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Gsm Based Fully Automated Surveillance Ensuring Road Safety And Data Acquisition For Legal Prosecution

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Abstract

Negligence in the ethical codes of road safety thrives the rate of occurrence of accidents. Lack of monitoring and rescue system in pre and post conditions of accidents is being the emanating factor in the loss of invaluable human life. The victims of 'hit and run' cases are deprived of their fair insurance claim due to insufficient records, on the other hand it encourages fake FIRs and false insurance claims. The above factor insists the development of a complete autonomous system for monitoring and data acquisition to ensure road safety. The automated surveillance system uses novel technologies to achieve our needs. Road safety comprises of collision intimation evaluating the severity of the crash through MEMS and also the exact spot of the crash is known using GPS. Since an automated system of evaluation and intimation is made use, medical aid can be availed sooner, thus reducing the risk of loss of life due to delayed medical attention. Operator safety deals with the continuous monitoring of the individual driving the vehicle. The system is designed in such a way that if any abnormal health condition has been sensed, the vehicle immediately moves out of the lane and comes to halt. With the usage of GSM, communication is established to patrol, insurance, hospitals about the location, vehicle details and operator.

Keywords: health monitoring, crash intimation, rescue, hit and run, tracking.

Introduction

Driver has to be conscious to avoid accidents. We are visualizing many accidents this is because of negligence of driver and unsafe usage of the vehicle. Road accidents

occur mainly due to two reasons one if the driver is alcoholic and the other reason is drowsiness. In both the cases driver will lose his consciousness. This creates trouble in road safety. Nowadays hit and run cases are increasing in count. Though the laws are enforced, the public fail to fall it. The culprit finds loop holes in the law and tries to escape from the case and even police have no evidence to support the victim. Such issues lead to unfair FIR's which doesn't provide any compensation. In the highways no proper medical aids are available due to lack of intimation at right time which leads to loss of lives.

Research Background

In present situation many thefts and accident occurs. This paper suggest a novel approach for identifying the reasons which may lead to collision also provides evidences to the police to make legal prosecution effective and emphasize justice for all.

Alcohol Usage and Jeopardy

Alcohol consumption is major cause for road accidents all over the world. In India about 70% of death are due to drunk and drive[1]. Alcohol is absorbed by the blood at a fast rate. This greatly influences the concentration which reflects on the driving skills. As a result of which mortality increases. As per the statistics of 2010 about 1,34,000 people were killed in accidents (mean of 336 persons/day)[1].

Drowsiness and Aftermaths

The second major cause of accident is drowsiness of driver. Long distance drivers are more vulnerable to such accidents. The driver tends to have a short sleep during the travel these small breaks give them worst consequences. U.S Transport Authority claims around 5021 accidents between the year 2005-2009.Also in the year 2009, 2.5% of the total accidents account to drowsy driving[2].

Cardio Vascular Risk

Recent days elderly drivers encounter heart attacks during the travel and loose control over the vehicle and had their last breath. We also realize that the passenger's life lies in the hands of driver. Consequently passengers are also killed. According to U.S department of transportation 84% older drivers faced accident due to seizures[3]. Heart attack can be avoided by prior medical checkups. Cardio vascular arrest have symptoms before head such as nausea, giddiness, excess sweating, pain .Medical prescribed by the doctor has to be followed.

Speed and Tragedy

Speed thrills but kills. Youngsters like to drive the vehicles at a dashing speed but this is a big hindrance to the public. They are at the gun point of their life if they loose their control over the vehicle they loose their life. A report conveys that mortality doubles for every speed hike of 5km/h more than 60km/h[4].

Hit and Run

Road safety is the major part in road design. The highways are designed with stretches in such a way to minimize accidents. The Union Ministry of Road Transport and Highways provides a statistics of 3340 death in Mumbai city in the year 2008-2009[5]. The government take many steps like giving proper training to drivers, maintain standards in vehicles (seat belts, rear view mirror tightening, power steering) and also conduct awareness programmes. It is indigestible truth that most of the hit and run cases are unsolved because of lack of evidences like details of offenders vehicle and physiological evidences of the real driver. Pedestrians are more vulnerable to such accidents. Also many are killed due to the delay in medical attention.

Bankruptcy

Vehicle insurance claims that deceive the insurance agencies are in the rise. The types of claims that can be made are claiming more than one insurance for a single injury, staging an accident, claiming insurance for an accident that person was not involved, fakely reporting a vehicle as stolen, claiming for injury that was not happened in that accident. From the reports of NICB stated in foxbusiness, about 50,472 false injury claims are made[6].

Taking all these scenarios into account an optimum solution is discussed in this paper. In existing system security lock, air bag release during collision. There are many demerits in the system a owner looses complete control over his vehicle when lost also there is no data acquisition method to help police to find the offender's vehicle. Proper compensation are not given to the victims.

Related Works

Vehicle Ignition over Ride System Using Breath Analyzers for Preventing Drunken Driving [21] this system specifically concentrates in drunk and drive by using gas sensors .gas sensor are not reliable as they get affect by numerous external factor such as fumes in petrol bunk.

Driver fatigue and drowsiness monitoring system with embedded electrocardiogram sensor on steering wheel [9] this system precluded many other health condition which requires immediate attention.

Design & Development of a GSM Based Vehicle Theft Control System' [10] here it fails in collecting information about the individual who are actually drives the vehicle. all the above system are designed as per user's specification which favour them a loop hole in legal procedure.

None of the above system intensifies need of ensuring welfare of hit and run case victims and lack of real time date makes system vulnerable which in turn encourages the insurances fraudulent activities.

Proposed System

This system ensures complete safety of the vehicle and the operator during ON and OFF condition. If the driver is alcoholic the vehicle would not start. If the driver feels

drowsy he is alerted with a buzzer. The driver's heart rate is monitored. In case of abnormality message is sent to Emergency care unit. In case of accident the MEMS sensor estimates the severity of crash then message is sent Emergency care unit, Police station and Insurance. In case of diminutive accident the driver can use a switch to send a "not emergency" message so that the patrol need not rush into the site but the message will be saved in the database. Message consist of Vehicle Reg no, Chassis no, Owner details such as owner name, blood group, phone no, finger print of the driver etc. Along with GPS the message is sent. 'Hit and Run' case, this message in the database can be revived to nab the driver also the real driver can be found by using finger impression. Incase of theft, police can activate the tracking system and follow the signal.

Methodology

In this section the type of sensors used and their working is described. The proposed system is briefly explained with consecutive steps.

STEP 1: Alcohol content is sensed. If it senses the alcohol the engine would not start. If not the engine is started.

STEP 2: Eye blink is sensed. If the receiver's output is high it indicates the driver is drowsy, so alert sound with a buzzer is provided else continuous monitoring occurs.

STEP 3: Heart beat is kept monitoring throughout. If it is abnormal, message is sent to nearby emergency care unit.

STEP 4: In case of crash, a time delay for switch input is provided. If the switch input is given a message is sent to rescues with a code 'NOT EMERGENCY'. Else message is sent to rescue teams and insurance which indicates that it is emergency.

STEP 5: When the tracking message is received by the controller it responds by sending the GPS location of the vehicle to the owner's mobile number.

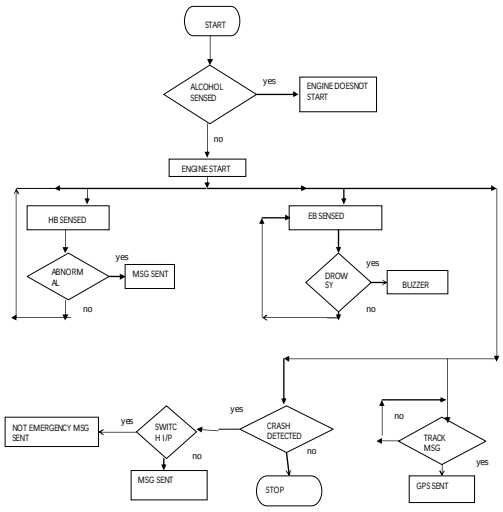

Figure 1: Working of the system

Alcohol Sensors

The alcohol sensor mounted on the steering will first emit a light which will be reflected back to the same sensor from the driver's finger.

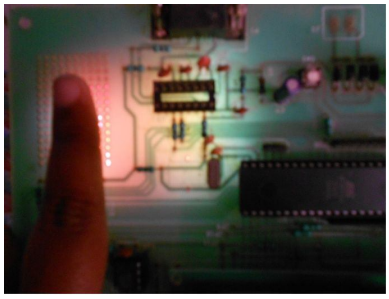

Figure 2: (a) Finger type Sensor

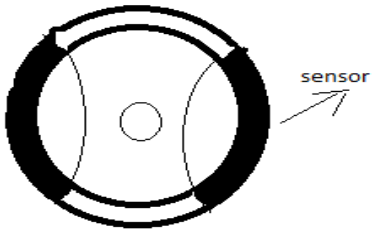

Figure 2: (b) Steering

This is the input to find out whether the person has drunk. From the wavelength of the light emitted varies with alcohol consumption. The blood alcohol content (BAC) and the chance of accident are discussed. For 0 level the risk of accident is 3%.Whereas for 0.21 the risk is whooping 64%.

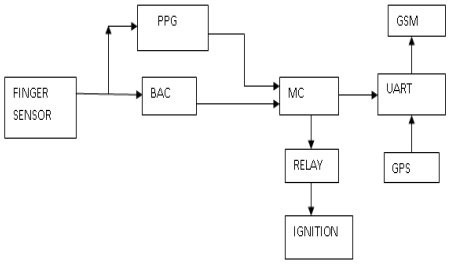

Figure 2: (c) Working of alcohol sensor and heartbeat sensor

On the identification of alcohol the ignition is blocked. So the vehicle does not start. Thereby the accidents which may occur due to lack of consciousness can be avoided.

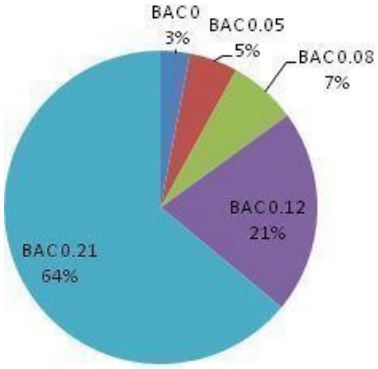

Figure 1: Relative risk

Heartbeat Sensors

The heart beat sensor utilized works on the principle of plethysmography. These are also finger type sensors (Figure.1). The heartbeat sensors and BAC sensors is a shared network both use the same input[15]. The sensor detects the heartbeat as electric pulses. During every cardiac cycle the blood flow in the vessel varies. For every contraction cycle the blood flow increases so there is a slight variation in the size of the vessel. Similarly during relaxation period the blood is withdrawn from the vessel and so the size reduces. When an optical input of certain wavelength is passed during this alternating condition their reflection differs. This is taken as the input to find the heartbeat rate.

The input from the finger type sensor used to find the PPG (photo plethysmograph) pulse. This is given to the controller which checks with the preset value and predicts whether it is normal(Figure.8) or abnormal condition(Figire.10). Incase if abnormal condition persist the controller stops the vehicle slowly (Figure.2). It also send a message of the vehicle location to the nearby emergency care unit. It helps the person to get a proper medical attention at right time and prevent life loss.

Heartbeat Sensors

The eye blink sensor uses IR transmitter and receiver[7] IR light does not create any discomfort like glare to the driver because of its wavelength[8]. The black color absorbs more radiation. This is the principle used by the IR sensor to detect the blink. The iris of the eye is black in color when the eye is open more light will be absorbed and the output in the receiver will be low[9](Figure.11). When the eye is closed the output in the receiver will be high (Figure.12). By the output we can find whether the driver's eye is in open or closed position[14].

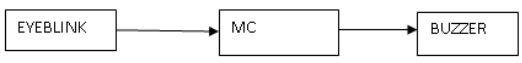

Figure 2: Eye blink working

The eyeblink sensors are placed in specs which have to be worn by the driver[17].This IR receiver output is given to the controller[20]. If the closing period is greater than the threshold time limit, the controller gives command to activate buzzer and alert the driver[22](Figure.4). The casualties caused due to drowsy driving can be reduced.

MEMs

MEMS is micro electronic mechanical systems[19]. MEMS almost find application in all industries. MEMS is used to find vibrations, accelerations. Here we use tri axial accelerometric type MEMS to find the variation in all three axis. Firstly the MEMS is caliberated with gravity(g). From the MEMS output voltage versus time graph is plotted[16] . During the time of collision there will be a sudden change in voltage in two or more axis, from which we can identify the plane of crash Variation in X,Y voltage implies a FRONTAL collision.

Variation in Y,Z voltage implies a SIDE collision Variation in X,Y and Z voltage implies a BACK collision. MEMS input is given to the controller. When a crash is identified the controller gets the finger print of the driver from the finger type sensor along with the vehicle details (chassis no, engine no), owner details (phone no, Reg. address), GPS location of the vehicle are sent to hospitals, police station and insurance agencies.

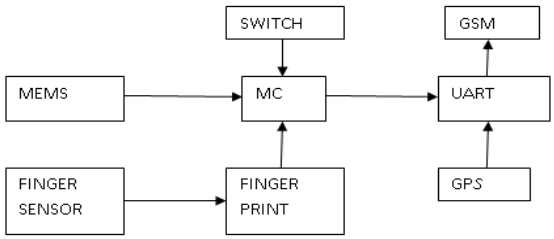

Figure 3: MEMS in operation

In case of a diminutive accident the driver can give a switch input to the controller so the message will be delivered with a code ‘NOT EMERGENCY’ so the concerned authorities need not rush to the place but the information will remain in the database. By this system we can reduce the death due to collision, can find the real culprits using finger impression in hit and run cases, and also reduce fake insurance claims.

Tracking System

In existing systems the owner losses complete control over his lost vehicle[10]. In this system there is a remedy to this problem. Here there is an in-built system to send GPS location to the concerned owner’s number[11]

The controller in this system supports two GSM[12]. When the owner sends a message to one of the GSM in the system , the controller response by sending GPS location of the vehicle through other GSM in the system to the owner’s number[13].

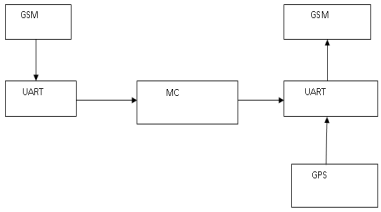

Figure 4: (a) Overall Tracking system

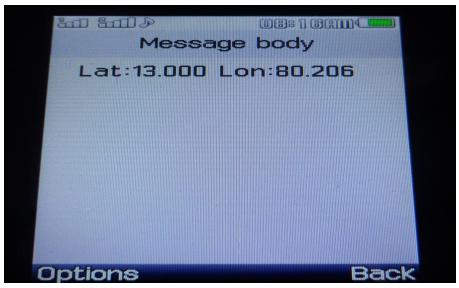

Figure 6: (b) Tracking Message

Methodology

Heartbeat Sensor

Heart beat sensor works on the principle of light modulation. It counts the number of beats per minute. The normal heartbeat rate is 60-80 BPM. But during the condition of heart attack the count will reduce.

Figure 5: Normal ECG

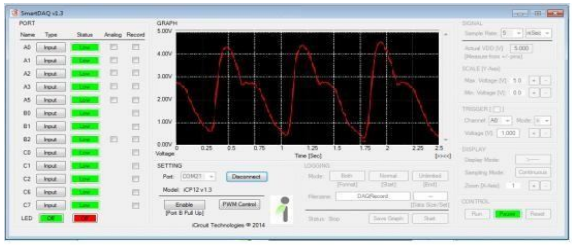

Figure 6: Normal PPG

The Figure.7 shows a normal ECG 72 BPM for which the corresponding PPG output is shown in Figure.8. During this the controller will not take any actions. The Figure.9 shows abnormal heartbeat 50 BPM now the PPG output(Figure.10) will be very less and it will not be counted as a pulse. When the pulse rate decreases than the threshold value, the necessary actions are taken.

Figure 7: Abnormal ECG

Figure 8: (a) Abnormal PPG

The threshold value of 40 BPM is programmed.

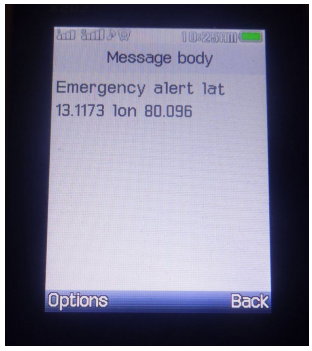

Figure 10: (b) Emergency Alert

Eye blink Sensor

The voltage across the receiver can be used to find the drowsiness state of the driver. If the eye is open the output is low and if the eye is closed the output is high.

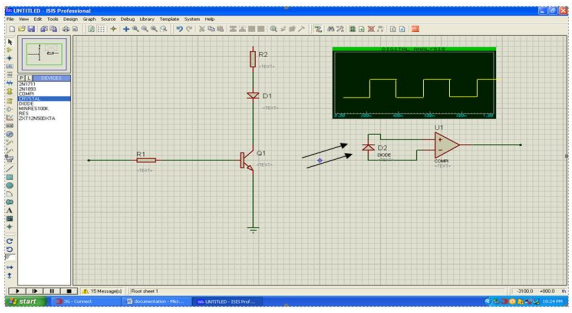

Figure 9: Normal blink

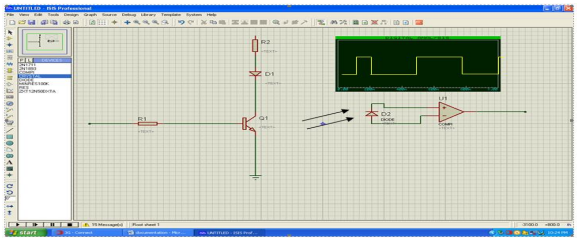

Figure 10: Drowsy state

In Figure.11 there is a periodic open and closure of eye lids. So the output goes high for a moment and then decreases which indicates the closing period is smaller than opening period so the driver is awake. In Figure.12 the output is high for a long period of time which denotes that the driver is drowsy and the controller gives buzzer alert.

The micro sleep is 1000 ms which is 16 seconds and so we set threshold time limit as 20 seconds.

MEMs

The accelerometric type sensor is used to detect the deceleration that occurs after collision. The system must be carefully designed to detect crash. The speed changes that occur during an accident are taken to judge whether it is a collision or not.

Figure 11: (a) MEMS value

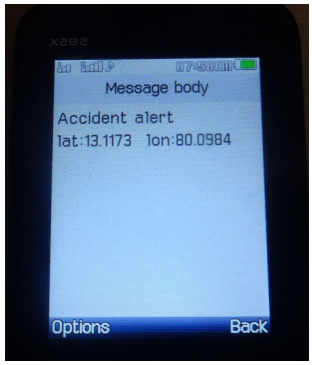

Figure 13: (b) Accident Alert

The velocity changes are detected by the MEMS sensor which produce a corresponding voltage output. This voltage output when exceeds the threshold value necessary actions are taken by the controller. The vibrations are plotted in 3 axis so variation in voltage of a single axis will not be considered as collision.

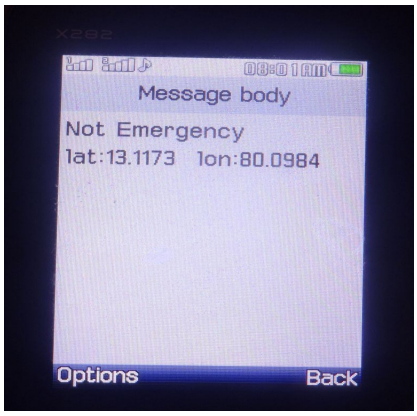

Figure 13: (c) Not Emergency

The acceleration on first integration gives vibration which on further integration provides electrical signal.

The steep decrease in the acceleration of 15kmph – 35kmph is set as threshold value.

Conclusion

It monitors the overall safety of the vehicle as well as the operator and intimates the driver's health to local system. With the usage of automatic emergency alert system and accident locator the medical aids are provided at right time thereby the loss of human life reduced. By the precautionary system the number of accidents is reduced. It also provides 24*7 security surveillance give hands to hit and run cases as it doesn't encourages fake FIRs , it reduces the revenue losses for insurance agencies also the

real criminals are traced by the unique finger impression. This provides proper reimbursement for hit and run victims. From the data acquisition system the real criminals can be traced and it serves as a trust worthy evidence for judicial proceedings. Vehicle tracking is possible in case of thefts.

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