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A Dedicated Web-Based Learning System

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***Abstract*—The fields of Learning Management Systems (LMS) and Learning Content Management Systems (LCMS) are full of open source and commercial products including Blackboard, WEB CT, and Moodle. These systems are tutor-oriented, not designed to facilitate personalized learning support for an individual learner. Professors and students, frustrated with current LMS, need a new, innovative, user-friendly alternative to encourage and empower students to take control of their education, and teachers to explore new styles of teaching, depending on their students' needs. Most of the students in the developing world, specially in the middle east region, suffer from limited English proficiency, in addition to limited computer skills. These obstacles compose a barrier to, and impose limitations on the design and implementation of E-learning systems. This paper introduces a prototype for a simple, dedicated, learner-oriented e-learning system to facilitate the learning process. The proposed system enables the student (even with moderate English level and general IT knowledge) to wander through the system, and register for a specific course to make use of the scientific material available there in. In addition, the design of a computer engineering course conforming SCORM standards is introduced. The proposed prototype is made available for students to examine and evaluate. Feedbacks will be analyzed and enhancements will be proposed.**

Keywords-component; e-learning; Learning Management Systems; Content Management Systems; Virtual University.

I. INTRODUCTION

Learning Management Systems (LMSs) are reporting systems created for tracking registration, attendance, class lists, grades, test results, class scheduling, other administrative requirements of schools and instructor-led classes. Learning Content Management Systems (LCMSs) provide authoring, sequencing, and aggregation tools that structure content to facilitate the learning process. To be a learning content management system, the content should also be aware of learners. At a minimum, learning content should recognize who the learner is, and record information about the learner's experience. As the learners interact with the content, results are passed back to the system. The system can change its behavior based on real time student interaction including test scores, learning style preferences, skills, communication abilities, organizational roles or any other relevant data. [1]

A good LMS provides an infrastructure that enables an organization to plan, deliver, and manage learning programs in any format it chooses. It will support multiple authoring systems and integrate easily with the leading LCMS systems. In its role as a catalyst for the overall learning environment, an LMS can integrate LCMS learning objects via technical specifications and standards and assume responsibility for all content management, including delivery and tracking, storage in a content repository, assembly and reassembly of content objects, incorporation of content objects into blended curriculums, and tracking learner progress through courses [2].

Certain learning tasks are well suited for an LMS (centralized functions like learner administration and content management). Learning itself is different - it is difficult to manage. Learning is by nature multi-faceted and chaotic. Organizations that now lock into enterprise-level systems will be able to do an excellent job of delivering courses. They won't, however, be positioning themselves well for informal learning, performance support, or knowledge management. The concept is simple: one tool can't do it all without losing functionality. The more feature-rich an individual tool becomes, the more it loses its usefulness to the average user. The following are some of the more glaring weaknesses of an LMS [3]:

1. The initial reaction to the interface is confusion for many learners. This confusion is due to two flaws in the LMS:
   i) LMSs try to do everything. Simpler tools, with the intent of performing one task seem to be easier for end users to understand.
   ii) LMSs are designed as a learning management tool, not a learning environment creation tool (interface design explores the importance of social considerations: the key criteria in interface design is obviously "what does the end user want/need to do". Current LMS interface design relies too heavily on "what do the designers/administrators want/need to do").
2. Large, centralized, mono-culture tools limit options. Diversity in tools and choices are vital to learners and learning ecology. In essence, the LMS determines what an instructor could do. It should be the other way around - instructor needs first, tool selection second.

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3. When content is viewed as the most valuable contribution to learning, an LMS will suffice. When interaction and connections are viewed as the most valuable aspect of learning, then other options - like social tools - are a reasonable alternative. Ultimately, careful analysis of the learning task and tools available should drive the method selected. However, as thinking skills move to higher levels, the artificial constructs of content and interaction imposed by an LMS are limiting to constructivist learning.

Professors and students bothered with current LMSs such as Blackboard [6], proposed new, innovative, user-friendly alternatives such as Instructure Canvas [4], and Artemis [5]. These projects are designed to encourage and empower students to take control of their education and teachers to explore new styles of teaching, depending on their students' needs.

Most of the students in the developing world, specially in the middle east region, suffer from limited English proficiency, in addition to limited computer skills. These obstacles compose a barrier, and impose limitations on the design and implementation of learning management systems. Taking these factors into consideration, this paper aims to design a simple, customized, learner-oriented e-learning system that facilitates the learning process. This objective is treated as a two-fold problem; to design a user-friendly, customized, learner-oriented e-learning system, and to create the material of a specific course conforming SCORM as a case study.

The paper is organized as follows. Part II reviews related work. Part III introduces the proposed system. Part IV presents the results and discussion. The paper is terminated by a conclusion summarizing obtained results and proposing problems for future investigation.

II. RELATED WORK

In a Gripe Session at Blackboard [6], complaints ranged from the system's discussion forum application, to the improved -- but still lacking -- user support, to the training materials for faculty members. Michael said: "Except for those hardy souls who are teaching either distance learning and/or blended class, what solution does Blackboard provide? Web page design system exists for people who lack even a high school education can maintain a web site. These systems cost far less than Blackboard. Free services such as PBwiki and Typepad allow a course instructor to maintain a wiki and/or blog for each course. Blackboard is the equivalent of AOL and Facebook; a proprietary system that walls out users or, in this case, students and other faculty. Besides a drain on college and individual resources, why does anyone use Blackboard? It neither improves nor hinders students' learning. What is the point of it? Save yourself time and your employer money. Stop using Blackboard.".

George Siemens in [3] stated that certain learning tasks are well suited for an LMS (centralized functions like learner administration and content management). Learning itself is different - it is difficult to manage. Learning is by nature multi-faceted and chaotic. Organizations that now lock into enterprise-level systems will be able to do an excellent job of delivering courses. They won't, however, be positioning themselves well for informal learning, performance support, or knowledge management. The concept is simple: one tool can't do it all without losing functionality. The more feature-rich an individual tool becomes, the more it loses its usefulness to the average user. Connected specialization, modularization, and decentralization are learning foundations capable of adjusting to varied information climate changes.

Mfeldstein in [4] presents a new, innovative, user-friendly alternative called Instructure Canvas. The program is designed to encourage and empower students to take control of their education and teachers to explore new styles of teaching, depending on their students' needs. One of the philosophies behind their LMS is "technology should help magnify rather than inhibit teaching".

Tan Kun and Pei Yunzhang in [5], provided an integrated management and information service for distant learning (Artemis). It supports not only real-time, synchronous activities for live lectures based on IP multicast network, but also asynchronous cooperating services such as course management or student assignment. The system supports on-line live lectures in a virtual tele-classroom. Students can access the classroom from anywhere via network. An interesting way in which Artemis live media-board differs from other counterparts is that instructors can not only place static media objects, e.g. graphics and texts, but also continuous media objects, e.g. audio or video, on the board. The synchronization between continuous media objects and the live audio/video of the instructor, as well as other static media objects are maintained. The instructor can use tele-pointer tool to grip students'attention to a specific portion of the media board, while he is talking on a certain problem. He can also create dynamic annotations on the media board. The annotations are overlaid upon the teaching document. Text chat tool provides an alternative channel for students and instructors to exchange messages without disturbing the process of the lecture.

Hazem M. El-Bakry and Nikos Mastorakis [7], presented an integrated intelligent E-Learning system. The implementation of an open, adaptive and multi-subject E-learning system is introduced. This system allows the students to use interactive tasks and open communication channels among students and teachers; using a series of intelligent agents that are performing learning tasks on the behalf of teachers, learners, and administrator. The idea has been applied to design an E-University learning system. The interface has been implemented by using agent technology. Furthermore, the proposed system has been developed considering learning management and business continuity management. In addition, security in E- Learning has been discussed.

Sam K.P. Ma [8] designed a Virtual Learning Environment in which both learners and instructors do not need to be familiar with the high technology, while they can still communicate with each other effectively, using the advanced Internet technology. Moreover, the Virtual Learning Environment provides its users with appropriate guidance and support, which help the learners to achieve an overall progress across all courses and study programs. In short, the Virtual Learning Environment allows an interactive, and dynamic

educational center to be developed and fulfilled in a modern studying environment.

In South Africa, one of the best-developed economies and highest standards of living in Africa, two pilot e-learning courses on forestry for undergraduate learners have been offered by the University of Stellenbosch, South Africa, and students responded favorably to the e-learning format. The results suggest that e-learning may also be an appropriate format for corporate workplace training, which has prompted the present study. Using a qualitative approach, this research project investigated various pedagogical approaches in order to determine the most appropriate ways of conducting online workplace training in the South African wooden furniture sector. More specifically, it explored whether *constructivist teaching and learning* was an effective approach. The principal research question of the study was "Is constructivist teaching and learning an effective pedagogical approach for use in Web-based training for adult learners in South Africa?" [12].

III. PROPOSED LEARNING MANAGEMENT SYSTEM

The objective of this phase of project is to construct the design elements for a web-based e-learning system that can be used to enhance the learning process at Taif University. The proposed system is called "Taif University e-Learning System". Taif University contains several colleges, each college has a set of departments offering a variety of programs in a variety of areas. Each program contains a set of courses. Each course is made up of a set of topics. Tutors in the organization are assigned courses to teach according to the area that they specialize in and their availability. The organization publishes and maintains a calendar of the different courses and the assigned tutors every semester. There is a group of course administrators in the University who manage the courses including course content, assign courses to tutors, and define the course schedule, in addition to assigning courses to course creators. The proposed system is a web-based learning system that provides:

1- An efficient and easy learning system that students can interact with.
2- A simple user interface that facilitates the interaction with the system.
3- Administration tools that provide capabilities for implementing online courses.
4- An efficient Student Management System that presents all the functions required by the student to fully implement the concept of Distance Learning System.

According to ADDIE Instructional Model, the system lifecycle passes through the following phases: Planning, Analysis, Design, Implementation, and Testing & Maintenance. This model is followed during the whole lifecycle, and the proposed product is under investigation

A. System Database Design

To add, access, and process data in database, we choose to use SQL SERVER 2000 database management system. The proposed system has many objects that should be represented:

1. STUDENTS: who will join the system.
2. TUTORS: who will teach the students the required courses.
3. COURSES: those are available in the System.
4. COURSE CREATORS who create the course according to a set of given specifications
5. COLLEGES: more than one college exists on the System.
6. DEPARTMENTS (PROGRAMS) for each college
7. TOPICS of a specific course
8. CLASSROOMS for (hybrid) blended learning
9. COURSE-CALENDAR of the different courses and the assigned tutors

B. Object Oriented Design of the Proposed System

A software system can be said to have two distinct characteristics: a structural, "static" part and a behavioral, "dynamic" part. In addition to these two characteristics, an additional characteristic that a software system possesses is related to implementation. The static characteristic of a system is essentially the structural aspect of the system that defines what parts the system is made up of. It includes *Use case* diagram and *Class* diagram. The dynamic characteristics of a system are essentially **t**he behavioral features of that system including *Object* diagram, *State* diagram, *Activity* diagram, *Sequence* diagram, and *Collaboration* diagram. The implementation characteristic of a system describes the different elements required for deploying a system, including *Component* diagram, and *Deployment* diagram [17].

For the proposed system, we presented the two structural components (*Use case* diagram and *Class* diagram), and two behavioral features (*Activity* diagram and *Sequence* diagram), using ***Visual Paradigm for UML 8.0, Community Edition*** [9] for depicting these diagrams.

B.1. Use Case Diagram

A use case diagram, is a visual depiction of the different scenarios of interaction between system actors and use cases. The usefulness of use case diagrams is more as a tool of communication between the requirements capture team and the user group. After finalizing use case diagrams, the business functionality is to be documented into clear-cut and detailed use case specifications. Elaborate use case specifications are used as an input for design and development and for writing test cases. The proposed system includes four actors; Administrator(s), Course Creators, Tutors, and Students. Each actor interacts and participates in a set of use cases as shown in Figure 1.

B.2. Class diagram

A class diagram is a pictorial representation of the detailed system design. It consists of a group of classes and interfaces reflecting important entities of the business domain of the system being modeled, along with the collaborations and relationships among these classes and interfaces. The "active" entities of the proposed system are: Administrators, Tutors, Course Creators, and Students. The business domain ("passive") entities of the system are Colleges, Departments, Courses, Topics that make up a course, Course calendar, in addition to Classrooms for cases of blended learning. The class diagram of our Proposed System built after a careful analysis of the requirements is shown in Figure 2.

B.3. Activity diagrams

The Activity diagram is a simple way to represent the workflows and their steps of an entire system or a subsystem. Activity diagrams represent the business and operational workflows of a system. It is a dynamic diagram that shows the activity and the event that causes the object to be in the particular state. Each of the use cases described earlier is actually a workflow. Hence, we can easily depict these use cases by using the Activity diagram. Figure 3 depicts the activity diagram of the "Manage course " use case.

B.4. Sequence diagram

As shown in Figure 4, the sequence of steps carried out in the "Study course " flow proceeds as follows:

The student invokes the “Study course” functionality. If he is not registered, the system informs him to register. If registered, the system informs him to log in. Logged in, the user invokes the course material and starts learning.

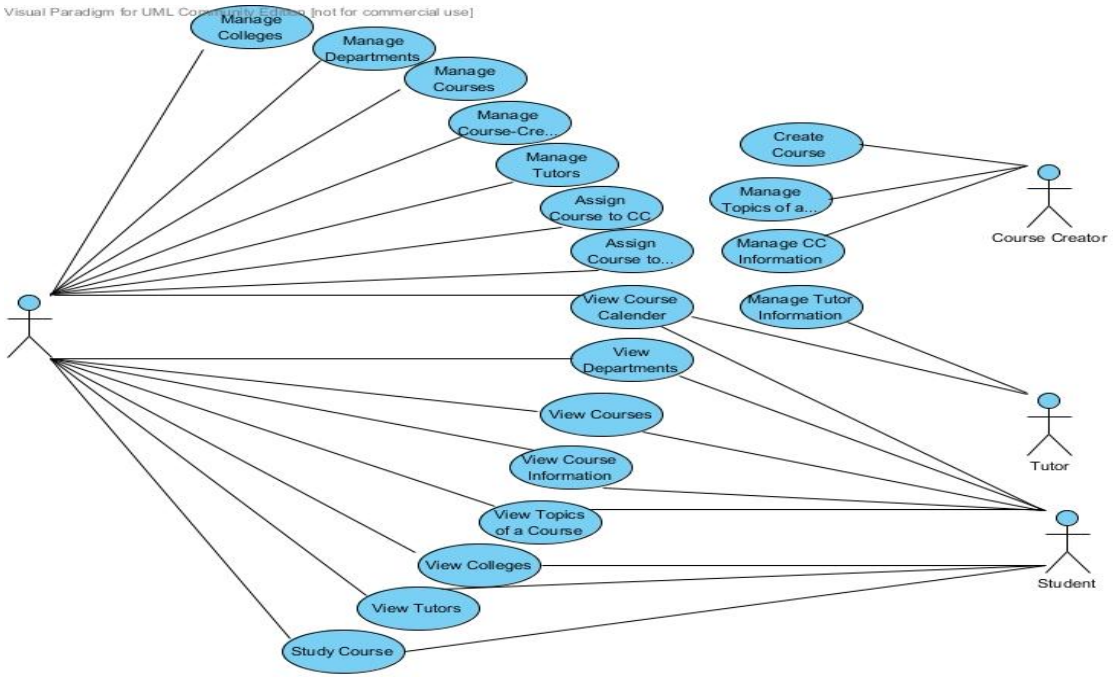

Figure 1. *T*he use case diagram of the proposed System

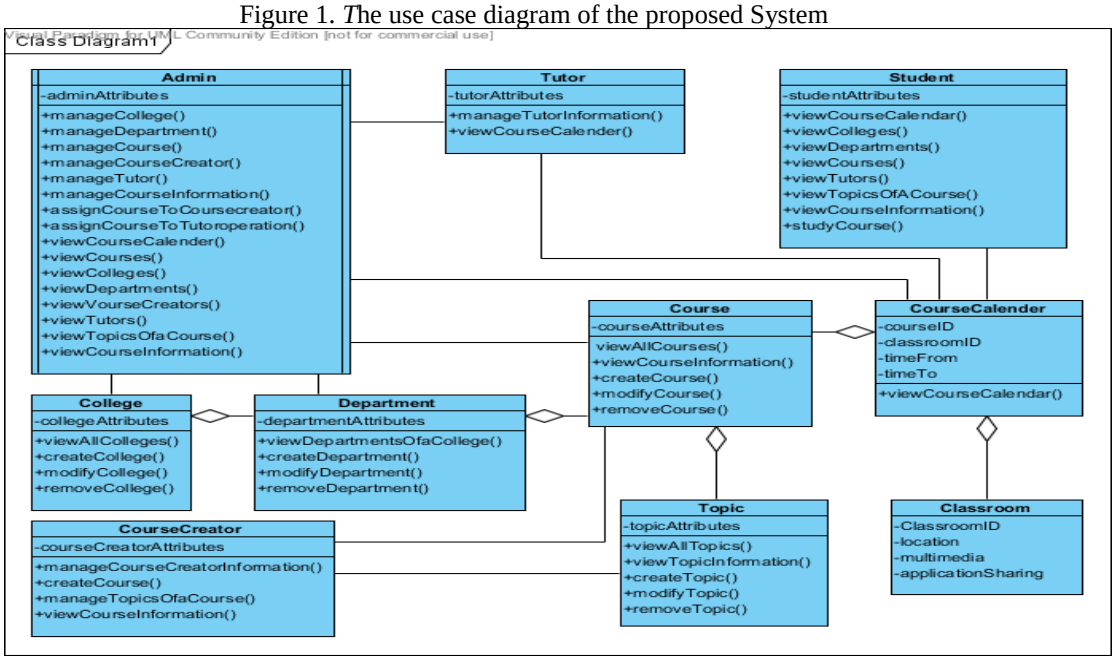

Figure 2. The class diagram of the proposed System

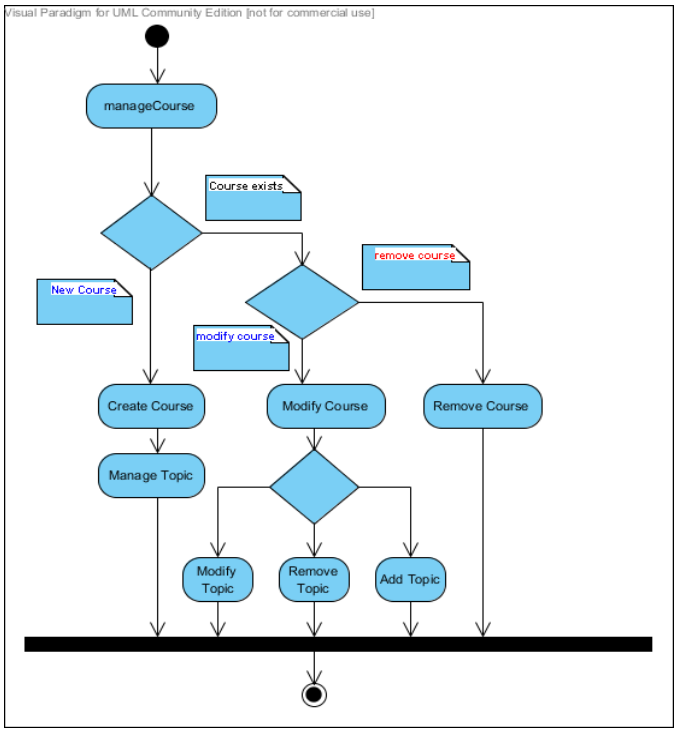

Figure 3: Activity diagram for the "Manage course " flow

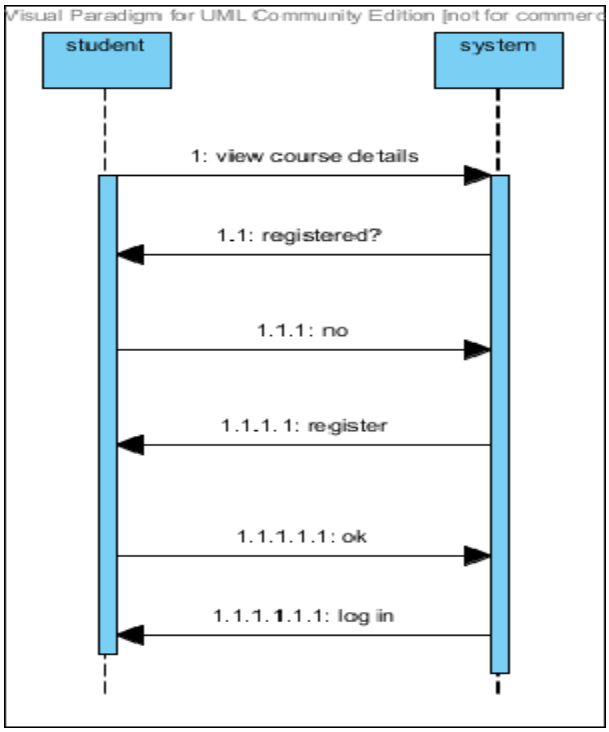

Figure 4: Sequence diagram for the "Study Course" flow

C. *Website Design*

Figure 5. shows the suggested web site structure for the proposed system. This structure clarifies the pages of the web-based system and the navigation paths that the user can go through while navigating the site.

The proposed website is developed on the Microsoft Active Server Pages (ASP.NET [10]) technology and can be used in any network based on a Windows server. The database is created with SQL Server 2000 Application [11].

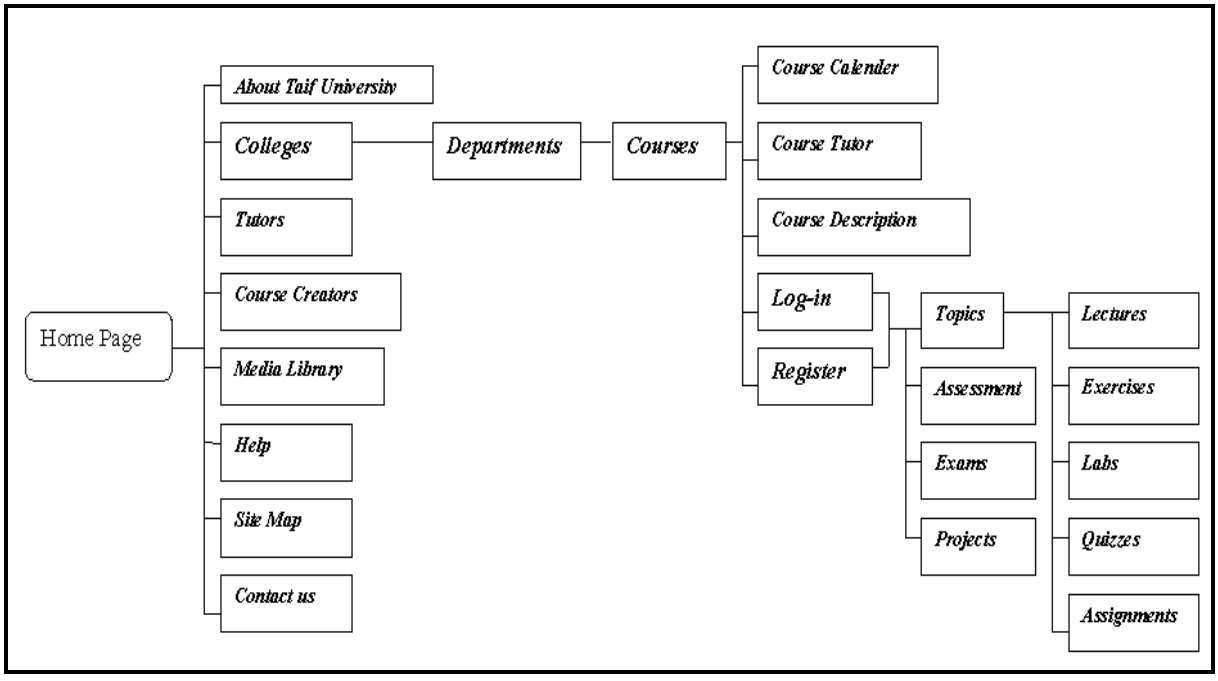

Figure 5. Proposed sitemap

D. Course Design

Beyond instructional materials, the organizational structure of a course plays a key role in the success of an online learning environment. Courses should be divided into modules for easy access and navigation. Whether these modules are arranged in terms of weeks, topics, days, units, or lessons is not as important as the fact that they are broken into smaller units that are readily accessible and easy to update. Moreover, as part of the course structure, individual sections or pages should be designated for specific purposes, such as an area for announcements and a separate area for posting of homework assignments. This organizational structure should be familiar in concept and intuitive or easy to master so that it does not intrude into the students usage of the learning content [13].

Quality learning is most likely to happen when it is student-centered, because that is where the responsibility lies. From the pedagogical point of view, the learner's learning activities should be directed at activating his own prior conceptions and relating it to new knowledge.

Learning objects are defined as digital, re-usable pieces of content that can be used to accomplish a learning objective. That means that a learning object could be a text document, a movie, a picture, digital files, books, or maybe even a website or any digital resource that can be reused to support learning. A course is composed of topics. Each topic contains a set of learning objects. A learning object is an information object that meets one and only one objective.

SCORM stands for Sharable Content Object Reference Model, which is a set of specifications that, when applied to course content, produces small, reusable e-Learning objects. A result of the Department of Defense's Advanced Distributed Learning (ADL) initiative, SCORM-compliant courseware elements are easily merged with other compliant elements to produce a highly modular repository of training materials. SCOs are a standardized form of reusable learning object. An LMS is (for the purposes of SCORM) any system that keeps learner information, can launch and communicate with SCOs, and can interpret instructions that tell it which SCO comes next. Additional components in the SCORM model are tools that create SCOs and assemble them into larger units of learning [16]. SCOs are self-contained units of learning. They can be used as building blocks (or legos) to create packages of SCOs, but they cannot be broken down into smaller units.

Following Chrysostomos Chrysostomou and George Papadopoulos approach [14,15], with little modifications, the hierarchy of LO classes is shown in Figure 6. Having defined the syllabus, courses were broken down into content module. These building blocks were largely self-contained allowing greater flexibility for further development of the course and for building new courses. The course is an aggregated structure that contains the learning material, the references and the content for assessment. The learning material is structured on the learning objects, which are named *topics* and *lessons*. Every course is divided on the topics. Every topic is divided on the lessons. The lesson is the basic learning unit. One lesson is related to one LO. The aggregated course (designed) from learning objects is shown in Figure 7.

In the design and implementation of the system, there were some design principles:

1. divide the topics into short and easily designed sections;
2. provide the facility for students to interact with each other at the end of each section by using the chat room;
3. provide links to other internet sites, E-books, and journals relevant to the topics being studied, as a means of expanding the knowledge base;
4. present the course content in an interactive design form;
5. questions at the end of each short section as a self-assessment tests which is a very powerful interactive device.

The proposed system is applied to design the "Computer Architecture & Organization" course, which is now available for the students to investigate and give feedbacks.

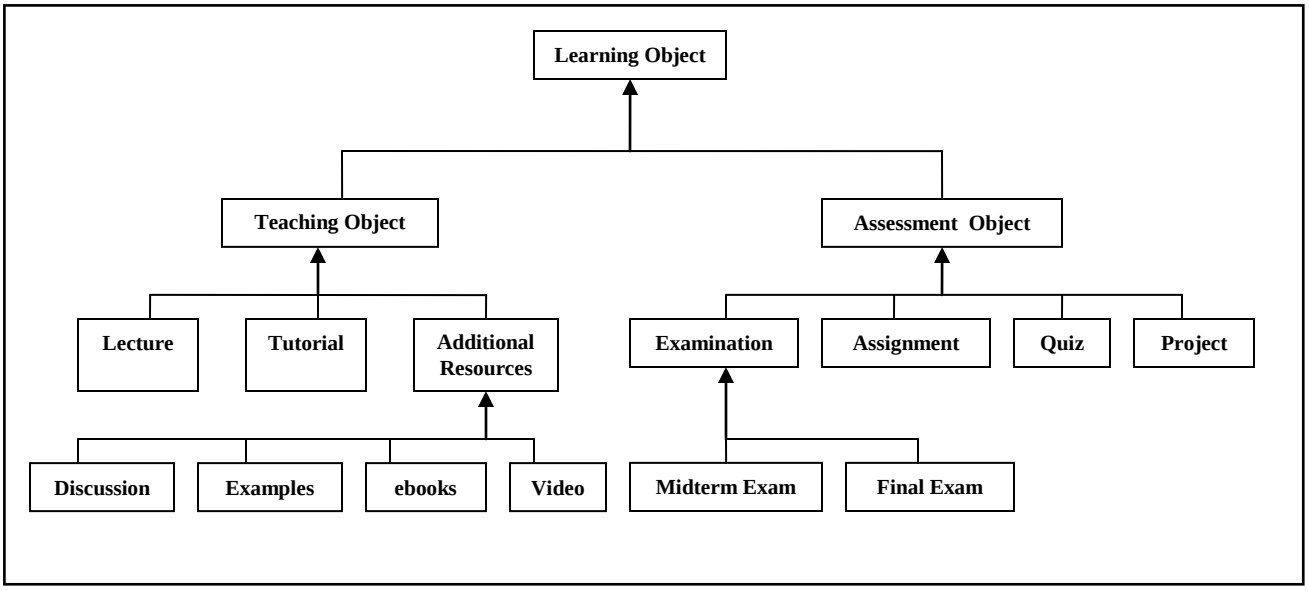

Figure 6. A hierarchy of LO classes

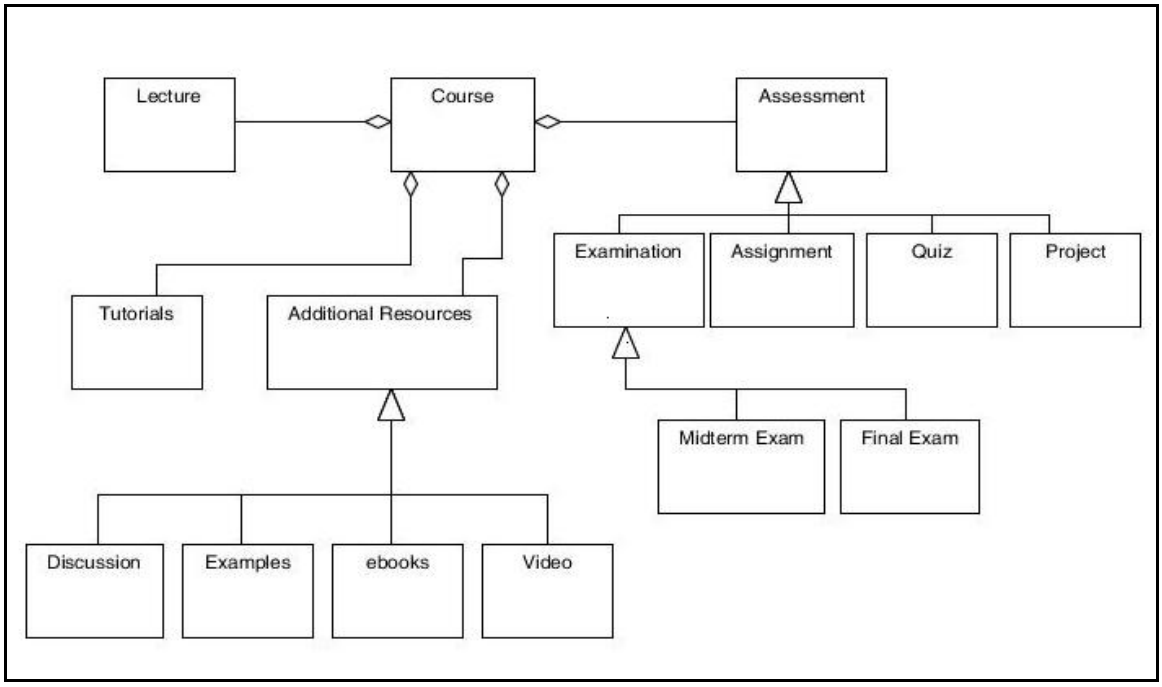

Figure 7. Course designed from learning objects

IV. RESULTS AND DISCUSSION

The proposed web-based e-learning system is developed on the Microsoft Active Server Pages (ASP.NET) technology and can be used in any network based on a Windows server. The database is created with SQL Server 2000 Application. The actors of the system are: Administrator, course-creator, tutor, and student.

The Administrators have full authority to:

- Manage colleges
- Manage departments
- Manage courses
- Manage course creators
- Manage tutors
- Manage course information
- Assign course to course creator
- Assign courses to tutor
- View course calendar
- View colleges
- View departments
- View courses
- View course creators
- View tutors
- View topics for a course
- View course information

The student has authority to:

- View course calendar
- View colleges
- View departments
- View courses
- View tutors
- View topics for a course
- View course information
- Study course

The course creator has authority to:

- Manage course creator information
- Create courses
- Manage topics for a course
- View course information

The tutor has authority to:

- Manage tutor information
- View course calendar

The proposed system allows the guest (general user including students) to navigate freely within the site. He can view the colleges at Taif University, the departments of each college, the courses of each department. He can view the tutors of a specific course as well as courses description. If a student is to study a specific course, he should be registered. A registration screen is opened automatically, and after registration an email is sent to him with the login username and password. Only those who login correctly can invoke the course, follow the course activities, collaborate with other students, discuss with the tutor, download assignments, carry out self tests, and join exams. Figures 8-10 present screen-shots extracted from the initial phase to clarify the concept, final revised forms are under processing.

The system prototype as well as the course "Computer Architecture & Organization" designed following the scorm standard are now available for the students to examine and evaluate. The system assessment will be carried out at the end of this semester (winter 2010), and enhancements will be proposed.

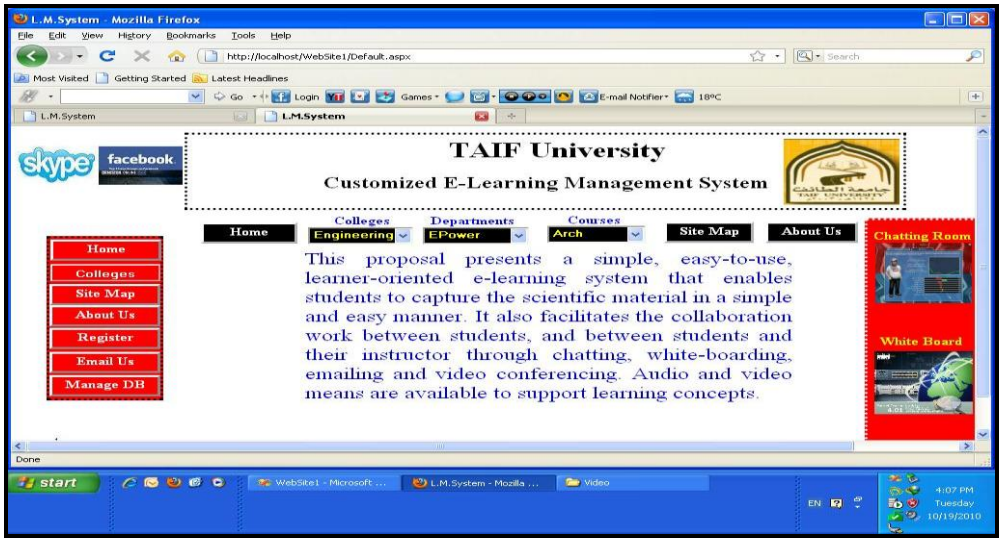

Figure 8. Home page

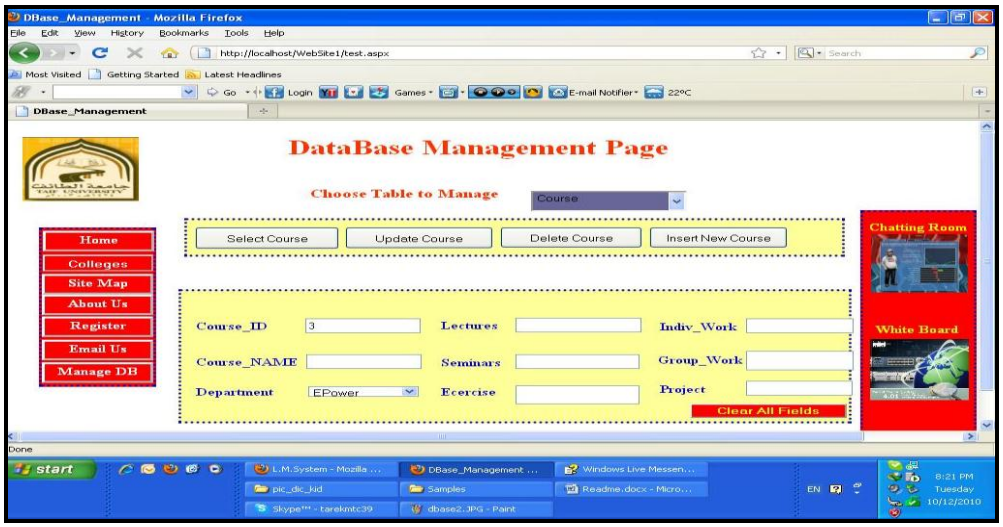

Figure 9. Database management (Courses)

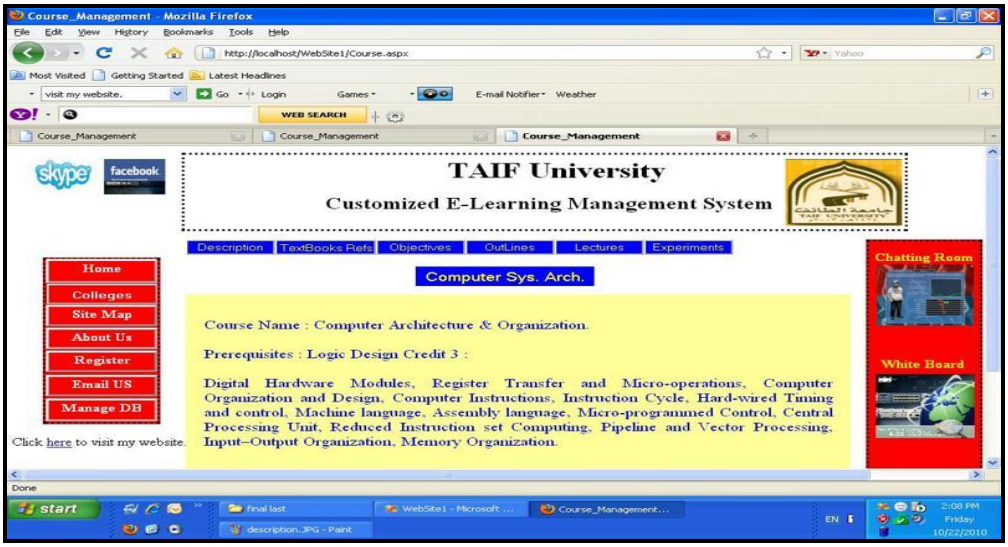

Figure 10. Course Homepage

V. CONCLUSIONS AND FUTURE WORK

Traditional classrooms still take a main role in present day education because they are interactive environments for any participant to communicate with each other freely with rich methods, e.g. voice, expression, gestures, etc. It is a nature thought for us to build a virtual classroom over networks that can provide live courses and lectures for instructors and students while closing the gap between the participants in distance. A platform that provides live courses should be simple, learner-oriented, supporting rich multimedia document formats, in which the teaching materials are prepared.

A lot of open source and commercial e-learning products are available in the market. However, these systems are usually complex, and tutor-oriented. Professors and students, frustrated with such systems, need a new, innovative, user-friendly alternative to create a learner-centric, rather than teacher-centric, environment for learners.

Most of the students in the developing world, especially in the middle east region, suffer from limited English proficiency, in addition to their limited computer skills. These obstacles compose a barrier to, and impose limitations on the design and implementation of E-learning systems.

This work proposed a prototype for a simple, customized, learner-oriented system to facilitate the learning process. This system is composed of a web-based e-learning system in which the guest can navigate freely within the system. If a student is to study a specific course, he should be registered. A registration screen is opened automatically, and after registration an email is sent to him with the login username and password. Only those who login correctly can invoke the course, follow the course activities, collaborate with other students, discuss with the tutor, download assignments, carry out self tests, and join exams.

The prototype of the proposed e-learning platform is developed on the Microsoft Active Server Pages technology and can be used in any network based on a Windows Server. The database is created with SQL SERVER 2000 Application. Furthermore, the proposed system has been developed considering learning management as well as course content management.

The system prototype as well as the course "Computer Architecture & Organization" designed following the SCORM standard are now available for the students to examine and evaluate. The system assessment will be carried out at the end of this semester, and enhancements will be proposed.

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