Call U Back:  
An Agent-Based Infrastructure for Mobile Commerce  

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ABSTRACT

Mobile commerce (M-commerce) is an attractive research area due to its relative novelty, rapid growth, and great potential in business applications. Over the last decade, various M-commerce applications have been geared to target mobile users and achieved great success. However, most M-commerce applications are developed by different retailers for special purposes and thus lack fully automated business processes to integrate various existing services. This paper presents a novel infrastructure, Call U Back (CUB), for M-commerce applications. The proposed scheme integrates concepts of agent and context-aware workflow to implement automated trading tasks and compose services dynamically. The context awareness is based on ontology and logic models which derive from a set of descriptive contextual attributes for knowledge sharing and logical inference. Based upon the context-aware workflow analysis, the system will generate automated intelligent agents to conduct commerce transactions on behalf of mobile users. The middleware layer of the CUB server has been implemented. An experimental prototype of the system is under development and testing.

Keywords:  Agent, Context-Aware, Mobile Commerce, Mobile Device, Web Services, Workflow Analysis

INTRODUCTION

Over the last two decades, Internet technology has grown rapidly and has reshaped about every important realm of our modern life. One of the most significant changes is the way of conducting business. There is no doubt that one of the most successful Internet applications is Electronic commerce (E-commerce) which offers an easier and robust business model for buyers and sellers to conduct business transactions effectively and efficiently (Wu & Hisa, 2008). E-commerce opens the door to virtual market for various consumers to navigate among a mass of Web sites to search for goods and make their purchases. According to statistics from Forrester Research, U.S. E-commerce growth rates are 13% in 2008, 11% in 2009 and 13% in 2010. Meanwhile, it is expected to have 11% growth rate in Western Europe, going from 68 billion Euros in 2009 to 114.5 billion Euros in 2014. The Canada B2C E-Commerce report also estimates that between 2007 and 2012, Canadian E-commerce sales will show a compound annual growth rate of 10.6%.

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On the other hand, with advances in wireless and telecommunication networks in terms of technology, protocols, standards and user acceptance, as well as various handheld mobile devices, such as PDA’s, mobile phones, smart phones and Pocket PC’s, opportunities are presented to mobile users to engage in time-critical, goal-driven tasks (Dekleva, Shim, Varshney, & Knoerzer, 2007). Even though the whole world has been facing financial crisis and economic slowdown, according to IDC’s Worldwide Mobile Phone Tracker, smart phone sales rose 49% in the first quarter of 2010, a strongest year-on-year score since 2006. Mobile computing devices are primarily designed to increase efficiency and productivity for mobile users. However, people invariably appropriate such devices to meet their social and business needs as well. Consequently, a new commerce model, namely, M-commerce has emerged and attracted a growing number of research efforts (Bhasin, 2005; Bai, Chou, Yen, & Lin, 2005).

Generally speaking, M-commerce can be identified as business transactions conducted through the use of mobile handheld devices over wireless or telecommunication networks. M-commerce not only extends Internet-based E-commerce, but also offers a unique business opportunity with its own features, such as ubiquity, accessibility, portability, etc. The most important aspect which has determined the wide increasing interests of M-commerce is the fact that it can help mobile users to do business on an anywhere and anytime basis. According to recent survey on customer behavior (Ankeny, 2010), M-commerce is growing at astounding rate and will be an increasingly major area of growth for years to come. For example, on the Black Friday 2009, mobile payments processed via PayPal jumped up nearly 650% over the previous year, and mobile page views for U.S. retailers increased an average of 388%. In the current commerce industry, M-commerce has entered in many sectors. Typical applications involve mobile advertising, mobile couponing, mobile bargain hunting, mobile ticketing, mobile banking, mobile marketing, and mobile auctioning, etc. Due to the wide adaptation and convenience, M-commerce is likely to become the main business model in the near future (Ngai & Gunasekaran, 2007).

However, in comparison to desktop-based E-commerce, M-commerce has some limitations due to physical constraints of mobile handheld devices. For example, devices such as smart phones usually have small screen size, poor network connectivity, low transmission bandwidth, limited battery capability, limited storage and computing capacity. As mobile technology is accelerating at a rate of Moore’s law, and wireless transmission rates also follow Moore’s law, some of these limitations are expected to diminish, while some will remain for a long time. In addition, traditional E-commerce applications mostly adopt client/server model in which a commercial transaction generally requires a stable communication connection being established between the client and the server. Obviously, the client/server approach poses a barrier to the development of M-commerce applications. First, it will become expensive and unreliable when a lot of raw data has to be transferred between the client and the server. Second, it will be impossible to retain a long-time connectivity to maintain face-to-face communication between mobile consumers and venders. Third, it typically requires clients to check trading opportunities frequently and make most decisions manually. Another challenge in M-commerce development is the lack of service integration. Currently, most existing M-commerce applications are aimed at simple interactions with mobile consumers and are developed for special purposes and by different retailers. However, commerce transactions usually involve a sequence of activities, such as searching, negotiation, purchasing, shipment, payment and logistic services. These activities might require services offered by different service providers and demand additional features of automation, optimization and security. Although some of M-commerce applications have become very popular recently, the research in this area is still in very early stages. Due to various mobile devices, evolving wireless and telecommunication technologies, heterogeneous platforms and
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