INTELLIGENT VEHICLE NAVIGATION

'IZZAT HAIMAN BIN ANUAR

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BORANG PENGESAHAN STATUS LAPORAN
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For my father, Anuar bin Abd Aziz and my mother, Hazizah bt. Ismail and beloved family ‘Izzat Haizan, ‘Izzat Sharizan, Zulhayah and Nurul Iman.

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ABSTRAK

Pengemudi kenderaan pintar adalah satu teknologi untuk memandu kenderaan secara automatik. Projek ini mempunyai keupayaan untuk mengawal pengemudi dan kelajuan kenderaan bergantung situasi jalan atau litar. Pengemudi kenderaan menjadikan garis rujukan sebagai panduan di mana di dalam projek ini ia meggunakan garis putih. Ia akan mengawal kenderaan mengikut garis jalan itu. Pada masa yang sama, ia juga mengawal kelajuan kenderaan bergantung kepada lengkungan jalan. Selain itu, ia mempunyai keupayaan untuk mengelak halangan. Projek pengemudi kenderaan pintar ini mendapat idea daripada keadaan harian di mana terdapat sekurang-kurangnya satu kemalangan pada setiap hari.Dengan menggunakan alat ini, ia akan mengurangkan punca kemalangan terutamanya disebabkan oleh manusia. Objektif utama projek ini adalah untuk membangunkan atau reka bentuk sebuah model mempunyai keupayaan untuk mengawal pengemudi dan kelajuan model kenderaan berdasarkan lengkungan jalan dan mengelak halangan. Dalam projek ini ia menggunakan inframerah pengesan sebagai input. Untuk keluaran adalah pengemudi dan enjin. Mikropengawal PIC digunakan untuk menentukan tindakan keluaran.

ABSTRACT

The intelligent vehicle navigation is a technology to drive the vehicle automatically. This project has an ability to control the steering and the speed of vehicle depends on a condition. The steering of vehicle based on the reference line which in this project uses white line. It will control the vehicle to follow the track. At the same time, it also controls the speed of vehicle depends on the curve of track. Besides that, it also has an ability to avoid obstacle. The idea of intelligent vehicle navigation project is from the daily situation which there is at least one accident occurs for everyday. By using this device, it will reduce the accident especially cause by humans. The major objective of this project is to develop or design a model has ability to control steering and speed of model based on the curve of track and avoid obstacle. In this project it uses infrared as an input. For the output are steering and engine. PIC microcontroller used to determine the output action.

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CCD	-	Charge-Coupled Device
MOSFET	-	Metal Oxide Semiconductor Field Effect Transistor
IGBT	-	Insulated Gate Bi-polar Transistors
SCR	-	Silicon Controlled Rectifier
PWM	-	Pulse Width Modulation
FDC	-	Fuzzy driving controller
FBC	-	Fuzzy braking controller
AGV	-	Autonomous Guided Vehicle
LAFC	-	Lateral fuzzy controller
PIC	-	Programmable Interface Controller
DC	-	Direct Current
PID	-	Proportional Integral and Derivative
IR	-	Infrared
LED	-	Light Emitter Diode

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CHAPTER I

INTRODUCTION

1.1 Introduction of project

Intelligent vehicle navigation is a new intelligent technology uses to drive vehicle. It can control the steering and speed of vehicle. This device controls angle of steering based on the curve of track or obstacles. For this project the track is a wall. Besides that, it also depends on the existed of obstacles front of vehicle. It also has ability to control the speed of vehicle either to reduce or improve based on the suitable condition such as take a corner and avoid obstacles.

The intelligent vehicle navigation devices can use in night or day. Both of conditions didn't effect to this devices because the sensor can be function in night and day but this devices also has a weakness. It can't be used in bad weather such as raining and snow. When raining the sensors has a difficulty to determine the obstacles because the water interrupts the signal from transmitter to receiver.

The user target for this project is more to driver because it is very useful and important for them. Actually this intelligent vehicle navigation is more to four wheels vehicle such as car, van and so on. This type of vehicle is one of the most vehicles used

on the road. It is very useful especially for long and short distance drive. For long distance drive, it helps the driver when they are tired or exhausted and sleepy.

The intelligent vehicle navigation used the infrared sensor as an input. Then the input it will send a signal to microcontroller to decide the output. In this project, it uses the Programmable Interface Controller (PIC) as a microcontroller. The output is steering and engine.

1.2 Operation of project

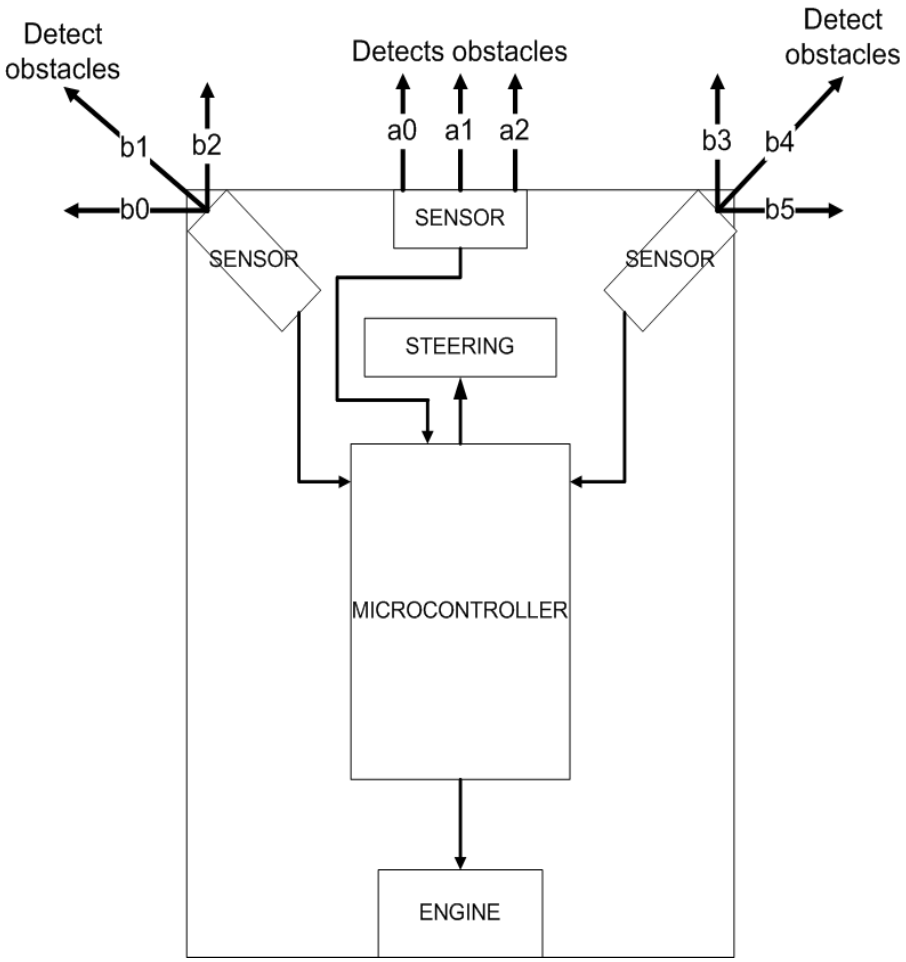

Figure 1.1 Block diagram of model

The operation of intelligent vehicle navigation is started from the detection of sensor until the output either engine or steering. When the sensor on the left of model is detects any obstacles, so the microcontroller gives the output that steering to the right. The angle of steering is control by a controller which is depends on the distance of obstacle with sensor. The angle of steering become higher when model is closed to obstacle. Besides that, it also controls the speed of model. If the obstacle is closed with model so the speed will be reduce. To reduce the speed it needs some brake on the wheel of model. The same operation if there is obstacle at right of model.

1.3 Objectives of project

The objectives of intelligent vehicle navigation project are:

1. To develop a small model of car without a driver or remote controller
2. To design a model which is has ability to turn right or left based on obstacles
3. To build a model which is can avoid obstacles
4. To design a model has ability to move in a suitable speed based on condition of track.

1.4 Problem statements

The purpose of this project is to develop a small model which has ability to turn right or left based on the track and avoid obstacle. The idea is get from our life activities. Everyday almost all people used vehicle especially car to go anywhere such as office, factory, shopping complex and many other places. At the same time, almost every day there is a new about accident between vehicle and other vehicle in television, radio and so on. In accident, there must be a people who get injured or died. So the new of accident is very scary to every person especially person has relationship with them.

Many of the accidents happen because of the human mistake. For example middle and side mirror have not used when take a turn. Sometimes it is because of blind spot where there is some position of behind vehicle has not seen using the mirror. The driver should be alerted the condition of road and vehicle front of them. It is very important to avoid from crash other vehicles or obstacles. Because of that, this project is designed which has ability to avoid from any obstacles such as other vehicles.

Besides that, many accidents happened because the weakness of humans. Some people have difficulty to estimate distance between vehicles with other vehicles. This situation common happens in traffic jam and traffic light. When the accident happens in this situation it will become more havoc for the traffic where more traffic jam. But it will make other people or driver suffering.

Furthermore, sometimes the driver takes more speed to turn. It is very dangerous because the possibility to accident is very high. If the vehicle in high speed, the grip between tires and road become low and the vehicle is easy to slip. The condition becomes worse if in a bad weather. So by using this device, it will determine the suitable speed especially to turn.

1.5 Scope of work

The scope is developing the model of intelligent vehicle navigation besides try to reduce the error of this model. Then overcome the weakness and problems of this project. In this part, it is including the process:

1. Determine input and output components. In this project, the input must be sensors which are to detect the obstacles. Besides that, it also determines the right sensors so it will suitable in any condition. For the output, it more to steering and engine. In this process, it also shows the component or device to use in steering and engine.

2. Find the suitable microcontroller as a main of circuit. Microcontroller use to determine the output based on input. The application of microcontroller must have enough port for the number of bits of input and output.

3. Learn to program and burn it in microcontroller. Determine the software to code the program and burn in microcontroller. Before burn it, make the simulation by using the software for example Proteus.

4. Design the output circuit including steering and engine circuit. For the steering circuit, the output should be turn to left and right. In engine circuit, it same with steering circuit but for forward only with different speed.

5. Assemble all parts including input, microcontroller, output and controller. Make the model of intelligent vehicle navigation.

1.6 Methodology of project

In this part, it introduces the steps or processes to develop prototype. The process is:

1. Design the block diagram of project with all parts have situated in a model.

2. Determine the input and output components of the project.

3. Choose, learn and make a programming for the microcontroller. At the same time, do some simulation of that programming.

4. Design the input and output circuit and tune it until the range of operating of input is suitable with the operating range of output.

5. Combine all the circuits and assemble all parts of the project. Test the model and troubleshoot if there is any problem.

CHAPTER II

LITERATURE REVIEWS

2.1 Track or line guidance system

The purpose of the tack guidance system is to obtain information from the changing environment, obstacle course which is usually bounded by solid as well as dashed lines. The model adapts this information through its controller which guides the model along the obstacle course. For line tracking, two CCD cameras used to determine the left and right lines. Only one line is followed at a time, however when one camera lose the line a video switch changes to the other camera. Image processing is accomplished with the Iscan image tracking device. This device finds the centroid of the brightest or darkest region in a computer controlled window and returns the X, Y coordinates of its centroid as well as size information of the blob. If no object is found, a loss track signal is generated. This information is updated every 16 ms however the program must wait 10 ms after moving the window to get new data. This results in a 52 ms update time for the vision system. The camera is angled down at 32 degrees and panned to the right at 30 degrees. This setup gives a 4 ft wide view of the ground. Once the data points are collected, they are entered into the algorithms. From these calculations, the angle and distance are sent to the motion control sub-system.

Image co-ordinates are two-dimensional while physical co-ordinates are three dimensional. In an autonomous situation, the problem is to determine the three dimensional coordinates of a point on the line given its image coordinates. As a solution to this problem, an innovative algorithm is developed to establish a mathematical and geometrical relationship between the physical 3-D ground coordinates of the line to follow and it's corresponding 2-D digitized image coordinates. The algorithm utilizes a calibration device to determine the focal length of the cameras and the orientation of the projection system with respect to the global coordinates system. The calibration device is constructed to obtain physical co-ordinates of a point on the line with respect to the centered of the robot within an accuracy of 0.0001". From the physical and image coordinates, the camera parameters (coefficients) are computed through a C program subroutine. Figure 4.1 compares the X and Y coordinates for the measured and computed vision calibration sample points. As a result of this reliable performance, the direct coefficients computation model is implemented to solve the vision problem.

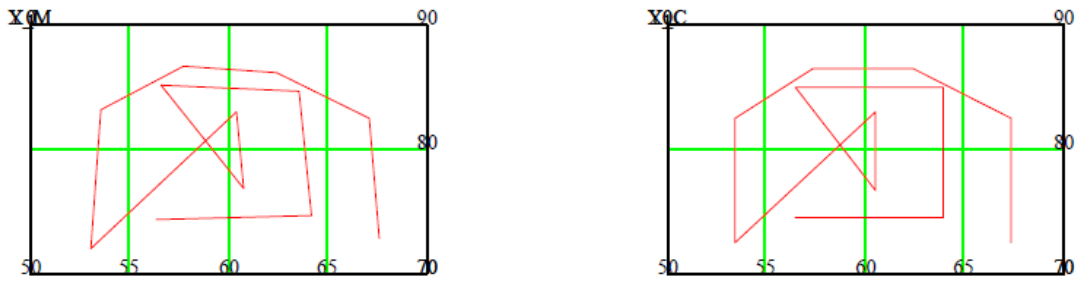

Figure 2.1 X and Y measuring for the measured and computed vision calibration point

After the camera parameters are computed, the next stage is computing the physical coordinates, given any image coordinate. To show how the physical coordinates are computed given any image coordinate, another calibration is performed. Here, the z coordinate for each of the points is treated as constant because in the real time implementation of this method, the z-coordinate is constrained by the ground. Table 2.1 shows the results of the physical coordinate computations. Correlation plots for the original and the computed x and y coordinates are computed. The linearity of the plots means that the difference between the original coordinates and the computed ones is