International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
December 2017

Driver Eye Tracking Over Iot

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Abstract— *Naturalistic driving studies have shown that a driver's allocation of visual attention away from the road is a critical indicator of accident risk. Such work would suggest that a real-time estimation of driver's gaze could be coupled with an alerting system to enhance safety when the driver is overly distracted or inattentive High precision eye tracking that includes an estimate of pupil orientation in the vehicle is costly and difficult. From an image processing perspective alone, difficulties involve the unpredictability of the environment, presence of sunglasses occluding the eye, rapid changes in ambient lighting including situations of extreme glare resulting from reflection, partial occlusion of the pupil due to squinting, vehicle vibration, image blur, poor video resolution etc. For example, in, a state-of-the-art algorithm for detecting pupils in the presence of specula reflection achieves only 83% accuracy. In, an accuracy of 87% is achieved for a camera that is positioned off-axis, as it likely may need to be located inside a vehicle. Costs of high resolution recording equipment and other computational requirements further enhance the difficulty of developing practical, deployable solutions. Since pupil detection for eye tracking is often unreliable in real world conditions, the natural question we ask is: how well can we do without it? This is the question that motivated our efforts and makes this work distinct from a large body of literature on gaze estimation. We do not assume that the head pose vector is the same as the gaze vector (i.e., eye pose plus head pose). Most of the automobile accidents are caused by distracted driving. Passively monitoring driver's eyes can help in detecting state of mind and alertness of driver and thus can reduce risk of accidents. Proposed system includes three main parts 1) Arduino Uno 2) USB web based camera 3) Eyes off the road and fatigue detection*

Keywords: Eye gaze tracking, automobile safety, driver monitoring system, head pose estimation, arduino,wifi.

1.1 INTRODUCTION

Naturalistic driving investigations have demonstrated that a driver's portion of visual consideration far from the street is a basic pointer of mishap hazard. Such work would propose that a constant estimation of driver's look could be combined with an alarming framework to improve wellbeing when the driver is excessively diverted or preoccupied

High accuracy eye following that incorporates a gauge of understudy introduction in the vehicle is exorbitant and troublesome. From a picture handling point of view alone, challenges include the flightiness of nature, nearness of shades impeding the eye, quick changes in encompassing lighting including circumstances of extraordinary glare coming about because of reflection, fractional impediment of the student because of squinting, vehicle vibration, picture obscure, poor video determination and so forth. For instance, in, a cutting edge calculation for identifying understudies within the sight of specula reflection accomplishes just 83% precision. In, a precision of 87% is accomplished for a camera that is situated off-hub, maybe as it likely ought to be situated inside a vehicle. Expenses of high determination recording hardware and other computational prerequisites additionally improve the trouble of creating reasonable, deployable arrangements. Since understudy identification for eye following is regularly problematic in certifiable conditions, the normal inquiry we ask is: how well would we be able to manage without it? This is the issue that persuaded our endeavors and makes this work unmistakable from a vast assortment of writing on look estimation. We don't expect that the head act vector is a similar like the look vector (i.e., eye posture in addition to head posture).

PROBLEM STATEMENT

The fundamental point of eye stare following based driver observing framework is to diminish mishaps caused by occupied driving.

Diversion is specified as fundamental driver in 78% of accidents and 65% of close crashes in NHTSA (National Highway Traffic Safety Administration) think about (2013).Distraction is a main consideration in over 20% of all mishaps including fatalities and genuine wounds

1.2 PROJECT OBJECTIVE

The vast majority of the car crashes are caused by diverted driving. Inactively observing driver's eyes can help in recognizing perspective and sharpness of driver and along these lines can lessen danger of mishaps. Proposed framework incorporates three fundamental parts 1) Arduino Uno 2) USB online camera 3) Eyes off the street and weariness discovery. Camera introduced on auto dashboard tracks components of driver continuously. Camera interfacing done trough matlab programming and eye stare estimation. Calculation is actualized on Arduino uno board to make a minimal implanted framework. Distinctive zones are characterized which incorporates the side mirrors, the back view reflect, the instrument board, and diverse zones in the windshield as focuses few of which are eyes off the street focuses. In light of calculation yield if driver's eyes are off the street or eyes are shut because of exhaustion at that point as needs be message and bell notices are given to driver over IOT..

If any other features like head pose estimation is combined with eye gaze tracking can give better accuracy than eye gaze tracking alone especially in cases where spectacles and sunglasses are used by driver [3]. The detection of driver distraction mostly depends on the classification technique [2]. Support Vector Machine (SVM) classifier is widely used for gaze estimation. One or more features are used to design SVM. Real time Hidden Markov Models (HMMs) are also used in some approaches. But SVM are more common and accurate with average accuracy of 82%.

B. Eye gaze tracking methods

The concept of eye-gaze tracking and estimation is hot research topic in last few years. Eye-gaze tracking methods can be categorized into two approaches.

- Appearance based model: It use the position of the pupils and general shape of the eyes and relative to the eye corners for finding the point of gaze [8]. A pre-trained model of the appearance and shape of the eye region is fitted to a sequence of image frames.
- Feature based model: These methods use characteristics of the eye to identify a set of features like contours, eye corners of NIR illuminators (LEDs) [7]. They can be further divided into model-based methods and regression based. The eye-model-based techniques use the geometrical model of the eye along with NIR light sources. In regression based method, vector between the pupil center and corneal reflections is mapped and tracked geometrically with a polynomial regression function to find gaze coordinates on a virtual screen.

C. Head pose estimation methods

The methods for head orientation can be categorized into four categories [9].

- Methods based on shape features with eye position: These methods analyze the geometric arrangement of facial features to determine the head orientation e.g. AAM (Active appearance model) [8].
- Methods based on shape features without eye position: These methods use simpler features like center of the face, left and right borders etc. rather than detailed features of

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue-17
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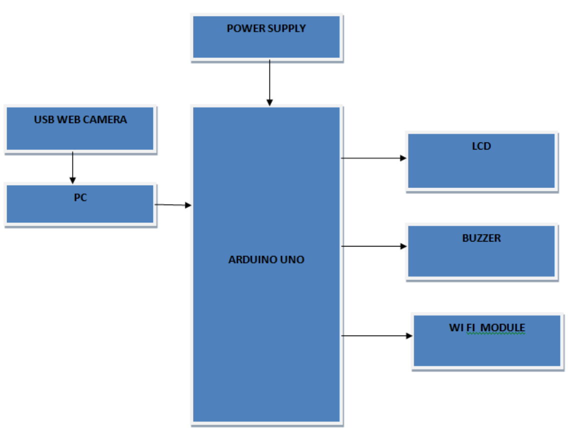
face such as nose, eyes, and face contour. Thus this method is simpler [6].

- Methods based on texture features: These methods identify driver's face in the image and analyzes intensity pattern to determine the head orientation. Many learning techniques such as KPCA, PCA, LDA, and kernel discriminate analysis (KDA) are used to extract texture features. These features are then classified to obtain head orientation [11].

- Methods based on hybrid features: These methods based on hybrid features combine texture and shape features to determine the head orientation. Initial head orientation is determined using texture based features and detailed head orientation is found by using 3-D face model tracking and fitting [6].

III. SYSTEM DESCRIPTION



REQUIRED COMPONENTS

HARDWARE TOOLS

1. Arduino Uno Controller
2. Power Supply
3. Lcd Display
4. Alarms (Buzzer)
5. Usb Web Camera
6. Esp8266 (Wifi Module)

SOFTWARE REQUIREMENTS

1. ARDUINO IDE SOFTWARE
2. EMBEDDED CPP
3. MATLAB

C. Facial feature tracking

Facial feature tracking algorithm is implemented in OpenCV using Raspberry Pi. Viola Jones algorithm is used which is a four step algorithm 1) Haar feature selection (eyes) 2) Create an integral image 3) Adaboost training on integral image 4) Cascading the classifier. Eyes.xml is the library file used for eye detection. Rectangular frames are used to denote eye. The Haar Classifiers algorithm rapidly detects object using AdaBoost classifier cascades with help of Haar features [4].

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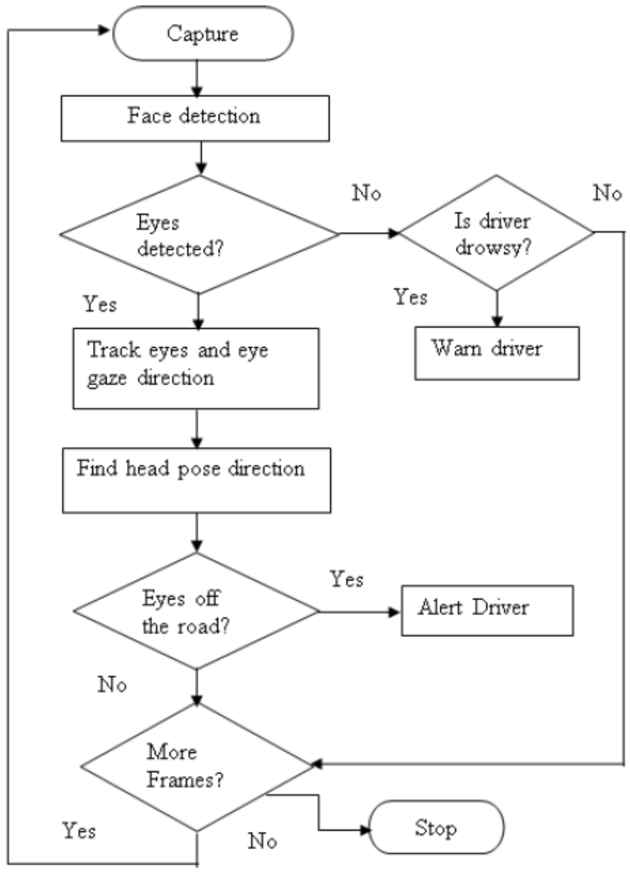

Fig. 2 Flowchart of the proposed system

D. Eye gaze tracking and estimation

Driver eye gaze is constantly changing during driving depending on surrounding conditions. Thus detecting eyes is not sufficient. Eyes need to be tracked in real time. Continuously Adaptive Mean Shift (CAMSHIFT) algorithm is used for real time eye tracking. Pupils of the eyes are tracked.

E. Head pose estimation

Drivers tend to change their head pose while driving. 3D head pose estimation is required to recognize in which direction driver is looking. 3D Head pose is estimation is proposed by combining Active Appearance Models (AAM) and Pose from Orthography and Scaling with ITerations (POSIT). Out of the three Euler angles only yaw and pitch angles are extracted and used and not roll angle. Yaw and pitch angles are sufficient to detect head pose direction.

F. Eyes off the road detection and fatigue detection

Similar to concept used in [3] [6] [9], Different zones are defined in the car as shown in fig.3. Zones are defined in point of view of a driver with left hand drive system. 11 different gaze zones representing the dashboard, the centre console, the rear-view mirror, two side mirrors and six zones on the windshield. These defined zones cover most of the possible gaze directions involved in real-world driving.

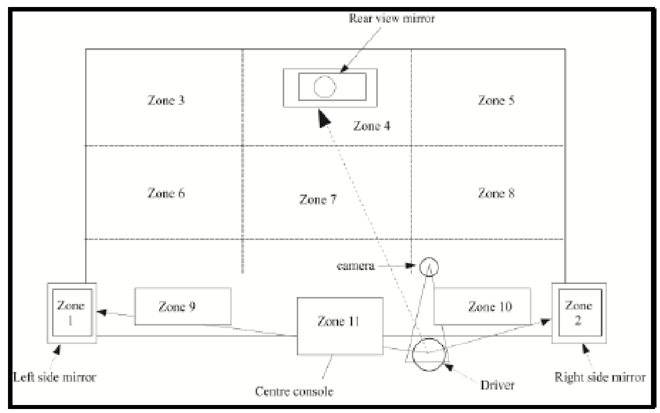

Fig.3.Different gaze estimation zones for left hand drive

TABLE II Shows different on the road and off the road points. Driver's gaze direction lies in which area depends on the combination of eye gaze estimation and head pose estimation calculations. SVM Classifier is defined for different combinations of eye and head pose directions. Then it is decided whether driver gaze lies in off the road and accordingly alerts are generated.

TABLE II GAZE ZONE PARTITIONING

Zones	Gaze zone type
2,4,5,7,8	On the road
1,3,6,9,10,11	Off the road

A scientific definition for fatigue has not been defined. But there are several relations. There is a relation eye movement, eye closure and fatigue. Eye movement is used to detect drowsiness i.e. fatigue. If closed eyes are detected longer than 3 seconds then driver is supposed to be in drowsy state and wake up alert is generated.

IV. RESULTS AND DISCUSSIONS

A. Facial feature tracking and fatigue detection

OpenCV allows user to select us region of interest (ROI). In this region of interest is eye region. Eyes are detected with a rectangular box. System is also able to detect eyes when wearing spectacles. Open and close eyes are detected by system. Images shown are the rectangular extraction of the eye area from face.

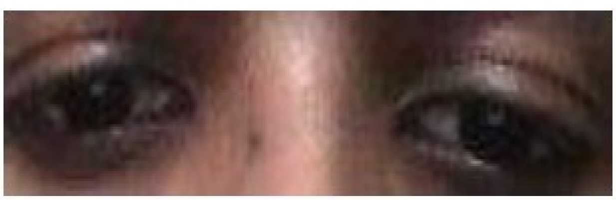

Fig.4 Open eyes

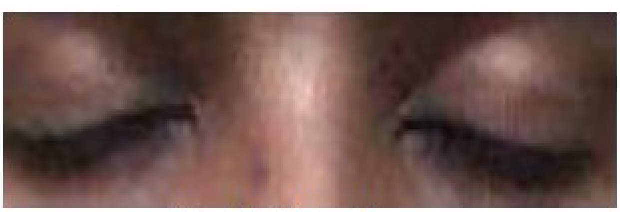

Fig.5 Closed eyes

Fig 6 shows the open eyes are detected. Both left and right eyes are detected with their x and y coordinate positions. Also for straight view face its showing correct head position.

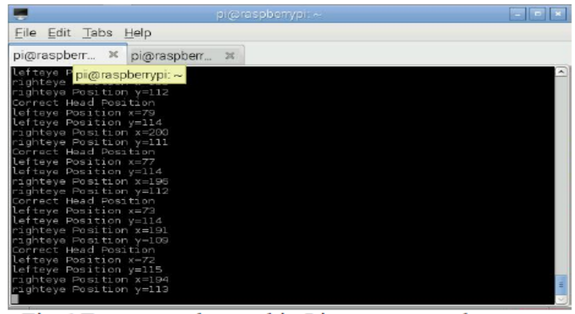

Fig.6 Eyes open detected in Linux command prompt.

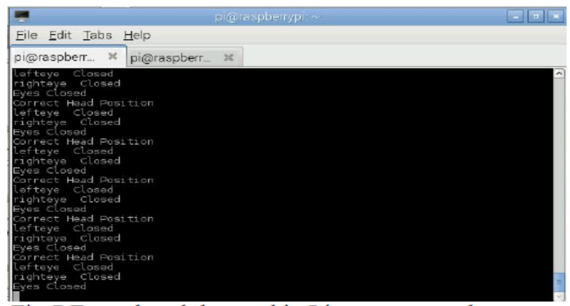

Fig.7 Eyes closed detected in Linux command prompt.

B. Face detection and Eye tracking

Face detection and eye detection can be observed in fig 8

Fig.8 Eyes tracking shown by blue circles

Eye pupil tracking is shown by blue circles and face is shown by a yellow square.

V. CONCLUSION

The principle objective of this proposed display is to distinguish the driver eye status while driving by utilizing
USB web camera trough IOT. This model continually checking or following the driver eye status and in the event that he close the eyes the model gives alarm through ringer and furthermore it show message and LCD. Camera introduced on auto dashboard tracks elements of driver progressively. Camera interfacing done trough matlab programming and eye stare estimation. Calculation is actualized on Arduino uno board to make a smaller inserted framework. Diverse zones are characterized which incorporates the side mirrors, the back view reflect, the instrument board, and distinctive zones in the windshield as focuses few of which are eyes off the street focuses. In light of calculation yield if driver's eyes are off the street or eyes are shut because of weakness at that point in like manner message and ringer notices are given to driver over IOT.

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