Course Title: Microprocessor Interfacing and Assembly Language Lab

Section: 03

Group No.: 07

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Driver Drowsiness Detection & Alert System Device

Introduction

Driver fatigue (‘falling asleep at the wheel’) is a major cause of road accidents. Feeling drowsy driving is a common phenomenon. As it hampers the vision due to dizziness. So to overcome this problem we’ll develop a system device which will overcome this problem. For the Road safety technology, this device will help to reduce the accidents that are caused by driver drowsiness. It is mainly for the safety of the people who travel & drive.

One mistake of the driver can lead to severe damages or physical injuries, deaths and consequential economic losses. The idea of elaborating such a device emerges from several aspects to concern about the safety of the people and economic losses. There are various reasons especially human errors which give rises to road accidents. The recent reports say that there is a huge increment in road accidents in every country along with Bangladesh in the last few years. In 2020, cumulatively a total of 5,397 accidents on roads, railways and killed 7,317 people and injured 9,021 others. It is a necessary step to come with an efficient technique to detect drowsiness as soon as the driver feels sleepy and give an alert before any could go wrong.

A detailed review of the report will provide intuition on this detection and alert system, issues equated with it. The enhancements that need to be done to make a strapping system.

Methodology

The methodology in our planned system “Driver sleepiness Detection & Alert System Device” is as follows:

1. **Video Recorder**

The Raspberry Pi3 camera is combined with a video camera that captures continuous video stream in sensible quality. Recorded video stream is regenerate into a few frames that area unit forwarded to face detection step.

2. **Face Alignment with OpenCV and Python**

Facial alignment could be a normalization technique, usually accustomed to improving the accuracy model of the face recognition algorithms. to place within the facial alignment accuracy, OpenCV and Python area unit applied here. The goal of facial alignment is to transform an input coordinate area to an output coordinate area, specified all faces across a whole dataset.

3. **Eyeblink detection with OpenCV, Python, and dlib**

The first step in building a blink detector is to perform facial landmark detection to localize the eyes exploitation given frame from a video stream. to make a blink detector exploit OpenCV, Python, and dlib. Once obtaining the facial landmarks for each eye, the aspect ratio for every eye will be computed, which provides input as a singular value. To relate the distances

between the vertical eye landmark points to the distances between the horizontal landmark points.

Procedures:

For our project, we used several components. All together they create a network that can not only reduce road accidents but also it can save several more lives. Our components list given below:

(a) Arduino Nano

(b) Raspberry pi 4

(c) Arduino Uno R3

(d) HC-05

(e) Buzzer Module

(f) Vibrator Motor

(g) GPS Module NEO-6M

(h) GSM Module SIM800L

(i) Battery

(j) Jumper Wires

(k) Some resistors

(l)Raspberry pi camera

Analysis: Our project is divided into 3 main parts. The first one is the raspberry pi which continuously monitors the face and eye landmarks of a driver.

The *dlib* library is arguably one of the foremost used packages for face recognition. A Python package fittingly named face_recognition wraps *dlib*'s face recognition functions into a straightforward, simple-to-use API.

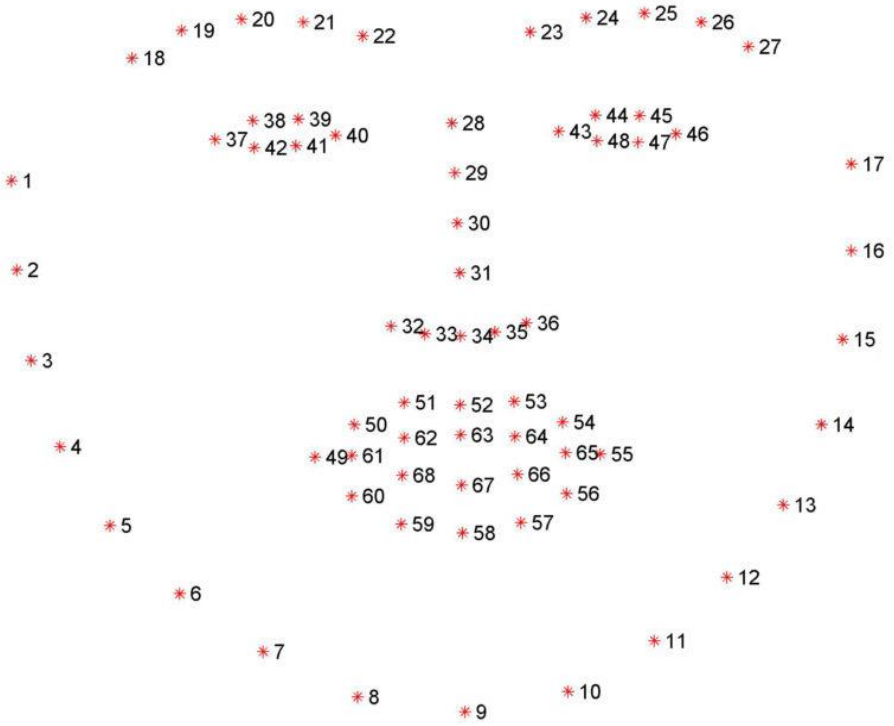

Fig.: Visualizing 68 face landmarks from *dlib* library *shape_predictor_68_face_landmarks.dat*
(Ref.: https://www.pyimagesearch.com)

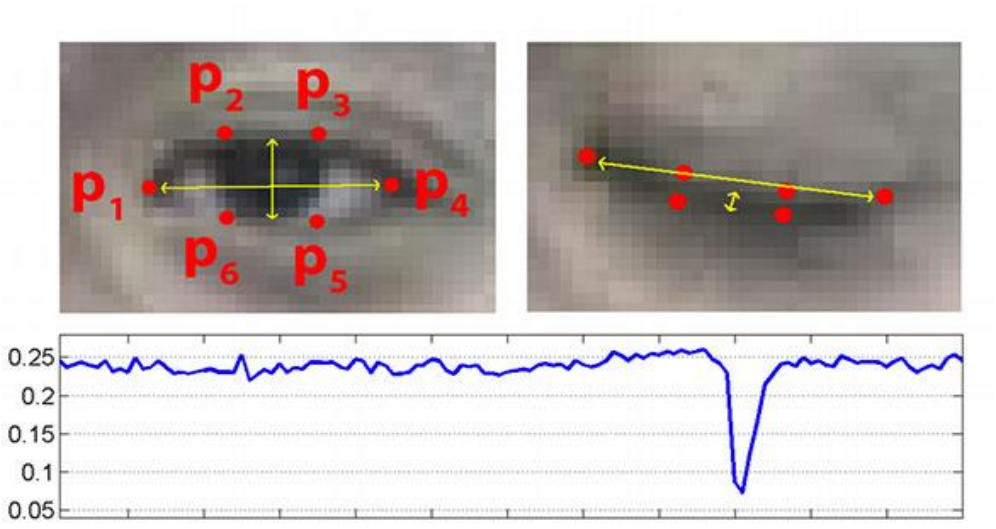

Fig. Visualizing eye landmarks
***(Ref.:* https://vision.fe.uni-lj.si/cvww2016/proceedings/papers/05.pdf)**

After processing each frame, the system decides eyes are open or not for more than 3 seconds. If not, then it decides drowsiness and shows an alert message in the screen then turns on the buzzer attached to itself then sends an alert signal to the Arduino master. If drowsiness is detected more than 2 times it initiates an emergency system and sends it to the Arduino master.

In our second part of the project, we used an Arduino Uno R3 to manage every command coming from the raspberry pi. First, the Arduino waits for signals from raspberry pi, if it receives an Alert then it turns on a buzzer attached to itself and sends commands through Bluetooth to the Arduino slave wristband to do its job. If the Arduino master receives an Emergency signal from the raspberry pi then it initiates the emergency commands first it gets the GPS signal from our GPS module, then it turns on the GSM module to connect to the GSM Network. When the Arduino gets connected to a network it sends the GPS data to the emergency system to track the vehicle. First, the emergency system tries to contact the driver by getting driver data for the BRTC Database. If he continues feel drowsiness, the data from the emergency system goes to the nearest Highway police patrolling station to track the vehicle to prevent Road accidents. This emergency system is what we planned to do as well as we also planned to detect road accidents to prevent more deaths. The program will continuously monitor the speed of the vehicle then if the vehicles speed suddenly drops then also if any kind of smoke or gas detected inside the vehicle the system will send an Emergency Accident Alert to the system with the GPS data and a picture of that vehicle and then the system will check if any kind of accident occurred or not if accident detected the system will send the GPS data to the nearest Police, Ambulance and Fire Department to save more lives.

In our third part, we made a wireless wristband connected to the Arduino master by Bluetooth. When it receives an alert signal from the Arduino Master it turns on a buzzer and two vibrating motors to prevent drowsiness of the driver.

Findings/results:

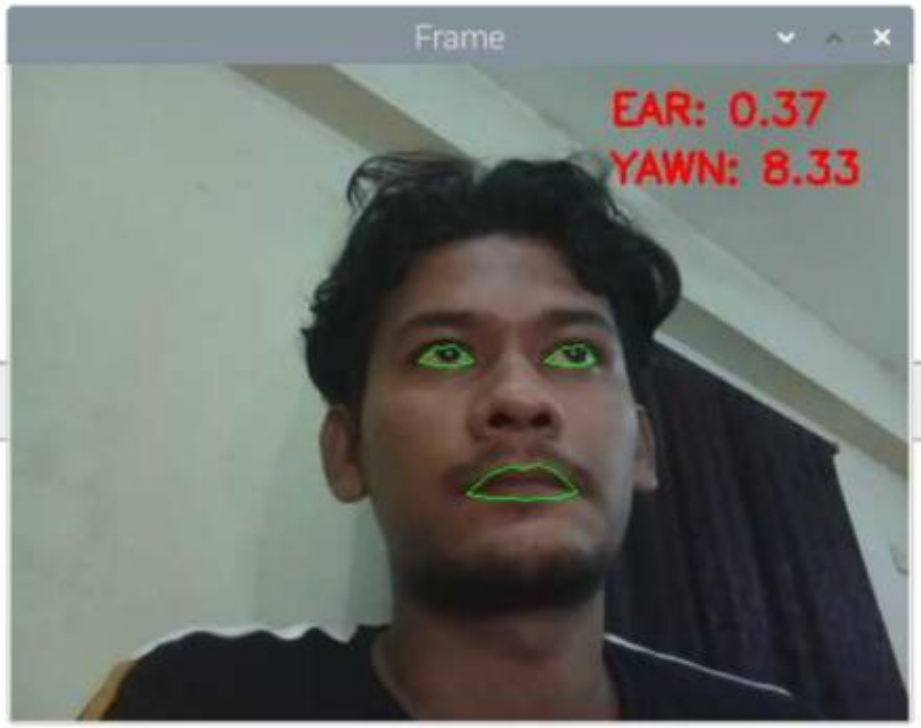

Fig.:Detecting face landmarks.

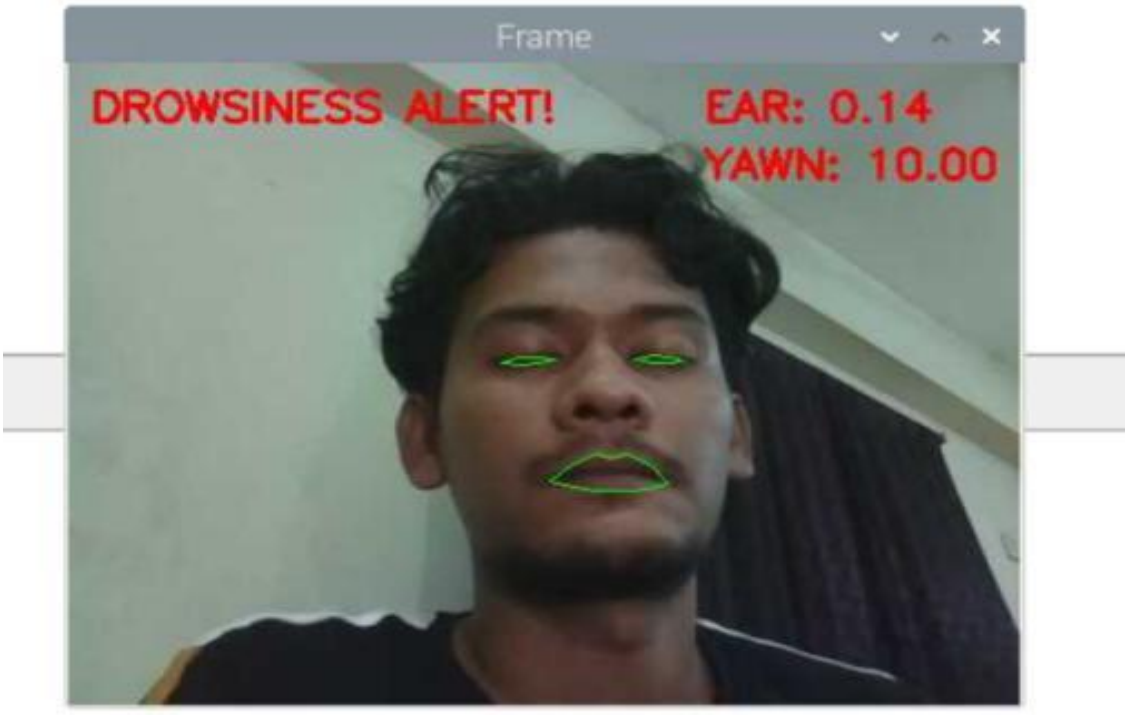

Fig.:Detecting Drowsiness.

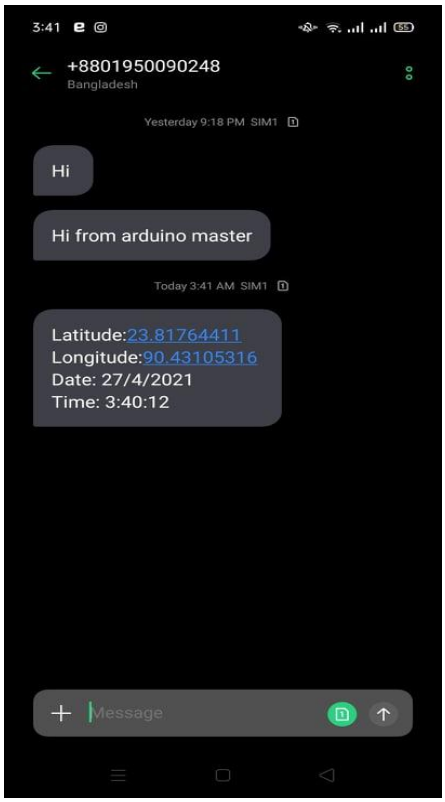

Fig.: Alert SMS received on mobile

After detecting drowsiness, the emergency system activates and sends GPS data to the emergency contact for further process.

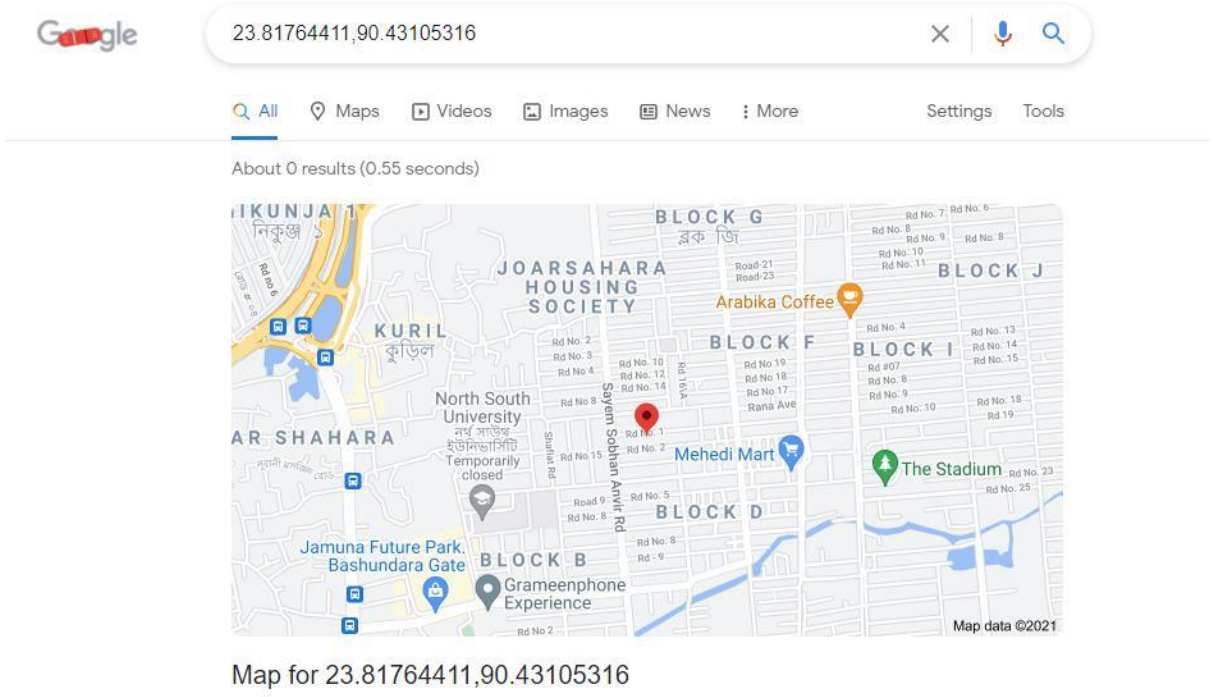

Fig.: Map locates the place of collision

Discussion

From the analysis of the tested result, it can be concluded that exploitation face landmarks don't modification under any conditions and its performance is a lot of accurate than the cascaded method. But this method takes a little bit longer to load at deep visual modality than the cascaded technique. Thus, this planned system has provided an efficient or eminent drowsy detection exploitation of the facial landmark method in addition as another interface for detection of collision because of drowsiness or unconscious state of driving. However, it's tested on 3 persons with varied situations and detection of drowsiness warned through speaking alarm with a connected SMS sent to the owner or authority whereas the random data set forwarded to the current system to visualize its practicality and it performed in 93.1% accuracy. because of this reason, this method can be additionally helpful for observation the fatigue of the driver and the impact of collisions.

At the end of the development of our planned system by trial and error, there are some research practices we could have done to our research in a better way:

a) **Broad research:** It is a lengthy task, so it is important to know where to start.

b) **Quality of source:** It is crucial to recognize and find the actual good sources from the average ones. For determination from a reliable source, to grow analytical skills and critical thinking, agree with other sources we need to explore and verify information from some authentic sources.

c) **Organized Plan:** During the resource articles, data collection process, we could have planned a more organized idea.

d) **Work management:** Our teamwork can be more effective if we know each other very well to adapt their skilled quality to work in an organized manner.

Conclusions and Recommendations

This analysis provides a sturdy method for detecting the drowsiness of drivers and collision impact (severity) systems within the present. This method usually combines 2 different systems in one integrated system. But the present techniques area unit supported the psychological or vehicle-based approach to finding the drowsiness of drivers and additionally, the severity of the collision is individually measured, however, such technology is very intrusive additionally as totally activates the physical setting. So, the planned system is used to construct a non-intruding technique for measurement the drowsiness of the driver with the severity of collision because of braking or mishap.

This system’s main parts area unit the Raspberry Pi camera module that's used for the persistent recording of face landmarks that area unit localized through facial landmark points then to calculate the aspect ratio of the eyes. However, if the calculated quantitative relation value will increase from the threshold value, then the eyes area unit kept open and no modification within the state of the system happens. Similarly, if the aspect ratio of the eyes value falls from the threshold value, then the system desperately alerts the exploitation through speech speaker and warning SMS to the authority (owner) for further validating alertness to the driver. additionally, measuring of collision severity (impact) is formed through the implementation of sensors with the GPS module to properly track the situation of the accident

thereby alerting the nearer medical service center to serve emergency identification. As part of the recommendations, we can develop this system more user effectively. So that it can create an impact on the automobile industry to grow interface capabilities to make a user-friendly system.

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