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LETHARGY DETECTOR

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ABSTRACT

Lethargy driving is one among the primary reason for street mishaps and passing always. Along these lines, Driver's sleepiness discovery and its sign is a functioning examination zone. The greater part of the customary strategies are either vehicle based, or conduct based or physiological based. Barely any strategies are meddling and occupy the main impetus , some require costly sensors and information readings. Along these lines, during this investigation, a minimal effort, Lethargy detection framework is created with satisfactory exactness. In this created framework, a webcam records accents of driver's face and identifies in each edge utilizing picture preparing strategies. Facial spots are identified on the face are pointed and along these lines the consideration proportion ,nose length proportion and mouth opening proportion are processed and their qualities are depending on ,sleepiness is recognized and created in versatile thresholding. AI calculations have been very much actualized in offline.

Keywords: Raspberry Pi, Visual Processing, Lethargy detection, Image behaviour, Retina aspect ratio, mouth opening percentage, nose measurement ratio

1. INTRODUCTION

Problem Definition Given a video, the problem is to detect the facial features of the driver and alerts the driver by determining the drowsiness.

1.2 Introduction to Driver Drowsiness

Torpidity driving is one among the primary reasons for deaths and street mishaps. The truck drivers who drive for consistent extended periods of time (particularly around evening time), transport drivers of significant distance course or overnight transports are more powerless to this issue. Consistently, an outsized number of wounds and passings happen in light of weakness related street mishaps. Thus, recognition of driver's weakness and its sign is a functioning territory of examination because of its massive viable materialness. The Lethargy detector has three squares/modules; securing framework, handling framework and cautioning framework. Here, the video of the driver's frontal face is caught in securing framework and moved to the handling square where it is prepared outline to identify sluggishness. On the off chance that tiredness is distinguished, caution is send to the driver from the notice framework. Languor in drivers can be recognized in three sorts; social based, vehicle based and physiological based. In this vehicle based technique, various capacities like brake example or quickening agent, sidelong increasing speed ,vehicle speed, deviations from path position, guiding wheel development and so forth are checked progressively. On the off chance that any Discovery of strange conduct in these qualities is considered as sleepiness in driver. This is a nonintrusive estimation as the sensors are not appended on the driver. In conduct based strategy, the visual conduct of the driver i.e., eye squinting, eye shutting, yawn, head twisting and so forth. Are analized to recognize languor. This is likewise nonintrusive estimation as straightforward camera is utilized to recognize these highlights. In physiological based strategy, the physiological signs like Electrocardiogram (ECG), Electroculogram (EOG), Electroencephalogram (EEG),heartbeat, beat rate and so on are checked and from these measurements, exhaustion level is identified.

2. EXISTING SYSYTEM

Some systems are suggested and even implemented in a number of the commercial vehicles for drowsiness detection. Still, these systems struggle to seek out major materials due to various cons that each of them have. Attention Assist program watches a driver's steering input at the start of a trip which contains the pressure of the hands on the steering and also the changes in the movement of the steering wheel. A pattern is calculated for normal driving behaviour of the user and saved in the database. When there's a drastic change within the current driving behaviour as compared to the preset, the system generates an alarm or warning to alert driver. The most important con of this technique is that the technology that it uses is extremely costly and proprietary as a results of which it's offered only in luxurious cars. The system is also very difficult to implement and algorithm for pattern understanding is still naïve and debatable.

2.1 Drawbacks of other models

Attention Assist uses elaborated algorithm which analyse around 50 factors which helps in identifying driver’s drowsiness. This algorithm is patented and it also requires thorough research to conclude how these factors affects driver's drowsiness. It also requires heavy computing. Electro dermal activity – EDA technology is patented by STOPSIEOP. So to make this product, it needs a lot of permissions. The sensors used in the system are rarely available. So, its a costly process. Motion Sensors are not accurate and their alarm rate is expontentially high. It generates alarm even if driver simply moves his neck. The proposed system’s advantage over all above technologies is that, it is built by open source utilities and its accuracy is very high with less warning rate. Major factor is that its cost is less than the existing systems like above.

3. IMPLEMENTATION OF THE PROPOSED MODEL

The system that has been developed is cheaper as compared to the opposite systems available in the market. As to develop the proposed system, the utilization of open source libraries that are easily available on the online with no cost has been done. The system contains a well proposed algorithm that clearly detects the face and therefore the eye according to the threshold it sets for the detection. This reduces the difficulty and makes it cheaper compare to systems like Attention Assist. The efficiency of other systems available within the market depends upon the exhaustive study of the driver’s behaviour which needs building up of large data set with time. Real time applications can’t wait for computing large data of such systems. On the other hand designed system here does not need any rigorous study and it easily manages the security of driver and provides the best result.

3.1 THE PROPOSED FRAMEWORK AND CALCULATION OF ITS BOUNDARIES

A square chart of the proposed driver sleepiness observing framework has been portrayed in Fig 1. From the start, the video is recorded utilizing a webcam. The camera will be situated before driver to catch the front face picture. From the video, the casings are extricated to get 2-D pictures. Face is distinguished inside the casings utilizing histogram of situated slopes and direct help vector machine for object identification..

A. Data Learning

The video is recorded utilizing webcam and the edges are separated and prepared during a PC. In the wake of gathering the casings, The picture handling procedures are applied on these 2D pictures. By that driver information has been produced. The volunteers are approached to take a gander at the webcam with discontinuous eye flickering, eye shutting, yawning and head bowing. The video is caught for half-hour span.

B. Face Recognision

Subsequent to gathering the casings, first the human appearances are identified. Various online face location calculations are there. In this investigation, histogram of arranged angles and straight SVM strategy is utilized. In this technique, positive examples of towards zero. As yawn is one of the attributes of languor, MOR gives a measure in regards to driver tiredness NLR=Nose Length(P_{28} -P_{25})/Average nose length.

C. Facial Landmark

In the wake of distinguishing the face, the following errand is to discover the areas of various facial highlights like the sides of the eyes and mouth, the tip of the nose then on. Before that, the face pictures ought to be standardized in order to downsize the impact of good ways from the camera, non-uniform brightening and shifting picture goal. In this way, the face picture is resized to a width of 500 pixels and changed over to grayscale picture. After picture standardization, gather of relapse trees from the scanty subset of pixel forces is utilized to gauge the milestone positions on face. In this strategy, the entirety of square blunder is upgraded utilizing inclination boosting learning. Various priors are utilized to discover various structures. Utilizing this strategy, the limit purposes of eyes, mouth and the focal line of the nose are stamped and the quantity of focuses for eye, mouth and nose are given in Table I. The facial tourist spots are appeared in Fig 2. The red focuses are the distinguished milestones for additional handling.

D. Feature Extraction

In the wake of identifying the facial territories, the qualities are processed as depicted underneath. Eye viewpoint proportion (EAR): From the eye edge focuses, the eye angle proportion is determined utilizing proportion of tallness and width of the eye as given by EAR=$P_2 - P_6 + (P|3 - P_5)$)/2($P_4 - P_1$) where Pi speaks to point set apart as I in facial milestone and (Pi-Pj) is the separation between focuses set apart as I and j. Subsequently, when the eyes are completely open, EAR is high worth and as the eyes are shut, EAR esteem goes towards zero. In this manner, successively diminishing EAR esteems shows gradually shutting eyes and it's just about zero for totally shut eyes (eye winks). Thusly, EAR esteems show the languor of the driver as eye flickers happen because of sleepiness. Mouth opening proportion (MOR): Mouth opening proportion is a boundary to distinguish yawning during sluggishness. EAR, it is determined as MOR= /3($P_{19} - P_{13}$ As characterized, it increments quickly when mouth opens because of yawning and stays at that high incentive for some time because of yawn (showing that the mouth is open) and again diminishes quickly towards zero. As yawn is one of the qualities of sluggishness, MOR gives a measure with respect to driver laziness.

E. Classification

Subsequent to figuring all the three highlights, the following assignment is to distinguish tiredness in the removed casings. To start with, versatile thresholding is considered for characterization. Afterward, AI calculations are utilized to arrange the information. To register the limit esteems for each component, We need to at first accept that the driver is in finished conscious state. This is called arrangement stage. In the arrangement stage, the EAR esteems for initial 300 (for 10s at 30 fps) outlines are recorded. Out of these 300 beginning casings containing face, normal of 150 greatest qualities is considered as the hard edge for EAR. The higher qualities are thought of with the goal that no eye shutting cases will be available. In the event that the test esteem is not as much as this limit, at that point eye shutting (i.e., languor) is recognized. As the size of eye can change from individual to individual, this underlying arrangement for every individual will diminish this impact. Essentially, to compute the edge of MOR, since the mouth may not be available to its ideal level in starting casings (arrangement stage) so the edge is taken tentatively from the perceptions. On the off chance that the test esteem is more noteworthy than this edge, at that point yawn (i.e., languor) is distinguished. . The normal nose length is figured as the normal of the nose lengths in the arrangement stage accepting that no head twisting is there. In the wake of figuring the limit esteems, the framework is utilized for testing. The framework identifies the sluggishness if in a test outline tiredness is distinguished for at any rate one element. To make this thresholding more reasonable, the choice for each edge relies upon the last 75 edges. On the off chance that at any rate 70 edges (out of those 75) fulfills the conditions laid for the sluggishness at any rate of one component, at that point the framework demonstrates languor recognition sign and alert. To make this versatile thresholding another single edge esteem is determined which at first relies upon EAR limit esteem.

Features	**Area Points**
Nose	[25-28]
Left Eye	[7-12]
Right Eye	[1-6]
Mouth	[13-24]

Table I: *Facial landmark points Parts Landmark Points Right eye [1-6] Left eye [7-12] Nose [25-28] Mouth [13-24]*

EAR from setup phase (average of 150 max values out of 0300 frames)	0.0034
Threshold=EAR- offset	0.034-0.045=0.00295
At Howling,(MOR> 0.06)	Threshold=Threshold +0.0002 *Maximum bound exist
At Head Bending, (NLR<0.07 OR NLR >1.002)	Threshold=Threshold +0.0001 *Min bound exist

Table II: *Threshold for the computed parameter values*

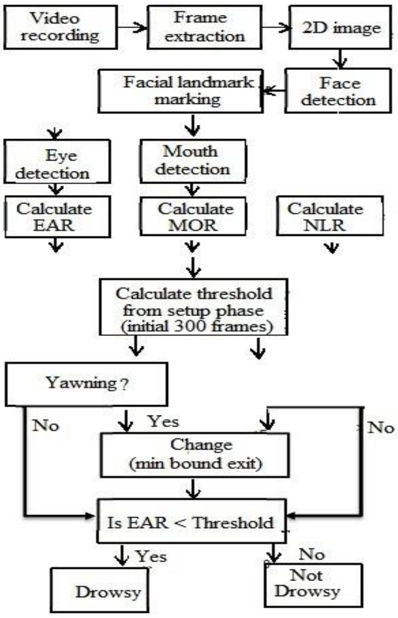

Fig 1 *The block diagram of the drowsiness detection system*

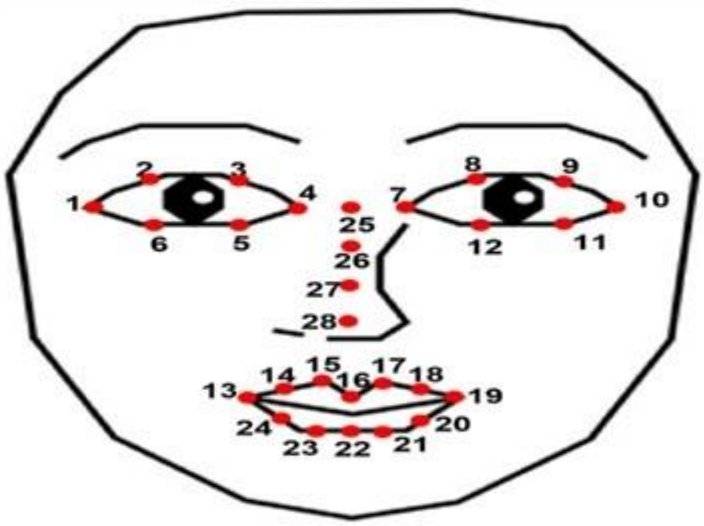

***Fig 2** The facial landmark areas*

4. TECHNICAL SPECIFICATION

The Drowsiness Detection System runs on 5V power source which uses Raspberry Pi . It is the primary processing unit for the right working of the system and which is suitable for most of the vehicles. It as well requires an best light source. In terms of frequency it corresponds to a band within the vicinity of 400nm to 930nm. The camera should take High Quality Pictures so as to require the video clearly and therefore the frame rate for capturing the video must be over 70 frames per minute. The camera which is be connected to GPU of Raspberry Pi would be well suited to the system to make the processing faster.

4.1. Components

It uses an ARMV6 microprocessor architecture, with 512 MB RAM, 700 MHz clock frequency processor core which is said to be a high processing speed. It contains four USB 2.0 ports, a separate Audio Jack and one Ethernet port .

4.2. Training Set

To train the classifiers, images of two set are needed. where ,One set contains an image or scene that does not contain an object , during this case a facial feature,is to be detected. This set of images is related to the negative images. The other set of images and the positive images, contains one or more instances of the object..

4.3. Real Time Analysis

Average Eye Blinks of person per 4-6 seconds	1 to 2
Time to capture and process ten frames	4-6 seconds
Frames Processed Per Second	1.5 to 2.5
Average Eye Blinks of person per 60 seconds	15-20 times

***Table III:** Real Time Analysis*

Alarm Sounds when over 5 out of 10 frames don't detect open eyes. Maximum frames during which eye can remain closed because of natural blink is 2 frames. The system sounds an alarm when it finds but 5 frames detecting the eye. It means if the eye is detected only one, two, three or fourfold out of ten frames, the system produces an alarm. If a person falls asleep, then the system will start an alarm every 5 seconds till the person wakes up. In normal conditions, an eye fixed won't remain closed for over this point in 5 seconds. Even if the wink of an eye captures both times, it still allows two more frames to through. The system will not be ready to detect eye when an individual goes to sleep or if the lighting conditions become extreme.

4.4. Performance

It performs better in all lighting condition. It gives less false alarm rate Response time is better compare to other available systems paper cost-effective. The Pi NoIR infrared sensitive is able to capture images without distracting the driver in most lighting conditions. This ensures the cost-effectiveness as well as the quality of the system . Raspberry Pi is preferred When compared to the other processing units available, . It has optimal computing power when compared to different processing units .

5. PARAMETERS

A working prototype was developed in the lab and tested to be successful in proper detection of drowsiness.

Input

Figure 3 shows the video being recorded by the camera to keep track of driver's facial signatures as an input.

Fig 3 *prototype with camera to keep track of driver's facial signatures*

Hardware components: Camera sensor, memory and Raspberry pi

Output

After the readings taken from the driver the alarm activates accordingly if driver feels dozy the alarm rings as shown in figure 4.

Fig 4 *prototype alarms when driver feels dozy*

Hardware components: VGA to HDMI conversion cable and buzzer

6. CONCLUSION

In this paper, a low cost, real time driver drowsiness monitoring system has been proposed based on machine learning and visual behaviour .The Driver Drowsiness detection System is basically a device proposed in order to save the lives of many that are continuously driving the cars without sufficient sleep due which severe accidents occurs especially in the developing countries like India, where the number of running vehicles increasing every year. The proposed system is cheap compare to other systems that are present only in the luxury car models. Also, due to its high portability, it can be installed in old cars easily as well. This is one of the most effective and important feature of the system ,making it so practical. It can be able to detect whether the eyes are closed or open and accordingly it issues warning to the driver. The eye detection is potential and can be increased using hybrid of different algorithms which uses machine learning concepts, edge detection techniques, and good support from open source libraries like Open CV.

7. REFERENCES

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