Designing Learning Objects using Ontology

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Abstract— E-learning facilitates a lot more than online learning, virtual learning and distributed learning. E-learning incorporates all educational activities that are carried out by individuals or groups working online or offline. The growth of e-learning is directly related to the increasing access to information and communications technology, as well it's decreasing cost. From e-learning, the user finds useful information about any domain areas. Though e-learning plays a critical role for providing information to users, it is necessary to identify and design the e-learning or m-learning system semantically over semantic web. The web based learning systems deal with numerous kinds of data but they don't maintain consistency and semantics in data. Here in this paper we have identified learning objects based on contexts for an e-learning or m-learning system.

Index Terms—About four key words or phrases in alphabetical order, separated by commas.

I. INTRODUCTION

E- learning is the process of learning educational content on desktop based systems where as M-learning is the ability to obtain or provide educational content on personal pocket devices such as PDAs, smart phones and mobile phones. Educational content refers to digital learning assets which includes any form of content or media made available on a personal device. Because of their relatively low cost and accessibility in low-income communities, handheld devices can help the advance digital equity, reaching and inspiring populations at large, children from economically disadvantaged communities and those from developing countries.

M-learning hardware may include mobile phones, handheld PCs, tablets, the iPad, and net books as well as devices such as the iPod touch that are able to run mobile applications. Because m-learning utilizes a variety of devices, many of which are ever-present in the lives of students, it can encourage student engagement in learning and offer opportunities to make learning integral to their daily life.

II. LITERATURE REVIEW

A. Various Modalities in e-learning

The various modalities of e-learning activities are discussed as given below (Naidu, 2003)[1].

Individualized self-paced e-learning online: It refers to situations where an individual learner is accessing learning resources such as a database or course content online via an Intranet or the Internet. A typical example of this is a learner studying alone or conducting some research on the Internet or a local network Submit your manuscript electronically for review.

Individualized self-paced e-learning offline: It refers to situations where an individual learner is using learning resources such as a database or a computer-assisted learning package offline (i.e., while not connected to an Intranet or the Internet). An example of this is a learner working alone off a hard drive, a CD or DVD.

Group-based e-learning synchronously: It refers to situations where groups of learners are working together in real time via an Intranet or the Internet. It may include text-based conferencing, and one or two-way audio and videoconferencing. Examples of this include learners engaged in a real-time chat or an audio-videoconference.

Group-based e-learning asynchronously: refers to situations where groups of learners are working over an Intranet or the Internet where exchanges among participants occur with a time delay. Typical examples of this kind of activity include on-line discussions via electronic mailing lists and text-based conferencing within learning managements systems.

B. An e-learning model:

Here the fig-1[2], shows an e-learning model which is associated with various elements such as learning activity, learners, learning advantage, intended outcomes, physical context, social context and curricular context. Social context includes communities of practice, group identification, attitude, values and belief.

In this context teachers will recognize that when students work collaboratively to assist one another and take on expert roles. Teachers will consider strategies that they can use to build learning communities and to enhance their learning strengthened, reinforced and refined. Collaboration is highly supported for mobile learning. The mobile learning technology [3], removes borders and allows learners to collaborate with peers to peer learning around the world, how and when they want to. Mobile learning environment includes interactions such as learner–to-content, learner-to-teacher, learner-to-learner interactions and learner to interface interaction. These interactions are highly supported by mobile technology and can be utilized quite effectively in a mobile learning environment.

Learner-to-Content interaction plays a key role in forming ways of thinking for the learner that will facilitate learning.

Learner-to-Teacher interaction is a motivational and facilitation role in learning as well as providing a supporting role. Learner-to-Learner interaction allows for more collaborative to take place. Learner-to-interface interaction is about the learner's experience with the mobile learning and the quality of it.

The curricular context [4],associated with the content, teaching/learning methods, assessment and learning resources in e-learning. This context [5], usually defines the learning that is expected to take place during the programme of study in terms of knowledge, skills and attitudes. It also specifies the main teaching, learning and assessment methods and provides an indication of the learning resources required to support the effective delivery of the course. The physical context in e-learning deals with resources, tools, facilities and services.

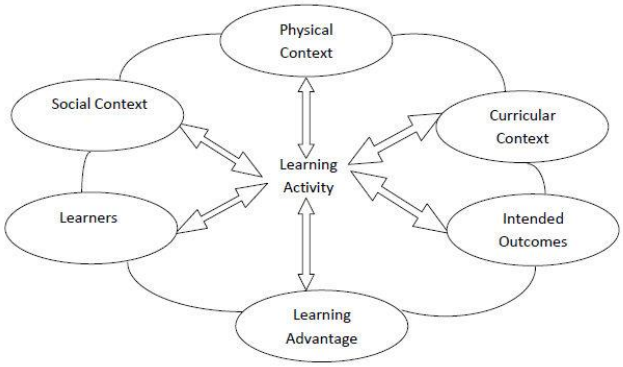

Fig.1 An e-learning model

C. M-learning Model:

The Venn diagram [6], aptly represents the three aspects of mobile learning, Device, Learner and Social. The Device aspect refers to the various capabilities of the mobile device that includes its specifications, physical and functional characteristics. These characteristics have a significant impact on the usage habits of the learner and therefore require a comprehensive investigation before being implemented. Acting as a bridge between human being and technology, devices should be designed for
maximum comfort.

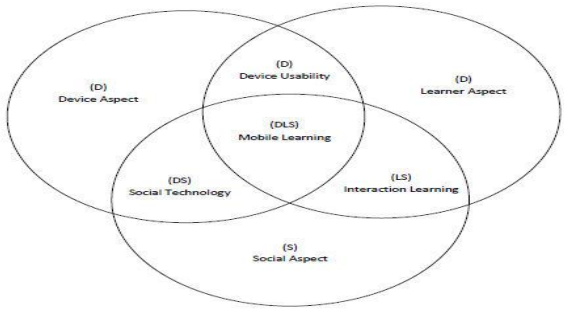

Fig.2. M-learning model

III. IDENTIFICATION OF LEARNING OBJECTS

For getting information in a web based ubiquitous under learning domain, it is important to design learning systems semantically or meaningfully. At first, it is required to determine the learning objects in an e-learning or m-learning system. The learning objects are identified and classified under some specific components which is shown in table-1.

Leaning Objects	Attributes
Device	1.Keyboard 2.Type of device 2. Screen size 3.Screen resolution 4.Mouse 5. Monitor 6. Gestures
Learner	1. Learner profile 2. Learner's preference 3. Learner's cognitive, physiological states 4. Learning style
Learning Content	1. Text file 2. PDF file 3. Audio File 4. Video File

Table.1 Identification of learning objects

A. As it is shown in table-1, e-learning or m-learning include mobile devices or desktop based systems as learning in which learning occurs. Mobile learning is impossible without learning components or mobile devices. These devices vary in features, size and ability. These learning objects include mobile phones, PDA and tablets. The physical characteristics of these devices include size, weight, configured technology and one hand or two hand operability. These physical characteristics enable the user, how it can manipulate the device and move around while using the device. The input mechanisms includes using of keypad, touch screen, pen/stylus, swipe types that allows to position and selection of objects and data on the mobile device. The output mechanisms include using of screen, speakers and other audio/visual methods to allow the human body to sense changes in the device and also allow the user to interact with the device.

B. The learning object includes learner which consist of some attributes such as learner profile, cognitive, physiological and preferences. The learner profile includes learner's personal information such as name, age, address, goal and profession. The preference contains information about the learner's preferences including learning style and learner's intention. Physiological and Cognitive states are related to the learner's physical and cognitive characteristics or abilities. A learning style is a particular method of learning to an individual that is presumed to allow that individual to learn best. Learning styles can be

defined as characteristics which are cognitive, affective, physiological behavior that serves as relatively stable indicators of how learners perceive, interact with and respond to learning environment. Each learner has its own learning style and preferences that can help him/her to accelerate his/her learning process.

Learning styles can be classified into some dimensions such as active, reflective, sensing, Intuitive, visual, verbal, sequential and global. Active learning style refers to the learner preference on actively processing information on the learning content. In reflective learning style, the learner has the preference to read and think about the learning content. Sensing learning style refers to the learner preference in reading concrete material such as facts and data. Intuitive learning style refers to the learner preference in reading abstract material such as theories and concepts on the learning content. Visual and verbal learning styles refer to the learner preference in reading pictures, images and texts on the learning content. Sequential learning style also called as bottom-up style where the learner focuses on the narrow details first and brings them together to form the larger picture. Global learning style also called as top down style where the learner finds easier to learn by

C. The learning content is another learning object which is the central element in the success of any mobile or e-learning application because it determines whether the learner fully engage in the learning experience. The mobile learning application must be able to support all relevant file formats and content types so that learner could access all required content seamlessly. The learning content delivered to the learner is of any format that includes text, audio, video, animation or slide show. The determination of format of learning contents is made by sets of constraints such as display, screen size, processing power, memory and location of the mobile device or learning objects having the overall picture and getting the details.

IV DESIGNING LEARNING OBJECTS OVER SEMANTIC WEB

A. Ontology in Web

Ontology represents semantics, concepts and relationships among the data in web. Ontology-driven applications [7], exhibit features such as expressiveness, extensibility, ease of sharing and reuse and logic reasoning support. To achieve interoperability and knowledge in a shared schema, ontologies are used in web any based application domain [8]. The ontology is the combination of classes, subclasses, axioms, relations, functions and instances which designs data in a meaningful way. Hence ontology provides a well founded mechanism for the representation and reasoning of information from the web [9]. Also ontology-based approaches have been used for enquiry-based learning activities in recent projects like the Concept map Learning System (CLS) and the Science Created by You (SCY) project [10].

B. Ontology in learning domain

Now–a-days OWL ontologies are used in any web based information system which improves the information retrieval by designing the data consistently and semantically on web. It is because OWL ontologies allow building several classes, subclasses, relation/property and defining class axioms and property restrictions in any domain. The OWL ontologies can be used in e-learning or m-learning information system to deliver semantic information to users. After identifying the learning objects, these learning objects are used in learning domain for consistent and semantic retrieval of data.

V. BUILDING ONTOLGY FOR LEARNING DOMAIN IN OWL DL

OWL DL stands for web ontology language description logic which is a sublanguage of OWL and provides logics for formal description of concepts and roles. Here concepts in ontology describe a set of individuals and role defines the relationship/property holds among them. Semantically these logics are found in predicate logics and have efficient decidability to build knowledge base information system or ontology.

Here we have built ontology based on learning domain and define various classes and design them in the class hierarchy. In this learning ontology we have taken the classes such as Device and the attributes are taken as subclasses such as device type, screen size and gestures. Similarly the learning object LearningContent can be considered as class and it's attributes text file, audio, video file can be treated as sub classes which form the learning ontology.

A. Building disjoint classes

The classes are made disjoint class so that simultaneously the instance of one class can't be the instance of another class. It is done with the "&owl;AllDisjointClasses". For example the subclasses of class LearningContent are made disjoint such

that an individual of TextFile can't be an individual of AudioFile. This can be represented in OWL DL by the following syntax as follows

1) Syntax:

DisjointClasses(TextFile,PDF,AudioFile,VideoFile):
TextFile∩PDF∩AudioFile∩VideoFile= { }

2) OWL description logic in Protégé 5.0:

```
<rdf:Description>
<rdf:type rdf:resource="&owl;AllDisjointClasses"/>
<owl:members rdf:parseType="Collection">
<rdf:Description
rdf:about="http://www.semanticweb.org/ontologies/201
5/2/untitled-ontology-98#TextFile"/
<rdf:Description
rdf:about="http://www.semanticweb.org/ontologies/201
5/2/untitled-ontology-98#PDF"/>
<rdf:Description
rdf:about="http://www.semanticweb.org/ontologies/201
5/2/untitled-ontology-98#AudioFile"/>
<rdf:Description
rdf:about="http://www.semanticweb.org/ontologies/201
5/2/untitled-ontology-98#VideoFile"/>
</owl:members>
```

</rdf:Description>

VI. CONCLUSION

Although there exists e-learning and m-learning information systems, but they are not designed in a meaningful manner. Also these learning information systems don't identify learning objects. Here in this paper we have identified learning objects and their attributes. Further these learning objects are designed semantically using ontology where we build the learning ontology. In this learning ontology, learning objects are modeled as classes and their attributes are designed as sub classes. The classes and the subclasses are designed semantically through property axioms and class axioms using OWL DL in protégé framework.

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