Multi-agent Technology as an Enabler of Computer Supported Cooperative Work for the Mobile Workforce

Habin Lee, Patrik Mihailescu, and John Shepherdson

Intelligent Systems Research Centre, BT Group,
B62 MLB1/pp12, Adastral Park, Martlesham, Suffolk, IP5 3RE, UK
{ha.lee,patrik.2.mihailescu,john.shepherdson}@bt.com

Abstract. This paper proposes an agent-based computer supported cooperative work system known as TeamWorker that enables cooperation between mobile workers for the execution of their jobs by providing services via conversational components (C-COMs). C-COMs encapsulate agent interaction protocols, which can be dynamically plugged into participating agents. Furthermore, the intelligence and autonomy of agent technology is applied to overcome the barriers faced in mobile computing environments, such as difficulty in monitoring work progress, device diversity, need for multi-modal human agent interface, etc. Finally, we discuss how TeamWorker has been applied to a real mobile business process in a telecommunications company in the UK.

1 Introduction

There have been many investigations into the IT support required to facilitate cooperation of team members in cooperative information systems [18] area, however, most of these are targeting an office-based workforce. On the other hand, a mobile workforce requires different types of IT support due to the inherent constraints faced within a mobile computing environment such as mobility of workers, device diversity, and unreliable network connections.

Based on the experiences from two field trials in which a multi-agent platform was applied to support a mobile workforce in the UK and Germany [2], this paper addresses three main issues that need to be challenged by information system developers to support the coordination of a mobile workforce. Firstly the reach-ability of each mobile worker should be considered. Typically mobile workers spend the majority of their time either in transit, moving from one location to another, or working in the field. This prevents them from constantly monitoring a device screen (and using the application), as well as preventing the real time tracking of assigned jobs from an administrator’s point. Technologies such as text to speech and speech recognition can enable users to interact with their colleagues in a timely manner.

Secondly the diversity of mobile computing devices should be considered. Mobile computing devices differ significantly from each other in terms of not only their hardware, and operating system functionality but also their physical appearance, and usability properties. This prevents the use of a fixed GUI client for interaction with
the user, as a GUI developed for a PDA cannot be used on a mobile phone, which has a smaller screen, and a limited keypad. Thirdly the flexibility to adopt new coordination services should be considered. Typically once an information system is rolled out, additional services may need to be deployed, including enhancements to existing services. Some of these services may only be applicable for specific types of mobile computing devices and users that satisfy certain preconditions. Therefore the provision of services should be on demand, considering both the computing environment at the time of installation, and the user role.

This paper proposes TeamWorker as a Computer Supported Cooperative Work (CSCW) system based on multi-agent technology to support the coordination of mobile workers. In TeamWorker, an intelligent agent supports each mobile worker for the cooperative execution of assigned works. The requirements identified above can best be supported by MAS technology due to the following aspects. Firstly, MAS technology provides well defined interaction protocols (or conversation policies) that are essential for the implementation of location-based coordination of remotely distributed workers. Secondly, the intelligence of a software agent can be applied to capture the progress of a mobile task by monitoring the actions and location changes of a worker. For this purpose, the internal architecture of a software agent can be applied to capture the belief, desire, and intention of a human worker. Thirdly the autonomy of an agent can be applied to increase the usability for mobile workers who have difficulties in making real time responses due to their frequent movements, and working with field equipment. Furthermore, an agent can autonomously configure GUI components or services for a user considering the constraints imposed by a specific mobile device.

This paper is organized as follows. Section 2 reviews related work and section 3 details the main features of TeamWorker. In section 4 TeamWorker is applied to a real mobile business process, and finally, section 5 summarizes and concludes this paper.

2 Related Works

CSCW [12] has been considered as one of the key technologies to implement a virtual workspace that enables distributed team-members to work together, regardless of location and time differences.

Reviewing the current CSCW systems, they can be characterised by the use of network infrastructure to facilitate the communication, collaboration, and coordination of team members. Examples of CSCW include an electronic meeting system [16], a group decision support system [21], a workflow management system [11] and so on. Most of these technologies are based on the assumption of a reliable network connection for the transmission of high volumes of multi-media data, which limits their application to in-office work.

Handheld CSCW [20] or mobile CSCW [22] extends the application area from in-office work to mobile work. Domingos et. al. [6] propose a mobile CSCW system to support mobile cooperative work from the workflow management system’s