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System for Detecting Driver Alertness while Driving

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Abstract: ***In this project, we are going to present a system for sleep detection alarm to monitor the driver, based on the real time surveillance and alert him as well as post it at remote location whenever it's necessary using cloud platform. This device is to be developed using the Raspberry Pi, Open CV library and camera module. The required coding part of the project will be done using Python language. The main component of the project will be pretrained landmark detector as a software part. It identifies 68 points on the human face. The Dlib's landmark will detect 68 facial landmarks which enables us to extract the various facial structures using simple Python array slices. The facial landmarks of fully closed eye and a fully opened eye will be first plotted. This data is further processed and tested with some results which will give the information about driver's alertness. Once the facial landmarks associated with an eye are determined, we can apply the Eye Aspect Ratio (EAR) algorithm. In our case, we'll be monitoring the eye aspect ratio to see if the values of the facial landmarks, thus implying that the driver/user has closed their eyes or distracted from driving or yawn. Once implemented, our algorithm will start by localising the facial landmarks on real time basis. We can then will be able to monitor the eye aspect ratio to determine if the eyes are close or nearly close which will be the indicator for driver is falling asleep. And then finally raising an alarm if the eye aspect ratio is below a pre-defined threshold for a sufficiently long amount of time. The alarm will be loud enough to wake up the driver and bring back his attention. At the same time data is passed to remote location using cloud whenever it's necessary.***
Keywords: Opencv, raspberry pi, camera module, python, machine learning

I. INTRODUCTION

Car accident issue is current a serious epidemic in all countries in the world as it can lead to unpreventable deaths and several other severe consequences. Every year, car accidents kill nearly 1.5 lakh people and result in hundreds of thousands of injuries. Therefore, it is important to understand some factors that mainly contribute to car accidents and how to avoid them!

According to WHO and World Bank, nearly 1.8 lakh people died in India on the road in 2019 and the number is predicted to rise by to 65 percent by the year 2020. Besides, car accidents are the leading cause of death in the developed countries like United States. Owing to the mentioned statistics, it cannot be denied that a car accident is one of the most dangerous killers. It is important for us to know what is causing the car accident issues to avoid undesired consequences. The negative effects of car accidents may include the loss of earning, injuries or even death, so it is important to ensure how to get safer when driving on the road and knowing clearly about the major causes of car accidents. Almost car crashes are caused by human errors so we can say that the greatest threat is the drivers themselves. The causes of car accidents:

A. Distracted Driving
B. Drunk Driving
C. Rain
D. Reckless Driving
E. Speeding
F. Running the Red Light
G. Unsafe Lane Changes

Leading cause of car accidents in the India. In order to drive car safely, drivers should not take focus off the road. In fact, they usually take a call, send a text message, listen to music or eat food without knowing that they are the major threats on the lives when driving on the road. As you can see, more than one distraction driver does one or more of these things. For example, when drivers are driving, they want to have a glance outside the window. Meanwhile, they also have to take their focus off the road to look at what is going on outside to fulfil their curiosity. Besides, they have more action in distracted driving to be more likely in a car accident or car crash. So, our project mainly focuses on building an accessory that can keep a check on the driver. It will in turn help in reducing the number of road accidents, using simple, low-cost devices affordable to all.

II. METHODOLOGY

A. *Block Diagram*

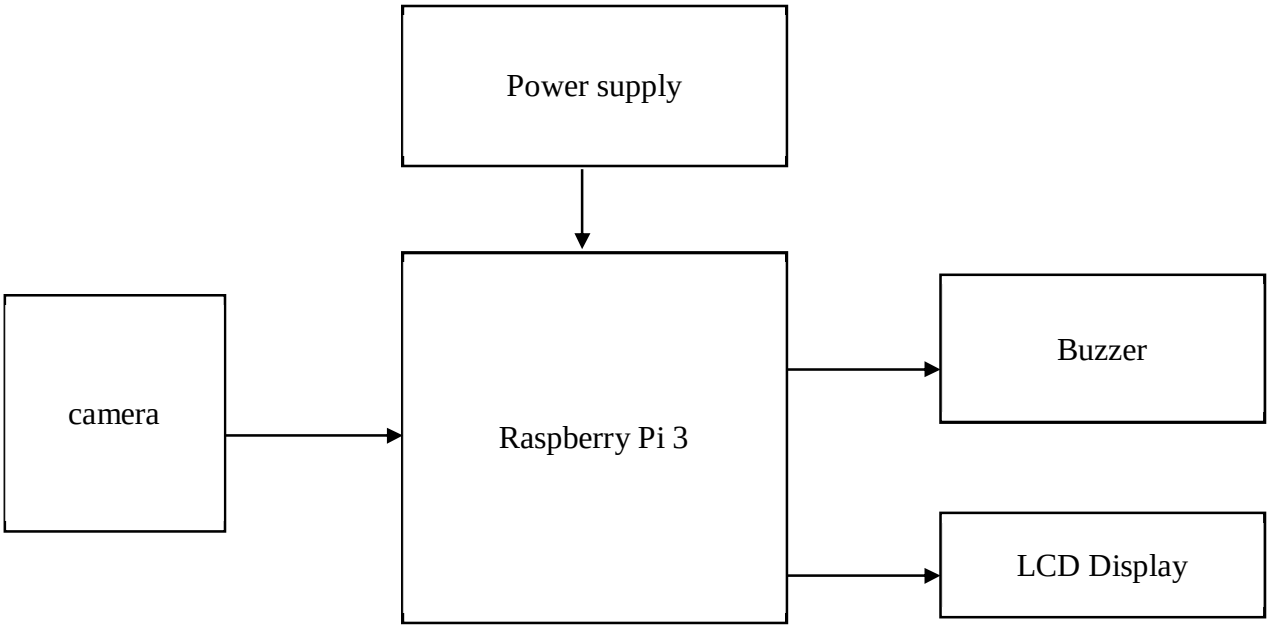

Figure 1- Block diagram

Description of each block of above block diagram:

1) *Camera:* It will act as a input block in the project. It will detect the diver's face and will detect the landmarks points on the face of a driver.
2) *Power Supply:* Power Supply The power supply requirements differ by Raspberry Pi model. All models require a 5.1V supply, but the current supplied generally increases according to model. All models up to the Raspberry Pi 3 require a microUSB power connector, whilst the Raspberry Pi 4 uses a USB-C connector.
3) *Raspberry pi:* It will be interfaced with the camera module. Raspberry Pi is always a good choice for Image processing projects as it has more memory and speed than other controllers. It is mostly used Raspberry Pi for some complex image processing projects like facial landmark detection and Face recognition application.
4) *Buzzer:* After the comparing the position of eyes and face of driver to standard image the buzzer will be get activated which is enough to wake up sleeping driver.

III. HARDWARE COMPONENTS

A. *Raspberry PI*

Raspberry Pi is the name of a series of single-board computers made by the Raspberry Pi Foundation, a UK charity that aims to educate people in computing and create easier access to computing education. The Raspberry Pi launched in 2012, and there have been several iterations and variations released since then. The original Pi had a single-core 700MHz CPU and just 256MB RAM, and the latest model has a quad-core 1.4GHz CPU with 1GB RAM. All over the world, people use Raspberry Pi to learn programming skills, build hardware projects, do home automation, and even use them in industrial applications. The Raspberry Pi is a very cheap computer that runs Linux, but it also provides a set of GPIO (general purpose input/output) pins that allow you to control electronic components for physical computing and explore the Internet of Things (IoT). The Raspberry Pi 3 Model B is the third generation Raspberry Pi.

Figure 2.Raspberry PI module

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B. Camera Module

The 5MP Raspberry Pi 3 Model B Camera Module with Cable equips flexible cable for attaching with Raspberry Pi 3 Model B. The 5MP camera module is perfect for small Raspberry Pi projects which have very little space allowance just boot up the latest version of Raspbian. The high-definition 5MP camera delivers outstanding photos but can also shoot video, ideal for drones or a CCTV project. The lightweight camera module allows for it to be used in more practical roles, such as a hidden camera or even a camera for a Pi-phone, for example, This Raspberry Pi Camera Module is a custom designed add-on for Raspberry Pi. It attaches to Raspberry Pi by way of one of the two small sockets on the board upper surface. This interface uses the dedicated CSI interface, which was designed especially for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data. The board itself is tiny, at around 25mm x 23mm x 8mm. It also weighs just over 3g, making it perfect for mobile or other applications where size and weight are important.

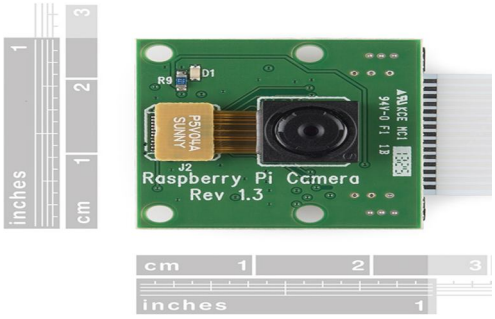

Figure 3.camera module

C. Memory Card

A memory card is a type of storage device that is used to store videos, photos, or other data files. It offers a volatile and non-volatile medium to store data from the inserted device. It is also referred to as a flash memory. Commonly, it is used in devices like phones, digital cameras, laptops, digital camcorders, game consoles, MP3 players, printers, and more.

Figure 4.Memory card

D. BUZZER

An Active Buzzer Alarm Module for Arduino is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Just like what you are viewing now, it is 3.3V-5V DC Electronic Part Active Buzzer Module. Using top quality material, it is durable in use. An active buzzer rings out as long as it is electrified. Compared with a passive buzzer, it is a bit expensive but easier to control. Typical uses of buzzers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Figure 5.Buzzer

IV. SOFTWARE COMPONENTS

A. Python IDE

An IDE (or Integrated Development Environment) is a program dedicated to software development. As the name implies, IDEs integrate several tools specifically designed for software development.

Most IDEs support many different programming languages and contain many more features. They can, therefore, be large and take time to download and install. You may also need advanced knowledge to use them properly.

Figure 6.Python IDE

B. VNC Viewer

In computing, Virtual Network Computing (VNC) is a graphical desktop-sharing system that uses the Remote Frame Buffer protocol (RFB) to remotely control another computer. It transmits the keyboard and mouse input from one computer to another, relaying the graphical-screen updates, over a network. VNC is platform-independent – there are clients and servers for many GUI-based operating systems and for Java. Multiple clients may connect to a VNC server at the same time. Popular uses for this technology include remote technical support and accessing files on one's work computer from one's home computer, or vice versa.

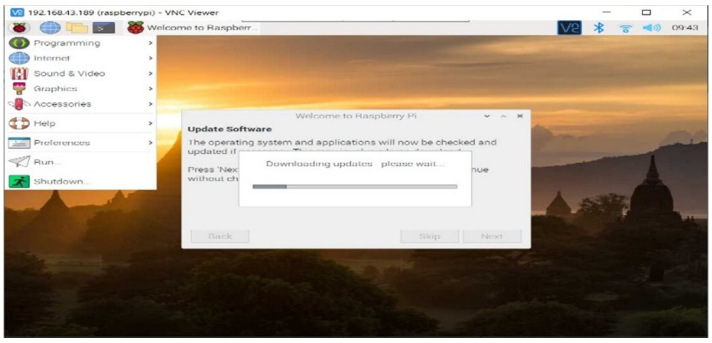

Figure 7.VNC viewer

C. Advanced IP Scanner

Advanced IP Scanner is fast and free software for network scanning. It will allow you to quickly detect all network computers and obtain access to them. With a single click, you can turn a remote PC on and off, connect to it via Radmin, and much more.

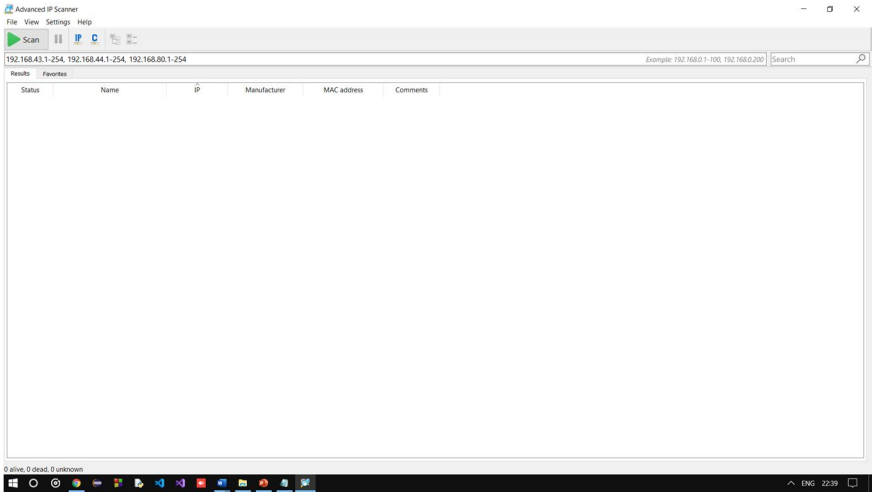

Figure 8.Advanced IP scanner

V. RESULTS

The results are obtained at the end of project are shown in the following images. The drowsiness alert can be seen after the change in the EAR value. Also, the buzzer connected in the system will turn on to alert the driver.

VI. CONCLUSIONS

We have built an affordable device and a real time drowsiness application to minimize loss of lives during the road accidents and will save the lives of pedestrians. By using the Facial landmark detection and eye aspect ratio as attributes we have built real time application of sleep detection alarm. It is a system with very minimal cost and small in size. It will be very helpful in automobile industry. In the future view this project can be used in every vehicle to minimize the damage happened due to accidents.

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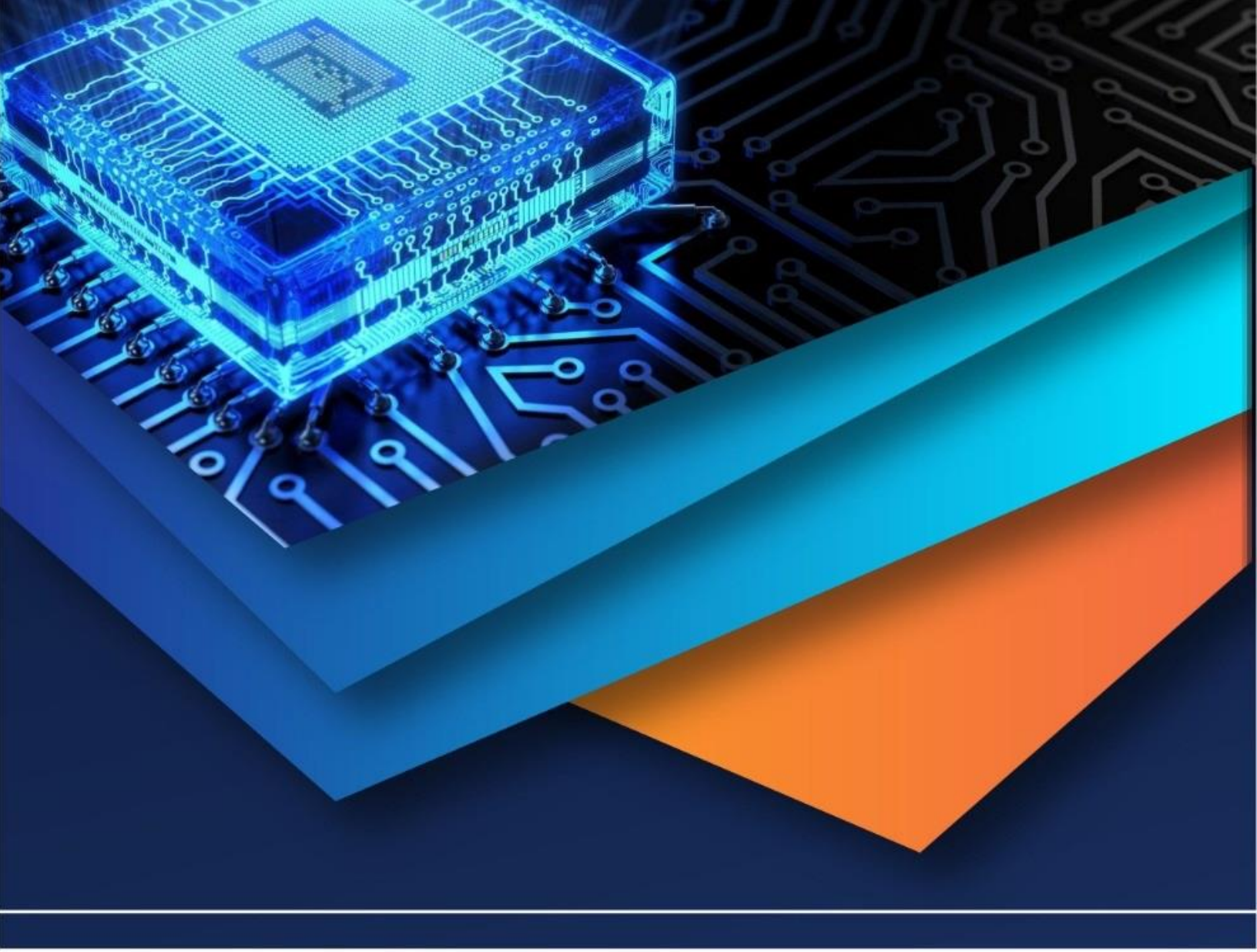

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