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New Approach to Road Detection in Challenging Outdoor Environment for Vehicles

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***Abstract*—The challenge part in roads have irregularities due to the presence of certain path holes, faded lanes and obstacles hence to hand these challenges need a intelligent system. In this concern, we are proposing a edge detector, corners and lanes of the roads using different algorithm. The earlier proposed systems were giving good results where there are straight lane roads, but they failed in case of curved lane roads especially during night. A new color feature technique is introduced in order to detect the boundaries, edges and path holes of the roads and also for enhancing the quality of the images of the roads. Our main focus on designing algorithm which capture, the input with the camera mounted on the semi-automated vehicle. Our system also detect the obstacles which on a way to vehicles the driver will be alerted by the alert system. Thus the driver can re-route or reduce the speed of the vehicle to overcome the obstacles.**

***Index Terms*— Path holes, edge detection, corner detection, lanes, alert system.**

I. INTRODUCTION

Road detection in environmental conditions in the light, sunny and obstacles is very challenging. The appearance of the road depends on type of the road and intensity of the light the growing traffic requires higher safety [1]. The driver must be more careful when driving and during the changing of lane. Therefore an alerting system is needed when vehicle is moving on the road. In this paper, the algorithm is proposed by using the information of camera and road. Firstly, the acquired video stream file is extracted to image frames [1]. Secondly, converting RGB image to the gray-scale image. Thirdly, creating an image filter to implement and detect the edges, corners and lanes of the road. The algorithm will be presented by reviewing the different methods and algorithms presented previously that can increase the accuracy of the road detection. For alerting the system and for the safety driving system on the roads, in this paper we have provided the information about edges, corners and lanes of the road. The purpose of this study is to detect lane boundaries, edges and corners using on-board video camera and also to develop image processing techniques [2].

II. Existing system

For detecting lanes of the road within an image the existing system uses Hough transform . A Hough transform has been developed to aid the driver in decision making while lane departure, when there are path

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holes and to prevent accidents when driving. While riding the vehicle the complete image of the road should be known in order to prevent the accidents. The Hough transform is used for detecting lines, circles or parametric curves [3]. The goal is to find the location of lines in the images captured using camera/video. If the parametric equations of the images is known then the Hough transform is used to detect the lines, circles, lanes and other structures. It can give robust detection even in the presence of noise and occlusion

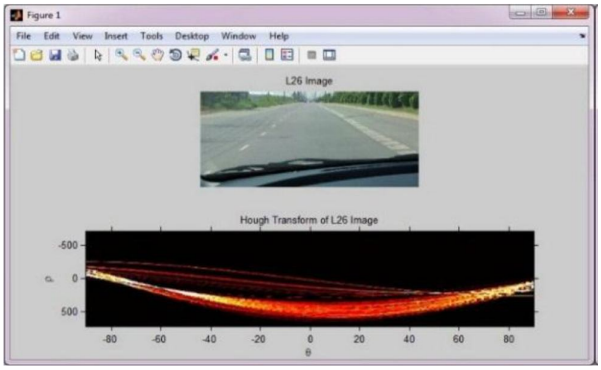


Figure 1. Road detection using Hough transform [1]

III. PROPOSED SYSTEM

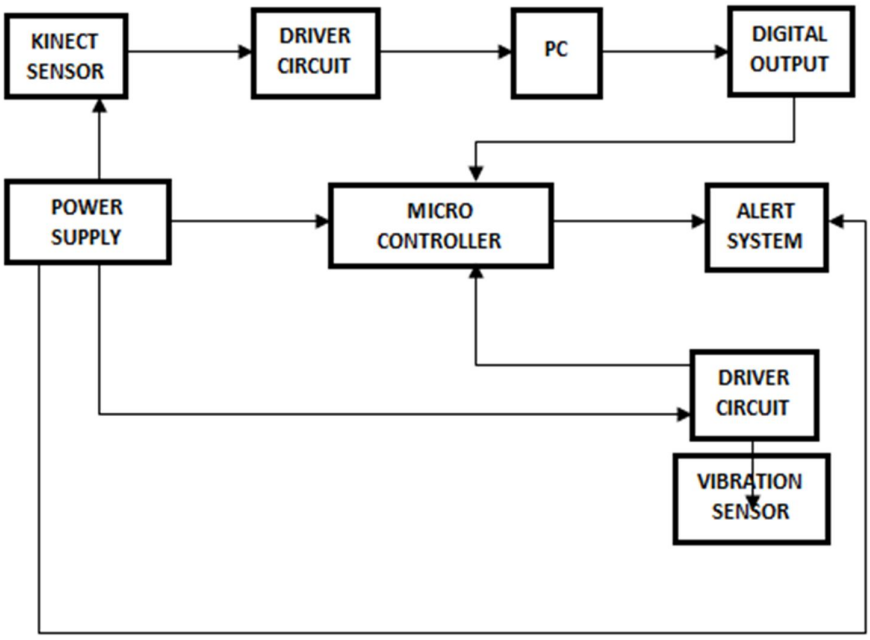


Figure 2. Block diagram

In the proposed system the image of the road is captured through the Kinect sensor, which consists of one color VGA video camera, two depth sensors and multi-array microphone. The video and camera of Kinect sensor has 640*480 pixel resolution and runs at 30 FPS (Frames per second). The snapshot of the road is taken and is given to personal computer and the digital output of the image is obtained. The digital output is the input to the microcontroller. The three dimensional image is converted to the two dimensional gray scale

image and this is achieved with the help of Gaussian filter and DOG filter, the Gaussian filter smoothens the image and difference of the Gaussian filters is the DOG filter. If any pit holes or obstacles are present the alert system alerts the driver using vibration sensor.

Figure 3. Image of Kinect sensor

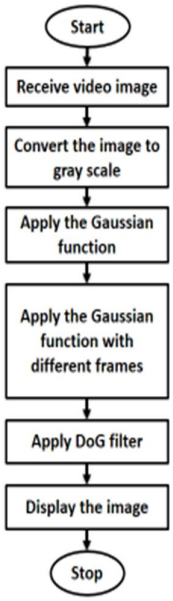


Figure 4. Flow chart for smoothening the image

Step1: Receiving video stream file: The developed system is able to acquire images from video stream files. This is the first step in the algorithm [1].
Step2: Converting RGB image: From RGB image, we have to convert it to gray scale image respectively.
Step3: Applying Guassian filter: A 2-D Guassian filter is implemented to an image for smoothening.
Step4: Applying DoG filter: A difference of Guassian is implemented to images for reduction of noise.
Step5: Display the output image: After finishing all the processing, we display the output image.

A. Guassian Filter

Guassian blur also known guassian smoothing is the blurring of an image by a guassian function and is used to reduce image noise. It is also used to enhance image structures. The equation of a guassian function in one dimension is

$$G(x) = 1/\sqrt{2\prod}\sigma^2 e^{-x^2/2\sigma^2} \qquad \text{----------(1)}$$

In two dimensions, it is the product of two such Guassians, one in each dimension

$$G(x, y) = \frac{1}{2\prod\sigma^2} e^{-x^2+y^2/2\sigma^2} \qquad \text{--------(2)}$$

Where x is the distance from the origin in the horizontal axis, y is the distance from the origin in the vertical axis and σ is the standard deviation of the guassian distribution.

B. DoG Filter

DoG is actually band-pass filter which removes a high frequency components representing noise, and also some low frequency components representing the homogeneous areas in the image .The frequency components assumed to be associated to the edges in the image. It can be given as

$$DoG = G(x)-G(x, y) \quad \text{---------- (3)}$$

C. Infrared Sensor

An infrared sensor is used to sense certain characteristics of its surrounding by either emitting and detecting infrared radiation. It has two leds, one for emitting radiations and other is for receiving. Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye. It is operated at a supply of 5V, the IR transmitter consumes about 3 to 5 mA of current. Infrared transmitters can be modulated to produce a particular frequency of infrared light. Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. Infrared sensor is used to check whether the driver is wore the seat belt or not.

Figure 5. Infrared Sensor

D. Ultrasonic Sensor

Ultrasonic sensors are also known as transceivers and transducers, work on the principle similar to that of the radar. Ultrasonic sensors generate high frequency sound waves and evaluates the echo which is received back. Ultrasonic sensors are also used to determine the distance to the object. Here we use HC SR04 ultrasonic sensor because of its stable performance and high ranging accuracy. It operates at 5V DC power supply and about 2mA of current, effectual angle less than 15°, ranging distance of about 2cm to 500 cm and ultrasonic frequency of 40 KHz.

This module has 4 pins – Vcc (5V), Trig (trigger), Echo and Gnd. Trig is used to send out an ultrasonic high level pulse or at least 10us and the echo pin then automatically detects the returning pulse.

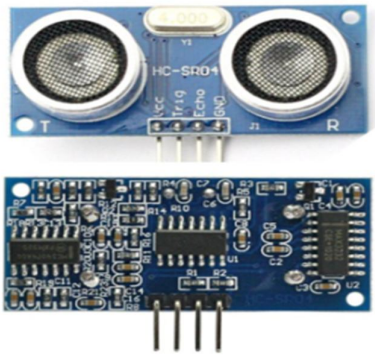
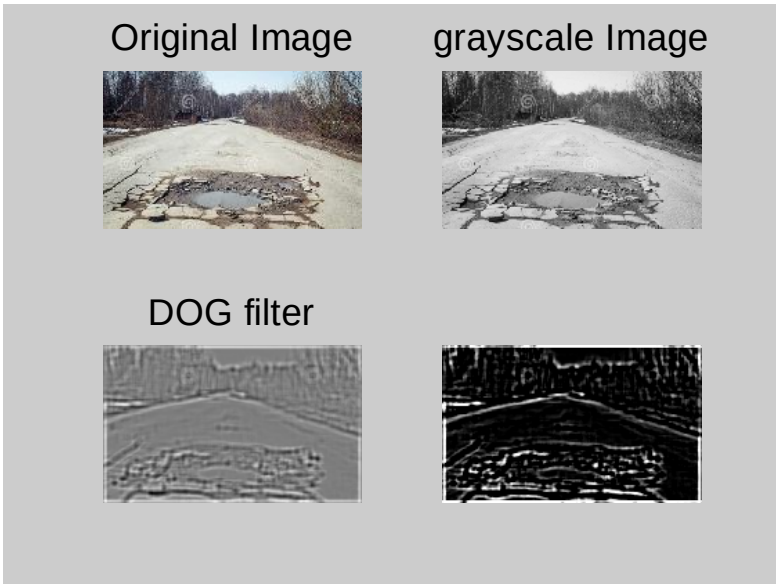


Figure 6. HC-SR04 Ultrasonic Sensor

IV. VALIDATION

The road is detected by taking the images of the road as input from the Kinect sensor. The image is converted to the grayscale image. Guassian and Difference of Guassian filter is implemented to smoothen the image, thus the noise is reduced



Above figure shows the original image of the road taken from the Kinect sensor, the grayscale image of the road converted from RGB image, the image obtained by implementing Guassian and Difference of Guassian filter on the image and the output image the road from the proposed system

V. CONCLUSION

In this work, a new approach to detect the road was proposed. In this paper a system for corner detection, edge detection and path holes is presented for helping the drivers using alerting system. The advantage of the edge, corner and lane detection are easy to use, low cost and also efficient in detecting the roads. So far most of the road detection analysis has been done. Using the description of the road scene drivers can be warned to slow down or directed to alternative routes. This system can be implemented during night vision. As a part of future work this can be implemented for long sighted roads.

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