UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CROSS WIND DETECTION FOR DIRECTION AND SPEED MONITORING SYSTEM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka(UTeM) for the Bachelor Degree of Electronics Engineering Technology (Industrial Electronics) (Hons.)

By

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I hereby, declared this report entitled “Cross Wind Detection For Direction and Speed Monitoring System” is the results of my own research except as cited in reference.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor Degree of Electronics Engineering Technology (Industrial Electronics) (Hons.). The member of the supervisory is as follow:

…….

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ABSTRACT

The transportation and communication is very important in a developing country. The highway or expressway plays an important role in transportation. By using the highway, people can travel to anywhere or any states in order to communicate with their relative or customer by calling them. Unfortunately, nowadays the weather is unpredictable. The cross wind is a disaster for a travelling vehicle. Cross wind can affect the stability of the vehicle and trailer. Stronger cross wind can cause a car turnover or sideslip when there was raining at that area. In that situation, the car may be threat another road user's life especially the motorists. The road user that involve in such situation may cause them die on the road. Furthermore, road users don't know the strength of the cross wind when they are travelling on that area. The old sign board and the windsock will not be seen by the road user at night time. By solving this cross wind problem, the cross wind detection for direction and speed monitoring system is being introduced in my final year project. The monitoring system will provide the warning signal to the road user by using the concept of LED blinking. The monitoring system has LCD display to show the current value of wind speed and wind direction in that area. Besides, the road user can also access the graphical user interface to obtain the current information of the wind.

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ABSTRAK

Pengangkutan dan telekomunikasi adalah sangat penting kepada negara yang sedang membangun. Lebuhraya memainkan peranan penting dalam pengangkutan. Dengan penggunaan pengangkutan, penduduk boleh melancong ke mana-mana tempat dan mereka juga boleh menghubungi kawan-kawan atau pelangan mereka masing-masing. Malangnya, cuaca sekarang sangat susah untuk dijangkakan oleh pengguna jalan raya. Angin lintang akan mengganggu kestabilan sesebuah kerata ataupun lori. Angin lintang yang bertiup kencang akan menyebabkan kereta mengalami kemalangan semasa kawasan itu berhujan. Pemandu kereta yang terbabit dalam kemalangan jalan raya yang disebabkan oleh angin lintang juga akan cedera. Selain itu, pengguna jalan raya tidak dapat tahu tentang maklumat kelajuan dan arah angin lintang dalam perjalanan mereka. Papan tanda yang lama dan usang tidak mudah dilihat oleh pengguna jalan raya semasa waktu malam. Dengan menyelesaikan masalah tersebut, projek 'Sistem pengesanan angin lintang untuk arahan dan kelajuan' telah diperkenalkan untuk projek saujana muda. Sistem ini akan memberi isyarat lampu yang berbeza kepada pengguna jalan raya supaya mereka dapat menganalisiskan tahap bahaya untuk angin lintang. Sistem tersebut juga memberitahu pengguna jalan raya bahawa maklumat kelajuan dan arah angin lintang di kawasan perjalanan mereka.dengan menggunakan paparan hablur cecair. Pengguna jalan raya juga boleh mendapat informasi angin lintang dengan menggunakan aplikasi yang diciptakan untuk kegunaan sistem pemantauan angin lintang tersebut.

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DEDICATION

To my beloved parents and supervisor, this thesis is dedicated to them,

For their endless love, support and encouragement.

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Firstly, I have to thank to my lovely parents for their love and encouragement throughout my life. Thank to you mum and dad who grew me up and provide me the must and the need materials. I will try my best to achieve your dream to be a professional engineer in the future.

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Thank a lot to all the people that help me before this. As “Rome is not built in one day”, I will do my best to complete the task. The result is not so important ; the most important thing is the knowledge that we gained from this project.

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CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter will discuss briefly the background of the Crosswind detector. Besides, this section will also discuss the problem statement, main objective, scope and summary of the project.

1.1 Project Background

Transport and communication are the keys for a developing country because it can make a rapid economic growth. The efficient movement of resources and the infrastructures facilitate between the central consumption and production. It also played a significant role in promoting the rural area to well-developing cities. There was a greater demand on the distribution, capacity and efficiency of communication network and transport in the country due to the rapid growth of the country's economic. With this purpose, Malaysia introduced the North-South Expressway project (PLUS) for people to across from South to North areas. North-South Expressway was introduced on 1994. This expressway is about 823 km from Thailand border to Singapore. It connects all the states on the West Coast, the peninsular Malaysia.

Crosswind is a wind blowing at an angle of 90 degree from the direction of a vehicle which is travelling. There are some dealers have to travelled form Johor Bahru to

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Kuala Lumpur to promote their products to customer. During New Year, most of the people will use the North-South Highway to go back their home town to visit their parents or relative. With the effect of the crosswind, they maybe involve in the road accidents because the effect of crosswind is the one of the most critical problems connected to the vehicle safety and stability. Strong cross wind is a disaster, which can cause the road accidents in the North-South Highway. In certain areas at bridge and highway, there are few spots of cross wind that may cause danger to the road users. As we normally note, there are less awareness on harmful crosswind by respective party. The PLUS authorities only put the notice board and wind sock in the crosswind area, the signboard of reducing speed limit and manual cross wind indication as the as road user reference to warming the road user. The objective of putting the wind sock is to detect the wind speed and wind direction but it is not enough because the wind sock do not show exactly the information of wind speed and wind direction. There is a new about the road accident caused by crosswind. In 21 June 1994, an air force officer and a lorry driver were killed while a lorry attendant was injured in an accident involving a motorcycle and two Lorries at the cross wind zone near the Ayer Keroh toll plaza. The cross wind detector and monitoring system is required to that kind of areas. This is important to produce a smart device monitoring system which can provide the exactly wind speed and wind direction information to alert the road users and prevent the road accidents.

1.2 Problem Statement

The weather is unpredictable nowadays, the road user needs some devices that can monitor the current crosswind speed and cross wind direction to reduce the unwanted accident on the highway or the bridge. Although there has the cross wind sign and wind sock, it is not enough to warn the road user because the cross wind sign and wind sock already old fashioned and the visibility of those sign are poor due to the colour of wind socks are faded. Furthermore, the road user cannot see the cross wind sign and wind sock at night. This project determines the design criteria used for the cross

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wind detector to protect the vehicles moving on the crosswind spot areas. This project is important due to the portable cross wind detector can help the road user to drive the vehicle according to the situation that they meet to prevent their vehicle from overturning or side-flip. The user can know the current wind speed and wind direction from the android apps and there are some LCD board to alert the road user about the information of the crosswind.

1.3 Project Objectives

(i) To measure the cross wind speed and direction.

(ii) To provide danger signal to road user.

(iii) To reduce the possibility of road accident occurs on the cross wind spot area.

1.4 Scope

The scope of this study involves the study of characteristics for crosswind and the area of the crosswind at highways in Malaysia.

Software: This system uses the Arduino Software to develop the Arduino Mega 2560. Arduino software normally provides the coding to program the Arduino Mega 2560 to process the Local indication and LCD display.

Hardware: This project developed the system by using the Arduino Mega 2560. The Arduino Mega 2560 will connect to the prototype and the reading will the wind speed and wind direction will transmit to the Arduino Mega 2560. For the wind direction, the potentiometer's value will transmit to the Arduino Mega 2560 and the formula is used to calculate the wind speed of crosswind. The cross wind information is then transmits to the local indication and the transfer the data to the graphical user interface.

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1.5 Structure / Summary of the report

This report is about the dangerous of the crosswind in highway and how to solve this problem scientifically. The crosswind detection monitoring system can solve the problem. By this monitoring system, the road user can know the currently wind speed and wind direction information. So that, the road user will more caution and give more attention when they across that crosswind area. For chapter 1, there is a briefly explanation about the background of the crosswind spot area in the Malaysia North-South Southern Expressway Route and the aim of this project is explained in the chapter 1.3. The software, hardware and the prototype for crosswind detection for measurement wind speed and wind direction monitoring system is well explained in chapter 1.4.

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CHAPTER 2
LITERATURE REVIEW

2.1 Introduction of project

The term of crosswind is means that the horizontal wind blowing at 90 degree from the direction of the moving vehicle with the speed limit of 45 km/h. An essential disturbance from the driving characteristics of vehicle combinations is crosswind. Crosswind has significant factor, particularly at the trailer, its forces and torque will affect the stability of vehicle. At low to medium wind speed, the crosswind will make the driver execute steering action to stay on the track. When the vehicle passes by or overtaking other vehicle, high lateral forces and high yaw-torque will act on the vehicle. The lateral force from the crosswind will lead the driver to an over-correcting in steering-action. This action will cause the vehicle overturn when crosswind blow through it. However, the North-South highway has only the windsock and the warning sign for the road user to know there is a wind blow without any static data about the wind speed and the wind direction. That why road user need a crosswind detection monitoring system to make them know the currently crosswind speed and the direction of the crosswind. This project will alert the road user to drive slowly at the area that the monitoring system mentioned or the road user can rest at the R&R station to prevent the blowing of the crosswind. [1]

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2.1.1 The Cross wind model

The crosswind usually is divided into 12 ranges of wind force, dependent on the velocity in Beaufort scale (Bft). The wind force 0 Bft is described as a calm crosswind and 12 Bft can be explained as a hurricane wind force. The safe wind forces are those from 0 to 7 Bft. For the wind force at 8 Bft, it can make the branches snapped off. For 9 Bft wind force, it can damage the roofs of the house. The present of the wind blasts are very dangerous for the automobile that moving in the road. The wind velocity of 100 km/h is choosing as the upper limit for crosswind sensitivity of the the passenger vehicles for crosswind analysis. For 1 Bft is almost equal to 1 m/s ; 3 km/h ; 2 knots ; 2 miles/h. [2]

Table 2.1: The Description of the wind status in different level of wind speed [3]

Wind speed in km/h	Description
30-40	Considerable wind , may lead unstable of vehicle
20-30	Rather slow wind
0-20	Very slow wind

2.1.2 Highway in Malaysia

In a developing country, The North-South Expressway Southern Route and the East Coast Expressway is very important road to link the all the states and the people can communicate with each other. Since the North-South highway is too long, there is a possibilities of crosswind to happen at somewhere at the highway. There are three highlighted crosswind area at the North-South Highway. The three areas are:

(i) Senawang-Pedas/Linggi on North-South Expressway Southern Route
(ii) Alor Gajah – Ayer Keroh on North-South Expressway Southern Route
(iii) East Coast Expressway

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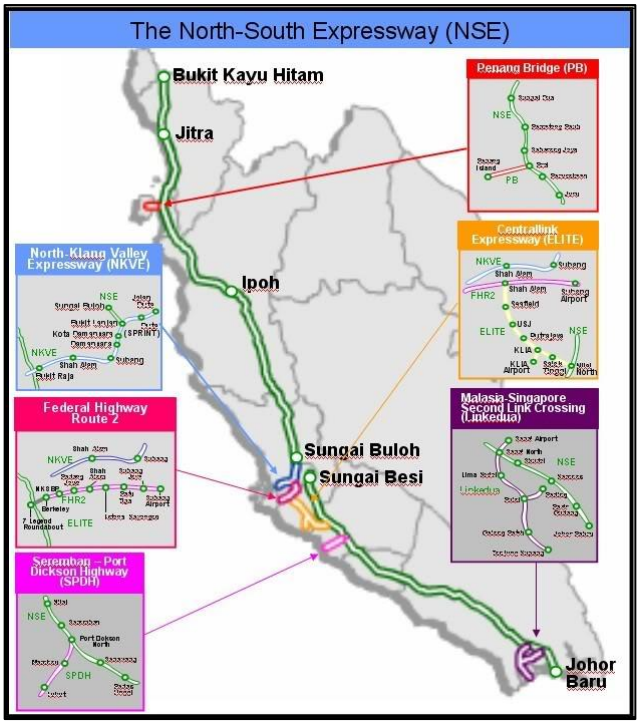

Figure 2.1: The North-South Expressway (NSE)

Abas AB.Wahab and Haslinda Mohamed Kamar have conducted an analysis about the characteristics of the crosswind at KM212 on the North-South Expressway Southern Route. The analysis concluded that the crosswind possible happen during North-East Monsoon Season. With this study, the plus authorities need to do some prevention to avoid the road accident due to the crosswind. [3]

2.1.3 Contribution of wind forces to rollover stability of vehicle

Every year, there are a lot of cases about the heavy duty rollover cases and it cost about hundreds of million dollars. The accidents involving in HDVs case is multiplied by 2.4 in comparison to the same risk which involved for the light vehicles. The wind is the significant factor that must be considered when investigating the HDV rollover cases.

The vehicle rollover accidents are a dangerous form of road accident. Due to their high center of gravity, the commercial cars are easily involved in the rollover

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