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DRIVER DROWSINESS DETECTION SYSTEM

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Abstract : **— Nowadays, more and more professions require long-term concentration. Drivers must keep a close eye on the road, so they can react to sudden events immediately. Driver fatigue often becomes a direct cause of many traffic accidents. Therefore, there is a need to develop the systems that will detect and notify a driver of her/him bad psychophysical condition, which could significantly reduce the number of fatigue-related car accidents. However, the development of such systems encounters many difficulties related to fast and proper recognition of a driver's fatigue symptoms. One of the technical possibilities to implement driver drowsiness detection systems is to use the vision-based approach. The technical aspects of using the vision system to detect a driver drowsiness are also discussed. Drowsiness and Fatigue of drivers are amongst the significant causes of road accidents. Every year, they increase the amounts of deaths and fatalities injuries globally. In this paper, a module for Advanced Driver Assistance System (ADAS) is presented to reduce the number of accidents due to drivers fatigue and hence increase the transportation safety; this system deals with automatic driver drowsiness detection based on visual information and Artificial Intelligence. We propose an algorithm to locate, track, and analyze both the drivers face and eyes, a scientifically supported measure of drowsiness associated with slow eye closure.**

I. INTRODUCTION

Real Time Drowsiness behaviors which are related to fatigue are in the form of eye closing, head nodding or the brain activity. Hence, we can either measure change in physiological signals, such as brain waves, heart rate and blinking to monitor drowsiness or consider physical changes such as sagging leaning of driver's head and open/closed state of eyes. The former technique, while more accurate, is not realistic since highly sensitive electrodes would have to be attached directly on the driver' body and hence which can be annoying and distracting to the driver. In addition, long time working would result in perspiration on the sensors, diminishing their ability to monitor accurately. The second technique is to measure physical changes (i.e. open/closed eyes to detect fatigue) is well suited for real world conditions since it is non-intrusive by using a video camera to detect changes. In addition, micro sleeps that are short period of sleeps lasting 2 to 3 minutes are good indicators of fatigue. Thus, by continuously monitoring the eyes of the driver one can detect the sleepy state of driver and a timely warning is issued. Driver in-alertness is an important resulting from sleep deprivation or sleep disorders and is an important factor in the increasing number of the accidents on today's roads. Drowsy driver warning system can form the basis of the system to possibly reduce the accidents related to driver's drowsiness. In a year there were 824 fatalities recorded in NHTSA's FARS database that were drowsy driving -related. According to the results of the study presented at the International Symposium on Sleep Disorders, fatigue of drivers is responsible for30% of road accidents[1] Different techniques are used in driver-fatigue monitoring systems. These techniques are divided into four categories. The first categories includes intrusive techniques, which are mostly based on monitoring biomedical signals, and therefore require physical contact with the driver. The second category includes non-intrusive techniques based on visual assessment of driver's bio behavior from face images. The third category includes methods based on driver's performance, which monitor vehicle behavior such as moving course, steering angle, speed, braking ,etc. Finally ,the fourth category combines techniques from the . above mentioned three categories. The computer vision based techniques from the second category are particularly effective, because the drowsiness can be detected by observing the facial features and visual bio-behavior such as head position, gaze, eye openness, eyelid movements, and mouth openness. Proposed algorithm is based on computer vision method. The main focus is on the detection of blinks by estimating the EAR(Eye aspect Ratio). This is achieved by monitoring the eyes of the driver throughout the entire video sequence. An IR camera will be used for capturing live video of driver eyes in all light conditions and frames will extracted for image processing scheme of video capturing .

II. LITERATURE SURVEY

A. Driver Drowsiness Detection System and Techniques

According to the experts it has been observed that when the drivers do not take break they tend to run a high risk of becoming drowsy. Study shows that accidents occur due to sleepy drivers in need of a rest, which means that road accidents occurs more due to drowsiness rather than drink-driving. Attention assist can warn of inattentiveness and drowsiness in an extended speed range and notify drivers of their current state of fatigue and the driving time since the last break, offers adjustable sensitivity and, if a warning is emitted, indicates nearby service areas in the COMAND navigation system.

B. Implementation of the Driver Drowsiness Detection System This paper is about making cars more intelligent and interactive which may notify or resist user under unacceptable conditions, they may provide critical information of real time situations to rescue or police or owner himself [2]. Driver fatigue resulting from sleep disorders is an important factor in the increasing number of accidents on today's roads. In this paper, we describe a real-time safety prototype that controls the vehicle speed under driver fatigue [2]. To advance a system to detect fatigue symptoms in drivers and control the speed of vehicle to avoid accidents is the purpose of such a mode. In this paper, we propose a driver drowsiness detection system in which sensor like eye blink sensor are used for detecting drowsiness of driver .If the driver is found to have sleep, buzzer will start buzzing and then turns the vehicle ignition off[2] .

C. Detecting Driver Drowsiness Based on Sensors Researchers have attempted to determine driver drowsiness using the following measures: (1) vehicle-based measures; (2) behavioral measures and (3) physiological measures [3]. A detailed review on these measures will provide insight on the present systems, issues associated with them and the enhancements that need to be done to make a robust system [3]. This paper reviews the three measures as to the sensors used and discuss the advantages and limitations of each. The various ways through which drowsiness has been experimentally manipulated is also discussed [3]. It is concluded that by designing a hybrid drowsiness detection system that combines non-intrusive physiological measures with other measures one would accurately determine the drowsiness level of a driver. A number of road accidents might then be avoided if an alert is sent to a driver that is deemed drowsy [3].

D. Eye Tracking Based Driver Drowsiness Monitoring And Warning System This project represents a way of developing an interface to detect driver drowsiness based on continuously monitoring eyes and DIP algorithms [4]. Micro sleeps are the short period of sleeps lasting 2 to 3 seconds, are good indicator of fatigue state. Thus by monitoring continuously the eyes of the driver by using camera one can detect the sleepy state of driver and timely warning is issued. Aim of the project is to develop the hardware which is very advanced product related to driver safety on the roads using controller and image processing [4]. This product detects driver drowsiness and gives warning in form of alarm and it also decreases the speed of vehicle. Along with the drowsiness detection process there is continuous monitoring of the distance done by the Ultrasonic sensor [4]. The ultrasonic sensor detects the obstacle and accordingly warns the driver as well as decreases speed of vehicle [4].

E. Driver Drowsiness Detection System: One of the major cause of traffic accident is Driver‘s drowsiness. It is a serious highway safety problem. If drivers could be warned before they became too drowsy to drive safely, some of these crashes could be prevented. In order to reliably detect the drowsiness, it depends on the presentation of timely warnings of drowsiness [5]. To date, the effectiveness of drowsiness detection methods has been limited by their failure to consider individual differences. Based on the type of data used, drowsiness detection can be conveniently separated into the two categories of intrusive and non-intrusive methods [5]. During the survey, non-intrusive methods detect drowsiness by measuring driving behavior and sometimes eye features, through which camera based detection system is the best method and so are useful for real world driving situations [5]. This paper presents the review of existed drowsiness detection techniques that will be used in this system like Circular Hough Transform, FCM, Lab Color Space etc [5].

III. EXISTING SYSTEM

The current drowsiness detection systems include the usage of the devices that detect the respiration rate, heart rate, blood pressure, etc. These devices can cause the driver to be uncomfortable for driving. Cannot be assured that the drivers wear these devices all the time while driving. May get lost or improper functioning which may lead to low accuracy in the result.
The existing system does not produce good results in low light conditions. If the light conditions are dark or too low it is unable to detect the face and eyes of the driver which results in lower accuracy.

IV. PROPOSED SYSTEM

4.1 Face and Eye Detection by Open CV Algorithms

In this approach to critical parts of face detection problems is given, based on analogic cellular neural network (Open CV) algorithms. The proposed Open CV algorithms find and help to normalize human faces is, effectively while cause for most accident related to the vehicles crashes. Driver fatigue their time requirement is a fraction of the previously used methods. The algorithm starts with the detection of heads on color pictures using deviations in color and structure of the human face and that of the background. By normalizing the distance and position of the reference points, all faces should be transformed into the same size and position. For normalization, eyes serve as point reference. Other Open CV algorithm finds the eyes on any grayscale image by searching characteristic is features of the eyes and eye sockets. Tests made on a standard database show that the algorithm works very fast and it is reliable. In proposed method, first the image is acquired by the webcam for processing. The images of the driver are captured from the camera which is installed in front of the driver on the car dashboard. It will be passed to preprocessing which prepares the image for further processing by the system. Its main operations are to eliminate noises caused by the image acquisition subsystem and image enhancement using Histogram Equalization. Then we search and detect the faces in each individual frame. If no face is detected then another frame is acquired. If a face is detected, then a region of interest in marked within the face. This region of interest contains the eyes. Defining a region of interest significantly reduces the computational requirements of the system. After that the eyes are detected from the region of interest. If an eye is detected then there is no blink and the blink counter is set to „20‟. If the eyes are closed in a particular frame, then the blink counter is decremented and a blink is detected. When the eyes are closed for more than 4 frames then it is deducible that the driver is feeling drowsy. Hence drowsiness is detected and an alarm sounded. After that the whole process is repeated as long as the driver is driving the car.

4.2 Face Detection

Face detection is accomplished by the Open CV algorithm proposed by Paul Viola and Michael Jones in 2001. Due to the complex background, it is not a good choice to locate or detect both the eyes in the original image, for this we will take much more time on searching the whole window with poor results. So firstly, we will locate the face, and reduce the range in which we will detect both the eyes. After doing this we can improve the tracking speed and correct rate, reduce the affect of the complex background. Besides, we propose a very simple but powerful method to reduce the computing complexity.

i) Open CV-like features: The simple features used are suggestive approaches of Open CV basis functions which have been used by Papageorgiouetal. A Open CV-like feature considers affixed rectangular regions at a specific part in a detection window; each Open CV like feature expressed by two or three jointed black and white rectangles shown in figure 2. The value of a Open CV like feature is the difference between the sums of the pixel values within the black and white rectangular regions. These sums are used to find the difference between regions. Then the differences can be used to classify the sub region of an image. These differences are compared against learned threshold values to determine whether or not the object appears in the region.

ii) Integral image The simple rectangular features of an image are calculated using an intermediate representation of an image, called the integral image as in (1) .The integral images are an array which consists of sums of the pixels‟ intensity values located directly to the left of a pixel and directly above the pixel at location (x,y) inclusive. Here, A[x,y] is the original image and Ai[x,y] is the integral image. $Ai[x, y] = \Sigma A[x', y']\ x' \leq x, y' \leq y$ (1) iii) Adaboost. Adaboost, nothing but "Adaptive Boosting ", It can be used with many other types of learning algorithms to improve their performance. Adaboost takes a number of positive and negative images features and training sets, The machine creates a set of weak classifiers of Open CV-like features. It selects a set of weak classifiers to combine and that assigns lesser weights to good features whereas larger weights to poor features. This weighted combination gives strong classifier.

iii) Cascaded classifier: The cascade classifier consists of number of stages, where each stage is a collection of weak learners. The weak learners are simple classifiers known as decision stumps. Boosting is used to train the classifiers. It provides the ability to train a highly accurate classifier by taking a weighted average of the decisions made by the weak learners. Each stage of the classifier shows the region defined by the current location of the sliding window as either positive or negative. Positive indicates an object was found and negative indicates no object. If the label is negative, the classification of this region is complete, and the detector shifts the window to the next location. If the label is positive, the classifier passes the region to the next stage. The detector reports an object found at the current window location when the final stage classifies the region as positive. It is used to eliminate less likely regions quickly so that no more processing is needed. Hence, the speed of overall algorithm is increased.

4.3 System Architecture

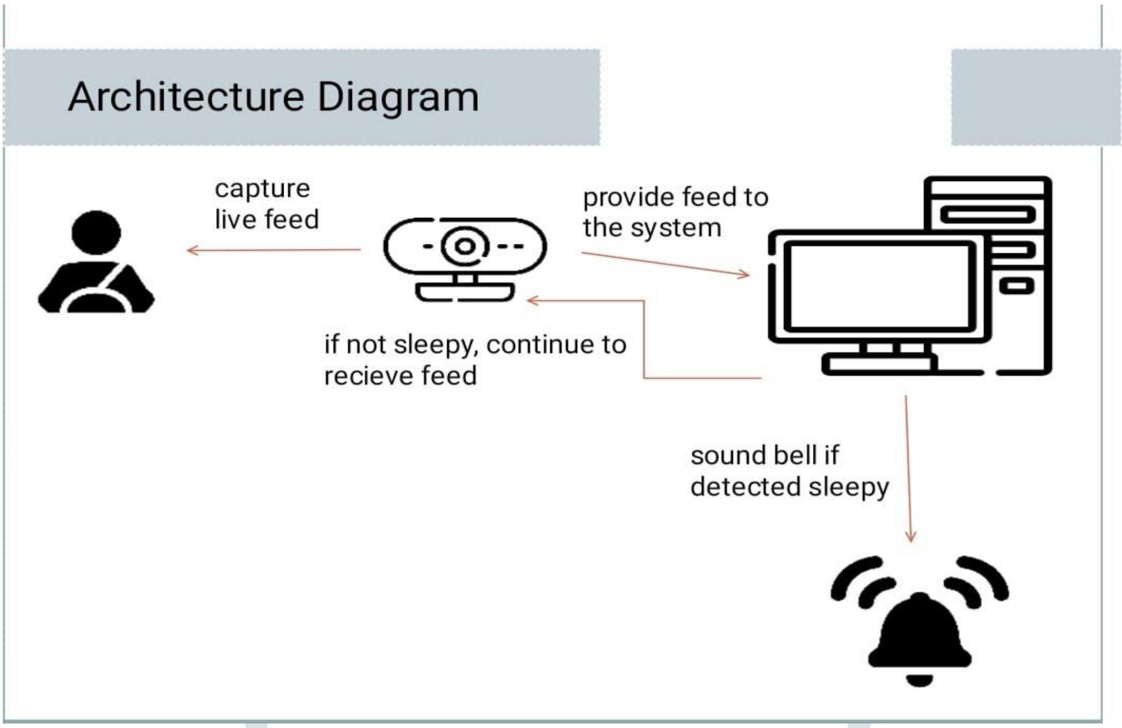

Fig 1 System Architecture of drivers drowsiness detection system

The Driver drowsiness Detection System will be having a camera which will be capturing the live feed of the drivers facial and eye expressions. The camera will be sending the live feed to the system. Depending on the eye expression if the driver is detected to be sleeping, the alarm will ring. If the driver is not sleepy then the recording will continue.

4.4 Algorithm Used- EAR and Open CV Algorithms:

Using Eye Aspect Ratio(EAR) technique. A developed system that occupied with the camera, dlip and cv2 modules are used to detect and analyse continuously the state of eye closure in real time. This system able to recognize whether the driver is drowsy or not, with the initial, wearing spectacles, dim light and micro sleep condition experimental conducted successfully give 90% of accuracy.

$$EAR = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

4.5 Block Diagram

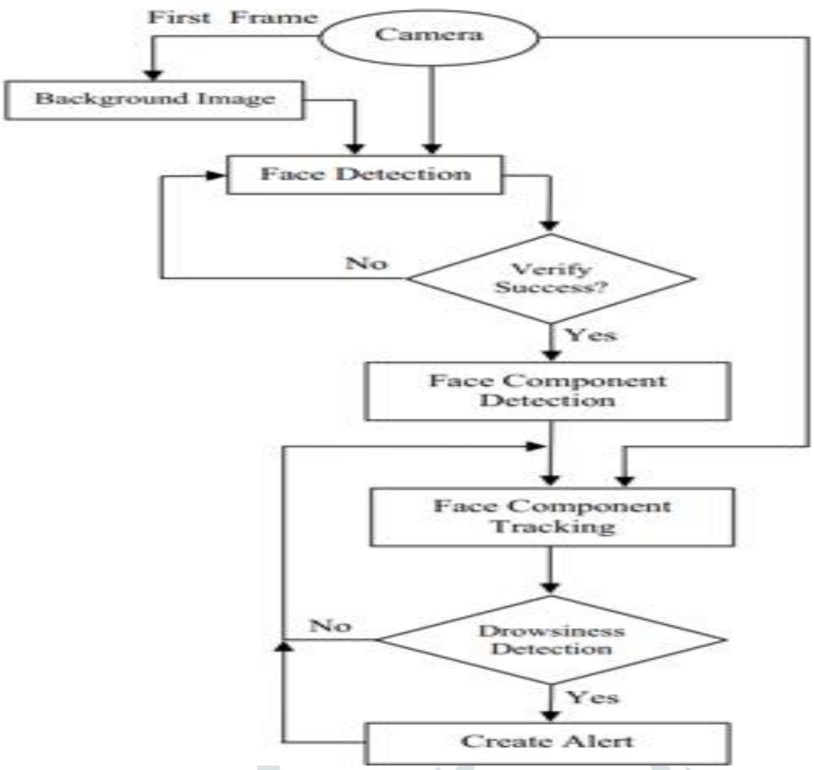

Fig 2 System Flow

Following are the components used for development of drowsiness detection system.

SL.NO	COMPONENTS	SPECFICATION
1	system	Intel® core ™ 2 duo
2	monitor	19 inch
3	Hard disk	160GB
4	Ram	8GB
5	camera	Standard web cam or dashcam
6	mouse	Optical scroll mouse
7	CPU	E7300@2.66HZ

Table 1 Hardware Requirement Specifications

SL.NO	COMPONENTS	SPECFICATION
1	Operating System	Windows
2	Coding language	Python
3	Packages required	Open CV, CV2, Dlib ,hypot, play sound

Table 2 Software Requirement Specifications

V. IMPLEMENTATION

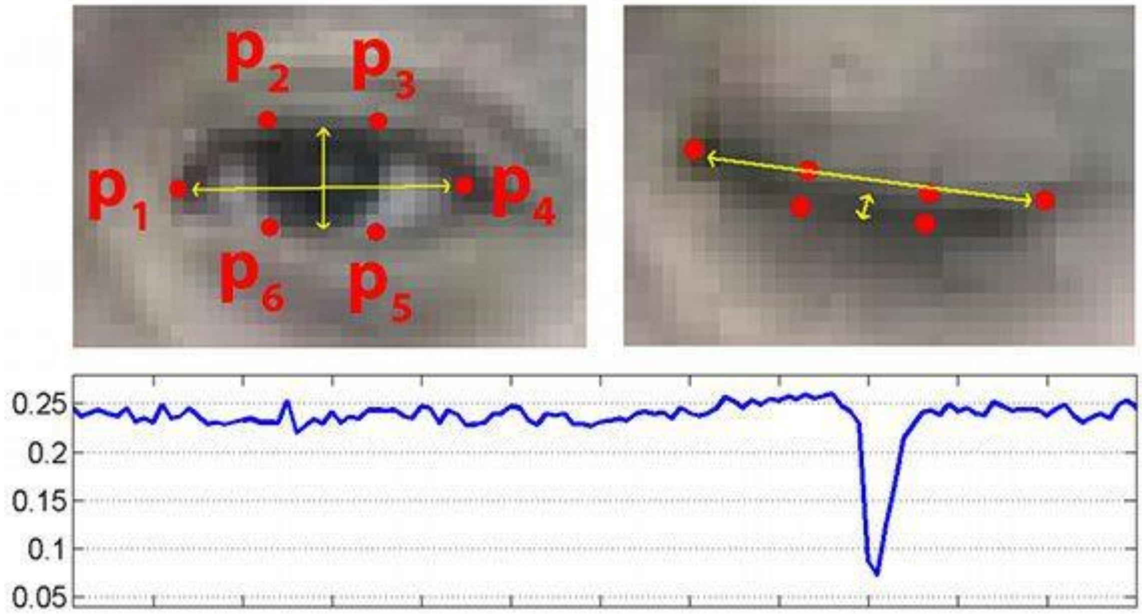

Fig 3 Eye detection

Using EAR technique the status of the eye is detected. As we can see six points p1,p2,p3,p4,p5,p6 are marked on the eye. If the eye is closed then the points will collide and it will detect that the driver is sleeping or drowsy.

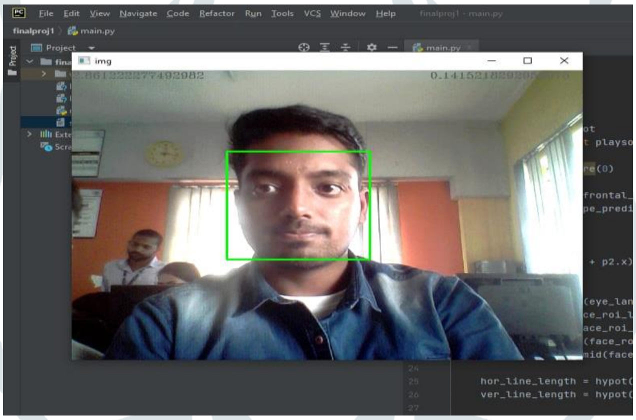

Fig 4 face detection

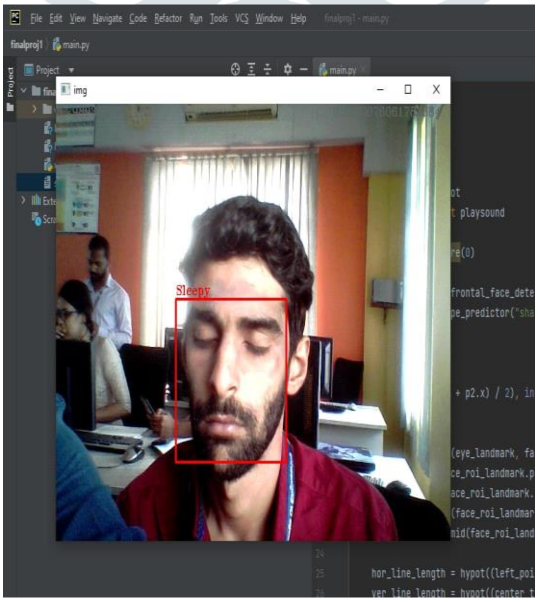

Fig 5 Drowsiness Detection

Using the camera the face is detected in the frame which will be monitored throughout. If the eyes are closed for a for a long period of time then the system will tell us that the person is drowsy or sleepy and the alarm will ring.

VI. CONCLUSION

This project tells how to build a drowsiness detector using Open CV, Python, and Dlib open source Libraries. The first step in building a blink detector is to perform facial landmark detection to localize the eyes in a given frame from a video stream. The eye aspect ratio for each eye can be calculated using Euclidian distance functions of OPEN CV , which is a singular value, relating the distances between the vertical eye landmark points to the distances between the horizontal landmark points. Once the eye aspect ratio calculated, algorithm can threshold it to determine if a person is blinking the eye aspect ratio will remain approximately constant when the eyes are open and then will rapidly approach zero during a blink, then increase again as the eye opens. The duration of blink further provide estimation of micro sleep. The proposed algorithm has been tested on personal car driver for testing purposes. For authentic results, the camera position was focused on the driver's face. Further, the algorithm has been tested in day time driving and Night time using IR camera. The results are discussed in Result section and found satisfactory. The proposed algorithm focused solely on using the eye aspect ratio as a quantitative metric to determine if a person has blinked in a video stream. However, due to noise in a video stream, subpar facial landmark detections, or fast changes in viewing angle, a simple threshold on the eye aspect ratio could produce a false-positive detection, reporting that a blink had taken place when in reality the person had not blinked. To make our blink detector more robust to these challenges further following improvements can be implemented Computing the eye aspect ratio for the Nth frame, along with the eye aspect ratios for N – 6 and N + 6 frames, then concatenating these eye aspect ratios to form a 13 dimensional feature vector.

VII. REFERENCES

[1]Association for international road travel(ASIRT),road crash Statistics.http://asirt.org/initiatives/informingroadusers/road-safety-facts/road-cras h-statistics, 2016

[2] https://en.wikipedia.org/wiki/Microslee

[3] Journal of VLSI Signal Processing 23, 497–511 (1999) c °1999 Kluer Acadmic Publishers. Manufactured in The Netherlands.

[4] https://docs.opencv.org/trunk/d7/d8b/tutorial_py_face_de tection.html

[5] Eye Detection Using Morphological and Color Image Procesing Tanmay Rajpathaka, Ratnesh Kumar and Eric Schwartzb

[6] A Robust Algorithm for Eye Detection on Grey Intensity Face without Spectacles- JCS&T Vol. 5 No. 3

[7] Froba Kebbuck: Audio- and Video-Based Biometric Person Authentication, 3rd International Conference, AVBPA 2001, Halmstad, Sweden, June 2001. Proceedings, Springer. ISBN 3-540-42216-1.