BASIC POWER SYSTEM FUN LEARNING

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A report submitted in partial fulfillment of the requirements for the degree of Electrical Engineering

Faculty of Electrical Engineering

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"I hereby declare that I have read through this report entitle Basic Power System Fun Learning and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power)"

Signature   : ....

Supervisor's Name   : Pn. Jurifa bt Mat Lazi ....

Date   : 13th of May 2009 ....

بِسْمِ اللهِ الرَّحْمٰنِ الرَّحِيمِ

To my beloved father and my late mother,

En. Samsol Bin Selamat and Rosidah Binti Abdullah

To my sisters,

Nor Hafina Binti Samsol and Norhayati Binti Samsol

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ABSTRACT

Nowadays, technology is very advanced compared to ten years ago. This same thing also happened to learning system. Because of the technology, many students prefer study by computer than study by traditional learning process such as study in classroom, study by book or by power point. *'Basic Power System Fun Learning'* is a learning through computer (e-Learning) about Basic Power System subject. This project can be use by students, lecturer or other people to know the Basic of Power System. It can also be use as a teaching equipment where the medium of instruction is computer techonology. The purpose for this project is to develop an interactive and attractive courseware of Basic Power System through e-learning concept. This project is developed by using a Macromedia Flash 8 Software. *'Basic Power System Fun Learning'* will cover a scope of Fundamental of Power System, Per-Unit System and Load Flow Analysis. Fundamental of Power System will discuss about Power System Overview, Basic Principle and Balanced 3 Phase System. Per-Unit System discuss about Advantages of Per-Unit System, Circuit Diagram and Per Unit Quantities. While, Load Flow Analysis discuss about Introduction, Bus-Admittance Matrix, Methods of Power Flow Analysis and Gauss-Seidel Method. All the topics include an explanation, example and some tutorial for the user. Those topics will briefly discussed in an easy way and with some animation and moving images to make it clearer to be understand. User can explore every scene themselves with only just a click.

ABSTRAK

Pada zaman ini, teknologi adalah sangat maju berbanding sepuluh tahun lepas. Perkara yang sama turut berlaku kepada sistem pembelajaran. Oleh kerana teknologi yang berkembang ini, para pelajar sekarang lebih gemar mengikuti pembelajaran melalui komputer daripada mengikuti pembelajaran secara tradisional seperti belajar di dalam kelas ataupun belajar menggunakan buku. *'Basic Power System Fun Learning'* adalah sebuah pembelajaran melalui komputer (pembelajaran elektronik) mengenai Asas Sistem Kuasa. Projek ini boleh digunakan oleh para pelajar, pensyarah dan sesiapa sahaja yang ingin mengetahui mengenai Asas-Asas Sistem Kuasa. Ia juga boleh digunakan sebagai peralatan pengajaran yang mana bahan pengantarnya adalah teknologi komputer. Tujuan projek ini dibuat adalah untuk membina sebuah perisian kursus mengenai Asas Sistem Kuasa yang menarik dan saling bertindakbalas terhadap pengguna melalui konsep pembelajaran elektronik. Projek ini dihasilkan dengan menggunakan perisian Macromedia Flash 8. *'Basic Power System Fun Learning'* ini meliputi skop tajuk Pengenalan Sistem Kuasa, Sistem Per-Unit dan Analisis Aliran Beban. Pengenalan Sistem Kuasa membincangkan tajuk Gambaran Keseluruhan Sistem Kuasa, Prinsip Asas dan Sistem Tiga Fasa Seimbang. Sistem Per-Unit pula membincangkan tajuk Kelebihan Sistem Per Unit, Gambar Rajah Litar dan Kuantiti Per Unit. Manakala, Analisis Aliran Beban membincangkan tajuk Pengenalan, Matrik Bas-Galangan, Kaedah Menganalisis Aliran Beban dan Kaedah Gauss-Seidel. Semua tajuk akan dibincangkan melalui penerangan, contoh dan sedikit latihan untuk pengguna. Tajuk-tajuk berikut akan dibincangkan secara ringkas dengan cara yang mudah termasuklah dengan menggunakan animasi dan imej-imej bergerak bagi menjadikan penerangan menjadi lebih jelas dan mudah difahami. Pengguna boleh meneroka setiap halaman dengan hanya satu klik sahaja.

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NOMENCLATURE

AC   -   Alternating Current

BTN   -   Button

DC   -   Direct Current

FKE   -   Faculty of Electrical Engineering

FYP   -   Final Year Project

ODL   -   open and distance learning

pu   -   Per-Unit

RLC   -   resistor, inductor and capacitor

rms   -   Root Mean Square

UTeM -   Universiti Teknikal Malaysia Melaka

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CHAPTER 1

INTRODUCTION

1.1   Project Background

Basic Power System Fun Learning is a project that used an e-Learning approach. E-learning or also known as Electronic Learning is a type of technology supported education or learning where the medium of instruction is through computer technology. E-Learning can also defined as a network or online that takes place in a formal context and uses a range of multimedia technologies. The learning process can be carried out either individually or on small or large group basis. Since this learning process is using computer technology, for some instances there is no face-to-face interaction takes place for example it is exclusively used in open and distance learning (ODL). However, it also can be used in conjunction with face to face teaching. As such, e-Learning is not confined to the boundaries of the online format but also includes the offline format using any form of electronic media to facilitate the teaching and learning process. Users have the ability to work on the course at any time and from anywhere as long as there is a computer, internet access and a board email account if needed. E-Learning furnishes user with the self-paced modules, knowledge of the internet and computer skills, an opportunity to become independent and self reliant, flexibility of time-tabling and scheduling.

The importance of e-Learning can be seen through the interactive technology that offers a new mode of engagement with ideas via both material and social interactivity online. E-learning offers the ability to manage quality at scale, and share resources across networks, its greater flexibility of provision in time and place makes it good for widening participation. And also reduction in social difference afforded

by online networking fits with the idea that students should take greater responsibility for their own learning.

The Basic Power System Fun Learning is an e-Learning lesson on Basic Power System subject. Three chapters are involved which is Fundamental of Power System, Per Unit System and Load Flow Analysis. The aim is to make the study about Basic Power System subject interesting, simple and easy. The project is designed to guide students in Faculty of Electrical Engineering (FKE), Universiti Teknikal Malaysia Melaka (UTeM) especially second year students through information in an easy way with animations to make it easy to be understood. Hence, this project is profitable and helpful in education process since it can increase consistency among student when learning is captured and delivered by technology.

1.2   Problem Statement

Problem statement is a clear concise description of the issues that faced during developing this project. The problem statement needs to be addressed by problem solving so that a good result can be achieved.

Currently e-Learning has not rapidly advanced in nowadays technology. Most of students are not exposed to this kind of learning process caused less understand to the environment. As such, students are not comfortable with e-Learning method, as they are more familiar with the traditional learning process. Since the implementation of e-learning system by any institution or this institution not extensive, the exposure to students about this learning environment is limited. Owing to as such, students cannot fully understand the benefit of the e-Learning education system. Indeed, this project might help to solve this problem by exposing to students an interactive e-Learning on Basic Power System subject.

The existences of e-Learning system in the market nowadays are mostly focus on children education whereas the exposure to e-Learning course among the high education is in smaller amount. This may due to lack of support from the top management since in order to successfully develop an online learning in higher

education needs a total commitment and support from top management. Besides, the participation, cooperation and support from major universities are needed to expose the e-Learning to higher education. The Ministry of Education needs to have guidelines to help schools and higher learning institutions to implement e-Learning successfully and efficiently.

The manual learning process which is in classroom is less encourages most of students in understanding the subject of Basic Power System (Fundamental of Power System, Per-Unit System and Load Flow Analysis). Most of them have difficulties to clearly understand about this topic. Concern to this problem, Basic Power System Fun Learning is constructed to make the study about Basic Power System (Fundamental of Power System, Per-Unit System and Load Flow Analysis) simple and easy besides to convince the students to use this kind of learning system.

1.3   Project Objectives

In order to make sure this project perfectly complete, this project was developed based on several objectives. The objectives of this project are as below:

1. To develop an e-learning courseware on Basic Power System subject (Fundamental of Power System, Per-Unit System and Load Flow Analysis).
2. To study and explain the Basic Power System subject in creative way.
3. To expose an interactive way in study on Basic Power System (Fundamental of Power System, Per-Unit System and Load Flow Analysis) to electrical student.

1.4   Project Scope

This Basic Power System Fun Learning project scope is divided into three main topics. Each topic has several subtopics to be discussed. The scope is undertaken based on the Basic Power System subject syllabus. Table 1.1 shows the topics and subtopics for each topic.

Table 1.1: Project Scope

No	Topic	Sub Topic	
1.	Fundamental of Power System	i.	Power System Overview
		ii.	Basic Principle
		iii.	Balanced Three Phase System
2.	Per-Unit System	i.	Introduction
		ii.	Circuit Diagram
		iii.	Per-Unit Quantities
3.	Load Flow Analysis	i.	Introduction
		ii.	Bus-Admittance Matrix
		iii.	Methods of Power Flow Analysis
		iv.	Gauss-Seidel Method

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is a body of text that aims to review the critical points of current knowledge on a particular topic. A literature review can be just a simple summary of the sources, but it usually has an organizational pattern and combines both summary and synthesis. A summary is a recap of the important information of the source, but a synthesis is a re-organization, or a reshuffling, of that information. It might give a new interpretation of old material or combine new with old interpretations. It also might trace the intellectual progression of the field, including major debates.

The literature review ultimate goal is to bring the reader up to date with current literature on a topic and forms the basis for another goal, such as the justification for future research in the area. In this chapter, all the procedure of web-based system will be explained. This includes the domain that related to this web-based system, the current system that exists and the result after some research and comparison.

2.2 Domain

Electronic Learning (e-learning) is a method that used an animation to deliver information and learning to the user and the domain is Macromedia Flash Professional 8 software. Macromedia Flash Professional 8 is a set of multimedia

software created by Macromedia and currently developed and distributed by Adobe Systems. Since its introduction in 1996, Flash has become a popular method for adding animation and interactivity to web pages; Flash is commonly used to create animation, advertisements, and various web page components, to integrate video into web pages, and more recently, to develop rich Internet applications. Flash can manipulate vector and raster graphics and supports bi-directional streaming of audio and video. It contains a scripting language called Action Script. Several software products, systems, and devices are able to create or display Flash content, including Adobe Flash Player, which is available for most common web browsers, some mobile phones and other electronic devices (using Flash Lite). The Adobe Flash Professional multimedia authoring program is used to create content for the Adobe Engagement Platform, such as web applications, games and movies, and content for mobile phones and other embedded devices.

This software will make the learning through e-learning interactive and attractive by sound effects (musical), audio instructions (linguistic), simple example with animation, and the tutorial about the topic.

2.3 Existing System

The research on existing examples which related to this project is a must. It should be a good guideline or references as the case study on the existing system will be constructed in finding the advantages and disadvantages in order to accomplished this project successfully.

i)   Example 1: E-learning on '*Sistem Tiga Fasa*' (Three Phase System)

This is a quite good e-Learning example. It is about '*Sistem Tiga Fasa*' developed by Prof Dr Marizan Sulaiman, Zainuddin Mat Isa and Mrs Azrita Alias from Universiti Teknikal Malaysia Melaka (UTeM) [12]. Figure 2.1 shows one of its learning content. This example of e-learning explained about the Three Phase System topic by using the approach of drawing diagram and colourful word. Furthermore, this e-Learning also provides some animation for user understanding. After going

through this page, user can simply understand and gain knowledge. However, this e-Learning provides no example. Overall, this '*Sistem Tiga Fasa*' e-Learning example is interactive and attractive.
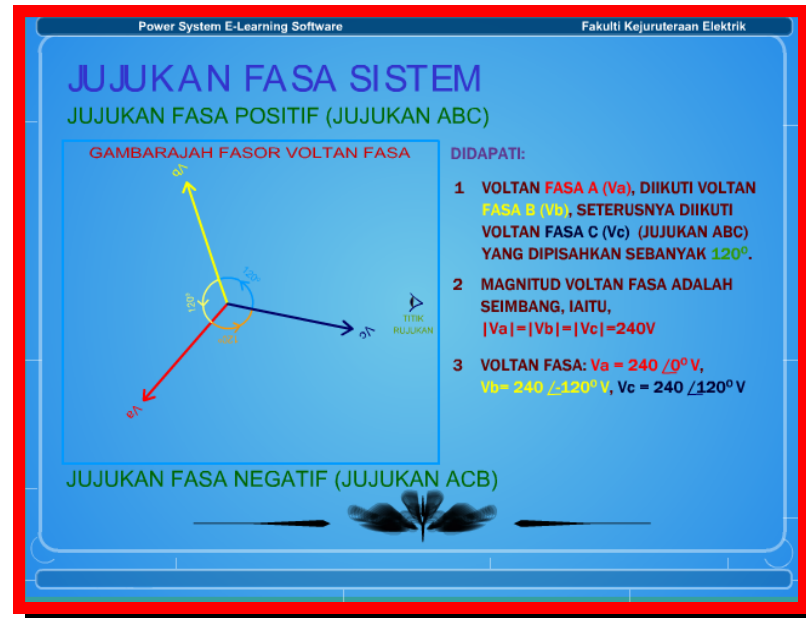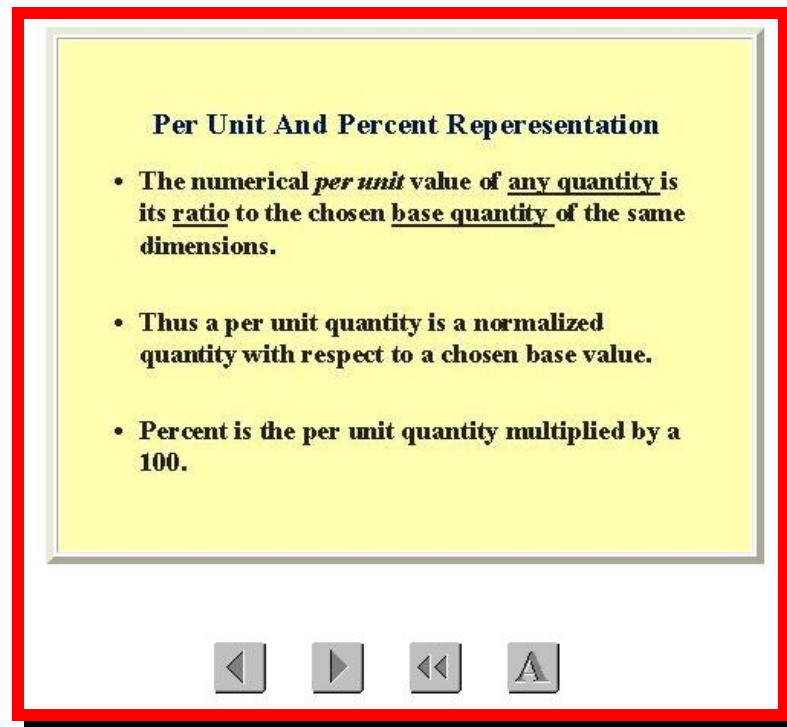

Figure 2.1: Learning content of '*Sistem Tiga Fasa*'

ii) Example 2: E-learning on '*Per Unit and Percent Representation*'

Figure 2.2 show an example about the '*Per Unit and Percent Representation*' by Vijay Vittal [13]. This example of e-learning was briefly explain about the Per Unit topic by the note and includes many calculation examples to make sure the user understand after going through this page. This e-learning also can be presented with text, so user can study about Per-Unit topic by using flash or manually using note. However, user might get bored when using this kind of e-Learning because it has lack of animation. Apart from that, the user interface was less attractive. Overall, this example is interactive but not so attractive.

Figure 2.2: Learning content of *'Per-Unit and Percent Representation'*

iii) Example 3: E-learning on *'Power Flow Solution'*

This is an example of e-Learning lesson on Power Flow Solution topic developed by Professor David C. Yu from University of Wisconsin [14]. Figure 2.3 shows the page of this e-Learning example. This e-learning provides sufficient notes and lots of formulas related to Power Flow Solution topic. It explains step by step to solve the problem. Besides, it also includes some examples in order to make sure the user can easily understand the topic discussed. However, the user interface was less attractive. Overall, this Power Flow Solution e-Learning example is interactive but not so attractive.
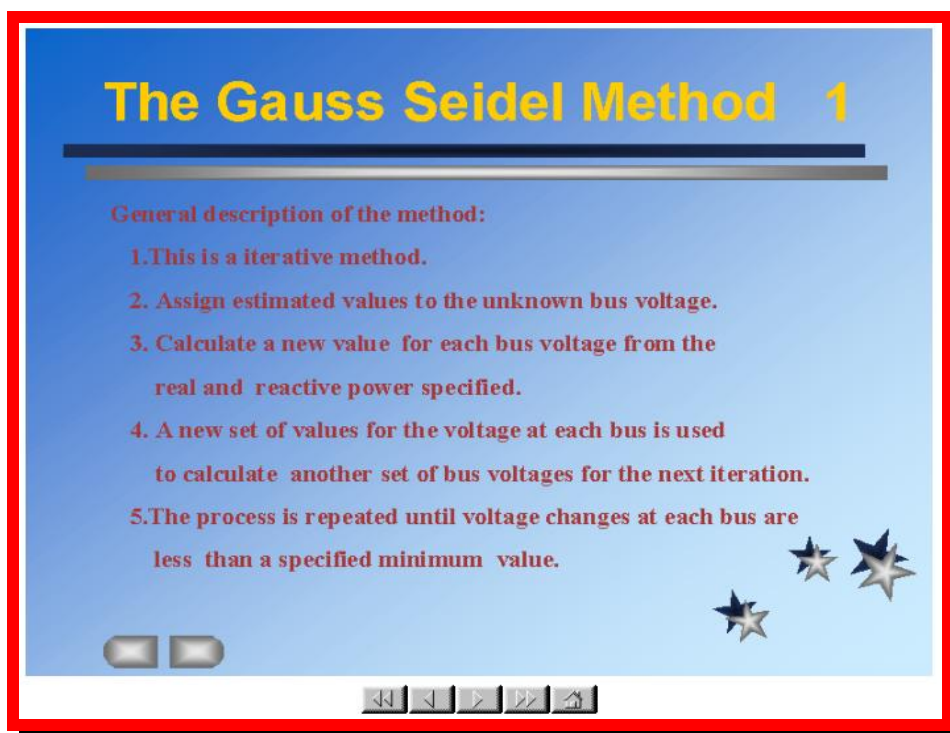
Figure 2.3: Learning content of *'Power Flow Solution'*

2.3.1 Comparison of Existing System

The e-Learning lesson examples of 'Sistem Tiga Fasa' and 'Power Flow Solution' are attractive, whereas, an e-Learning lesson example of 'Per Unit and Percent Representation' is not so attractive. The e-Learning lesson example on 'Sistem Tiga Fasa' developed by Prof Dr Marizan Sulaiman, Zainuddin Mat Isa and Mrs Azrita Alias from Universiti Teknikal Malaysia, Melaka (UTeM) as in Figure 2.1 seems to be attractive because it is using a simple background with the colourful words and animations that might help learning process. The e-Learning lesson example on 'Power Flow Solution' developed by Professor David C. Yu from University of Wisconsin as in Figure 2.3 seems to be attractive because it is using a suitable background colour with beautiful graphics design. Whereas, the e-Learning lesson example on 'Per Unit and Percent Representation' developed by Vijay Vittal as in Figure 2.2 seems to be less attractive because it using a simple background and word colour and there are no graphics design on the e-Learning lesson.

All three e-Learning lesson examples are interactive. The e-Learning lesson example on 'Sistem Tiga Fasa', 'Per Unit and Percent Representation', and 'Power

Flow Solution' is interactive because it is using simple and easy words. However, the e-Learning lesson example on '*Per Unit and Percent Representation',* and *'Power Flow* Solution' are more interactive because it provides a lot of examples for the users while the e-Learning on *'Sistem Tiga* Fasa' has no example at all. The comparison between the three e-Learning examples is shown in Table 2.1.

Table 2.1: Comparison of Existing System by using Heuristic Evaluation

	Sistem Tiga Fasa	**Per Unit and Percent Representation**	**Power Flow Solution**
Attractive	Good	Average	Average
Interactive	Good	Good	Good
The Uses of Simple and Easy Word	Average	Average	Average
The Background	Average	Average	Good
Animation	Very Good	Average	Average
Example	Average	Very Good	Very Good
Interface	Good	Average	Average
Clearly Marked Exits	Average	Average	Average
Shortcuts	Good	Good	Average
Easy To Deal With	Good	Good	Average

2.4 Outline of E-Learning Module

To develop this project courseware, a clear understanding on the e-Learning module is a must. Research and study are made on Macromedia Flash Professional 8 software. At the same time, study also made on the Fundamental of Power System, Per Unit System and Load Flow Analysis subtopics based on the Basic Power System syllabus.