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User centric model of E-learning to build up virtual learning environment

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Abstract: ***Knowledge Society, the warehouse of knowledge has its origin in knowledge management, comprising of knowledge acquisition, knowledge sharing, knowledge distribution, knowledge transfer, etc. Learning sciences being the sources of knowledge management, the automated teaching and learning environment e-learning can be a pragmatic approach for knowledge management. Distance learning being the predecessor of e-learning, Information and and Communication Technology (ICT) plays the major role in in the e-learning pedagogy. In this paper, we have proposed a new model for e-learning which will be more user-centric and a useful tool to build Virtual Learning Environment (VLE) which is the container of the knowledge society. The VLE is structured from the components of the e-learning system such such as the end-users, the learning and teaching methodologies, infrastructure, learning resources, etc. The proposed component-based model is a Service-Oriented Architecture (SOA) which aims at empowering the learning technology for the creation of knowledge society. The distributed approach of SOA can help to overcome the limitations of the existing models by incorporating two new functional components such as ICT Orientation Module (IOM) and Pre-Enrolment Module (PEM) and reconfiguring the other functional components such as Interface Management Module (IMM), Rule Management (RM), Role and Security Management (RSM), etc. With the incorporation of the above said new components, the present Learning Management System (LMS) will be more dynamic, user-centric and interactive to attract the novice users towards e-learning. On the other hand, this proposed model shall definitely be a milestone for creating a knowledge society.***

Keywords: Knowledge Society, E-learning, Virtual Learning Environment, Adaptation, Service-Oriented Architecture, Learning Management System.

1. INTRODUCTION

It is being sensitized that knowledge is increased at an incredible speed in this modern technical world due to which mankind is in need of efficient and better Technology Enhanced of Learning (TEL) methods. In this regard, e-learning i.e., the learning through World Wide Web (WWW) plays a vital role for creating online learning. E-learning refers to learning and teaching through digital or electronic means which enables the knowledge and performance [1]. E-learning is the replacement of classroom learning eliminating the timing, and traveling expense constraint. So, distance education is considered as the predecessor of e-learning. E-learning, a part of learning process is included in the e-education. In contrast to synchronous approach of classroom learning, the asynchronous distance learning may offer the course to the learners residing at different locations. This teaching can take place in real time, in the form of virtual lecture, or asynchronously in the form of programmed objects and activities across several modalities, audio files, streaming video, pictures, text, live interaction with artificial humans or 'chatbots', quizzes, problem-based learning, student seminars, lecture material, interactive surveys, games, quests, assessments and blended learning with existing web-based resources. [2]. Thus network space is changed to be a society space [3]. This society space leads to the creation of knowledge society. To overcome the limitations of the existing models, a simple client/server model of e-learning system has been proposed. At present, the groupware management or collaborative learning part has not been included in the proposed model, in fact, the proposed model is assumed to function for a single client. Thus, this proposed model can be compared with a balloon which can be expanded to adopt new features but to a certain extent.

2. THE EXISTING E-LEARNING FRAMEWORKS

2.1 General architecture of e-learning

In 2003, Siqueira, Braz and Melo proposed a general architecture that supports the content reusability and learning content interoperability to develop a flexible e-learning system [4]. The architecture is a "semi-complete" framework of e-learning as shown in Figure 1.

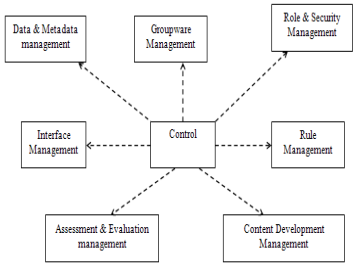

Figure 1 The existing e-learning framework

The strategy is to develop systems from the above framework using component configuration mechanism in order to create a more adaptive system to achieve the pedagogical and didactic goals.

2.1.1 Limitations of the existing framework

In general, the deployment of e-learning architecture consists of two logical divisions: a client side and a server. All the components should be very clearly divided into these two parts while building the e-learning system. The existing framework does not provide any distinction between the client and the server which creates confusion for the researchers. The model lacks in describing the logical relations among the components to create a user-centric view.

2.2 The Adaptive e-Learning with Eye Tracking(AdeLE) Architecture

In 2008, Christian Gütl introduced the AdeLE architecture shown in Figure 2.

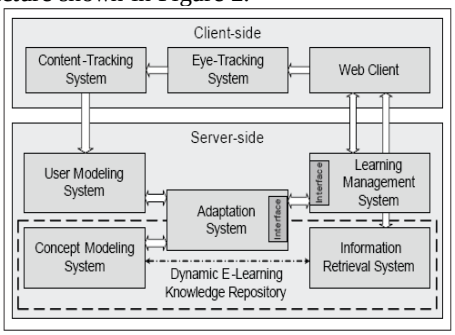

Figure 1 Overview of the AdeLE architecture

The AdeLE architecture overcomes the limitations of the previous framework by distinguishing the client and the server side architecture so also providing a clear picture of the components. It presents the teaching and learning methodology beautifully. It uses the eye-tracking and content-tracking mechanism in the client side to measure student's cognitive activity and delivering learning content in one-fit-for-all approach to students. This distributed SOA helps in fulfilling the abstract requirements such as (1) flexibility in terms of the support of various teaching and learning activities as well as the support of different e-learning standards, (2) openness for utilization and inclusion of existing systems, and (3) interchangeability of learning resources with the aspects of organizational information security, reliability and scalability. It instead includes a variety of didactic aspects and cognitive characteristics [5].

2.2.1 Limitations of AdeLE architecture

AdeLE architecture has focused on both learner's view and instructor's view. The teaching and learning styles are beautifully configured. As the environment is completely new for a novice, and she/he has no idea about the use of ICT, so many learners will definitely be disinterested for taking the course. It also does not provide any pre-enrolment procedure to measure the cognitive activity of the learner prior to taking the course. It would seem that e-learners should be provided with relevant training prior to enrolment to avoid any difficulties, especially for individuals without much ICT background [6]. Carr (1999) mentioned that the lack of ICT skills is one of the barriers in e-learning training. As the learner directly enters into the course, due to technical problems, or financial or any other problems drop out rate may increase. The protocols, roles, security features and the interface management features such as assessment and evaluation system, the different phases of content development management in the LMS are not focused in the AdeLE architecture. In this way, AdeLE lacks to have user-centric view. The lack of personal contact demotivates the learners and increases the drop-out rate [6]. The poor design of interface management may demotivate the learners.

3. PROPOSED MODEL

Clear guidelines and a good interface management can attract the users towards e-learning. The proposed model given in Figure 3 below provides a clear picture among all the logical units with their functionalities and the interface management is configured very elaborately to make the model more user-centric.

- Differentiation between traditional classroom learning and e-learning.
- Idea about synchronous and asynchronous modalities of learning.
- Gives a clear idea about ICT.
- Elaborates the concept of e-learning and VLE.

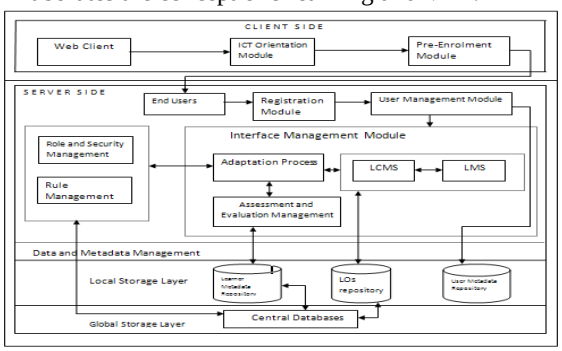

Figure 3 Proposed e-learning model

The existing models have been expanded to handle the protocols, reliability, scalability, and security, etc. So,

instead of creating a new environment, the present environment is re-configured to create an adaptive system in the proposed model [4].

4. CLIENT SIDE ARCHITECTURE

4.1 ICT Orientation Module (IOM)

• The client side of the proposed model is composed of two basic modules such as IOM and PEM. The IOM enables any novice user to acquire fundamental knowledge about ICT to attract the novice towards the e-learning course. IOM is an audio-visual system and is a front-end to the browser.

4.2 Pre-Enrolment Module (PEM)

The PEM is just like the mirror image of an information brochure. It gives a clear picture about the pre-enrolment procedure of e-learning course to measure the cognitive activity of the learner to cope up with the e-learning course. The PEM has three logical units presented as Stage 1, Stage 2 and Stage 3 and each unit has its own set attributes. Each stage has a number of attributes and for certain attributes set of choices are given and the learner has to opt his choice. After completion of one stage the learner will enter into the next stage. The attributes of the various stages are the following:

Stage 1:

- Medium of Instruction (Language)
- Course Duration
- Course Types
  - Free Course
  - Paid Course
- Qualification
- Fee Structure Range
- Preferred mode of payment
  - On-line payment
  - One time payment
  - Instalments

Off-line payment
  - One time payment
  - Instalments

Stage 2:

- Course categories
  - Core Categories
  - Elective Categories
  - Subcategories
- Course Structure & Course Features

Stage 3:

- Credit Points
- Marketability
- Time Expansion
- Change of course

Cafeteria approach

The design of PEM is given in Figure 4 below:

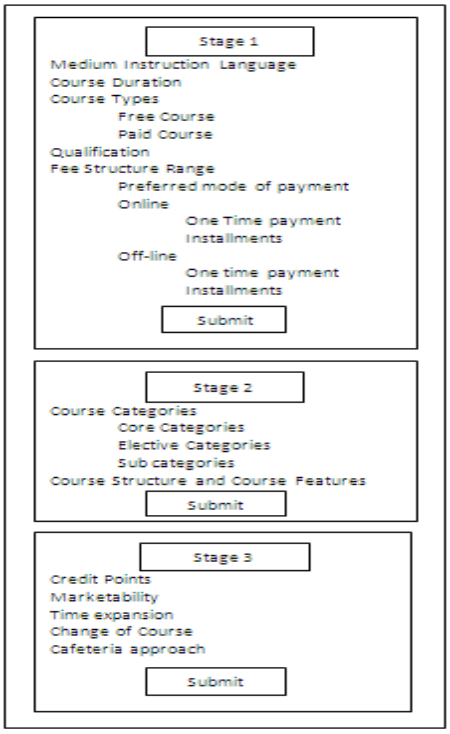

Figure 4 Structure of Pre-Enrolment Module

In stage 1, each attribute has number of choices from which the learner can opt either one or multiple choices. In stage 2, the core category contains the compulsory courses, the elective category contains list of optional courses from which the learner can choose as per his interest. The subcategory contains the free packages for certain paid courses of stage 1 but not for all courses, which the learner can get if she/he has opted the free course option in stage 1. The free packages are provided as per the choices the learner has given in paid course in stage 1. The "cafeteria approach" in stage 3 is a combo package offered with some of the courses to motivate more number of learners. "Continuing Education Programme should be targeted at those who have had the benefit of university education but need to return, either for updating knowledge or skills or acquiring new skill... In this regard, the "cafeteria approach" is the best method. As introduced in the University of Kerala, the "cafeteria approach" to education -offering education in manner most needed by various sections of society. According B. Vijayakumar, the cafeteria approach should be of three-fold. First, to enable current students of the university to upgrade their job-earning skills, second, to enable unemployed youth to acquire skills for gaining employment and last, to provide those who are employed in various jobs a new set of skills so that they get a deeper understanding of their current job.

Basically, the certificate courses fall under the cafeteria approach like the IT-based courses such as "Hardware Management" and "Office Automation" fall under this

category [7]. Upgradation of certificate is also an important aspect of cafeteria approach. For example, the learner can get any integrated degree for example, BBA and MBA with financial benefits if opted for cafeteria approach. So that if the learner quits in between after completion of one course, he/she can get the certificate. But if not opted for cafeteria approach, and registered for the integrated course, and quits in between, then the learner cannot get the certificate.

5. SERVER SIDE ARCHITECTURE

To process the requests of the client side, the server side architecture is configured with the following components:

5.1 Registration Module (RM)

All the users have to register to be a part of the system. Separate registration forms are available for learner and the other type of users. The user has to click on the desired link as shown in figure 5 below to enter into the registration process.

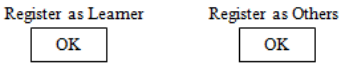

Figure 4 Structure of Pre-Enrolment Module

At present the sample of learner registration form is given in Annexure – I.

The design of registration form of other role playing users mentioned in the RSM are kept for future scope. In the learner case, the learner data is already filtered in between the PEM and RM by applying AI techniques. The learner only enters into the registration procedure based upon certain pre-defined automated filtered eligibility criterion after the completion of pre-enrolment procedure.

5.2 User Management Module (UMM)

Each user is identified with a unique ID, to which roles can be assigned with distinct privileges [8]. The different types of user are the students, instructors, instructional designers (IDs), Subject Matter Experts (SMEs), etc. The UMM accepts the required data from the RM. Any individual user can also be assigned with multiple roles. For example, any author can be the instructor.

5.3 Interface Management Module (IMM)

IMM is the interface between the learner and the learning system. This enables the learner to access to the learning resources and enables the course creators to make the course available in the www for use of the learner. The IMM is logically divided into 3 modules: Adaptation Process (AP), Learning Management System (LMS), and Assessment and Evaluation Management (AEM).

5.3.1 Adaptation Process (AP)

The AP is the heart of the server side. The AP centrally controls the logical flow among all the components of the entire server side processing. The AP establishes a communication gateway among all the components of the server side. An adaptive e-learning system adapts and processes all the users' requirements such as any modification of learning content if identified by the Subject Matter Expert (SME) and is to be done by the content developer. Any other changes in the system as per students' feedback and other learning related issues are based upon certain rules decided by the expert system. The adaptation process is the controlling engine of the LMS as a result the LMS delivers the user-adapted content to the client-side [5]. The rules for teaching and learning process defined in the rule management module are implemented at the time of development of the system and being controlled by AP. The role management module allocates the roles to different types of users as per the user data stored in the UMM.

5.3.2 Learning Management System (LMS)

The LMS is a software application for the administration, documentation, tracking, reporting and delivery of education courses or training programs [9]. Being the brain of learning services, LMS is the interface between the student and the learning environment. It interacts directly with the UMM to allow the student to access the learning resources as per their privileges mentioned in the UMM. More recently, organizations involved in e-learning have invested in LMSs to deliver content in Web-based learning environments that may include a variety of synchronous and asynchronous communication channels (e-meil, chat, discussion boards, whiteboards, group-surfing Voice-Over-IP, etc.) and instructional support tools (grade books, student tracking, etc.) [10]. The Learning Content Management Service (LCMS) is embedded in the LMS and responsible for online course content development.

5.3.2.1 Learning Content Management System (LCMS)

Learning contents are embedded in LCMS in form of digitized modules referred to as Learning Objects (LOs). LO is a knowledge object that has been contextualized to the domain of learning – including a learning objective [10]. Inside the LMS, the development of course material is done by the Learning Content Management System (LCMS) that facilitates storage, reuse, manage and deliver digital learning content through a central repository with its mirror image in local repository. A LO is a knowledge object that includes relevant learning metadata objectives, content, activities, and assessment [10].

5.4 Assessment and Evaluation Management (AEM)

Assessment and evaluation is one of the most important functions of LMS and relevant to LO. It is the measuring factor of the learner, the instructor and the course in any educational modalities. Technically, assessment and evaluation is difficult in distance learning course. A comprehensive assessment taxonomy would accommodate

not only the types of questions used (multiple choice, fill-in-the-blanks, problem, essay, case study, etc.) assessment criteria and rubrics, meta-cognitive factors, and integration across multiple objectives [10]. In this regard, more enhanced assessment and evaluation techniques are to be introduced in the proposed model by the application of Artificial Intelligence (AI) techniques.

Assessment refers to measuring the learner's performance and evaluation refers to measuring the quality of the course. The term evaluation is used relevant to evaluation of course and programmes, and assessment is used relevant to evaluation of student learning [11]. The two types of assessments are: (1) Formative assessment and (2) Summative assessment. Formative assessment is done phase-wise and summative assessment is the collective assessment done after completion of the course. Evaluation is performed by taking learner feedback about the course.

5.5 Rule Management (RM)

Protocols play vital role in the development of e-learning system. Some protocols must be mentioned in the rule management unit for the adaptation of the proposed e-learning system. Some set of rules are incorporated which can be expanded to a certain end to include new set of rules. AI Techniques can be used to implement the logic of the rules at the time of development of e-learning system as per the user data in the UMM based upon certain logic. Some of the general rules are given below [12][13]:

- Rule 1: Don't create the course.
- Rule2: Treat your audience as king.
- Rule 3: Spread ideas and people.
- Rule 4: Understand your objective.
- Rule 5: Free up the navigation and help them see what you're saying.
- Rule 6: Don't push, Let the learner pull.
- Rule 7: Consider the pacing & flow.
- Rule 8: Get inspired outside of e-learning.
- Rule 9: Practice. Design not decoration.
- Rule 10: Commit to engaging e-learning.

5.6 Role and Security Management (RSM)

Most significantly, the term role should be very clearly explained. Role in an e-learning system refers to the various types of functions assigned to the end-users. The stakeholders of the system are known as the "end-users". The different types of stakeholders are the following:

- Curriculum sponsors
- Instructional Designers (IDs)
- Developers
- Authors
- SMEs
- Learners
- Administrators

The roles of each type of end-users should be very clearly addressed by the system. Since, e-learning is the replacement of traditional learning, contrast to classroom learning, where roles are assigned manually, in an e-learning environment, the role management is an automated logical unit in which roles are assigned to each and every end-user/stakeholder by using AI techniques.

The Administrator is solely responsible to handle the security features. The administrator has the right to authenticate the users and assign privileges to the users. For example, the administrator authenticates the learner and gives the privilege to only read any learning resources which are in read-only mode, but at the same time, the administrator authenticates the author of the content gives the privilege to modify the content.

5.7 Data and Metadata Management (DMM)

It has two logical divisions: the local storage layer and the global storage layer.

5.7.1 Local Storage Layer

Mirror images of the central repository in particular are stored in the local storage layer. In case, there is any crash happens in the global storage layer data can be recovered from the local storage layer. Copy of some databases such as rule and role databases are not kept in the local repository, only the databases of frequently changeable units such as LMS, AEM and UMM are kept in the Local Storage Layer.

5 Global Storage Layer

The global storage layer is the huge repository known as the data warehouse of the entire system. Information can be retrieved from the warehouse by using intelligent mining technique.

6. ADVNTAGES OF THE PROPOSED MODEL

The proposed model establishes transparent logical relationship between all the functional units of the e-learning system. The functionalities of all the components are described clearly which in order to diminish the drop out rate of the learners. With the incorporation of new components along with the reconfiguration of the existing components, the proposed model can enhance learning, otherwise learning outcomes may be unsatisfactory.

7. CONCLUSION

Several models have already been proposed for e-learning. We have proposed a model, based on intelligent web techniques and intelligent mining techniques, and the introduction of IOM & PEM enables the people around the globe to know about the emergence of e-learning and its usefulness. The interaction between the learner and VLE system be a step for revolutionize the e-learning system. As the knowledge society is meant to globally educate the mankind, so the emerging trends of Life Long Learning (LLL) acts as a pillar to form knowledge society. It is being realized that e-learning is the root of LLL and includes the two broad categories of

end-users/stakeholders i.e., the front-end users are the learners and back end users are the rest six types of users, both categories of the citizens together form the knowledge society. Looking into the limitations of the proposed model, at present groupware management is not included in the system to support collaborative learning and that we have kept for future scope. Hopefully in this proposed model, we have enlightened the potentiality of e-learning to create a user-centric environment. In fact, the VLE can be an excellent platform for knowledge management process in order to create a knowledge society.

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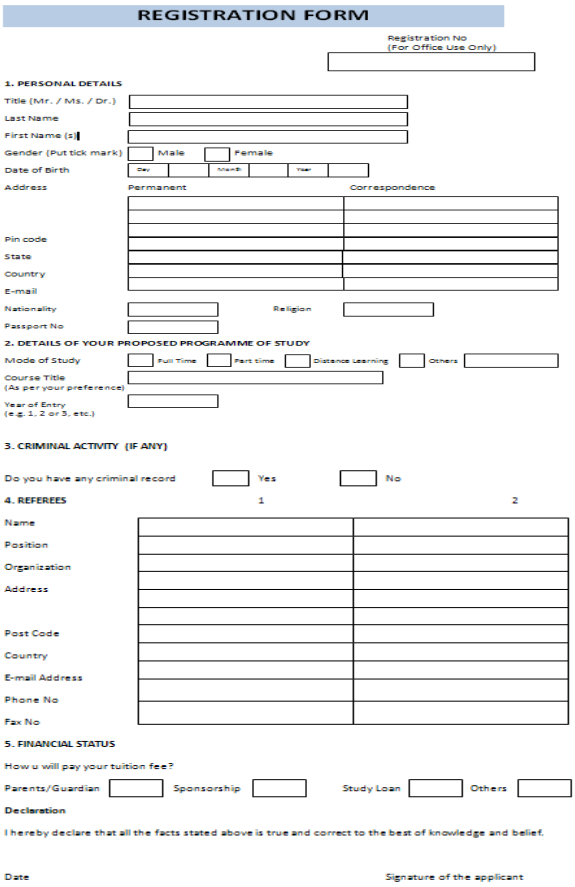
ANNEXURE – I



REGISTRATION FORM

Registration No
(For Office Use Only)

1. PERSONAL DETAILS

Title (Mr. / Ms. / Dr.)
Last Name
First Name (s)
Gender (Put tick mark) Male Female
Date of Birth Day Month Year
Address Permanent Correspondence
Pin code
State
Country
E-mail
Nationality Religion
Passport No

2. DETAILS OF YOUR PROPOSED PROGRAMME OF STUDY

Mode of Study Full Time Part time Distance Learning Others
Course Title
(As per your preference)
Year of Entry
(e.g. 1, 2 or 3, etc.)

3. CRIMINAL ACTIVITY (IF ANY)

Do you have any criminal record Yes No

4. REFEREES 1 2

Name
Position
Organization
Address
Post Code
Country
E-mail Address
Phone No
Fax No

5. FINANCIAL STATUS

How u will pay your tuition fee?

Parents/Guardian Sponsorship Study Loan Others

Declaration

I hereby declare that all the facts stated above is true and correct to the best of knowledge and belief.

Date Signature of the applicant

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