A Collaborative Framework for Multiagent Systems

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ABSTRACT

In this paper, the authors demonstrate the use of software agents to extend the role of humans in a collaborative work process. The extended roles to agents provide a convenient means for humans to delegate mundane tasks to software agents. The framework employs the FIPA ACL communication protocol which implements communication between agents. An interface for each agent implements the communication between humans and agents. Such interface and the subsequent communication performed by agents and between agents contribute to the achievement of shared goals.

Keywords: Agent Communication Language, Collaboration, Collaborative Work, Intelligent Software Agents, Multi-agent Systems

1. INTRODUCTION

In human-centered collaboration, the problem of adhering to deadlines is a major issue. The diversity of tasks imposed on humans poses a major challenge in keeping time to implement scheduled tasks. One way of overcoming this problem is to use time management systems which track deadlines and provide reminders for time-critical tasks. However, such systems do not always provide the needed assistance to perform follow-up tasks in a collaborative process.

In this paper, we demonstrate the development and application of software agents to implement a collaborative work of Examination Paper Preparation and Moderation Process (EPMP) in an academic faculty. We use the Foundation for Intelligent Physical Agents (FIPA) agent communication language (ACL) to implement message exchanges between agents to take over the communication tasks between humans. An interface for each agent implements the communication between a human and his/her corresponding agent. Such interface and the subsequent communication performed by agents and between agents contribute to the achievement of a shared goal, i.e., the completion of examination paper preparation and moderation.

We use the FIPA ACL to demonstrate the usefulness of the agents to take over the timing and execution of communication from humans to achieve the goal. However, the important
tasks, i.e., preparation and moderation tasks are still performed by humans. The agents intelligently urge humans to complete the tasks by the deadline, execute communicative acts to other agents when the tasks are completed and upload and submit documents on behalf of their human counterparts.

This paper reports an extension to our previous work in the same project (Ahmed, Ahmad, & Mohd Yusoff, 2009). Section 2 of this paper briefly dwells on the related work of this research. In Section 3, we present the development of our framework that uses the software agent technology to solve the problems of EPMP. Section 4 discusses the development and simulation of the framework and Section 5 concludes the paper.

2. RELATED WORK


A significant part of our work draws references from the work of Chavez and Maes (1996), and Tsvetovaty et al. (1997). Both groups developed and demonstrated a multi-agent system (MAS) that carry out transactions and tasks on behalf of humans. Their applications focused on virtual markets based on MAS to address the need of autonomous agents to make automated purchasing for their owners. Kasbah (Chavez & Maes, 1996) and MAGMA (Tsvetovaty et al., 1997) are MASs that provide a virtual market for buyer and seller agents to communicate, negotiate, and make a possible deal on their owners’ behalf.

Other researchers attempt to resolve issues in collaboration involving individuals, groups and software agents (Steinfeld, Jang, & Pfaff, 1999; Chen, Wolfe, & McLean, 2000; Chen, Manikonda, & Durfee, 2008). For example, Steinfeld, Jang, and Pfaff (1999) developed TeamSCOPE, which is a collaborative system specifically designed to address problems faced by distributed teams. It is an integrative framework that focuses on facilitation of group members’ awareness of group activities, communications, and resources. Chen, Wolfe, and McLean (2000) presented DIAMS, a system of distributed, collaborative agents to help users access, manage, share and exchange information. Chen, Manikonda, and Durfee (2008) proposed an innovative shared intelligence framework for flexible human-agent collaboration in which the level of collaboration is selected through a negotiated and iterative human-agent collaboration (HAC) process. This ensures that the needs of a system user are balanced with the availability of suitable experts to form and maintain an expert team that supports the user’s decision-making.

Many business processes use workflow systems to exploit their benefits such as automation, coordination, and collaboration between entities. A workflow describes the order of a set of tasks performed by various software and humans to complete a given procedure (Bramley, 2005). Repetitive workflows are often automated, particularly in organisations that handle high volumes of forms or documents according to fixed procedures. Fluerke, Ehrler, and Purvis (2003) described the advantages of their agent-based framework JBees, such as flexibility and ability to dynamically incorporate a new process model. Muehlen and Rosemann (2000) outlined the economic aspects of workflow-based process monitoring and controlling and the current state-of-the-art in monitoring facilities provided by current workflow management systems and existing...
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