Faculty of Electrical and Electronic Engineering Technology

GSM-BASED LIGHTNING MONITORING AND ALERT SYSTEM

MUHAMMAD HAFIZUDDIN SYAHMI BIN MOHAMAD TAHAR
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GSM-BASED LIGHTNING MONITORING AND ALERT SYSTEM

MUHAMMAD HAFIZUDDIN SYAHMI BIN MOHAMAD TAHAR

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PROF. MADYA MOHD ARIFF BIN MAT HANAFIAH
Pensyarah Kanan
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan Elektrik Dan Elektronik
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I declare that this project report entitled "GSM-BASED LIGHTNING MONITORING AND ALERT SYSTEM" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

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Supervisor Name : PROF MADYA MOHD ARIFF BIN MAT HANIFIAH

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DEDICATION

To my beloved mother and other family member whose does always gives me support and motivation throughout my whole life and journey in studying at UTeM. Also thank you for all the motivation that helps online learning in this pandemic which is quite hard due to different surrounding, especially settling my assignment. Special thank you to my siblings who always help me in advising, giving idea and solving problems. Besides, giving inspiration by showing their hardworking in pursues studying and end up with a good career.

ABSTRACT

Malaysia is the third country in the world with the most frequent lightning strikes, after Rwanda and Congo, with an average of 190 days of occurrence in a year. In April 2006, Petronas which is a well-known Malaysian oil and gas company lost about RM100 million when two oil tanks and a natural gas tank of its own exploded and caught fire due to lightning strikes at an oil depot in the Pasir Gudang industrial area, Johor. The consequences of lightning on oil depot have repercussions a few tanks also can be life threatening for the worker that happen to be nearby. Oil and gas industries face the risk of fire and explosion due to ignition of flammable vapours or gases. In this project, a system that can give the early warning of lightning phenomena is developed and implemented to reduce the damage due to lightning specially to ensure the safety of the worker. The lightning is detected, and the signal is sent by the Arduino based controller to alert the worker via alert message through smartphone and monitor the occurrence of lightning disturbance with distance estimation. As the result, the worker can take early counter measure by avoid being near to the lightning occurrence area.

ABSTRAK

Malaysia adalah negara ketiga di dunia dengan serangan kilat yang kerap, setelah Rwanda dan Kongo, dengan purata 190 hari kejadian dalam setahun. Pada bulan April 2006, Petronas yang merupakan syarikat minyak dan gas terkenal Malaysia kehilangan sekitar RM100 juta apabila dua tangki minyak dan tangki gas asli sendiri meletup dan terbakar akibat serangan kilat di sebuah depot minyak di kawasan perindustrian Pasir Gudang, Johor. Akibat berlaku kilat di depot minyak, ia memberi kesan kepada beberapa tangki dan juga boleh mengancam nyawa pekerja yang kebetulan berada berdekatan dengan tangki tersebut. Industri minyak dan gas menghadapi risiko kebakaran dan letupan kerana pencucuhan wap atau gas yang mudah terbakar. Dalam projek ini, sistem yang dapat memberi amaran awal mengenai fenomena kilat dikembangkan dan dilaksanakan untuk mengurangkan kerosakan akibat kilat khususnya dalam menjamin keselamatan pekerja. Kilat dikesan, dan isyarat dihantar kepada pekerja berasaskan Arduino untuk memberi amaran kepada pekerja melalui pesanan amaran melalui telefon pintar dan memantau kejadian gangguan kilat dengan menganggar jarak. Akhinya, pekerja dapat mengambil langkah awal dengan mengelakkan diri dari berada di kawasan berlakunya kilat.

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Firstly, I thank Allah (SWT) for his blessing because I finally complete my PSM successfully. With this, I would like to express my heartfelt gratitude to all people who helped me in making my Bachelor project successful. I would like to express my gratitude to my supervisor, PM Mohd Ariff Bin Mat Hanafiah for the guidance and suggestions, words of wisdom and patient throughout out this project and for giving me moral support throughout the journey. My highest appreciation goes to my parents and family. An honourable mention also goes to my siblings and to my colleague, thanks for all the hardship, cooperation, and memories during our journey in UTeM.

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V	-	Voltage
km	-	kilometer

LIST OF ABBREVIATIONS

f	-	frequency
LC	-	Liquid Crystal
Q	-	Q factor
Bw	-	Bandwith

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CHAPTER 1

INTRODUCTION

Background

Development in technology become more advance as people strive to create more and more technology with their creative innovation to reduce workload in daily life. Besides technology, people also create advance system such as create drainage system that prevent flooding of low-lying areas, there by avoid causing property damage and health risks. There are many systems have been develope. One of the system is warning system against natural phenomenon which is ligtning. Lightning is an electrical discharge caused by imbalances between storm clouds and the ground, or within the clouds themselves. Most lightning occurs within the clouds. Even it occur as natural phenomenon lightning is very dangerous. Lightning strikes on people, though comparatively rare, can cause conditions ranging from amnesia to cardiac arrest or known as the abrupt loss of heart function. Lightning can also cause the surrounding air to heat up to 27,700 degrees Celsius (almost 50,000 degrees Fahrenheit), often setting nearby objects on fire. This natural phenomenon cannot be stop but people can take safety precaution of it.

This project will discuss about how to monitor the lightning and send alert notifications to user using GSM. Furthermore, the encouragement to develop this project is stated in the problem statement given of this chapter. Hence, the main objective in developing and scope are both mention in this chapter.

Problem Statement

Lightning strikes are wildly erratic and unpredictable natural phenomenon, and their immediate and erratic effects can be disastrous to structures. Because of the low possibility of a hit, building owners and managers sometimes fail to ensure that their structures are adequately protected from direct lightning strikes. As a result, the structure is exposed to the risk of being struck by lightning with no protection. Different structures are located in areas

where lightning strikes as frequently as possible, making a direct impact on the structure essentially unavoidable and maybe rehashed a few times each year.

Figure 1 shows Lightning occurs near construction buildings.

The advancement of technology has made it possible to use security situations for private, commercial, and mechanical structures, such as leading lightning releases from the point of impact via the protection system and securely into the ground. The system's ability to function safely is contingent on the environment in which it is maintained. Even in a facility with a defensive mechanism, measurements show that a quick lightning strike might produce a fire or, more commonly, can obliterate electrical apparatuses and other gear. As a result of the problem caused by lightning, a system that forecasts its appearance and alerts authorities to take preventative steps is needed.

Project Objective

For this project the aim is to propose a systematic and effective method for monitoring and warning system. Specifically, the objectives are as follows:

- To design the GSM-based lightning monitoring and alert system.
- To predict lightning using sensor to detect lightning and make estimation distance from where the lightning occur.
- To send the alert message to user with the help of GSM.

Scope of Project

This project scope is focus on two main components which is monitor the lightning that occur and send a warning message via wireless network. The system uses Arduino interfaced with sensors, LCD and GSM module for real time monitoring of data. Data from sensors is sent to Arduino and displaying on LCD. The results of the analysis in the form of lightning warnings will be provided to the user with the help of GSM. Hence lightning detection system alert where the disturbance of lightning by using sensor values. Specifically, Arduino UNO is used which will processes the input from the sensors and monitor data. It also displays output on LCD and sends the message to smartphone via GSM Module.

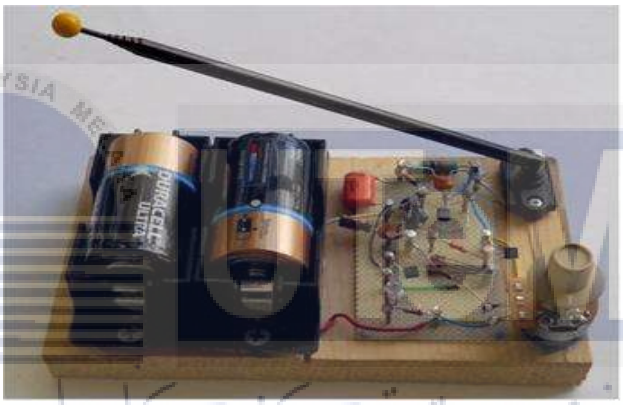

Figure 1.1 An example circuit of lightning detector circuit.

Figure 1.1 shows a simple sample of a diagram just to illustrates the scope of this project or study with simple connection of components while this project will be more advance which involve GSM. Thus, send alertg message to smartphone.

1.5 Thesis Organization

The report explained all the process of making GSM-based lightning monitoring and alert system. It has an overall of five chapters which is an introduction of project, literature review, methodology of the project, final outcomes of the project and final summary about this project.

In chapter one, an introduction of this project is explained which contains the background of the project, the problem statement, the objective that need to be achieved, and the scope of this project.

While for chapter two, it will be focused on about the journal that show some research that has been done on theory and literature review that related to this project.

Chapter three will be the methodology of this project operation. The method and component were chosen based on some references and studies. Therefore, the components and system that will be use on this project is decided. Flowchart, coding and works flow also explained in this chapter.

Next chapter is chapter four. For this chapter, it will focus on the result of the project. Still, the theoretical finding and some analysis of this project also will be discussed in this chapter.

Lastly, chapter five will show the conclusion of this project and upcoming recommendation to improve this project with grasp based on the research that have been conducted.

CHAPTER 2

LITERATURE REVIEW

Introduction

This subtopic will go through some of the previous work that has been done on the obvious verification of lightning, lightning concept utilisation, and other helpful knowledge that will be needed to complete this project.

2.2 Lightning Detection System

Lightning is a natural phenomenon that causes people great concern. In addition, industry is evaluating the negative impact on human prosperity, risk, and hardware disappointment caused by AC rule control driving electrical transient. As a result, the Lightning Detection System was developed to determine the current state of lightning in a specific location. The Lightning Detection System is used to identify and break down continuous lightning data, including lightning strokes, lightning area, and peak current.

The Lightning Detection System can reliably confirm the presence of lightning at a certain location and time. Lightning imagery corresponds to that of the environment satellite and environment radars in a similar way. Aside from that, the lightning data is extremely useful and can be utilized repeatedly in current environmental tossing and climatological analysis. In addition, the Lightning Detection System is employed to plan for the flight plan's use. The precision of a Lightning Detection System is determined by several factors, including the types and number of sensors available, sensor space, design, and condition. Lightning detection equipment primarily detects cloud-to-ground lightning. It's difficult to distinguish between cloud-to-cloud and intra-cloud lightning streaks. The size and type of lightning streaks varies (trade positive or 6 negative charges to the ground). The proportion of current fluctuates in a similar way, affecting the waveform's character.

Furthermore, in the evolution of lightning strikes, previous lightning detection systems were unable to predict the event of a lightning strike. The three main types of lightning can be distinguished by where they strike: within a single storm cloud, between

two mists, or between a cloud and the ground. Numerous other observable variations are seen, including "hot lightning," which can be seen but not heard over a long distance, dry lightning, which can trigger woodlands fires, and ball lightning, which is logically overlooked.

2.3 Lightning Monitoring System

There are two classes of lightning checking, to be specific earth and space-based system. In this framework, just the previous is thought of. For the most part, lightning checking, and identification systems have a similar unbiased, that is, to anticipate the area and power of lightning events. The principal segments are the sensors. In a commonplace framework, the sensor arrangement differs. It might comprise of Atmosphere Electric Field (AEF) sensors along with lightning sensors or lightning sensors alone. The advantage of the previous design is that it can follow storm cloud improvement cycles and developments.

Hence, it gives a freedom to foresee the rainstorm's area before it shows up. Utilizing the last mentioned, such forecasts cannot be accomplished. Different segments of a detecting framework incorporate a sign conditioning unit to deal with the yield signal from the sensor. For the most part, it comprises of a sign enhancer and channel segments. It might likewise include a microcontroller to deal with the information and yield signals from the sign molding unit. At that point, the condition sign will be sent as a simple or advanced sign, contingent upon the information transmission convention embraced. At last, the information is gathered and put away in a PC system. They will be breaking down utilizing certain numerical prediction apparatuses, and the outcomes will be utilized for additional activities.

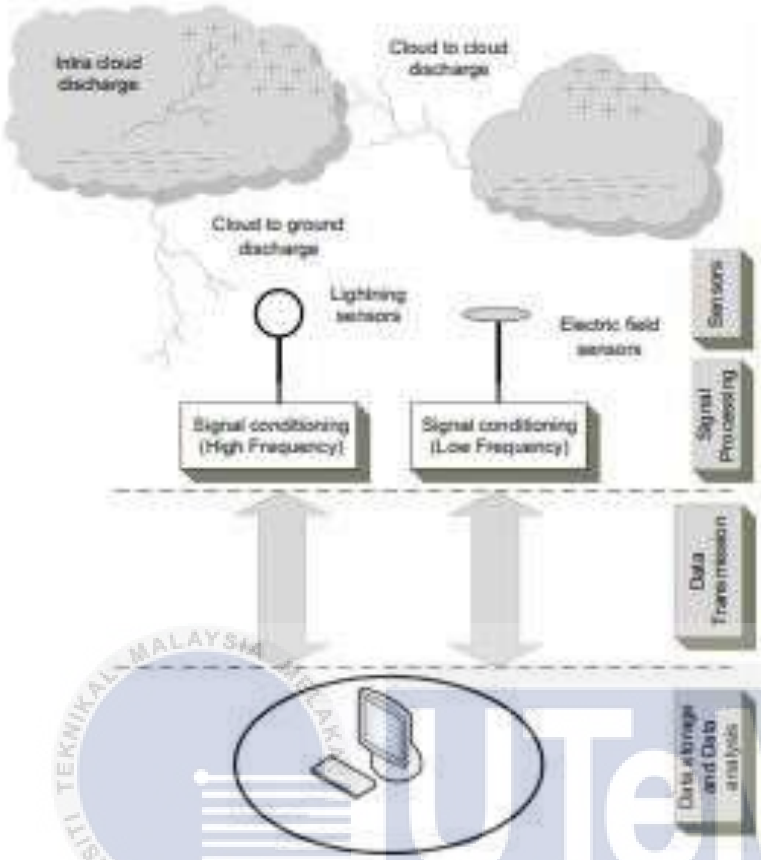

Figure 2 shows the overall square chart of an average lightning monitoring system.

2.4 Lightning Warning System

A lightning warning system is a gadget which cautions of lightning strike hazard in territories that should be ensured against the impact of climatic electrical releases.

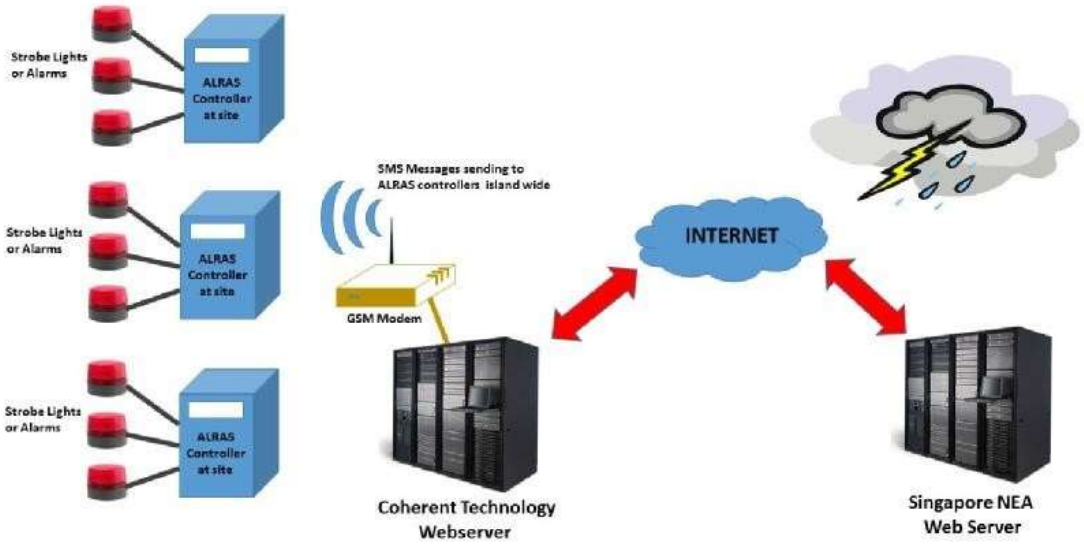

Figure 2.1 shows the lightning warning system in Singapore.

Figure 2.1 shows how Singapore lightning warning system works. Singapore is an island country which is prone to lightning strikes all year round. With the location laying near the Equator, the weather here is hot and humid create a condition that are favorable for lightning and thunderstorm clouds.

With an average of 168 thunderstorm days per year this make Singapore one of the highest lightnings occurrence in the world. So, they have developed Lightning Alert or Warning System or ALRAS to detect lightning activity in Singapore and alert the public to take necessary precautions.

2.5 Previous related work

Previous related research focuses on the researcher who has completed a project in a similar manner. A few scholars throughout the world are almost finished with the comparative study, but the equipment and system they have created for the project are inadequate. The most relevant articles had to be chosen and summarized to fulfil this section.

All the articles that were chosen and summarized are included as references.