SLEEP DETECTION SYSTEM

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Abstract

In today's day by day developing technological area, automobiles have become more of a software tool than a mechanical tool. Moreover, safe driving becomes more important than motor technologies. Considering these, in this study, we focus on safe driving and we develop a system that can make alert in emergency situations. While developing our proposed system, we consider the driver of a vehicle as an object representation and then we measure the distance of this object to a camera placed in this vehicle using specific distance measures. The performance evaluation results of our proposed model prove that it is quite effective for assisting safe driving.

~~As a priority when designing our project, we needed an open source image processing library. At this point, we have reviewed many projects that will be examples of image processing and computer vision thanks to OpenCV. Finally, we have prepared an algorithm to get the security alert we want. A measurement will be made between the driver's eyes and the steering wheel while the driver is actively at vehicle. The result of this measurement will give a warning message on the screen with the arrival of the driver at a dangerous distance, that is, if he gets too close to the steering wheel. In this way, it will reflect a safety warning for the driver. Another issue I would like to mention here is the incident when the driver falls asleep, that is, if his eyes are completely closed or yawned, the warning system is activated. Because this is also a very dangerous situation in traffic.~~

Keywords: *Driver, Safety, Security* ~~***Clothes; Color Detection; Filtering.***~~

~~1.~~ Introduction

~~**In today's conditions, clothing and accessories consumption is increasing. This increased consumption can make people to have difficulty in finding a color outfit or jewelry they require which in return causes a lot of energy and time consumption. Considering this problem, a model detecting the color of the clothes and accessories required and then displaying the images of the clothing and accessory data it contains according to their color is developed in this study. It could be easily stated that color is the significant feature for our proposed model. Human eyes and brain work in coordination to convert light into color, and light receptors in the eyes transmit the signal to the brain, which in turn recognizes color. Adapting this strategy to the machines is the key factor in identifying the color names in the developed model and fulfilling its main task. To express the color of some pictures, Red, Green, Blue (RGB) based color recognition system [1] is used. In this system, each color always consists of 3 values between 0 and 255 followed by RGB [1]. In the literature, there are some models relying on this system, for instance; Lee et. al. [2] applied the color identification technique for the NOKIA smart mobile device. This system uses phone cameras to**~~

Biçimlendirilmiş: Girinti: İlk satır: 0 cm

Biçimlendirilmiş: Sağ: 0,5 cm, Satır aralığı: tek, Tek kalan satırları önleme

Biçimlendirilmiş: Başlık 1, Girinti: İlk satır: 0 cm, Numaralı + Düzey: 1 + Numaralandırma Stili: 1, 2, 3, … + Başlangıç: 1 + Hizalama: Soldan + Hizalandığı yer: 0,5 cm + Girinti yeri: 1,14 cm

~~recognize colors. This system's disadvantage is to only use three basic colors (red, green, blue) [2]. Duth et.al. shade and model images in the color detection system proposed in [3].~~

~~Contrary to the existing systems in the literature, using RGB in our proposed model is not efficient. The reason behind this is that it is desired and aimed to detect the color of a currently displayed image and to show its color in our model. For this purpose, the HSV in OpenCV method is used in our proposed study. There are red, green, and blue colors in the HSV method but in addition to these there are H, S, V. In HSV, color can be changed with 'H', saturation can be changed with 'S', value can be changed with 'V'[4]. This makes it easier to adapt the system to real life. Another reason for using this method is that the CCD camera used to define color in more complex systems is not used. The abbreviation for this camera is device with charging connection. Cameras with such image sensors perform well in low light conditions [5]. But in the proposed system, the webcam is used to detect the object.~~

~~In our proposed model, another important factor other than color is to save the data in the system and display it on the screen. The filing method was used to make this happen. With this simple and time-saving filing (dataset) method, the desired images are displayed on the screen according to the colors. As a result, a webcam is used to model real life objects, the colors are determined by the HSV method to detect the colors of these objects and display on the screen, and a window is created using some libraries in Python. Colors can be printed on the screen with OpenCV. Finally, the requested data is displayed with the file system.~~

1. ~~The remainder of the article is organized as follows. The model proposed is introduced in the second section. The proposed model is discussed in section 3. In section 4, the results are presented. Finally, in section 4, conclusions and considerations for future work are presented.~~

With the day by day developing technology, automobiles have been considered as a software tool than a mechanical tool. When we look at recent years, they are more noted for their safe driving equipment than motor technologies. At this point, our main goal is to highlight the dynamism of safe driving. It is carelessness that causes thousands of traffic accidents every year. In this study, important causes such as inattention and insomnia are examined. In order to prevent these things, we believe that it is right for computer vision to come into play at this point. In addition to the safe driving, we want to design a system that could also be used as a stimulus system in emergency situations. It should also be used for unexpected head drops, sudden approach to the steering wheel, for example, in emergency situations such as a heart attack.

As a priority when designing our study, we use an open source image processing library. At this point, we have reviewed many projects that will be examples of image processing and computer vision thanks to OpenCV. Finally, we prepare an algorithm to get the security alert we want. A measurement will be made between the driver's eyes and the steering wheel while the driver is actively at vehicle. The result of this measurement will give a warning message on the screen with the arrival of the driver at a dangerous distance for instance if he gets too close to the steering wheel. In this way, it will reflect a safety warning for the driver. Another issue is the incident when the driver falls asleep, that is, if his eyes are completely closed or yawned, the warning system is activated. Because this is also a very dangerous situation in traffic.[3]

Thanks to the introduction of computer vision into our lives, it is possible for us to see autonomous vehicles. However, autonomous driving is being tested before autonomous vehicles. We also wanted to try a more reliable and inexpensive way of autonomous driving in our study. Its cost as an integration is low, and its application efficiency is high. At this point, it is possible to say that our project is distinctive.[5]

The remainder of the article is organized as follows. The model proposed is introduced in ~~the~~ second section. The proposed model is discussed in section 3. In section 4, the results are presented. Finally, in section 4, conclusions and considerations for future work are presented.

Biçimlendirilmiş: Başlık 1, Satır aralığı: tek

Biçimlendirilmiş: Başlık 1, Satır aralığı: tek, Numaralı + Düzey: 1 + Numaralandırma Stili: 1, 2, 3, … + Başlangıç: 1 + Hizalama: Soldan + Hizalandığı yer: 0,5 cm + Girinti yeri: 1,14 cm

Biçimlendirdi: Yazı tipi: 11 nk

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Biçimlendirilmiş: Normal, Girinti: Sol: 0 cm, İlk satır: 0 cm, Satır aralığı: Birden çok 1,15 satır

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Biçimlendirdi: Yazı tipi: 11 nk

2. Proposed Model

~~As a priority when designing our project, we needed an open source image processing library. At this point, we have reviewed many projects that will be examples of image processing and computer vision thanks to OpenCV. Finally, we have prepared an algorithm to get the security alert we want. A measurement will be made between the driver's eyes and the steering wheel while the driver is actively at vehicle. The result of this measurement will give a warning message on the screen with the arrival of the driver at a dangerous distance, that is, if he gets too close to the steering wheel. In this way, it will reflect a safety warning for the driver. Another issue I would like to mention here is the incident when the driver falls asleep, that is, if his eyes are completely closed or yawned, the warning system is activated. Because this is also a very dangerous situation in traffic.~~

The framework of our proposed system is presented in Figure 1. It shows the driver as an object representation. We use the focal length and distance formulas presented in this framework. In order to handle these formulas in our proposed model, we consider measuring the distance as can be observed from Figure 2. For measuring the distance, we proceed taking the distance at first from the shoulders of the drivers. Our pixel size and the distance we take from the heads of the shoulders successfully measured the distance when we approach the camera. However, no warning returns a signal. Then, we decide to draw the distance at eye level as the right place. At this point, the resource scanning discussed in the literature become quite useful to us. In this way, it has become more effective for us to analyze the driver's sleep stop or sudden health problem at eye level.[6]

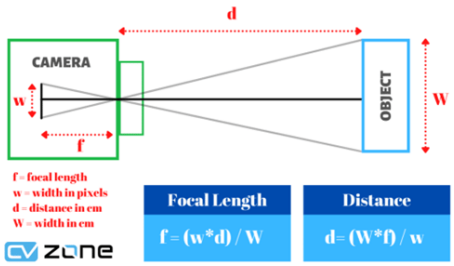

Figure 1. *The framework of our proposed model*

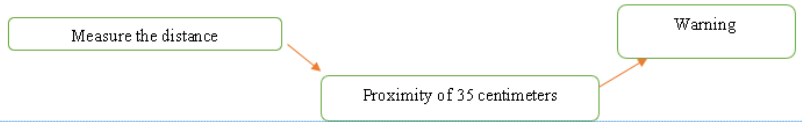

Figure ~~1~~2. *The distance measurement~~framework~~ of our proposed model ~~of the proposed model~~*

3. Results and Discussions

While deriving results using our proposed system, first of all, there is a section where the camera should be turned on on our current machine.[1] Then, in a while loop, our face section is located. We keep our FaceMash command “False". Because we don't want the driver to see the "FaceMashes" at this stage. Since we can calculate

Biçimlendirilmiş: Girinti: İlk satır: 0 cm
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Biçimlendirilmiş: Girinti: İlk satır: 0 cm
Biçimlendirilmiş: Girinti: İlk satır: 0 cm
Biçimlendirilmiş: Normal, Sola
Biçimlendirdi: Yazı tipi: Kalın Değil, İtalik
Biçimlendirilmiş: Resim Yazısı, Sonraki ile birlikte tutma
Biçimlendirilmiş: Girinti: İlk satır: 0 cm
Biçimlendirdi: Yazı tipi: Kalın Değil
Biçimlendirilmiş: Normal, Madde işaretleri veya numaralandırma yok
Biçimlendirilmiş: Resim Yazısı

the points in the background ourselves, we can determine the image closest to the natural image as “draw=False” both in terms of the driver's attention and in terms of the natural image. We have points inside the Try block. Thanks to these points, we are able to decipher the distance between the two eyes. After this distance, it remains to add conditions as seen in Figure 3. [4]

```
#kamera komutları
video = cv2.VideoCapture(0)
video.set(3, 1280)
video.set(4, 720)

detector = FaceMeshDetector(maxFaces=1)

while True:
    success, img = video.read()
    img, faces = detector.findFaceMesh(img, draw=False)

    try:
        face = faces[0]
        leftEye = face[145] #sol goz icin belirlenen nokta
        rightEye = face[374] #sag goz icin belirlenen nokta
        cv2.circle(img, leftEye, 5, (255, 0, 255), cv2.FILLED) #sol goz icin RGB renk tonlari
        cv2.circle(img, rightEye, 5, (255, 0, 255), cv2.FILLED) #sag goz icin RGB renk tonlari
        cv2.line(img, leftEye, rightEye, (0, 200, 0), 3)
        w, _ = detector.findDistance(leftEye, rightEye) #distance'i hesapladigimiz bolum
        W = 6.3
        # d = 50
        # f = (w*d)/W
        f = 740
        d = (W * f) / w
```

The condition block is the golden key to our security system. Because the value of 35 centimeters is peeped here. As soon as it drops below 35 centimeters, the warning system that will come out is kept here as seen in Figure 4.[2]

As seen from Figure 5, we also consider about closed eyes and yawning and while deriving detection decouple the the results. We as the distance pixels, measured them and lips.[7] We between the two eyelids trial and error. fix the ideal time by We press the same warning on the screen for situations that will occur due to yawning and drowsiness.[8]

Biçimlendirdi: Yazı tipi: 11 nk, İtalik Değil, Yazı tipi rengi: Metin 1

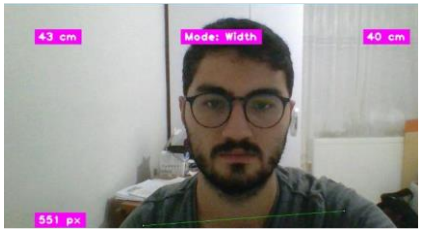
Biçimlendirilmiş: Resim Yazısı, Satır aralığı: tek, Madde işaretleri veya numaralandırma yok

Biçimlendirdi: Yazı tipi: Kalın Değil, Yazı tipi rengi: Metin 1

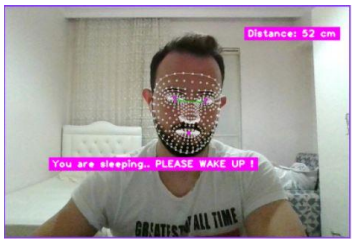
Açıklamalı [GNY1]: Slaaytlarda kameranin cekimini gosteren figure vardi diye hatirliyorum. Onu da bu sectiona koylim lutfen.

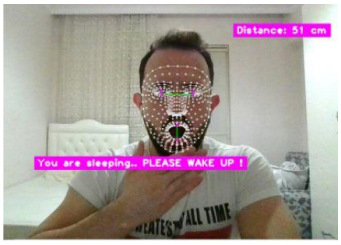
Biçimlendirilmiş: Normal, Madde işaretleri veya numaralandırma yok

~~2.~~

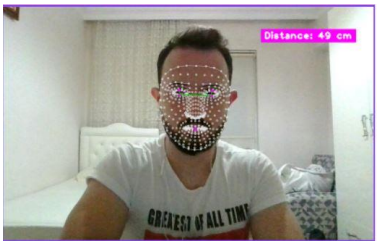


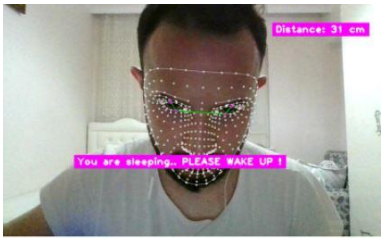
Biçimlendirilmiş: Normal, Girinti: Sol: 0,5 cm, Madde işaretleri veya numaralandırma yok





Biçimlendirilmiş: Normal, Girinti: Sol: 0,5 cm, Madde işaretleri veya numaralandırma yok





Biçimlendirilmiş: Normal, Girinti: Sol: 0,5 cm, Madde işaretleri veya numaralandırma yok

Figure ~~1~~3: FaceMash and Camera

Biçimlendirilmiş: Normal, Girinti: Sol: 0,5 cm, Madde işaretleri veya numaralandırma yok

Biçimlendirilmiş: Ortadan

```
    cvzone.putTextRect(img, f'Distance: {int(d)} cm', (900, 100), scale=2)
    if d <= 35: #condition is here
        cvzone.putTextRect(img, "You are sleeping.. PLEASE WAKE UP !", (300, 500), scale=2)


except IndexError:
    cvzone.putTextRect(img, "You are sleeping.. PLEASE WAKE UP !", (300, 500), scale=2)

cv2.imshow("Sleepy Driver Checker", img) #output
cv2.waitKey(1)
```

Figure ~~2~~4: Detection for 35 cm

```
cv2.circle(img, leftEye, 5, (255, 0, 255), cv2.FILLED)
cv2.circle(img, sagKasUst, 5, (255, 0, 255), cv2.FILLED)
cv2.circle(img, solKasUst, 5, (255, 0, 255), cv2.FILLED)
cv2.circle(img, rightEye, 5, (255, 0, 255), cv2.FILLED)
cv2.circle(img, ustDudak, 5, (255, 0, 255), cv2.FILLED)
cv2.circle(img, altDudak, 5, (255, 0, 255), cv2.FILLED)

cv2.line(img, leftEye, rightEye, (0, 200, 0), 3)
cv2.line(img, leftEye, solKasUst, (0, 200, 0), 3)
cv2.line(img, rightEye, sagKasUst, (0, 200, 0), 3)
cv2.line(img, ustDudak, altDudak, (0, 200, 0), 3)
w, _ = detector.findDistance(leftEye, rightEye)
closeEyePX, _ = detector.findDistance(leftEye, solKasUst)
yawnDistPX, _ = detector.findDistance(ustDudak, altDudak)
W2 = 2
W = 6.3
d = 50
f = 740
d = (W * f) / w
```

Figure ~~5~~3: Close Eye – Yawning Detection

Biçimlendirdi: Yazı tipi: Kalın Değil, Yazı tipi rengi: Metin 1

Biçimlendirilmiş: Resim Yazısı, Madde işaretleri veya numaralandırma yok

4. Conclusions and Future Work

In this study, we have focused on safe driving and we have developed a system that can make alert in emergency situations. We have considered the driver of a vehicle and then we have measured the distance of this driver to a camera placed in this vehicle in this system. Specific distance measurement equations have been considered while measuring these distances. The performance evaluation results of our proposed model have proven that the proposed system is quite effective for assisting safe driving.

~~3.~~

With the day by day developing technology, the detection time is significantly reduced, and even thanks to autonomous driving features, it is possible to park the car in a safe area at the time of danger, call for emergency assistance. We believe that we have released a system that is suitable for integration with the new technological improvements.

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Biçimlendirdi: Yazı tipi: Kalın

Biçimlendirilmiş: Girinti: Sol: 1,14 cm, Madde işaretleri veya numaralandırma yok

Biçimlendirdi: Yazı tipi: Kalın

Biçimlendirilmiş: Girinti: Sol: 1,14 cm, Madde işaretleri veya numaralandırma yok

Açıklamalı [GNY2]: Referanslar burada sirlandi ancak text icinde de nerede bu referanslaraa citation vrilecekse [referans numarasi] seklinde ifade edilmesi gerekmekte.

Biçimlendirilmiş: Girinti: İlk satır: 0 cm

Biçimlendirdi: Yazı tipi: 9 nk

Biçimlendirilmiş: Numaralı + Düzey: 1 + Numaralandırma Stili: 1, 2, 3, … + Başlangıç: 1 + Hizalama: Soldan + Hizalandığı yer: 0 cm + Girinti yeri: 0,63 cm

Biçimlendirilmiş: Girinti: İlk satır: 0 cm