Smart Drowsiness Detection System & Remedy For Drivers

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Abstract- *There are several technologies released world-wide to have a control over auto traffic i.e. providing i-traffic control. These Technologies includes automated traffic surveillance systems and traffic monitoring systems which reduces chances of accidents and drivers from speeding.In general cases the accidents take place due to certain common reasons like driver is in drunken state or he feels sleepy while driving. So to improve the current accidental control systems and preventing the drivers from accidents, such a system this will deliver a vision which will prevent driver from having indecency, drowsy and distraction. We have overcome some limitations and challenges of previous technologies, but here the actual logic remains the same. So here the system is particularly focusing on accuracy and performance.*

The Basic idea is to monitor the driver's behaviour while driving and if above behavioural changes found then the system provides an emerging alarm and notification, which will notify the driver's state to the owner.

Keywords- Eye Gaze, Image Processing, J2ME, Open-CV libraries, SQLite.

I. INTRODUCTION

Today, the surveillance systems are widely used as a need to monitor the traffic. Here we know that these surveillance systems are not much capable to prevent the accidents in real-time, and moreover these systems lack of visual quality and performance. In the other Countries like U.S, London, Canada etc, where these systems are widely used to monitor the traffic and city crowd, After the surveillance systems DARPA(Defence Advanced Research Projects Agency) introduce some new surveillance systems i.e. centralized monitoring stations which identify and track the bogies, individuals and vehicle as well. That was an impressive advancement in traffic control systems, but these systems again lack in performance and human identification. After knowing the limitations DARPA provided aerial surveillance systems which were developed in late 1960s. These systems are capable of monitoring a wide range of area and a clear view of vehicles and individuals, but as per these systems are power dependent, so they can't survive for longer durations. So from 90's onwards DARPA and other researchers are working on DFT (Drivers Fatigue Detection), so these Technologies include the following:

There are Four Emerging Technologies introduced:-

- Steering pattern Monitoring
- Vehicle Position in Lane Monitoring
- Drivers Eye/Face Monitoring
- Physiological Measurements

From Above what we conclude that these systems do not emphasise on human behavioural detection while driving, which is important since accidents are taking place due to these reasons only. So we are introducing a Drivers Eye/Face Monitoring system, which will provide a proper detection of human behavioural patterns.

II. EXISTING SYSTEM

2.1. Fighting Accidents Using Smart Phone

In this system two devices were used first is a Samsung galaxy S4 smart phone and secondly Module for measuring the changes in physiological signals brain waves. In this the Driver operation and vehicle behaviour can be implemented by monitoring the steering wheel movement, accelerator or braking patterns, speed, lateral acceleration, and lateral displacement. These too are non-intrusive ways of detecting drowsiness, but these are limited to vehicle type and driver conditions. The final technique for detecting sleepiness is by monitoring the behaviour of the driver. This involves periodically requesting the driver to send a response of alertness to the system. The problem with this technique is that it will become annoying some times to the driver and moreover there are chances of system failure [1].

Fig 1: Module for measuring the changes in physiological signals brain waves [2]

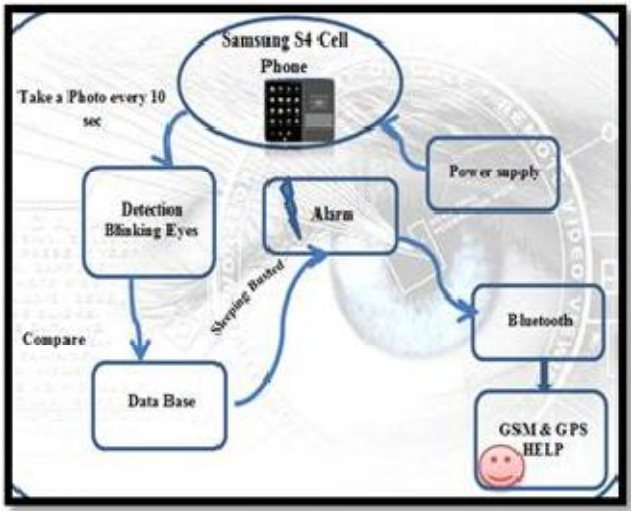

Fig 2: Block diagram of the system [3][4][5]

2.2 Eye Gaze Using Human Computer Interaction

The system has some predefined requirements such as the capturing of user images, processing them, detecting essential regions of eye tracking and calibration process. The block diagram for the proposed system is presented is

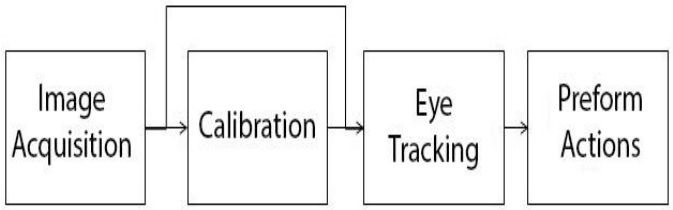

Fig 3: eye gaze block diagram [2][10].

The application starts with image acquisition, either from a web camera or a pre-recorded video for testing Purpose, after image acquisition, there is a calibration block where eye gaze is initialized for the pointer position on the screen. This block contains two stages:

i) Detection of pupil position;
ii) Estimation of the transformation matrix that will convert the centre of the pupil into a point in the screen.

The eye tracking consists of pupil detection and tracking along the image sequence. With pupil position and the transformation matrix, it is possible to determine the point on the screen where the user is looking.

But in this system the devices which are used are costly and provides low quality images and more over this system has some limitations one is the lighting conditions and particularly face and eye illumination, which should be Homogeneous and most natural possible (sun light is better than artificial light).

III. PROPOSED SYSTEM

In the proposed system, we have worked on limitation of previous researches and improved the accuracy, performance and provided less cost devices. Here the physical devices used is just an smart phone, Basically the idea is that an android application is developed, where the camera of the smart phone is used as an interface, so when the driver sits in the car the first thing the smart phone does is that it just captures an initial images of the driver and stores as an templates in the smart phone database. Secondly the when driver start driving the application continuously processes the real time images and compares with the templates, This real time process continues until the driver shows some behavioural changes like yawning, sleepy or drowsy or any other face movements greater than 5 seconds then the system generates an alarm with an tone which will be loud enough to wake up the driver if he is in drowsy state. In the case if driver is unresponsive and doesn't come to original state, then a notification is delivered to owners mobile that the driver's is not appropriately driving and then on actions can be taken. Since this system is required in ever growing smart cities, which can be a devastating change in the current technologies.

IV. WORKING OF THE SYSTEM

Fig 4: Smart Drowsiness Detection System Architecture

The main working of the system is when the system gets started it firstly recognize the region of face which includes eye lids and eye ball positioning. Firstly the whole face region is captured and then the original position of eye lids and their distance is captured as default templates. When this process is done without interrupting the driver the system monitor's the driver continuously, basically for complete above mentioned procedure there are two algorithms used:

A) Haar Cascade Classifier
B) Hough Circle transform

For face detection Haar classifiers is used [6]. These classifiers are based on features extraction, which are found to be contrast in variation inside a set of pixels making two distinguish areas, darker and lighter shades. The classifiers are prepared with two groups of images, good and bad examples of the specific features. To increase the accuracy of the system the proposed algorithm uses different Haar filters which make the face detection step more robust. For the purpose of minimizing the chances of errors and reduce processing time, relevant regions are cropped for further processing.

Fig 5: a) Face Detection b) Eye Detection

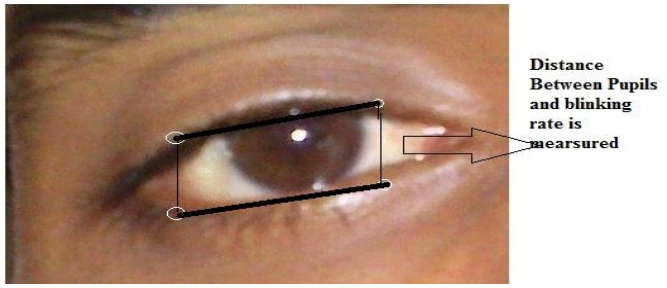

Fig 6: Distance between Pupils and blinking rate

The pupil position is obtained as shown in fig :5(a). To speed up the process, only the image window with the eyes is used (see fig: 5(b)). In this step, the image is changed to gray scales and histogram equalization and kalman blur filter[9] are applied to reduce noise components. Haar Classifier and Hough Transform is not used in real time, but it is used for computational purpose. Now for eye tracking Mean shift algorithm is used Mean Shift is an algorithm which performs image segmentation [8]. An image map is created through image projection based on object histogram. For better performance, the algorithm selects one of the objects to follow based on the map and object position on previous image. Due to the small variations in pupil positioning during detection, the Kalman filter is preferred, assuming a fixed position motion model.

V. PROGRAMMATIC IMPLEMENTATION

For the programmatic implementation of system basic components are needed. The Components are explained below:

1. **Android Studio:-** This platform is used for android application development, since we know that android applications are widely used and has less compatibility issues. So we have used android as a platform and J2ME as language for coding.

2. **OPEN-CV:-** Here Open-CV (version 2.4.10) is used, open-cv is an image processing library which is generally used for face recognition, Motion tracking, gesture recognition etc.

3. **SQLite:-** Here SQLite is used for storing the templates which are captured at the initial stage of procedures, and it is also used for comparing real time images.

VI. ADVANTAGES

- System can be used in other fields like healthcare, Industrial purpose, Government Institutions, Education societies.
- System can work in dim light and moreover light illumination is reduced.
- Performance and accuracy is achieved without increase in the cost.
- Power issues are reduced, since mobile devices are used.
- System is pervasive in nature.
- High sensitivity as compared to previous software and hardware.
- Refresh rates are higher as compared to previous devices.
- Less cost for implementation.

VII. DISADVANTAGES

If the driver is wearing any glasses, mask or muffler then the system faces some critical issues while tracking the regions of face, but this issues will be resolved in version II of the system.

VIII. CONCLUSION

An extensive and exhaustive work in implementing face recognition and Eye detection with smart phone and making it work in real time on Android.Several risk operations can be easily performed with this type of application, further research and study on these areas will open up a new trend of interacting with machines. This System is been improved and presents two important goals are achieved first eye tracking and face movement recognition is achieved without human intervention, secondly higher refresh rates, image quality and proper pupils positioning is achieved. Regardless of issues, system can handle the current circumstances and can cover the future aspects as well.

During the development cycle,System has shown some impressive results like latency issues were reduced while communicating withowner's server, calibration of multiple modules were easy and were working good enough, the best part is that system is designed with less interfacing devices, which reduces overall cost of the system.

Well we know that the device which is used is power dependent, but we have improved it in version-II.Besides power issues it is quit efficient to track the individual approximately up to 8 hrs. Secondly the application which is developed is friendly with other mobile devices, since this application is compatible with wide range of android versions.

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