

Fleet Management and Vehicle Accident Prevention System

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ABSTRACT: Vehicle accidents have become very common today and most of the accidents occur due to improper driving behaviour of the driver. The proposed system focuses on monitoring drunk and drive condition and drowsiness of vehicle driver through webcam while driving to avoid accidents and also deal with accident detection of vehicle and necessary actions to be taken. The objective is to develop tracking system to provide location information and keep a check on driver behaviour.

Another important part of the project is to develop an android application for fleet management which involves vehicle tracking, driver management and safety management. Fleet management software and tracking system find application in various business organization and government agencies which rely on transportation in business, to avoid or minimize the risks associated with vehicle investment.

KEYWORDS: GPS, GSM, Monitoring unit, Tracking unit, Haar cascade classifier, Cortex M3 controller, buzzer, Vehicle tracking, Google MAP.

I. INTRODUCTION

A group of vehicles are known as fleets having similar features mostly used for regular, common work. To manage a fleet is nothing but managing the transportation of collection of vehicles. The vehicles vary from vans, cabs, ships etc. Many private companies need fleet vehicles for their business. The goal of the project is to develop hardware for vehicle tracking, driver management, vehicle safety and to develop a smart phone application for fleet management. Software application for managements of fleet serves different professions around the globe. For cargo vehicles, managing delivery of products from start to end is easy as they greatly reduce paper work.

Management of fleets is an important function for the business organization which depends on transportation in business to avoid or reduce the loss risks associated with investment, improves efficiency, increases productivity and reduces overall employee costs and transportation. They reduce administrative overhead and can make the staff concentrate on critical issues rather than chasing the drivers.

Here vehicle tracking is GPS based where this device will be mounted on the hardware and the GPS location information of the vehicle at perpetual intervals is captured and provided to central server. The other information can include date, speed and time. GPS satellites send this information along with some math to solve receiver's position on earth. This information is very helpful in tracking actual vehicle usage thereby fuel usage.

Accident avoidance is one more goal of the project. According to Annual Global Road Crash Statistics, approximately 1.4 million human deaths happen in road crashes that means on an average 3178 deaths per day. In addition to this, 25 to 55 millions of people are harmed. Over 85% of all road crashes occur in developing countries which have less than 50% of world's vehicles. Unless precautions are taken, road crashes and injuries are depicted to become driving reason for death by 2025.

Vehicle Accident Prevention System (VAPS) is all about preventing accidents because of improper driving propensities of the driver like alcohol consumption and driving a vehicle when he is feeling drowsy or sleepy. Driver management is another important factor. More number of accidents lately cause due to inadequate driving. Whenever there is vehicle-vehicle crash, most of the time the driver of larger vehicle will be the culprit.

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If driver is drowsy or alcoholic accident causes. Driver sleepiness is perceived as a vital variable in the vehicle accidents. Driving performance crumbles with increased sluggishness results in more than 30% of all vehicle accidents. But the life lost once cannot be got back. Many drivers feel that they are fully armed when they are drunk but the fact is that it reduces the performance of rule based driving. So we need to keep an eye on drink and drive. We can use technology to determine whether a person has consumed alcohol or not. A buzzer is fixed to wakeup driver. Some vehicles carry goods like chilled items like cakes and ice-creams, agricultural products, vaccines etc. All these have to be maintained at lower temperature. Hence temperature sensor is needed to monitor the temperature of goods carried by the vehicle. Section II describes survey based on the proposed work. Section III describes proposed methodology. Section IV details about experimental results and outcome. Section V concludes the paper.

II. RELATED WORK

There are many papers concern about the vehicle tracking system but in different manners. They were used in different fields like military applications, transportation sectors, business organizations, educational institutions and government agency. Driver exhaustion and diversion during travel are real reasons for the road accidents.

S.P. Bhumkar et al provide a solution to this in which driver should have to place his cell phone in mobile stand while driving. In the event that the driver doesn't do as such then the arm begins its working accordingly and tend driver to stop the car and then continue the conversation on cell-phone, which leads to the least chances of happening of accidents. For another situation if road setbacks occurred, this anticipate sends crisis message to the rescue group and surrounding individuals to spare the life of casualties [1]. Float level sensors are used for monitoring the fuel level in the fuel tank in turn fuel theft is avoided. Vehicle security is enhanced by ignition control system. Anti-vehicle theft is provided by engine locking unit. Heart beat sensors have been used for driver fatigue monitoring to determine the heart rate of driver [2].

S. Boopathi et al proposed system to work the vehicle in safe velocity at basic zones. The base station has transmitter, intended for Frequency Modulation (FM), the receiver part is actualized in Vehicle. The ARM processor at receiving end gets critical frequency and is enacted in critical mode. Speed Control Driver (SCD) is planned to place in vehicle's dashboard, and shows data on vehicle. Once the information is received, it automatically alerts the driver, to reduce the speed according to time and zone [3].

Crash sensors are placed on the chassis of car, this crash sensor is capable of sensing the force produced by an accident i.e. in terms of "G" (G - Force against gravity). Once the force is prominent than or equivalent to the limit set on the sensor, it produces an output which in turn is amplified by a signal conditioning unit, normally a CE mode amplifier acts as a signal conditioner [4].

Face detection technique is applied in car security system. Memory unit stores various driver images. FDS (Face Detection Subsystem) is needed to detect face of driver and compare with existing image. If image mismatches, then information is sent to owner via MMS. Proprietor can follow the area through GPS [5].

Prof. Zing Xu et al, talks about a vehicle to vehicle Location-Based Broadcast correspondence convention, in which every vehicle produces crisis messages at a consistent rate. Message sending can help cautioning people in surrounding vehicles past the radio transmission range. The authors propose a multi-bounce telecast convention taking into account space reservation MAC. Motion properties of vehicles are utilized to help with message hand-off. Two conventions to lessen the measure of sending messages were proposed [6].

N. Dheerthi et al proposed a system which is used for data monitoring that records various parameters like seat belt state, crash state, and engine temperature and speed control of the vehicle. ARM 7 has been used as embedded controller in this system design. An IR based eye blink sensor needed to identify the drowsiness of the driver. The crash sensor module on model vehicles records crash data at the moment of impact [7]. Since infrared rays are illuminated on eyes, this was not a proficient strategy for eye blink detection.

Boon Giin Lee et al proposed a strategy to screen driver wellbeing by breaking down data identified with weakness utilizing eye movement checking and bio signal processing. It is implemented using smart phone and sensors are embedded through Bluetooth. But the processing time is slow because of the native camera feature [8].

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III. PROPOSED WORK

Vehicle tracking system is designed to monitor driver behaviour and android application is developed for fleet management. Fig. 1 shows the solution architecture. The system consists of different modules which are interfaced to the ARM Cortex M3 (32 bit) controller. Temperature sensor, alcohol sensor, accelerometer acts as input to controller. LCD display and buzzer are outputs. The input power is step down to 5v DC from 230v AC power line by the power supply unit. The main module is the Cortex M3 processor having greater performance efficiency allowing more work to be done without increasing the frequency or power requirements and low power consumption enabling longer battery life. The system continuously monitors temperature exceed condition of vehicle container, alcohol intoxication of driver, and accident occurrence of vehicle.

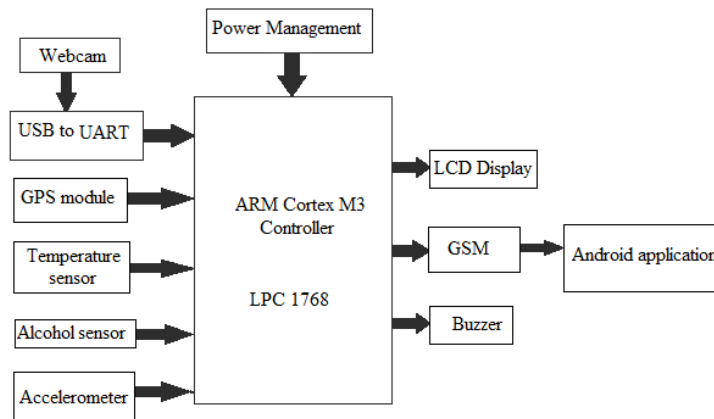


Fig. 1 Block diagram of Hardware implementation

It also monitors drowsiness of driver in view of eye open/ close condition in continuous frames of images taken through camera. These parameters are messaged through gsm to a phone, which has an application to display the information to the authenticated person with vehicle recognition, and location information that is on Google map. So it is a complete package having fleet management, driver safety and management and quick communication.

Accident Monitoring

Accelerometers yield a voltage subject to the separation between two planar surfaces either of these "plates" is accused of an electrical current. So when an accelerometer is tilted, the space between the plates changes which changes the electrical limit of the framework, which can be measured as a voltage yield. This method of sensing is known for its high accuracy and stability. Capacitive accelerometers are less inclined to noise and vary with temperature, regularly scatter less power, and can have bigger data transferring capacities because of internal feedback circuits. Usually when vehicles meet with an accident, it is tilted or jerked. Accelerometer senses the tilt, and it is intimated to authenticated person through GSM.

Alcohol consumption detection

This sensor module comprises of a steel exoskeleton under which a detecting component is present. This is subjected to current through interfacing leads. This current is known as heating current through it; the gasses approaching the element get ionized and are consumed by them. This modifies the resistance of detecting component which modifies the estimation of the current leaving it. When the driver has consumed the alcohol it is intimated to authenticated person through GSM.

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Temperature sensing

It is placed at the container side to monitor the temperature of the goods (chilled items, vaccines, sea foods, agricultural products etc.) to see that they are fresh and consumable. This sensor is alternative when the refrigeration fails in reefer vehicles. It has 3 pins as vcc (5v), ground, output pin connected to controller. The sensor produces output voltage proportional to Celsius temperature. It has low heating capability and draw only 60uamps of current from supply.

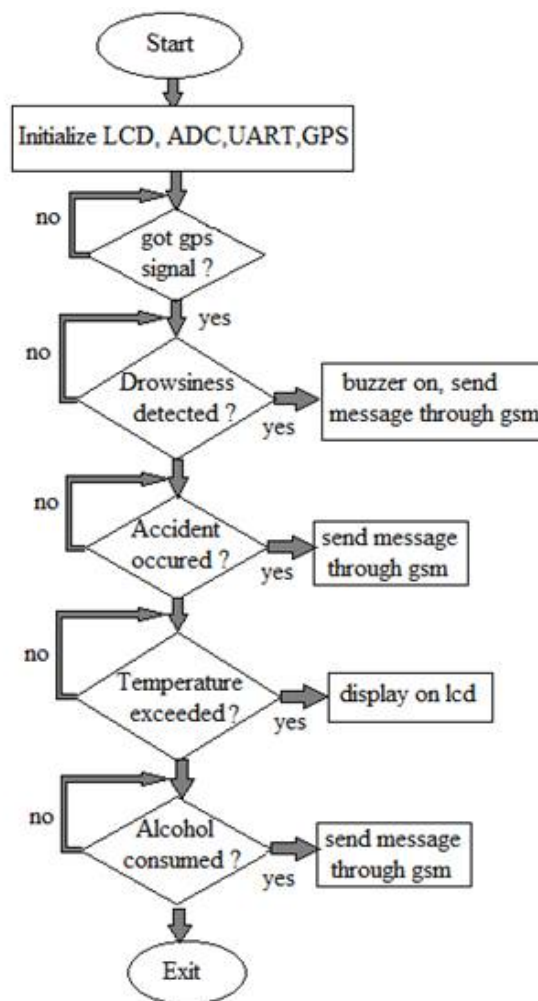


Fig. 2 Overview of proposed system

As shown in Fig. 2, when the system is turned on, the LCD display, ADC, GSM are initialized. GPS receiver persistently screens for gps signal. When signal is reached, the system monitors for the parameters like drowsiness, accident occurrence, exceed in temperature, alcohol consumption etc serially. When the event detected, it performs the respective process like alerting driver, messaging authenticated person etc.

Drowsiness detection

When a person is drowsy, his eyes are closed more than usual time. In view of eye close or eye open condition

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drowsiness of driver is getting decided. MATLAB is used to detect face, eyes of driver. Webcam is used to detect eye close/eye open condition. Computer Vision System Toolbox provides train cascade object detector for detecting objects in image. It can identify object classifications whose aspect ratio does not fluctuate essentially, for example, stop signs and vehicle seen from one side. Webcam continuously take the snapshots of driver, among which it considers three frames are considered. If driver eye is closed in these frames then driver is alerted using buzzer. The detector detects the object in the image by sliding a window over the image.

Fig. 3 shows the flowchart of face and eye detection technique. Snapshot of video is input to the webcam, algorithm tries to detect face in given image. It will move on until face is detected. After detection of face, it tries to detect eyes and calculate mean intensity. If threshold is greater than then conclude eyes are open else closed.

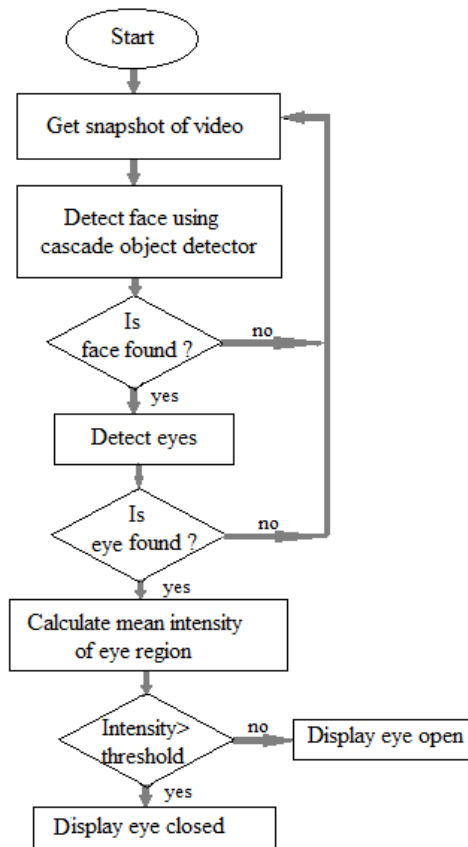


Fig. 3 Flowchart for face and eye detection

They use haar features to detect the presence of that feature in given image. Every component results in single value which is ascertained by subtracting aggregate of pixels under dark rectangle. Algorithm uses 24 x 24 window as the base window size to start evaluating these features in any given image. Adaboost technology is used, which is a machine learning algorithm helps in finding only best features. After these features are found a weighted combination of all these features is used in evaluating and decide if any given window has a face or not.

IV. EXPERIMENTAL RESULTS

The system is successfully designed and tested. Various tests are done to make sure the system works as required. MATLAB code is tested and when the drowsiness was detected the buzzer will beep.

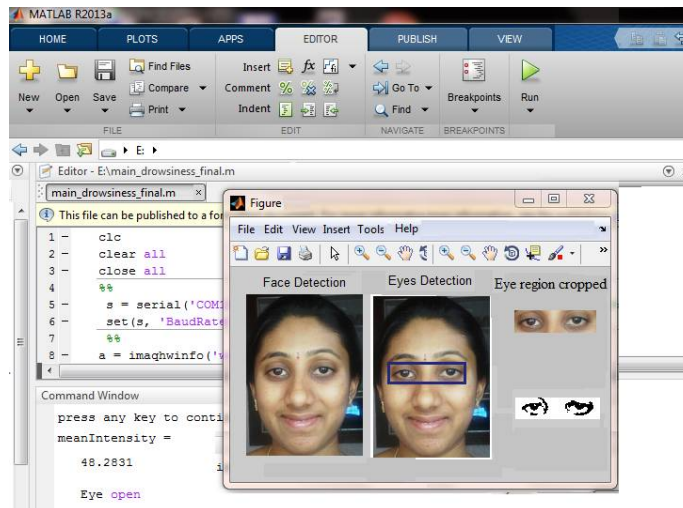


Fig. 4 Detecting eye open condition

The first step in simulation is creating new M-file in MATLAB. A text file with editing window with command window, command history, current directory is opened. The code is saved with .m extension and run. As shown in Fig. 4 above, the person's face is detected and cropped. Then eye region is detected and cropped and then it is converted into gray scale image. If mean intensity found less than threshold concluding eyes are open.

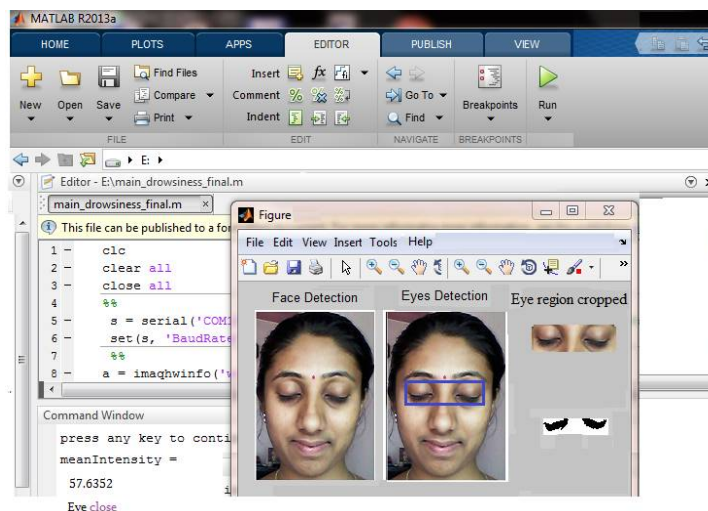


Fig. 5 Detecting eye close condition

Likewise, snapshots are taken with eye closed. Then eye region is detected and cropped and then it is changed over to gray scale image and mean intensity found greater than threshold as shown in Fig. 5. The mean intensity is found using matlab function "mean2" which calculates average or mean of matrix elements. Usually mean intensity value of eye closed region is greater than eye open region.

Similarly, Exceeded temperature is displayed. Alcohol consumption, accident occurrence is intimated to authenticated person. An android application is developed to display this information along with location information using GPS. The Fig. 6 shows hardware structure used in the project. It is placed on vehicle which needs to be tracked; the hardware components are as indicated in block diagram.

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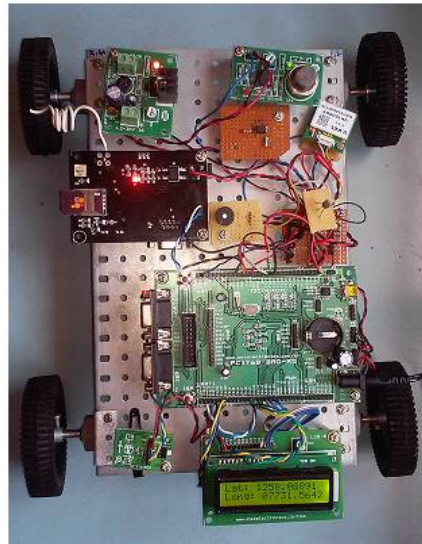


Fig. 6 Hardware system

The hardware sends various parameters to the smart phone via GSM. All the information is stored in a database. The Fig. 6 is showing gps co-ordinates in the display.

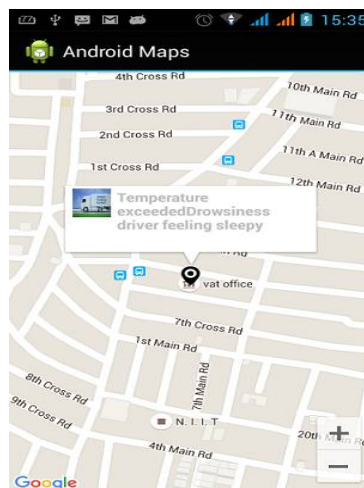


Fig. 7 Android Maps

Smartphone application developed is able to display them in Google map as shown in Fig. 7 above. The concerned person should have this application so that he monitors the driver behaviour (alcohol consumption and drowsiness of driver), vehicle speed, accident occurrence if any, and temperature of goods carried by the vehicle. The application itself will leave a message to the ambulance in case of vehicle crash.

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V. CONCLUSION

This project has successfully made an attempt to develop a system to avoid accidents due to improper driver behavior. It likewise gives safety measures in case of vehicle accidents. An android application is successfully developed for fleet management and driver management. The hardware is interfaced with the webcam in the laptop and the camera acts as input device. Since the platform for the system is ARM Cortex M3 controller, it has an advantage of low power consumption, low cost, and greater performance efficiency. Application for fleet management which is android based makes it more user friendly rather than desktop application.

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