IMPLEMENTATION OF REAL TIME LIGHTNING DATA FOR PEKAN AND VALIDATION DATA WITH LIGHTNING TNBR

NURUL FAZIRAH BINTI GHAZALI

This thesis is submitted as partial fulfillment of the requirement for award of the Bachelor Degree Electrical Engineering (Power System)

Faculty of Electrical & Electronic Engineering
University Malaysia Pahang

June 2012

ABSTRACT

Pekan are located at east of peninsular Malaysia which that like other tropical countries which experience very high cloud to ground (CG) density. Many members of public has lack information about lightning, therefore the website are responsible to publish the lightning real time data at this area. This thesis presents the real time lightning data for Pekan which detected by using LD-250 Boltex lightning detection hardware that connected to the computer and analyze the data using Lightning/2000 software. LD-250 is sensor that detect lightning using magnetic direction finder (MDF). Data collected by Lightning/2000 is compared with Tenaga Nasional Berhad Research Sdn.Bhd (TNBR) to avoid from forecast error before it can be publish to the website.

ABSTRAK

Daerah pekan terletak di timur semenanjung Malaysia yang mengalami kemungkinan besar kilat seperti Negara tropic yang lain. Kebanyakkan penduduk daerah ini kurang pengetahuan dan informasi mengenai kilat, jadi dengan adanya laman sesawang dapat mempamerkan maklumat taburan kilat bagi daerah pekan. Thesis ini mempamerkan maklumat kilat yang berlaku pada waktu semasa yang dikesan menggunakan Boltex LD-250 yang terus disambungkan ke komputer untuk dianalisis menggunakan Lightning/2000. Pengesan LD-250 menggunakan cara pencarian arah magnet. Data yang disimpan oleh Lightning/2000 akan dibandingkan dengan Tenaga Nasional Berhad Research (TNBR) bagi mengelakkan dari kesilapan sebelum dipamerkan di laman sesawang.

TABLE OF CONTENTS

LIST OF CHAPTER

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBRIVATION

IMPACT	-	Improved Accuracy through Combined Technology
ESP	-	Enhanced Sensitivity and Performance
LDN	-	Lightning Detection Network
CSS	-	Cascading Style Sheet
FTP	-	File Transfer Protocol
AJAX	-	Asynchronous JavaScript and XML
XML	-	Extensible Markup Language
HTML	-	Hyper Text Markup Language
PHP	-	Hypertext Preprocessor
ECMA	-	European Computer Manufactures Associate

CHAPTER1

INTRODUCTION

1.1 Background

The process of developing lightning occur when the charge separate cause by the collisions between the ice crystal and graupel produce electric field. As the thundercloud moves over the surface of the earth it will approach the ground, the presence of the opposite charge on the ground enhance the strength of the electric field.

Lightning is a common phenomenon in Pekan region which located at coast of South China Sea. The populations in this area consist of fishermen who make a livelihood from the sea and industrial park which exposed to damage that cause by lightning. The information about lightning occurrences at this region may help these people to buckle up during lightning. It is important to understand the phenomena and characteristic of the lightning because lightning cannot be prevented.

This project is to develop a website for real time lightning data in Pekan region. The purpose of developing this website is to publish real time lightning data in 50km radius from the sensor coordinate which is located on the rooftop of UMP FKEE building. This website can contribute in safety and knowledge in lightning to people in this region as the discussed in this thesis.

Malaysia meteorological department can broadcast the weather information to people around, but they are not focusing on lightning occurrence, but their website not mentioning the location of real time lightning data which is very important for some factory or organization for safety purpose. By implementing the real time lightning data for Pekan in the website, people will start take a serious precaution during storm which might bring lightning along.

This project is collaboration with Tenaga Nasional Berhad Research (TNBR) to validate the data collected by LD-250 with data collected by TNBR using IMPACT ESP sensor which is located at eight difference location in Malaysia. TNBR also tracking the real time lightning data and estimating fault location.

1.2 Objectives

1. To develop a website on real time lightning data for Pekan.
2. To validate the data of Lightning/2000 with lightning TNBR

1.3 Project scope

1. Use LD-250 as the sensor to detect the lightning strike within 30km radius and validate the data with lightning TNBR.
2. Develop a website to publish real time lightning data and provide the information of lightning occurrence on that area. (output data contain of: strokes, flashes, energy and noises)

1.4 Thesis outline

There are all five chapters being structures in this thesis and every chapter will elaborate in detail. For the first chapter, in the background about this project discussed how important the implement of real time lightning data, objectives and project scope.

Chapter 2 will explain and discuss on the literature review of real time lightning data. It also focused on how important the real time lightning data and its implementation nowadays. This chapter gives brief review about the type of sensor and software used in this project and explains the method of detection use by the sensor.

Chapter 3 discusses the methodologies which have been applied in completing this project. This chapter consists of block diagram and flow chart which explained the step on doing this project which is started with the detection of lightning by sensor and end with real time lightning data in the website.

Chapter 4 is discussing and displaying all the results obtained and the limitation of the project. All discussions are concentrated on the result and the overall performance of the software when it is link directly to the website.

Chapter 5 will include all the summaries and conclusion of the implementation of real time lightning data for Pekan and validation data with lightning TNBR. This chapter also discuss on the project problem and recommendation for this project development or modification.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review for this project has been taken from various sources like journals, books, articles and others. From the literature review, the input that have been collected and it is useful for better understanding of this project.

2.2 Boltex LD-250

The LD-250 is type of sensor that is used for this project which contains a small active antenna to receive the radio signals from lightning strikes. The antenna is using the magnetic direction finder (MDF) technique to detect the lightning. The receiver consists of 2 orthogonal magnetic loops from which the source azimuth can be deduced. The source location is then estimated by the triangulation technique [5].

2.2.1 Magnetic direction finder

LD-250 is using magnetic direction finder method to detect the occurrence of lightning within 300km radius from where the sensor been setup. The sensor operates by sampling North-South and East-West component of the return stroke magnetic field at the initial peak using the 2 orthogonal loops.

This method does not contain the polarization error in the recorded result. The magnetic antenna systems and direction finding electronics are simple, reliable, and easy to conduct using modern solid-state component [2].

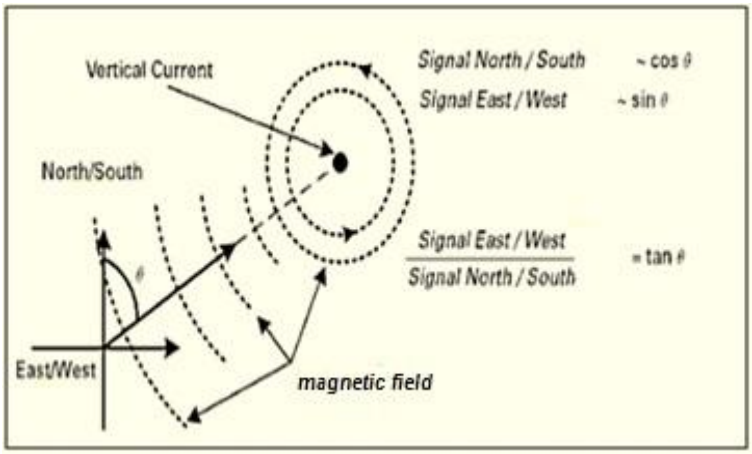

Figure 2.1: Determine azimuth angle to a vertical current source with MDF

2.3 Lightning/2000

This software can be used to replay lightning achieve files created by Lightning/2000 or when use a system that has Boltex lightning detection hardware and antenna, can detect and analyze real time lightning data [12].

Real time lightning data display by Lightning/2000 will directly publish into the website. By using this software the display data is more clear and easier to understand. The software also summarizes daily lightning distribution within the sensor zone.

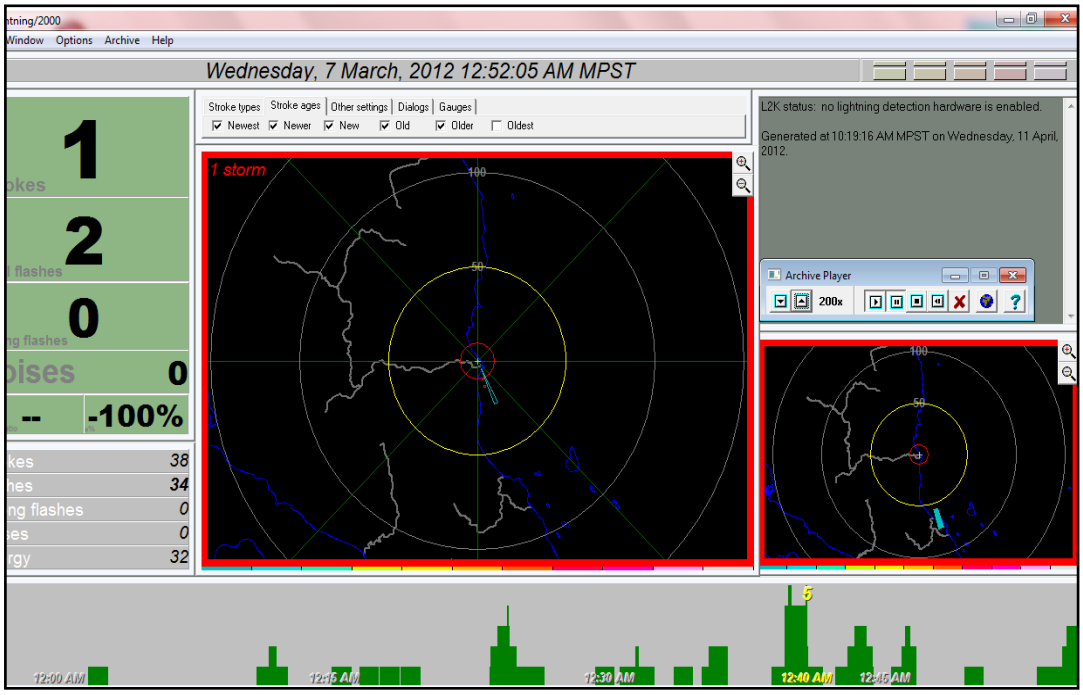

Figure 2.2: Lightning/2000 display

2.4 Lightning detection network (LDN)

The need for an accurate lightning data and the desire to reduce the impact of lightning on the supply reliability and quality has motivated TNB Research Sdn. Bhd. (TNBR) to install the Lightning Detection Network (LDN) in Malaysia [1].

In an effort to reduce the impact of lightning in TNB, TNB Research Sdn. Bhd. (TNBR), a research arm of TNB, has installed a Lightning Detection Network (LDN) in Peninsular Malaysia in 1994. Continuous monitoring of sensors performance for upgraded network is being carried out by Lightning Detection System Laboratory operated by TNBR. Lightning events and its locations are recorded by a system called Lightning Processor 2000 (LP 2000), which is developed by VAISALA [11].

The function of LDN is tracking the lightning activities in real-time.LDN also estimation faults locations based on location of lightning strokes and speedy supply restoration. LDN also do an analysis of faults on power lines and justification for lightning mitigation efforts and assessment for its effectiveness. LDN is using IMPACT sensor to detect lightning which:

1) Isolates electromagnetic waveforms of lightning
2) Combines MDF and TOA technology
3) Detects C-G and C-C lightning
4) Detects radio frequency energy in range of 0.4 to 400kHz
5) Has detection range up of about 1500 km, up to 625km is use.

2.5 Accurate lightning data

An accurate data is necessary because it is presented in the website for public awareness. It has been long realized that there has been a lack of accurate and reliable lightning data in Malaysia to enable accurate studies on lightning and its mitigation. The accurate data will enable the reader to estimate the thunderstorm and flash density values for their particular locations [3].

The available information about the Td (thunderstorm) in Malaysia has so far been erratic. Several maps that indicated the Td level presented in local seminars and conferences seemed to be inaccurate when compared to the actual data provided by the mms. Among important factors to consider are location accuracy and detection efficiency of the network which in turn depends on the number and the positions of the sensors. Sensor communication medium selected must be reliable and reasonable in term of cost [3].

After several weeks of collecting data, all the collected data must be validate with lightning TNBR before proceeding to the next step. Once the data had been validate, analyze on comparison between data and find the error percentage. Only accurate data will be publishing in the website.

2.6 Ground based Lightning Locating System

Modern LLS are able to determine the location, intensity, and movement of thunderstorms in real-time, and can help locate lightning-caused damage to resources and infrastructure [16]. The implementation of real time lightning data in this project is through the published data in the lightning detector homepage which is the created website. This website is based on the ground based Lightning Locating System concept.

The lightning occurrences data are visualize in the map which is plotted by Lightning2000. Various mapping system have been developed over the last 50years, operating in various frequency ranges and bandwidths. These system focus on detailed discharge structure, but do not provide direct measurement of polarity, charge, or current magnitude [16].

There is a growing number of ground-based LLS and technique. This show the expanding importance of lightning, and more specifically, its impact on modern human life and infrastructure [16]. Pekan is one of the locations that may influence a bad damage as the impact of lightning strike, but there is room for improvement in human life by the development on lightning detector homepage.

2.7 Create website

Real time data captured by lightning/2000 will be display in a website which is the main goal of this project. A few steps should be taken seriously to create a new website which needs expertise in IT knowledge.

2.7.1 NetKL network

Choosing the right kind of web hosting service can be a very daunting task at times as there are some very important features that we need to make sure of such as *amount of web space, ftp access, data transfer and pricing plans.*

NetKL Network is **reliable web hosting company with a good reputation** and trusted by many bloggers in Malaysia. Their servers are quite reliable and they offer reasonable price for each of their hosting plans. One of the **biggest strength of NetKL** is their **24x7x365 support system. NetKL Network**, assure their customers of for soonest response to every ticket they send. On top of that NetKL **guarantee minimum uptime of 99%** . This is an important aspect one has to look at since without that guarantee, web hosting company will have little incentive to ensure that its servers are running all the time. Most of the plans come with standard features such as *spam protection, PHP My Admins, Webmail and E-mail Forwarding. NetKL Network* also use **Softaculous Auto Installer** for easy installation of your blog.

2.7.2 Ajax

The website display required the data to update every 60 second, so it will automatically refresh and update itself. This application required Ajax tool for JavaScript to communicate between lightning/2000 and server to achieve the desired behavior.

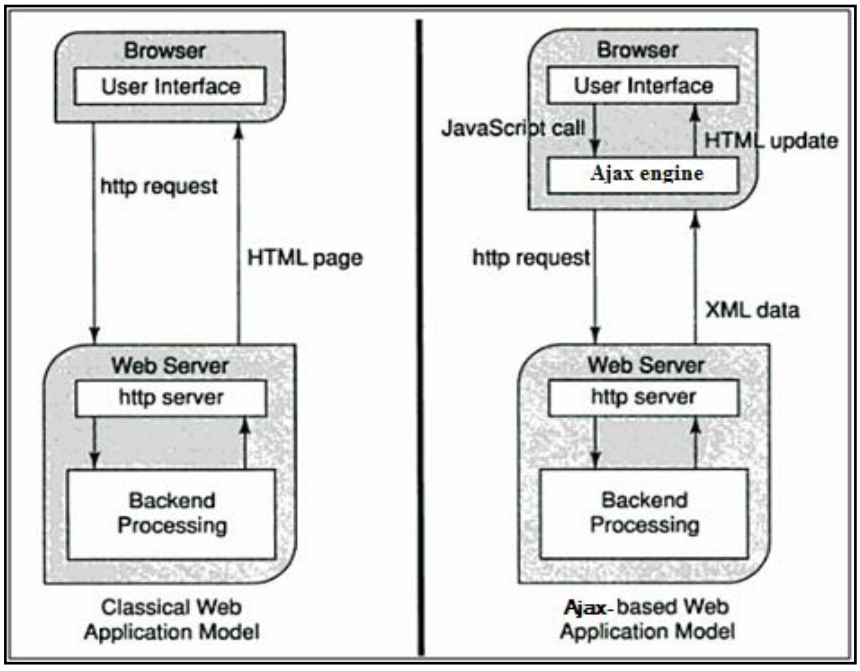

Figure 2.3: Application of Ajax in web server

Ajax is used to submit a request to a server which sends the respond back to the browser. The browser then parses the response and update relevant portions of the screen using DOM objects and defined by HTML [13].

Ajax-based performed better for two reasons. One, being that on the server side, only the relevant data that need to be retrieved or updates are processed. In classic web applications, other extraneous information on the page has to be refetched by server side scripts.

2.7.3 Dreamweaver coding

Web development required Dreamweaver software to write PHP, CSS and JavaScript. Adobe's Dreamweaver is a simple HTML editor. It can support a great number of scripting languages (PHP, ASP, CSS and more) and provided with feature web developer tools. This software tools implies a user interface that allows the user to view something very similar to the end result while the document is being created which work with FTP which support script formatting option. Dreamweaver sustain the user to access the code and it support the auto complete, error checking and script formatting features.

Dreamweaver help to display the web page in the design window and the code of related file that had been transfer from the Lightning/2000. Dreamweaver can edit can save the file that selected from toolbar without interrupt the web server display. Dreamweaver is so flexible because it has so many ways to customize it and make it work the way we want it to. In the options window, there are code coloring, code formatting, code hints, and code rewriting options that can adjust.

Dreamweaver enable users to develop web pages and create style sheets without having to learn the XHTML and CSS code languages, it also allows one to work directly with this code. This capability extends Dreamweaver's power and scope for experienced web authors, and serves as a valuable learning tool for anyone interested in understanding web documents' underlying code [14].

Dreamweaver also have multiple ways that a uniform design may be maintained across all pages of the site. The user may choose to use any combination of CSS, and Dreamweaver templates and libraries to ensure consistency on their site. Dreamweaver offers a robust support for CSS, so many aspects of the design may be defined in a separate CSS document that is referenced across the pages of a site.

2.7.4 JavaScript

JavaScript used on client side for the implementation of a web browser in order to provide enhanced user interfaces and dynamic websites. A client side language is run directly through the client being used by the viewer. JavaScript is written in the ECMA Script language standard and is primarily used in the form of client-side JavaScript. It can access and read file from client but it cannot update the file, therefore we use Ajax tools to update the file on web server.

With a client side language, the browser reads and interprets the code, and the result can be given to the viewer without getting information from the server first. This process can make certain task run more quickly [15].

A client side language can also access special feature of a browser window that may not be accessible with a server side language. [15].