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Fighting Accident Using Eye Detection forSmartphones

Mohamed A. Mohamed[1], A. I. Abdel-Fatah[1], Bassant M.El-Den[2]
[1]Faculty of Engineering, Mansoura University, Mansoura, Egypt
[2]Faculty of Engineering, Delta University, Mansoura, Egypt

ABSTRACT
This paper is an attempt to investigate an important problem and approaches of human eye detection, blinking, and tracking. A new system was proposed and implemented using android technology for smartphones. System creatively reduces accidents due to drivers' fatigue by focusing on treating the driver after fatigue has been detected to achieve decrease in accident likelihood.
Smartphone's have been the important tools in our society for the abundant functions including communication, entertainment and online office etc. as the pivotal devices of mobile computing. Smartphone development has also become more important than before. Android is one of the emerging leading operating systems for smartphones as an open source system platform. Many smartphones have adopted this platform and more smartphones will do so in the future. The proposed system is well-suited for real world driving conditions since it can be non-intrusive by using video cameras to detect changes. Driver operation and vehicle behavior can be implemented by equipping automobiles with the ability to monitoring the response of the driver. This involves periodically requesting the driver to send a response to the system to indicate alertness. The propose system based on eyes closer count & yawning count of the driver. By monitoring the eyes and face, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident and providing the driver with a warning if the driver takes his or her eye off the road.
Keywords- Smartphones, Android, Multimedia, Eye Blinking, Eye Detection, Software Development

I. INTRODUCTION

This paper presented new technique to reduce accident by provides the vehicle with the capacity to assess in real-time the visual behavior of the driver. The "National Highway Traffic Safety Administration" "*NHTSA*" estimates that drowsiness is the primary causal factor in 100,000 police-reported accidents per year. Another *NHTSA* study suggests that 80% of collisions occur within three seconds of a distraction. By equipping automobiles with the ability to monitor drowsiness, inattention, and cognitive engagement driving safety dramatically enhanced.

"Lexus claims to have equipped" its "LS460" with the first driver monitor system in 2006, providing a warning if the driver takes his or her eye off the road. The ever increasing numbers of traffic accidents all over the world are due to diminished driver's vigilance level. Drivers with a diminished vigilance level suffer from a marked decline in their perception; recognition and vehicle control abilities & therefore pose a serious danger to their own lives and the lives of the other people.

For this reason, developing system that actively monitors the driver's level of vigilance and alerting the driver of any insecure driving condition is essential for accident prevention. Many efforts have been reported in the literature for developing an active safety system for reducing the number of automobiles accidents due to reduced vigilance. Among these methods, the techniques based on human physiological phenomena are the most accurate. These techniques used for detecting drowsiness, but are limited to vehicle type and driver condition. The other techniques for detecting drowsiness are by monitoring the response of the driver. This involves periodically requesting the driver to send a response to the system to indicate alertness. The propose system based on eyes closer count & yawning count of the driver. By monitoring the eyes and face, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident. The eye blink frequency increases beyond the normal rate in the fatigued state. In addition, micro sleeps that are the short periods of sleep lasting 3 to 4 seconds are the good indicator of the fatigued state, but it is difficult to predict the driver fatigue accurately or reliably based only on single driver behavior. Additionally, the changes in a driver's performance are more complicated and not reliable so in this system second parameter is considered. In order to detect fatigue probability the facial expression parameters must be extracted first.
Smartphone the combination between the "personal digital assistant " "*PDA*" and mobile phone has totally changed the myth about mobile phone which is only mobile phone company can develop its application. Since the launch of the "Android operating system" "*OS*" [1] in 2007, mobile development has been high in demand [2]. Android is

developed by Google and is based upon the Linux kernel and software.

Recently, Android has reached great success in mobile operating system especially in smartphones and tablets. New versions of Android are being updated continuously to satisfy android users. Due to these circumstances, Android developers introduce new application to satisfy the needs of the Smartphone users. Libraries such as "*Open GL"* "Open Graphics Library" and "*Open CV"* "Open Computer Vision" [3] are used for the development of the application. Android application developers tend to interface hardware into their application such as camera, sensors, compass, Bluetooth, Wi-Fi and etc. Application that uses camera usually involves an image processing method such as Gaussian, Median, Mean Laplacian, Sobel filter and others. Developers who have basic knowledge about image processing can write their own codes to apply those image processing methods in their application. Developers usually prefer to import libraries in their work. In the image processing field, an open source image processing library known as "*Open CV"* had made developers can apply image processing methods in their work. Nowadays "*Open CV"* library has widely implemented in several of image processing projects such as in building a robot that can distinguish some objects [4].

The increasing need for low power systems had reflected Android developers to consider power consumption in their applications. Power dissipated in any embedded device can be reduced with hardware optimization techniques, which only applied in earlier design steps [5]. Another way to reduce power consumption is software transformation. In software optimization techniques, power dissipation can be reduced with compiler, instruction level, and source code level optimization methods [6].

This paper is organized as follows. In Section 2 describes the main goals of the work. Section 3 describes the methods and design and of the proposed system. Section 4 presents the eye blink detection. Section 5 presents the environment of the presented work and description of dataset. Finally, Section 6, 7 and 8 offers the result, conclusions and future work.

II. GOALS

1) Designing a real-time eye tracking software able to detect and track face and eyes in variable face pose and compatible with an android environment for smart phone.
2) Reduce the probability of accidents caused by driver fatigue.
3) Inform the driver of his/her awareness status.
4) Slow down the process of falling asleep.
5) Recommend to the driver to take an alternative way to the nearest possible resting point.

2.1 Advantage

1) Eye tracking provides package designers with the opportunity to examine the visual behavior of a consumer while interacting with a target package.
2) Analyze distinctiveness, attractiveness and the tendency of the package to be chosen for purchase.
3) Eye tracking is often utilized while the target product is in the prototype stage.
4) Prototypes are tested against each other and competitors to examine which specific elements are associated with high visibility.

2.2 Challenging

1) Eye tracking has major problems such as head motions, closure of the eye lid, blink frequency, existence of glasses, lighting and implementing real time performance.
2) All these problems may cause an eye tracking system to fail in detecting eye position and affect system performance.

III. THE METHODS AND SYSTEM MODEL

3.1 Concept

Sleep related accidents tend to be more severe, possibly because of the higher speeds involved and because the driver is unable to take any avoiding action, or even brake, prior to the collision. Horne describes typical sleep related accidents as ones where the driver runs off the road or collides with another vehicle or an object, without any sign of hard braking before the impact. In 2002, the "*NHTSA*" estimated that 35 percent of Every driver/car owner who understands the danger of driving under fatigue condition all traffic deaths occurred in crashes in which at least one driver or no occupant had a "*BAC"* "Blood Alcohol Content" of 0.08 percent or more and that any alcohol was present in 41 percent of all fatal crashes in 2002.Such statistics are sometimes cited as proof that a third to half of all fatal crashes are caused by "drunk driving" and that none of the crashes that involve alcohol would occur if the alcohol were not present. But this is incorrect and misleading because alcohol is only one of several factors that contribute to crashes involving drinking drivers. Furthermore, some fatally injured people in alcohol-related crashes are pedestrians with positive "*BAC"s*, and these fatalities still would occur even if every driver were sober. Distracted driving is a top danger behind the wheel. In fact, about eight out of 10 crashes involve some sort of driver inattention within three seconds of that crash. We've all seen it and likely even done it, driving distracted includes anything from talking on the phone, to messing with your music, to attending to your children or even pets [7]. All of these actions can lead to serious consequences. Martha Meade says, "People are dying because of a simple missed phone call, a dropped toy or some

other event that is completely not important." Possible techniques for detecting drowsiness in drivers can be generally divided into the following categories: sensing of physiological characteristics, sensing of driver operation, sensing of vehicle response, monitoring the response of driver:

- Companies who want to keep track of their workers so they do not drive under fatigue condition.
- Parents, who want to take care of their children.
- The Army, police.
- Vehicle producers for use in new cars.

3.2 Methods

Driver operation and vehicle behavior can be implemented by monitoring the steering wheel movement, accelerator or brake patterns, vehicle speed, lateral acceleration, and lateral displacement. These too are non-intrusive ways of detecting drowsiness, but are limited to vehicle type and driver conditions. The final technique for detecting drowsiness is by monitoring the response of the driver. This involves periodically requesting the driver to send a response to the system to indicate alertness. The problem with this technique is that it will become annoying some times to the driver [8].

3.3 Monitoring Physiological Characteristics

Among these methods, the techniques that are best, based on accuracy are the ones based on human physiological phenomena. This technique is implemented in two ways: (i) Measuring the changes in physiological signals, such as brain waves or heart rate or; (ii) Measuring physical changes such as eye blinking or sagging posture, leaning of the driver's head and the open/closed states of the eyes. The first technique is not realistic, since sensing electrodes would have to be attached directly onto the driver's body, and hence be annoying and distracting to the driver. In addition, long time driving would result in perspiration on the sensors; diminishing their ability to monitor accurately as shown in Fig.1 the IR sensors & camera module that is to be used for measuring the changes in physiological signals brain waves. The second technique [9] which discussed and implemented in this paper is well suited for real world driving conditions since it can be non-intrusive by using optical smartphone cameras to detect changes as shown in Fig.2. That shows the camera module that which used by the driver for eye blink detection.

Fig.1. Module for measuring the changes in physiological signals brain waves

Fig.2 The proposed system model

Each method of eye tracking has advantages and disadvantages, and the choice of an eye tracking system depends on considerations of cost and application. There is a trade-off between cost and sensitivity, with the most sensitive systems costing many tens of thousands of dollars and requiring considerable expertise to operate properly. Advances in computer and video technology have led to the development of relatively low cost systems that are useful and fairly easy to use. Interpretation of the results still requires some level of expertise.

IV. EYE BLINK DETECTION

It is necessary in the present work to find the blinking of eye, since it is used to drive the device and to operate events. So blink detection has to be done by using a video camera and android software with incorporate it with a special instruction written in *MATLAB* program for image processing that, if there is no pupil found for the certain period of pre-determined i.e. time greater than the human eye blinking time then consider an event called "blink",for which the set of operations will be followed. Here, in this case set time as 2 second or above it, as "blink event" is different from "normal eye blinking". Perform testing for only blink event

estimation, and not to find normal eye blinking is needed.

V. ANDROID ENVIROMENT

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. The Android "*SDK"* "Software Development Kit" provides the tools and "*APIs*" "Application Programming Interface" necessary to begin developing applications on the Android platform using the Java programming language.Android works in many devices like mobile and tablet.

What is needed to build my own application?

1) Java Programming Language.
2) Tools and Utilities.
   a. Android "*SDK"*.
   b. Android "*AVD"* "Android Virtual Device".
   c. Eclipse"*IDE"* "Eclipse Integrated Development Environment".
   d. Android *"ADT" "Android Development Tools"*.
3) Mobile device or tablet.

The android environment showed in Fig.3.

5.1 Component Description

The following components are used in the proposed system

- Database – VIDMIT database is developed for testing and evaluation theVIDMIT dataset is comprised of video and corresponding audio recordings of 43 people, reciting short sentences. It can be useful for research on topics such as multi-view face recognition, multi-modal speech recognition and person identification. The dataset was recorded in 3 sessions, with a mean delay of 7 days. In addition to the sentences, each person performed a head rotation sequence in each session. The sequence consists of the person moving their head to the left, right, back to the center, up, then down and finally return to center or live images.
- *Mobile Platform* – System is embedded into Samsung Galaxy S4 model of mobile phone and supports Java technology and is integrated with Java. *Android Mobile Technology* –Java "*SDK"*, android technology and *DROID* emulator.
- *Face Recognition Method* – Face Recognition part is developed using *MATLAB.*

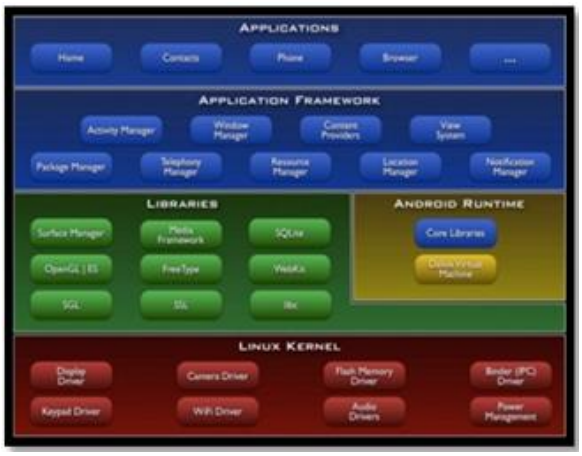

Fig.3 Android Architecture

VI. RESULTS

Eye tracking while driving a car is a difficult issuefor studying the eye movement *VIDMIT* database and live imageswhile driven have been filmed with a phone camera as shown in Fig.4 Novice and experienced drivers had their eye-movement recorded while approaching a bend of a narrow road. The series of images has been condensed from the original film framesto show 2 eye fixations per image for better comprehension [10]. Each of these stills corresponds approximately to 0.5 seconds in real time. The series of images shows an example of eye fixations for a typical novice and an experienced driver.

The system was primarily developed and tested on a Samsung Galaxy S4 cell phone with

- OS: Android OS, v4.2.2 (Jelly Bean)
- CPU: Quad-core 1.6 GHz Cortex-A15&quad-core 1.2 GHz Cortex-A7.
- Internal: 16 GB storage. 2 GB RAM.
- Camera Primary: 13 MP, 4128 x 3096 pixels.
- Video was captured Quickcam Pro 4000 webcam at 30 frames per second.

All video was processed as color images of *320×240* pixels using various utilities from the *VIDMIT* database or live images. Fig. 4 shows the block diagram for the proposed system.

The*VIDMIT* dataset is comprised of video and corresponding audio recordings of 43 people, It can be useful for research on topics such as multi-view face recognition, multi-modal speech recognition and person identification. The dataset was recorded sequence consists of the person moving their head movement to the left, right, back to the center, upand eye movement after taken images and detecting the eyes blinking by using *MATLAB and JAVA* code to profiling and testing the eye detection and blinking algorithm then implemented it on the Samsung Galaxy *S4* model of *DROID* phone. compare it with the stored images in mobile memory there is two results (i) if the comparison gives sleeping busted

alarm Working Link between Mobile and Motor Arab give signal to fire alarm and another sign of the brake to stop the vehicle and send a signal in with *GPS* positioning and get help [11-13] (ii) if there is not sleeping busted keep taken images every 10 second.

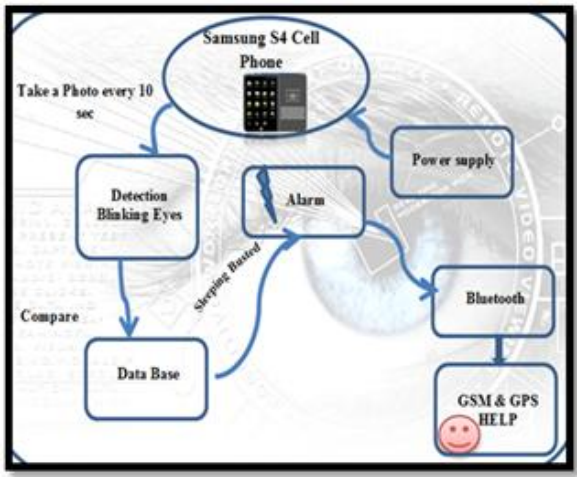

Fig.4 The block diagram for the system

An Android app that captured eye images was successfully created from the ground up as showed in Fig. [5-10]. Furthermore, the eye detection algorithm was executed on Android, as well. Since the difficulties of implementing eye detection on an Android device, is solved and now a new area of using it as a security feature for the device.

Fig.5 Main Menu for the Fighting System Application

Fig.6 Face Recognition Progress

Fig.7 the Process of Organize the Owner System in Sub-Menu

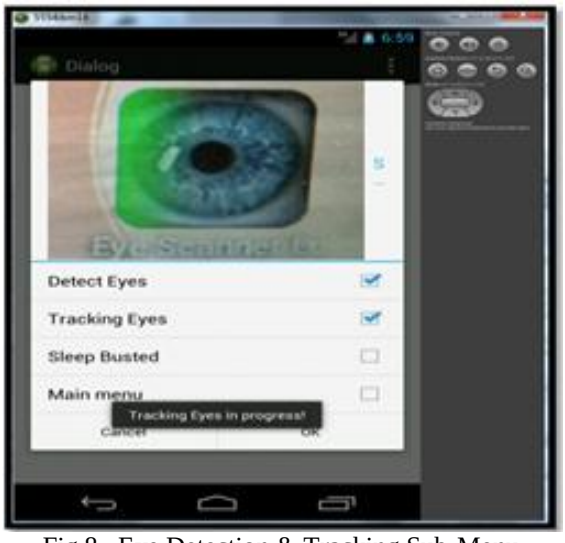

Fig.8 Eye Detection & Tracking Sub-Menu

Fig.9 the Sleep Busted Progress in Sub-Menu

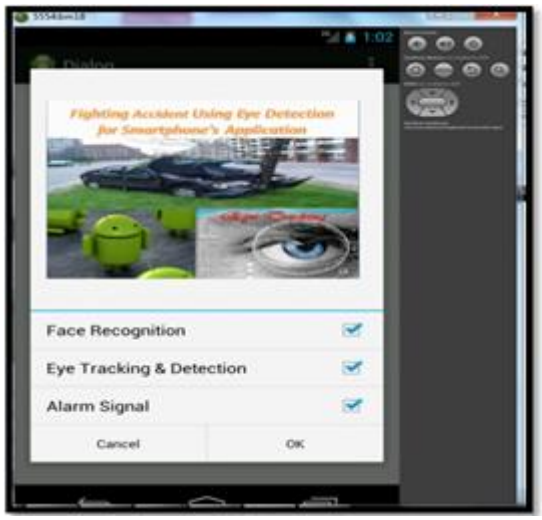

Fig.10 the Alarm System Activate in Main Menu

VI. CONCLUSION

In this paper, examination of how can improve the effective of a mobile phone, authentication and fighting accident application implemented. An extensive and exhaustive work in implementing face recognition and eye detection with mobile phone and making it work in real time on Android Samsung Galaxy S4 has been done. *MATALB* and *JAVA* algorithms have developed for the human protection application for Android system.

Eye based control will be the future of all types of device control, thus making the operation so comfortable and much easier with less human presence.Several risk operations can be easily performed with this type of application and further research and study on these areas will create a new trend of interacting with machines. Hence, a system to monitor fatigue by detecting face & eye blink was developed.

VII. FUTURE WORK

- Using *3D* images is another possibility in finding the eyes. The eyes are the deepest part of a *3D* image, and this maybe a more robust way of localizing the eyes.
- Instead of alarm Automatic Braking System can be used which will reduce the speed of the car.
- Automatically park the car by first using Automatic braking system, which will slow down the car and simultaneously will turn on the parking lights of the car and will detect the parking space and will automatically park the car preventing from accident.
- Using Pressure sensor on the steering alarm System can be set in case of drowsiness.

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