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# Providing A Way to Detect Drowsiness of Driver According to Processing the Eye Images

**Zohreh Fasihfar[1*] and Hossein Hokmabadi[2]**

[1]Faculty member in college of Electronic engineering and Computer, Hakim Sabzevari University, Sabzevar, Iran.
[2]Computer Engineering Student, Hakim Sabzevari University, Sabzevar, Iran

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**ABSTRACT**

Background and Purpose: making the car accident inhibitor systems intelligent can be influential in minimizing mortalities caused by car accidents. One of the death leading factors which have a major share in creating car accidents are human errors. Fatigue during driving is from the things causing errors and loss of carefulness in controlling the vehicle. Examining method: Based on processing the image, we can recognize fatigue and drowsiness symptoms in the person's face when driving. In the first step, the system separates the face area and then the eyes area with receiving the image and through the opencv algorithms. In the next step, using imfindcircles function, it determines the presence or absence of the eyeball (pupil), in other words, it identifies if the eye is open or close. In qualitative assessment of the proposed system it can be said that the results presented are acceptable. This system was tested on 100 photos with open and close eyes and the results were accurate in 80% of the cases.
**KEYWORDS**: Image Processing, Opencv Algorithms, Driver's Drowsiness

## 1. INTRODUCTION

Annually all over the world, many people lose their lives due to the accidents caused by driving. Recently, the research on the field of improving safety of vehicles in order to save the lives of passengers and reduce the car accidents has become very important. Due to the development of automotive industry in most of the countries of the world, the statistics of mortalities caused by driving accidents are alarming. In situations where one million and two hundred people lose their lives due to the driving accidents annually and 80 percent of the deaths are related to the developing countries, the death toll from the accidents in Iran has a high share and it imposes huge casualties and economic losses on the country and the society [1]. This is while Iran has the first rank in the world in terms of road losses and annually about 30 thousands of the people lose their lives in these accidents [2]. Intelligent driver monitoring systems are from the cases which have been considered in the vehicles' safety so that these systems try to help and warn the driver through intelligent detecting the accident conditions. Using these types of intelligent systems can decrease the road accidents significantly. The driver's drowsiness is a nightmare which always overshadows the souls and hearts of the passengers. Unfortunately, this nightmare in our country's roads becomes a reality and we always see the loss of our loved ones in the country's roads[3, 4].

## 2. Drowsiness and Its Causes

The driver's drowsiness is a process in which the consciousness of the driver decreases due to fatigue or lack of sleep. In some cases, the driver may fall to sleep for a short while about a few seconds and rapidly get up with no change in the conditions of the car; these kinds of sleeps are called micro-sleep which mostly is accompanied with nodding [5]. Many factors influence the person's drowsiness which three samples of them have been investigated in the following.

- **Lack of sleep**

Lack of sleep is from the most important reasons of drowsiness. The human's body requires a certain amount of sleep per day. Sleep has a cumulative effect, so losing one or two hours of sleep can cause a more sever sleep deprivation [6].

- **Driving Time**

Also the driving time plays a role in creation of drowsiness. Most of the people also feel drowsiness in the afternoon despite having sufficient sleep per day. By analyzing the accidents which have been caused by falling asleep of the driver, we find out that the most accidents occurs between 2 to 6 a.m. and then between 2 to 4 p.m. [7].

- **Correlation of the driver in the road**

Correlation is called to the situation in which the environment's state remains unchanged or the changes can be predicted [8]. When the driver experiences drowsiness, he does not have sufficient dominance to control the car; therefore there is the risk of car accident or vehicle rollover. There is no certain method or solution in order to prevent the driver's drowsiness; for the same reason, generally it is tried to take preventive measures in order to prevent the car

[*]**Corresponding Author:** Zohreh Fasihfar, Faculty member in college of Electronic engineering and Computer, Hakim Sabzevari University, Sabzevar, Iran. E-mail: fasihfar@hsu.ac.ir

accident through timely diagnosis of it. Hence, a system which is able to detect the driver's drowsiness or consciousness level intelligently with controlling his behavior and the status of his appearance and face is very important.

Such systems warn the driver when they detect his drowsiness and do some precautions. For example, when facing the diver's drowsiness, they are able to warn him using sound alarms, seat vibration, playing loud music or alarm and play a significant role in decreasing accidents through activating emergency braking systems and airbags of the car.

## 3. Drowsiness Detection Methods

The process of falling asleep behind the wheel of the car can be considered as a gradual decrease in the driver's consciousness. The most important issue which must be considered about the intelligent drowsiness detecting systems is the accuracy and speed of detecting the drowsiness in the first stages. Unfortunately, there is no certain and accurate criterion for detecting the drowsiness and generally it is tried to detect the driver's consciousness level through investigating its effects. Accordingly, different methods have been suggested for detecting drowsiness and each of them has its own weak and strength points. In these methods, different parameters are used in order for detecting the person's drowsiness which may relate to the person or the car. These parameters may be eyes, brain waves, appearance of the driver's face, speed, status of the car on the road, etc. Generally, these methods can be divided into three categories regarded to the symptoms they use for detection:

### 3.1. Methods based on physiological symptoms

Physiological symptoms are from the most accurate symptoms for diagnosing drowsiness of the person which are obtained from the performance of human body components like heart and brain. These symptoms have been used in the project of intelligent machine of the MIT University [9] and also the advanced project of safe car of Toyota Company [10]. One of the most known physiological symptoms is the brain wave. The figure 1 is an example of brain waves. The extent of drowsiness can be detected efficiently and accurately using the brain waves. In this method, the brain signals are recorded by using the electrodes connected to the brain and they are processed in order to detect the drowsiness. When the person experiences the drowsiness, his / her brain signals also change. With examining these signals, we can realize the activity of nervous system of the brain when consciousness and sleep and in this way determine the consciousness level of the person and detect his / her drowsiness. In spite of the high accuracy of the physiological method, the electrodes which are connected to the body will be unpleasant.

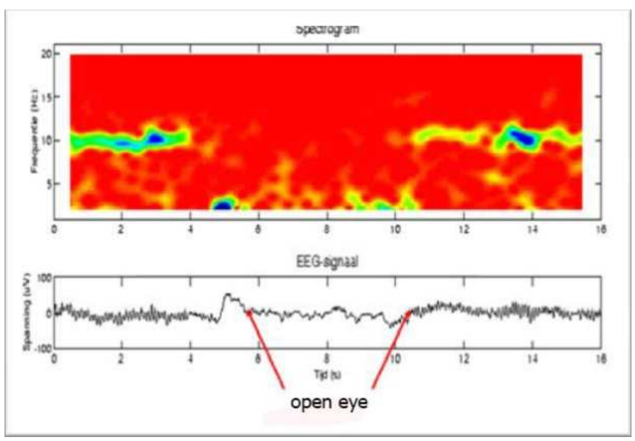


**Fig 1.**An example of the brain signal which has been determined in the area where the person's eye is open

### 3.2. Methods based on the driver's performance

In this method, the person's driving way and the status of the car are used in order to detect drowsiness. In researches done in this field, generally tracing the road lines, changes in the steering wheel, the numbers of crossing the road lines and the distance from the car to the front car are used in detecting the drowsiness.

### 3.3. Methods based on appearance and mode of the driver

The appearance and face of the driver change when drowsiness and the most important changes occur in eyes, head, mouth and the status of sitting. The visual signs of drowsiness can be extracted through taking pictures of the driver and relying on the image processing methods [11]. People show some certain behaviors in the tiredness situations which are simply detectable. Slow motion of the eyelids, closing the eyelids to each other or even closed eyelids, frequent nodding, yawning, dazing of the eye, etc. are the most common apparent features of the sleepy people [12]. The most researches have been done in this category of methods are about examining the eye and extraction of its characteristics. The most important characteristics are changes in the number of blinking, the extent of closeness of the eye and the path of eye daze. In this method the driver's eye is examined in order to detect micro-sleeps through a color video camera which is directly located in front of his face. This system detects the driver's face in the image using the skin color and performs the segmentation action on the pixels having the skin color and then detects the area of the face. After that, the eyes area is separated from the main image in order to detect the eyes and then the rest of the desired processing is done.

**4. The Structure of the Proposed System**

The aim of this research is to propose a method in order to detect the drowsiness of driver based on processing the eye images. The system includes two parts except the imaging section: 1) machine's vision, 2) determining the consciousness level of the driver. In the figure 2, we have indicated the overall structure of the proposed system. The machine's vision section includes the algorithms for processing the image which extracts the tiredness and drowsiness signs from the images and the determining consciousness level of the driver section determines the driver's drowsiness and makes decision about the driver's status and alarming him / her based on the signs extracted from the visual section of the machine.

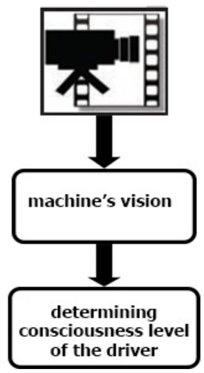


**Fig 2.**The general structure of face monitoring system

According to the figure 3, the visual section of the machine includes: 1) detection and tracing the face using opencv algorithms, 2) detection of eye, 3) detection of openness or closeness of the eye through finding the eye pupil using imfindcircles function.

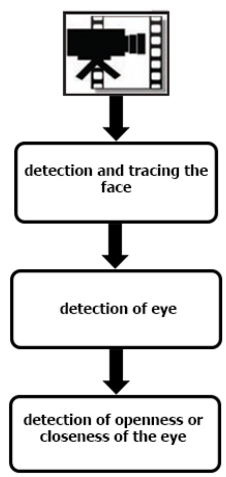


**Fig. 3.**the structure of the visual section of machine from the face monitoring system

**5. Processing the Images**

A dataset of the face of different peoples with close and open eyes has been used in order to test the system. The stages of processing images by the system are according to the following steps:

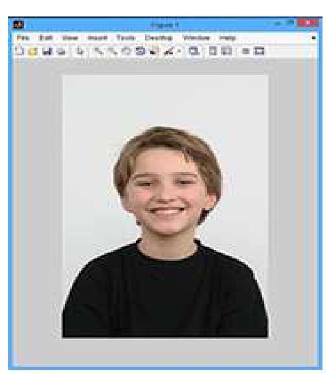

**Fig. 4.a.** The main image

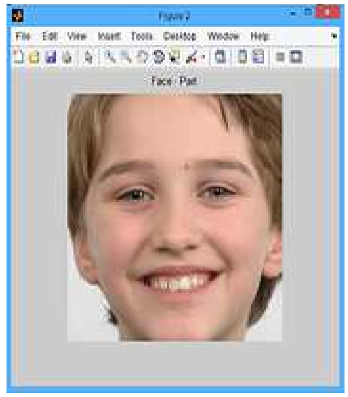


**Fig. 4.b.** Detection of the face area


**Fig. 4.c.** Detection of the left eye

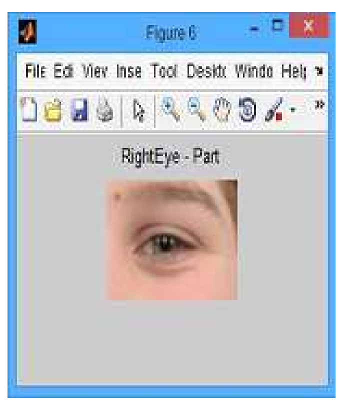


**Fig. 4.d.** Detection of the right eye


**Fig. 4.e.** Resizing the image

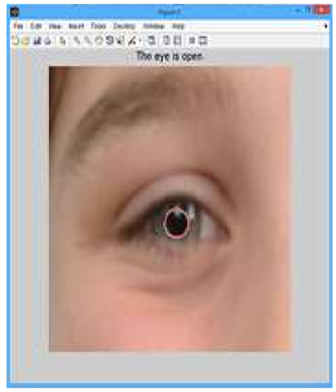


**Fig. 4.f.** Detection of the pupil

**Fig. 4.**Detection of the openness of eye

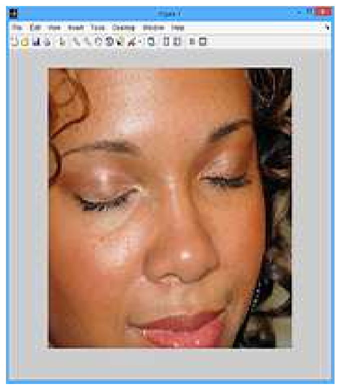

**Fig. 5.a.** The main image


**Fig. 5.b.** Detection of the face area


**Fig. 5.c.** Detection of the left eye


**Fig. 5.d.** Detection of the right eye

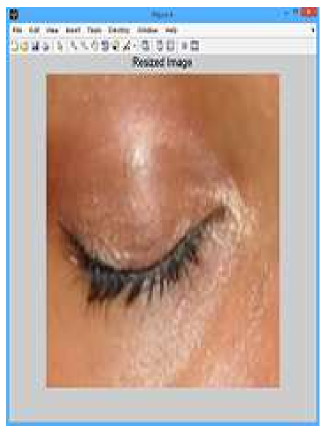


**Fig. 5.e.** Resizing the image and detection of the closeness of eye
**Fig. 5.**detection of the closeness of eye

As it is clear from the above pictures (figure 4), in the first step, the system receives the person’s image as the input image, in the next step, the system separates the face area from the main image by opencv algorithms which are based on skin color detection and segmentation operations (figure 4.b). Also in the next stage, the eyes areas are separated from the face image using opencv algorithms and other processes must be done on the eyes areas (figure 4.c and figure 4.d). Continually, the image is resized in order to better do the processes (figure 4.e). Also in the final step, the circles in the image are detected by the help of imfindcircles function of MATLAB software. This function finds the circles with certain radius in the image and determines them. In other words, the absence or presence on the pupils in the image or closeness or openness of the eye is examined (figure 4.f). The output of this function is an array which has the values of the center coordinates and the radiuses of the circles existing in the image; if the value returned by the above function is really a value, it is the indicative of the openness of the driver’s eye and in case of closeness of the driver’s eye, the returned array by this function will be null. The openness or closeness of the eye can be detected with investigating the value of this array.

## 6. CONCLUSION

Regarded to the posed discussions, the system can be efficient in order to detect drowsiness which acts as fast as possible. In this paper we have presented a driver’s face monitoring system in order to detect his tiredness and drowsiness. In this system the eye area has been used in order to extract the drowsiness signs in the person. In qualitative assessment of the proposed system, it can be said that the results presented are acceptable. This system was tested on 100 photos with open and close eyes and the results were accurate in 80% of the cases.

The proposed system has been designed and tested for the peoples without glasses. Due to the light reflection from the glasses, it decreases the accuracy of the algorithms of the face detection and the eyes area so that the system has some disorders for the people with sun glasses. One of the most important purposes of this plan in the future is to study in the field of possibility-feasibility of commercialization of the system and presentation of it to the domestic auto companies and also presenting some strategies for detection behind the glasses.

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