Chapter XII
A Multi-Agent System Approach to Mobile Negotiation Support Mechanism by Integrating Case-Based Reasoning and Fuzzy Cognitive Map

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ABSTRACT

This chapter proposes a new type of multi-agent mobile negotiation support system named MAM-NSS in which both buyers and sellers are seeking the best deal given limited resources. Mobile commerce, or m-commerce, is now on the verge of explosion in many countries, triggering the need to develop more effective decision support systems capable of suggesting timely and relevant action strategies for both buyers and sellers. To fulfill a research purpose like this, two artificial intelligence (AI) methods such as CBR (case-based reasoning) and FCM (fuzzy cognitive map) are integrated and named MAM-NSS. The primary advantage of the proposed approach is that those decision makers involved in m-commerce regardless of buyers and sellers can benefit from the negotiation support functions that are derived from referring to past instances via CBR and investigating inter-related factors simultaneously through FCM. To prove the validity of the proposed approach, a hypothetical m-commerce problem is developed in which theaters (sellers) seek to maximize profit by selling their vacant seats to potential customers (buyers) walking around within reasonable distance. For experimental design and implementation, a multi-agent environment Netlogo is adopted. A simulation reveals that the proposed MAM-NSS could produce more robust and promising results that fit the characteristics of m-commerce.

INTRODUCTION

The modern mobile computing world is characterized by one of both ubiquitous connectivity and ubiquitous computational resources (Edwards, Newman, Sedivy, & Smith, 2004). Recent popular forms of mobile computing encompass omnipresent short-range communications (including both infrastructure-based technologies such as WiFi and peer-to-peer technologies such as Bluetooth), and also omnipresent long-range communications (such as cellular telephony networks). This maturing mobile environment justifies conservative estimates based on the 2000 Census report suggesting that by 2006 10% of U.S. workers will be completely mobile, with no permanent office location (Lucas, 2001). This trend will be fueling development of new mobile applications as advances in mobile technology increase coverage, data speeds, and usability (Barbash, 2001; Crowley, Coutaz, & Bérard, 2000; Parusha & Yuviler-Gavishb, 2004; Pham, Schneider, & Goose, 2000; Turisco, 2000).

In this sense, it is no wonder that **mobile commerce** (or **m-commerce**) replaces traditional forms of electronic commerce rapidly. Various types of m-commerce services include mobile shopping, location sensitive information service, traffic updates, and logistic tracking services, all of which utilize the concepts of customization, personalization, location sensitive, context awareness (Lee & Yang, 2003; Schilit, 1995; Schilit, Adams, & Want 1994; Wang & Shao, 2004; Want, Hopper, Falcao, & Gibbons, 1992; Want, Schilit, Adams, Gold, Petersen, Ellis, et al., 1995). M-commerce has been successfully activated in some industries, leading to competitive advantage (Rodgera & Pendharkarb, 2004; Varshney, 1999) and improved workflow as well as reduced costs and risk management (Miah & Bashir, 1997; Porn & Patrick, 2002; Turisco, 2000). However, such a success story is confined to specific applications where the decision support framework is not considered seriously. To reap better results from the users' view, decision makers engaged in a specific type of m-commerce should be supported more intelligently and robustly.

It cannot be overstated that decision makers under a specific m-commerce situation need more timely and robust decision support because they are in several types of contexts. For example, they cannot afford to receive detailed information from a decision support system because of the limited display capability of mobile devices they carry. Besides, they do not have enough time to consider all the related factors before making decisions because they are usually on the move. This kind of environmental limitations require that a **decision support framework** should be developed for enhancing decision making effectiveness for m-commerce users.

For this purpose, this chapter proposes a new kind of decision support framework named **MAM-NSS_**(multi-agent mobile negotiation support system) which can benefit both m-commerce buyers and sellers. MAM-NSS is based on a multi-agent mechanism in which buyers and sellers are respectively represented by agents. Each agent tries to coordinate with each other until reaching a compromised decision. Especially, the proposed MAM-NSS focuses on the fact that decision makers engaged in a specific m-commerce situation are often facing two kinds of needs: (1) to refer to past instances carefully and (2) mull over inter-related factors simultaneously. A literature survey shows that there exist few studies dealing with those research needs. To fill such a research void, this chapter proposes two important mechanisms like **case based reasoning** (CBR) and **fuzzy cognitive map** (FCM). The proposed MAM-NSS combining CBR and FCM is therefore expected to provide more robust decision support to m-commerce decision makers irrespective of buyers and sellers. To prove the validity of the proposed approach, a hypothetical m-commerce problem is developed in which theaters (sellers) seek to maximize profit by selling their vacant seats to potential customers (buyers)