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DRIVER AIDED SYSTEM USING FATIGUE DETECTION

Kajal Karbhal, Madhumati Kavale,* Supriya Kumbhar and Nikhil Lohar

Department of Computer Science, KJ College of Engineering and Management Research, University of Pune, India.

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***Corresponding Author**
Madhumati Kavale
Department of Computer Science, KJ. College of Engineering and Management Research, University of Pune, India.

ABSTRACT

The main motive of this project is to develop android application which detects driver fatigue and give safety alert to driver. By analyzing some facial expression it is possible to detect that driver falling asleep. Increased forehead lines, Eyelids moment, as well as yawning moment are the facial expression which can be consider as early signs of drowsiness. Systematic combination of signs of drowsiness will help to give much more accurate characterization of fatigue state than using single symptom of fatigue.

Index Terms: Android application, Driver fatigue, Safety alert, Drowsiness.

I. INTRODUCTION

Life saving ideas are more crucial area in today's research. Now a day's it is very common for people for drive themselves to various places like work places. Each person have at least one vehicle and traffic accident is critical issue. Based on research it is found that 1.3 million road crashes happens per year and this count increases rapidly day to day. There are many reasons of road accidents that can be categorized as I] Visual and II[Non-Visual.

I]Visual

1. Use of Mobile while driving: 300000 of road accidents occur due to texting or calling while driving.
2. Drowsiness: 71% of road accidents occur due to fatigue of driver.

II]Non-Visual

1. High Speed: 1000's of accidents occurs due to high speed of vehicle.
2. Drink and Drive: 1/3 of road accidents occurs due to drunk driving.

It found that drowsiness is one of major factor for road accidents.
Drowsiness can be defined as tiredness resulting from mental or physical exertion or illness. Drowsiness occur due to increased working hours, work at night, not getting good sleep, high blood pressure, heavy weight and other medical issues , It can occurat inappropriate situation or at inappropriate time. Hence it important to detect drowsiness to avoid accidents.

The rest of this paper is organized as, Section I gives brief introduction, Section II focus on related work, Section III presents system architecture and working in detail, Section IV briefly describe algorithm's used, Section V Presents experimental results, Section VI summarizes the study.

II. RELATED WORK

Many system are developed to detect driver drowsiness as follows systems detect physical factors like hand pressure on staring an blood pressure. Heart rate is measured by ECG. As driver suffer from fatigue, the pressure of hand on staring becomes less and temperature inside and outside the vehicle also calculated to detect drowsiness.[1]

Eye and eyebrow moments also used to detect fatigue using MATLAB platform. Captured image converted into binary form, only eye portion of image is stored and other part of image is discarded. Then eye and eyelid moments calculated and fatigue is detected.[2]

Facial expression and head movement detected using two cameras, this mainly focuses on bright pupil effect. It minimizes interference with driver driving.[3]

In this paper [4], to detect driver's drowsiness gaze tracking is method used to prevent accidents. This approach focus on the head orientation of the driver in each direction and analyse eye movements like blinking of eyes, closed eye or open eye to detect the level of sleepiness of driver. Automotive learning and particle filtering algorithm is used in this approach. This algorithm helps to track head and face movement accurately by camera. Single camera is used to capture eye movements. This approach does not take various important factors into account like if driver is wearing glasses, contact lenses. Therefore there is scope to enhance system by considering these conditions.

The paper describes an innovative application for assisting driver while driving.[5] This paper includes non-intrusive measurement approach for detection of driver fatigue and monitoring driver's health. Driver Aided system remotely detects the bio-potential signals without any physical contact with human skin. This does not cause any problem to the user compared to conventional ways like using electrodes which need to be in contact with human body. Using delicate sensors and ECG, EEG health can be monitor or eye blinking can be measured. The system is able to detect the electrical signals through cloth or hair without any contact with human. This method is not much cost effective because it requires measuring Electrocardiography (ECG), Electroencephalography (EEG) for health monitoring and eye blinking detection of driver. It does not consider other conditions like yawning and tracking facial expression to provide all type of fatigue detection.

III. SYSTEM ARCHITECTURE AND WORKING

System architecture of proposed system is given in figure below Proposed Method makes use of android and OpenCV library. OpenCV provides training dataset which makes it easy to detect face and track facial expressions and various regions on face. Alarm system includes use of message, audio message to alert driver.

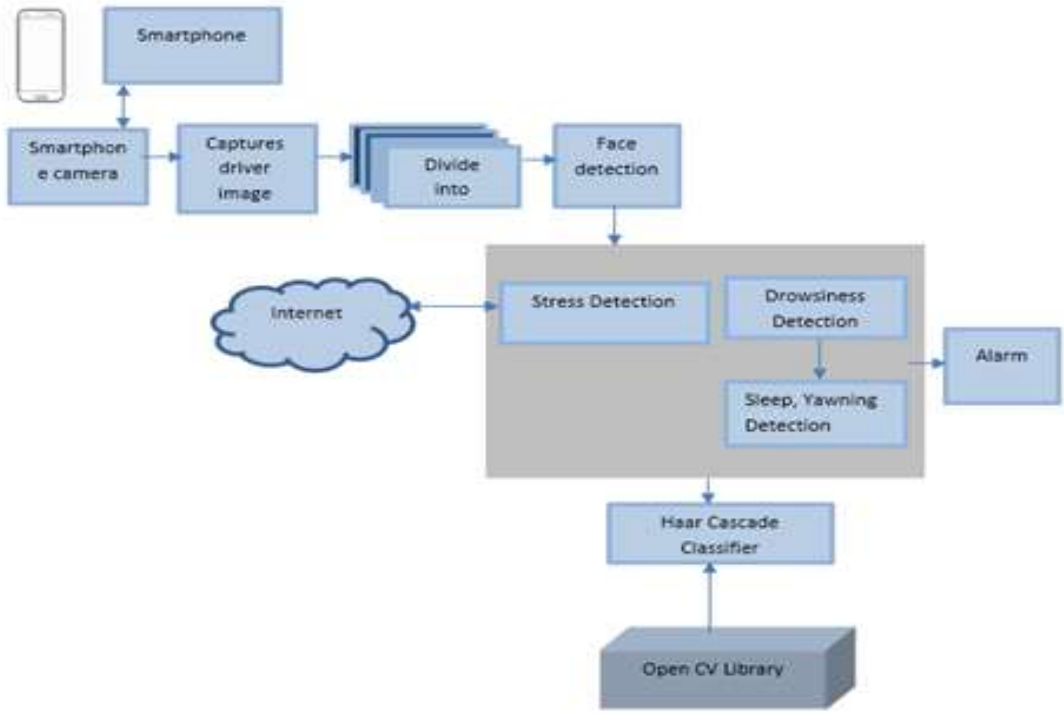


Figure 1: System Architecture

The whole system consists of three parts

a) Eye Detection

b) Forehead Detection

c) Yawning Detection

Eye Detection

Eyes are present on the top portion of face i.e. eyes are present at the few pixels below from top of face. After Face detection, we track eyes by using Haar classifier training set. Rectangular frame are used to show both left and right eye. To detect open eyes we track pupils using black coloured pixel which represents open eyes and if closed eyes. In this if white pixels are detected then eyes are in open state and if white pixels are not detected then eyes are in closed state. Through the decrease in the distance of eyelids, closed eyes are detected. If these pupils are not detected for given fraction of time then system will ring alarm.

a)Captured image b) Database image c) sleepy eyes

Figure 2: Eye detection

Forehead Detection

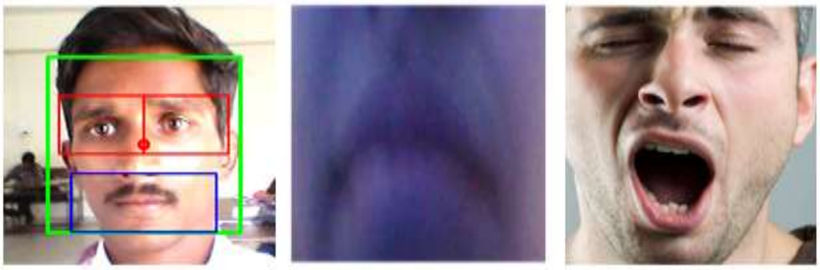
Driver Aided System (DAS) detects stress by detecting driver's facial expressions. Stress is measured by tracking facial expressions like forehead lines comes in stress conditions or raised eyebrows. Algorithm used for mouth tracking is used for driver's forehead Detection. After forehead detection system calculates no of lines on the forehead. If eyebrows are in raised condition for fraction of time or if forehead lines appears for the given fraction of time or both then stress gets detected by system. System raises an alarm to alert driver and passengers to stop driving.

a)Captured image b) Database image c) Stressed forehead

Figure 3: Forehead detection

Yawning Detection

Yawning is a pre-drowsy state. Open mouth helps to track yawning. When mouth is open, inside area is darker. Same algorithm which is for eye tracking is used for yawn detection. The only difference is increased distance between lips are calculated in yawn detection. Here we track black region i.e. darker area to detect open mouth. If the distance of mouth increases then yawning is detected and after this system alerts driver by providing voice alert. Driver's mouth contour is used to detect yawning.



a)Captured image b) Database image c) yawning

Figure 4: Yawning detection

Flow Chart

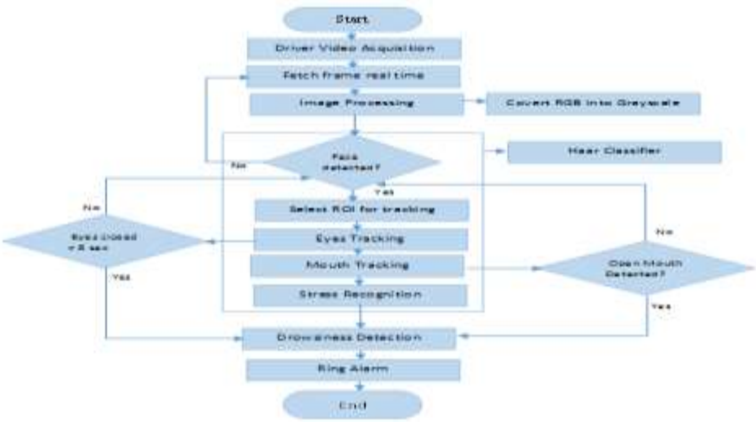


Figure 5: Flow chart

V. Technologies and Algorithms

OpenCV

Open Source Computer Vision (OpenCV) is an image processing library which provides real time image processing. OpenCV is freely available to use. It provides fast processing and requires low power for processing. This library contains more than 2500 algorithms. These algorithms are used in different applications like Face recognition, facial regions tracking, segmentation, 2D and 3D object identification, tracking objects in motion, identifying moving objects action. OpenCV also provide input/output libraries for real time video acquisition and processing of each frame in video. OpenCV runs on Windows, Android, iOS, Blackberry, OS x, Linux.

OpenCV is becoming very popular library in image processing environment. OpenCV have many important features like Speed, Efficiency, Portability etc.

OpenCV provides different Machine Learning algorithms as follows

1. Haar Detector: Haar detector is used for face detection purpose and for various facial region tracking.
2. K-Means: It is clustering algorithm used for distribution of data by allocating it to specific categories
3. Naïve Bayes Classifier: It is one of the probabilistic classifier which is often assumed to be Gaussian distribution.

In this project mainly used algorithms are

a) Haars Cascade Algorithm
b) HSV Algorithm

Algorithm for proposed System is

1. Acquire driver's picture from front camera of smartphone
2. Then from real time captured image driver's face is detected using haarcascade_frontalface_alt.xml
3. Then after detection of face region of interest is marked on face.
4. Centroid of face is calculated which is generally nose.
5. After selection of ROI (Region of Interest), other facial regions are tracked for detection of fatigue

V. RESULTS

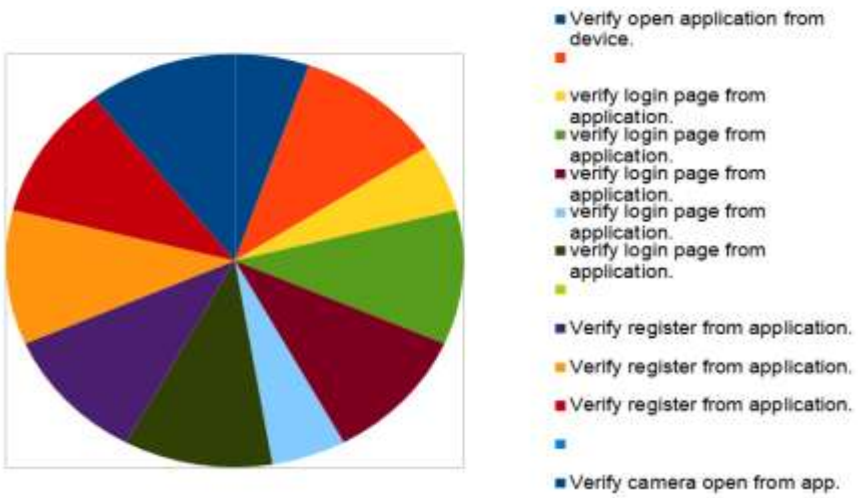


Figure 6: Result Analysis

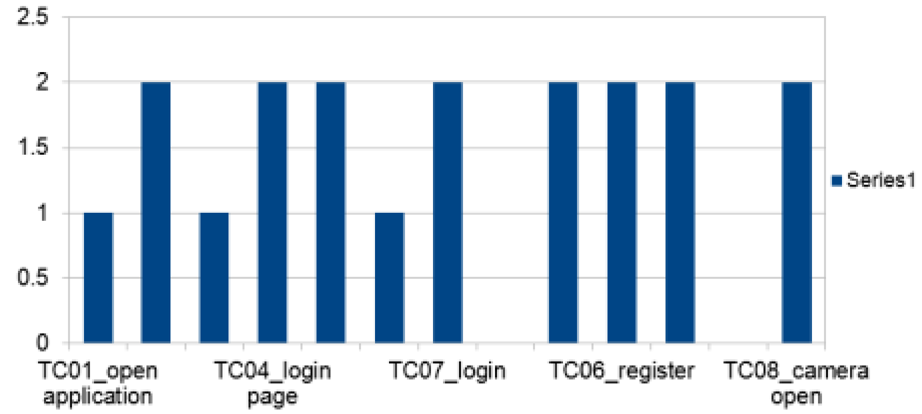


Figure 7: Graphical Analysis

VI. CONCLUSION

Proposed Real time Driver Aided System helps to reduce accidents occurred by driver fatigue and drowsiness while driving. It provides real time driver's facial tracking. By tracking different fatigue and stress conditions; Driver Aided System (DAS) provides all level of drowsiness detection by tracking sleepiness, yawning and stress status of driver. DAS has potential of tracking driver fatigue by using all above methods to detect fatigue and keep driver alert by raising alarm.If the eyes are closed for some fraction of time then system will raise an alert. Same process is used for assessing yawning conditions. If mouth is open for too much time then system detects yawning and alerts user. Driver Aided System detects facial expressions of driver and detects stress from expression then alerts driver and passenger (if available) if stress is detected. DAS uses OpenCV library to implement all functionalities because of its fast processing and efficient working for fatigue detection by facial tracking.

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