

ESTIMATION AND IDENTIFICATION OF LIGHTNING
ELECTROMAGNETIC FIELD WAVEFORMS UTILIZING SIGNAL
PROCESSING METHOD

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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SIGNAL PROCESSING METHOD**

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I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.

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DEDICATION

This thesis is wholeheartedly dedicated to our beloved parents, who have been our source of inspiration and gave us strength when we thought of giving up, who continually provide their moral, spiritual, emotional, and financial support.

Secondly, to Dr Mohd Riduan Bin Ahmad our supervisor who have laid out the direction, tried to eliminate the blisters and to open our eyes to understand the excellence of continuing the education.

Thirdly, to our brothers, sisters, relatives, mentor, friends, and classmates who shared their words of advice and encouragement to finish this study.

At last, I dedicated this thesis to the Almighty God, thank you for the guidance, strength, power of mind, protection and skills and for giving us a healthy life. All of these, we offer to you.

ABSTRACT

Lightning has been a strange natural phenomenon since antiquated time. Although, the phenomenon of lightning is uncovered as the transmission of electrical discharges, there are numerous obscure regions inside the event of lightning itself. Consequently, the studies and researches about lightning are still an interesting issue these days. The main equipment that used for lightning studies and researches is lightning detectors. The lightning detector already invented in the year of 1894. One of the famous lightning detector devices used is LD-350 with price of RM 200,000. The problem of that lightning detector is not able to process the lightning data automatically and it is not able to identify the type of lightning which is fundamental of the lightning researches. Therefore, we are motivated to build a cheapest and automated lightning detector by using the Picoscope 2204A (a PC-based oscilloscope) and Raspberry PI 3B (minicomputer). The Picoscope 2204A plays its role to fetch signal from the antenna in analogue form and convert it into digital form and save it in the memory of Raspberry PI 3B in the text file format. The Raspberry PI 3B was assigned to transfer the text file data from its memory to local computer by using network arranged storage

(NAS). In the computer, the MATLAB platform was used to process the lightning data and identify the type lightning automatically without human intervention.

ABSTRAK

Kilat adalah sejenis fenomena semulajadi yang aneh sejak zaman kuno. Fenomena kilat ditemui sebagai penghantaran pelepasan caj elektrik tetapi terdapat juga banyak kawasan kabur dalam kejadian kilat itu sendiri. Selain itu, kajian dan penyelidikan mengenai kilat merupakan isu yang menarik yang sedang dilakukan hingga ke hari ini. Seterusnya, peralatan utama yang digunakan untuk kajian kilat dan penyelidikan adalah pengesan kilat. Pengesan kilat telah ditemui pada tahun 1894. Salah satu alat pengesan kilat yang terkenal adalah LD-350 dengan harga RM 200,000. Walau bagaimanapun, kelemahan pengesan kilat itu adalah, ia tidak dapat memproses data petir secara automatik dan tidak dapat mengenal pasti jenis kilat yang merupakan asas penyelidikan kilat. Oleh hal yang demikian, kami bermotivasi untuk membina pengesan kilat yang murah dan beroperasi secara automatik dengan menggunakan Picoscope 2204A (pc osiloskop), Raspberry PI 3B (komputer mini) dan sebuah komputer. Picoscope 2204A akan memainkan peranan untuk mengambil isyarat dari antenna dalam bentuk data analog dan mengubahnya menjadi bentuk digital dan menyimpannya dalam memori Raspberry PI 3B dalam format fail teks. Raspberry PI 3B telah ditugaskan untuk memindahkan data fail teks dari memorinya ke komputer

tempatan dengan menggunakan storan rangkaian tersusun (Network Attached Storage). Tambahan pula, platform MATLAB akan digunakan untuk memproses data kilat dan mengenal pasti kilat jenis secara automatik tanpa kewujudan manusia. Kesimpulannya, jenis kilat akan dikenal pasti secara automatik.

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LIST OF SYMBOLS AND ABBREVIATIONS

IP	:	Internet Protocol
CG	:	Cloud to ground
IC	:	Intra cloud flashes
NBE	:	Narrow bipolar event
USB	:	Universal Serial Bus
OS	:	Operating system

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CHAPTER 1

INTRODUCTION

1.1 Background

Lightning is a standout among the most erratic and risky marvels concerning climate. It has been estimated that lightning strikes somewhere on the surface of the earth about 100 times every second [1]. Lightning is a splendid blaze of light flash delivered by the release of electricity produced via friction and the estimated power around 100 million volts [2]. Lightning flash is one of the world's fascinating wonders. The lightning is the main agent for the thunderstorm. The thunderstorm is remarkable for its lightning and thunder impacts.

Lightning happens when the negative charges (electrons) in the base of the cloud are pulled down toward the positive charges (protons) in the ground. The accumulation of electric charges must be great enough to overcome the insulating properties of the air. When this happens, a stream of negative charges pours down towards a high point