Conceptual Framework of Secure Cloud-Based E-Learning Platform as Content Delivery Tool in Teaching Thermodynamics

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ABSTRACT

Approach to content delivery is one of the problem militating against the engineering students understanding of thermodynamics concept in our higher institutions of learning. Among the problems faced by engineering students in learning thermodynamics are difficulties to understand concepts like enthalpy or entropy and their use for concrete applications. To provide solution for the problems, a cloud-based e-learning platform was designed and developed based on thermodynamics lesson plan Scenario for mechanical engineering students in Nigeria polytechnics education sector. We use the Thermodynamics I curriculum for ND mechanical engineering in Nigeria polytechnics test bed for this research work. The choice of programming language is PHP (Hypertext pre-processor) for server-side scripting, Action script and Macromedia-Flash for media content authoring and MySQL as the back-end database.

Keywords: Cloud computing, e-learning system, engineering students, mechanical engineering, Nigerian polytechnics, thermodynamics

INTRODUCTION

One of the most advanced tools for understanding physical universe is thermodynamics. Literature has shown that difficulties in learning thermodynamics by engineering students is a global phenomenon. Problems associated with learning of thermodynamic among students can be overcome through blended learning approach, active learning techniques, computer-based instruction, virtual lab Normah Mulopa, Khairiyah Mohd. & Yusofb, Zaidatun Tasirc (2012).

Thermodynamics is the division of physics that deals with the affiliations between heat and other forms of energy. In exact, it describes how thermal energy is converted to and from other forms of energy and how it affects matter. Jim Lucas, (2015). The course content of thermodynamic for national diploma mechanical engineering is divided into two: theoretical and practical content and the general objective revolve round knowing the following: Understand and apply the basic principles of thermodynamics; Understand Thermodynamic processes; Know the basic properties of different quality of steams; Know different types of fuels and their composition; Understand Heat transfer; Understand the principle and the use of air conditioners and refrigerators which is to be delivered within maximum of fifteen weeks NBTE, (2001).

Affordability of computers, Internet broadband connectivity, android phone, and social medial platform has created a global phenomenon in which information and communication technology (ICT) is being used to transform social interaction globally. ICT become a household name especially in e-learning. It is very convenient and does not need physical attendance always. E-Learning is the at this time is a up-to-the-minute term used to describe use of information and communications technologies to support and enhance learning, teaching and assessment from resource based learning to fully online courses Ladipo, Oyeyinka, & Yekini (2012).

At this moment in time, most of the conventional methods (writing note for students on chalk/marker board, dictating of note to students in class, and drawing of diagram on the board) of content delivery in education are becoming obsolete.

This research work aim at designing and implementation of secure cloud-based e-learning platform as content delivery tool in teaching thermodynamics in mechanical engineering. The system will uses cloud computing layers from end to end for which lecturer can upload their lecture notes, and student can access it before or during the lectures at anywhere.

1.1 Aim/objectives

The basic aim of this work is to design and implement a secure cloud-based e-learning platform as content delivery tool in teaching thermodynamics in mechanical engineering. When completed the following objectives can be achieved among others.

- Providing access to a range of resources and materials use or to be use by lecturer in teaching thermodynamics.
- It will give students access to lecture materials on or before the class hence enhance efficiency and possibility of syllabus coverage by the lecturer.
- Support improved communications between lecturers and students.

1.2 Scope of the Study

The scope and area of study is limited to teaching of thermodynamics in mechanical engineering with particular reference to national diploma syllabi for polytechnics in Nigeria.

1.3 Significance of the Study

This research work when completed and implemented, it will add values to teaching thermodynamic in higher institution of learning in many ways:

- It will help to reduce lecturer stress of writing note and drawing of diagram on marker board.
- It will help to reduce student stress of copying note and diagram from marker board.
- Since the course material may be available before the students before class, it will enable students to prepare for next class on their own.

2. RESEARCH BACKGROUND

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation Monaco, (2012). Essentially, the Cloud is a notion of a group of computers acting as one - and all connected to a network (and usually, the World Wide Web).

Further, the Cloud is a model of computing that allows for scaling of resources based upon real-time needs. So, if there are many users utilizing the system, a larger number of resources will be called upon to help distribute the load Dalace & Leonard (2012).

The problems in learning thermodynamics such as difficulties in visualizing basic concepts and in problem solving are a worldwide phenomenon, engineering thermodynamics is abstract and challenging to visualize. Students do have trouble in solving thermodynamic problems, designing and analyzing thermodynamic cycles, also number of students perceived thermodynamics as a difficult course because even after instruction, they were still confused and retained significant misconception about thermodynamics principles. Learning styles can affect the academic performance of students, also students' learning will improve when information is presented to them in a manner that matches with their learning styles. In engineering disciplines, students need additional support with illustrative animations, simulations, or further explanation with visualizations when they experience complex or abstract principles that are difficult to understand. Interactive multimedia systems can give motivation, increase learning rate, contribute to retention, and effectively manage large classes of students with different learning styles.

E-Learning can delivers a range of technologies and applications such word-processing, databases, and Spreadsheets, as well as statistical and qualitative data analysis tools, learners can use the mentioned technologies and application to develop their skills, understanding, & develop ideas and hypotheses, and present their results and findings Zorrilla & Alfarez (2008).

3. RESEARCH METHODOLOGY AND FRAMEWORK

3.1 Proposed Design

The curriculum content was taken into consideration in design of the proposed system. It determine the contents of the information (database) of the proposed system. The flowchart of the proposed system is shown in figure 1, while the figure 2 give the system architecture that illustrates user interaction. Security of the system is taken into consideration through the use of password for students to log-in after registration and approval by the lecturer or system administrator as shown in the flowchart. The proposed user interface is as shown in figure 3, it is adapted from web-based module for Thermodynamics developed at the University of Oklahoma.

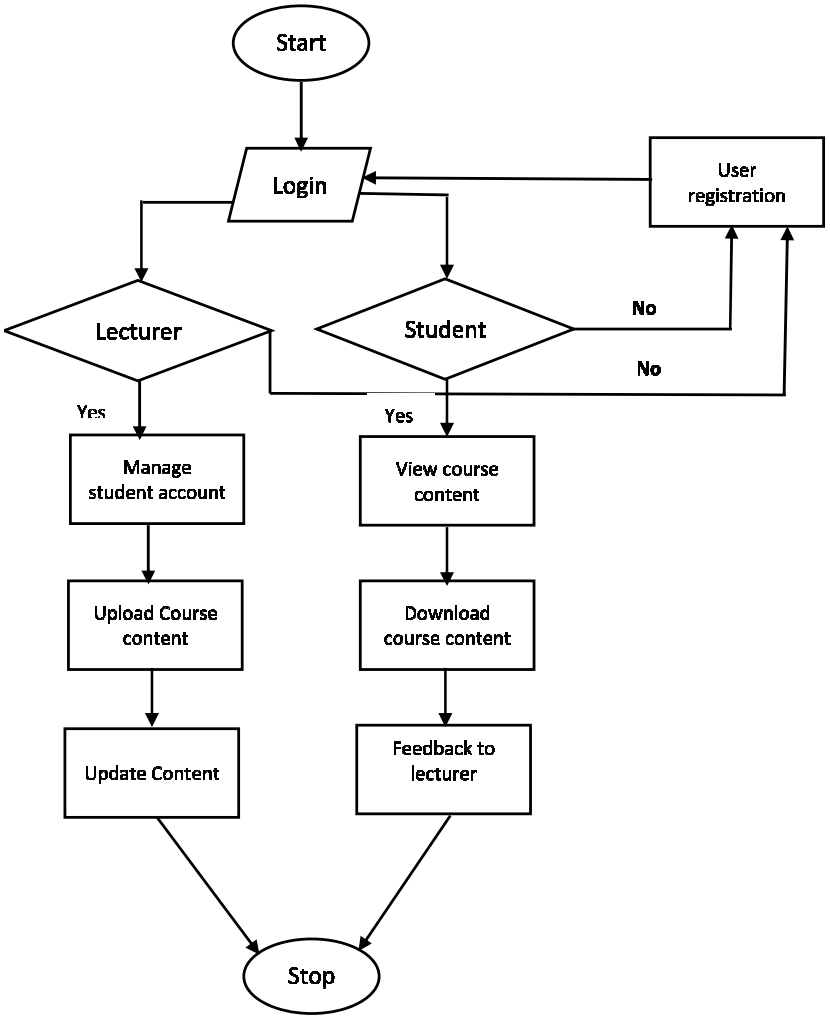

Figure 1: Proposed System Flowchart

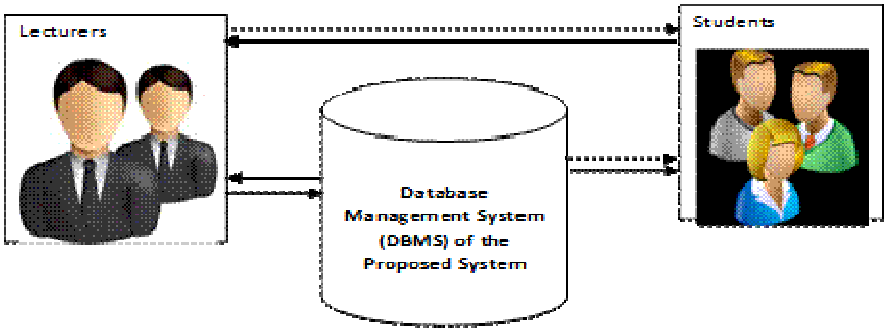

Figure 2: System Architecture

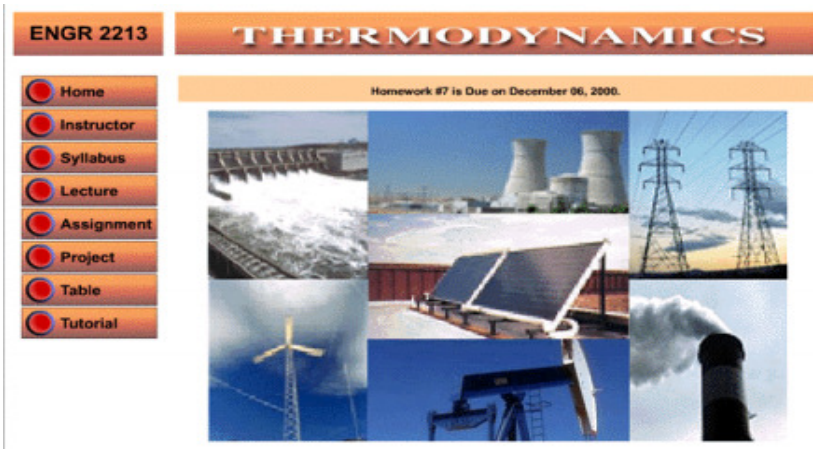

Figure 3. Proposed User Interface C. C. Ngo, F. C. Lai (2001)

4. DESIGN AND IMPLEMENTATION

Choice of programming language

The choice of programming language for the proposed system is PHP (Hypertext pre-processor) for server-side scripting, Actionscript and Micormedia-Flash for media content authoring and Mysql as the back-end database.

Input Design

The input design will illustrates the means in which users in general introduce data to the system for processing. The user interaction with the system begins with the login form to collect the user's login credential and validates against the database. The credential are verified and validated by determining the roles each user can play in session. New users can find a link to a register and login to the system.

The roles perform by users:

The input stage allows the users (Students, Lecturers and System-Administrator) to login. New users can register. Roles accrue to each of the user is as in the flowchart figure 2.

5. CONCLUSION

The massive proliferation of computer system and IT infrastructure has made cloud-based e-learning platform as content delivery tool a necessity for content delivery in the institutions of learning. This paper presents the conceptual framework of design and implementation of cloud-based e-learning platform as content delivery tool. Design and implementation of this system will enable some students to study on their own and also serve as alternative platform for learning after school hours for thermodynamic. It will also go long way for students visualize abstract thermodynamics concepts by using constructivist learning principles and visualization characteristics.

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