



**Faculty of Electrical and Electronic Engineering Technology**



**DESIGN AND DEVELOPMENT OF ENHANCED BLIND SPOT  
INDICATOR SYSTEM AT CURVE ROADS**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**POJAPRAKASH A/L CHANDRASEKARAN**

**Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics)  
with Honours**

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**DESIGN AND DEVELOPMENT OF ENHANCED BLIND SPOT INDICATOR  
SYSTEM AT CURVE ROADS**

**POJAPRAKASH A/L CHANDRASEKARAN**

**A project report submitted  
in partial fulfilment of the requirements for the degree of  
Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics)  
with Honours**



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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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## DECLARATION

I declare that this project report entitled “: Design and Development of Enhanced Blind Spot Indicator System at curve roads” 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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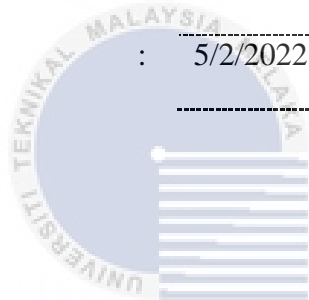
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## APPROVAL

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 (Industrial Automation & Robotics) with Honours.

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## DEDICATION

*To my beloved parents, siblings, teachers, and friends.*



## ABSTRACT

In this era of globalization, road accident is a global tragedy with the ever-rising trend. The number of accidents increasing year to year due to several causes such as a blind spot, adverse weather conditions, landslides, and road conditions especially at the curve or sharp roads which mostly located at mountains and hills. Therefore, the purpose of this project is to design and develop a blind spot indicator system in order to minimize the number of collision and death at the curve or sharp roads. The objective of this project is to design and develop a blind spot indicator traffic system and fog or mist situation detector to avoid accidents and crashes at curve roads, to develop a system to detect an accident at curve roads and alert the drivers by using IoT and to establish a landslide or inclined plane detector at the edge of the blind curve to alert the drivers. This blind spot indicator system used an Arduino Mega as a main controller with additional NodeMCU esp8266 for wireless communication. Furthermore, this system consists of ultrasonic sensor, temperature and humidity sensor, tilt sensor, and vibration sensor. Ultrasonic sensor is used to detect the presence of vehicles at curve road while the temperature in Celsius and the humidity rate in percentage are being sensed by DHT11 sensor. Besides that, tilt sensor is used to detect the landslide or inclined plane. Vibration sensor is used to detect accidents happens at the curve road. In addition, an alert message using Internet of Thinking (IoT) has been designed using ThinkSpeak platform and IFTTT services. From the results, the hardware circuit in the prototype was run smoothly as the simulation circuit and all the inputs and output displays were working well. The speed for the vehicle approach to the corner of the prototype also been predicted and tabulated to help real time implementation. In a nutshell, this project is easy to use and will be a better improvement to the blind spot system at a curve road.

## ***ABSTRAK***

Dalam era globalisasi ini, kemalangan jalan raya adalah tragedi global dengan trend yang semakin meningkat. Jumlah kemalangan meningkat dari tahun ke tahun disebabkan beberapa punca seperti titik buta, keadaan cuaca buruk, tanah runtuh, dan keadaan jalan raya terutamanya di jalan selekoh atau tajam yang kebanyakannya terletak di kawasan pergunungan dan bukit. Oleh itu, tujuan projek ini adalah untuk mereka bentuk dan membangunkan sistem penunjuk titik buta bagi meminimumkan bilangan pelanggaran dan kematian di selekoh atau jalan tajam. Objektif projek ini adalah untuk mereka bentuk dan membangunkan sistem trafik penunjuk titik buta dan pengesan situasi kabus atau kabus untuk mengelakkan kemalangan dan kemalangan di jalan selekoh, untuk membangunkan sistem untuk mengesan kemalangan di jalan selekoh dan memberi amaran kepada pemandu dengan menggunakan IoT dan untuk mewujudkan pengesan satah tanah runtuh atau condong di pinggir selekoh buta untuk memberi amaran kepada pemandu. Sistem penunjuk titik buta ini menggunakan Arduino Mega sebagai pengawal utama dengan tambahan NodeMCU esp8266 untuk komunikasi tanpa wayar. Tambahan pula, sistem ini terdiri daripada sensor ultrasonik, sensor suhu dan kelembapan, sensor kecondongan, dan sensor getaran. Penderia ultrasonik digunakan untuk mengesan kehadiran kenderaan di jalan selekoh manakala suhu dalam Celsius dan kadar kelembapan dalam peratusan sedang dirasai oleh penderia DHT11. Selain itu, sensor kecondongan digunakan untuk mengesan tanah runtuh atau satah condong. Sensor getaran digunakan untuk mengesan kemalangan yang berlaku di jalan selekoh. Selain itu, mesej amaran menggunakan Internet of Thinking (IoT) telah direka bentuk menggunakan platform ThinkSpeak dan perkhidmatan IFTTT. Daripada keputusan, litar perkakasan dalam prototaip berjalan lancar kerana litar simulasi dan semua paparan input dan output berfungsi dengan baik. Kelajuan untuk pendekatan kenderaan ke sudut prototaip juga telah diramalkan dan dijadualkan untuk membantu pelaksanaan masa nyata. Secara ringkasnya, projek ini mudah digunakan dan akan menjadi penambahbaikan yang lebih baik kepada sistem titik buta di jalan selekoh.



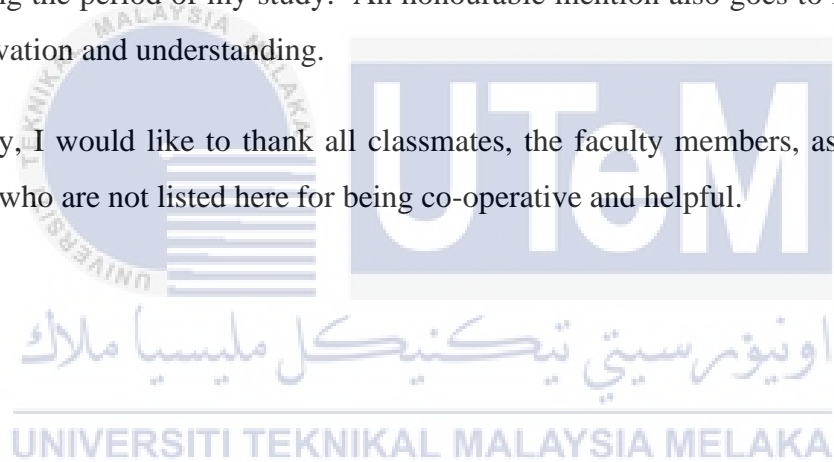
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## LIST OF SYMBOLS

$\delta$	-	Voltage angle
	-	
	-	
	-	
	-	
	-	
	-	
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## LIST OF ABBREVIATIONS

V	-	Voltage
°C	-	Degree Celsius
°F	-	Fahrenheit
km	-	kilometer
mm	-	millimeter
mA	-	milliAmpere
s	-	second



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# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Project

In this era of globalization, the number of accidents is increasing frequently day by day and there is not much concern about the accidents happen at curve roads which located in hills and mountains. According to (Rusdi, 2017), road traffic crashes along mountainous highways are more injurious compared to the highways on plain topography. He also mentioned that crash statistics show that the ratio of fatalities to road injuries along mountainous highways in Malaysia is about four times higher than non-mountainous roads. As a solution, an indicator system is design and develop for blind spots in curve roads which mostly located at mountains and hills. Blind spot refers to the area surrounding a car where the driver cannot see directly. Vehicles such as cars, trucks, motorboats, sailboats, and aeroplanes all have blind spots. There is much research out there are relatable with the usual blind spot which involving the vehicles in the same lane or road. Therefore, the project planned to design a blind spot indicator involving traffic system for the vehicles which move towards in opposite roads at blind curve. The primary goal of this initiative is to reduce the number of collisions and accidents on curve roads. In fact, curves in the road are irregular twists in the road that cause a graduated shift in direction. Railways and canals have similar curves. Horizontal curves are those that are given in the horizontal plane and are either circular or parabolic. There are four types of horizontal curves on roads such as a simple curve, a compound curve, a reverse curve, and a spiral curve.

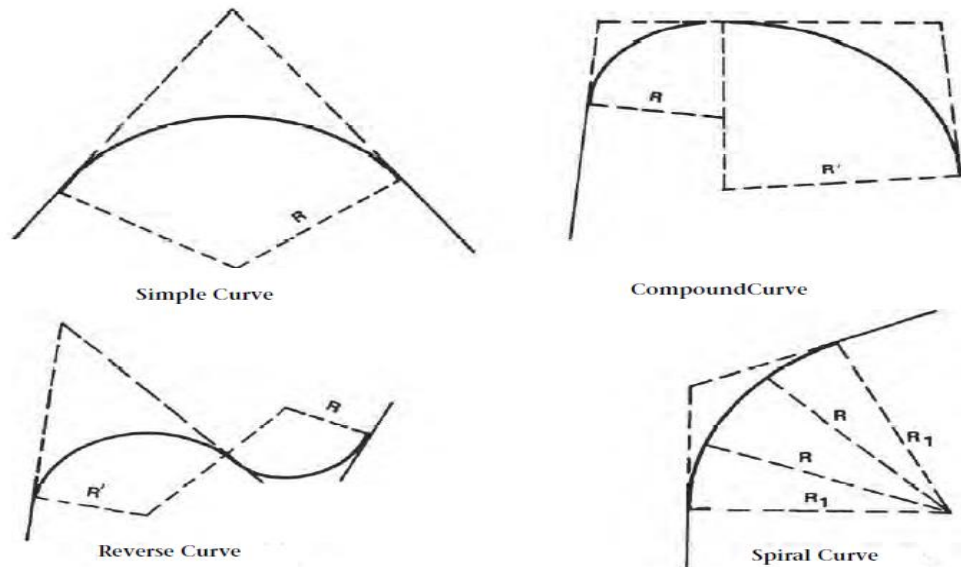


Figure 1.1: Type of Horizontal curves

Additionally, the system also detects the presence of accidents and crashes at curve road and indicate warning alert to the drivers by using the IoT (the Internet of things). This project would also assist in the avoidance of injuries caused by fog or mist situations at blind curves. Low visibility due to the fog/mist will result in accidents, casualties, and vehicle damage. Furthermore, the system also will be developed with landslide detection and indicate the message to the drivers. Aside from that, this project includes both hardware and software developments. The Arduino Mega 2560 is used as a main microcontroller which act as a brain for this project to control all the sensors and components involve in the system. The coding of the project was developed in Arduino IDE software involving embedded system programming and C++.

## 1.2 Problem Statement

There are so many curve roads and mountainous roads are found all over the world which is dangerous due to some factors. Mountainous highways generally associate with the complex driving environment because of constrained road geometries, limited cross-section elements, inappropriate roadside features, and adverse weather conditions. Because of that the

number of accidents and crashes also increase year by year at mountainous curve roads. There are also some curve roads are located in our neighborhood countries which also facing the same issues. Figure 1.2 shows a picture of curve road in Indonesia and figure 1.3 shows curve roads in Thailand.



Figure 1.2: The curve road in Indonesia

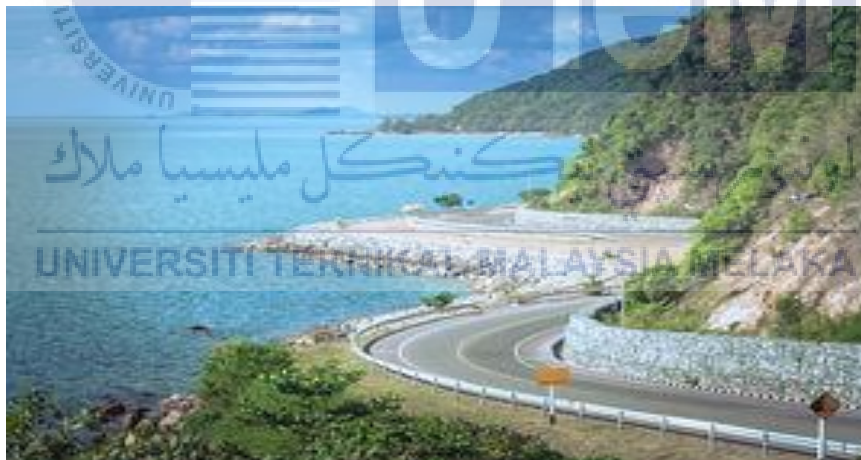


Figure 1.3: The curve road in Thailand

Most importantly, there are some dangerous curve roads in East Malaysia as well in west Malaysia which typically contributed to the country's productivity in agriculture sector and tourism sector which are the Cameron Highlands, the Genting Highlands, Bukit Fraser at Pahang and Kundasang, Kota Kinabalu in Sabah. Figure 1.4 shows an example of a curve road



at the Cameron Highlands, whereas figure 1.5 shows a curve road at Kota Kinabalu, which usually consumed by the surrounding peoples.



Figure 1.4: The curve road at Cameron Highlands



Figure 1.5: The curve road at Kota Kinabalu

On top of that, the absence of an indicator/ traffic system at curve road was cause more accidents and crashes. Blind spot happens at curve roads for both vehicles came along towards in the same direction with opposite roads. According to (Saraf & Chavan, 2013), accessible roads have an extremely tedious blend of S-curve and blind-curve roads. He further stated that as a result of such road designs, the number of accidents has increased because exiting drivers have very little visibility in both directions.

As we can see environmental factors are one of the reasons can cause road accidents at the blind spot of curve roads. According to the findings, the most common environmental factors contributing to road accidents were bad/adverse weather and driving at night by (Harith et al., 2019). Weather condition, particularly the adverse weather phenomenon, is one of the unsafe operation issues that could undermine the qualities in all aspects of road transportation and thus, increasing the risk of road accidents and casualties by (Jawi et al., 2009). The fog/mist is one of the weather hazards in curve roads especially which can reduce visibility and lead to multiple vehicle collision and high casualty rates. The weather condition is a crucial influence factor on road safety issues. According to (Zhang, 2012), claimed that the fog is one of the most noticeable weather conditions, which has a significant impact on traffic safety. He also said that such condition reduces the road's visibility and consequently can affect drivers' vision, perception, and judgments.

Apart from that, there is no alerting system to warn the drivers when there is an accident suddenly happens in curved roads. That is because, curve roads along mountain and hillside are usually located far from basic facilities like a hospital, shops, and a police station. Moreover, the drivers from a different direction also not notified when there is an accident happens due to the blind curve at the edge of the road.

On the same track, there is also no landslide or inclined plane detector to alert the drivers at curve road. Because of the landslide, the vehicles will lose their control and resulting accidents and deaths. If there is landslide happens at the edge of curve road, it will not notice by the drivers from both site due to the blind spot.

Therefore, this project proposed a blind spot indicator system at curve roads by implement some features such like traffic light indicator system, temperature and humidity display system, landslide, or inclined plane detection system and also accident detection system at blind curve as a solution for this problem statement.

### 1.3 Project Objective

The objectives of this project are as follows:

- a) To design and develop a blind spot indicator traffic system and the fog/mist situation detector to avoid accidents and crashes at curve roads.
- b) To develop a system to detect an accident at curve roads and alert the drivers using IoT.
- c) To establish a landslide or an inclined plane detector at the edge of the blind curve to alert the drivers.

### 1.4 Scope of Project

A few guidelines are proposed to ensure that this project meets its objectives with narrowing the needs for this project. This project's scope includes:

- a) Arduino Mega 2560 act as main microcontroller to this project.
- b) Design a blind spot indicator based on a traffic system by using ultrasonic sensor and Traffic lights to avoid accidents at curve roads.
- c) Develop the system by implement fog/mist indicator at mountainous curve roads by using humidity and temperature sensor and display through Liquid Crystal Display (LCD) and LEDs.
- d) Develop the system to alert the drivers cross along the curve road when there is an accident happens by using hardware of NodeMCU esp8266, vibration sensor and IoT technology especially through an app called Thingspeak.
- e) Develop the system with the implementation of tilt sensor to detect a landslide or inclined plane at the edge of the blind curve.