Driver Drowsiness Detection Based on Face Feature and Perclos

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Abstract- *Driving vehicles are complex and require undivided attention to prevent road accidents. Fatigue and distraction are a major risk factor that causes traffic accidents, severe injuries, and a high risk of death. Some progress has been made for driver drowsiness detection using a contact-based method that utilizes vehicle parts (such as steering angle and pressure on the pedal) and physiological signals (electrocardiogram and electromyogram). However, a contactless system is more potential for real-world conditions. In this study, we propose a computer vision based method to detect driver's drowsiness from a video taken by a camera. The method attempts to recognize the face and then detecting the eye in every frame. From the detected eye, iris regions for left and right eyes are used to calculate the PERCLOS measure (the percentage of total time that eye is closed). The proposed method was evaluated based on public YawDD video dataset. The results found that PERCLOS value when the driver is alert is lower than when the driver is drowsy.*

Keywords- Facial Images, PERCLOS, resnet architecture, YawDD, electrocardiogram, traffic accidents, driver drowsiness detection

I. INTRODUCTION

In today's fast moving world, people depend on their means of transport excessively. Feeling drowsy and fatigued during a long drive or after a short night's sleep is common among everyone. This physical feeling of tiredness brings down the level of concentration of the driver. Such conditions are not favoured while driving and result in the increase of accidents. Driver drowsiness and exhaustion are prime contenders in the cause of road accidents. The cases of car accidents caused by driver drowsiness is increasing at a shocking pace. Recent numbers indicate 10% to 40% of all road accidents are due to drivers feeling exhausted and sleepy. In the trucking industry, about 60% of fatal accidents are caused by driver fatigue. For the reasons stated above, developing systems to continuously monitor the driver's concentration on the road and level of drowsiness and alerting them is important. Researchers and innovators have been working on producing such systems for the betterment of the human race. From years of research, the best way of predicting such behaviour is from the physical factors like breathing, heart rate, pulse rate, brain waves, etc. Such systems never made it to public use as they required attachment of sensors and electrodes onto the bodies of the drivers, causing frustration. Some representative projects in this line are the MIT-Smart Car, and ASV (Advanced Safety Vehicle) project performed by Toyota, Nissan and Honda. Some other systems proposed included monitoring the movement of pupils and movement of head using specialised helmets and optical lenses. Such systems were not accepted even after not being disturbing as production costs were challenging. Some indirect methods were also introduced to detect the drowsiness in a driver by reading the maneuvering of the steering wheel, positioning of the wheel axles etc. These systems were also not entertained as they had other difficulties such as the type of vehicle, environmental conditions, driver experience, geometric aspects, state of the road, etc. Contrarily, the time taken to analyse these user behaviours is too much and thereby it doesn't work with the blinking of eyes or micro-sleeps. In this line we can find an important Spanish project called TCD (Tech CO Driver) and the Mitsubishi advanced safety vehicle system. People with exhaustion or fatigue show some visual behaviours easily notable from changes in their physical features of the face like eyes, movement of the face and head. Computer Vision is free from disturbance and a natural approach to monitor the driver's vigilance. In this context, it is critical to use new and better technologies to design and build systems that are able to monitor the drivers and to compute their level of concentration during the whole process of driving. In this project, a module for Advanced Assistance to Driver Drowsiness (AADD) is presented in order to control the number of accidents caused by driver drowsiness and thus improve transport safety. This system will manage to detect the driver drowsiness using machine vision and artificial intelligence automatically. We present an algorithm to capture, locate and analyse both the driver's face and eyes to measure PERCLOS (percentage of eye closure).

II. SYSTEMANALYSIS

2.1 Existing System

The existing system evaluate whether changes in the eye-steering correlation that can indicate distraction. The auto-correlation and cross-correlation of horizontal eye position and steering wheel angle show that eye movements associated with road scanning procedure a low eye steering correlation. The eye steering correlation will control the relationship on a straight road. The straight road led to a low correlation between the steering movement and eye glances. In this system it is aim to detect the driver distraction based on visual behavior or the performance of the driver so for this purpose it is used to define the relationship between the visual behavior and the vehicle control. This system evaluates the eye-steering correlation associated with the straight road with the assumption that it might show a qualitatively and quantitatively different relationship compared with curvy road and that it might be sensitive to distraction. Here in the visual behavior and vehicle control relationship reflects a fundamental perception-control mechanism which plays a major role in driving and a strong eye steering correlation associated with this process has been observed on curvy roads.

2.2 ProposedSystem

In the proposed system, the driver fatigue and distraction is detected only by processing of eye region. The main symptoms of driver fatigue and distraction appear in the driver's eyes because of sleeping while driving. Nowadays, there are many fatigue detection methods and the best is capturing the eyes in real time using web camera to detect the physical responses in eyes. Moreover, the processing of the eye region instead of the processing of the face region has less computational complexity.

III. SYSTEMDESIGN

System design is the process or art of defining the architecture, components, modules, interface, and data for the system to satisfy specified requirements. This chapter deals with various design and function of the system.

3.1 System Architecture

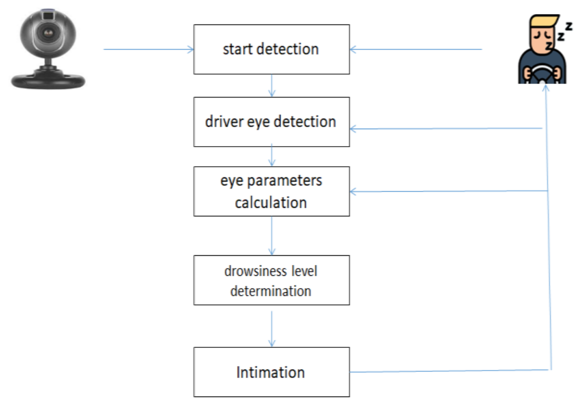


Fig. 3.1 Architecture Diagram

3.2 Use case Diagram

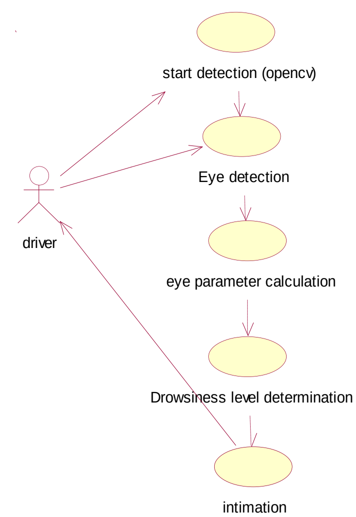


Fig. 3.2 Use case Diagram

Use case diagram are usually referred to as behavior diagram used to describe a set of actions that some system should or can perform in collaboration with one or more external users of the system.

3.3 Sequence Diagram

A sequence diagram is an interaction diagram that shows how objects operate with one another and in what order. It is a construct of a message sequence chart. A sequence diagrams hows object interactions arranged in time sequence.

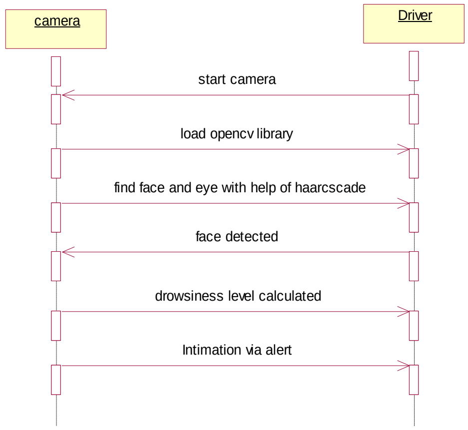


Fig. 3.3 Sequence Diagram

3.4 Class Diagram

Class diagram in the unified modeling language(UML) is a type of static structure diagram that structure of a system by showing the system classes attribute operators.

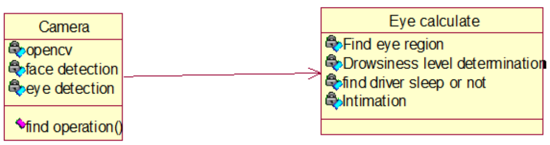


Fig. 3.4 Class Diagram

3.5 Collaboration Diagram

A **collaboration diagram**, also known as a communication **diagram**, is an illustration of the relationships and interactions among software objects in the Unified Modeling Language (UML).

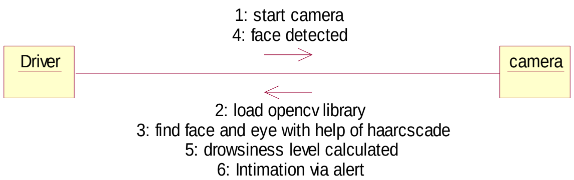


Fig. 3.5 Collaboration Diagram

IV. SYSTEMIMPLEMENTATION

4.1 Modules

- start detection (Camera Opencv)
- driver eye detection
- eye parameters calculation
- drowsiness level determination
- Intimation

4.2 Start Detection (CAMERA OPENCV)

- This the first module of this system, its used to open a camera with (Opencv) library.
- After initialize the camera its ready to detect the human face or driver face.

4.3 Driver Eye Detection

- This the second module with the help of this module to detect human eye through (haarcascade_frontalface_alt) this xml file.
- After with help of this haarcascade file to find the x,y coordinates of eye.

4.4 Eye Parameters Calculation

- In this module for recognize the face of the atm user. So if the user cover the face using helmet or etc, This module going to detect that face covered or uncovered

V. SYSTEMTESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies, and/or a finished product. It is the process of exercising software with the intent of ensuring that the software system meets its requirements and user expectations and type address a specific testing requirement.

5.1 Unit Testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software unit of the application. Itis done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is in vasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or System configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results. Unit testing is usually conducted as part of a combined code and test phase of the software life cycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

5.2 Test Strategy and Approach

Field testing will be performed manually and functional tests will be written in detail.

5.3 Test Objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, message and response must not be delayed.

5.4 Features to Be Tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

5.5 Integration Testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

5.6 Functional Test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:
Valid Input : Identified classes of valid input must be accepted.
Invalid Input : Identified classes of invalid input must be rejected.
Functions : Identified functions must be exercised.

Output : Identified classes of application outputs must be exercised.
Systems/Procedures : interfacing systems or procedures must be invoked. Organization and preparation of functional tests is focused on requirements, key Functions, or special test cases. In addition, systematic coverage per taining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing.

5.7 System Test

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predicate results. An Example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flow emphasizing pre-driven Process links and integration points.

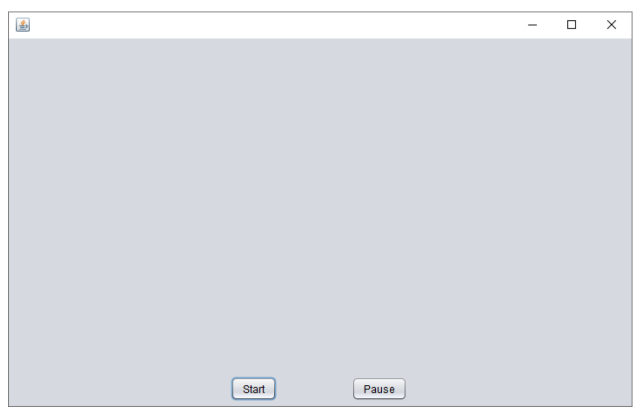
5.8 Acceptance Testing

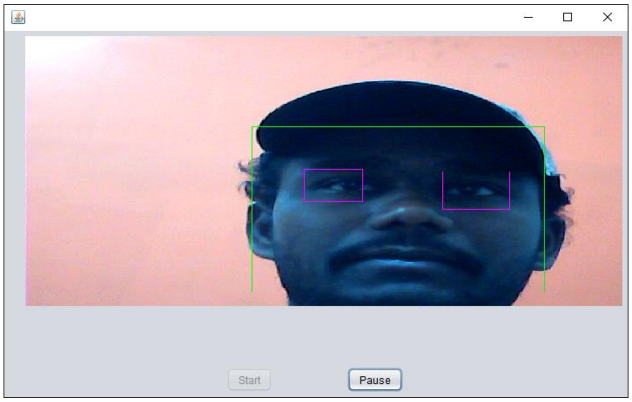
User acceptance testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

VI. CONCLUSION

In this paper, we have presented the concept and implemented a system to detect driver drowsiness using computer vision which focuses to notify the driver if he is drowsy. The proposed system has the capability to detect the real time state of the driver in day and night conditions with the help of a camera. The detection of the Face and Eyes applied based on the symmetry. We have developed a non-intrusive prototype of a computer vision-based system for real-time monitoring of the driver's drowsiness.

VII. SCREENSHOTS



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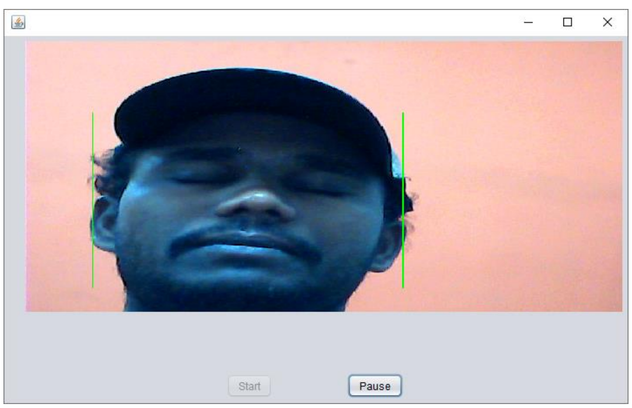


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eyes closed-------------------------------->sleeping
eyes closed-------------------------------->sleeping
eyes open
eyes closed-------------------------------->sleeping
eyes closed-------------------------------->sleeping
eyes closed-------------------------------->sleeping
eyes closed-------------------------------->sleeping
eyes open
eyes closed-------------------------------->sleeping
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REFERENCES

[1] Girshick,R.,Donahue,J.,Darrell,T.,Malik,J.,(2014).Rich feature hierarchies for accurate object detection and semantic segmentation, in: Proceedings of the IEEE conference on computer vision and pattern recognition, pp. 580–587.

[2] Glorot,X.,Bengio,Y.,(2010).Understanding the difficulty of training deep feed forward neural networks., in: Aistats,pp.249–256.

[3] Good fellow,I.J.,(2013). Piecewise linear multi layer perceptrons and drop out. Stat 1050,22.

[4] He,K.,Zhang,X.,Ren,S.,Sun,J.,(2016). Deep residual learning for image recognition, in: Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, pp.770–778.

[5] Jung,K.,(2012).Object recognition on mobile devices, in: Consumer Electronics-Berlin (ICCE-Berlin), 2012 IEEE International Conference on, IEEE. pp.258–262.

[6] Kingma,D.,Ba,J.,(2014).Adam: A method for stochastic optimization. arXivpreprintarXiv:1412.6980.

[7] Krizhevsky,A.,Sutskever,I.,Hinton,G.E.,(2012). Image net classification with deep convolutional neural networks, in: Advances in neural information processing systems, pp.1097–1105.

[8] Le,Q.V.,Karpenko,A.,Ngiam,J.,Ng,A.Y.,(2011). Ica with reconstruction cost for efficient over complete feature learning, in: Advances in Neural Information Processing Systems, pp.1017–1025.

[9] LeCun,Y.,Boser,B.,Denker,J.S.,Henderson,D.,Howard,R. E.,Hubbard,W.,Jackel,L.D.,(1989). Back propagation applied to hand written zip code recognition. Neural computation 1,541–551.

[10] LeCun,Y.,Bottou,L.,Bengio,Y.,Haffner,P.,(1998)a.Gradient-based learning applied to document recognition. Proceedings of the IEEE86, 2278–2324