ADVANCE VEHICLE CONTROL AND SAFETY SYSTEM USING FACE DETECTION

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ABSTRACT

Advanced Vehicle Control and Safety System using Face Detection is about providing security in terms of driver identification , drowsiness detection and providing different vehicle control function using Android mobile. This paper outlines a novel approach for real time face detection for driver identification and drowsiness detection. There are large number of car thefts, and also road accidents which takes place due to fatigue. Car security is nothing but providing the security in terms of keyless authentication for the driver using face detection. Computer vision is combined to an embedded system to achieve this goal. Driver fatigue is a severe problem which results in thousands of road accidents per year. It is difficult to correctly tell the exact number of sleep related accidents but traffic survey shows that driver fatigue may be a contributory factor in up to 20% of all road accidents. This project aims to create one more step towards solving of this serious problem. The design is based on computer vision and embedded system application principles. There has been significant progress in improving the performance of computer-based face recognition algorithms over the last decade. This work is a combination of face detection, eye region detection and eye closing rate detection in real time environment. The proposed system is realized with a digital camera supported by embedded system board Raspberry Pi loaded with Raspian-OS and Python-IDLE with OpenCV installed. Also different vehicle control functions like center locking and unlocking, opening and closing of windows, bonnets etc. can be controlled by using Android mobile phone.

Keywords*: *Drowsiness, Raspberry pi, Open CV, Embedded System, Python IDLE, Raspbian

I. INTRODUCTION

In the era of automation different vehicle control functions and driver safety functions has been introduced in modern cars by many companies. But these functions are been brought up only in the luxurious car. Car security and also drivers safety has become very important as there has been a constant rise in accidents. Therefore every car should have a driver safety system which is effective also economically viable. Advanced Vehicle Control and Safety System using face detection strives to achieve that very fundamental aspect of car security and driver safety and also different vehicle control functions which has become a must in today's world. Advanced Vehicle Control and Safety System using face detection combines both these technologies into single low cost package which is more feasible for the common man.

II. BACKGROUND

Every year the number of car thefts and road accidents are increasing in India. Therefore security of car as well as the driver safety is very important. Such a system for driver safety and car security is present only in the luxurious costly cars.

The main hindrances in the widespread use of such car security and driver safety system is the cost factor involved. Hence, the primary concern while implementing the project AVCSS using face detection is to make it economically feasible.

Additionally, within the costs of the project features like driver safety and car security using a normal camera were included, unlike CCTV camera's, hereby adding to the above point, to keep the cost low. The learning curve embarked on is considerably steeper than previous work that we have undertaken. The knowledge of the software and hardware components to be used is both challenging and interesting.

III. METHODOLOGY

The working of AVCSS using face detection can be divided into two parts. The project consists of two different modules which perform their respective functions.

1) Car Security and Driver Safety.
2) Vehicle Control Functions.

3.1 Car Security and Driver Safety

Face detection for the keyless authentication of the driver: Firstly the camera interfaced with the Raspberry Pi is used for keyless access for the driver using face detection. The camera captures the photo and compares with the database and display the message whether the driver is authenticated or not.

Drowsiness Detection: Drowsiness detection is to implement driver's attentiveness in car. The eye movement is monitor by the camera. If the driver is not paying attention on the road and a dangerous situation is detected, the system will warn the driver by giving the warning sounds.

Vehicle Control Function: Vehicle control function like centre locking and unlocking, opening and closing of windows, bonnets etc., can be controlled by using Android mobile phone.

IV. BLOCK DIAGRAM AND CIRCUIT DIAGRAM

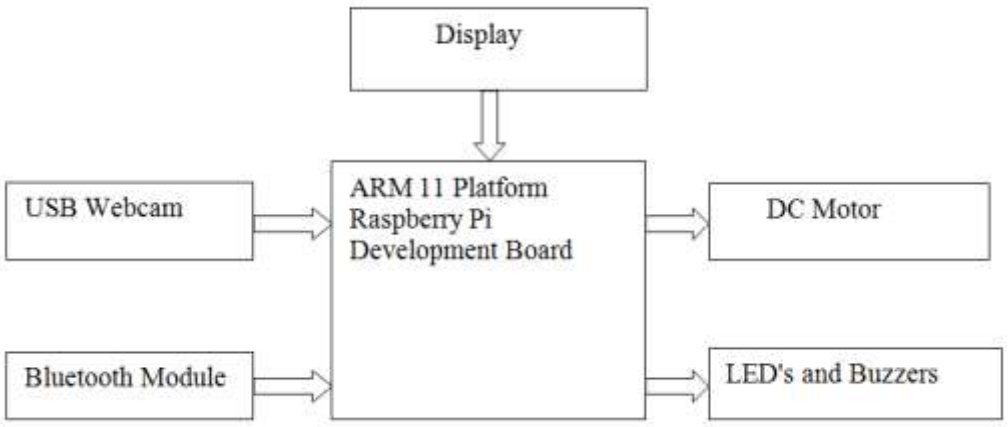


Fig.1 Block Diagram

Block diagram description:

Block diagram consist of

1) **Webcam:** used for to take the Driver Face image .
2) **Communication Module:** used to connect with the android mobile phone like Bluetooth or Wi-Fi.
3) **Display:** used for to provide the GUI with display facility.
4) **DC Motor:** used for vehicle control functions.
5) **LED& Buzzers:** LED acts as the indicator for the car & buzzer used to provide the siren if user is unauthorized and for drowsiness detector.
6) **Raspberry pi:** It is the main Heart of the system used for to control of the whole system.

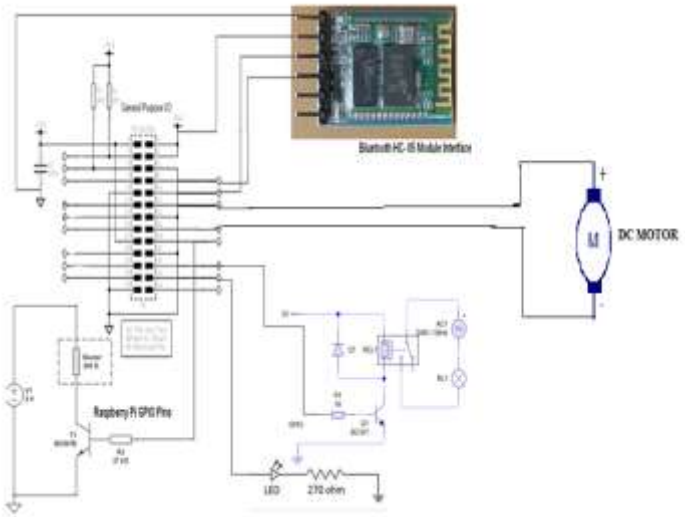


Fig.2 Circuit Diagram

V. HARDWARE & SOFTWARE CONFIGURATION

5.1 Hardware Configuration

The proposed design contains Raspberry Pi module B+, Bluetooth module HC-05, LCD screen, Camera, relay, relay driver ULN 2803, DC Motor, DC Motor IC L293D, buzzers and LED's. Raspberry Pi module B+ is shown in Fig.3, Bluetooth module HC-05 in Fig.4.

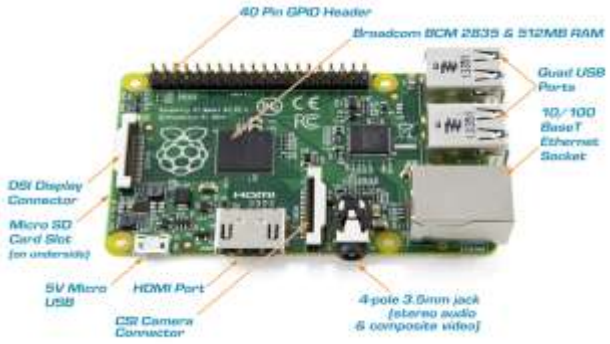


Fig.3 Raspberry Pi Module B+

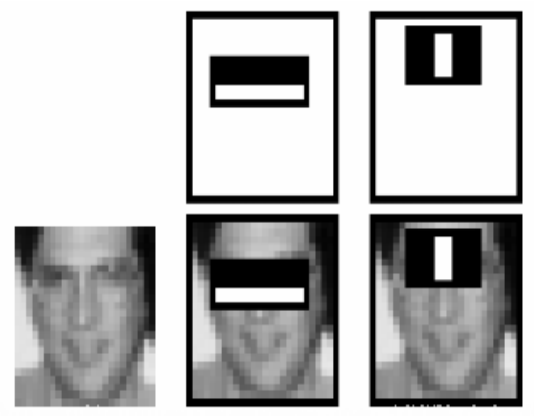
Fig.4 Bluetooth Module HC-05

5.2 Software Configuration

The necessary software tools required for the system includes Raspbian operating system, Python IDLE, Open CV computer vision software extension for python with Haar object detection trainer.

VI. ALGORITHM FOR FACE DETECTION ALGORITHM: HAAR CASCADE ALGORITHM

Haar-like features are digital image features used in object recognition. They are used in real time face detection. A Haar-like feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums. This difference is then used to categorize subsections of an image.



For example, let us say we have an image database with human faces. It is a common observation that among all faces the region of the eyes is darker than the region of the cheeks. Therefore a common haar feature for face detection is a set of two adjacent rectangles that lie above the eye and the cheek region. The position of these rectangles is defined relative to a detection window that acts like a bounding box to the target object (the face in this case).

In the detection phase a window of the target size is moved over the input image, and for each subsection of the image the Haar-like feature is calculated. This difference is then compared to a learned threshold that separates non-objects from objects. For better accuracy Haar like features are organized in cascade classifiers for better accuracy.

6.1 Cascade of Classifiers

Instead of applying all the 6000 features on a window, group the features into different stages of classifiers and apply one-by-one. (Normally first few stages will contain very less number of features). If a window fails the first stage, discard it. We don't consider remaining features on it. If it passes, apply the second stage of features and continue the process. The window which passes all stages is a face region. It has 6000+ features with 38 stages with 1, 10, 25, 25 and 50 features in first five stages.

6.2 Training of Classifiers for Facial Features

To train the classifiers two sets of images are needed. One set contains an image that does not contain an object(face) i.e. negative image. And second an image that contains an object(face) i.e. positive image. For training thousands of positive and negative images are required, accordingly the threshold value is set.

6.3 Advantages

The key advantage of a Haar-like feature over most other features is its calculation speed. Due to the use of integral images, a Haar-like feature of any size can be calculated in constant time (approximately 60 microprocessor instructions for a 2-rectangle feature).

VII. EXPERIMENTAL RESULTS

AVCSS using face detection is implemented in two parts:

1. Driver Authentication using face detection and Drowsiness Detection for driver safety.
2. Vehicle Control Function using Android Mobile.

For driver identification a database is created which contains the photos of authorized drivers. The system captures the person's image who is trying to access the car, compares with the database and displays result whether the driver is authorize or not. When the driver is not authorized the buzzer is turned ON. Face detection for keyless authentication for driver is shown in Fig. 5

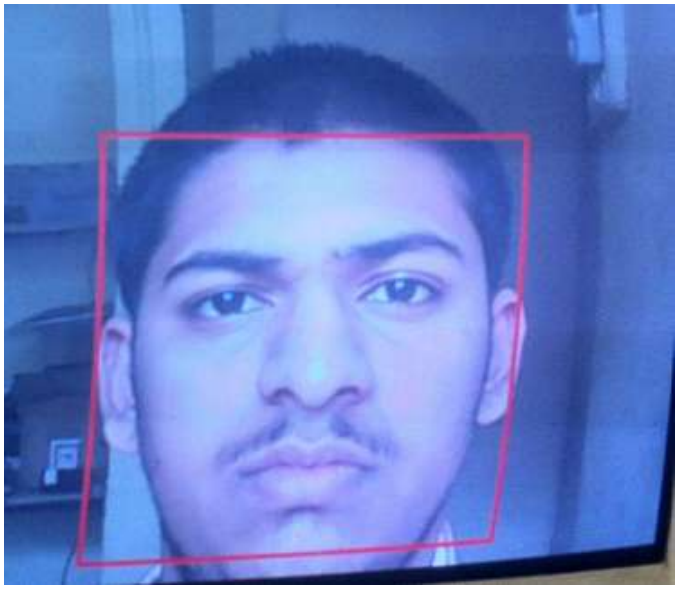


Fig.5 Face Detection for Keyless Authentication for Driver

The camera continuously monitors the drivers eyes for drowsiness detection. If the driver is not paying attention on the road and when drowsiness is detected, the system will warn the driver by giving the warning sounds. Fig. 6 shows eye movement detection for open eyes and close eyes for drowsiness detection.

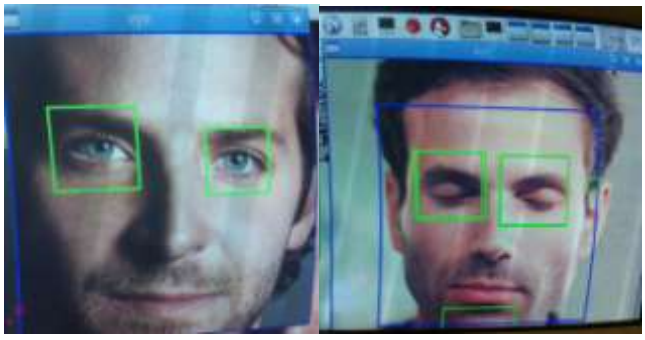


Fig. 6 Eye Movement Detection for Open Eyes and Close Eyes for Drowsiness Detection

For the vehicle control function the Android app is used. It is paired with a bluetooth device HC-05, receives commands and operates different control functions accordingly.

VIII. CONCLUSION

Advance Vehicle Control and Safety System Using Face Detection will reduce the number of accidents and ensure driver safety. Also keyless authentication will provide car safety and reduce the number of car thefts. Using Android mobile the different vehicle functions are easily operated.

Such a kind of a system for driver safety and car security is present only in the luxurious costly cars. Using Advance Vehicle Control and Safety System Using Face Detection driver security and driver safety system can be implemented in normal cars also.

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