FORESTALLING OF IMPRUDENT DRIVERS

(Detect drowsiness and drunk cases along with Driver's authentication using iris scan)

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Abstract: Operating vehicle while under the influence having blood alcohol content level 0.08 or more than it is a crime. The largest group at risk for drinking and driving are those who binge drink or are struggling with alcohol use disorder. Statistics show that over 10,000 people dies yearly in our country due to such deed. This piece of work mentions and compares various methods to detect and avoid cases of drunk and drowsy driving along with user identification to minimize fatal accidents.

Index Terms -- Biometric, Iris Scan, Wavelet, Zernike, Gray Gradient, EER, EAR, MOR, NLR, Infrared Spectrograph.

I. INTRODUCTION:

Biometric is an application to do statistical analysis of biological data. Every person has their own intrinsic physical and behavioral traits. It is combination of two Greek words Bio denotes life and metric means measurement. Biometric are classified mainly in 2 types:

Physiological

Physiological is what person carries or inherit the physical characteristics [1]. It includes fingerprint, hand, iris, retina, face, DNA and some more [2].

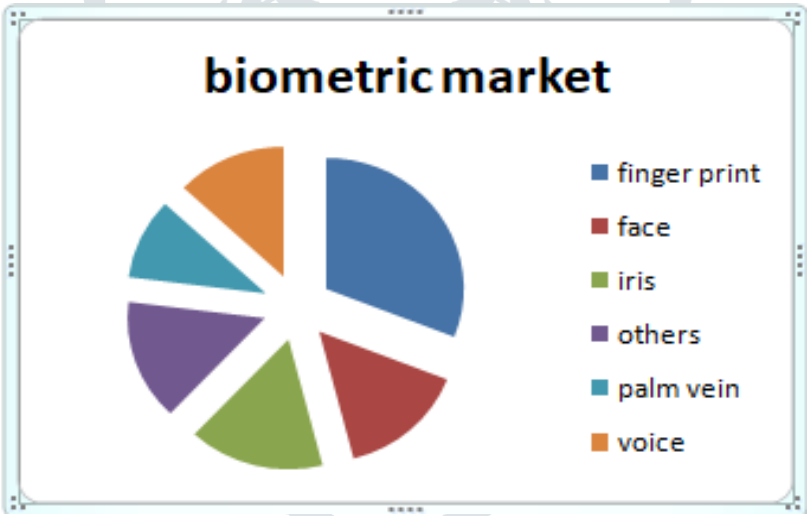

Figure 1: Comparison between biometric [4]

Behavioural

Behavioral is how person behaves or different performance patterns [1]. It includes keystroke, signature, voice etc [2].

II. LITERATURE SURVEY

1) Iris scan:

It is thin elastic pigmented circular connective tissue in the eye. It controls the size and the diameter of pupil. It also controls the light entering the eye of a person. Iris of twins is different also right and left iris of same person is different. Iris remains same throughout the life. It does not change by wearing glasses or lenses not by a eye surgery also. Iris recognition and authentication is best protected approach. Accuracy is best of this biometric. FAR and FRR is very low compared to other biometric. It is affected by very poor lighting and also if the size differs.

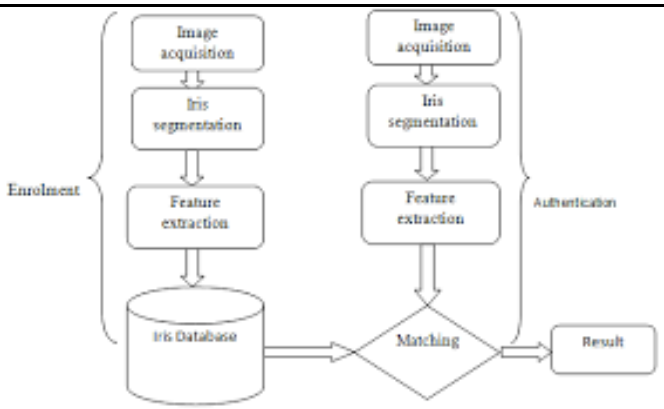

Figure 2: Iris recognition steps[3]

A gray scale camera at 10-40 cm distance is used for capturing. Different algorithms are there for feature extraction and iris code is created. Methodologies used for example are hamming distance.

2) Iris Recognition:

1. Localization of eye
2. Boundary segmentation
3. Normalization
4. Feature extraction
5. Matching

TECHNIQUES

Acquiring Image is either manual or automated procedure [16]. Iris Recognition techniques are:-

1) DCT

It is a technique to separate the image into different parts of various importance. The DCT is same as Discrete Fourier Transform. It transforms a signal or image from a spatial domain to the frequency domain[3].

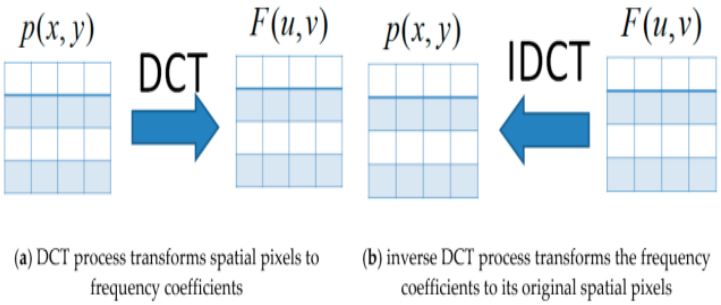

Figure 3: DCT methodology[2]

2) Wavelet

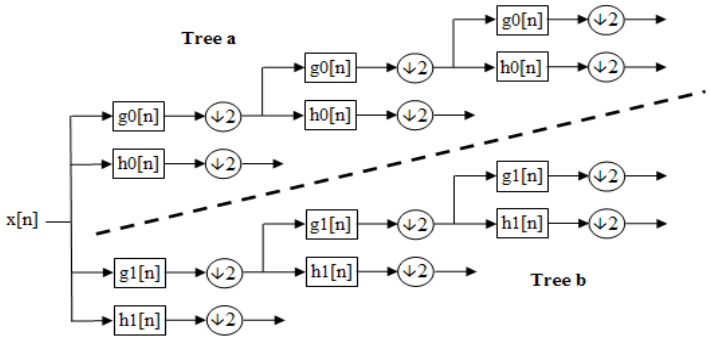

Figure 4: Wavelet technology[3]

Wavelet Transform produces as many coefficients as there are pixels in the image. These coefficients can then be compressed more easily because the information is statistically concentrated in just few coefficients. After this transform coding the coefficients are quantized and the quantized values are entropy coded and/or run length encoded.

3) Zernike Movements

As Zernike polynomials are orthogonal to each other, Zernike moments can represent properties of an image with no redundancy or overlap of information between the moments. Although Zernike moments are significantly dependent on the scaling and the translation of the object in a region of interest, their magnitudes are independent of the rotation angle of the object. Thus, they can be utilized to extract features from images that describe the shape characteristics of an object.

Iris Localization

It is important step in whole process of iris recognition. The iris gray image is transformed to a binary image using an adaptive threshold obtained from analyzing the image intensity histogram [12]. Main task is to find and locate inner and outer boundaries. It also points eyelids, eyelashes. Methods of iris localization are:-

1. Least Square Method
2. John Daugman Calculas
3. Gray Gradient
4. Hough Transform

Gray Gradient Edge Location Method

The human eye is dividing into three main parts sclera, pupil and iris. It consist a gray part between all the 3 parts of the eye. These gray values keep on increasing. Edge of the iris is affected the most of these gray scale. Advantage of this method is it has very high accuracy, it needs ideal environment. Disadvantage occurs when local light spot is present[5].

Binary Edge Point Positioning Method

Least square method is used to get an image for iris localization. This method locates the inner and outer boundaries of the iris in eye. Using least square method divides edge points and non-edge points and avoids non-edge points to get accuracy and reduce the no. of errors [5]. Iris recognition techniques has various types of application such as access control, financial transactions, internet security etc [15].

Methodology for Drowsiness

Drowsiness driving usually refers to emergence of driver's psychological and physiological dysfunction about long continuous driving [14]. Drowsiness detection methods are classified based on 3 ways.

1. Vehicle based
2. Behavioral based
3. Physiological based

1) Vehicle Based

Vehicle based detection method involve steering monitor and lane monitoring. This method has limitation when the paths are jerky and driver can't drive car perfectly. On this path the system acquires false data and alert driver for uneven driving.

2) Behavioral Based

Behavioral based detection involves yawning detection, eye closure and eye blinking. These methods are more accurate than vehicle-based method. However, limitation in these methods are low light (cameras installed to detect driver face can't process in during night due to low light intensity)[6].

3) Physiological based

Physiological based detection involves ECG (Electrocardiogram) and EOG (Electrooculogram). These methods give precise results[6]. However, the limitations here are variation I result if person is in stress due to other factors and also the ECG and EOG are not comfortable.

Behavioral Based detection is carried out by measuring Eyes aspect ratio (EAR), Nose Length Ratio (NLR) and Mouth Opening Ratio (MOR). Moreover, today the machine learning methodology and artificial neural network (ANN) is also implemented to increase the accuracy and efficiency.

Yawn is one of the symptoms of fatigue. The yawn is assumed to be modeled with a large vertical mouth opening. Mouth is wide open is larger in yawning compared to speaking. Using face tracking and then mouth tracking one can detect yawn [10].

The above mentioned terminologies like EAR, MOR, and NLR are measured with the projected face using dot pointer. The eyes pointers are pointed as below in the Fig.5.

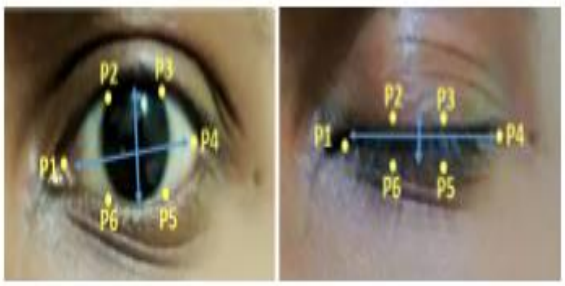

Figure 5: EAR points are shown[6]

Nose and mouth dot pointer are also pointed, where Nose length is measure to check weather the driver is facing the road in front or is his/her distracted. Mouth opening ratio is calculated to measure the frequent yawning of a person. If a person starts yawning too much than the counter will exceed the threshold and the alarm or alert mechanism will set on.

This measurement and statistical analysis is done to increase the efficiency of drowsiness detection of driver. Additionally this system requires the camera that could take the video images in day and night time both. However it is also accounted that the efficiency of drowsiness detection decreases during night time due to lighting condition.

For computing threshold value, initially it is assumed that initially driver is in completely awake state [13]. Apart from behavioral based detection system there is steering based monitoring system, vehicle based system, physiological method containing EEG, EOG, and ECG. All this various methodologies have advantages and limitation mentioned below in table [6].

It is also acknowledged from the result of all the methods mentioned above that the physiological method has the highest accuracy of all but also highly intrusive. Moreover, vehicle based method is very less accurate and contains fuzzy results. However, the behavioral based methods has on an average accuracy greater than 98% in light condition while around 90-92% during dark and night condition. The combination of the temporal-based feature vector and SVM classifier helps reduce false-positive blink detections and improves the overall accuracy of the blink detector [11].

Infrared spectroscopy for drunk detection

Using infrared cameras, scientists have taught a computer algorithm to recognize drunk people by their facial flush. After a glass of wine or a nice whiskey on the rocks, alcohol makes your blood vessels relax and widen. This expansion brings the blood vessels closer to your skin, making your face hot and red.[9] The blush can depend if you have a deficiency in the enzyme aldehyde dehydrogenase, which helps in the metabolism of alcohol. That's why people with Asian heritage can tend to "glow" when they're drinking. Relying totally on the temperature difference detected on a person's face. As the theory goes, alcohol in the bloodstream dilates blood vessels, increasing blood flow just under the skin. This heats up certain parts of your face, skewing its otherwise even heat map.[9]

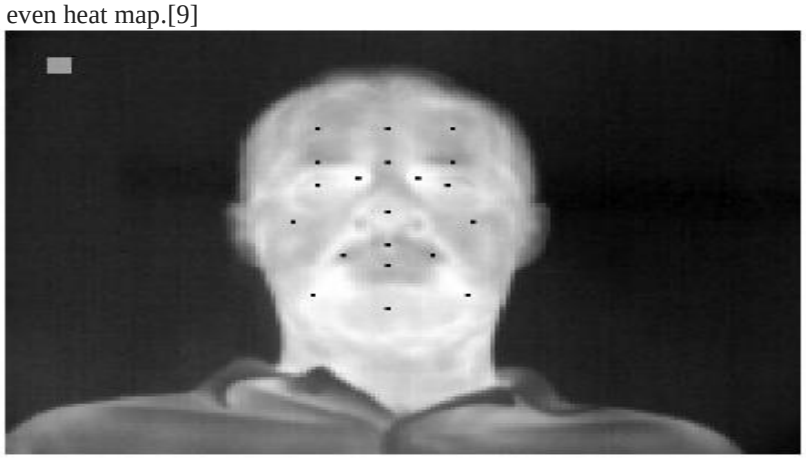

Figure 6: Facial points for drunken detection [8]

Figure 7: Infrared spectroscopy[8]

So basically infrared lights are projected on driver's face which shall detect the temperature of skin and glow providing the result of blood alcohol concentration in blood [8].

There are infrared cameras in the market which range from 1000 to 40,000 rs with various features. That which is for this project purpose will cost approx 3000 to 4000 rs. Now in comparison to above listed methodologies this is more comfortable with affordable cost and size is also small. Accuracy is 90% [8].

Such a system could perhaps be put to use in a car as well. If a car can check heartbeat, it's not inconceivable that it could be programmed to lockdown if you sat at the wheel with a hot nose.

III. CONCLUSION:

Authenticity, drowsiness and drunken detection done with above proposed method shall benefit the society and prevent the accidents and thefts of cars. This embedded software application will be affordable by middle class car owners. This will reduce the deaths and severe injuries caused.

This research work pertaining to application of forestalling imprudent driver involves IRIS recognition and Infrared Camera, implementation of models/methods involving AI techniques and technologies, which are proposed by researchers, experimentation with modification and combination of methods/models and analysis of result. Authentication, Drowsiness and Drunk detection all of three safety precautions to be installed and fixed in the car.

Below mentioned is comparison tables for various methods previously used for iris scan, drowsiness detection and drunk and drive detection.

Table 1 Iris recognition methods

Iris recognition technique	Speed	Accuracy	Remarks
DCT	Moderate of all	High on near iris	Divide images into small sub images
Wavelet	Moderate	Higher in all dataset	Poor shift and rotation invariance
Zernike	Excellent	Higher in all conditions	Speed and accuracy is better
DTCW	Poor	Very high on near iris	Provides shift and rotational invariance
HVC	Moderate	Best in both	Capable to detect live iris

Table 2 Drowsiness detection methods

Measures	Parameters	Advantage	Limitations
Subjective measures	Questionnaire	Subjective	Not possible in real time
Vehicle based measures	Deviation from the lane position Loss of control over the steering wheel movements	Nonintrusive	Unreliable
Behavioral Measures	Yawning, Eye closure, Eye blink. Head pose	Non-intrusive; Ease of use	Lighting condition Background
Physiological measures	Statistical & energy features derived from ECG EOG EEG	Reliable; Accurate	Intrusive

Table 3 Drunken detection comparison [8]

Sr no	Methodology title	Cost	Size	Accuracy	Comfort level
1	MQ-3 and IOT	Low	Small	85%	High
2	Android app	V.Low	Small	79%	Medium
3	Facial detection camera and heartbeat sensors	High	Less	89%	LOW
4	MQ-135 gas sensor and GPS system	High	Small	83%	H igh
5	CO2 Sensor System	Medium	Small	89%	High
6	Bench Testing of diluted gas pulsing	Medium	Small	88%	LOW
7	Vehicle simulation	High	Less	90%	LOW
8	Infrared technology	High	Small	95%	High

IV. ACKNOWLEDGMENTS:

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