ASSEMBLING A PERSONALISED AGENT-BASED MOBILE E-LEARNING PLATFORM

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Abstract

This paper presents an agent-based m-Learning platform, "Mobile E-learning Platform", which incorporates personalisation and collaborative learning for adaptive e-learning. The main objective of this platform is to provide University College Dublin with a single supported intelligent mobile learning environment that will promote adaptive and collaborative learning, human computer interaction on mobile clients anywhere, anytime and also provides useful recommendation about available educational resources.

Introduction

University College Dublin recently switched from a traditional education metaphor to a credit-based and modularized educational system. There is a vast scale of students at this university that requires access to resources in a ubiquitous manner. The provision of a fast and efficient wireless local area network (WLAN) makes it possible for student to access resources anytime, anywhere. Mobile Learning Environments (MLEs) in this institution doesn't only serve as a resource repository but also an intelligent learning environment to aid students through their entire learning stages. UCD has two MLEs known as Blackboard and Moodle. Research (Ayoola, McGovern, Mangina, & Collier, 2008) showed that skills learnt to use one MLE in UCD are not transferable to other MLEs in the same institute. Furthermore, a lot of the facilities such as collaborating learning service are not used by the students and lecturers. In order to address these problems, a single supported platform that will act as resource and administrative repository is proposed to employ intelligent strategies to assist students and also promote collaborative learning. MEP is a personalized learning platform that provides seamless content delivery and promotes collaborating learning via mobile clients and personal computers. MEP will act as a single supported platform to serve the student and staff of the entire university. The objective of this paper is to establish how MEP will provide intuitive content delivery and also promote collaborative learning. The next section provides a summary of the background reading related to this work while the other sections give the concept of MEP, an outline of the components of the system and a conclusion and describes the future work to be carried on the MEP.

Summary of Related Work

There are several e-learning tools currently enhancing second and third level education around the world. In Europe, the United Kingdom is the leading player in mobile learning field. Bates (2000) stated that learning in the 21st century will become ubiquitous and organised to suit individuals. Ireland has rapidly embraced MLEs to provide improved individual learning and adaptive personalisation in the academia (Tarasewich, 2002). E-learning tools in the third-level institutes make distant learning students feel like a third level student because MLEs provide access to academic resources anywhere, anytime (Bates, 2000). These tools also reduce time spent to acquire skills and knowledge (Koedinger, 2003). Using a meta-analysis research that considers the needs, interests, current knowledge, and learning styles of students, Kulik (1994) discovered that students, who receive computer-based instruction, learn faster and are more knowledge driven. Evolution of Human Computer Interaction (HCI) research facilitated the development of adaptive e-learning environments (Dillion, 2004). Visualization technologies enable students to observe, absorb and analyse and gain information via intelligent HCI (Flinzer & Erickson, 2002). Collaborative tools such as computer mediated cooperative work benefit students with common goals and interest (Duval et al, 2005) and facilitate learning through the sharing and commenting on each other's work (Flinzer & Erickson, 2002). "Argue Graph" revealed that collaborative effort had a positive impact on the arguments used to justify the solution given for the questions (Jermann & Dillenbourg, 1999).

Since the evolution of computers and wireless networks (Satyanarayanan, 2002) mobile devices have gradually become enhanced and in popular demand. Mobile devices have so much to offer consumers in terms of size and functionality such as GPRS, wireless LANs, etc. Mobile clients have intelligent interfaces that comprises of multimodal input and output and interaction management. Techniques, such as suggesting alternative actions to user, are used by interaction management to enhance interaction between student and device (Alcaniz, Rey, Riva, & Davide, 2005). Mobile devices make use of agent-oriented intelligent interface. The intelligent interface agent is proactive, autonomic and has a simple interface. The interface is intuitively used by users. Agents perceive users' interests and assist the user in expressing their tasks to the rest of the system (Alcaniz et al., 2005). The advanced development of mobile technologies offers mobile e-learning opportunities to enhance distant learning (Kruger, Baus, Heckman, Kruppa, & Wasinger, 2007) since most residents of developing countries own at least one mobile device (Issack, Hosany, & Gianeshwar, 2006). The provision of mobile learning in primary and secondary school evolved when Professor Mike Sharples worked with primary school children who recorded and analysed data on PDAs (Keegan, 2008).

Issack et al. (2006) developed a prototype application which is a single computer-based infrastructure based on both m-learning and e-learning. Kinshuk and Lin (2004) investigate how to enhance learning process by adapting personalising content presentation in accordance to student learning style on PC and PDA. Some m-learning applications are developed with Macromedia Flash (Nicholas, 2006), Java 2 Micro Edition (J2ME). Therefore, applications can run on variety of mobile clients because

J2ME's platform independent and can handle different operating system, such as MS Pocket PC, Symbian OS, Palm OS, etc, and the operating system's components and features, such as different screen resolution and different modal input technologies (Meisenberger & Nischelwitzer, 2006). Mobile clients and specialised gadgets, such as Apple iPhone, gaming stations, MP3 players, etc, are key devices used daily for information, education, communication and entertainment (Hildebrand, Schmidt, & Engelhardt, 2007).

University College Dublin (UCD) deploys MLEs to guarantee a higher standard level of education for the entire student body. This institute faces issues such as registration costs for multiple platforms, repetitive modules on multiple platforms, time costs, and redundancy of educational services. In order to address cost issue, a single supported online platform was considered as the best way to improve e-learning at the Australian Catholic University (ACU) (Gauder, 1990) hence to reduce registration MEP is proposed to serve as a single supported platform that will provide for all staff and students of UCD. With m-learning application such as iUMELA (McGovern et al, 2007) in UCD, students can now register courses, pay fees and listen to course content via internet phone (Avellis, Scaramuzzi, & Finkelstein, 2004). MEP aims to provide academic resources anywhere, anytime, promote collaborative learning and offer HCI for improved learning experience. It will consider the needs, interest, peer influence, and current knowledge of student for personalized educational resources recommendation.

Adaptive Mobile E-Learning Platform

University is not only about learning aspect, it also comprises of a social aspect. If universities make education the only feature on campus and learning becomes an obligation, there are millions of learning databases online that students can use to enhance their knowledge. The Web 2.0 launched social networks which the youths are gradually embracing. These youths can now interact with their friends across the globe at anytime and from anywhere via mobile clients. University College Dublin has MLE platforms such as Blackboard, Moodle, etc. Research (Ayoola et al., 2008) showed that in this institution, MLEs lack personalisation; many students do not make use of the facilities such as collaborative tools that is provided by the MLEs hence these facilities are redundant. Most of the student felt the skills learnt to use one MLE is not transferable to the other. The research also showed that a lot of students do not know the capabilities of mobile clients — for example, they do not know the generation of their mobile phones. Social networks such as Bebo, Facebook, etc., have encouraged millions of students to make use of the features mobile clients that has the 2.5G and 3G mobile technology provide. Students are seamlessly networking and using these networking tools intuitively. MEP will address the issues the students of this academic institution identified by incorporating personalisation and collaborative learning for intuitive and seamless learning. It will introduce a single MLE that will be in form of social network. This will encourage social networking among students, teachers, improve system's service delivery and also promote collaborative learning. MEP main components consist of a web-based user-friendly interface, the agent platform, content registry, login system, ontology,

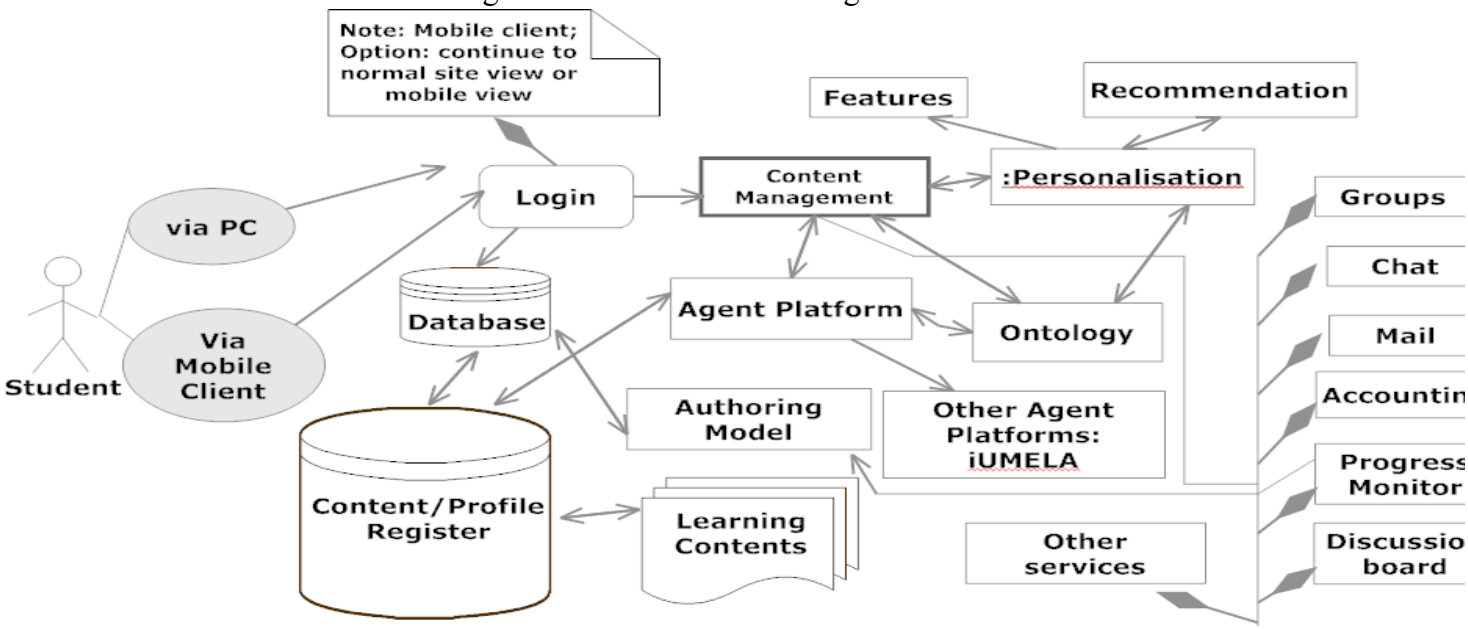
database, authoring model, design personalisation model, progress monitor and interactive tools. Students can register modules or pay fees with another extended agent-based application such as iUMELA (McGovern, Mangina-Phelan, & Collier, 2007), access lecture materials, change the system preferences, remove redundant optional features, access their academic progress, send feedback to their lectures, interact with their lectures, friend and colleagues via discussion boards, groups, mails, etc and they can also create groups for modules and interests, e.g. a study group.

The system will adapt context for learning content, study groups, friend suggestion, i.e., recommending lecturers teaching the modules to students that are taking the modules, similar students across the university taking same modules and students with common interest in academia or in non-academic material such as recreational activities, books, music, etc. MEP will be accessed via PC and mobile clients to provide adaptive and collaborative learning by enabling access to information, lectures material such as notes, videos, etc. anytime, anywhere.

MEP Components' Architecture

The system's architecture (Figure 1) will incorporate learning related activities and the management of learning materials. MEP services will be available on web pages hence during learning session, students' devices such as PC, mobile phone can access MEP directly via a web browser. Students will need to authenticate in order to access MEP services. Before students can login, they must be registered to the system and the system will provide registration services as well. The login system will store the user's session while the user is browsing the services; once the user logs out the session is ended.

Figure 1: UML interaction diagram



The system will detect the device which the student is using to access its services. At the login stage after authentication, students can adapt the screen to mobile view if it's detected that they are using a mobile client but this is optional to students since most 3G devices support full webpage view. Hence it depends on the mobile client the student is using and the student's preference. After logging in, the student can search for courses, attend study group session and enrol for study group session. Anytime a student logs in, the personalisation service also observes the tools that users are not making use of. It makes use of this observation by suggesting to the student to either remove the tools or keep them. It will also promote redundant features that are useful to students by giving them a brief explanation of the tools' usefulness. The content management model is in charge of helping the student to find courses, book and attend studying sessions. The ontology model collects the search terms, edits them and retrieves keywords. It also checks the type of searching technique the user specified. It sends the keywords and the preferred search technique to the agent platform. The agent platform uses available learning contents or profile, depending on the search type the student specified, provided by the content register and profile register to find similarities and make suggestions. The suggestions are sent to content management, which then request for personalisation according to the user's preference, e.g. display 5 results at a time. The authoring model will enable lecturers or tutors to send updates or announcements, edit, publish and create learning contents. The tool will enable students to update, create, edit their study groups, profile, discussion boards, etc. Learning content are learning materials, learning services such as groups, etc. When groups, discussion board and discussion topics are created, their details are stored inside the database. These details can be retrieved by the content registry and passed onto the agent platform. The agent platform can also access other platforms such as iUMELA to provide access for students to pay fees, enrol for courses, etc. Content and Profile Registry will retrieve details about users' interests and courses from the database. The content manager will also support interoperability between any of the services. Hence the personalisation manager, progress monitor, and accounting manager can collaborate on student interaction with the system and progression of the learning sessions. It will also provide the services such as chat tools, mailing, accounting, progress monitor, group tools, discussion board tools and any other services.

A progress manager will coordinate all assessment result for online examinations, specific module assignments' results and general assignments' results into an overview. An overall module overview of a specific module will be available to both tutors and students while the overall modules overview will not be accessible for tutors. An accounting manager will manage study group enrolment and store student participation for system retrieval. The profile manager will be in charge of creating student and module profile (i.e., user and document modelling) for collaboration filtering. The content manager (this only occurs when the search term employs content-based technique) and ontology model will invoke the agent platform which will pass search keywords to the mediator agent. The mediator agent communicates with other agents and retrieves results which are then passed by the agent platform to the user interface.

Adaptive Content Delivery and Support

Mobile clients face issues such as power durability, screen resolution, browser functionality support, and connection bandwidth. The advanced and rapid development of mobile client has vastly enhanced personalization and content delivery. Moreover, mobile client users can now browse anywhere, anytime due to the advanced development of wireless connectivity hence there are ways to address these issues. The main limitations that MEP faces are mobile clients' screen resolution and content-based recommendation results' predictability issues (Ayoola & Mangina, 2009). In order to address these issues, MEP will make use of a hybrid recommendation technique that employs Lucene[1], agent-based technique and case-based reasoning. This technique will use the modelling of documents and modelling of profiles which hold information such as module details, user's interests and academic strength for personalisation. MEP will employ this technique to enhance availability of learning content; the information retrieval techniques will strengthen each other's result (Ayoola & Mangina, 2009). Furthermore, adaptive navigation support and content presentation will adaptively delivery content to suit students' mobile clients. The system will give the students options for adaptively altering the appearance of recommended results on every browsed page, using such methods as direct guidance, adaptive ordering, link hiding and removal, and adaptive link annotation (Ayoola & Mangina, 2009). A knowledge-based architecture will also be constructed to encapsulate students' interaction with the mobile platform for system retrieval, filtering, evaluation of its employment and adaptation of system's behaviour to filter irrelevant redundant features.

Conclusion and Future Work

This paper illustrates how enhancement of wireless technologies, social networking, multiple MLEs, and context-awareness motivate the development of MEP to help enhance the third level education for an intuitive and seamless learning process. UCD's current MLEs are not adaptive and ubiquitous to meet modern students' needs. They lack personalisation and they are not intuitive for users who use both MLEs. MEP aims to use enhanced adaptive personalisation, content management and collaborative learning to boost the third level educations. It will make personalised educational contents and activities available to UCD's students anywhere, anytime. The MEP multimedia tool is currently being developed and its future work will focus on completion of the application, evaluation of the system's performance, users' acceptance and optimization of PULP's recommendation technique.

[1] Lucene is high-performance, full-featured text search engine library that employs content-based recommendation technique.

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