REFERENCES

- [1] David Chess, Colin Harrison, Aaron Kershenbaum, Mobile Agents: Are They a Good Idea?, 1995
- [2] John R. Graham, Keith S. Decker, Michael Mersic, DECAF - A Flexible Multi Agent System Architecture, Appearing in Autonomous Agents and Multi-Agent Systems. Accepted, to appear, 2003
- [3] Keith S. Decker, Victor R. Lesser Generalizing the partial global algorithm. Intelligent Cooperative Information Systems, 1(2), pp.319~346. 1992
- [4] Keith S. Decker, Task Environment Centered Simulation, 1996
- [5] Sánchez, AGS: Introducing Agents as Services Provided by Digital Libraries, 1997
- [6] Jonas Holmstrom, A framework for Personalized Library Services, October 2002
- [7] Kohonen, Self Organizing Map, 1995