DRIVER ASSISTING SMART VEHICLE SYSTEM USING RASPBERRY PI

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Abstract: **According to Global status report on road safety 2018, launched by WHO, vehicle safety is increasingly critical to the prevention of crashes and has been shown to contribute to substantial reductions in the number of deaths and serious injuries resulting from road traffic crashes. Our proposed system comprises features such as warning the driver of fatigue using real-time non-intrusive concepts, electronic stability control, and automatic braking of the vehicle that can prevent a crash from occurring or reduce the severity of injuries. We make use of the small security camera to capture the drivers face and then employ the facial landmark algorithm which localizes and represent salient regions of the face, in this case, the eyes. An accelerometer is employed as a crash detector of the vehicle before, during, or after a crash. An alcohol sensor is made use of to detect the alcohol content in human breath. Distance measurement of any obstacle in the path of the vehicle which may be stationary or moving is done using the ultrasonic sensor. As the automation of automotive technology advances rapidly and driver assistance systems quickly become the new standard in day-to-day driving and we will soon be relying on these systems to ensure our safety on the road.**

Keywords: Accidents, Drowsiness, Driver Assistance System, Raspberry Pi, Arduino UNO.

I. INTRODUCTION

Road accidents cause more than 150 thousand deaths per year; there are various causes for these accidents to occur, the most important reason being the alcohol consumption by the driver. Drowsiness is the other reason and it is found out that 22% of the road accidents are due to drowsiness of the driver [5]. Driver assisting systems are the systems that are developed to adjust, automate and improve the vehicle systems; it plays a major role because it can not only be used to protect the life of the driver but also the life of passengers. The automatic driver assisting systems has proven to reduce road accidents which are caused by human errors. The proposed system is not only helpful in detecting the drowsiness of the driver but it can also detect alcohol consumption and it is also helpful in stopping the vehicle when the accident occurs and hence reduces the further damage that can be caused. The ultrasonic sensor is used to provide an automatic braking system.

Drowsiness is detected by making use of the facial landmarking algorithm in OpenCV. Facial landmark detection is the process of finding the points of interest in an image, for drowsiness detection the point of interest is the eyes. A ratio is calculated, called the EAR (Eye Aspect Ratio) which can be used to detect the drowsiness. Alcohol consumption is detected by using MQ3. The MQ3 sensor can identify alcohol consumption by the breath of the driver. The sensor can detect the presence of alcohol gas at concentrations from 0.05mg/L to 10mg/L. The ultrasonic sensor plays a major role in providing an automatic braking system. The ultrasonic sensor uses SONAR to determine the distance of an object. Depending upon the range it can be used to detect

the obstacles and hence stop the vehicle. Accelerometers are the devices that measure the vibration, or acceleration motion of a structure, and therefore help detect any irregularity in the motion of the vehicle.

II. LITERATURE SURVEY

In this section, a survey of studies conducted before in the field of driver assistance system is listed. Varsha.E.Dahiphale and et al. in their work have developed a Computer Vision System for Driver Fatigue Detection, in which the system monitors the driver's attentiveness and alerts the driver for any insecure driving condition. It is based on the viola jones algorithm for face and eye detection. The system is designed using a Raspberry Pi hardware, video camera, and open-source computer vision library (OpenCV) and Microsoft visual studio [1]. Jian-Da Wu and et.al. in their work have developed a drowsiness warning system based on the fuzzy logic image analysis, this is a vehicle driver drowsiness warning system using an image processing technique with fuzzy logic inference [2]. Dwipjoy Sarkar and et al. in their work have developed A Real-Time Embedded System Application for Driver Drowsiness and Alcoholic Intoxication Detection, this is a computer vision and alcohol gas sensor based application which is combined to an embedded system to prevent road accidents which takes place due to fatigue or alcohol drinking of the driver. The system is developed using the Raspberry Pi, Arduino UNO, Open CV, and Embedded System [3].

III. IMPLEMENTATION

In the block diagram shown in figure 1, various components are interfaced to the Arduino Uno board. The alcohol sensor will detect whether the driver has consumed alcohol depending on the driver’s breath. When the MQ-3 sensor senses the alcohol content, the vehicle slowly moves towards the left and stops with the indicator on. The Accelerometer sensor has an ADXL335 three-axis analog accelerometer mechanism, which reads the X and Y axis as analog voltages. In the proposed system The HC-SR04 whenever the X coordinate value exceeds 400 or when it is less than 300, similarly when the Y coordinate value exceeds 400 or when it is less than 270, the driver will be alerted with a loud beep and the vehicle stops. SR04 Ultrasonic sensor is used to detect any obstacles which are in the vicinity of the vehicle. Whenever there’s an obstacle at a distance less than 20cm from the vehicle the driver is alerted with a loud buzzer and then the vehicle slows down and stops.

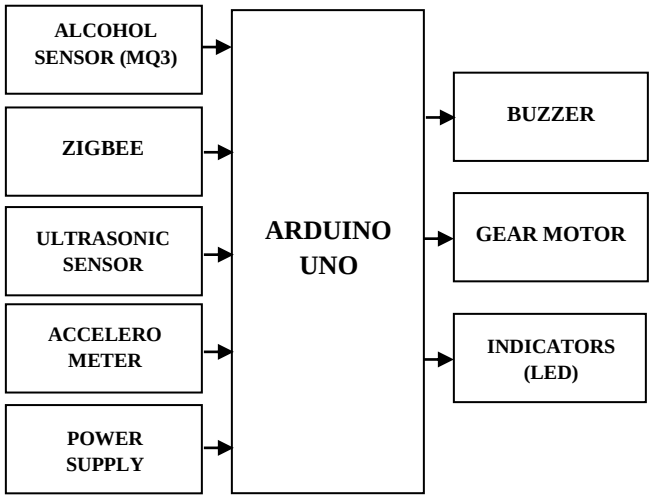

Figure 1. Car Model Block Diagram.

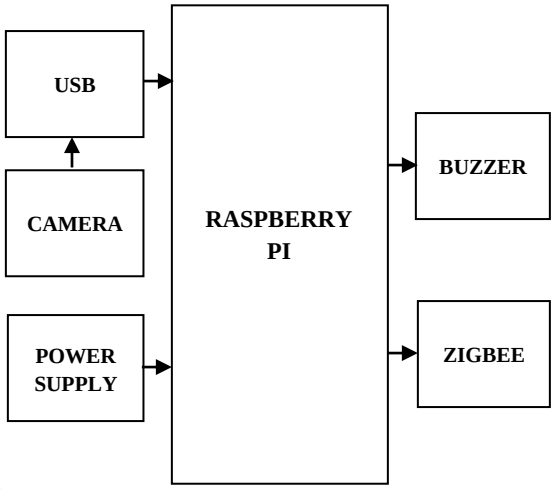

Figure 2. Drowsiness Detection Block Diagram.

Figure 3 shows the flow chart of drowsiness detection.

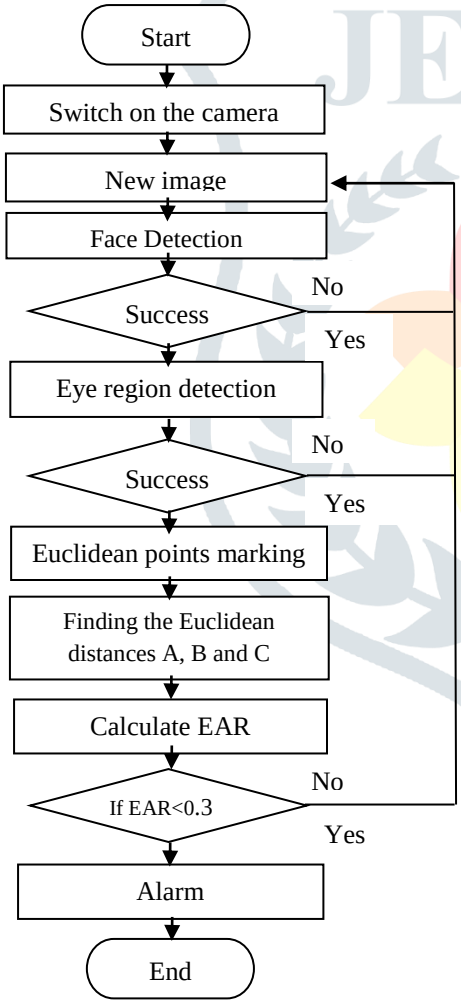

Figure 3. Flow Chart Of Drowsiness detection.

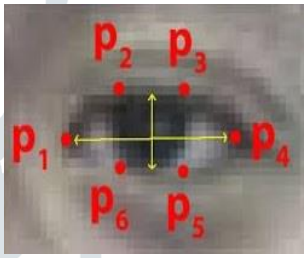

Figure 4. Points marked around eye

Drowsiness is detected in this module with the help of a facial landmarking algorithm, certain libraries have to be included in the python program. When an image is given, the shape predictor tries to identify the key points of interest, it detects the eye region using shape prediction methods. The first step is the staring of video

streaming, the input has to be continuously taken to detect the drowsiness in the driver. The file video stream takes care of this. Next is to draw points all over the face and detect the eyes as shown in figure 4. The EAR is calculated using the formula below. A threshold is fixed and whenever the ratio falls below this the drowsiness is detected [4].

$$EAR = \frac{\left|\left|p2 - p6\right|\right| + \left|\left|p3 - p5\right|\right|}{2\left|\left|p1 - p4\right|\right|}$$

IV. RESULTS

The car model is interfaced with an alcohol sensor, an accelerometer, and an ultrasonic sensor as shown in figure 8; with the help of all these sensors, an effective driver assisting system can be obtained. A ZigBee module is used to communicate with the Raspberry Pi.

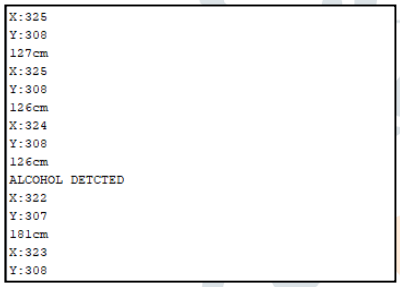

Figure 5. Result of Alcohol Sensor

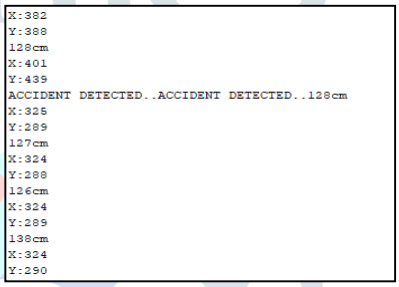

Figure 6. Result of Accelerometer

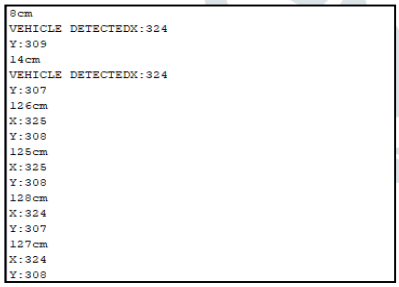

Figure 7. Result of Ultrasonic Sensor

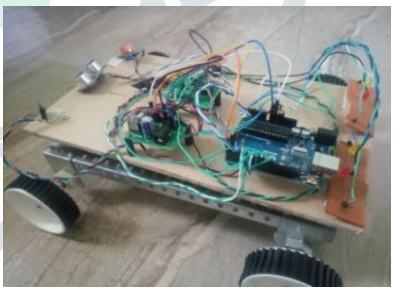

Figure 8. Car Model

When alcohol is detected, the vehicle slowly moves towards the left and stops with the indicator on as shown in figure 5. In the case of the accelerometer, whenever the X value exceeds 400 or when it is less than 300 and similarly when the Y value exceeds 400 or when it is less than 270, the driver will be alerted with a loud beep and the vehicle stops as shown in figure 6. When the ultrasonic sensor detects an obstacle at a distance less than 20 cm from the vehicle the driver is alerted with a loud buzzer and then the vehicle slows down and stops as shown in figure 7.

V. CONCLUSION

Drowsiness is the biggest threat to drivers, most of the accidents are caused due to this, but the proposed system effectively identifies the drowsiness using the facial landmarking algorithm and also provides the alert. The system deals with alcohol detection which is the next reason for accidents. Accelerometer and ultrasonic sensors are also used to improve the system. The system is cost-efficient, portable and the results obtained are accurate.

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