Emerging M-Education Model Utilizing Wireless Internet Technologies

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Introduction

This paper examines the impact of the proposed Mobile Education Model (MEM) on enhancement of educational access and academic quality in traditional university environment through implementation of emerging wireless technologies. By 2003, more than half of all Internet access will be wireless, and the number of people using wireless Web will reach over 200 million by 2005. Proposed M-Education Model represents an entirely new paradigm whereby students enrolled in the traditional classroom setting (as opposed to an online mode) would greatly benefit from an added wireless solutions infrastructure allowing them to perform many academic transactions at any time and from many places - seamlessly, interactively, and efficiently.

Fundamental Benefits of MEM

Similar to the commonly accepted in the industry E-business models of B2B (business-to-business) and B2C (business-to-customer), the applications, challenges and opportunities associated with widespread adoption of wireless networking solutions via the proposed Mobile Education Model are centered around three major MEM architectures: U2S (university-to-student), P2S (professor-to-student), and S2S (student-to-student).

The obvious benefits for the mobile users (students) in supplementing their traditional classroom mode derive from the significantly enhancing access, retrieving and reporting capabilities, response time, personalized service options, ease of use, and location/time flexibility to be supported by MEM infrastructure.

Technological advances and critical regulatory decisions have greatly increased availability of wireless communications while reducing costs. The compound annual growth rate for wireless data from 1996 through 2003 is projected to be 35 percent, and market is expected to grow to ten

times its current value reaching close to \$2.5 billion by the year 2002. More over, by the end of 2002 virtually all wireless phones will be pre-loaded with mini browsers and will be Internet enabled¹. Beyond the massive numbers of wireless users is the realization that educational marketplace would be looking to wireless technological solutions as the ways of both enhancing and supplementing the traditional classroom environment.

Development of wireless technology applications on the university campuses could be conceptualized in several ways. The first experiment of this kind has been announced last August by the Tulane University in New Orleans²: a new wireless LAN (local area network) will ultimately include up to 1,000 wireless access points on the campus. Such model would enhance communications capabilities of students, faculty and university administrators because users are roaming all over the place. In addition, specially designed wireless subnets are expected to be dedicated to specific categories of traffic that only a given department or set of individuals would be allowed to access.

Another concept of wireless enhancement might be leading to an added flexibility in assisting the growing number of professional adults enrolled in academic programs while working full-time. For those students, the value added by utilization of the wireless applications on the university campuses would allow them: a) an on-the-go access to the servers containing class materials and student assignments as well as access to the library databases (U2S), b) all-time communication with class professor for consultations and exchange of relevant data (P2S), and c) keeping in touch with the group of fellow students working on the same team project (S2S).

Yet the most beneficial utilization of wireless capabilities would be expected in the form of supporting and enhancing traditional classroom environment. The following recommended middleware components would enhance effectiveness of the Mobile Education Model:

- *Interactive syllabus* would allow students immediate access to the contents of the course with ongoing updates on the relevant data, video clips, recent findings, and supplement course materials with readings selected by the instructor.
- *Mobile Journal* would allow the student to post messages that only this student and professor would be able to view.
- *Document sharing* option would allow uploading a document to the course server or downloading a document from the same server or database.
- The *Webliography* feature would allow student's access to the course-related web sites with hyperlinks from over the World Wide Web with several options to view the entries, conduct search, and submit an entry.
- By establishing a link between, for example, the project team members via the *Mobile Chatroom*, the students would be able to participate in the real-time discussion.
- Through the *Mobile Message Center*, the class professor would be able to post important messages to the entire class.

Network Integrated Mobile-Based Linking Environment and Applicable Wireless Technologies

The issues arising when designing mobile applications within the institutional environment could be broken into two categories.

- Different kinds of device technologies, such as a) Internet-enabled desktops, personal digital assistants (PDAs), WAP phones (Forrester Research estimates that smart phones with wireless Web access will outnumber PDAs by 60:1 before the year 2005); b) different devices supporting multiple kinds of browsers; c) conversational speech accessed through any telephone.
- Network protocols with different parameters, such as a) voice, data, messaging supporting traffic from real-time conversations to one-way messaging; b) WAP, GSM, CDMA, TDMA, CDPD, AMPS, Mobitex.

Design Factors

Specific characteristics that need to be factored into the design of the mobile applications can vary widely. The design factors for hardware, networks and interaction issues are discussed below.

The *presentation* factor deals with questions such as: a) what browser capabilities does device need for both intercampus and out-of-campus communications? b) what markup language? c) how much text can device hold? d) does it support graphics and color? e) can several forms of presentation be used in concert, for example, spoken requests for data?

The *information characteristics* factor deals with the following kinds of questions: a) what type of information is device designed to hold? b) can new kinds of information be added? c) how does the information get added? d) is information synchronized? e) is information backed up? f) is information secured?

The *computational* factor is concerned with the following issues: a) can device perform calculations and logic? b) what language is used? c) how does the new functionality get added to the device? d) how much functionality can the device hold?

The *coverage* factor deals with questions such as: a) where does the network coverage end to support both in-campus and out-of-campus communication? b) how would roaming be provided

outside those areas? c) what would be the cost? d) would the coverage be uniform across the campus and spotty outside?

The *performance* factor has relevance to the issues like a) how fast would information be transmitted? b) how long would it take for the request to be serviced?

Security issues are obvious since, for different MEM modes such as S2U and S2P, proprietary information would be in the air.

The *continuity* factor refers to the occurrences when the student user or professor would need to stop the interaction to deal with something else, or when user will want to resume the interaction later. The issues of concern with regard to the *duration* factor: how long would interaction take overall or how much time would be allocated for expansion if necessary. Finally, the issue of *multitasking* capabilities might become critical since, for example, ability to concurrently download the material from the course database and participate in the discussion session with fellow team members would certainly enhance both effectiveness and efficiency of interaction.

Application Development Software

In an attempt to add mobile capabilities to the mix of LAN- and Web-based delivery systems, application development software should be flexible and easy to use. The competition is split between wireless service providers and development software companies. Wireless service providers such as Aether Systems Inc. in Owings Mills, Md., and Everypath Inc. in San Jose do the coding for their customers.

Based on assessment of several prospective providers of application development software, it seems reasonable to suggest utilization of the Visual Drag-and-Drop Interface conceptualized and designed by the iConverse Corporation in Waltham, Mass³. The interface lets developers visualize applications by dragging enterprise data onto their screens and then seeing how the results will appear for different types of wireless devices. A developer can customize the resulting screens and use the iConverse parallel publishing tools to automatically build an application for each wireless device targeted.

One of the important iConverse features allows providing a browser client that supports applications even when out of the wireless network coverage area. In particular, this browser allows offline content to be viewed and forms updated wherever and whenever needed, ensuring that transaction processes can continue regardless of network coverage. In other words, when the MEM user would be out of network coverage areas, updated forms would be queued on the mobile device by the browser and submitted when the network is available.

Wireless Messaging Services for the Students

As a supplement to the inquiries and transactions initiated by the student, the MEM infrastructure would support the Wireless Messaging Mode (WMM) by adding the capabilities of the system to send announcements to the students directly to their cell phones as text messages or to their PDA's with wireless messaging services.

One of the options in support of the Wireless Messaging Mode would be through utilization of the *Bluetooth* standard, a wireless system that uses radio waves to communicate – within relatively short distances - with other devices equipped with the same technology. For example, while on the university campus, students' wireless devices would be able to scan important proprietary and uniquely encoded personal messages waiting for them and initiated either by the class professor (P2S) or university administration offices (U2S), such as Records, Financial Aid, Dean's office. This type of the *Bluetooth* technology application has been proposed in the shopping industry whereby the customer's *Bluetooth* phone – once the customer is on the premises of the shopping mall – would pick up the wireless message with information about discount prices on the items of interest to that particular customer (from the database's statistical analysis leads). Such features would make it possible to communicate specific academic information (change in matriculation requirements, graduation check, outstanding balance on the account, scheduling highlights, course prerequisite reminders, changes in textbook for the course, current student's grade point average) directly to the student's wireless device anywhere, anytime.

Anticipated Trends in Future MEM Applications

The current developments and anticipated breakthroughs in wireless technological advances combined with evolving networking standards indicate towards the adaptive trends with regard to future expansion and diversification of the MEM features.

- Proliferation of the cell phones that allow users to surf the wireless Web promises expansion of MEM capabilities in support of a simple scenario: by pressing a button on the cellular phone and logging on to the class Web site, the MEM student-user would be able, first, to download a trailer of the video clip related to the course subject, then to look into the phone's built-in digital video camera, record a video message stating your opinion or proposal with regard to the downloaded video clip, and then - with a voice command – to e-mail both the video message and the downloaded video trailer to the fellow project team members' phones, PCs or handheld computers.
- Gradual progress in implementing successive cellular phone generations provides a blueprint for further MEM expansion. The cellular phones currently in circulation are classified as 2G – second generation – and offer Internet access through various standards as WAP (Wireless Application Protocol) and the Japanese i-mode, also known as information mode. The 2.5 upgraded phones use “packet switching” technology (as opposed to “circuit switching”) that speeds up services by taking data apart and putting it back together at the receiving site.

- The next generation - 3G phones - will support continuous online presence and would allow the user to access Web instantly by providing a combination of streaming audio and video, as well as even faster speeds. They will also likely be equipped with *Bluetooth* features. The next frontier of cellular phones (in 3 to 4 years or earlier) is expected to be the fourth generation (4G) with capabilities of portable entertainment centers, with faster speeds, with capabilities of adapting to the standards of wireless communications in any part of the world, and with anticipated features to support video on demand and digital television broadcasts (HDTV) modes.
- For immediate implementation of the MEM infrastructure, some outstanding features of the cellular phones already available would greatly enhance MEM attractiveness on many university campuses. For example, the Nokia 3330 model⁴ has a WAP browser to access Internet and also includes a “chat” feature, so that the MEM users could talk to each other as in a regular chatroom session and to concurrently exchange with photographic images. The Nokia’s 6310 model, in addition to a WAP browser, offers a) GPRS (General Packet Radio Services) feature which allows for uninterrupted online Internet service and charges the user for only the data received and sent, b) another innovative feature such as the WTAI (Wireless Telephony Application Interface) Public Library which makes it possible for the MEM user to initiate a phone call while still online without having to disconnect and then log on again. Finally, the amazing combination of features combined into the Nokia’s 8310 model would allow the MEM user to make or receive a call to or from the professor or student, demonstrate to the group of fellow students particular drawing or other object, and surf the Web or the course database/server simultaneously.

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