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VISION BASED ROAD LINE RECOGNITION

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BEKE

2009

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VISION BASED ROAD LINE RECOGNITION

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**A report submitted in partial fulfillment of the requirements for the degree of
Bachelor In Electrical Engineering (Power Electronic and Drive)**

**Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

2009

I declare that this report entitled "*Vision Based Road Line Recognition*" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

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Date :13/5/2009

To my dearly beloved father and mother

To all my teachers and friends

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ABSTRACT

The project is titled as “*Vision Based Road Line Recognition*”. This project is to design and develop a system that able to analyze and recognize the left and right boundary lines of the lane and sent the signals to RS232 serial port in hex format according the position of the vehicle during driving. The MATLAB software is used to obtain the image acquisition, image analysis and image processing part. Some of the useful functions in the MATLAB such as Image Acquisition Toolbox and Image Processing Toolbox are use to analyze and recognize the actual road line from the captured images. MATLAB is chosen because it has its own advantages in combining image processing with to real time simulations. The hardware implementation in this project is camera, laptop and RS232 serial port. The response of this system is able to control the car steering and brake system when the vehicle was steered off its lane. The connection of RS232 port to the vehicle controller such as microcontroller (PIC) is not in this scope of project. Thus, the Hybrid Hard Drive (HHD) Software Serial Monitor software is used to check and prove the data is sent out from the system to RS232 serial port.

ABSTRAK

Projek ini ialah bertajuk "*Vision Based Road Line Recognition*". Projek ini adalah untuk mereka dan membangunkan sebuah sistem yang berupaya untuk menganalisis dan mengenali garis-garis sempadan kiri dan kanan jalan dan menghantarkan isyarat dalam hex code ke RS232 mengikut kedudukan kenderaan semasa dipandu. Perisian MATLAB digunakan pada bahagian pengambilalihan imej, analisis imej dan pemprosesan imej. Sesetengah fungsi-fungsi yang amat berguna seperti "Image Acquisition Toolbox" dan "Image Processing Toolbox" digunakan untuk menganalisis dan mengenali garis jalan sebenar yang ditangkap dalam gambar. Perisian MATLAB ini dipilih kerana kelebihanannya dalam penggabungan pemprosesan imej dengan masa simulasi-simulasi yang nyata. Perkakasan yang digunakan dalam pelaksanaan projek ini adalah kamera, komputer riba dan mikropengawal. Reaksi kepada sistem ini ialah ia berupaya mengawal kemudi kereta dan sistem brek apabila kenderaan tersebut terpesong ke jalan lain. Penyambungan RS232 dengan mikropengawal (PIC) bukan dalam skop projek ini. Oleh itu, perisian "HHD Software Serial Monitor" digunakan untuk memeriksa dan membuktikan data dihantar daripada system ke RS232.

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CHAPTER 1

INTRODUCTION

1.1 Introduction of Project

According to the Road Safety Department in Ministry of Transport Malaysia, a lot of serious accidents happened in highway involved unintended lane or road departure. Vehicle straying out of lane are because driver lack of concentration and sleepy during long distance driving.

To reduce the likelihood of a vehicle straying out of lane, my project, “**Vision Based Road Line Recognition**” is developed. The purpose of this project is to develop a system that able to analyze and recognize the left and right boundary lines of the lane, monitor the position of the vehicle within its lane and notifies the driver and sending the signal via RS-232 to the car controller (microcontroller) if the vehicle are moving across a lane or move out of its lane. This project is divided into two parts: hardware implementation and software part.

In the hardware part, a camera will be installed in a vehicle to capture the images of the road surface in front of the vehicle from the driver view. The video information about lane markings and road conditions will be transmitted from camera to a microprocessor unit (laptop) installed on the vehicle to proceed with the image analysis and recognition by the specific software. So if a distracted driver looks away from the road and starts to veer out of their lane, the car will recognize this as an unintended lane departure. The response of the system can be alert the driver and control the car steering back to the lane by using microcontroller connected by RS232.

In the software part, the software MATLAB is used to obtain the image acquisition, image analysis and image processing part. Some of the useful functions in the MATLAB such as Image Acquisition Toolbox, Video and Image Processing Toolbox were used to analyze and recognize the actual road line from the captured images. Indeed, Hough Transform, Hough Lines and Kalman Filter blocks were used to create line detection and tracking algorithm. This software is chosen because it has its own advantages in combining image processing with real time simulations.

1.2 Objectives

The objectives of this project were:

- i) To design and develop a “Vision Based Road Line Recognition (VBRLR)” system using MATLAB.
- ii) To detects and tracks road lane markers of actual road in a video sequence using camera installed in a vehicle and notify the driver if they are moving across a lane to provide more safety road line recognition system to the driver.
- iii) To interface between MATLAB with the Image Acquisition Device (camera); MATLAB with the RS232 (can be connected with microcontroller as car controller).

1.3 Scope of Project

- i) To design and develop a Vision Based Road Line Recognition system to recognize the left and right boundary lines of the lane using Video and Image Processing Toolbox (Hough Transform, Hough Lines and Kalman Filter blocks) of MATLAB.
- ii) To interface between the Image Acquisition Device (camera) and MATLAB to get the input.
- iii) To interface between MATLAB and PC's serial port (RS232).
- iv) To give response to the microcontroller by sending out the output signal in type of hexadecimal codes to the RS232 regarding the position of the vehicle on the lane during driving. The part of microcontroller as a car controller to control the car steering back to the lane will be carry on by other students on next semester.

1.4 Problem Statements

Every year, many serious accidents happened because of reckless driving. The main factor for the vehicle straying out of lane is due to the lack of concentration during long time driving. Thus, it is a necessity to develop a system to reduce the likelihood of a vehicle straying out of lane.

In the present world, there are many types and methods of road line recognition systems that have been developed by the automotive engineers. The designs in the market almost are based on the particular processors or devices and software. Furthermore, these particular processors or devices might be costly and difficult to be re-programmed.

One of the objectives of this project is to design and develop the system to analyze the image acquired as input. Acquiring an image in real time from a camera is not a problem but the major problem is to ensure the system can analyze and recognize the image acquired by the camera and give a response as output to the driver in real time.

To overcome these problems, this project is to develop the Vision Based Road Line Recognition by using MATLAB Simulink model. Just a laptop is used as the processing unit in this project. This system is able to detect and track road lane markers in a video sequence and notify the driver if they are moving across a lane in real time. Besides, the signal also can be sending out via RS232 in hexadecimal codes to microcontroller for steering control. Hereby, on the terms of low cost effective and easy to reprogram this system is developed by using MATLAB.

1.5 Organization of the Project

The report will be conducted in few chapters and each has stated as below:

i) Chapter 1: Introduction

This part will simply introduce about the project. This chapter will contains introduction, objectives, scope of project and problem statement.

ii) Chapter 2: Literature review

This part will explain the study that been done before and some analysis will be stated at the second part which are relevant to the project. Every facts and information that is found from journals or other references will be mentioned in this chapter. Besides that, the techniques will be compared to get the best method for this project.

iii) Chapter 3: Theory and background

This chapter will state the clear and complete theory related to this project.

iv) Chapter 4: Methodology

This part will show the project methodology used in this project such as acquisition image, analyze image, processing image and steering control. All these methodologies will be described detail in this chapter.

v) Chapter 5: Results and Discussion

This part will present the result and provide a general discussion on the results of the project, stressing the significance and implications of the findings of the project undertaken. Contributions of project findings to the field of study should be highlighted.

vi) Chapter 6: Conclusion and Recommendation

This chapter contains a brief summary of the entire work, including methods, results and major conclusions or recommendations arising from the work. Weaknesses, shortcomings and strengths of the project are presented. Suggestions for future work may also be included together with contributions of project.