Drowsiness Detection using Image Processing with GSM

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Abstract— Road accident is one among the foremost causes of life insecurity in now days. Every single second consciousness is very important or crucial to require care while driving. Single moment of carelessness can cause lifetime regret. Most of the studies say that over 1/2 the road accidents occur due to carelessness and inactiveness of the person who is on the driving seat, that is the driver.. People fatigueless, inactiveness and carelessness are the main causes of terrible and dangerous road accidents, especially accidents lead by cars. It's found that drowsiness is one the main factor that causes inactiveness of the chauffer. It results in increased number of road accidents per annum. If drowsiness is detected early enough then it could save many road accidents. Drivers who don't take regular breaks when driving long distances run a high risk of becoming drowsy and cause accidents. It's a state which they often fail to acknowledge early enough per the experts. Studies show that around one quarter of all serious motorway accidents is owing to sleepy drivers in need of a rest, meaning that drowsiness causes more road accidents than drink-driving. Drowsiness Detection System has been developed, employing a machine vision based concepts.

Keywords— *Video acquisition, Face detection, Image processing, Drowsiness detection*

I. INTRODUCTION

Driver somnolence detection could be a automotive safety technology that prevents accidents once the chauffer is obtaining drowsy. Varied studies have instructed that around 2 hundredth of all road accidents square measure fatigue-related, up to five hundredth on sure roads. Recent statistics estimate that annually thousands may be attributed to fatigue connected crashes. the event of technologies for detection or preventing somnolence at the wheel could be a major challenge within the field of accident turning away systems. The objective of this project is to develop a somnolence observation system which will detect drowsy or fatigue in drivers to forestall accidents and to boost safety on roads. This method accurately to watch the open and closed eye state of driver. It uses a right away approach that creates use of vision primarily based techniques to observe somnolence. The major challenges of the projected technique embrace (a) Developing a true time system (b) Face detection (c) Iris detection below varied conditions like driver position, with/without spectacles, lighting etc (d) Blink detection and (e) Economy. the main target are going to be placed on coming up with a period of time system that may accurately monitor the open or closed state of the driver's eyes. By watching the eyes, it's believed that the symptoms of driver fatigue may be detected early enough to avoid a automotive accident. Detection of fatigue involves the observation of eye movements and blink patterns in 'n' sequence of pictures of a face extracted from a live video.

II. METHODS

A. Product Perspective

This system uses Video acquisition that involves obtaining the live video feed of the chauffer. Video acquisition is achieved, by making use of a camera then dividing into frames. The face detection function takes one frame at a time from t frames provided by the frame grabber, and in each frame, it tries to detect the face of the chauffer. Once the face detection function has detected the face of the chauffer, the eyes detection function tries to detect the auto chauffer's eyes. After detecting the eyes of the car driver , the drowsiness detection function detects if the auto driver is drowsy or not.

B. Functions

The proposed system has following functionalities

1. *Video acquisition:* Video acquisition mainly involves obtaining the live video of the car driver. This module is employed to require live video as its input and convert it into a
series of frames/ images, which are then processed

2. *Face detection:* The face detection function takes one frame at a time from 't' frames, and every and each frame it tries to detect the face of the car driver.

3. *Eyes detection:* The eyes detection function tries to detect the auto driver's eyes.

4. *Drowsiness detection:* The drowsiness detection function detects if the car driver is drowsy or not, by taking in consideration the state of the eyes and mouth, that is , open or closed and also the blink rate.

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C. Constraints

This system should be fixed within the automobile near the auto driver seat and will be fixed in a very right position to feed the focused video to the detection system. Quality of the video helps in efficient detection of drowsiness

D. Hardware Interfaces

Hard Disk	: 40GB hard disk or more.
RAM	: 4GB RAM or more.
CPU	: Dual core processor or higher

WEB CAMERA : Minimum 16 MP

E. Software Interfaces

Operating System: Windows 7 or higher
Tool: MATLAB 2013a
Toolbox: Image processing toolbox,
Image acquisition toolbox, Machine learning toolbox
Programming Language: MATLAB

III. FUNCTIONAL REQUIREMENTS

Driver drowsiness detection could be a car safety technology which helps prevent accidents caused by the driving force getting drowsy.

A. Inputs

Video acquisition: Video acquisition mainly involves obtaining the live video of the car driver. This module is employed to require live video as its input and convert it into a series of frames/ images, which are then processed.

B. Processing

- Face detection: The face detection function takes one frame at a time from 't' frames, and every and each frame it tries to detect the face of the auto driver.
- Eyes detection: The eyes detection function tries to detect the car driver's eyes.
- Mouth detection: The mouth detection function tries to detect the car driver's mouth.

C. Outputs

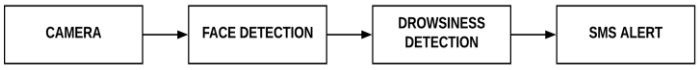
Drowsiness detection: The drowsiness detection function detects if the auto driver is drowsy or not, by taking in consideration the state of the eyes , that is , open or closed and therefore the blink rate. And message is forwarded to respective authority.

IV. DESIGN

Inappropriate drivers are the reason for a huge number of accidents on the streets which prompt wounds and deaths. Therefore, it is vital to take preventive measures against such mischance. As indicated by study, driver weakness brings about more than half of the street mishaps every year. Utilizing innovation to identify driver drowsiness is a fascinating test that would help in reducing accidents. The primary point of this is to build up a drowsiness recognition framework by checking the eyes and mouth; it is trusted that the indications of driver tiredness can be recognized sufficiently early to keep away from a mischance. Identification of drowsiness includes the perception of eye developments, blink patterns and mouth opening for yawning.

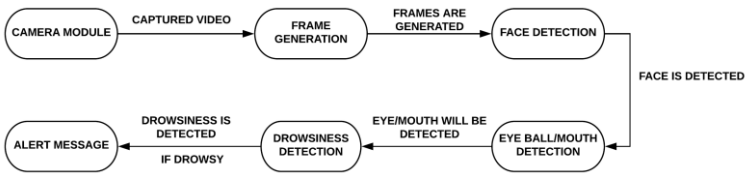
A. Architectural design

Framework configuration is where we deliver an answer for the issue explanation we said before and design the whole procedure as to accomplish the whole prerequisite we indicated in the necessity determination phase of our task. In different terms we are gazing with a plan that would enable us to see how to take care of the considerable number of issues determined by the prerequisites particular. The framework configuration is utilized to comprehend the diverse modules in the framework and the improvement of every module and a point by point depiction of the whole framework. The framework configuration is utilized to shape a correspondence connect between the necessities determination and the usage. The framework configuration organize demonstrates the variety in survey the framework from a client's perspective to a software engineer's perspective. In our framework plan we have two modules and they are: Equipment Module, Programming Module (Explosion Analysis).



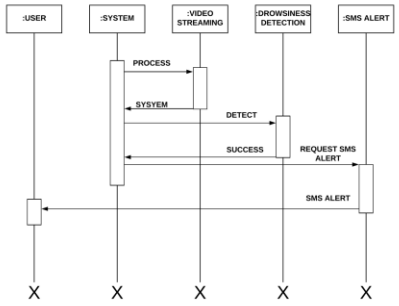
System architecture is the high level design and hence our architectures basically comprises of four main aspects i.e. Camera to obtain the live video of the automobile driver , Face detection function to detect the driver's face, Drowsiness detection function to detect if the driver is drowsy or not based on eye blink patterns and finally SMS alert provision to the respective person if the driver is found drowsy.

B. Data Flow diagram



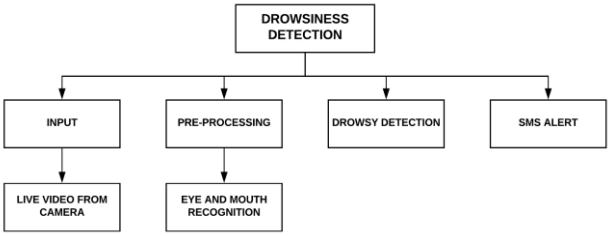
Data flow diagram is a graphical portrayal of the "stream" of information through a data framework, demonstrating its procedure viewpoints. Camera module is used to capture the live video of automobile driver and then frame generation process takes place where frames are generated. Once the generation of frame is done, face detection function is used to detect the face . After the detection of face, eyes are detected and monitored if it's open or close or half-open/close to come to an conclusion if the driver is drowsy or not. Drowsy detection function gives the required result about the state f the driver and if the driver s found drowsy , alert message is sent to the concerned person of the driver.

C. Sequence Diagram



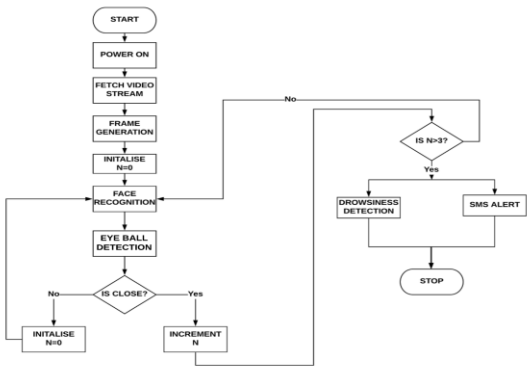
A Sequence diagram is in UNIFIED MODELLING LANGUAGE(UML). It is a kind of an interaction diagram that shows how process operate with one another and in what order. Sequence diagrams are sometimes called Event diagrams, Event scenarios and timing diagrams.

D. Modular Diagram



Modular design is a plan approach that subdivides a framework into littler parts called modules or slides, that can be autonomously made and afterward utilized as a part of various frameworks. In our project, Main module is named as Drowsiness detection which in turn has four sub-modules namely Input to collect the live video stream of automobile driver from camera, Pre-processing to process the video into frames and to detect drowsiness based on eye blink patterns , Drowsy detection to detect if the driver is drowsy or not and SMS alert to send message to the driver's concerned person if he's drowsy.

E. Flow Chart



Flowchart is a pictorial representation of the algorithm or diagram of sequence of movements. The working of our project is being depicted in the above flowchart. Firstly, we turn on the automobile which is represented as Power on and fetch the live video stream as input and generate the frames. We initialize the frames N as 0 and use face recognition function to detect face. Once the face is detected we use Eye Ball Detection function to detect eyes and apply following cases; If eyes is detected as close we will increment N and if N value exceeds 3 then the conclusion is Driver is found drowsy as well as SMS alert is sent to the concerned person else we re-initialize the value of N as 0 and repeat the process.

V. IMPLEMENTATION

Implementation is the stage of the project where the theoretical design is turned to a working system. At this stage the main work load, the greatest upheaval and the major impact on the existing system shifts to the user department. If the implementation is not carefully planned and controlled it can cause chaos and confusion.

Implementation includes all those activities that take place to convert from the old system to new one. The new system may be totally new, replacing an existing manual or automated system or it may be a major modification to the existing system, Proper implementation is essential to provide a reliable system to meet the user needs.

A. Implementation Procedure

The most important step in detecting the active state of driver depends the position of the camera. The place where the camera is placed must satisfy few constraints that is face must be visible to the camera and a good light source is preferred for better results. The optimal location to place the camera is in the gap between the main glass and the steering which provides valuable light source and better view of drivers face to the camera. Next comes the GSM module connected the system. It can be placed anywhere is the car. And last one is the alert buzzer which is turned on when the driver is detected drowsy it must be placed a bit near to the driver to awake him in case he is drowsy. This is the implementation of all hardware's which are further connected to a computer which will processing all the inputs and provides the output.

B. User Manual

A well designed system if not operated and used properly could fail. Training the user is important, as if not done well enough could prevent the successful implementation of a information system. After the development of the complete product the system is handed over to the user so in order for better results user needs to be trained. They must know their roles, how they can use the system and what the system will do and will not do. Both system operators and users need training.

C. Operational Documentation

Once the documentation plan is needed, it is essential that the user of the system is made familiar and comfortable with the environment. Education involves right atmosphere and motivating the user. A documentation providing the whole operations of the system is being developed. The system is developed in such a way that the user can work with well consistent way. The system is developed user friendly so that the user can work the system from the tips given to them. Users must be made aware how system works and what are all the benefits of the system.

D. System Maintenance

A perfect system when not maintained well fails. So even this product that id drowsiness detection project needs some amount of maintenance. It doesn't cost too much , all you need is a camera lens cleaners to keep the camera lens clean. Software and hardware maintenance are key constraints to achieve a great success.

VI. TESTING

System testing is the process used to help identify the correctness, completeness, security, and quality of developed computer software. Testing maybe a method of technical investigation, performed on behalf of stake holders, i.e. intended to reveal the quality related information regarding the product with reference to context during which it is suppose to be control. This includes, however it is not restricted to, the method of executing a program or application with the intension of finding errors. Testing furnishes a 'criticism' or comparison that compares the state and behavior of the product against specification.

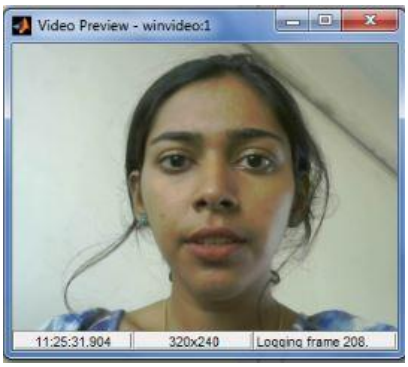
A. Testing Methodologies

- Unit Testing.
- Integration Testing.
- User Acceptance Testing.
- Output Testing.
- System Testing.

B. Test Cases

These are the various different test cases we have considered here.

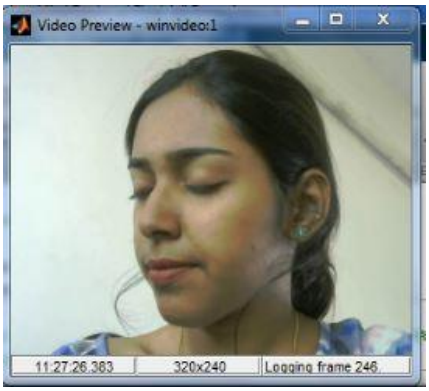
1. **Eyes open**
   In this case the driver is normal, where the eyes of the driver is said to be open



2. **Eyes closed**
   In this case the driver is considered to be drowsy and has his eyes closed for a particular time.

3. **Eyes are half closed.**
   In this case, the eyes of the driver is considered to be half drowsy with having his eyes to be closed partially.

4. **Driver falls left**
   In this case, the driver is falling to the left by sleeping and has his head facing left.



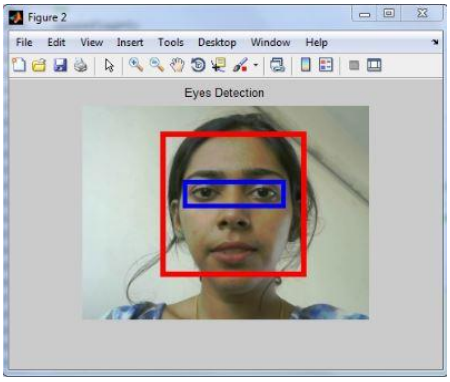
5. Driver falls right

In this case, the driver is falling to the right by sleeping and has his head facing right.

VII. EXPERIMENTAL RESULTS

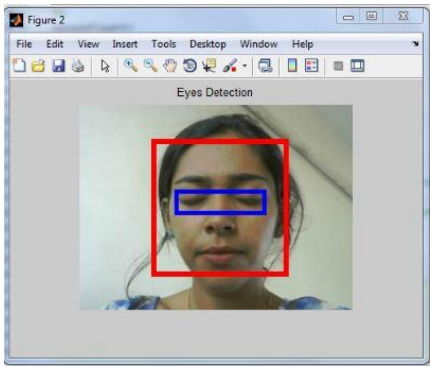
For the above specified inputs our developed system provided the following results.

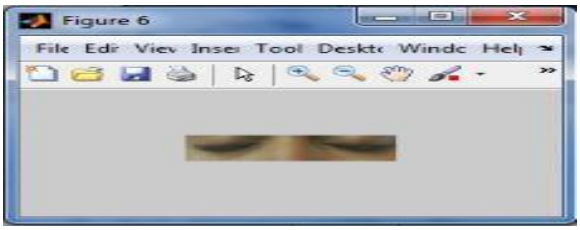
1. When eyes are open:



The system successfully detected the open eyes and didn't provide any alert sensing the drivers alertness since he was detected awake.

2. When eyes are closed:

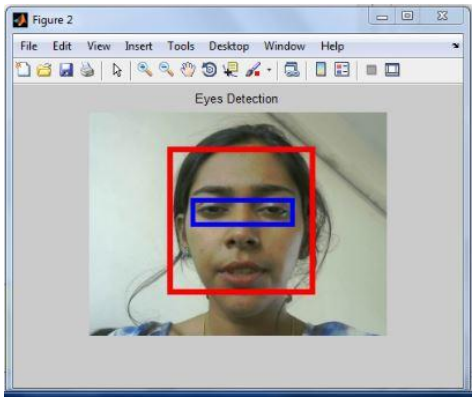


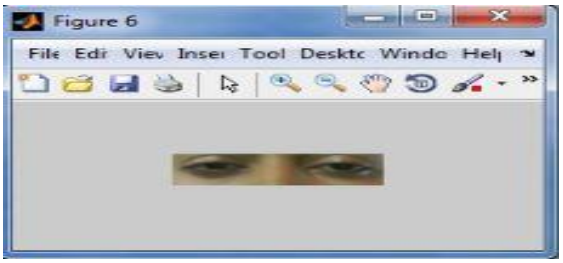


The system successfully detects the close eyes and alerts the driver to focus on driving by providing a beep.

3. When eyes are half closed:

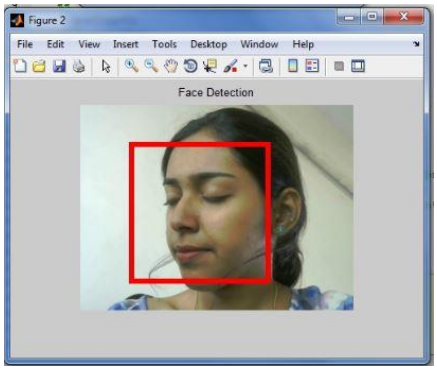
4.





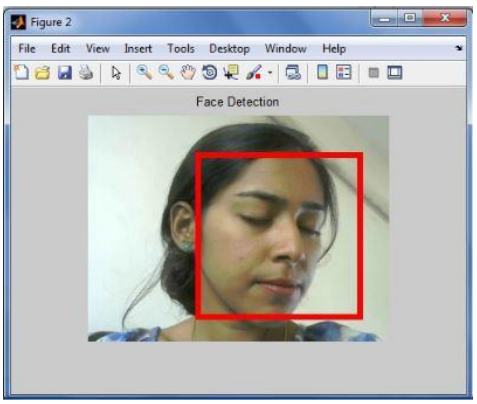
The system successfully detects the half closed eyes which is a sign of drowsiness and alerts the driver with a beep.

4. When driver falls left:



The system detects the drivers facial conditions and alerts him with a beep.

5. When Driver falls right:



The system detects the drivers facial conditions and alerts him with a beep.

6. GSM message:

Message is sent to respective person incase driver continuous to drive even after too many alerts.

VIII. CONCLUSION AND FUTURE SCOPE

Thus we developed a system of anti-accident based on drowsy driving detection and tries to look at the emerging technologies and determine the best approaches in trying to prevent the number one cause of fatal vehicle crashes. Currently, the number one selling product in the market is nothing more than a reed switch to detect head angle tilt. Available product is extremely limited and not very effective. In our future enhancement of our project we plan to slow down a vehicle automatically when fatigue level crosses a certain limit. Instead of threshold drowsiness level it is suggested to design a continuous scale driver fatigue detection system. It monitors the level of drowsiness continuously and when this level exceeds a certain value a signal is generated which controls the hydraulic braking system of the vehicle.

Dedicated hardware for image acquisition processing and display Interface support with the hydraulic braking system which includes relay, timer , stepper motor and a linear actuator. When drowsiness level exceeds a certain limit then a signal is generated which is communicated to the relay through the parallel port(parallel data transfer required for faster results).

IX. REFERENCES

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