Mobile Learning Courseware Development Process Using Java Web Services

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ABSTRACT
Various projects have looked into the development of courseware for mobile devices. Examples are the four major projects in mobile learning funded by the European Commission in Brussels. In these projects, mobile learning courseware was created using Microsoft Reader Work; installing a web-authoring tool like Micromedia dreamweaver MX version 1.0 and installing a desktop browser that has page rendering characteristics (opera 7TM); use of Flash Lite etc. This paper examines the process of developing courseware that can be consumed by mobile phone via web services. We discussed briefly the web service technology and also provided its architecture. Besides the presentation of the object-oriented analysis and design for the courseware development, the pseudo-code algorithm for creating courseware, a method of the web service class was provided. Finally, the courseware was developed using Java programming language and employed web services technology.

Keywords: Mobile learning, Courseware, Java web services, Development process, Algorithm.

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1. INTRODUCTION
With the advances in mobile technology, it is already possible to support learners and teachers on the move, through what we call mobile learning. Mobile learning is the provision of education and training on PDAs/Palmtops/handhelds, smart phones and mobile phones [1]. Mobile learning through the use of wireless technology allows anyone to access information and learning materials from anywhere and at anytime. Courseware (short for course material in a software format) is considered as software. In particular, it is software designed to provide pre-written courses in an electronic format. The electronic aspect offers several key advantages such as instant access and customizable flexibility so that the trainer can localize the content. The courseware development process may be engineered using a variety of approaches. One possible approach to courseware development process itemizes the various activities or steps that are involved. These steps include: to determine needs and goals, collect resources, learn the content, generate ideas, design instructions, flowchart the lesson, storyboard displays on paper, program the lesson, produce supporting materials, and evaluate and revise [2]. Mobile learning courseware development can also follow these steps listed above, only that those limitations of mobile devices such as limited display and memory capacity should be considered during the development process. Because of these restrictions, some current e-learning course materials may not be in the format that mobile devices would accept. Thus an instructor needs to prepare course materials in a compact form that can be displayed in a user friendly way on mobile devices. The 21st century workforce will be filled with people who have grown up with devices, and are used to having easy access to search engines, sharing and collaboration are the norm, and creative freedom is king [3]. Why not let students use technology they will need in the future? This paper focuses on how to program a lesson for mobile learning assuming that the course material or lesson has already been prepared following the steps mentioned above and making the design compact and readable.

2. LEARNING AND LEARNING PARADIGMS
Education and training is the process by which the wisdom, knowledge and skills of one generation are passed onto the next [4]. Learning is fundamentally a social construct that allows access to instructions, collaboration, informed research, relevant resources, critical analysis and integrated results; which manifest itself in knowledge and often in wisdom [5]. The learning tradition has invariably been based on face-to-face communication from teacher to learner in a learning group, otherwise known as conventional learning. However, the changing instructional strategy and a constantly evolving set of technological breakthrough introduced another style of learning different from conventional system of learning. Today there are two forms of education and training namely, conventional education and distance education. Distance education can comprise distance learning (d-learning),
3. WEB SERVICES TECHNOLOGY

Web services are web of software building blocks (routines) stored on one computer that can be accessed via method calls by an application (or other software components) on another computer over a network [7]. Other systems interact with the web services in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with XML serialization in conjunction with other web-related standards [8]. The computer on which a web service resides is called the remote machine or server and the application that accesses the web service is referred to as the client. The client (application) that accesses the web service sends a method call over a network to the remote machine, which processes the call and returns a response over the network to the application. In Java, a web service is implemented as a class. A web service is said to be published, when it is made available to receive request from client and said to be consumed when it is accessed from a client application. An application that consumes a web service consists of two parts- an object of the proxy class for interacting with the web service and the application that invokes methods on the proxy class. Three standards were developed with the introduction of web services: Web Service Description Language (WSDL), Universal Description, Discovery, and Integration (UDDI), and Simple Object Access Protocol (SOAP) [9]. Programmers use WSDL to publish their web services, thereby making the web services available to other programmers over the network. They use UDDI to locate the web services that have been published and SOAP is used to invoke a particular web service. Shown below is the architecture of web services [8].

4. MOBILE COURSEWARE DEVELOPMENT PROCESS

In this section, the analysis and design of the courseware development system, pseudo code algorithm for creating coursemodule (courseware) were presented and the system implemented.

4.1 Analysis and Design of the Mobile Learning Courseware Development system

Object-oriented analysis and design methodology was used for the analysis and design of this system because of its benefits such as lower development time and effort, and maintainability of the product. Here, we have the use case diagram, the class diagram, and the database diagram.

Use case diagram

The use case model models the interaction between a system and its external entities (actors) in terms of use case (system capabilities). As shown in the fig 2 below the external actor is the lecturer and he is provided with the following privileges: adding a course, updating a course, adding course-module, updating course-module and viewing course.
Class diagram

This models the class or "building blocks" used in the system and their relationship. Fig 3 below depicts all the class and their associations. Each class contains attributes and operations.

Fig. 2: Use Case Diagram

Fig. 3: Class Diagram
Database diagram

Here, classes are represented as tables, attributes as columns and associations as relationships. The fig 4 below depicts the database diagram.

Fig. 4: Data Base Diagrams of the Courseware

4.2 Algorithm for the Creation of Coursemodule (Courseware)

The algorithm below shows the step-by-step instructions for the creation of the coursemodule which is one of the operations (methods) of the web service class. The web service class provides services that are consumed by the mobile application. The algorithm can be defined as follows:

```java
Long createCourseModule(String name, String description, int studyOrder, String content, long courseId)
1. Request data
   1.1 Request name
   1.2 Request description
   1.3 Request studyOrder
   1.4 Request content
   1.5 Request courseId
2. Create Coursemodule
   2.1 Open connection to database
   2.2 Set courseModule = null
   2.3 Create a copy constructor of courseModule
   2.4 Set id for courseModule
   2.5 Insert into CourseModule Table (name, courseModuleId, description, content, studyOrder, courseId)
   2.6 Close connection to database
3. Return courseModuleId
```

4.3 The Implementation

Here, implementation means the development of the software for the system using the system design, in any language of your choice. Our system was implemented using Java programming language. Java has become the language of choice for implementing internet-based applications and software for devices that communicate over a network [7]. Netbeans Integrated development Environment (IDE) was used for the development of this application and PostgreSQL Database Management System (DBMS) provides database management support for our system. The database houses the courseware. The deployment platform for the system is windows. Windows offers users robust foundation for high quality experience across applications, services, personal computers and devices. Below is a demonstration of course material that was programmed and made available to students, using java-enabled mobile phone for learning. This was achieved using programming tools such as those mentioned above. Learning supported with mobile device is more practical and enhanced than exclusive classroom learning [10]. Fig 5 is a form showing where the lecturer creates the course module and fig 6 is the view of the course module.
5. CONCLUSION

People tend to be focused on constantly improving their skills, so an environment with a comprehensive mobile learning programme is attractive to them. This will encourage learners by making the cost of learning less expensive. With m-learning, learners are freed up so that they could study at anytime and in any place and in structures suited to their employment and family commitments. The obligation to join a learning group, at a fixed time, at a fixed place, for a fixed period of time, in order to learn is no longer there. In this paper, mobile learning courseware was developed, and the result was tested using Java2 Micro Edition (J2ME) application to access the courseware. This will be of immense benefit to both learners and educators by enabling educators to design learning materials for delivery on mobile technology and enabling learners to access learning materials via their mobile technologies. The big question now is how ready are school administrators to incorporate mobile learning into the mainstream education?
REFERENCES


Authors’ Brief

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