Develop a web tool for Electrical Engineering Courses

K. M. Carman Cheng, K. W. Eric Cheng, K.W.Chan
Department of Electrical Engineering
The Hong Kong Polytechnic University
Hung Hom, Hong Kong
Email: eecheng@polyu.edu.hk

Abstract - This paper describes a web tool – EElearning, which is developed for the use of Electrical Engineering department in the Hong Kong Polytechnic University. The purpose of this study is to provide an interactive learning and communication platform for both electrical engineering teachers and students. In order to enhance the study motivation, various functionalities are implemented in the EElearning. This paper presents the main functions in detail, which are Virtual laboratory, Webinar, Interactive course material presentation, and Web translator.

INTRODUCTION

Computers and Internet are developing rapidly during the last few decades. From an innovative invention to furniture like electric equipment that most of the people can afford one at home. A computer is nowadays part of our life especially when the internet is as common as telephone.

Information is all over the internet. People can search, browse and access information according to their needs. Moreover, the style of communication has been changed. Not only getting information by one way but also expressing ideas are encouraging in the interactive internet world. People can communicate to everyone or part of selected audiences at anytime anywhere. Traditional education, which means one-way communication, is not good enough for the changing environment.

On the other hand, electrical engineering is involving in practical application in daily life. It is related in different areas, such as power supply, traffic, or even every piece of different electric devices. Electrical engineering is so important. However, for those students who are interested in electrical engineering, courses in electrical engineering are relatively difficult compared with other departments, since it implies many mathematical calculations and abstruse electric circuits. It is not easy to understand the concepts by just reading lecture notes on paper.

Hence, a functional web tool EElearning is being developed. It is to support the teaching and learning by developing different useful and educational functions and to package them in a web tool [1] [2] [3]. To be able to enhance study effectiveness, different multimedia techniques, such as Macromedia Flash 8 and Java applet, are involved in the project too.

The system has been developing for a few years. And the development life cycle is being looped. In every life cycle, some teachers' and students' are invited to do a revision test for the web tool. This is so important to maintain and improve the EElearning with quality. After analysing the opinions and suggestions, Improvements are implemented by programmers.

SYSTEM ARCHITECTURE

Fig 1 shows the system architecture. It is a simple structure with the only necessary elements.
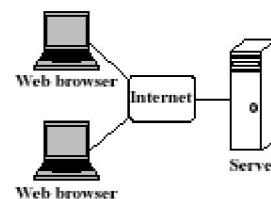

Figure 1 System Architecture

To design a web tool that is suitable for every students and teachers, it is important to keep the requirement as low as possible. Hence, the EElearning web tool is developed with a simple methodology. There is a web server supporting Hypertext Markup Language (HTML) for the web tool with an Access database for storing important data.

Users are requiring a computer with internet connection, and a web browser in order to access the web tool.

In the EElearning, it is developed with three different modules, which are Administrative module, Teacher module and Student module. Each of them has different functions and accessibility. Hence, they are requiring a user name and password to login the system. The administrator is the one responsible to manage and maintain the system. All different aspects such as hardware and software management, web tool and database updates, user's access rights, web tool and database reboot are controlled by the administrator. Teachers are able to manage their accounts with uploading lecture notes, managing their files,

uploading the lecture videos and posting news for their registered subjects. Students are able to manage their accounts with reading lecture notes online, downloading lecture notes, watching lectures online, doing virtual laboratory online and reading news for different subjects.

WEB TOOL FUNCTIONS

The design of the EElearning interface is based on the subjects in Electrical Engineering. Teachers and students are requiring to login for accessing advanced materials. The home page of the EElearning is developed with two simple and clear navigate menus, which provide users an option (Fig. 2).

Figure 2 Home page of the EElearning

One of the aims to develop the EElearning web tool is to enhance students' study motivation. Traditionally, teachers and students are communicating in a static way. Teachers are teaching face-to-face. Students are receiving useful materials by taking classes and reading handouts. Even when students are having difficulties, they have to make an appointment in order to meet the teachers. Students' motivation is easily affected by this one-way communication. Therefore, developing a web tool in an interactive way is so important for students.

Different means are developed to explore various ideas. This is because we want the web tool EElearning can give a go in different aspects. In this paper, four functions will be mentioned in the following sections. Each of it is independent, but fully relate to the electrical engineering course.

A. INTERACTIVE COURSE MATERIAL

Reading handouts and materials from lecturers are probably one of the most common methods for studying. Students have their responsibilities to read and study by their own. However, it is not easy for a student to study something new that he or she has no idea what it is about. To be able to help in this situation, we think that is important to have some interactive course materials in the EElearning.

In order to develop interactive contents, lecture notes are re-designed and published on the EElearning. In lecture notes, interactive graphical circuits (Fig. 3) are displayed in the web tool, which are being made using macromedia flash. When students read lecture notes on the EElearning,

the flash is loaded in the internet browser. Students can choose the status of the circuit. The flash is then run to simulate proper circuits in that "real situation". On the other hand, students can play with the electrical circuits and get some ideas on how it is working. Students are able to understand different electrical circuits easily.
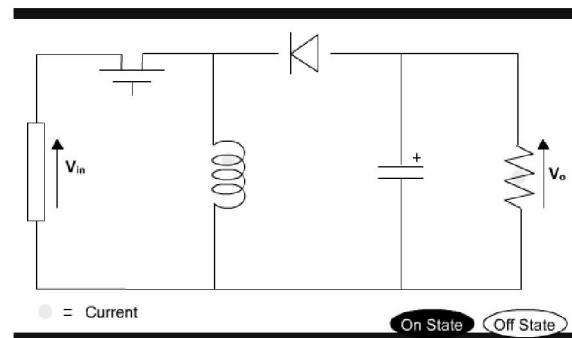

Figure 3 A flash electrical circuit

The design of the flash electrical circuits is relatively simple. It only consists of the symbols instead of the electrical devices and a moving yellow point to represent the electricity. Students are able to choose states for the circuit to simulate the electricity flow. It aims to demonstrate the students the idea of how electrical circuits are working.

B. WEBMINAR

Studying in the university is actually a self-learning studies mode. Students are required to take their responsibilities to study on their own. It is very different to study in secondary school. In order to provide a helpful platform for students, we designed to provide a lecture view system in the EElearning.

Webminar is another function using macromedia flash to develop. It is a lecture review system, which allows student to review lectures through the EElearning. This is not only for the students who miss the lecturers, but also for students who want to review the lectures anytime.

Teachers are able to upload their lecture's videos to the system, which supports PowerPoint slide show to incorporate with the video. As soon as the teachers upload their lecture videos and PowerPoint on the Webminar, simple modification is required for combining the video and PowerPoint. Students then are able to choose a lecture from a list and view the lecture video immediately with a computer and internet. However, another login is required to access this function for security reason.

The interface design of the Webminar consists of a video window, a table of contents of the lecture PowerPoint and a PowerPoint slide show according to the video. When students view a lecture in the Webminar, the video is playing on the top left-hand corner, with a table of contents on the bottom left-hand side, also a PowerPoint slide is showing on the right-hand side (Fig 5). They are synchronising to provide a lecture-like environment to students.
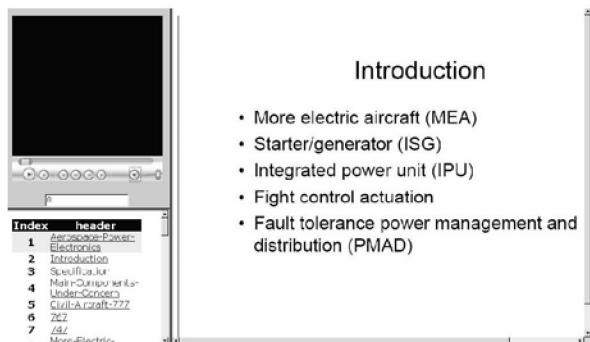
Figure 5 Webminar interface

C. VIRTUAL LABORATORY

Experiment is an important element in Electrical Engineering course. Students are learning how to connect electrical circuits through course to course. However, resource and time are limited to students. They are not allowed to do any experiment without the existence of teachers or laboratory assistants. Furthermore, equipments are not enough to support every student, one set of equipment are using by a group of three students. They might not be able to learn efficiently. Place and time are not flexible at all.

Virtual laboratory is not new [4]. Method using pure computer simulation is also very popular. However, a remote control experimental web system is not very common especially for power applications such as power electronics. Refs [5-7] are some examples.

In order to improve this situation, a virtual laboratory system is being developed using National Instruments LabVIEW (Laboratory Virtual Instrument Engineering Workbench) software. LabVIEW is a graphical programming language; also its appearance and operation imitate physical instruments. Moreover, this software is able to connect and control hardware with corresponsively response. On the other hand, students are able to do experiment not only in laboratory, but also in anywhere with computers and internet.

Students are able to choose and book the experiment that they are willing to do on specific period of time. Then they are requiring login the system to perform the experiment. As the experiment hardware is controlling by the software through the internet, real feedback are responded immediately. This can give students a feel that he or she controls the real instruments remotely instead of simulators. This is very different to what simulation does (Fig. 6).

User-friendly interfaces are developed in the virtual laboratory. Users are able to do the experiments through Virtual laboratory with similar instrument controls to in the university laboratory. Furthermore, Teachers has different accesses to students. They are able to view the statistic of how frequent the Virtual laboratory is using by students.

However, despite of laboratory safety, there is a regulation. At least one laboratory assistant is required when there is a booking for the virtual laboratory. It is because some experiments are involving some high voltage/ energy devices, which may overheat after a period of time and cause fire. In order to accommodate this criterion, students are only able to choose time in office hour.
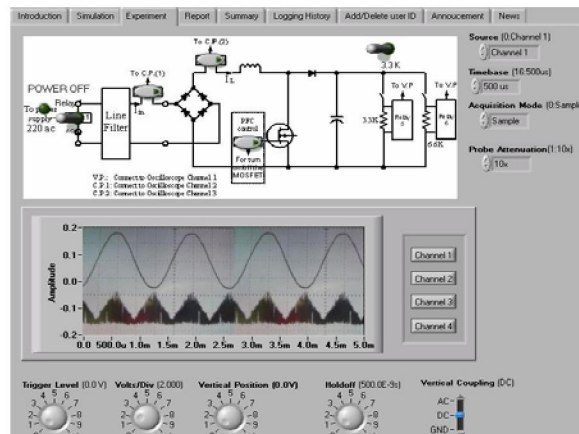

Figure 6 Interface of the Virtual Lab System

D. WEB DICTIONARY

Dictionary is a useful tool for most of the people in the world. People are able to find out a word's meaning and information related to the word. This is a great tool for people who are learning foreign languages. With the convenience of a communication platform EElearning, developing a web translator is an additional feature. In order to help students, this web translator is specifically on focusing the English vocabularies that are related to the Electrical Engineering courses.

The design of this dictionary is with a simple outlook. Users are able to type in an English or Chinese vocabulary, then choose if it is English to Chinese or Chinese to English format, and search if there is explanation match to the word.

This function is developed using a PHP script. The PHP script is handling the searching algorithm to do searching in an Access database. There are currently more than fifty thousand words storing in an Access database. To provide a better function, in the coming days, more and more words will be adding to the database.

FEEDBACK FROM STUDENTS

In order to improve the performance of the EElearning and the interest of the students by using the web tool, an inquiry was made to the students. Through analysing the response to the inquiry, this verifies the following:

84% of the students acknowledge that EElearning web tool has increased their interest and understanding in Electrical Engineering courses.

90% of the students agree that EElearning is a useful web tool to them.

89% of students are satisfied the performance of functions in the EElearning.

94% of students are looking forward to have different enhancements for the EElearning web tool.

Based on the students' opinion, they agree EElearning can benefit their studies. It is a very positive result to the development of the EElearning.

PLAN FOR THE FUTURE

Several improvements are formulated so as to incorporate some of the drawbacks indicated by the students and/ or by our own experience. For the Interactive course material, we may add some interactive exercises for testing student's knowledge. Secondly, for the virtual laboratory, due to the development cost and time, there are three laboratory exercises are available at this moment. We may implement a few more laboratories for student's advantage. Last but not least, the development of the web dictionary is scheduled to enhance. The database will be changed to MySQL rather than using Access, since the searching speed is much faster and the storage is more suitable for large database. Furthermore, we are considering adding more information for each word, for example, its tense and some example sentences.

CONCLUSION

In a development of a new web tool, many efforts and researches were being done. The main motivation for implementing this environment is to provide teachers and students a tool with various useful functions. This is to improve the study effectiveness of the Electrical Engineering students. The system is now being used for a few years. Some improvements are implemented every year after conducting survey to students. This is a good opportunity for us to enhance the system. In the future, we will keep our open mind to teachers and students, and maintain the EElearning with good quality.

The location of the web site can be found at:

http://eelearning.ee.polyu.edu.hk or
http://eelearning.polyu.edu.hk

ACKNOWLEDGEMENT

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