MITIGATING BLIND SPOT COLLISION UTILIZING ULTRASONIC GAP PERIMETER SENSOR

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ABSTRACT

Failure to identify the vehicle by the side of the vehicle or in other word as blind spot area, especially larger vehicles are one of the causes of the accident. For some drivers, the simple solution is to place an additional side mirror. However, it is not the best solution because this additional side mirrors do not provide an accurate picture of actual or estimated distance to the object or another vehicle. The objective of this project is to identify the causes of automobile collisions, notably the side collision impact causes by the blind spot, to develop a system that can detect the presence vehicles on the side and to develop a system that are affordable for normal car users. To achieve this objective, flow chart was designed to help write coding using Arduino 1.0.2 and design hardware. This system can detect the obstacle within range 2cm to 320cm from the edge of the project vehicle. Before this system developed, the survey was conducted to determine what the driver wants. After that, the design process is carried out. The input to this system is Ping ultrasonic sensor, LCD, LED, and siren for the output part. LCD and LED were displaying the distance from the vehicle and the siren will be switched on to warn the driver when have obstacle in the blind spot area. As a conclusion, the Mitigating Blind Spot Collision Utilizing Ultrasonic Gap Perimeter Sensor System has successfully completed. This system able to detect the presence of other vehicles on the side of the project vehicle, especially in the blind spot area and will alert the driver when the vehicle is nearby when the alarm system is operated. The efficiency of this system to detect objects in the blind spot area is 79.82%. Others, it will give the display value less than one second after obstacle exists in front of the sensor. This operating time is most important because if the system is slow, the main function of this system to detect the obstacle in the blind spot area is not achieved.

ABSTRAK

Kegagalan untuk mengenal pasti kenderaan di sisi kenderaan atau dalam perkataan lain sebagai kawasan titik buta, terutama kenderaan yang lebih besar adalah salah satu punca kemalangan. Bagi sesetengah pemandu, penyelesaian yang mudah adalah dengan meletakkan cermin sisi tambahan. Bagaimanapun, ianya bukanlah penyelesaian terbaik kerana cermin sisi tambahan tidak memberi anggaran gambaran jarak sebenar yang tepat atau anggaran kepada kenderaan lain. Objektif projek ini adalah untuk mengenal pasti punca perlanggaran kereta, terutamanya kesan sampingan perlanggaran yang disebabkan oleh titik buta dan untuk membangunkan satu sistem yang boleh mengesan kehadiran kenderaan di sebelah sisi. Akhir sekali, untuk membangunkan satu sistem amaran perlanggaran sampingan yang berpatutan untuk pengguna kereta biasa. Untuk mencapai objektif ini, carta aliran telah direka untuk membantu dalam penulisan kod menggunakan Arduino 1.0.2 dan reka bentuk perkakasan. Sistem ini boleh mengesan objek halangan diantara jarak 2cm ke 320cm dari sisi tepi kenderaan projek. Sebelum sistem ini dibangunkan, kajian telah dijalankan untuk menentukan apa yang pemandu perlukan. Input bagi sistem ini adalah penderia ultrasonik, LCD, LED, dan siren sebagai keluaran. LCD dan LED memaparkan jarak dari kenderaan dan siren akan berbunyiuntuk memberi amaran kepada pemandu apabila mempunyai halangan di kawasan titik buta. Sebagai kesimpulan, Sistem Perlanggaran Tebatan Titik Buta Menggunakan Penderia Perimeter Jurang Ultrasonik telah berjaya disiapkan. Sistem ini mampu untuk mengesan kehadiran kenderaan lain di sebelah kenderaan projek, terutamanya di kawasan titik buta dan sistem penggera akan berbunyi untuk memaklumkan kepada pemandu apabila terdapat kenderaan berdekatan. Selain itu, ia akan memberi nilai paparan kurang daripada satu saat selepas halangan wujud di hadapan penderia. Masa operasi ini adalah paling penting kerana jika sistem pemprosesan perlahan, fungsi utama sistem ini untuk mengesan halangan di kawasan titik buta tidak tercapai.

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CHAPTER 1

INTRODUCTION

1.0 Overview of the Project

Blind spot is the area of vision around the vehicle that you as a driver cannot observe when you are driving. Blind spot exists in a wide range of vehicles such as cars, trucks, motorboats and aircraft. Other types of transport such as motorcycle and bicycle did not have blind spots at all. Usually, blind spot happen to the driver that is seated in regular driving position, either by occlusion of the field-of view, by the vehicle support pillar, when looking through the, or by scanning the vehicle's rear and side view mirrors, without turning the head to view the area directly.

Figure 1.1 shows an example of how the accident happened due to the blind spot area. Blind spot can occur in front of the driver when the A-pillar, side-view mirror, and interior rear-view mirror block a driver's view of the road. Behind the driver, there are additional pillars, headrests, passengers, and cargo, this may reduce driver visibility. Blind spots are affected directed by vehicular speed, since they increase substantially the faster one goes. Besides that, blind spot increases with vehicle size. Nowadays, there are many vehicles have gotten longer, bigger and higher on the road. As the result, this will cause the probability of blind spots for these vehicles have also gotten bigger.

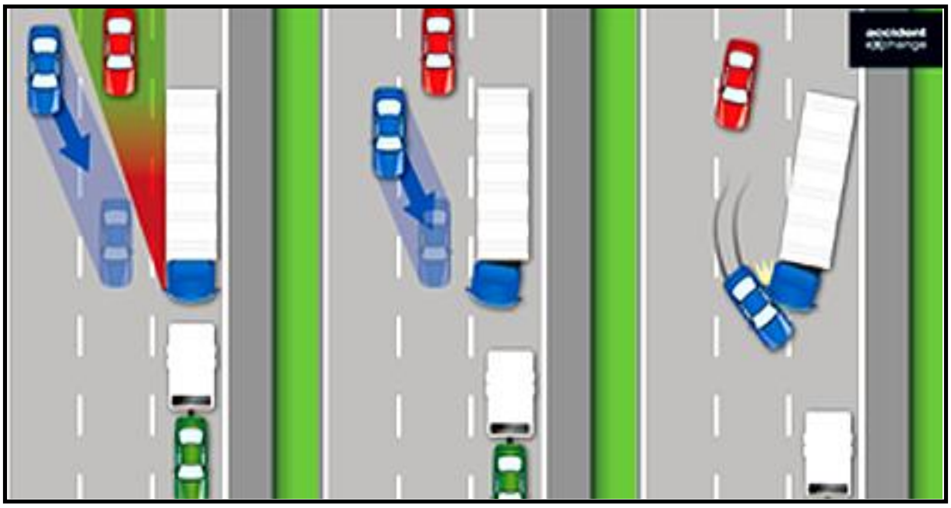

Figure 1.1: Example of How The Accident Happen caused by Blind Spot.

According to the Edmunds.com, [3] the tests was conducted to show for the average driver in a sedan car, the blind spot extends up to 10 feet behind the vehicle. For SUVs, the blind spot is more than 20 feet and for a pickup truck is more than 30 feet. The shorter the driver is the larger the blind spot.

Figure 1.2 shows the statistical source of road accidents in the year 2011 taken by the JKR (Jabatan Kerja Raya). From these statistics, it is found of 18.88% occurred due to side collision [1]. This percentage is quite higher if compared with others. Side collision occurs because the driver usually cannot see the side of the vehicle in the blind spot area. If this blind spot problem can be solved, the percentage rate number of accident will be reduced.

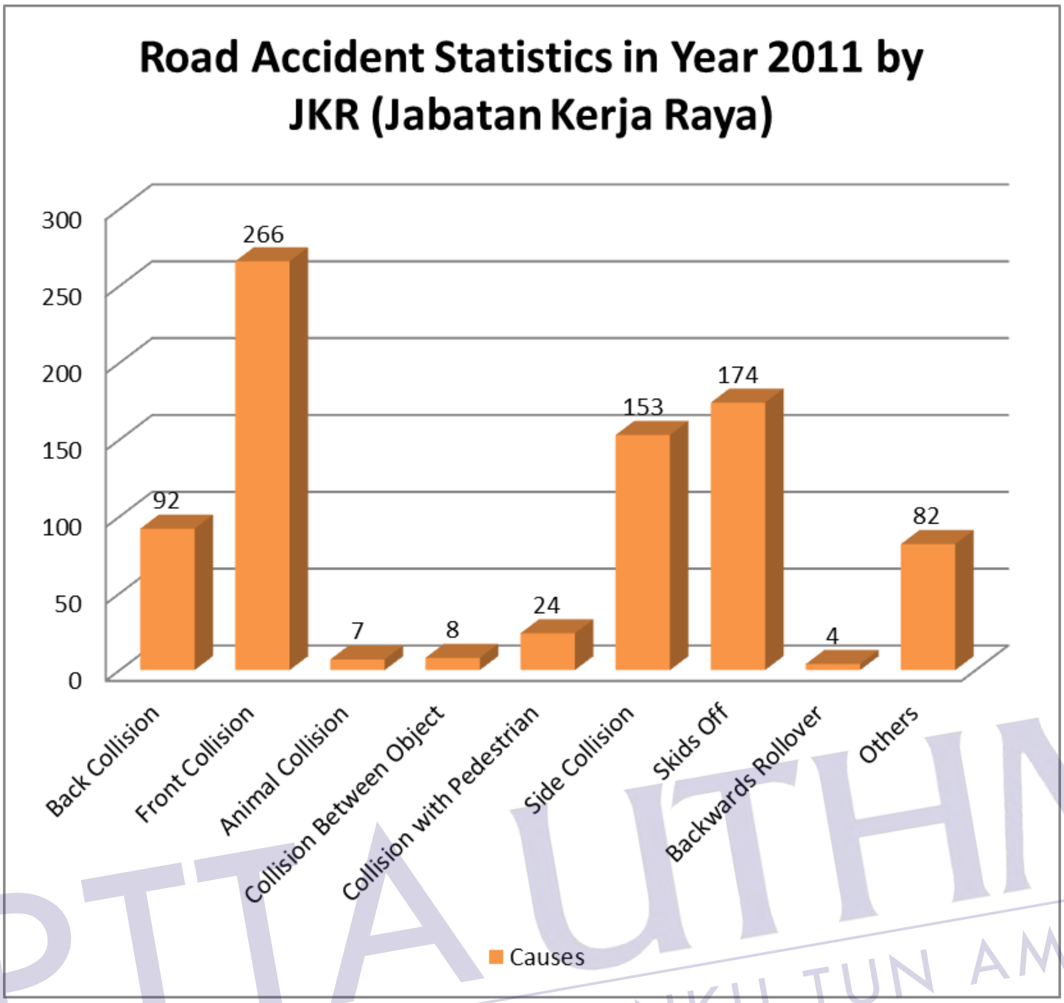

Figure 1.2: Causes of Road Accidents Statistics in Malaysia in the Year 2011

Figure 1.3 shows accidents that were caused by blind spot. Because of the obvious size and weight differences between passenger vehicles and big trucks, injuries are generally tendency of an accident involving the blind spot is higher.

Figure 1.3: Accidents caused by Blind Spot.

Therefore, this Mitigating Blind Spot Collision Utilizing Ultrasonic Gap Perimeter Sensor system was specifically designed to overcome the number of accident involve because of the blind spot problem. Objective of this system is to make driver know when a blind spot occur around the vehicle area. This system will use ultrasonic as the method to detect the vehicle at blind spot area.

1.1 Problem Statement

One of the causes of the accident faced by the drivers is in the blind spot area, where the driver failed or did not see the vehicle at the side of the vehicle, especially the large vehicles difficult to see in the blind spot area. For some drivers, simple solution is to place an additional side mirror. However, it is not the best solution because this additional side mirrors do not provide an accurate picture of actual or estimated distance to the object or another vehicle [2]. In addition, it also interferes with the driver in the driver's concentration that a person should not be doing more than one focus in a time. For new driver's license, this gives difficulty to them to estimate the distance to cut or pass, at the same time it will reduces the confidences in themselves and they must take long time to cut the vehicle. In addition, there is no warning to the driver when the vehicle is nearby and is revealed to the accident.

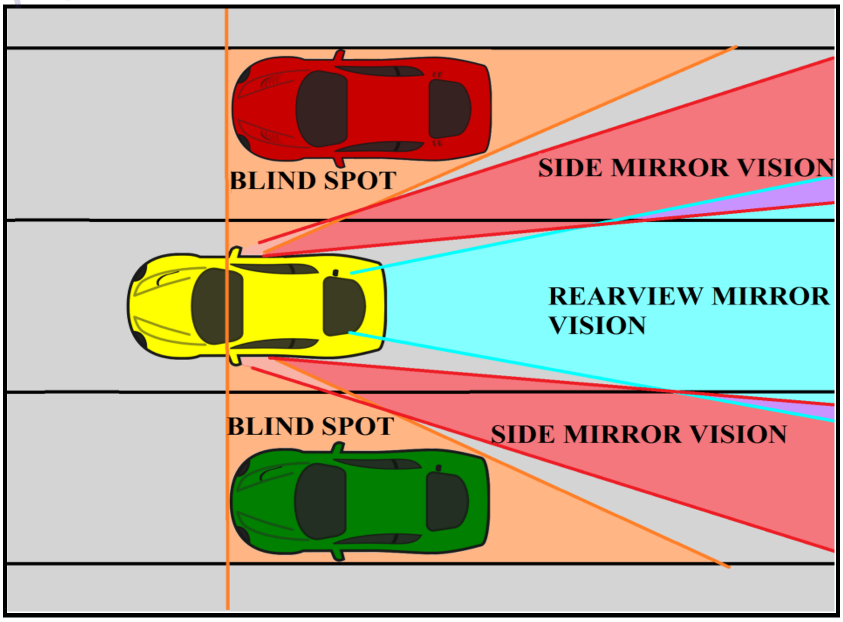

Figure 1.4: Blind Spot Zones

The normal vehicles mirrors position may originate large blind spot area, such as the one displayed in Figure 1.4. The major problem that emerges with the existence of these invisible areas occurs during lane changes, when the driver has to remark and check in an appropriate mean all that is surrounding him to have situational awareness, while moving the vehicle, to avoid potential collisions.

1.2 Project Objectives

The purposes of this project are;

i. To identify the causes of automobile collisions, notably the at the side collision between the driven car and the car in the blind spot area.
ii. To develop a system that can detect the presence vehicles on the side of the driven car.
iii. To develop a side collision warning systems that are affordable for end car users.

1.3 Scope of Project

This project is primarily concerned with Mitigating Blind Spot Collision Utilizing Ultrasonic Gap Perimeter Sensor System. The scopes of this project are:

i. The survey is conducted to identify the cause of a side collision.
ii. This project will cover hardware and software for side collision warning system.
iii. The hardware development consists of the ultrasonic measurement sensor, sensor placement and alarm system.
iv. This project will construct in minimal cost compare to market price at least 50% of the market price.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

Before furthering the project, some research was done to assure that the product achieves its objectives. This literature study involved an observation and research about the technology that relates to this project.

2.2 Previous Study

In 2008, a similar concept was produced by Sung Moon Jeong, Sang-Woo Ban et al (2011) in [3]. They have developed about autonomous detector using the saliency map model and modified mean-shift tracking for a blind spot monitor in a car. The method that had been using is morphology-based saliency map (SM) model and the method of combining Scale Invariant Feature Transform (SIFT) with mean-shift tracking algorithm. The used side view camera to obtain a region of interest (ROI) which includes the blind spot from the successive image frames. Besides that, they used topology information of the salient areas obtained from the SM model to detect a candidate of dangerous situations in the ROI, and the SIFT algorithm is considered for verifying whether the localized candidate area contains an automobile. This algorithm that had been proposed successfully provides an alarm signal to the driver in a dangerous situation caused by approaching an automobile at the side view.

However, the same method from paper of ultra-sonic sensor based blind spot accident prevention system had been use as reference to this system. R. P. Mahapatra, K. Vimal Kumar et al (2008) in [4] describes a blind spot detection device for protection against misshapenness such as automobile collisions, obstacles, and accident that leads to great loss of human lives and can have disastrous results. The technology used for this purpose worked by detecting the other automobiles, obstacles and bystanders. They used the sensor to detect blind spot and made the LED`s and audible alarm are triggered. Thus, this system created a great deal in increasing road safety, reduces accidents and misshapenness.

C.T Chen and Y.S Chen, (2009) in [5] have investigated the real-time approaching vehicle detection in the blind - spot area. It detects the object including all kinds of vehicles, bicycles, and pedestrians). This paper presents an image-based method to detect approaching objects in blind-spot area and proposes a verification method by using the recorded video database from real traffic environment. The accuracy rate of this blind-spot detection system (BDS) is 91% and the frame rate is more than 20 frames per Sec (fps), in the day and night and all weather conditions. The results had shown this system are satisfied with the system specification and show the algorithm is excellent for approaching vehicle detection of vehicle imaging system.

Besides that, David P. Racine, Nicholas B. Cramer et al in [6] is investigated about active blind spot crash avoidance system. They used force feedback gas pedal and a force-feedback steering wheel to improve upon existing blind spot detection and avoidance systems. Volvo has implemented their Blind Spot Information System (BLIS) [7], shown in Figure 2.1, to alert drivers that a vehicle is traveling in their blind spot. BLIS uses an intelligent digital camera system incorporated into both door mirrors that constantly monitor the area alongside the car for cars or motorbikes, then alerts the driver via an orange light housed in the car's A-pillar by the door mirror [7]. Preliminary human testing results show that by adding an active blind spot crash avoidance system to the already visual blind spot light can help to reduce the number of collisions. The implementing an active blind spot crash avoidance system with a force feedback pedal and a steering wheel in an automobile can help to reduce blind spot collisions.

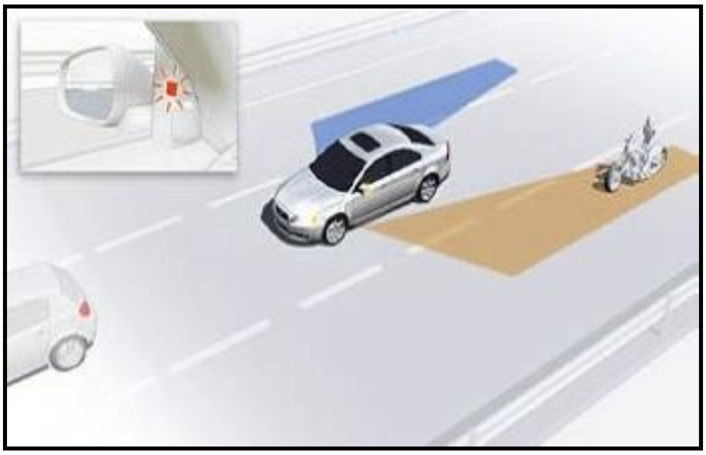

Figure 2.1: Volvos' Blind Spot Information System (BLIS)

Figure 2.2: The driver was seated in front of a monitor that had the driving simulation on it. Here the driver is interacting with the simulator using the force-feedback pedal and steering wheel

Figure 2.2: Simulator Using The Force-Feedback Pedal And Steering Wheel.

Besides that, Bin-Feng Lin, Yi-Ming Chan, et al (2010) in [7] was developed incorporating appearance and edge features for vehicle detection in the blind-spot. The method that they had used is the image features which are directly obtained from vehicle images to detect the vehicles possibility in the area. In order to overcome large variation problems due to the significant difference in viewing angle during the process of detecting vehicles in the blind-spot area, they then propose a method to combine two kinds of part-based features. The experiments of their research show that the system is reliably in detecting the vehicles in the blind-spot area. Then the method that they had been proposed can correctly detect the vehicles in the blind-spot area. And the proposed system can overcome some variations of the vehicle's appearance, and the results are slightly affected by the complex background.

Junpei Kuwana and Makoto Itoh (2008) in [ref] were developed the dynamic angling side-view mirror for supporting recognition of a vehicle in the blind spot. They had proposed a novel driver support system named DAMS (Dynamic Angling Mirror System) which changes the yaw angle of the corresponding side-view mirror as shown in Figure 2.4. Dynamically, when another vehicle entered the blind spot, by looking at the vehicle directly in the side-view mirror, the driver may be able to understand the risk of a collision. The DAMS move the corresponding side-view mirror dynamically when another vehicle entered the blind spot. A cognitive experiment with a driving simulator was conducted to investigate the effectiveness of the DAMS.

Figure 2.3: Changing The Yaw Angle Of A Side-View Mirror

The default field of view and the default blind spot are as shown in Figure 2.5. When a vehicle enters the host vehicle's blind spot, the yaw angle of the side-view mirror is changed in order for the host driver to be able to see the vehicle by looking at the side-view mirror. Figure 2.5 represents the revised field of view and the blind spot. After the vehicle has gone away, the yaw angle of the side-view mirror returns to the default potion.

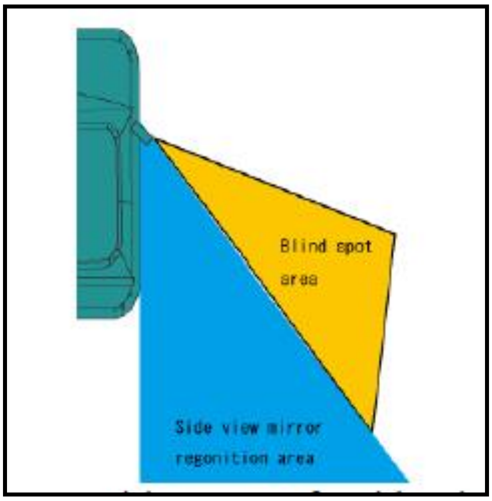

Figure 2.4: Default Blind Spot Area

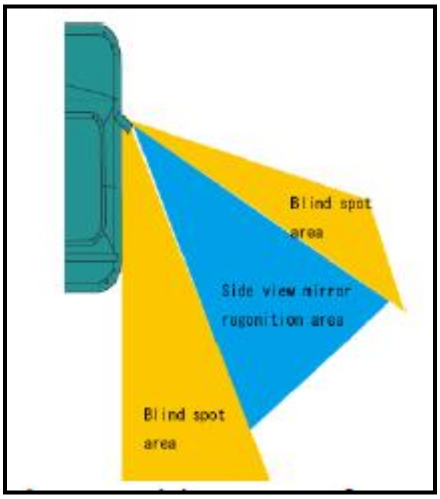

Figure 2.5: Revised Field of Blind Spot.

In addition, they have modified the original DAMS. The new one is named EDAMS (Enhanced Dynamic Angling Mirror System), which turns on a lamp when the system changes the yaw angle of the side-view mirror for supporting driver's situation awareness. The result of an experiment suggests that EDAMS is more effective and acceptable than the conventional DAMS.

Besides that, Kai-Tai Song, Chih-Hao Chen and Cheng-Hsien Chiu Huang (2004) in [16] was investigated about the Design and Experimental Study of an Ultrasonic Sensor System for Lateral Collision Avoidance at Low Speeds. The sensor system is useful for detecting vehicles, motorcycles, bicycles and pedestrians that pass by the lateral side of a vehicle. The system can be adopted to enhance the rear-view mirrors of present vehicles, which have blind spots on the lateral sides. The developed Ultrasonic sensors, which have been widely used on cars for rear object detection during parking, are developed for lateral object detection at low speeds. Experimental results show that the proposed system can detect a vehicle at speeds up to 40km/hour with a maximum range of 6 meters.

They had installed the sensor system on the vehicle to developed system for lateral safety warning in the real world. Figure 2.6 shows a picture of the experimental vehicle. The deployment of the sensors on the vehicle is illustrated in Figure 2.7. They have used a notebook PC is put on-board for sensor control and data storage. Two experiments were conducted to investigate the performance of the sensor system.

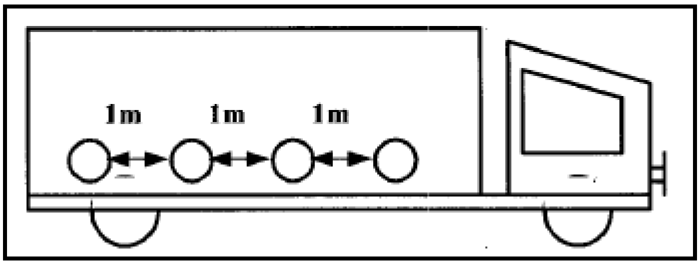

Figure 2.6: Installation Of Ultrasonic Sensors Along One Side Of The Vehicle

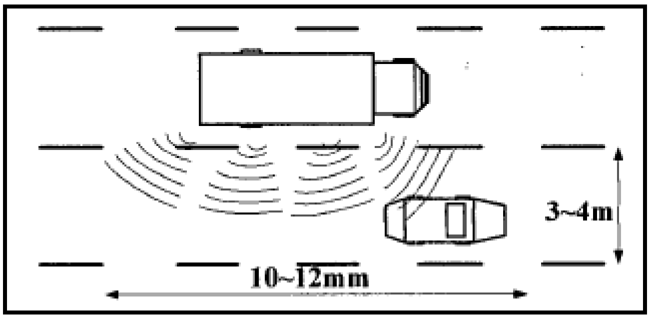

Figure 2.7: Lateral Detection Condition

Next study, a Wireless Sensor-Based Driving Assistant For Automobiles by Fred Yu, Bozena Kaminska, and Pawel Gburzynski. This paper [8] presents a new concept and an experimental validation of a real-time driver assistance system involving multiple sensors and actuators monitoring an area around the vehicle and conveying alerts to the driver. The proposed system, dubbed the driving assistant, detects the presence of obstacles within the monitor and alerts the driver via a combination of audio, and visual signals. It features simple ultrasonic sensors installed at the two front corners and the two blind spots of the vehicle. The design is inexpensive and flexible, which makes it deployable as an add-on to existing vehicles. In particular, the interconnection of modules is achieved via a low-bandwidth low-power wireless link. It explain the rationale behind the driving assistant concept, discuss its performance within the context of human reaction time affecting the safety of vehicle operation, and suggest ways of incorporating such a system into real-life cars. Starting from conceptualizing, designing, building to finally presenting, we have designed a driving assistant system which could be a possible solution for accident prevention. Three innovative features are characteristic of the prototype design discussed in this paper. First, an ultrasonic sensor system is implemented to detect foreign objects in areas around the blind spots and the front corners of the vehicle. They do experiments show that the low-cost ultrasonic yield satisfying accuracy in distance measurement. Secondly, an LED display, tactile vibrators, and a buzzer are introduced as the enhanced indicator design, which provides different levels of hazard warnings to the vehicle driver.

From this previous study we can conclude that almost many systems have been built using image processing. Image processing is a complex system in which the image should be taken repeatedly to teach the system so that it can identify the objects that exist in a detector on the system. In addition, the use of wireless for connecting between the sensor and the main system is also implemented. This is not necessary because it's relatively high cost and irrelevant. Many systems in the vehicle produced waves that can interfere with the wireless system. Thus, using the ultrasonic method as a sensor and an analogue system is more effective as cheap, not influenced by other systems, and architecture that easily understand.

2.3 Study on Sensor Device

Dr. Thomas Kenny (2005) in [5], said that a sensor is a device that converts a physical phenomenon into an electrical signal. As such, sensors represent part of the interface between the physical world and the world of electrical devices, such as computers.

Jon Stenerson (1993) in [6], wrote in his book, sensors, in fact, perform simple tasks more efficiently and accurately than people do. Sensors are much faster and make far fewer mistakes.

2.3.1 Ultrasonic Sensor

Generally, ultrasonic sensors use a narrow ultrasonic beam to detect and measure such as height. A narrow beam (about 5mm) is bounce off the object to the sensor. The sensor is able to determine the distance to the object and detect the size of object [7].

The ultrasonic distance sensor works by transmitting an ultrasonic (above human hearing range) burst and providing an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width the distance to target can easily be calculated.

Precise distance(s) of an object moving to and from the sensor are measured via time intervals between transmitted and reflected bursts of ultrasonic sound. Since sound in the air travel at slightly under 1 foot per millisecond, the elapsed time between initial transmission and echo detection then is converted to distance.

For this project, PING))) Ultrasonic Distance sensor as shown in Figure 2.8 provides precise, non-contact distance measurements from about 2 cm (0.8 inches) to 3 meters (3.3 yards). It is very easy to connect to BASIC Stamp microcontrollers, requiring only one I/O pin, compare to others sensor, they are using two pins, one for echo and the other one for signal burst. The PING))) sensor works by transmitting an ultrasonic sound burst that well above human hearing range and providing an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width the distance to target can easily be calculated.

Figure 2.8: PING))) Ultrasonic Distance Sensor

The Ultrasonic sensor works perfectly for 5VDC of voltage supply and 30mA until 35mA of current supply. The PING))) sensor has a male 3-pin header used to supply power, ground, and signal. The header allows the sensor to be plugged into a solderless breadboard, or to be located remotely through the use of a standard servo extender cable. Standard connections of Ultrasonic sensor are show in Figure 2.9.

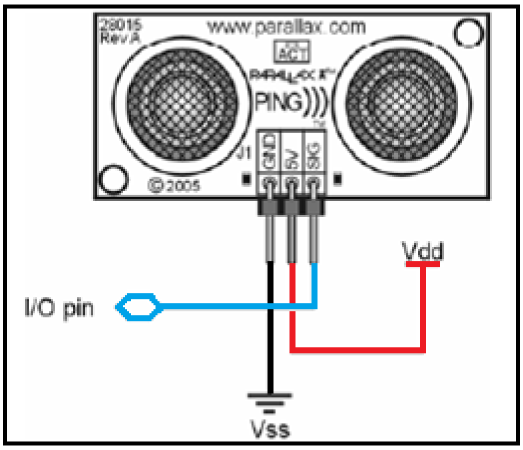

Figure 2.9: Standard Connections Of Ultrasonic Sensor

2.4 Study On ARDUINO Board

The Arduino Mega 2560 is a microcontroller board based on the Atmel Chipset, ATmega2560 [8]. The ATmega2560 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. It has 54 digital input and output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Arduino boad operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. The Arduino Mega can be programmed with the Arduino software. The ATmega2560 on the Arduino Mega comes preburned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

The Arduino Mega2560 has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed. Figure 2.10 show the board of Arduino Mega 2560.

Figure 2.10: The ARDUINO Mega 2560 Board

CHAPTER 3

METHODOLOGY

3.0 Overview

This chapter will explain in detail about the overview for all steps using in this project, the process of project design and development, the element used in developing the sensor circuit, controller circuit, alarm circuit and implement of software element in the controlled system. Then design the flow chart to help write coding using Arduino 1.0.2 and design hardware.

In order to make this project a success, a guideline had been drawn from the beginning when this project is being carried out. From the beginning of this project, a lot of resources had been searching to get relevant information about the sensor.

Many sensors were available in the market that can use. Among the sensors available in the market are laser sensors, ultrasonic sensors, infrared sensors and radar sensors. After making various studies, ultrasonic sensors were selected because of its relevance to this project, easy to use and low cost.

In this chapter, circuit design, simulation, flowchart is used to explain the processes involved during the project done in order to achieve project objectives. The flowchart fully covered overall process, starting from the ultrasonic sensor until the alarm operated. A brief description of several components, calibration, and how the project operates will be explained in this chapter.

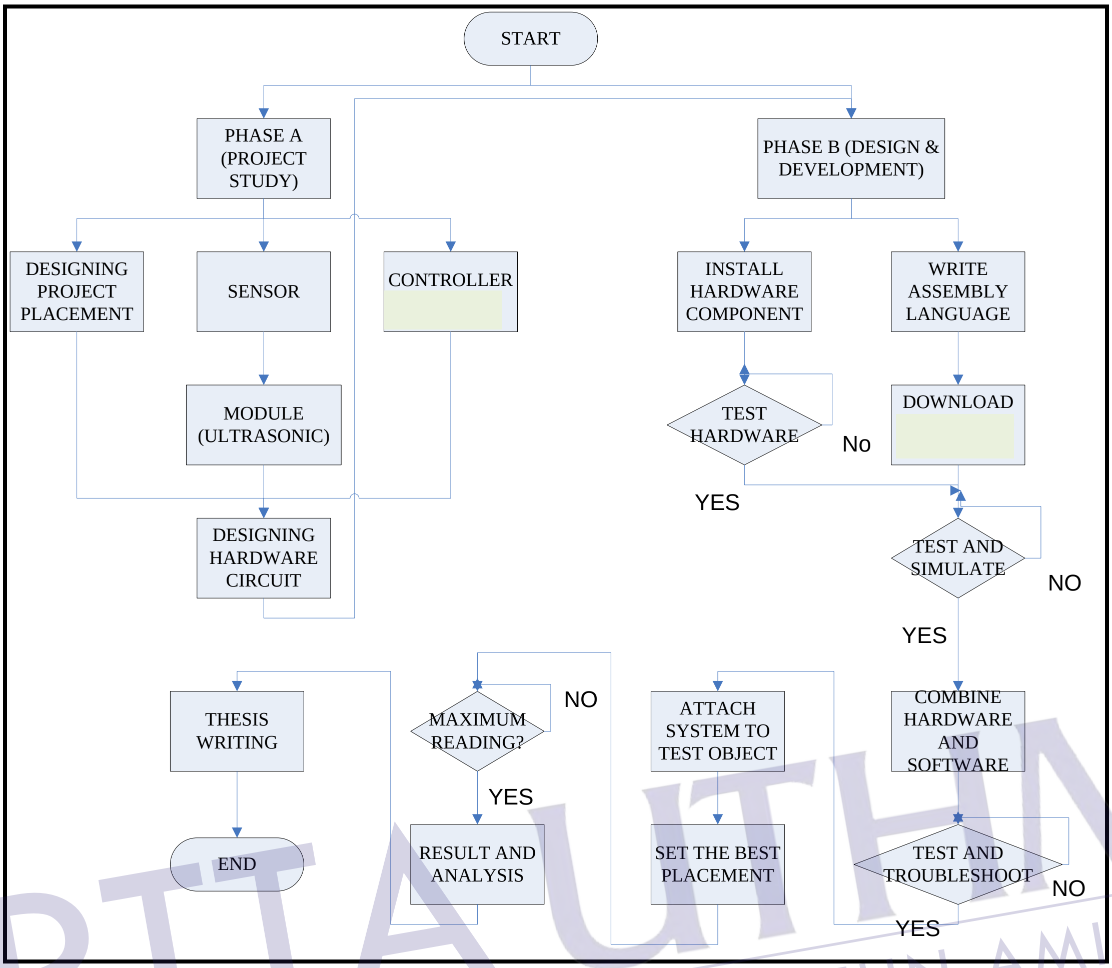

Figure 3.1: General Overview of The Project

Figure 3.1 shows an overview of the movement of this project. This project is divided into two parts. A project study phase is where we review the appropriate position for the sensor. Further, the selection of appropriate sensor for this project and is available ultrasonic sensor is a most suitable sensor in terms of propagation distance and costs. The third part is the system controller. Here, the Arduino Mega 2560 microcontroller has taken over this task. Further, proceed with designing hardware circuit using Proteus.

This project continued in the Master Project 2, starting with phase 2. Phase 2 is the designing and development. Firstly install the hardware to PCB board and then test the hardware to make sure the output normal. Then, for the software part, the C language was done. Next, the C language downloads to the Arduino. After this stage, hardware and software will be combined and tested. If succeed, the system will be attached to the test object. After doing some adjustment to make sure the signal output is in maximum critical point, the analysis and result will be taken. The result will be analysis. Finally the thesis writing process implemented.

3 .1 Block Diagram of the Project

Figure 3.2: Block diagram for the overall project

The overall process block diagram conducting in this project is shown in Figure 3.1 above. This block diagram explains the steps taken in this project. For the overall, this project work when the ultrasonic sensor detects the difference signal (voltage) which emitted a signal that is acceptable. The data received are in analogue signal and the voltage range is from 0V received up to 5V. The data obtained will then be filtered using the concept of stochastic coding and adaptive filtering. This data is filtered because usually, the data obtained with ultrasonic interference with other ultrasonic signals. After the data was filtered, the analogue data will be converted to digital form. Analogue to Digital Converter process (ADC) will be used in this process. The output data from this signal are in digital form.

Next, the input signal data will be processed by the Arduino to control the output data. The Arduino will be calculated the input data and will produce output data for the alert system. Alert system is the final output of this system. It is the interface between the system and users. The output of this system is a siren and Liquid Crystal Display (LCD). LCD will display the distance between the project vehicle with another vehicle and also inform whether there are vehicles in the blind spot area or not. If there are vehicles in the blind spot, the siren will sound.

Finally, in the development of this project is the analysis of performance. Here is to distinguish between Undergraduate projects to Postgraduate project. Analysis of this performance is to test and do performance validation of the whole system.

3.2 Assumptions for the Whole Research

Before the study started a process, a number of assumptions need to be determined appropriate to facilitate the study done. For this study, the prescribed assumptions are as follows:

a) Project vehicle must be parallel or does not exceed an angle of 30 above the ground with other vehicles or objects that appear on the vehicle side of the project vehicle.

b) Ultrasonic sensor can detect vehicles or objects on the side of the project vehicle.

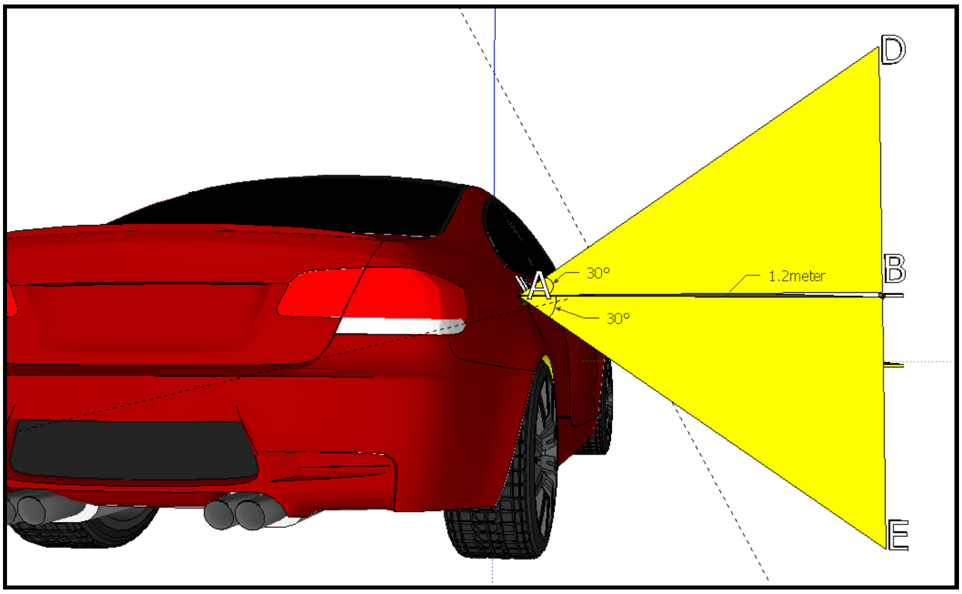

Figure 3.3: Appropriate Angle Between The Vehicle

3.3 Modelling

In this subtopic, a number of important components for electronic circuits in this project will be briefly discussed. Circuits in this project are as microcontroller and sensor circuit, voltage regulator circuit, a readout circuit distance and siren activation circuit (output).

Table 3.1 List Of Important Components

PROJECT COMPONENT	FEATURES / FUNCTIONS
1. Arduino Mega 2560	Microcontroller 20Mhz frequency EEPROM is 256 bytes
2. Ultrasonic sensor	Measure distance and detects the presence of an object
3. LCD 16x2	Display of sensor values
4. LED	Emit light and display the object presence
5. Siren	Make loud noise sound
6. Battery	Voltage source for this project

3.3.1 Power Supply

Power supply is an important factor to enable this project work. 12 Volt vehicle battery project because it is easier to use and can store high currents. To provide supply to the electronic components, batteries used are lead-acid battery 12 Volt. This battery can operate longer than other batteries due to charge more and can be recharged.

For Arduino 2560 microcontroller, two ultrasonic sensors and hardware circuit boards, power supply 5 volt direct current is required. Therefore, the LM7805 voltage regulator used to convert the 12 volt power supply to the required voltage.

3.3.2 LCD

A liquid crystal display (LCD) is a thin, flat, electronic visual display that uses the light modulating properties of liquid crystals (LCs). Figure 3.4 below shows the 16X2 LCD.

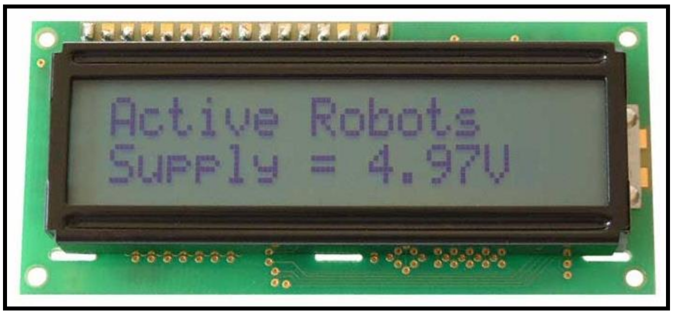

Figure 3.4: 16 x 2 Characters LCD

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly. LCDs with a small number of segments, such as those used in digital watches and pocket calculators, have individual electrical contacts for each segment. An external dedicated circuit supplies an electric charge to control each segment.

3.3.3 Sensor

Most of the latest technology usually equipped with various sensors that resemble the human senses. This simplifies the system gives a response after receiving input from the sensors. Analysis of some important sensor will be explained in the next section.

3.3.3.1 Ultrasonic Sensor

The ultrasonic sensor is a sensor that works on the principle of sound wave reflection and is used to detect the presence of certain objects in front. It works in the area above the sound wave frequency from 40 KHz to 400 KHz.

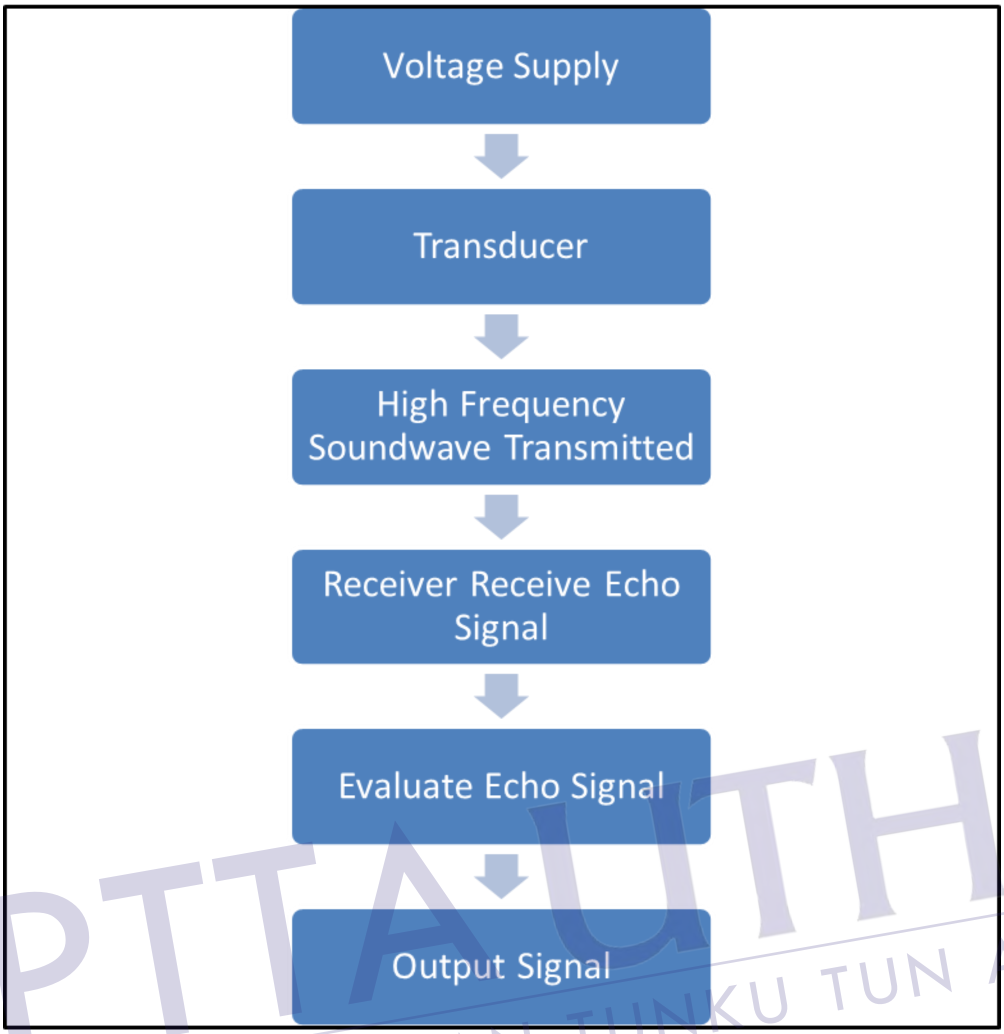

Figure 3.5: Ultrasonic Architecture

Figure 3.5 shows the ultrasonic architecture. Ultrasonic sensor consists of two units, the transmitter unit and receiver unit. Transmitter and receiver unit structure is simple, a piezoelectric crystal connected with mechanical anchors and associated only with the vibrating diaphragm. Alternating voltage with a frequency of 40 kHz - 400 kHz above is the metal plate. The atomic structure of a piezoelectric crystal to shrink (tie), expanded or narrowed to the applied voltage polarity, and called the piezoelectric effect. Shrinkage causes the diaphragm to be submitted to the ultrasonic vibrator is emitted into the air (environmental), and reflection of ultrasonic waves will occur when there is a certain object, and the reflection of ultrasonic waves to be received back by the sensor receiver unit. In addition, the sensor unit will cause the receiver diaphragm vibrator will vibrate and produce the piezoelectric effect of the alternating voltage with the same frequency [10].

Large amplitude signals generated electrical sensor receiver unit depends on a distant object detected nearby and the quality of the sensor transmitter and receiver sensor. Reflection signal is calculating the distance between the sensors with the target object. The distance between the sensors is calculated by multiplying half of the time spent by the ultrasonic signal by way of a series of Tx to Rx is received by the circuit, the signal propagation speed of ultrasonic propagation in the use of media, namely air.

3.3.3.2 Ultrasonic Sensor Package

Ultrasonic sensors have 3 packages which is thru beam, diffuse reflective, and retro reflective [11].

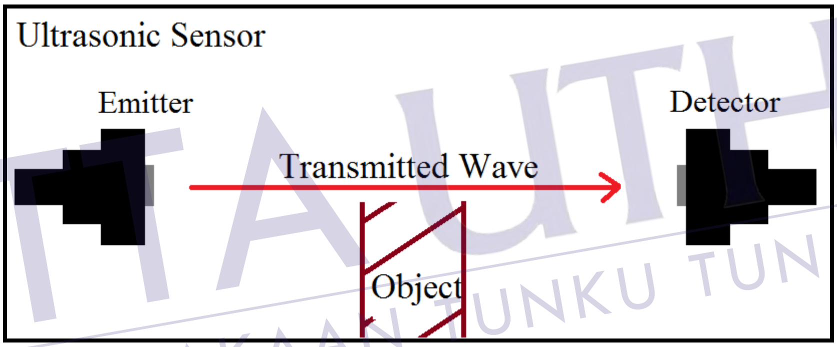

Figure 3.6: Thru Beam Package

Firstly is thru beam package. Figure 3.6 shows the emitter and detector are 2 separate units. The emitter emits the light which is detected by the detector. A target is detected when it passes in-between the emitter and detector.

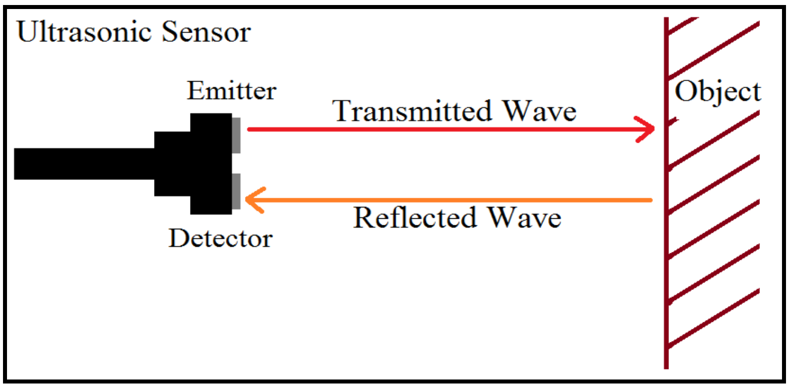

Figure 3.7: Diffuse Reflective Package

Figure 3.7 shows the second package of the ultrasonic sensor. The second package is diffuse reflective package. This type of sensor will put the emitter and detector in the single package in such a way that their field of view across. Here the emitter continuously emits the light. When the target comes within the operating range of the sensor the light from the emitter is reflected off the target and detected by the detector.

In this project, diffuse reflective sensor has been used because we just put the sensor on the car body projects only. Then, the sensor detects another vehicle coming from the side. When the signal is transmitted to the target object, the reflected signal will be taken as data into the Arduino system.

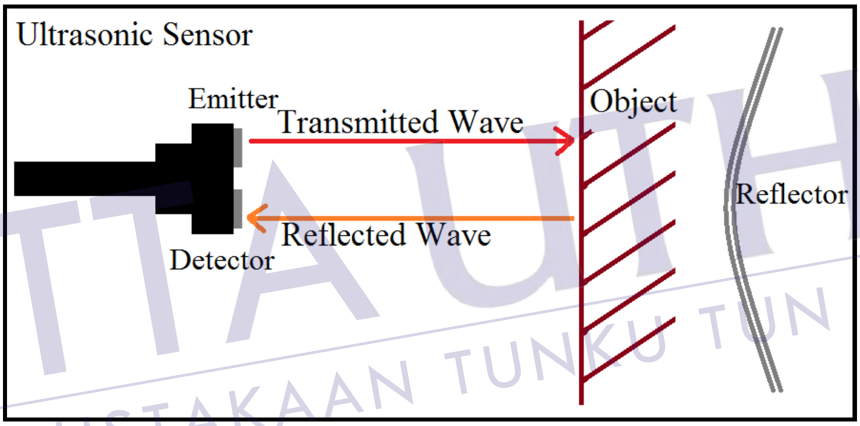

Figure 3.8: Retro Reflective Package

The third package is retro-reflective. Figure 3.8 shows the main components of this sensor are the emitter, detector and the retro-reflector. The emitter and the detector are in the same package. The retro-reflector is placed a little far from the sensor. The light from the emitter is reflected off the Retro-reflector and detected by the detector. When the target passes between the sensor and the retro-reflector the beam is not reflected back to the detector. Here the problem can be that the beam could reflect from the target itself. For this the polarizing filter is used in the sensor. Hence only the light reflected by the retro-reflector is detected by the detector.

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