IP-MLI: An **I**ndependency of Learning Materials from **P**latforms in a **M**obile **L**earning using **I**ntelligent Method

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Abstract— **Attempting to deliver a monolithic mobile learning system is too inflexible in view of the heterogeneous mixture of hardware and services available and the desirability of facility blended approaches to learning delivery, and how to build learning materials to run on all platforms. This paper proposes a framework of mobile learning system using an intelligent method (IP-MLI). A fuzzy matching method is used to find suitable learning material design. It will provide a best matching for each specific platform type for each learner. The main contribution of the proposed method is to use software layer to insulate learning materials from device-specific features. Consequently, many versions of learning materials can be designed to work on many platform types.**

***Index Terms*— Learning material, platform, mobile learning, fuzzy method.**

I. INTRODUCTION

What is mobile learning? A variety of meanings are attached to this emerging paradigm. Some definitions include the aspects which characterize mobile services such as location independence [2]; others focus on technology related features such as the wireless network infrastructure [3].

Mobile learning is defined by Clark Quin [4] as "… The intersection of mobile computing and e-learning: accessible resources whenever you are, strong search capabilities, rich interaction, powerful support for effective learning, and performance –based assessment. E-learning independent of location in time or space…". Also Mobile learning can be defined as "… any service or facility that supplies a learner with general electronic information and educational content that aids in acquisition of knowledge regardless of location and time…"[5].

Whenever one looks, the evidence of mobile penetration and adoption is irrefutable: cells phones, PDAs (personal digital assistants), MP3 players, portable game devices, handhelds, tablets, and laptops abound. No demographic is immune from this phenomenon. From toddlers to seniors, people are increasingly connected and are digitally communicating with each other in ways that would have been impossible to imagine only a few years ago. Even thought mobile networks and services in all countries are just at the beginning of broadband and broad-scale adoption, mobile technologies clearly have already changed life as we have always known it [6].

The exponential growth of mobile technology in recent years, increasing availability of high-bandwidth network infrastructures, advances in wireless technologies and popularity of handheld devices, have opened up new accessibility opportunities for education. The true potential of e-learning as 'anytime, anywhere' has finally started to be realized with the advent of mobile learning [7].

Even thought fundamentals issues remain unsolved, now is the time for the e-learning and educational technology community to pay serious attention to mobile learning and wireless devices [8]. However, these environments still suffer from various technological and access related problems in many parts of the world. Thus, any mobile learning system should be capable of delivering educational content anytime and anywhere the learners need it.

Mobile learning involves content that should be delivered in a location-independent and possible also device-independent method: as a new experience of such technologies in education, we don not choose any particular learning system to deploy the sub-modules of the course, but we develop content with the most used software(privileging open source one) in different format text, pdf, video, animation, html, etc in order that learning actors could read, write and manage it by using different devices[9].

Some researchers suggest that a great effort is required to have content device-independent since the lack of software. The adoption of a learning system could be used in future for offering a common framework, but probably it should be necessary to develop specific interfaces to provide this important feature [9]. Other researches, have found that "helps to use software layers to insulate learning materials from device-specific features"[1]. Even thought; delivering materials in browser helps. However, it does not offer full platform independence and there are still standards issues.

To support flexible learning requirements of mobile learning, solutions are needed that not only support mobile learning but also work on other platforms so as to reduce the problems of redundancy, out-of-sync content versions and mismatch of profiles when learners move from one platform to another. There is an urgent need for frameworks that support automatic adaption of educational content to suit various devices (both mobile and desktop platforms) and the individual preferences of the learners using those devices [7]. Extensions of educational framework, such as Multiple Representation Approach to mobile learning environments [10] are expected to fill the gap but there is still a long way to go before mobile learners actually perceive any real benefits from research.

The aim of this study is to develop a framework for basic understanding of the different services that mobile learning technologies provide and how they fit together into an all mobile learning application infrastructure. Using a fuzzy method, the proposed system will be able to choose which of learning materials is to be selected to the platform effectively when applied in mobile learning environment. The research of mobile learning systems can be divided into many categories; this study focuses on technical system development.

The rest of the paper is organized as follows: In section 2, introduce the background of Mobile learning environment. In section 3 the proposed framework is presented. Design methodology is presented in section 4 to evaluate the performance of this framework. Section 5 presents the conclusions.

II. BACKGROUND

Similar to e-learning mobile learning physically separates teachers and learners but provides a communication channel between them [11]. Table 1 clarifies the differences between electronic learning and mobile learning in term of technologies that uses in each of them.

TABLE I. :ELECTRONIC LEARNING VERSUS MOBILE LEARNING TECHNOLOGIES

Technology	E-Learning	M-Learning
Device	PC	Smartphones, pagers, PDAs,
Operating System	Windows, Unix, Linux	Symbian (EPOC), PalmOS, Pocket PC, proprietary platforms.
Presentation Standards	HTML	HTML, WML, HDML, i-Mode
Browser	Microsoft Explorer, Netscape	Phone.com UP Browser, Nokia browser, MS Mobile Explorer and other microbrowsers
Bearer Networks	TCP/IP & Fixed Wireline Internet	GSM, GSM/GPRS, TDMA, CDMA, CDPD, paging networks

A. Characteristics of M-Learning

A rich mobile internet experience includes the following attributes: Ubiquity, Accessibility, Convenience, Localization, Personalization, Time sensitivity, Instant connectivity, Bandwidth and capacity, and the value chain. The requirements of mobile learning systems: Device independence, bearer independence, security, reliability, and notifications are required to satisfy these attributes and requirements. Consequently, the framework of any mobile learning should be as follows (table 2):

TABLE II. A STANDARD MOBILE LEARNING FRAMEWORK:

Mobile Learning Application
Wireless User Interface (browser, handheld devices)
Mobile Middleware (WAP for content adaption)
Wireless Network Infrastructure (LANs, Cellular Systems, Satellites)

Many new applications are becoming possible, and many existing e-learning applications can be modified for mobile environment. However, the design of new mobile learning applications should consider the capabilities of the user infrastructure (Mobile devices).

There are a plethora of operating systems and microbrowsers used to run web-based applications on mobile devices. Thus, a wireless middleware must be found

- With its ability to hide the underlying network's details from applications while providing a uniform and easy-to-use interface.
- Middleware is extremely important for developing new mobile learning applications.

B. Network infrastructure

In mobile learning, service quality primarily depends on network resources and capabilities:

- GSM (Global System for Mobile)
- HSCSD (High Speed Circuit Switched Data).
- UMTS (Universal Mobile Telephone System)
- GPRS (General Packet Radio Service).
- And others

III. FRAMEWORK OF IP-MLI

This section describes the proposed framework of IP-MLI (An Independency of Learning Materials from Platforms in a Mobile Learning using Intelligent Method) and analyses the main components of the framework.

This study proposes a framework of IP-MLI for building different learning materials for learners who may have different platforms. The framework of the system is depicted in Figure 1. The system consists of four components: "getting platform information", "platform requirement information", "learning material matching analysis", and "choosing the suitable learning material" respectively.

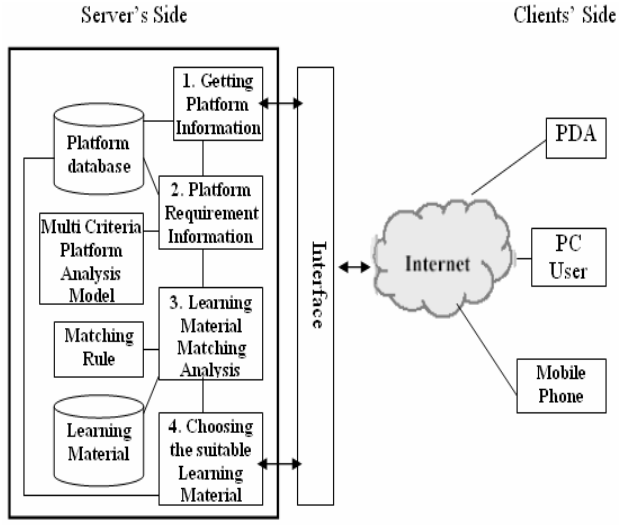

Figure 1. Framework of IP-MLI

The proposed system starts getting platform information storing it into platform database, platform requirements across learning materials are analyzed in platform requirement information. Platform requirement analysis model is used in analyzing and identifying platform requirements. In learning material matching analysis, matching rules are used for discovery associations between platform requirements and learning material design. In choosing the suitable learning material, a specific design of learning for a given platform is produced and selected.

Two key issues dealt with the framework are: how to accurately identify a ,requirement of platform which is handled by a platform requirement analysis model, and how to accurately find out the learning material designs which match the requirements of platform, handled by matching rules.

The multi-criteria platform analysis model is proposed by using the concepts of multi-criteria decision models, and constructed to run on all platforms. But each platform may have different features for criteria. A Fuzzy set technology is used to handle such situations in achieving a solution for multiple criteria problems [12].

IV. Design Methodology

A. Design Description

A fuzzy matching rules are used to find learning material design which match a given platform requirement. Learning material taxonomy should be represented in many designs (one design for each platform). Fuzzy set technique [13] can describe complex and uncertainty relationships, and can deal with unstable classifications such as classifications of learning materials to makes data analysis tasks more efficient. Fuzzy set based fuzzy distance [14] can introduce an environment in matching learner requirements to learning materials due to the elasticity of fuzzy sets. Fuzzy set based fuzzy distance definition is therefore especially suitable for measuring uncertain matching, and therefore can be used for the representation of justifications rules [12].

In this study, learners are represented as a vector A= (a_1, a_2, … , a_n). The multiple criteria for choosing learners platforms are represented as independent variable and written as criterion vector C = (c_1, c_2, .., c_m). A required platform of learner's device ai for learning material is represented as a vector R_{i1} (r_{i1}, f_1, .. , f_p) , 1<=i<=n, r_{i1} is the requirement for learning content , f_1, … , f_p are features of the requirement in learning material design, such as the type of device. The selection for the learner ai are to find a learning material design L_i = (l_{i1}, l_{i2}, …, l_{ik}) from a learning material taxonomy. The learning material design Li matches the learner's platform R_i(i=1,2,…,n) under a fuzzy matching rule $FM_m\{(R_m, L_{mj}, \mu(R_m,L_{mj}))\}$, m=1,2,…,k. In the fuzzy matching FMm, r_mЄ R and l_{mj}Є L, $\mu(R_m, y_{mj})$ is the membership of l_{mj} for r_m, r_m can be request learning material taxonomy, m=1,2,…,k.

In the learning material matching analysis, given a set of requirements R_i of platform a_i, and association rule implies the form $R_i \rightarrow L_i$, (find out L_i based on R_i) where L_i is a learning material design. The task of the matching analysis is to find out a learning material set L_i= (l_{i1},l_{i2},..,l_{ik}) for a platform a_i. The matching analysis may use a set of fuzzy matching rules to measure each requirements of platform and candidate learning material designs (if any).

B. Implementations of IP-MLI

Suppose that, there are:

- Four learning material designs (LMD1, LMD2, LMD3, and LMD4) are represented to meet specific platform type.
- Two platform types as follows:
  - Hybrid PDA/phone devices running the Pocket PC operating system.
  - Hybrid PDA/phone devices running the Symbian PC operating system.

The proposed IP-MLI is expected to support students' platforms in learning material design; it can choose and handle such conditions. For example, the fuzzy matching technique focuses on analysis of platform requirements. It is designed to acquire and analyze features of platform, and to help find which of learning material designs will match the features of platform. Then, the output of the proposed system: browsing the learning material design that best meet each specific platform type for each learner.

V. Conclusions

This paper presents a framework of an independency of learning materials from platforms in mobile learning using intelligent method and discusses related technologies. The framework has good characteristics in supporting platforms choosing learning material designs.

FUTURE WORK

The proposed framework (IP-MLI) must be implemented as any mobile system.

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