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# Portable Driver Monitoring System using Matlab

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***Abstract*:Various investigations show that driver's drowsiness is one of the main causes of road accidents. The development of technologies for preventing drowsiness at the time is a major challenge in the field of accident avoidance. The advance in computing technology has provided the means for building intelligent vehicle systems. The purpose of this study is to detect the drowsiness in driver's to prevent the accidents and to improve the safety on the highways.**

**A system aiming at detecting driver drowsiness or fatigue on the basis of video analysis is presenting. A real time face detection is implemented to locate driver's face region. A method of detecting drowsiness in drivers is developed by using a camera that points directly towards the face and capture for the video. As a detection method the system uses image processing technology to analyze the images of the driver's face taken with a video camera. The captured video is done; it is converted into number of frames of images and monitoring of the face region and eyes in order to detect drowsiness. The system is able monitoring eyes and determines whether the eyes are in an open or shows signs of drowsiness. This detection system avoids a noncontact technique for judging various levels of alertness and facilities early detection of a decline in alertness during driving.**

***IndexTerms*: Fatigue Detection, Eye Feature Extraction, ITS, Image Segmentation, MATLAB**

## I. INTRODUCTION

Improvement of public safety and the reduction of accidentsare of the important goals of the Intelligent TransportationSystems (ITS). One of the most important factors in accidents,especially on rural roads, is the driver fatigue andmonotony. Fatigue reduces driver perceptions and decisionmaking capability to control the vehicle. Researches show thatusually the driver is fatigued after 1 hour of driving. In theafternoon early hours, after eating lunch and at midnight,driver fatigue and drowsiness is much more than other times. In addition, drinking alcohol, drug addiction, and usinghypnotic medicines can lead to loss of consciousness. In different countries, different statistics were reportedabout accidents that happened due to driver fatigue and distraction.

Generally, the main reason of about 20% of thecrashes and 30% of fatal crashes is the driver drowsiness and lack of concentration. In single-vehicle crashes (accidentsin which only one vehicle is damaged) or crashes involving heavy vehicles, up to 50% of accidents are related to driver hypovigilance.According to the current studies, it is expected that the amount of crashes will be reduced by10%–20% using driver face monitoring systems. Driver face monitoring system is a real-time systemthat investigates the driver physical and mental conditionbased on the processing of driver face images. The driverstate can be estimated from the eye closure, eyelid distance,blinking, gaze direction, yawning, and head rotation. Thissystem will alarm in the hypovigilance states including fatigueand distraction. The major parts of the driver face monitoringsystem are (1) imaging, (2) hardware platform, and (3) the intelligent software.

Driver monitoring system includes some main parts:(1) face detection, (2) eye detection, (3) face tracking, (4)symptom extraction, and (5) driver state estimation.In the most of driver face monitoring systems, the facedetection is the first part of the image processing operations.Face detection methods can be divided into two general categories: (1) feature-based and (2) learning-based methods.In the feature-based methods, the assumption is that the face in the image can be detected based on applyingheuristic rules on features. These methods are usually used fordetecting one face in the image.

Color-based face recognitionis one of the fast and common methods. In these methods,the face is detected based on the color of skin and the shape offace. Color-based face detection may be applied on different color-space including RGB, YCbCr, or HIS.In noisy images or in the images with low illuminations, thesealgorithms have low accuracy.Learning-based face detection uses statistical learningmethods and training samples to learn the discriminative features. These methods are from statistical models and machine learning algorithms. Generally, learning-basedmethods have less error rates for face detection, but these methods usually have more computational complexity. Violaand Jones [14] presented an algorithm for object detection,which is very fast and robust. This algorithm was used in for face detection.Almost in all driver face monitoring systems, because ofthe importance of symptoms related to eye, the eye regionis always processed for extracting the symptoms. Therefore,before the processing of eye region, eye detection is required.

In this paper, a new driver face monitoring system isproposed which extracts the hypovigilance symptoms fromdriver face and eye adaptively. Then, the symptoms are analyzedby a fuzzy expert system to determine the driver state.

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**II.SYSTEM OVERVIEW**

This chapter deals with the Hardware components and software used in this project. The hardware components are as listed below. The block diagram that is being implemented in this project is as shown below.

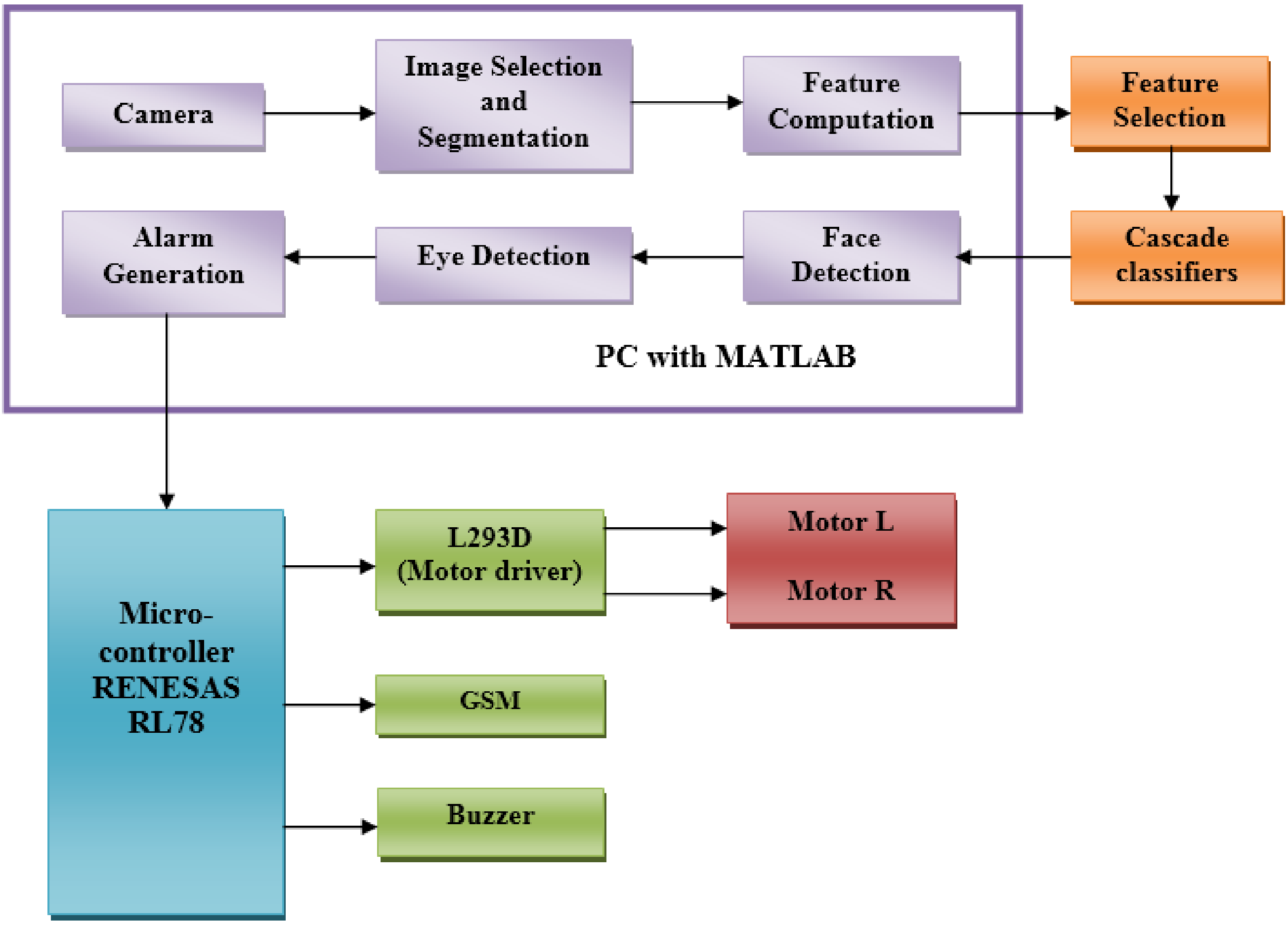


Fig 2.1: Proposed system block diagram

To design the complete working system for Driver monitoring system, it needs to select, study, analyze, design and testing of different sub-modules as follows.

**Image Acquisition:**A video camera with an array of Infrared LEDs is mounted in front of the driver to continuously capture the video of the driver.

**Face Detection:** A robust Face detection module detects the driver's face region to monitor it further. The face detection algorithm is based on Viola-Jones face detection approach.

**Eyes Detection:** The coordinates of the driver's eyes are detected for using HAAR Classifier based eyes detection module. It is main block to detect distraction of eyes. It compares results with normal condition of eyes required for secure driving.

**Visual Cues Extraction:** Using the face and eyes coordinates, other visual cues of the driver's face like eye lids movement, face orientation and gaze direction are extracted.

**Visual Cues Tracking:** The position and movements of the extracted visual cues are tracked frame by frame. This visual information for different visual cues is fused to form the state of the driver.

**Driver Vigilance Level Decision:** Depending on the state of the driver as determined in previous blocks, the vigilance level or alertness of driver is determined and an alarm is generated if the alertness of the driver is very low. If the conditions are normal then continuous monitoring is goes on.

Then the information is sent to the microcontroller which helps in alarming driver in times of drowsiness and also it will send an SMS to the driver using GSM.

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***2.1 Renesas microcontroller:*** These increasingly popular MCUs make possible ultralow-power applications by giving system designersadvanced power-savingfeatures and high-performance operation. Because the devices offer important capabilities such as an innovative Snooze mode that allows serial communication and ADC operation while the CPU is inactive, RL78 MCUs are demonstrably superior solutions for a vast span of battery-powered applications.

- Best-in-class performance for superior designs and low power.
- Scalability of package, memory and peripheral features.
- System cost-saving features.
- Wide voltage and temperature operation.
- On-chip safety features.

The Renesas controller group is ideal for applications that require high-performance timer and analog functions in small packages, such as motor control and sensor systems, as well as various consumer and industrial applications.

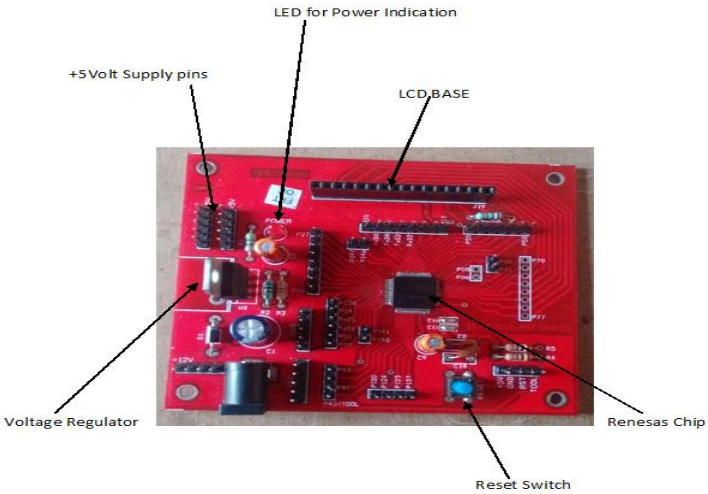


Figure of 64 pin Renesas Microcontroller Board

### *2.2 L293 Motor Driver*

The L293 is an integrated circuit motor driver that can be used for simultaneous, bidirectionalcontrol of two small motors.

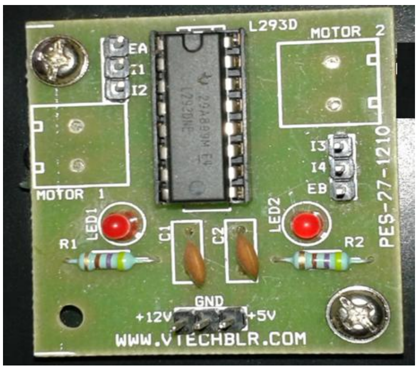


Fig 2.2: L293D Motor driver

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads ( such as relays, solenoids, DC and Stepper motor) and switching power transistors. To simplify use as two bridges each pair of channels is equipped with an enabled input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included.This device is suitable for use in switching applications at frequencies up to 5 KHz.

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The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking. Since L293D is an integrated circuit motor driver it can be used for simultaneous bidirectional control of two small motors. L293D is limited to 600 mA.

***2.3 GSM***

GSM stands for Global System for Mobile Communications.This is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies for second generation (or "2G") digital cellular networks. The GSM standard initially was used originally to describe switched circuit network for full duplex voice telephony to replace first generation analog cellular networks.

Fig 2.3: GSM Module

GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead (for example in Canada and the United States). In rare cases the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first-generation systems.

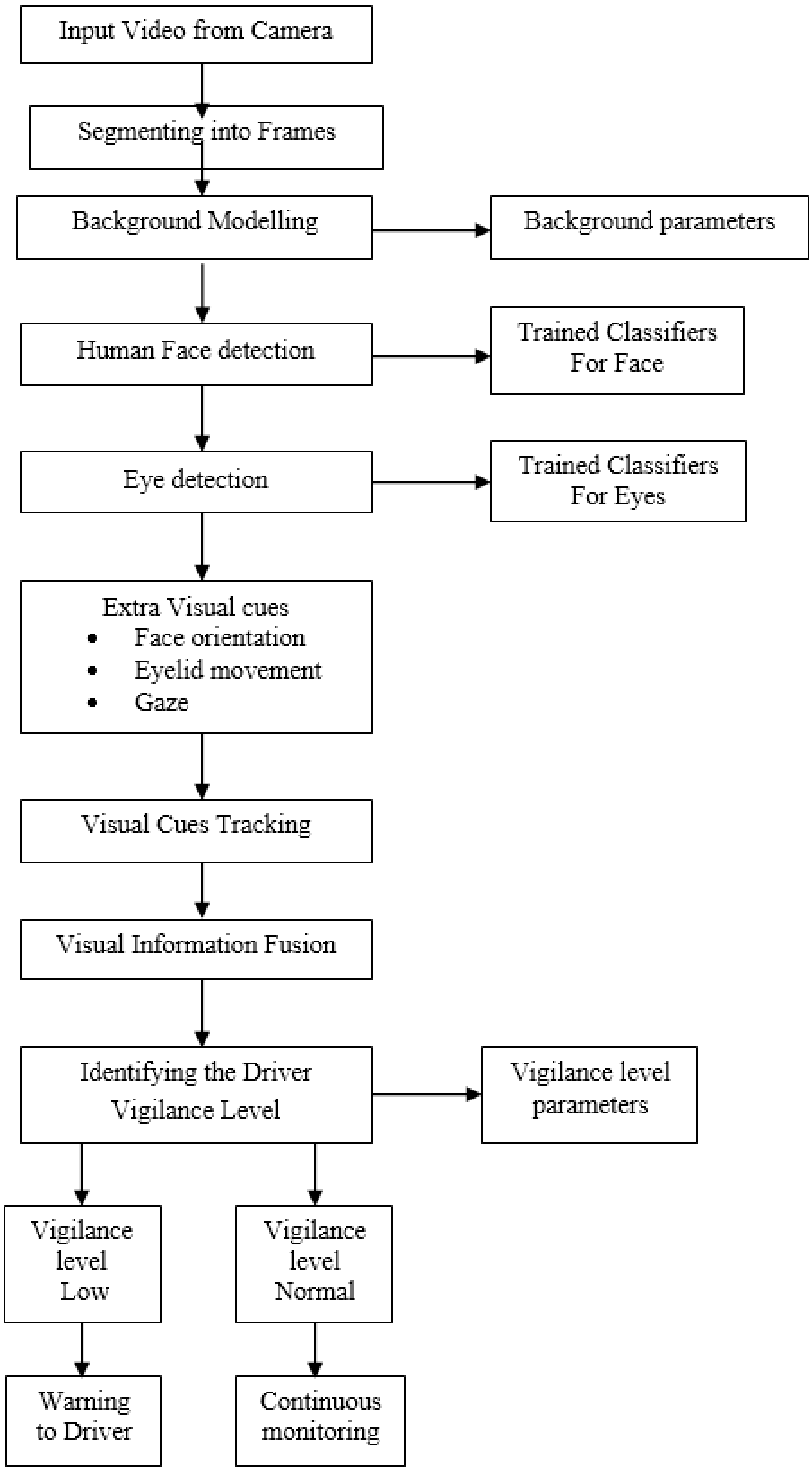
***2.4 Buzzer***

Fig 2.4 buzzer module

- Buzzer is an audio signaling device
- Typical uses of buzzers are for alarms, timers and confirmation of user input such as a mouse click or keystroke
- When the system detects the LPG gas leakage the microcontrolleralerts the user by giving the buzzer sound.

Operating Voltage: 5V DC,
Current : 40mA

## III. METHODOLOGY


Input Video from Camera
Segmenting into Frames
Background Modelling
Background parameters
Human Face detection
Trained Classifiers For Face
Eye detection
Trained Classifiers For Eyes
Extra Visual cues
Face orientation
Eyelid movement
Gaze
Visual Cues Tracking
Visual Information Fusion
Identifying the Driver Vigilance Level
Vigilance level parameters
Vigilance level Low
Vigilance level Normal
Warning to Driver
Continuous monitoring

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IV. RESULTS & DISCUSSION


Fig 4.1: Human detection

The Complete working prototype module of Driver monitoring system has been developed and tested for its functionality and performance using MATLAB. Here all the individual modules are studied, analyzed and tested before assembling the entire system. The working module is as shown in figure 4.1.

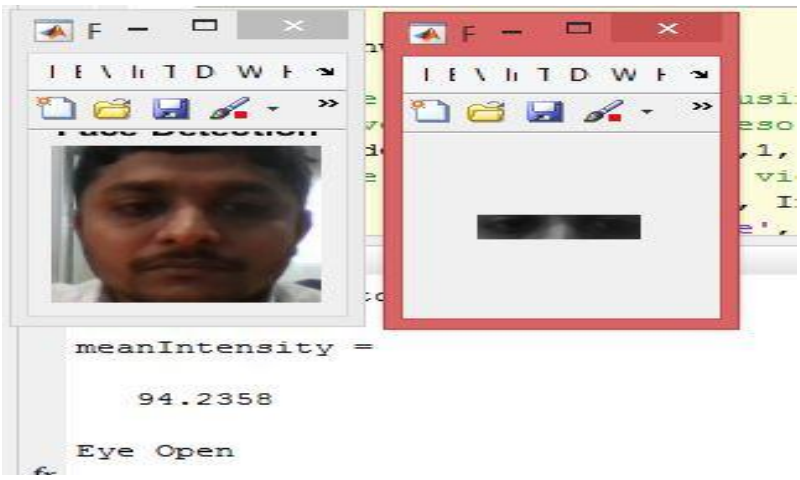


Fig 4.2: recognition of face

This graphical representation is of one frame among of all frames. Whenever the eyes are open, the intensity goes high otherwise low. And this intensity comes high in between two points. These two points are repeated. The analysis of all the images of only eye's region shows that the eyes will be open in between these two points.

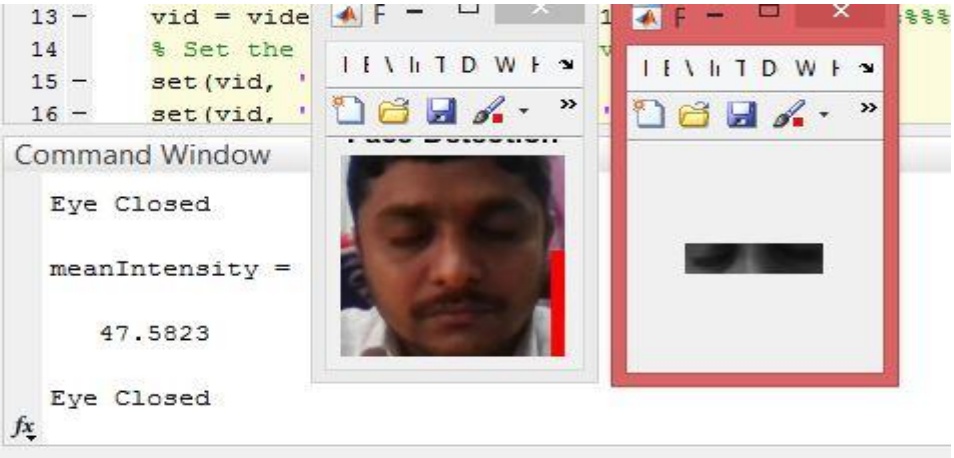


Fig 4.3 Resulted image of drowsiness

This shows the driver is in drowsy mood, hence the intensity varies from the previous record. Information about face and eye's position is obtained through various self-developed image processing algorithm. During this process the system is able to decide whether eyes are opened or closed.


Fig 4.4: Displaying person's state as drowsiness

Here it is displaying that driver is in drowsy condition as shown in figure 4.4.

## V. CONCLUSION AND FUTURE SCOPE

With the successful completion of the proposed work, this paper achieved the main objective of designing reliable, low cost and low power Driver monitoring system. This system reveals that the facial expressions are very reliable indicators of driver's drowsiness and facial expressions can be used to do fine discrimination in different levels of drowsiness. Here it involves greatly developed image processing algorithms to find driver's facial expressions which in turn lessen hardware requirements. It reliably decides whether the eyes are opened or closed along with its intensity values.

FUTURE WORK:

In real time driver monitoring system it is required to slow down a vehicle automatically when fatigue level crosses certain limit. If this crosses the threshold, a signal is generated which controls the hydraulic braking system of a vehicle. It is required to develop a system that will give result even though having multiple faces.

## VI. ACKNOWLEDGMENT

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