# Implementation Of Components Of Driverless Vehicle Algorithm

**Prerna Jain[1], Mr Nitesh Wadhera[2]**
[1]Dept of Information Technology
[2]Assistant Professor, Dept of Information Technology
[1, 2]Maharaja Agrasen Institute of Technology

***Abstract****- With the growth in population, the occurrence of automobile accidents has also seen an increase. A detailed analysis shows that around half million accidents occur in a year, in India alone. Further, around 60% of these accidents are caused due to driver fatigue. Driver fatigue affects the driving ability in the following 3 areas, it impairs coordination, it causes longer reaction times, and it impairs judgment.*

*Through this project, I provide a real-time monitoring system using image processing, face/eye detection techniques. The eyes are detected using the Haar cascade features by applying Viola-Jones algorithm and eye blink is fund out by using a histogram. An alarm is raised by the system whenever the driver starts feeling drowsy. Leaving the lane causes about 30% of all accidents on the highway, and most of these result from the distraction and fatigue of the driver. Therefore, a system that could provide a warning to drivers of a danger has a great potential to save a large number of lives. Vehicle detection and tracking applications play an important role for civilian applications such as in highway traffic surveillance control management and urban traffic planning. First, we performed a HOG feature extraction on a labelled training set of images and trained a classifier Linear SVM classifier. Then the sliding-window technique is implemented and trained classifier is used to search for vehicles in images. This helped us to get the boundary for the detected vehicle.*

***Keywords***- Haarcascade, HOG features, Hough Transform, Viola Jones

## I. INTRODUCTION

Each year hundreds of people lose their lives due to traffic accidents around the world. Unfortunately, Iran ranks first in the world in terms of road fatalities and each year approximately thirty thousands of fellow countrymen lose their lives in these events. In a study by the National Transportation Research Institute in which 107 random car accidents had been selected, fatigue accounted for 58% of all accidents. A main cause of fatigue is sleeplessness or insomnia.

The major challenges of the proposed technique include (a) developing a real-time system, (b) Face detection, (c) Iris detection under various conditions with/without spectacles, lighting, etc (d) Blink detection, and (e) Economy. placed on designing a real-time system that will accurately monitor the open or closed state of the driver's eyes. By monitoring the eye detected early is enough to avoid a car accident. Detection of fatigue involves the observation of eye movements and blink patterns in a sequence of images of a face extracted from a live video.

Leaving the lane causes about 30% of all accidents on the highway, and most of these result from the distraction and fatigue of the driver. Lane detection is the process to locate lane markers on the road and then present these locations to an intelligent system. In intelligent transportation systems, intelligent vehicles cooperate with the smart infrastructure to achieve a safer environment and better traffic conditions. The applications of a lane detecting system could be as simple as pointing out lane locations to the driver on an external display, to more complex tasks such as predicting a lane change in the instant future in order to avoid collisions with other vehicles.

Our proposed approach uses to canny edge detector to detect the edges. However, the image is converted to binary from RGB prior applying the filter. For better results, we implemented hough transform. The image is converted back to RGB after the lane has been detected in a particular frame.

One of the significant applications of video-based supervision systems is the traffic surveillance. So, for many years the researchers have investigated in the Vision-Based Intelligent Transportation System , transportation planning and traffic engineering applications to extract useful and precise traffic information for traffic image analysis and traffic flow control like vehicle count, vehicle trajectory, vehicle tracking, vehicle flow, vehicle classification, traffic density, vehicle velocity, traffic lane changes, license plate recognition, etc. In the past, the vehicle detection, segmentation and tracking systems used to determine the charge for various kinds of vehicles for automation toll levy system . Recently, vehicle recognition system is used to detect (the vehicles) or detect the traffic lanes or classify the type of vehicle class on highway roads like cars, motorbikes, vans, heavy goods vehicles (HGVs), buses and etc. However, the. traditional vehicle systems may be declines and not recognized well due to the vehicles are occluded by other vehicles or by background obstacles such as road signals, trees, weather conditions, and etc., and the performance of these systems depend on a good traffic image analysis approaches to detect, track and classify the vehicles. Breakthrough in the application of statistical learning techniques to real-time object detection was brought by the cascaded classifier of Viola and Jones who proposed a method for training a sequential classifier working on a simple to evaluate Haar-like features and demonstrated its real-time performance on the face detection problem.

## II. BACKGROUND

A completely autonomous vehicle is one in which a computer performs all the tasks that the human driver normally would. Ultimately, this would mean getting in a car, entering the destination into a computer, and enabling the system. From there, the car would take over and drive to the destination with no human input. The car would be able to sense its environment and make steering and speed changes as necessary. We perform many tasks while driving without even thinking about it. Complete automating the car is a challenging task and is a long way.

We have implemented the software part of three of the basic components of a driverless vehicle.Firstly, we have detected whether the driver is drowsy or not. Through this project, we provide a real-time monitoring system using image processing, face/eye detection techniques.

Further, to ensure real-time computation, Haar cascade [1] samples are used to differentiate between an eye blink and drowsy/fatigue detection.The steps involved in drowsiness detection are the following. The first step is video acquisition mainly involves obtaining the live video feed of the automobile driver. Video acquisition is achieved, by making use of a camera. Dividing into frames is used to take live video as its input and convert it into a series of frames/ images, which are then processed.

The face detection function takes one frame at a time from the frames provided by the frame grabber, and in each and every frame it tries to detect the face of the automobile driver. This is achieved by making use of a set of pre-defined Haarcascade samples. Once the face detection function has detected the face of the automobile driver, the eyes detection function tries to detect the automobile driver's eyes. This is achieved by making use of a set of pre-defined Haarcascade samples. After detecting the eyes of the automobile driver, the drowsiness detection function detects if the automobile driver is drowsy or not, by taking into consideration the state of the eyes, that is, open or closed and the blink rate [9].

Lane detection plays an important role in intelligent vehicle systems. We tried to implement a robust road lane marker detection algorithm to detect the left and right lane markers. The algorithm consists of optimization of Canny edge detection and Hough Transform [2]. The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. Canny edge detection [12] is a technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. It has been widely applied in various computer vision systems. Canny has found that the requirements for the application of edge detection on diverse vision systems are relatively similar. Thus, an edge detection solution to address these requirements can be implemented in a wide range of situations.

The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure. This voting procedure is carried out in a parameter space, from which object candidates are obtained as local maxima in a so-called accumulator space that is explicitly constructed by the algorithm for computing the Hough transform. Then a series of image processing is applied to generate the road model. Canny edge detection performs features recognition then followed by Hough Transform lane generation [6].

The algorithm detects visible left and right lane markers on the road based on video processing. The first step is low-level image processing, which deals with images from the vision sensor and generates useful information for detection parts. In this stage, the image of the road is copied for the computational part. The image is reduced to a smaller region of interest to save computational time. The image is also converted into grayscale as Canny edge detection works with the monochromatic image. Noise reduction with image processing such as erosion, dilation and image smoothing is also applied for better user information.

Canny edge detection is implemented in the post-processing stage. Lines and edges in the smoothed image are detected in the feature recognition stage.Then Hough Transform is implemented to connect discontinuous line and differentiate different lines. In short, post- processing is one of the most important steps as it ties together feature extraction stage and the road lane modelling stage.

Next, we have done the vehicle detection in which the approach we followed consists of the following steps. First, we performed a HOG feature extraction on a labelled training set of images and trained a classifier Linear SVM classifier. Then the sliding-window technique is implemented and trained classifier is used to search for vehicles in images. This helped us to get the boundary for the detected vehicle.

## III. METHODOLOGY

### DROWSY DRIVER DETECTION

In this project, we propose a direct approach that makes use of vision-based techniques to detect drowsiness. The major challenges of the proposed technique include

(a) developing a real-time system
(b) Face detection
(c) Iris detection under various conditions with/without spectacles, lighting, etc
(d) Blink detection, and

(e) Economy. placed on designing a real-time system that will accurately monitor the open or closed state of the driver's eyes. By monitoring the eye detected early is enough to avoid a car accident. Detection of fatigue involves the observation of eye movements and blink patterns [10] in a sequence of images of a face extracted from a live video.

### IMPLEMENTATION STEPS:

1.**Video acquisition**: Video acquisition mainly involves obtaining the live video feed of the automobile driver. Video acquisition is achieved, by making use of a camera.

2.**Dividing into frames**: This module is used to take live video as its input and convert it into a series of frames/ images, which are then processed.

3.**Face detection:** The face detection function takes one frame at a time from the frames provided by the frame grabber, and in each and every frame it tries to detect the face of the automobile driver. This is achieved by making use of a set of predefined Haarcascade samples.

4.**Eyes detection**: Once the face detection function has detected the face of the automobile driver, the eyes detection function tries to detect the automobile driver's eyes. This is achieved by making use of a set of pre-defined Haarcascade samples.

5.**Drowsiness detection**: After detecting the eyes of the automobile driver, the drowsiness detection function detects if the automobile driver is drowsy or not, by taking into consideration the state of the eyes, that is, open or closed and the blink rate.

### LANE DETECTION

After taking the image, it is converted into grayscale. This is done so as to minimize the processing time. Secondly, a Canny edge detector, which we will use in the next step, works best for monochromatic images. After that, we applied an average filter to remove the noise from the image. This is done because the presence of noise in the image will hinder the correct edge detection. After removing the noise from the image, we use the Canny edge detector to detect the edges in the image.

The result of applying Canny edge detection to an image is an edged image where only edges are white (or visible) and rest all is black. This edged image is then sent to the line detector which produces a left and right lane boundary segment. In the line detector, we apply Hough Transform to the edged image to get the probable lane segment endpoints. The main purpose of Hough Transform is to detect straight lines and curves in the image. Once we get the desired lane segments, we plot them in the original image to get the output image.

The lane detection algorithm consists of three phases:

i. Pre-processing,

ii. Post-processing,

iii. Road lane modelling.

### VEHICLE DETECTION

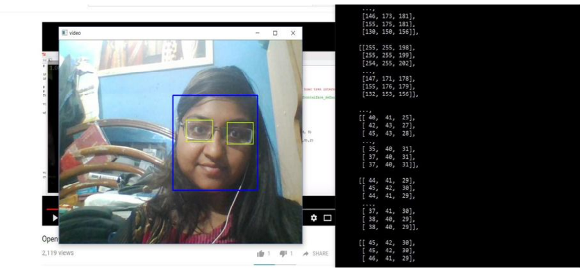
The steps of this project are the following:

Perform a Histogram of Oriented Gradients (HOG) feature extraction on a labelled training set of images and train a Linear SVM classifier.

Implement a sliding-window technique and use your trained classifier to search for vehicles in images. Run your pipeline on a video stream and create a heat map of recurring detections frame by frame to reject outliers and follow detected vehicles.

Estimate a bounding box for vehicles detected.

## IV. EXPERIMENTAL SETUP AND RESULTS



**Result screenshots for drowsy driver detection**

**Result screenshots for Vehicle detection**

**Result screenshots for Lane detection**

## V. CONCLUSION

My proposed project works absolutely fine and gives correct results for the live video camera. The system also generates an alarm when it feels that the user is feeling sleepy or fatigue. This project is extremely useful in real life applications and it can decrease the number of road accidents occurring each year by 30% if installed properly on every vehicle. The primary goal of this project is to develop a real-time drowsiness monitoring system in automobiles. We developed a simple system consisting of 5 modules namely video acquisition, dividing into frames, face detection, eye detection and drowsiness detection

Each of these components can be implemented independently thus providing a way to structure them based on the requirements. Four features that make our system different from existing ones are a focus on the driver, which is a direct way of detecting the drowsiness, a real-time system that detects a face, iris, blink, and driver drowsiness and cost-effective.

The lane detection algorithm works perfectly fine as is able to able to the detect the correct probable lane segments. It gives extraordinary results when the algorithm is applied to a sample video which was taken from a fixed mounted camera. This is so because the video quality is better and moreover as the camera is fixed at the top middle of the car, it doesn't shake that much while driving and video are more or less stable. Moreover, the fixed camera covers the relatively larger portion of the road and is unaffected by vehicle front glass. The algorithm also gives the satisfactory result for the video recorded from the mobile phone's camera. It is able to correctly detect lane segments on one side and sometimes work for both sides. It doesn't perform that well as the previous one because the camera quality is low as compared to the previous one. Moreover, the camera is not fixed to the car and it shakes a little bit as the vehicle moves. Also, as the video is recorded from inside the vehicle, it gets to suffer from some refraction and noise of the front glass of the vehicle.

Overall, the algorithm performs quite well given an input video and is able to detect the correct probable lane segments. This algorithm, when implemented in new upcoming cars, can reduce the number of accidents to a significantly smaller level.

A vehicle detection method is implemented using high-resolution images because these images give a high level of object details in the image. The feature extraction algorithms used is HOG algorithm. Also, classification process performed using SVM classifier. Using these steps satisfactory results were obtained.

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