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Intelligent Driver Assistance

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Abstract - *Street mishap is a worldwide misfortune with the number of cases expanding step by step. Owing to the bad infrastructure and dangerous driving habits, Most deaths around 105,000 every year happen in India. Around 20% of car crashes and up to 25 percent of serious accidents happen due to Driver's decreased carefulness. The expanding number of accidents because of a driver's cautiousness level decreasing has become a grave issue for us. So to prevent this we have come up with an idea of making a device titled "Intelligent Driver Assistance" which comprises many features in it to curb the death rate due to road accidents. The accidents occur due to many reasons, some of the reason being the driver feels drowsy, he/she has alcohol consumption, overtaking, over speeding, not wearing seat belts, after the accident the body was reported late to the hospital, etc. In our proposed model we have taken care of all the points mentioned above by inculcating different types of sensors and microcontrollers which are programmed using python language. A whole new concept of car accident prevention is introduced in this project.*

Key Words: Raspberry Pi, Arduino, LIFI, Drowsiness, Alcohol Detection

1. INTRODUCTION

Road accidents are a global tragedy with the number of cases increasing year by year. Owing to the bad infrastructure and dangerous driving habits, Most deaths around 105,000 per year occur in India. There are many things which can cause an accident like drowsiness, consumption of alcohol , not wearing a seatbelt and ignoring traffic rules. In this project we are making a system which can help drivers and provide them with some necessary alerts so that we can reduce the chance of accidents.

2. LITERATURE REVIEW

A. Drowsiness Detection and Head Pose Estimation

Nowadays, car manufacturing companies (Audi [1], BMW [2], Bosch [3]) release new cars that have inbuilt systems to prevent traffic accidents. Most of these inbuilt systems are getting driver's behavior using steering wheel sensors and body sensors. As an example, Bosch cars come up with their own driver drowsiness detection system [3]. But those inbuilt systems are in only a small number of vehicles and they are not affordable. Quantitative evaluation of face detection and tracking algorithms for head pose estimation in mobile platforms has used Viola-Jones, Artificial Neural Networks (ANN) and Support Vector Machine (SVM) to compare their accuracy, performance, and robustness on mobile platforms. Viola-Jones algorithm extracts key facial features (eyes, nose, mouth) to identify head pose. ANN and SVM used to classify the face of the driver. Since mobile platforms have limited processing power, higher accuracy algorithms might not perform well. So, head pose estimation in mobile devices becomes challenging. Driver drowsiness detection using Artificial Neural Networks (ANN) image processing is based on three types of methods: EEG (Electroencephalography), EOG (Electrooculography) signal processing and driver image analysis. The EEG method monitors brain activity through a special sensor. The EOG method tracks the eye movements and the eye image analysis can monitor the open state of the eye. For the classification of the driver's drowsy state, ANN is used.

B. Over Speed Detection and Warning System

The research about real-time detection and recognition of traffic signs [04] has been done for identifying the circular road signs. They have used the Viola-Jones algorithm which is based on cascade boosted Haar's features. The classification of the road signs is done by using neural networks. They have chosen a multilayer perceptron (MLP) with backpropagation (BP) for the training. To determine the speed limit, they have used a segmentation algorithm that is capable of separating digits from the sign. Detection and classification of speed limit traffic signs is a research about a modified method to recognize speed limit signs using the Circular Hough Transform(CHT) technique. It is based on color information of the speed signs. Extraction of the speed limit and classification are done by Support Vector Machine (SVM) which can be used for applications of classification. An approach for detecting Norwegian speed limit signs is proposed from the research. The extraction of speed limits is done by a bit array classifier system.

C. Forward Collision Warning System

A Raspberry Pi-based cost-effective vehicle collision avoidance system designed for real-time detection of

obstacles in . The system is implemented on the Raspberry pi Module by using OpenCV and Python. Logitech USB webcam is employed for object detection and image capture. Laplacian, Sobel and Canny Edge Detection Techniques are used for efficient edge detection. Predictive vehicle collision avoidance system using Raspberry-PI gives warning alerts to the driver when there are obstacles in front and unseen areas of the vehicle. Vehicle detection techniques for collision avoidance systems [05] is designed to use radar and one dash camera. If the front of the vehicle gets close to another vehicle, it identifies that vehicle through the radar system. Then the system gives the alert to the driver using sound and light signals.

D. Lane Departure Warning System

The front uncalibrated camera of the vehicle and the off center value it received used to determine the space between the vehicle and the road in [28] for LDW. The LDW system discusses how the lanes can be detected from a video clip. However, this is an offline system. A real-time LDW system based on field-programmable gate array (FPGA) systems uses vanishing point-based steerable filter algorithms for identifying the lane line in complex environments. This FPGA based system is more accurate and more complex. In [06] a machine vision system to estimate lane departure of a traveling vehicle on the road and a similar road is proposed. Lane departure detection is conducted by measuring the orientation of lanes marked in gray level images taken by a charge-coupled device (CCD) camera that is mounted on the vehicle. Most of the LDW research has been done for a target region and according to their regional stands and some of the existing systems are designed by vehicle companies and they are unique to their vehicles.

3. METHODOLOGY

To facilitate high efficiency and accurate driver assistant functionalities system is divided to,

1. Drowsiness detection and head pose estimation
2. Seat Belt & Alcohol Detection
3. V2V communication
4. Geo Location

A. Drowsiness Detection and Head Pose Estimation

In this function, the system detects the drowsy status and head pose estimation. "Intelligent Driver Assistance System" has a Pi Camera to capture the driver's face.

1) Camera Calibration: The focal length of the camera, skew, distortion, and image center parameters are calculated through camera calibration. The photos of the chessboard that are captured using a Pi Camera with different angles and distances are processed to calculate camera matrix values and camera distortion. The system will use those values to extract the 3D object points of the driver's face.

2) Facial landmarks detection: To obtain 2D points of the key facial structures (eyes, eyebrows, nose, mouth, and jawline), the system must identify the facial landmarks of the driver. Firstly, the system localizes the driver's face through Haar's Cascade algorithm [07]. Then the system extracts the key facial structures from the face using the facial landmark detection concept.

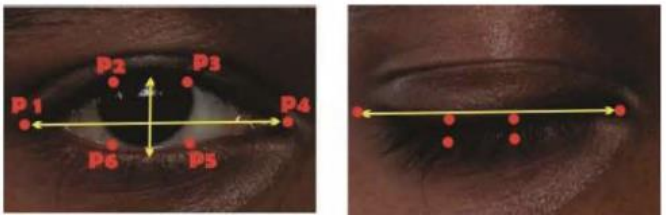

Fig -1: Open(left) and Closed(right) eyes with 2D landmarks points.

3) Calculate Eye Aspect Ratio (EAR):
Eye aspect ratio (EAR) is used to identify the status of the eye. We use the 2D eye landmarks to calculate EAR (Fig.1).
B. Seat Belt & Alcohol Detection

$$EAR = \frac{\{ED(P_2, P_6) + ED(P_3, P_5)\}/2}{ED(P_1, P_4)}$$

At the initial state the system is in a stable state where we stated some value of alcohol is not detected and the seat belt not worn. [09] Then, when the driver is inside of the car, the system will start to function. So, the alcohol sensor kept inside the car will start detecting the level of alcohol. If the alcohol is present more than legal limit i.e. 0.03% (30mg of Alcohol in 100ml of Blood) or if the driver has not worn the seat belt then the ignition of the will be locked completely. Also, if alcohol consumed by the driver is less or within limit then also the system will check for seat belt and if it is wearing by driver then the car ignition will be ON. As well as, if the driver drinks alcohol after the car has stated then also the system will stop at that point and location. That's how we can also send the details of the car to car owners or users of the car on mobile application.

C. V2V communication

This proposed system is implemented with the LIFI technology (Light Fidelity). Each vehicle was linked. This LIFI system is used for the transmission and receipt of vehicle information. [08] The entire system is to be made up of the transmitter and receiver part for the transfer of data using LIFI, through interfacing connections and different sensors. One can think of implementing one point to multipoint communication instead of a number of point to point communications. We can't rely on a single data, as actions of a vehicle would not be based on behavior of a single vehicle but all its adjacent vehicles. And transmission of data to vehicles at a distance would be slow. So, Li-Fi is an efficient mechanism of communicating information as far as V2V application is concerned.

D. Geo Location

GPS receiver is used for detecting coordinates of the vehicle, GSM module is used for sending the alert SMS with the coordinates and the link to google map.any axis. If any change occurs, then Arduino reads coordinates by extracting $GPGGA string from GPS module data and sends SMS to the predefined number to the police or ambulance or family member with the location coordinates of the accident place. The message also contains a google map link to the accident location, so that location can be easily tracked. When we receive the message then we only need to click the link and we will redirect to the google map and then we can see the exact location of the vehicle, in knots(1.852KPH), is also sent in the SMS and displayed on the LCD panel.

4. CONCLUSION

This project presents an efficient and affordable method for driver assistance. It facilitates drowsiness detection, detection of the driver's attention to the road, over-speed detection, Seat belt detection, and Alcohol detection. All the functions give over 80% accuracy. As a system "Intelligent Driver Assistance" achieved successful accuracy. As our future work, we will use machine learning to train the data and make the system more efficient. As our future work, we will use machine learning to train the data. That will increase accuracy. We are planning to use a pi-stack as the processing unit with paralleled pi boards to increase processing power.

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