

Development of Pedagogical Courseware for Mobile Learning System

Afolabi A.O.

Abstract- The Internet has brought a new lease of life to its subscribers who gain a wealth of information from it. Companies, Schools, Institutions gather information from the internet and even post information to the internet through their individual website.

The GSM phone has evolved from a mere talking device into a companion; it is used to communicate all sorts of information from one part of the world to almost any other part of the world. Recently mobile phones now come with the ability to connect to the Internet by the use of Wireless Access Protocol. This paper therefore is an attempt to discuss the work done on specification and design of M-learning for large audience in a virtual classroom environment by the use of Wireless Access Protocol). The pedagogical content serves as the courseware through mobile devices for the purpose of deploying learning in remote places in developing countries

Index Terms- Courseware, Mobile Learning System.

I. INTRODUCTION

M-learning is the term given to the delivery of training by means of mobile devices such as Mobile Phones, PDAs and digital audio players, as well as digital cameras and voice recorders, pen scanners etc[1].

It is a complement to both e-learning and traditional mode of learning, M-learning System is a process which allows students to learn at their own pace and convenience hence there is freedom of learning. It helps to meet the needs of student for greater individualization of instruction and improves efficiency in schools. M learning provides, through the internet a new channel for communication between distance learners and their tutor, and a new more economical way of getting materials. Technology has brought much comfort to the human race with the advent of mobile devices like personal digital assistants (PDAs), Laptops and GSM, Mobile phones, with the mobile phones lecturer can maintain contact with students, companies with clients, and friends. Also the great advancement in the use of mobile phones is now very possible to speak to one another over very long distances even browse the World Wide Web, it is known as mobile Internet. [2]

Afolabi A,O is a Senior Lecturer in the Department of Computer Science and Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.His research interest has been in E-Learning, Software engineering, Biometrics. Email address:aoafolabi@lautech.edu

The Mobile phone has evolved to be one of the most common companions that we see around today. Lecturers in institutions, workers, teachers, and students young and old are seen to move around with this small device everywhere.. This prompted the need for this study, so that there could be improvement in the use of M-Learning in order to make it much easier for learners to access instruction from their tutors at a distance.

II. METHODOLOGY

This project uses a topic in software engineering as learning content and the architecture of the whole system is based on the cocoon framework, which involves separation of content, logic, and management functions in an XML based WAP site.

The following methods will be used for the study

- Design of software by wireless markup language
- Consulting the internet for relevant material on M-learning wireless applications and recent development in wireless program development.

A. M-Learning

M-learning' is the follow up of E-learning which for its part originates from D-learning (distance education). M-learning is the delivery of learning to students who are not keeping a fixed location. The rapid growth of information and communication technologies (ICT) makes it possible to develop new forms of this education [4].

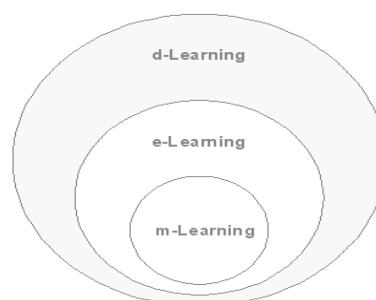


Fig .1 A scheme of learning forms

B M-learning Technologies

GSM

Global System for Mobile Communications (GSM) is one of the leading digital cellular systems. It uses narrow band TDMA (Time Division Multiple Access). Originally a European standard for digital mobile telephony, GSM has become the world's most widely used mobile system in use in over 100 countries. GSM networks operate on the 900 MHz

and 1800 MHz waveband in Europe, Asia and Australia, and on the MHz 1900 waveband in North America and in parts of Latin America and Africa. It provides integrated voice mail, high-speed data, fax, paging and short message services capabilities, as well as secure communications. It offers the best voice quality of any current digital wireless standard.

GPRS

A packet-linked technology that enables high-speed wireless Internet and other data communications. GPRS provides about four times greater speed than conventional GSM systems. Currently 288 operators around the world have commercial GPRS services.

BLUETOOTH

Wireless technology is a short-range radio technology. Bluetooth makes it possible to transmit signals over short distances between telephones, computers and other devices and thereby simplify communication and synchronization between devices

IEEE 802.11

This a type of radio technology used for wireless local area networks (WLANs). It is a standard that has been developed by the IEEE (Institute of Electrical and Electronic Engineers). Wi-Fi (802.11) is composed of several standards operating in different radio frequencies: 802.11b is a standard for wireless LANs operating in the 2.4 GHz spectrum with a bandwidth of 11 Mbps; 802.11a is a different standard for wireless LANs, and pertains to systems operating in the 5 GHz frequency range with a bandwidth of 54 Mbps.

Infra Red (IrDA)

This association defined a suite of protocols for infrared (IR) exchange of data between two devices, up to 1 or 2 meters apart (20 to 30 cm for low-power devices). IrDA devices typically have throughput of up to 115.2Kbps or 4Mbps.

C. Wireless Application Protocol (WAP)

This is a free, unlicensed protocol for wireless communications. It makes possible creation of advanced communications services and access to Internet pages from a cellular phone. It is a set of specifications for implementing services for wireless devices including mobile phones. It includes the following:

* Specifications for entire protocol stack, plus content specifications for XML based Wireless Markup Language (WML).

* Issues with security during protocol conversions from IP/HTTP to WAP stack WAP devices understand the WML language (an XML application) that is optimized for small screens and navigation without a keyboard. WAP also supports WML Script scripting language. On accessing a Web site using a WAP-enabled device the following events take place:

- You turn on the device and open the mini browser.
- The device sends out a radio signal, searching for service.
- A connection is made with your service provider.
- You select a Web site that you wish to view.
- A request is sent to a gateway server using WAP.

- The gateway server retrieves the information via HTTP from the Web site.
- The gateway server encodes the HTTP data as WML.
- The WML-encoded data is sent to your device.
- You see the wireless Internet version of the Web page you selected.

To create wireless Internet content, a Web site creates special text-only or low-graphics versions of the site. A Web server to a WAP gateway sends the data in HTTP form. This system includes the WAP encoder, script compiler and protocol adapters to convert the HTTP information to WML. The gateway then sends the converted data to the WAP client on your wireless device.

The WAP protocol stack

WAE - The Wireless Application Environment holds the tools that wireless Internet content developers use. These include WML and WML Script, which is a scripting language used in conjunction with WML. It functions much like JavaScript.

WSP - The Wireless Session Protocol determines whether a session between the device and the network will be connection-oriented or connectionless. What this is basically talking about is whether or not the device needs to talk back and forth with the network during a session. In a connection-oriented session, data is passed both ways between the device and the network; WSP then sends the packet to the Wireless Transaction Protocol layer (see below).

WTP - The Wireless Transaction Protocol acts like a traffic cop, keeping the data flowing in a logical and smooth manner. It also determines how to classify each transaction request: Reliable two-way, Reliable one-way, Unreliable one-way. The WSP and WTP layers correspond to Hypertext Transfer Protocol (HTTP) in the TCP/IP protocol suite.

WTLS - Wireless Transport Layer Security provides many of the same security features found in the Transport Layer Security (TLS) part of TCP/IP. It checks data integrity, provides encryption and performs client and server authentication.

WDP - The Wireless Datagram Protocol works in conjunction with the network carrier layer (see below). WDP makes it easy to adapt WAP to a variety of bearers because all that needs to change is the information maintained at this level.

Network carriers - Also called bearers, these can be any of the existing technologies that wireless providers use, as long as information is provided at the WDP level to interface WAP with the bearer.

Once the WAP client receives the information, it is passed to the minibrowser. This is a tiny application built into the wireless device that provides the interface between the user and the wireless Internet.

D. Wireless Markup language

WML has its roots in extensible Markup Language (XML). A markup language is a way of adding information to your content that tells the device receiving the content what to do with it. The best-known markup language is Hypertext Markup Language (HTML). Unlike HTML, WML is considered a Meta language. Basically, this means that in addition to providing predefined tags, WML lets you design

your own markup language components. WAP also allows the use of standard Internet protocols such as UDP, IP and XML. The content of a WML page is placed between WML tags within the document. WAP sites consist of cards rather than pages. Each card represents the text that will be displayed on the device's screen.

Table I: WML Card Attributes

Attributes for Cards	
Attribute	Description
Id	<p>The name of the card. This attribute acts as an anchor for navigating to the card. The name of the following card is "start".</p> <pre><card id="start" title="Juicy Studio"> <!-- Content of card --> </card></pre> <p>The card may be linked to from the same deck with:</p> <pre><go href="#start"/></pre> <p>If the card is in a different deck, the card may be linked to with:</p> <pre><go href="deckname.wml#start"/></pre> <p>If the card is the first card in the other deck, the card name may be omitted.</p> <pre><go href="deckname.wml"/></pre>
new context	<p>Determines whether or not a new context is initialized. If a new context is set, all variables are reset and the history stack is cleared. The possible values for this attribute are true or false.</p> <pre><card id="start" title="Juicy Studio" new context="true"> <!-- Content of card --> </card></pre>
onenterbackward	<p>Allows you to specify a URI to open if the card has been navigated to through a prey task.</p> <pre><card id="start" title="Juicy Studio" onenterbackward="#main"> <!-- Content of card --> </card></pre>
onenterforward	<p>Allows you to specify a URI to open if the card has been navigated to through a go</p>

	<p>task.</p> <pre><card id="start" title="Juicy Studio" onenterforward="#intro"> <!-- Content of card --> </card></pre>
ontimer	<p>Specifies the URI to open if the timer expires.</p> <pre><card id="start" title="Juicy Studio" ontimer="#nextcard"> <!-- Content of card --> </card></pre>
title	<pre><card id="start" title="Juicy Studio"> <!-- Content of card --> </card></pre>

III. SYSTEM ANALYSIS AND DESIGN

Web Architecture

The Internet is a gigantic collection of millions of computers, all linked together on a computer network. The network allows all of the computers to communicate with one another. In general, all of the machines on the Internet can be categorized as two types: servers and clients. Those machines that provide services (like Web servers or FTP servers) to other machines are servers. And the machines that are used to connect to those services are clients.[3]

Internet servers make the Internet possible. There are Web servers, e-mail servers, FTP servers and so on serving the needs of Internet users all over the world. When you connect to <http://www.yahoo.com/> to read a page, you are a user sitting at a client's machine. You are accessing the Yahoo Web server.

Web servers

Web servers are machines that handle request for web pages from clients. Examples include Apache web server by the Apache Software foundation group and Internet information server by Microsoft. The following steps occur when a URL, say "http://www.yahoo.com/login.htm", is typed in the address bar of a client browser:

- The browser breaks the URL into three parts:
 1. The protocol ("http")
 2. The server name ("www.yahoo.com")
 3. The file name ("login.htm")

In recent times new technologies such as the Apache Cocoon and other web publishing platforms have been developed to ease the problems associated with using scripts.[4] Most of these web-publishing platforms are based on XML.

XML

XML is a meta-language which is a language that's used to define other languages. XML is used to aid the exchange of data. It makes it possible to define data in a clear way.

Both the sending and the receiving party will use XML to understand the kind of data that's been sent. By using XML everybody knows that the same interpretation of the data is used. You can use XML for instance to define a language like WML (Wireless Markup Language). It offers the following possibilities:

- Ability to define data structures
- Make these structures platform independent
- Process XML defined data automatically
- Define Your own tags

XSL

If XML is about defining data, XSL (eXtensible Style sheet Language) is used to make XML documents understandable to humans; XSL can convert XML documents into HTML, WML or even PDF. It can be used client side but the best solution is to use XSL server side. XML documents can be converted into WML, thus making them visible to any WAP enabled browser.

The Cocoon Framework

The Cocoon project was created to solve the problem of Separation of content, style, logic and management functions in an XML content based web site as shown below:



Fig 2 The Apache Cocoon Pyramid Model

It has the following Basic mechanisms for processing XML documents:

- Dispatching based on Matchers.
- Generation of XML documents (from content, logic, Relation DB, objects or any combination) through Generators
- Transformation (to another XML, objects or any combination) of XML documents through Transformers
- Aggregation of XML documents through Aggregators
- Rendering XML through Serializes

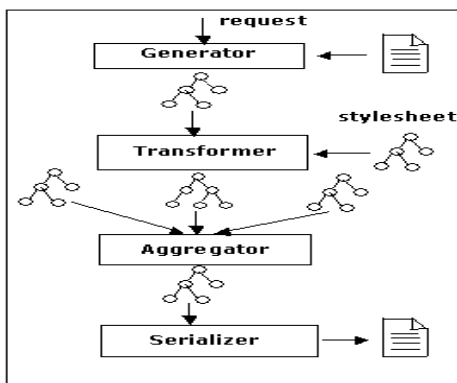


Fig 3: Basic Mechanisms of the Cocoon framework.

The following interactions occur when a page is requested:

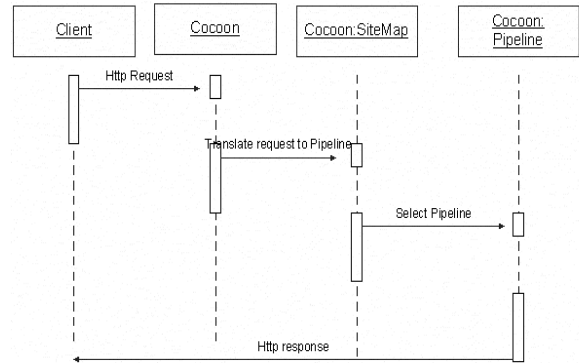


Fig 4: Interaction Sequence

The Sitemap contains configuration information for a Cocoon engine: List of matchers, • List of generators, • List of transformers

- List of readers, • List of serializers • List of selectors
 - List of processing pipelines with match patterns
- Sitemap is an XML file corresponding to a sitemap DTD. Sitemap can be edited to add new elements. Sitemap is generated into a program and is compiled into an executable unit.

System Design

The design of the m-learning is based on the client – server architecture where the clients are the mini-browsers on the mobile devices, and the server hosts the web server containing the Cocoon application.

System Requirements

For the system to function properly it must meet the following specifications must be met for the server and client respectively.[5]

Hardware Configuration For Server

- ❖ Intel Pentium M 1.13 GHz (MMX) or Higher ,At least 256 MB RAM
- ❖ 500 MB of storage on hard disk depending on size of learning content.

Software Configuration For Server

- ❖ Apache Tomcat Web Server v5.5.12
- ❖ Windows XP operating system.
- ❖ Cocoon WAR file.

Software Configuration for Client

- ❖ WAP –Enabled mini-browser or Simulator

System Overview

As can be seen in the figure below, the m-learning system is based on the Apache Cocoon framework which is an application that runs on the apache web server

When the user types in the appropriate URL in the address bar of the simulator, a request is sent to the web server and the requested page is generated and returned to the browser simulator and is displayed appropriately.[6]

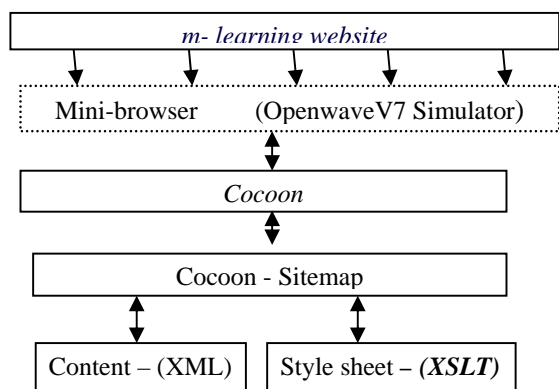


Fig 5: System Overview

IV. IMPLEMENTATION

The following screen shots capture various user scenarios associated with the system.



[1]

Figure 6: Home page of Mobile Learning software showing a course been taught.

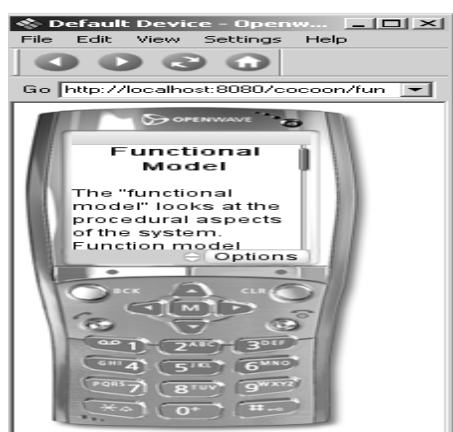


Fig 7 Screenshot of Functional Model on Mobile Phone



Fig 8 Screenshot of Data Model on Mobile Phone

V. CONCLUSION

As the world goes wireless by the day, individuals in this part of the world can now maximize the use of their mobile while at the same time student can have a better experiences at information retrieval.[7]

With this development it is possible to facilitate learning by the use of mobile device as we could see the design by the emulator of an handset. With this development there can be communication between the students and his facilitator by the use of the mobile devices which is an improvement upon E-Learning.

REFERENCES

- [1] *Mobile -Learning*, [Online] available at "<http://en.wikipedia.org/wiki/M-learning>", September 2006.
- [2] "*How wireless networking works*",[Online] Available at "<http://www.howstuffworks.com/wireless-internet.htm>", September 2006
- [3] "*M-learning a new stage of E-learning*",[Online] Available at <http://ecet.ecs.ru.acad.bg/cst04/Docs/sIV/428.pdf>.
- [4] Georgiev, T., E.Georgieva, A.Smrikarov.(2004)Journal of International Conference of Computer Systems and Technologies-CompSysTech,
- [5] "*Wireless Markup Language (WML) Tutorial*",[Online] Available at <http://www.developerfusion.com/>"
- [6] Open Wave [Online] available [http:// www.openwave.com](http://www.openwave.com).
- [7] Web Design Details. [Online] Available at www.about.com/webdesign.