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An Integrated Device for the Detection of Mis-Behavioural Conduct of Drivers and Intimation of Accidents in Roads

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ABSTRACT: Rapid Improvement of growth in technology (especially automobile sector), usage of time, economy and population leads individual and business people having a capability to own a vehicle based on their needs. To precisely reduce the transportation burden, time, communication difficulties etc., people could have spent money to own a vehicle. For the day-by-day increasing population, public agencies also introduced lot of transportation measures in different form to accommodate the public needs to get fulfil. As a result, vehicle counts are getting increased in roads every day. Lag of futuristic planning approach in road system to meet the increasing traffic, driver's inadequate skill in driving and rule violation behaviour while driving causing safety relevant issues among passengers in and outside of host vehicle, which could be an accident or health issues. Irresponsible behaviour of some driver's while driving (rash driving, drinking while driving & rule violation), accident preventive measures and location identification of accident if accident happens have raised too many questions among public in travel about their safety. To answer the questions which raised among public commuters despite inappropriate roads, proposed a centralized multipurpose system for monitoring and detecting the instances happening inside and outside of the vehicle that harmful to safe journey. The Objective of the proposed system is to identify the Instances (sleeping, alcoholic consumption, rash driving through continuous monitoring of driver using camera and sensors), accident preventive measure (an Intimidation alarm has been raised inside cabin, if the vehicle moves far ahead of pre-defined stated distance to the vehicle goes in front of it), accident location intimation (an intimation function written in controller board which triggers and informs the situation to the control room through SMS carried on once vehicle get accident using GPS and GSM).

KEYWORDS: Change Detection Algorithms, Drowsiness detection, alcoholic consumption, Sensors, Accident Detection, Accident Prevention, GPS, and GSM.

I. INTRODUCTION

Automobile sector has developed rapidly, as there could be a huge need from public, business sectors and in all forms of accessibility throughout global. Even though getting better usage, it's important to consider the safety of people who engaged in vehicle whether they might be passenger or a driver. Vehicles are categorized based upon their utility from transportation to farming, etc. As usages of vehicles for transportation of public, individual or business sector have increased, leads to issues in safety factors also. Rather than higher end model, most budget model type vehicles don't have any safety related devices to monitor the instances happening inside and outside the vehicle. Instances like driver drowsiness, alcoholic consumption of driver, rash driving and intimate the location once accident made needs to be informed if safety related concerns met in a vehicle. In this proposed integrated device for vehicle's and commuters safety, there are four phases has been implemented driver drowsiness detection using detection

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algorithms like viola and Jones algorithm [7], alcohol consumption detection using gas sensor, accident prevention using ultrasonic sensor and finally accident detection and Intimation using (detection by Vibration sensor, GPS and GSM respectively). The entire system is developed in Matlab code and then the m-file could be fetched into the controller board for the functioning of the device. The proposed device was tested with too many real-time scenarios as it works well and attained the targeted results when compared to traditional model systems.

II. LITERATURE SURVEY

A. *Driver Drowsiness Detection*

Being one of the parts in Integral System, Driver Drowsiness Detection functioning is used to identify driver drowsiness while driving through camera interfaced with the Raspberry pi kit. It sounds alarm inside the vehicle once driver caught. This module can be classified into two categories, one is using physiological characteristics and another one using facial image features. Legacy devices used for drowsiness detection should detect the changes in driver’s physiological characteristics such as brain waves, heart rate and pulse rate etc.,. Even though it’s good in factors like detection accuracy, there is need of some special devices must be attached on driver’s body. It is an intrusive and causing much annoyance to the driver. People in fatigue show some visual behavior can easily observable from changes in their facial features like eyes, head and facial terms. Then later detects using parts present in top of the body eyelid movement, head movement, and yawning based on some image features and its characteristics. Driver state of attentiveness can be predicted easily by observing the visual state of driver. [1] Tabrizi presented a method to estimate the open or close state of eye by the number of pixels in pupil. [2] Mai Suzuki proposed to use the open or close degree of eyelid and blinks time for drowsiness detection. [3] Zutao Zhang adopted a vertical projection technique to locate the position of eyes and judged open or close state of eye based on gray image feature. [5] Zhu used Kalman filter to track the eyes and obtain the parameters of the blink duration which are used to judge the fatigue of the driver. [4] Dengue Liu finds the difference between current frames and the previous frame. [6]Vidyagouri Hemadri proposed to detect drowsiness of driver by combining eyelid movement and yawing. However, all these algorithms used high definition and high quality images. In fact, low definition and low quality images are usually captured by a simple camera. In this paper we are finding the eye blink based on shape measurement which can also give good result for low quality camera. Performance evaluation of face recognition using Gabor filter, log Gabor filter and discrete wavelet transform[8]. The initial step is to start with a curve around the object to be detected, the curve moves towards to its interior normal and has to stop on the boundary of the object[9]. These images utilized for different purposes and noise is an unwanted component of the image[10]. Edge detection is the initial step for obtaining information from an image. A new edge detection operator is proposed, which is a hybrid one [11].

B. *Alcohol Consumption Detection*

The Alcohol sensor (MQ303A) is used to detect the presence of alcohol or any other LPG like gases. The sensor has an excellent sensitivity combined with a quick response time. The sensor can sense alcohol and cigarette smoke anyone consumed inside the vehicle. This unit it is incorporated into an emergency light interconnected with Arduino UNO Microcontroller, to give a visual indication inside the vehicle.

C. *Accident Prevention*

The ultrasonic sensor (HC-SR04) is used to find out the distance between moving successive vehicles. This unit is incorporated with an emergency alarm interconnected with Arduino UNO Microcontroller. When sensor detects the distance value with in the range of 100cm between the vehicle and its successive vehicle, leads to sounds the Alarm. This is very much useful for those who staying inside vehicle to know the rash driving made by driver of that vehicle.

D. *Accident Detection*

The vibration sensor is used to detect the collision of vehicle, the vibration sensor senses the vibration in terms of accident like event happened. This unit is interconnected with Arduino UNO Microcontroller, when accident happens, the system automatically find the Location using GPS and send SMS to the accident care Centre or pre-defined numbers already kept in microcontroller through GSM.

III. BLOCK DIAGRAM

Below the block diagram (Fig.1) represents the overall process of Integrated Device for the detection of mis-behavioral conduct of drivers and Intimation of accidents in roads

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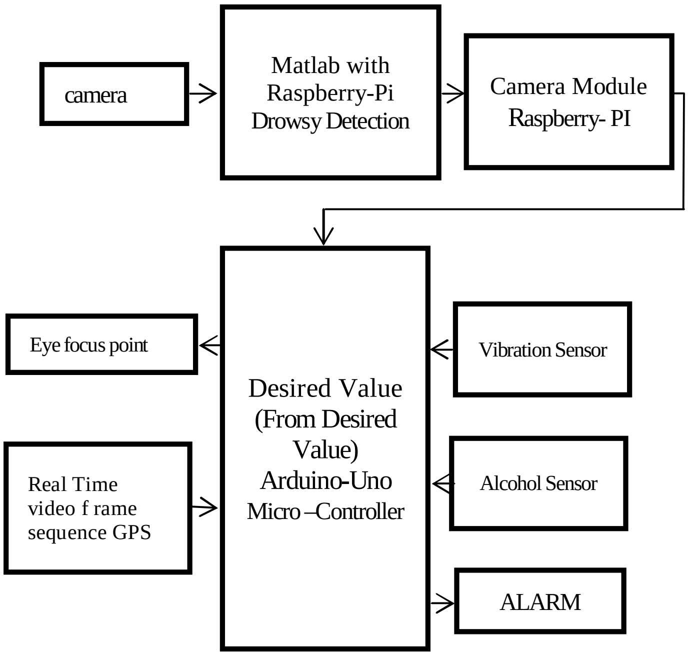

Fig.1. Block Diagram of Integrated device for Driver Awareness

IV. METHODOLOGY

A. Driver Drowsiness Detection

Driver Drowsiness Detection method is used to find out the sleeping nature of driver while driving. The code for this part is written in MATLAB. Matlab code is then fetched into the Raspberry pi, so that code can work with respect to image frames read from camera. MATLAB code can run permanently without system through any powered microcontroller is not easy as in general. But to do this, initially we need to install the Raspberry pi supported package in MATLAB to run the MATLAB code in Raspberry pi with system. To function Raspberry pi camera without system, its compulsory to convert MATLAB file into Linux supported file (like .dll file). Once Conversion takes place then the converted file fetched into the raspberry pi OS using WINSCP Software. Finally, run the .dll file using Python. So that system can work as described.

The image is captured from the video, where image is numeric representation (normally binary) of a two dimensional image. The video is acquired by using raspberry pi camera module. The camera provides 30 frames per second at VGA mode. Then the recorded video is opened in MATLAB and the frames are grabbed as required, then from every frame system detects the driver’s vigilance.

The face detection is done by the Viola and Jones algorithm [7]. In every given frame the face is detected using a Viola and Jones algorithm [7]. Face detection can be regarded as a specific case of object-class detection that determines the locations and sizes of human faces in arbitrary (digital) images which ignores rest of the parts such as human bodies, building and trees. Some Legacy face-detection algorithms focused on the detection of frontal portion of human faces, whereas the proposed one attempting to solve the more general and difficult problem of multi-view face detection. That is, the detection of faces that are either rotated along the axis from the face to the observer (in-plane rotation), or rotated along the vertical or left-right axis (out-of-plane rotation), or both.

The Proposed method takes into account the variations in image or video by factors such as face appearance, lighting, and pose. Many algorithms implement the face-detection task as a binary pattern-classification task. That is, the content of a given part of an image is transformed into features, after which a classifier trained on example faces

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decides whether that particular region of the image is a face, or not. If the result of face detection comes positive then the algorithm proceeds to the next, otherwise the flow of algorithm goes back to the image capture stage.

Once human face is detected, eye region has to be detected from it for further processing. As Eyes are present at top of the human face, leads us to extract the partial portion (eyes located region) from it removes rest of the face regions helps to speed up the process.

In this system, proposed an ESD (Eyelid's State Detecting) value, a measure used to classify the state of an eyelid, whether it is opened or closed. The value can be computed by using the ESD algorithm. The objective of this algorithm is to find the minimum threshold value, which means that binary image having at least one black pixel. In ESD, image with the threshold value (begin with 0) sequentially, represents absence of eye blink, If there is a white pixel occurred when successive count of 5 no's black pixel instantly ensures eye blink. If there is no black pixel increase the threshold value and follow the same sequence until get black pixel.

To detect the eyes status whether it's open or close normally a quite challenging task. Many different approaches were implemented for the detection of the status of the eyes. Some of them are listed below:

In correlation approach, the eye region is correlated with the previous eye region. The result will be different in case of change in eye status. It was implemented with the built-in function of 2D correlation in MATLAB. But the positioning of eye in each frame and the external factors affect the correlation results. The experimental results show that this system is also not very good for the implementation.

In this technique, the first step is to calculate the average intensity for each eye x – coordinate. These average values are found for both the eyes separately. When the plot of these average values was observed it was found that there are two significant intensity changes. The first intensity change is the eyebrow, and the next change is the upper edge of the eye. Thus with the knowledge of the two values, the position of the eyes in the face was found. The state of the eyes (whether it is open or closed) is determined by distance between the first two intensity changes (valleys) found in the above step. When the eyes are closed, the distance between the x– coordinates of the intensity changes is larger if compared to when the eyes are open.

Normally, human eye blinking rate is minimum 10 times per 60 seconds, the interval is about two to six seconds and the duration of each blink is about 0.15 to 0.25 seconds, then the number of groups of continuous blinks is not more than two times. Therefore, three criterions are proposed to judge drowsiness of driver.

The first criterion is the duration of eyelid closure. It is used as distinctive characteristic to judge whether a driver is drowsy or not. It is computed by counting the number of eye closed frames. If the number of related frames is larger than a threshold drowsiness is reported.

The second criterion is the number of groups of continuous blinks. It is another characteristic to judge whether a driver is drowsy or not. The number of groups of continuous blink can be computed by the eyelid open and eyelid close. When driver lies in normal condition, the number of groups of continuous blinks is not more than two times, otherwise he may be drowsy.

The third criterion is the frequency of eye blink. It is also used to judge whether a driver is drowsy or not. When a driver is drowsy, the frequency of his blink becomes slower. Numbers of eyelid open and close are counted continuously to check the drowsiness of the driver. It includes the structural process of this module and it is shown in following Fig.2

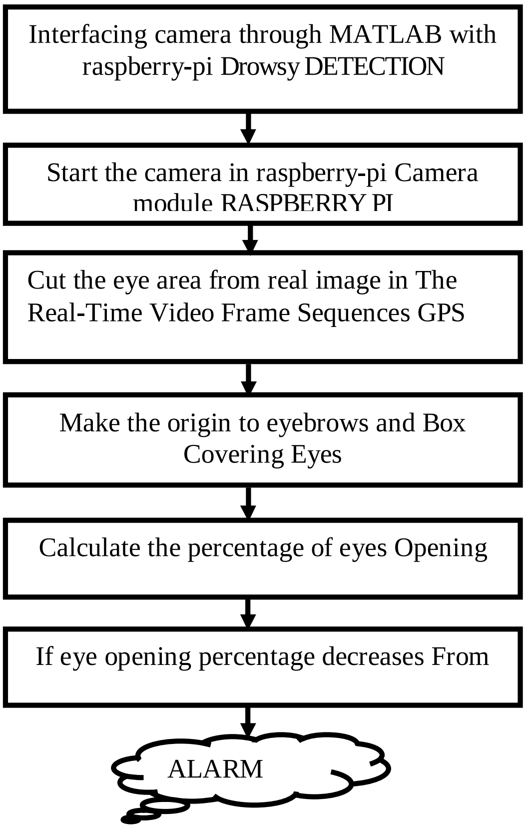

Fig.2. Methodology of Driver Drowsiness System

A.1 Algorithm

1. Turn on the Device.
2. Boot up of device
3. Camera starts its video streaming of object in front of it (Driver)
4. Classify the defined object as stated in Code.
5. Segregates the frames from videos as it requires one frame per second instead of 27 frames.
6. Extract the eyes alone region.
7. Calculate Percentage of Eyes Opening
8. If Eyes Percentage decreases threshold value. Indicate Drowsiness.

B. Alcohol Consumption Detection

Alcohol detection sensor (MQ3) is interfaced with Analog pin of Arduino UNO microcontroller. Sensor continuously sensing alcohol value. When the driver drunk alcohol at the time of driving, sensor value will goes above the threshold value (50). When the analog value goes above threshold value, the alarm will ON.

B.1 Algorithm

1. Turn on the Device.
2. Alcohol sensor ready to sense the alcohol value
3. Check the alcohol value is above or below the threshold value
4. If the value is above the threshold value, alcohol consumption is conformed
5. Then the Alarm is ON.
6. Otherwise the Alarm is OFF.

C. Accident Prevention

The Ultrasonic sensor is used to measure the distance between the vehicles. This is interfaced with Capture pin (10th GPIO pin) of Arduino UNO microcontroller. Sensor continuously sensing Distance value from vehicle to Object. When sensor detects the object within the range of 100cm, buzzer will ON. Otherwise buzzer will OFF.

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C.1 Algorithm

1. Turn on the Device.
2. Ultrasonic sensor ready to sense the distance between our vehicles to opposite object.
3. Check the distance value is above or below the fixed value
4. If the value is below the fixed value, Object near to the vehicle is conformed
5. Then the Alarm is ON.
6. Otherwise the Alarm is OFF.

D. Accident Detection And Intimation

The accident detection system includes GPS modem, GSM modem, and microcontroller and vibration sensor. The Vibration sensor is connected with Arduino UNO microcontroller. When collision of vehicle occurs, vibration sensor will sense the immense of vibration. One of the inputs of microcontroller will goes Low. It sends interrupt to microcontroller. When Microcontroller will receive interrupt it will enable the GSM modem. It will send SMS on predefine numbers already stored in microcontroller.

Then the microcontroller Reads the Latitude and Longitude values of accident location information by using Global Positioning system (GPS) and sends the message to the government accident care centers through GSM modem.

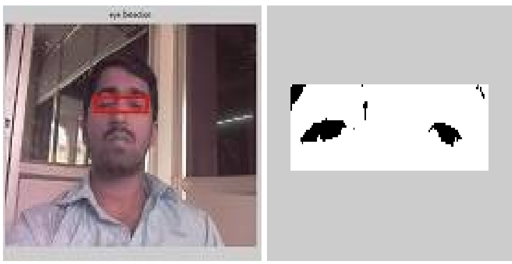
D.1 Algorithm

1. Turn on the Device.
2. Vibration sensor is ready to sense the Vibration.
3. If vehicle get accident, Vibration occurs
4. Then the GPS is used to find the location and send the SMS through GSM.

V. EXPERIMENTAL RESULTS

A. Driver Drowsiness Detection

A-1 (Eyes Open) A-1 (Result Image)



A-2 (Eyes Closed) A-2 (Result Image)

Fig.3 (A-1, A-2) States of Eyes Opening and Closing

The above pictures are eyes open and closed capturing and result image of the drowsy driver. If the capturing image of person eye is opened then the alarm is OFF state (i.e Disabled) otherwise closed then the alarm is ON state (i.e Enabled). When drowsy is detected the alarm is ON.

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B. Alcohol Consumption Detection

Analog value	23	37	59	96
Alarm Status	OFF	OFF	ON	ON

Table.1 Evalution of Alcohol Consumption Detection

Threshold value is 50 (analog value)
1 volt = 51 analog value

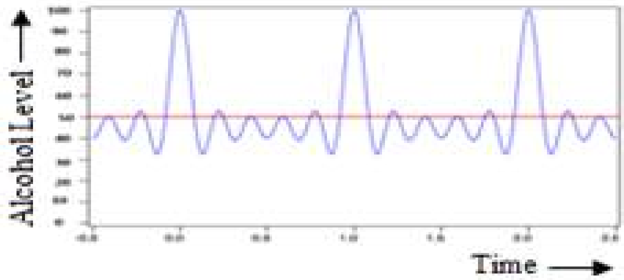

Fig.4 Evalution of Alcohol Consumption Detection

The threshold value is assigned in 50analog value. So when the analog value goes above the threshold value, the alarm will ON.

C. Accident Prevention

Distance in CM	Alarm Status
55	ON
120	OFF
70	OFF
95	ON

Table 2. Evaluation of Accident Prevention

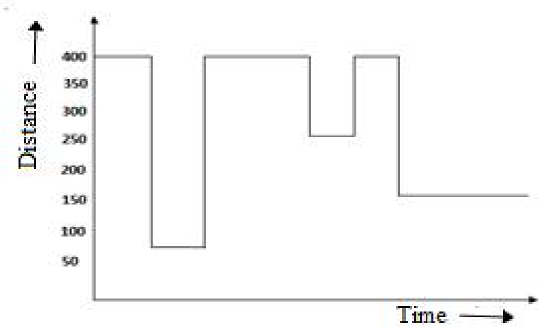

Fig.5 Evaluation of Accident Prevention

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The range is fixed in 100 cm. so within the range when the sensor detects the object(one car to another one), immediately the buzzer will ON. Otherwise buzzer will OFF.

D. Accident Detection And Intimation

Fig.6 Working Structure of Accident Detection and Intimation using GPS and GSM

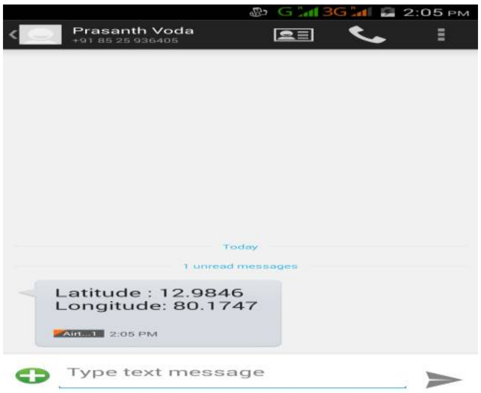

Fig.7 Evalution of Accident Detection and Intimation

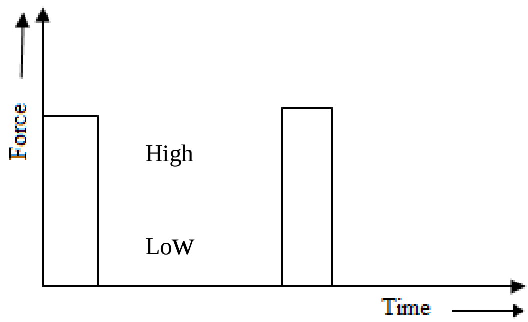

Fig. 8 Resultant Graph of Evalution of Accident Detection and Intimation

In this figure shows the latitude and longitude number displayed in the mobile phone by using GPS and GSM modem.
Threshold value is 5 volt
Low = 0 volt

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High = 5 volt

If the system reaches the low state '0' ,then no process in the system. i.e process is normal otherwise the system reaches high state '5' the system pass a message to the nearest government accident care center through GPS and GSM modem.

V. CONCLUSION

The proposed System ensures the safety of the passengers and driver of the vehicle. The analysis and design of this proposed device has derived based on the real-time scenarios. The proposed device is used to avoid various road accidents caused by instances inside and outside of the vehicle (drowsy, rash driving by drivers, speed alert and accident intimation). Integrated functioning, performance and accuracy made it smarter when compared to the traditional. Even though many expected functions exposing reliable factors in this system there are some pitfalls in scheduling the functions in modules for getting resource access concurrently. This is due to the unavailability of efficient and low cost processors in market. In future works, having a plan to focus on the issue in accessing resource concurrently to reduce the complications through advanced scheduling concept in same low cost efficient processors.

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Principal investigator:
Dr.D.Murugan
Co investigator:
T.I.Manish
T.Ganesh Kumar
Project Fellow:
V.Cibi Castro

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