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Survey : Automatic Understanding By Vehicle For Driver Distraction Problem

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Abstract: *Vehicle technologies have advanced significantly over the past 20 years, especially with respect to novel in-vehicle systems for route navigation, information access, infotainment, and connected vehicle advancements for vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) connectivity and communications. While there is great interest in migrating to fully automated, self-driving vehicles, factors such as technology performance, cost barriers, public safety, insurance issues, legal implications, and government regulations suggest it is more likely that the first step in the progression will be multi-functional vehicles.*

Today, embedded controllers, as well as a variety of sensors and high-performance computing in present-day cars, allow for a smooth transition from complete human control toward semi-supervised or assisted control, then to fully automated vehicles. Next-generation vehicles will need to be more active in assessing driver awareness, vehicle capabilities, and traffic and environmental settings, plus how these factors come together to determine a collaborative safe and effective driver–vehicle engagement for vehicle operation.

This article reviews a range of issues pertaining to driver modeling for the detection and assessment of distraction. The areas addressed include 1) understanding driver behavior and distraction, 2) maneuver recognition and distraction analysis, 3) glance behavior and visual tracking, and 4) mobile platform advancements for in-vehicle data collection and human-machine interface 5) Alcohol Detection

Key Word: **Image Processing, Alcohol Detection, Drowsiness Detection, open cv**.

1. INTRODUCTION

Driver inattention is defined as insufficient or no attention given to activities critical for safe driving. Inattention can either be a voluntary or involuntary diversion of attention by the driver. Driver distraction has been formally defined as " anything that delays the recognition of information necessary to safely maintain the lateral and longitudinal control of the vehicle due to some occurrence, activity, object or person, contained by or outside the means of transportation .that require or have a propensity to induce the driver's shifting attention away from the fundamental driving task by compromising the driver's auditory, biomechanical, cognitive or visual faculties or combinations thereof . It is important to note that driver distractions are generally caused by a competing trigger activity that may lead to driver inattention, which in turn degrades driving performance. Alternatively, other forms of driver inattention might not necessarily be due to a trigger or competing activity, making inattention difficult to detect and even harder to control. By identifying some of the causes of driver distraction, it is possible to isolate scenarios when the cause of distraction can be controlled. The Purpose of this project is Identify alertness in driving. If the driver is found to be yawning or sleeping or distracted from driving, then the continuous sound is played to alert him. If driver drink and drive, not only do you possibly put yourself at risk, but your passengers and pedestrians, and other people, who were on the roads. Just think about that. Every thirty minutes someone's life is cut short and families are devastated. So, here we implemented a prototype version Alcohol Detection system in order to control drunk and driving as much as we can. Driver's drowsiness detection based on biological and vehicle signals is being studied in preventive car safety. Autonomous nervous system activity, which can also be measured non invasively from the heart rate variability (HRV) signal obtained from the surface electrocardiogram, presents alterations during stress, extreme fatigue, and drowsiness episodes.

There are various reasons for accidents on road. The major reasons for accidents on road are fatigues of a driver and the second one is the alcohol intoxication. These are the two reasons due to which probability of road accidents increases. These road accidents can be overcome by different ways. In recent years, technologies are developed and various techniques are generated for the detecting the road accidents and also preventing the road accidents. The different technologies which are developed are depending on the vehicle, behavioral and physiological. In behavioral-based approach, it continuously sensed mouth's opening area, eye closure, blinking frequency of eye and head posture.

The proposed system used to detect real-time drowsiness along with alcohol intake of the car driver. Computer vision and embedded system are used to design the system. The system is based on behavioral-based approach, in which we consider eye closing rate, eye blink frequency, and pupil and iris edge detection. Image processing techniques such as Haar features and Hough transform are used for acquiring details of given eye object and further processing. On the other hand, an alcohol gas sensor is used to calculate Blood alcohol content (BAC) from Breath alcohol content (BrAC). Raspberry - Pi processor is used for image processing.

Continuously evaluate driving performance will be necessary for next-generation smart vehicles, to develop advanced driver-specific active/ passive safety systems. Important to examine on-road, real- traffic driving data for all possible driving variations in different maneuvers. Tracking eye movement can be an accurate measurement to identify the exact location of the gaze of the driver. In case the driver is distracted, then buzzer is played and led glows.

Objective:

We are searching for a system which will automatically detect drowsiness based on driver's performance. Current systems used to detect drowsiness are slow and consume more time to give the output and warn the driver accordingly. The systems utilized are also very expensive and are implemented only in high class or very expensive vehicles. Due to which the normal vehicles lack such systems and even the safety is low. This project aims at building a safety system for vehicles which can be implemented and build at low cost. This will, in turn, provide both securities as well as protection to the vehicle as well as the driver driving the vehicle. If such systems come into existence lots of lives can be saved.

If driver drink and drive risk to your passengers and pedestrians, and other people, who were on the roads. each thirty minutes someone life is cut short and families are destroyed. So, here we implemented a prototype version Alcohol Detection system in order to control drunk and driving as much as we can. Driver's sleepiness recognition based on biological and means of transportation signals is being studied in defensive car safety. Autonomous nervous system activity, which can be measured noninvasively from the heart rate variability (HRV) signal obtained from a surface electrocardiogram, presents alterations during stress, extreme fatigue, and drowsiness episodes.

2. RELATED WORK

[1] In this paper, a novel real-time computer vision algorithm to robustly discriminate which of the front-row seat occupants is accessing the infotainment controls. The knowledge of user can improve driver distraction and maximize passenger infotainment experience. The system consists of a visible and near-infrared imaging device observing the front-row seat area in the vehicle. This approach represents an alternative of detecting and tracking the hand movements and then classifying the hands into the respective classes.

[2] Traditional activation devices (e.g., knobs, switches, buttons, and touch screens) may be confused by operators among other system setting manipulators and also susceptible to inappropriate usage. Non-intrusive eye-tracking measures may assess driver states (i.e., distraction, drowsiness, and cognitive overload) automatically to trigger manual-to-automation ToC and serve as a driver readiness verification during automation to manual Toe. Integrated driver state monitor is overviewed in this paper. It combines gaze position, gaze variability, eyelid opening, as well as external environmental complexity from the driving scene to facilitate ToC in automated driving. As both drivers facing and forward facing cameras become increasingly commons place and even legally mandated within various automated driving vehicles, our integrated system helps inform relevant future research and development towards improved human-computer interaction and driving safety.

[3] To improve intelligent driver–vehicle systems that incorporate human-specific characteristics, We focused research on naturalistic driving studies, with the interest of understanding driver behavior and distraction from multichannel sensor data. Any secondary driver task activity in the vehicle can be a source of driving distraction and therefore impact driving performance. Regarding this, one typical approach is to first extract the driving context in terms of micro-level components (e.g., maneuvers), and then evaluate risky events and variations against similar driving patterns in the vehicle dynamics domain. An alternative approach is to directly monitor drivers' physical or glance behavior and assesses their cognitive and visual attention. Previous studies have shown precise results in the detection of driving distraction, driving performance analysis, and visual attention tracking. To take advantage of the fast-growing smart phone applications market and integrate telematics services, recent activities have resulted in a mobile platform that contributes to in-vehicle naturalistic driving studies and voice-based human-machine interfaces. These studies, if combined, would be able to provide a comprehensive understanding of the driver's state and drive performance, establish a comfortable driving experience with a human-centric assistant in the vehicle, and contribute intelligent transportation information sharing via V2V/V2I connectivity.

In[4], Design of ARM-based face Recognition system using Open CV library", the authors have implemented a system using ARM 7 based microcontroller and Opencv based machine. This is interfaced to USB camera for continuous images are captured and these images are processed with help of OpenCV and compared with existing database. If the current images are matching with any of the existing images the system generates the command to the output unit to perform the location identification using GPS and forward the

necessary information about the identified person using GSM/GPRS to concern authorities.

In[5]" Computer Vision System for Driver Fatigue Detection ", in this system can actively monitor driver vigilance level and alert the driver to any insecure driving condition. In that drowsiness detection of the driver is based on violations algorithm for face and eyes detection. The system is developed using a video camera, Raspberry Pi hardware, and open source computer vision library (OpenCV) and Microsoft visual studio. In [6]"Tracking Eye State for Fatigue Detection" the author focuses on eye states tracking. Images are captured using a camera and used for tracking as the input of the proposed method. In the first step, we use color space for drivers' face detection and crop the face from the background. In the next step, we estimate the area of the eyes and crop image from this region. The top and bottom coordinates of the eyes are located using retrench the face pixels from this area and canny operator for edge detection. In the last step, we count then a number of white and black pixels and compare the distance between these coordinates for recognition of the driver's fatigue. In "Advanced Vehicle Control and Safety System Using Face Detection", the design is based on computer vision and embedded system application principles. System work is a combination of face detection, eye region detection, and eye closing rate detection in a real-time environment. The proposed system is realized with a digital camera supported by embedded system board Raspberry Pi loaded with Raspian - OS and Python - IDLE with OpenCV installed. Also different vehicle control functions like central locking and unlocking, opening and closing of windows, bonnets etc. can be controlled by using Android mobile phone.

In[7],"Driver Behavior Analysis Using Non - Invasive sensors", developed system uses an ARM 7(LPC2129) controller as the main control unit and CAN bus a car. ARM 7 is used to obtain high performance. Use of CAN makes high-speed communication in control networks and also helps to share of data between all nodes which results in enhancing their collaborative work. With the help of this system, we can detect ECG, eye blink and alcohol Detection.

In[8], "Finger Vein Recognition Based Driver Authentication and Alertness System Using GSM", when a person wants to drive, will just press their finger in the biometric system. When the finger vein are matched automobile get ignited, this will be keyless authentication system. If the matching fails GSM get triggered on and transmits warming message. The same automobile has the facility to detect fatigue and intake of alcohol by the diver. GSM, camera and buzzers are interfaced with Raspberry Pi. Raspbian OS is loaded with python and open CV. Arduino is interfaced with alcohol gas sensor.

3. TYPE OF DISTRACTION

Three key types of distraction have mainly studied: visual, manual, and cognitive. These distractions deflect drivers' visual and cognitive resources away from the driving control task. These distractions can degrade driving performance and even can cause fatal accidents. Visual diversion and manual distraction can be directly observed through the external behaviors of drivers, such as glancing at billboards or releasing the steering wheel to adjust the radio. Visual distraction usually coexists with manual distraction because visual cues provide necessary feedback when people perform manual tasks. Visual and manual distractions disrupt nonstop visual awareness and physical operation necessary for driving and results in the absence of visual attention on safety-critical events.

4. PROPOSED SYSTEM

The main purpose of the project is to identify alertness in driving. If the driver is found to be yawning or sleeping or distracted and intoxicated from driving, then the continuous sound is played to alert him. and This system will actually give buzzer sound if car driver is intoxicated.

The system architecture has the following units.

1. Raspberry Pi

2. Sensor Unit

3. Open CV

4. Server

1. Raspberry Pi

Raspberry Pi single board computer is used in the system as a central module of the complete embedded image capturing and processing system. Raspberry Pi is the main component (Microprocessor) which has a Separate camera module mounted on it. The execution time is get reduced with the use of Raspberry Pi. Night vision camera is used for the observing the driver whether he\she gets distracted or not. The alarm is used to capture the driver's attention towards road The Raspberry - Pi system is loaded with Raspbian OS and Python packages for Open CV (Computer Vision). Haar features are used to calculate required part of the eye (pupil and iris).

Further, Hough transform is used for edge detection of pupil and iris. Pupil and Iris area is calculated and then it compares with a threshold value. If it exceeds the threshold value then driver drowsiness condition is detected and an alarm indicated by the buzzer. The buzzer is serially interfaced with Raspberry - Pi system board.

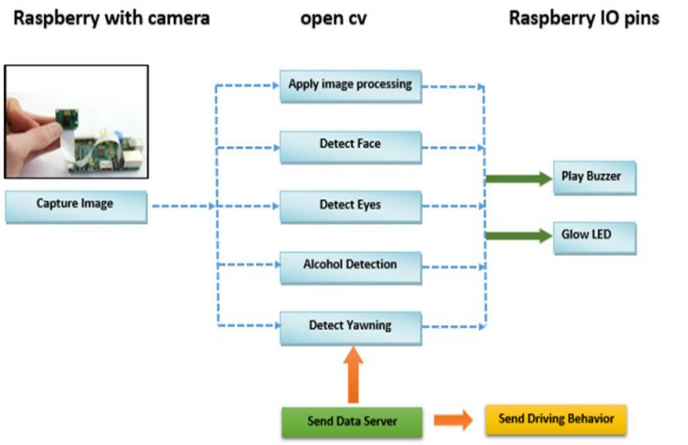

Fig.1- Architecture diagram of proposed System

2. Sensor Unit

ALCOHOL SENSOR:

This module is made using Alcohol Gas Sensor MQ3. It is a low-cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L.The sensitive material used for this sensor is SnO2, whose conductivity is lower in clean air. It's conductivity increases as the concentration of alcohol gases increases. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor, and gasoline.

This module provides both digital and analog outputs. MQ3 alcohol sensor module can be easily interfaced with Microcontrollers, Arduino Boards, Raspberry Pi etc.This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensors give an analog resistive output based on alcohol concentration. The drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0-3.3V ADC.The sensor able to detect BAC with different concentration and classified the range of BAC detected into a few level. The alcohol sensor is a heater - driven alcohol gas sensor, its output is an analog signal which measures alcohol content. It is used measure the presence of alcohol in the volume of breathmg/L.

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Fig 2 - Alcohol Sensor

3. Open CV

OpenCV is open source software, which is used for creating computer vision. OpenCV is available in C, C++, and Python and Java programming languages extension

Haar Feature-based Cascade Classifier technique, it is a machine learning based approach where a cascade function is trained from a lot of positive and negative images, and this positive image is used for detecting face region and eye region the update of a region of interest ROI. Open CV is packed with a trainer as well as the detector. The open CV is used for creating user-defined object classifier. The object classifier that has been created is stored in. xml file extension classifier can be used in the later stages of programming.

4. Server

All the driver related data is maintained its database, MySQL database system is used which advanced feature of Raspberry-Pi.By using Raspberry Pi based camera continuously captures the driver image and stores it on the sd card. Capturing of images is done using OpenCV and Java module. Haar cascade is used to detect eye and face from the captured image. If a closed eye is found then an alert is made to the driver. Yawing is detected from the face image using eye, nose, mouth order. Project's primary motto is to identify alertness in driving. If the driver is found to be yawning or sleeping or distracted from driving, then the continuous sound is played to alert him.This system will actually give buzzer sound if a car driver is intoxicated. Alert is given to the driver and notification is sent to the admin.

Our system will also focus on to detect driver alcohol consumption or not. The distraction alterations during stress, extreme fatigue, and drowsiness episodes. Raspberry is connected to led and buzzer modules. In case the driver is distracted, then buzzer is played and led glows. User driver statistics are synchronized to the server. Figure2 shows the flow of the system.

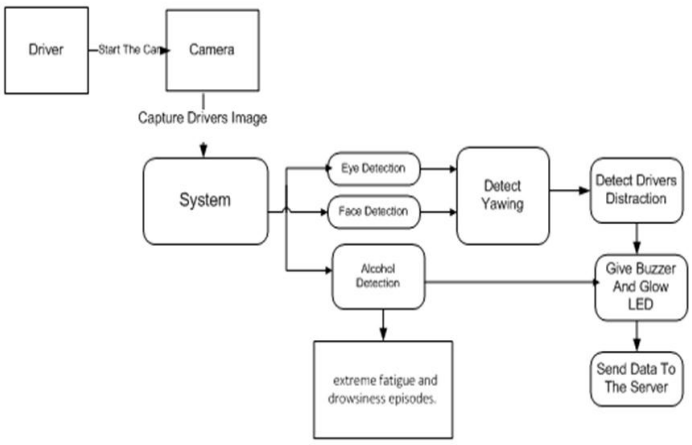

Fig 3-Flow Diagram Of the System

5. PROPOSED METHOD

Object Detection using Haar feature-based cascade classifiers is an effective object detection method. t is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. OpenCV comes with a trainer as well as detector. As we want to train own classifier for any object like car, planes etc we can use OpenCV to create one. The cascade classifier consists of a list of stages, where each stage consists of a list of weak learners. The system detects objects in question. by moving a window over the image. Each stage of the classifier labels the specific region defined by the current location of the window as either positive or negative .Positive meaning that an object was found or negative means that the specified object was not found in the image.

Training Steps to Create a Haar-like Classifier:

- Collection of positive and negative training images
- Marking positive images using objectmarker.exe or

Image Clipper tools

- Creating a .vec (vector) file based on positive marked images using createsamples.exe
- Training the classifier using haartraining.exe
- Running the classifier using cvHaarDetectObjects()

6. APPLICATIOPN AND ADVANTAGES

Applications of Alcohol Detector in Car:

1)A system" can be used in the various vehicles for detecting whether the driver has consumed alcohol or not.

2) Breathing analyzer project can also be used in various companies or organization to detect alcohol consumption of employees.

3)This system in an automobile is a must feature which every cab or bus should have.

Advantages of Alcohol Detector project:

1) "Alcohol Detection System in Cars" provides an automatic safety system for cars and other vehicles as well.

2)Reducing the number of accidents caused by driver distraction and to reduce the seriousness of such accidents.
3) Improve the driver's safety on the road.

7. CONCLUSIONS

About 20% of road accidents occur due to a distraction of driver. Among that 30% is due to driver fatigue. There are many methods to monitor driver and thereby alert him/her in case of distraction. This survey is conducted to study various methods to detect the driver fatigue and to select an appropriate method to detect the causes of driver's distraction. In order to reduce road accidents, there is also a need to detect the causes such as drowsiness, fatigue and to alert the driver. This survey enables to choose an efficient method to reduce road accidents due to driver fatigue.

We develop a system, which Helps drivers in driving car effectively. Also increases passenger safety and give the information about the driver's behavior while driving and detect if the driver is drunk or not.

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