Proposed Architecture for e - Learning System Incorporating Industrial and Academic Requirements

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Abstract—**In last two decades, a lot of research is going on e-systems such as e-learning system, e-government, e-commerce, and many others. e- learning is an umbrella term that describes learning done through computers, online or offline. e-learning provides a variety of features and benefits over the traditional learning methods. Many developed countries have established e- learning systems. Under developed countries are also trying to promote e- learning but are getting hurdles such as lack of information communication technology (ICT) infrastructure. In this paper, a new architecture of e-learning system is proposed that incorporates industrial and academics needs and requirements both. Contents are developed on the basis of these needs and requirements. To enhance the quality of e-learning system, quality assessment and assurance processes are added into this architecture. These processes will insure the quality of knowledge delivered to the learner.**

Keywords— **online Learning, e- learning, virtual learning, contents**

I. INTRODUCTION

Due to paradigm shift, traditional systems are replaced by e-systems. Similarly traditional education system is change with e-learning system. Today's traditional education system has many problems. One of the major problems in traditional education system is the old syllabus. Other reasons may be the physical reliance of learner, work load of instructor, traditional way of communication and teaching environment. Further more, these systems rely on the physical attendance of both learners and instructors. To over come above mentioned problems there is a requirement to adopt e- learning system. Old educational system needs to be replaced by e-system to get technological benefits. Many developed countries have successfully implement e-learning system to facilitate learners to study in a convenient way. Some under developed countries are also trying to established e- learning system. Due to less technological advancements and lack of information communication technology infrastructure, these countries can not take the full benefit from e-learning system.

In this paper authors proposed and discussed a new architecture of e-learning system that considers both academic and industrial needs and requirements. Further more, it introduces the quality assessment and quality assurance processes to enhance the quality of system. Rest of the paper organized into different sections. Section 2 represents literature review. Proposed architecture and algorithm is discussed in section 3 and section 4 conclude the research work.

II. LITERATURE REVIEW

A. e-learning

Advancement in Internet technology and web has changed the way people learn. *"The web provides significant new functionality in transmitting information to the student and providing forums for exchange"* [4]. It provides information in different formats, at anywhere and whenever a learner wants. According to Som Naidu, e-learning is referred to use networked information and communications technology in teaching and learning [5].

The simplest definition of e-learning is the use of Internet and web technology to facilitate learning. In other words e-learning is the process of delivering knowledge to the learners with the help of computers, Internet, the Web, from the hard disks, CDs or DVDs of the learner's computer.

e-learning provides opportunities for the learners to get knowledge whenever and wherever it is required [7]. According to Tajudeen A. Atolagbe, *"E-learning needs a set of shared components technologies that supports shared information, communication and co-ordinates access to shared objects on different platforms"* [7]. There are no barriers of time and distance in e- learning. Online learning, distance learning, virtual learning are the terms used interchangeably with e-learning.

B. Online Learning

Internet-based learning is called online learning. "*Online education can be defined as an approach to teaching and learning that utilizes Internet technologies to communicate and collaborate in an educational context. This includes technology that supplements traditional classroom training with web-based components and learning environments where the educational process is experienced online*" [8].

C. Difference between online learning and e-learning

The term e-learning involves a lot more than online learning. According to Som Naidu, "e-*learning would incorporate all educational activities that are carried out by individuals or groups working online or offline, and synchronously or asynchronously via networked or stand alone computers and other electronic devices* "[5].

D. Mode of e-learning

There are two modes of e- learning, i.e. synchronous and asynchronous. In synchronous e-learning mode, classes take place in a classroom in real-time. Communication between instructors and learners through teleconferencing or a chat room are examples of this mode. In asynchronous e-learning mode, learners can access educational material in their convenient time anywhere. In synchronous mode, learning takes place in real time but in asynchronous, it is not take place in real time.

E. Modalities of e-learning Activities

According to Som Naidu, there are four types of e-learning activities i.e. individualized self-paced e-learning online, individualized self-paced e-learning offline, group-based e-learning synchronously; and group-based e-learning asynchronously [5]. In individualized self-paced e-learning online; learners use Internet for accessing learning resources. In individualized self-paced e-learning offline, learners access learning resources without Internet. In group-based e-learning synchronously, groups of learners are working together in real time via the Internet. In group-based e-learning asynchronously, groups of learners are working over the Internet but not in real time.

F. Attributes of e-learning

According to Som Naidu, the critical and unique attributes of e-learning are a) the flexibility that information and communications technologies afford; and b) electronic access to a variety of multimedia-based material. These attributes are narrated below [5].

1. The flexibility that e-learning technology affords
"*Access and use of educational resources at a time, place and pace that is suitable and convenient to learners rather than the instructor and/or the educational organization is called flexible access*" [5]. E-learning provides flexible access to educational material.

2. Electronic access to hypermedia and multimedia based Resources
Information and communications technology provides the flexibility to capture, storage and communicate information in diverse formats i.e. audio, video, and multi media.

G. Benefits of e-learning

1. Enhance Communication
e-learning increases communication between learners and instructors. Discussion boards, chat rooms, and e-mails enhance the learner to learner and learner to instructor communication.

2. Accessibility of Instructor
e-learning provides learners additional layer of instructor accessibility [8]. Instead of visiting instructor's office in office hour learners can submit quires via emails at any time and anywhere.

3. Students Share Perspectives
"*Each student can view another student's answers and learn through the exposure to different perspectives in e-learning*" [8].

4. Continual Access to Materials
By using e-learning mode, learners can access educational material that is available on line anywhere and where ever it is convenient.

5. Accommodate different Learning distinct formats
e-learning facilitates different learning formats i.e. video tapes, power point slides etc.

6. Reduce Instructor Workload
By using e-learning facilities, instructors can save time by using different tools like quiz generator, automated grader and analysis tools.

7. Utilize Time Efficiently
e-learning saves the time of learners and instructors both. Learner's time saved because they do not have any need to go to classroom, instructor's desk, or library to access educational material. Instructors can address learner's issues online instead of going to their offices.

8. Eradicate Physical Attendance
Online learning does not require physical attendance of learners. Rizwana Irfan and Maqbool Shaikh pointed out "*in ordinary learning environment, the knowledge has limitations in terms of boundaries. Knowledge delivered in a class room is not accessible to a person beyond the boundaries*" [7].

H. Categories of e-learning Technologies

There are four main categories of e-learning technologies i.e. Web Based Training, Computer Assisted Instruction, Teleconferencing and Computer Based Training. Web based training (WBT) is an innovative approach to distance based learning [9]. WBT mode provides instructions that are delivered via web browsers through Internet for training. Learners learn more using computer based instructions then they do with conventional ways of teaching [7]. In computer assisted instruction mode, computers are used to provide instructions to the learners. *"Computer-assisted instruction could be of great help because of the drill-and-practice, tutorial, or simulation activities offered either by themselves or as supplements to traditional teacher directed instruction"*[10]. In teleconferencing, participants communicate in real time via Internet. It is a synchronous mode of distance learning. It combines audio, video, and data technologies for learning purpose. Use of computer in training is called Computer Based Training (CBT). It may refer training through stand-alone computer or through educational material introduced or taught by instructors with the help of computers.

I. Trend of Virtual and Distance Learning
This section shows some of the universities that implement distance and virtual learning for its students. Distance learning is a type of learning that provides the flexibility of location, time, or both. Virtual learning is a term that is interchangeably used with distance learning.

1. Open University (OU) UK
The Open University, United Kingdom is one of the largest distance learning universities in the world. The OU was established in 1969. OU provide distance learning courses and adult education. Before the invention of Internet, the communication between students and university is paper-based. After the rise of the Internet in the 1990s the OU use Internet as a new ways of communication and has tried to have an Information Communication Technology (ICT) infrastructure. The OU provides learning facility to those wishing to get education on a part-time and/or distance learning basis. The OU uses a variety of methods for distance learning, including written, audio materials, the Internet, and video programs on DVDs. In 2005, OU started Virtual Learning Environment (VLE) to provide open educational resources to the learners. The team of researchers and technical staff worked on Virtual Learning Environment. Now the VLE has been successfully implemented at the OU.

2. Allama Iqbal Open University (AIOU) Pakistan
Allama Iqbal University is a pioneer in distance education in Pakistan. It provides an opportunity for learners to learn at their homes in their convenient time. The AIOU course material consist of textual material accompanied with audio, video cassettes, radio and TV broad cast. The headquarter of AIOU is at Islamabad, 48 regional offices through out the country provide coordination to the learners. These coordination offices are also responsible for local examination, counseling and administration. AIOU established a quality enhancement doctorate to maintain learning standards.

The online facilities provided by AIOU to its students are library, communication box to enhance communication , display of students assignments and their results, activity calendar, date sheets, roll number slip, information about programs, faculty, departments, admission procedure, schedule and display of learners results.

3. Virtual University (VU), Pakistan
The Virtual University of Pakistan is first university in Pakistan that provides virtual learning to its students. It completely based on modern Information and Communication Technologies (ICTs). It allows students to learn regardless of their physical locations.
 The facilities provided by Virtual University to its students are online course registration, TV and radio channels, online video lectures, online lecture schedule, online access to digital library, online book shop, online admission process, DSL broadband Internet at subscribed rates, students e-mail accounts, campus based or home base study option, several campuses across the Pakistan, and self learning audio video modules for acquiring basic computer and Internet skill to pursue courses of VU effectively.

J. Existing Architecture of e-learning
Rizwana Irfan and Maqbool Shaikh in [7] have proposed a framework for embedding tacit knowledge in pedagogical model to enhance e-learning. This framework consists of three phases i.e. content organization, quality assessment and content delivery. These phases are narrated below. The framework is shown in figure 1.

In the contents organization phase; the contents are collected and organized based on the industrial requirements. The quality assessment phase analyzes and assesses the contents developed and gathered based on theoretical and experimental methods. These methods check the compliance of contents with industrial requirements. The third phase the contents delivery; learners are assessed by the use of different intelligent assisted tools to find out their aptitude and level.

III. PROPOSES ARCHITECTURE
Academic and industrial needs and requirements are provided by academic and industrial experts of a country respectively. Quality assessment process checks the quality of these needs and requirements. Finalized needs and requirements are converted into the contents. These contents are further classified in two categories; Tacit and

Explicit Knowledge. Cognitive and documented knowledge are classified as tacit and explicit knowledge respectively.
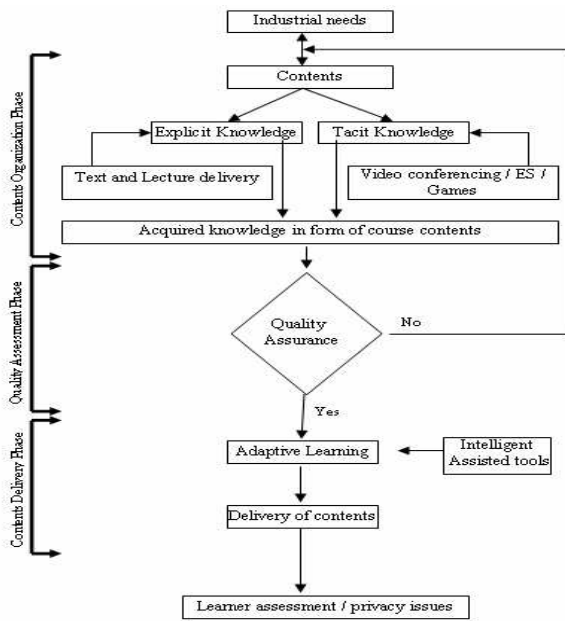

Figure 1: Framework for Embedding Tacit Knowledge in Pedagogical Model to Enhance E-learning

Experts, Scientific Foundations, Enterprise Applications, Business Process Models and external knowledge are the sources of proposed architecture. Purpose of adding so many multi-dimensional sources are to provide the maximum exposure and to cover all the aspects related to the learning environment. Like in our case, the knowledge and experience of experts are included in the tacit knowledge source category, while the business process models with detailed prescribed information are included in explicit knowledge source category. The only way to extract knowledge from tacit sources is through Knowledge Acquisition Process. Whereas, Explicit Knowledge can be easily extracted by using formal ways of Extract, Transform and Load (ETL) mechanism or some other relevant mechanism. In the following some of the data sources added in this architecture are discussed in detail.

Experts: Experts usually refers to persons who have sufficient knowledge and expertise in their specified field. They contain very useful and unique knowledge in the form of their experience. They have up-to-date and contextual knowledge. Their thinking ideas can boil out the information which is usually impossible to see in formal reports and methods. In case of universities and colleges these experts could be the Professors in relevant fields or the persons working in the industries.

Scientific Foundations: Scientific foundations source contains knowledge related to the current scientific research and innovations. This source is very important for learners to provide current trends and advancements in innovated technologies. It can involve more than one scientific organizations depending upon the designer.

Enterprise Applications Knowledge: This type of source contain knowledge coming from different management organizations, having up to date view of current market trends. It can also include how different organizations interact and collaborate with each other.

Knowledge coming from these sources is loaded in to the storage area called 'Repository of all sources'. To answer the learner's query, knowledge is extracted from this repository through knowledge acquisition process. In order to check validity of acquired knowledge the Quality Assurance Process is performed. At the end of each cycle of the quality assurance process /phase will check weather the results are according to the e-learner's demands or not. If the results are accurate; then it may be passed to the user now can be called e-learner. If results are not accurate; then the process may iterate again and until satisfactory results are found. Once the results are justified as required, they are sent to the e-learner side and leaner will view the results through dynamic learning scenes.

Proposed Algorithm

The algorithm for the proposed architecture is given below.

Begin

Take the Academic Needs and Requirements from Academic Experts

Take the Industrial Needs and Requirements from Industrial Experts

    If the Quality of Needs and Requirements are not high

    Repeat step 1 and 2 again until Quality is high

Transform high quality Academic and Industrial Needs and Requirements into Contents

Extract knowledge from Knowledge Sources

Transform and Load Knowledge into Repository

Acquire learner's needed knowledge from Repository

    If the Quality of knowledge is satisfactory

    Deliver it to the learner

    Else

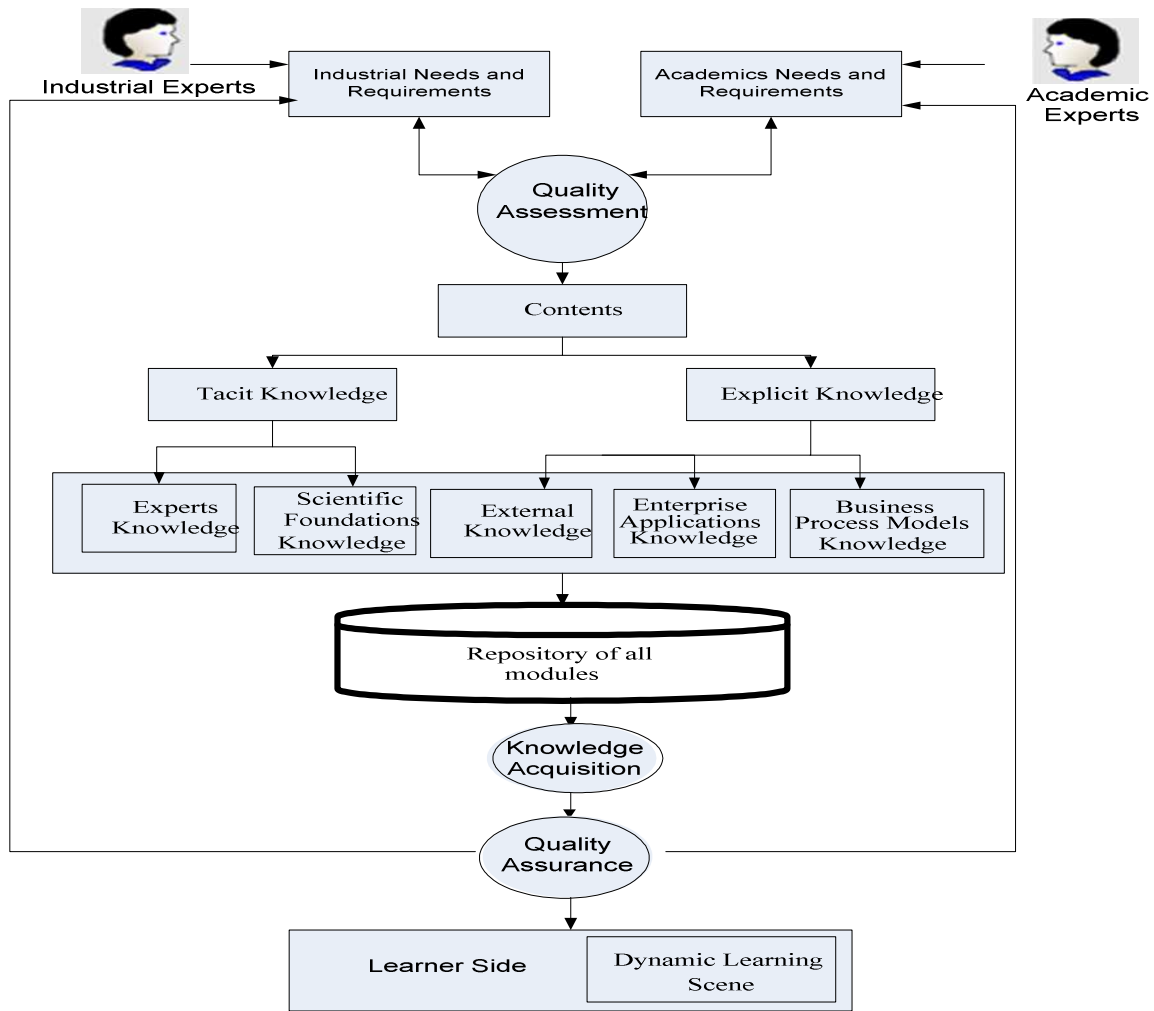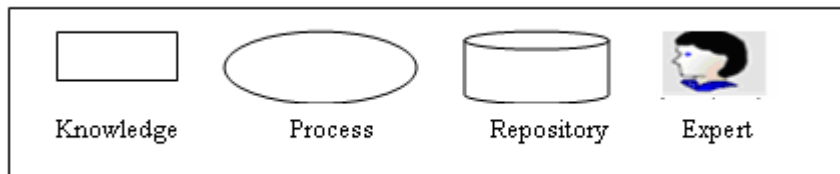   Check the Academic and Industrial Needs and Requirements

End

Figure 2: Proposed Architecture

IV.   CONCLUSION

In last two decades, e-learning is a very hot issue in developed countries. Developed countries use information communication technology for providing e-learning. Under developed countries are also trying to establish ICT infrastructure in their country to promote e- learning. Different modes of e-learning are available to facilitate learners in learning process. In this research work, a new architecture of e-learning system and its corresponding algorithm is proposed and discussed. This architecture considered the needs and requirements of industry and academics both. Contents are developed on the basis of these requirements to fulfill the needs of a country in an improved way. Quality assessment and assurance processes are added into the proposed architecture that will insure the quality of knowledge delivered to the learner.

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