REAL TIME INSOMINOUS AND DROWSINESS DETECTION BASED ON HCI

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Abstract-- The face, an important part of the body, conveys a lot of information. When a driver is in a state of fatigue, the facial expressions, e.g., the frequency of blinking are different from those in the normal state. Our proposed system is used to detect the drivers' fatigue status, such as blinking, and duration of eye closure, using video images, without equipping their bodies with devices. Owing to the shortcomings of previous algorithms, face-tracking algorithm was introduced to improve the tracking accuracy. Further, a new detection method for facial regions based on 68 key points was designed. Then the facial regions are used to evaluate the drivers' state. By combining the features of the eyes, this system can alert the driver using a fatigue warning. The experimental results achieved around 92% accuracy. A KNN and DNN algorithms are used to detect the level of the driver's fatigue. This method employs the use of only the vehicle-mounted camera, making it unnecessary for the driver to carry any on/in-body devices. It uses each frame image to analyze and detect the driver's state. This system is used to detect the driver eye blinking action. On detecting sleepy mood of driver, this system provide the buzzer sound as well as song and also vibrate the steering using sensors, which then intimates the user, owner and family members. This system reduces the accident occurrence.

Keywords- Face detection, openCV, recognition, vibrator, Drowsiness, supervised learning, unsupervised learning, Machine earning

I. INTRODUCTION

In recent years, an increase in the demand for modern transportation necessitates a faster car-park growth. At present, the automobile is an essential mode of transportation for people. In 2017, a total of 97 million vehicles were sold globally, which was 0.3% more than that in 2016. In 2018, the global total estimation of the number of vehicles being used was more than 1 billion. Although the automobile has changed people's lifestyle and improved the convenience of conducting daily activities, it is also associated with numerous negative effects, such as traffic accidents.

Many accidents are occurred due to driver's drowsiness. So we exhibit a method to prevent such a cases. By monitoring and providing an alertness problem can be reduced. The goal is to identify drowsiness of the driver while driving and it generates vibration on steering. This method drowsiness of eye is detected using OpenCV and analysis the state of driver. The camera observes the drowsiness of the eye and it generates alarm with vibration and alarm. It detect symptoms of driver fatigue to give an alert to the driver while driving.

Image Processing

In computer science, digital image process is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions digital image processing may be modeled in the form of multidimensional systems.

Arduino UNO

The Arduino Uno is an open-source micro controller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins 6 analog I/O pins, and is programmable with the Arduino IDE, via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo.

II. EXISTING SYSTEM

Most of the accidents occurs in travelling time. One of the main reason in that accident is driver drowsiness and sleepy nature. Drowsy driving is one of the major causes of deaths occurring in road accidents. The truck drivers who drive for continuous long hours (especially at night), bus drivers of long distance route or overnight buses are more susceptible to this problem. Driver drowsiness is an overcast nightmare to passengers in every country. Every year, a large number of injuries and deaths occur due to fatigue related road accidents.

III. DISADVANTAGES OF EXISTING SYSTEM

1. More accidents occurs due to driver drowsiness
2. Not user-friendly
3. Less security

IV. SYSTEM REQUIREMENTS

Software requirements

1. Embedded C

2. Proteus
3. PHP

Hardware requirements
1. LCD Display
2. Arduino Uno
3. ESP 8266
4. Vibration Sensor
5. Buzzer
6. Connecting Wires

V. PROPOSED SYSTEM

In general, this system is based on image processing. It uses the facial landmark detector to identify the face of the driver. the image is thus captured through the camera and it is to capture the image of the person. The camera observes the drowsiness of the eye and it generates alarm with vibrator. It develop a nonintrusive system which can detect fatigue of any human and can issue a timely warning. Drivers who do not take regular breaks when driving long distances run a high risk of becoming drowsy a state which they often fail to recognize early enough. According to the expert's studies show that around one quarter of all serious motorway accidents are attributable to sleepy drivers in need of a rest, meaning that drowsiness causes more road accidents than drink-driving. This system will monitor the driver eyes using a camera and by developing an algorithm we can detect symptoms of driver fatigue early enough to avoid the person from sleeping. So, this project will be helpful in detecting driver fatigue in advance and will give warning output in form of alarm and pop- ups.

List of modues:
The modules of this process are,
1. Feature Selection
2. Blink Detection
3. Decision Making
4. Event Triggering
    - Steering Vibration
    - Alarm or Playing Songs
5. IoT Integration
6. WebGUI

Login/ Sign up:
The first step in the system is the simple and flexible credential interface where the user/driver must enter the login credentials, or he/she can Sign up in order to be a part of the system

Face Detection:
For the face Detection it uses Haar feature-based cascade classifiers is an effective object detection method. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, Haar features shown in the below image are used. They are just like our convolutional kernel.

A cascaded Adaboost classifier with the Haar-like features is exploited to find out the face region. First, the compensated image is segmented into numbers of rectangle areas, at any position and scale within the original image. Due to the difference of facial feature, Haar-like feature is efficient for real-time face detection. These can be calculated according to the difference of sum of pixel values within rectangle areas. The features can be represented by the different composition of the black region and white region. A cascaded Adaboost classifier is a strong classifier which is a combination of several weak classifiers. Each weak classifier is trained by Adaboost algorithm. If a candidate sample passes through the cascaded Adaboost classifier, the face region can be found. Almost all of face samples can pass through and non face samples can be rejected

OpenCV:
OpenCV stands for Open Source Computer Vision. It's an Open Source BSD licensed library that includes hundreds of advanced Computer Vision algorithms that are optimized to use hardware acceleration. OpenCV is commonly used for machine learning image processing, image manipulation, and much more. OpenCV has a modular structure. There are shared and static libraries and a CV Namespace.

In short, OpenCV is used in our application to easily load bitmap files that contain landscaping pictures and perform a blend operation between two pictures so that one picture can be seen in the background of another picture. This image manipulation is easily performed in a few lines of code using OpenCV versus other methods. OpenCV.org is a must if you want to explore and dive deeper into image processing and machine learning in general.

VI. RELATED WORKS

In the system we have used facial landmark prediction for eye detection Facial landmarks are used to localize and represent salient regions of the face, such as:
- Eyes

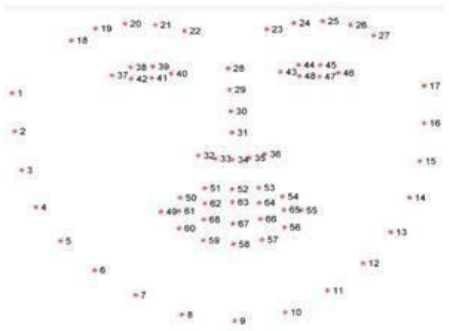
- Eyebrows
- Nose
- Mouth

Facial landmarks have been successfully applied to face alignment, head pose estimation, face swapping, blink detection and much more. In the context of facial landmarks, our goal is detecting important facial structures on the face using shape prediction methods. Detecting facial landmarks is therefore a two step process:

- Localize the face in the image
- Detect the key facial structures on the face ROI

Localize the face in the image: The face image is localized by Haar feature-based cascade classifiers which was discussed in the first step of our algorithm i.e. face detection.

Detect the key facial structures on the face ROI: There are a variety of facial landmark detectors, but all methods essentially try to localize.



Facial lamdmark detector

Recognition of eye's state

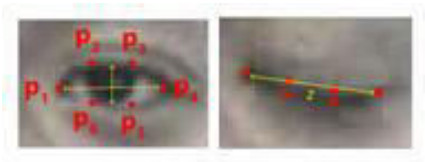
The eye area can be estimated from optical flow, by sparse tracking or by frame-to-frame intensity differencing and adaptive threshold and Finally, a decision is made whether the eyes are or are not covered by eyelids. A different approach is to infer the state of the eye opening from a single image, by correlation matching with open and closed eye templates, a heuristic horizontal or vertical image intensity project ion over the eye region, a parametric model fitting to find the eyelids, or active shape models. A major drawback of the previous approaches is that they usually implicitly impose too strong requirements on the setup, in the sense of are elative face-camera pose(head orientation), image resolution, illumination, motion dynamics, etc. Especially the heuristic methods that user a image intensity are likely to be very sensitive despite their real-time performance

Eye aspect ratio calculation

For every video frame, the eye landmarks are detected. The eye aspect ratio (EAR) between height and width of the eye is computed.

$$EAR = \frac{\|p2 - p6\| + \| p3 - p5\|}{2\|p1 - p4\|}$$

where p1, . . ., p6 are the 2D landmark locations, depicted in Fig. 1. The EAR is mostly constant when an eye is open and is getting close to zero while closing an eye. It is partially person and head pose insensitive. Aspect ratio of the open eye has a small variance among individuals, and it is fully invariant to a uniform scaling of the image and in-plane rotation of the face. Since eye blinking is performed by both eyes synchronously, the EAR of both eyes is averaged.



Eye state determination

Finally, the decision for the eye state is made based on EAR calculated in the previous step. If the distance is zero or is close to zero, the eye state is classified as “closed” otherwise the eye state is identified as “open”.

Drowsiness Detection

The last step of the algorithm is to determine the person’s condition based on a pre-set condition for drowsiness. The average blink duration of a personis100-400 milli seconds. Hence if a person is drowsy his eye closure must be beyond this interval. We set a time frame of 5 seconds. If the eyes remain closed for five or more seconds, drowsiness is detected and alert pop regarding this is triggered.

VII. ADVANTAGES OF PROPOSED SYSTEM

1. Quick response time
2. Real-time application
3. Reduces the human activity
4. Complete driver drowsiness monitoring
5. High security
6. High accuracy
7. User friendly
8. Reduces the human activity

VIII. CONCLUSION

A novel system was proposed evaluating the driver’s level of fatigue based on face tracking and facial key point detection. The DNN algorithm is used to track the driver’s face. The facial regions of detection are detected based on facial key points. A new evaluation method for drowsiness based on the states of the eyes and mouth was introduced. It is a real-time system as it has a high operation speed. From the experimental results, KNN is applicable to different circumstances and can offer stable performance.

IX. REFERENCES

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