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Drowsiness and Alcohol Detection in Vehicles to Prevent Accidents using IOT Technology

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Abstract:
In recent years, the usage of vehicles increased and this increase given raise to the road accidents. The road accidents are mostly caused by the fatigue drivers and drunken drivers. In order to reduce this we managed to make a system which closely monitors the driver's drowsiness and alcohol state, by doing so if the driver fall asleep or the alcohol state of the driver is high then the vehicle automatically stops. This monitoring system is connected to the vehicle braking system which is electromagnetic braking system helps to control the vehicle moment based on driver's state. This design is made for some type electrical vehicles which use DC motors in braking system. The drowsiness of the driver is continuously monitored on the webcam and the alcohol state of driver is monitored by the MQ3 alcohol sensor. The webcam detects the pupil moments of the eyes using a python program. This Python program uses Perclos algorithm to detect the eyes of driver. If the eye closes for a specific time then the signal is given to relay to apply brake of the vehicle. If the alcohol rate is high in the driver range then the alcohol sensor gives signal to the relay to apply brake same as drowsiness system. The MQ3 sensor is connected to Arduino board to work. The Arduino board acts as a microcontroller chip in this total system.

Keywords: Arduino, Drowsiness, DC motor, MQ3 Alcohol Sensor, Perclos algorithm, Relay

I. INTRODUCTION

Road accidents are unfortunately prevalent in the India and world, and the majority of these accidents are caused by human fault. It is imperative to be cautious, drive carefully and follow traffic rules. The major causes of these accidents are due to drunken driving, distracted driving, reckless driving and driving with tiredness. In this project we focus on drunken drivers and fatigue drivers where we put try to reduce these accidents to an extent caused by the drivers using technology. In order to effectively monitor and prevent vehicle accidents, we designed this set of vehicle-based alcohol detection system and drowsiness detection system based on Internet of Things technology. The system uses aurdino chip as the main controller, uses MQ-3 alcohol sensor to collect air alcohol concentration data, and uses. When the driver enters the driving position, the system automatically performs alcohol detection. When the drunk driving standard is reached, the system uses the relay to control the vehicle's breaking system, and for the drowsiness detection the webcam continuously monitor the eyes of the driver and if he closes the eye for a specific time then the vehicle braking system stops the vehicle. The experimental results show that the system is economical, practical, accurate and reliable.

The different approaches to detect drowsiness of a driver are three types namely behavioral parameters based, vehicular parameters based and physiological parameters based. In behavioral parameter based the drowsiness of the driver is detected using non-invasive instruments. In vehicular parameter based the fatigue state of driver is detected using lane changing patterns, steering wheel angle and many more. The third approach is physiological parameters based where the respiration rate, heart beat and many more are monitored to detect driver's fatigue state. In this three approaches the physiological parameters based is accurate approach but it will be purely based on driver's consent as he need to wear a relevant instrument on his body to detect his fatigue state. So we used behavioral based approach in our system.

For alcohol detection some systems detect alcohol at the starting of the vehicle and some systems continuously monitor alcohol state in their range. In this paper we suggest a system that continuously monitor the driver's alcohol state.

II. LITERATURE SURVEY

Every year a large number of deaths occur due to fatigue related road accidents. According to study around 20% accidents are occurring yearly with an average of 90 deaths per day due to drowsiness. Drivers who drive continuously will have a chance of

getting tiredness. Hence detection of driver's drowsiness and its indication can significantly decrease number of accidents. To decrease these type of accidents some image processing techniques like viola jones, Adaboost, haar cascade, gobar features, facial land mark detection. The following are some of the methodologies for detecting the drowsiness.

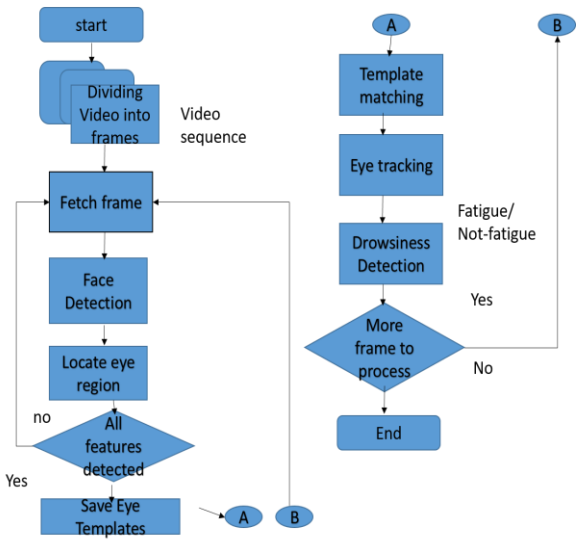
Tianyi Hong [1] presented a system which used face-detection method basing on the cascade of classifiers trained through Adaboost technique. Optimization in this system is performed by applying the integral image of the original image to develop a canny filter for cascade processing and improve the performance. Integrated performance primitives (IPP) have been used for better and faster computational results. This system is validated in GENE-8310 embedded platform.

B. Warwick [2] proposed a system that is based on physiological approach in which the driver wears a wireless biosensor called BioHarness, a wearable device capable of collecting the physiological data and then transmitting to a Smartphone. This data is then analyzed through Fast Fourier Transform (FFT) and Power Spectral Density (PSD) which provide the desired vectored inputs that can be fed into a Neural Network. This system is run on a drowsiness detection mobile app by the researchers.

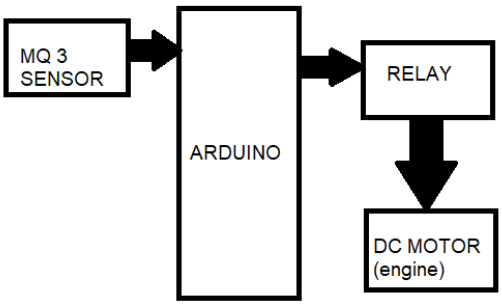
K. Dwivedi [3] developed a system which identifies drowsiness of the driver using representational learning. A Haar-like face detector feeds the images to a 2-layer convolution neural network for extracted features which are then used to train a softmax layer classifier for detecting whether a driver is drowsy or not drowsy. This system was able to yield a satisfactory result of 78% accuracy in detecting the drowsiness and alerting the driver.

In many civilized culture use of alcohol is taken as a tradition. The habit is also connected with traditions, used in festivities and different personal parties. A small level of alcohol will change the way human behave where its bodily behavior, its actions are diminished. This type of body inability to control itself can be highly dangerous and can involve car accidents which will risk the persons sitting inside the car also on the persons on the road. The legislation has brought in number of laws like fine, cancellation of driving license etc. so that this can be minimized. The above mentioned causes show the necessity of a simple, accurate and precise instrument to be used by the automobile manufacturers and vehicle modifiers so that vehicle will not start due to alcohol content in the air inside vehicle. The consumption of the people is more common in young group where they drink and cause accidents due to rash driving. The person consumed alcohol changes the blood alcohol concentration in the body thus affects the body actions. There is direct connect between blood alcohol and breathe alcohol concentration. For the blood alcohol content measurement blood samples have to be taken but for breathe alcohol concentration measurement there are sensors available which detects breathe. The first method of taking blood samples can be possible by taking on the spot samples by the traffic police which is also a good method. In the second method breathe analyzers are used to sense the breathe but this itself is not enough, this method can be integrated with car system. So that any smell of alcohol in the car will force the inability of car to start. The system proposed is developed on embedded applications on Arduino family of boards.

III. SYSTEM SETUP AND METHODOLOGY



The above flow chart digram is the drowsiness detection system. Firstly the webcam fetches the frame where the face of the driver is detected. The face detection is done by Haar casscade classifier. After detecting the face then the eyes are detected using Perclos algorithm. Then if all features are detected correctly then the system moves to next stage that is eye tracking where the drowsiness is detected by the eye closure time. If the features are not detected correctly the the system again goes back to the stage where the frame is fetched. The algorithm runs in this way to detect the fatigue state of driver. If the algorithm detects the drowsiness it immediately sends signal to the arduino chip which inturn operates the braking system of the vehicle using relay.



This above block diagram is for the alcohol detection system. In this firstly the alcohol state of driver is detected using the MQ3 sensor. This sensor monitors the alcohol rate in the air within the driver range. If the alcohol rate is high then this sensor sends signal to the arduino chip as it is connected to the sensor. This arduino chip controls the motion of the vehicle using relay which is connected to the braking system of the vehicle.

In this way the both systems work. Here the arduino chip is same for both systems. This arduino chip is connected to the relay on the other side and this relay is connected to the battery which runs DC motor in the braking system of the vehicle. In this proposed system we made both systems as a single unit.

IV. COMPONENTS

1. Arduino chip:

Arduino is a single board microcontroller, intended to make the application of interactive objects or environments more accessible. The hardware consists of an open source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. Pre-programmed into the on-board microcontroller chip is a boot-loader that allows uploading programs into the microcontroller memory without needing a chip /device programmer. In this paper we used arduino chip to access and control the alcohol sensor and webcam of laptop on the one side and relay on the other side.

2. Relay:

An electrical device, typically incorporating an electromagnet, which is activated by a current or signal in one circuit to open or close another circuit.
Whenever the alcohol concentration is more or drowsiness is detected then this system prohibits the motion of the vehicle through braking system of the vehicle.

3. Battery:

A battery is used to start a motor vehicle. Its main purpose is to provide an electric current to the electric-powered starting motor, which in turn starts the chemically-powered internal combustion engine that actually propels the vehicle. Once the engine is running, power for the car's electrical systems is still supplied by the battery.
In this paper we use battery to power the electromagnetic braking system in a vehicle.

4. DPDT Switch:

A DPDT switch (double-pole, double-throw) is an electromechanical switch that can be formed by adding a pole to the SPDT switch.
This is very easy to install because it is available with a locking system that can lock & unlock the switch directly in a remote cabinet without using any Nut-Bolts or screw for fitting. This Double Pole Double Throw switch includes two inputs & four outputs where every input has two equivalent outputs.
This switch is very versatile because each terminal in this switch can be either in one of two positions. The inputs of this switch can connect to four different outputs, so it can redirect a circuit into two different modes of operation.

5. DC Motor:

In this paper, the DC motor is used to control the braking system of the vehicle.
This type of system is mostly used in electric vehicles. This DC motor is powered by the battery and in turn helps to control the braking system of the vehicle.

In this system the motor is attached with gears in order to make it electromagnetic braking system. The gears are arranged in compound gear train order for its additional benefits.

6. Alcohol Sensor:

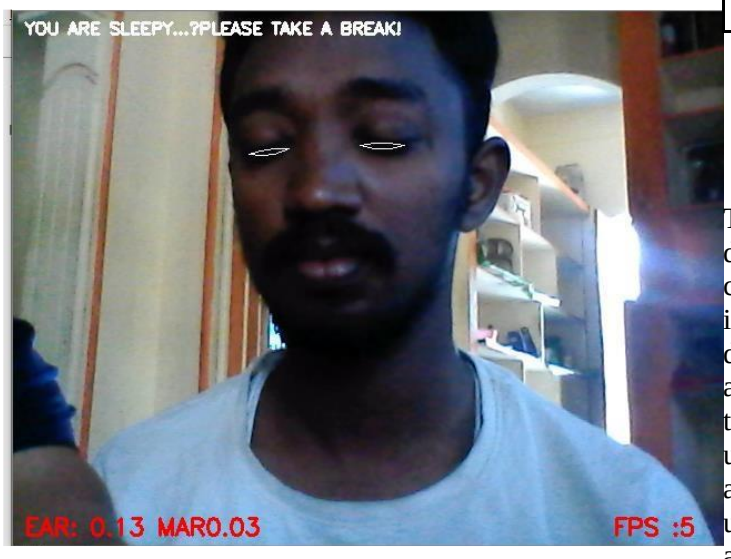
The MQ-3 alcohol concentration sensor we selected uses tin dioxide as a gas sensing material.
When the sensor is in an environment containing alcohol vapor, the conductivity of the sensor increases with the concentration of alcohol in the air. It is simple to use. The circuit converts the change in conductivity into a voltage signal corresponding to the gas concentration. MQ-3 has the advantages of high sensitivity and good selectivity to ethanol vapor, fast response recovery, long life and reliable stability, and simple drive circuit.

V. RESULT AND CONCLUSION

The testing of the system is performed on two circuits and tabulated as below:

Name of the Test:	Drowsiness Detection
Item Tested:	Eye
Sample Input:	Driver's face
Expected output:	Drowsiness Detection and Vehicle Stops
Actual output:	Same as expected output
Remarks:	Successful

The above table is the result for the drowsiness detection system and the sample screenshot of detection is shared below:



Now the alcohol detection system is tested and tabulated as below:

Name of the Test:	Alcohol detection
Item Tested:	Arduino
Sample Input:	Alcohol smell near sensor
Expected output:	Vehicle stops
Actual output:	Same as expected output
Remarks:	Successful

The current study developed an automated system for detecting drowsiness of the driver and alcohol concentration of the driver. The continuous video stream is read from the system and is used for detecting the drowsiness. It is detected by using haar cascade algorithm. The haar cascade algorithm uses haar features to detect face and eyes. Haar features are predefined are used for detecting different things. The haar features are applied on the image and blink frequency is calculated using perclos algorithm. If the value remains 0 for some amount of time then it detects as sleepy and alerts driver by stopping vehicle. If the value remains constant for longer periods then the driver is said to be distracted then also vehicle stops. If the MQ3 alcohol sensor senses

alcohol in air around the driver region then the vehicle stops immediately.

The work can be extended by extracting the features of mouth where the driver can be detected as drowsy through yawning. If the driver yawns repeatedly for more number of times then we can say that he is in sleepy mode. If the number exceeds a limit then we can alert the driver. This work can also be extended by implementing in full night light using IR web cam. It is camera which uses infrared radiations to detect whether the person is drowsy or not. The alcohol circuit also can improve the sensing range by implementing industrial alcohol sensors in cars.
While this is a research paper, there is scope when this completely turns out to be developed into an application which can be run by the end users on their own for their own purposes on their own systems. If this project is supported by the government then it can be made very cost effective and can be introduced in every four wheelers.

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