CONTROL AREA NETWORK (CAN) BASED SMART VEHICLE SYSTEM FOR DRIVER ASSISTANCE USING ARDUINO

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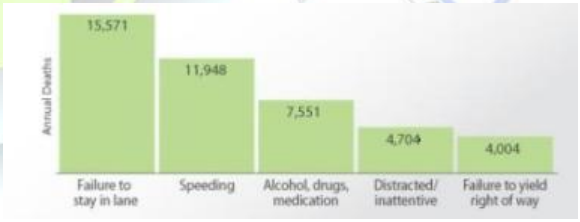
***Abstract* - Automotive Electronics sector is now a day's becoming more in demand due to its increasing technology. Most of luxurious cars consist of automatic controls for different parameters present in the car surrounding. As more and more applications are available of on-vehicle information system, the connection between the vehicle bus network and information system is becoming a trend. Basically in automobile industries CAN protocol is used for communication. The proposed system presents the development and implementation of a digital driving system for a semi-autonomous vehicle to improve the driver-vehicle interface. System contains controller block designed using Arduino ,Alcohol, Eye-blink,IR and Vibrating sensors, CAN controller, GPS and GSM modules.**

***Keywords* – ARDUINO , *Control Area Network, Sensor, Alcohol*.**

I. INTRODUCTION :

The health problems confronting the Indian society have been rapidly changing since there is removal of controls by the government and consequent globalization. As there is rapid increase in urbanization and industrialization the necessity to travel across the entire country by all age groups is taking place. With poor public transportation systems in the country, the people are referring their own personal modes of transport for traveling from one place to another which has increased across Indian cities and in rural areas. Poor infrastructural facilities results in motor vehicles accidents being in clash with people and other vehicles on roads. Considering Indian roads, nearly 20 to 30 types of vehicles of different shapes, sizes and speeds drive on available space and are in a rush to reach their destination. Road crashes, deaths and injuries have become an important and leading cause of deaths, hospitalizations cause of deaths,hospitalizations, and socioeconomic losses in the country. According to the Road accidents report 2008 in India by the Transport Research Wing the Ministry of Road transport and Highways, Government of India shows that driver fault is the single most importantfactor and accounted for 81 percent of total accidents. These include driving at very high speeds over the optimum speed limit as desired, presence of alcohol and drugs in the blood stream of the driver, fatigue and sleeplessness, distracted driving through use of cell phones, visibility issues such as fog or rain etc., road and vehicle related factors. The impact of crash severity is influenced by presence or absence of certain protective mechanisms such as use of airbags, use of safety devices like helmets in the case of motorcycles, seat belts in case of four-wheelers and use of child-restraints for infants . The graph1 bellow shows accidents caused by driver errors. Some experts say that 95 percent of accidents are caused by driver errors.

FACTORS CONTRIBUTING TO FATAL CAR ACCIDENT



GRAPH 1. Vehicle crashes caused by driver errors.

In order to reduce the number of road accidents caused by various driving factors and to improve the safety and efficiency of the traffic, the researches And companies on Intelligent Transportation System (ITS) are conducted worldwide survey for many years. Intelligent vehicle (IV) system aims to assist drivers in any dangerous situations to avoid the road system which is able to sense and understand the environment around itself. Hence there is a need to design a system which will overcome above Problems [1].

A new system is introduced which combines the features like lane detection, alcohol and drowsiness

detection. This system detects the mentioned parameters and makes the vehicle Intelligent by maintaining the parameters within specified safety conditions and avoiding road accidents caused by drowsiness and traffic rules are also not violated [1].

II. RELATED WORK

Different approaches for detection of driver drowsiness, alcohol and lane detection are presented below. In "Context-Aware Driver Behaviour Detection System in Intelligent Transportation Systems" [1], a context aware system is proposed which detects driver behaviour. A VANET (Vehi cul ar ad hoc networks) is used to detect abnormal behaviours of drivers and to warn other vehicles on the road to prevent accidents. A model based on dynamic Bayesian networks (DBNs) in real time is proposed which detects four types of driving behavior like normal, drunk, reckless, and fatigue. By observing 35 numbers of evidences differentiations between different drivers behavior are observed.

In, "Detection of Driver Fatigue Caused by Sleep Deprivation" [3], has presented driver drowsiness indications which are based on the driver–vehicle interaction characteristics. The experimental setup is developed in which 12 male participates have performed test in two sessions. These sessions Include different levels of sleep such as partial sleep deprivation and no sleep deprivation. This experiment shows that sleep deprivation had greater effect on no sleep deprivation of skill based cognitive functions. When the drivers were sleep-deprived, their performance of responding to unexpected disturbances degraded, which caused distractions in lane tracking, vehicle following, and lane changing. In, "The automatic control system of anti drunk-driving", in which a alcohol detection system is prepared which consists of a alcohol sensor connected to ADC and this ADC is interfaced to a Microcontroller which performs control action. When alcohol is detected the car is controlled automatically so that occurrence of Drink and Drive is avoided.In "Water-cluster – Dectecting Breath sensor and application in Cars for Detecting Drunk or Drowsy Driving" [5], has developed a system that detects drunk and drowsiness. In this the water-cluster- detecting (WCD) sensor is designed which works on breath detection. The WCD breath sensor detects breath in the form of water clusters in which measuring of electric currents of positively or negatively charged particles present in breath are separated by using an electric field.

The WCD sensor consists of an alcohol sensor which detects the alcohol contents and simultaneously detect the electrical signal of breath , which ensures that the sample is not an artificial source but from a person breath .This sensor is kept at a distance of about 50cm and is testing the level of alertness of a driver sitting on the driver's seat. The designed WCD sensor is highly sensitive to detect alcohol vapours and drowsiness of the driver by measuring breath peaks due to which drunk and drowsy driving is prevented.

In, "Self-Calibrated multiple –Lane Detection system" [6], has presented a multiple-lane detection system. This system works on detection of lane with the help of camera as well as GPS module.GPS module generates digital map data of the road based on vehicle's position. The camera is used time system is presented by combining camera and GPS module. Developed system concludes with vehicle's location, Camera position sensing and lane detection.

In, "On-Board Lane Detection System for Intelligent Vehicle Based on Monocular Vision" [7], a system is developed that locates the road lane position with help of monocular vision in real time. This system works in five steps viz. edge detection of road lane, matching of road edges with texture database, searching the continuity of road edges, linking for enhancing road lines, localization with a K-means cluster. As no assumptions are made about road structure the presented system is generalized one.

In, "Study on the Embedded CAN Bus Control System in the Vehicle" [8], developed system uses an ARDUINO controller as the main control unit and CAN bus within a car. ARDUINO is used to obtain high performance. Use of CAN makes high speed communication in control networks and also helps sharing of data between all nodes which results in enhancing their collaborative work. The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers.

Fig1 : Arduino Board

III. PROPOSED METHODOLOGY

The figure 1 show the proposed system block diagram and figure 2 show the tracking section.

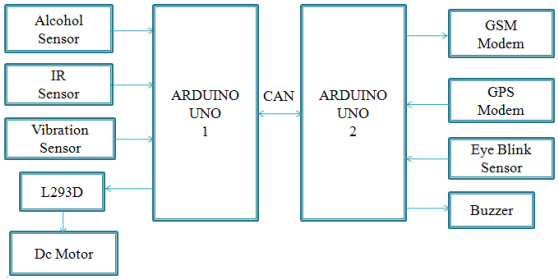


Fig 2 : Proposed Block diagram

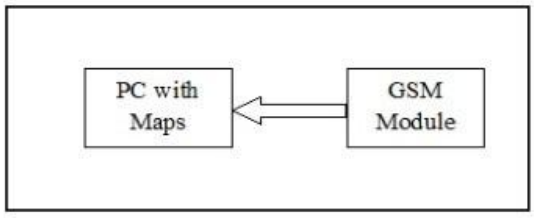


Fig 3:Tracking system

The proposed system is divided into three parts as Master, Slave and Tracking section as shown in figure2 and figure 3. Master block is responsible for detection various parameters such as of driver drowsiness, driver's alcohol content and unauthorized Lane shifting. Slave block is responsible for collecting all the data received from the master and to provide control action such as alerting the driver and to control lane shifting. There is use of GPS and GSM modules that provides Location of the vehicle which is useful for tracking the vehicle's position. The tracking section in figure 3 uses PC installed with maps interfaced with GSM module. Both the ARDUINO , Master and Slave are connected to CAN bus protocol for exchanging the information and for communication. CAN is used For more faster and reliable communication. The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins,6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. Christo Ananth et al. [4] proposed a system about Efficient Sensor Network for Vehicle Security. Today vehicle theft rate is very high, greater challenges are coming from thieves thus tracking/ alarming systems are being deployed with an increasingly popularity .As per as security is concerned today most of the vehicles are running on the LPG so it is necessary to monitor any leakage or level of LPG in order to provide safety to passenger. Also in this fast running world everybody is in hurry so it is required to provide fully automated maintenance system to make the journey of the passenger safe, comfortable and economical. To make the system more intelligent and advanced it is required to introduce some important developments that can help to promote not only the luxurious but also safety drive to the owner. The system "Efficient Sensor Network for Vehicle Security", introduces a new trend in automobile industry.

Sensors:

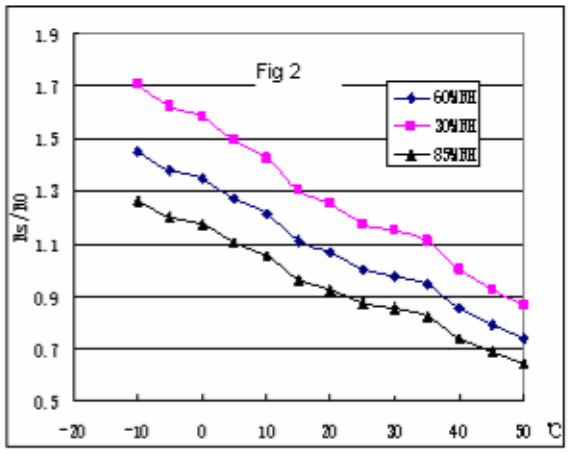


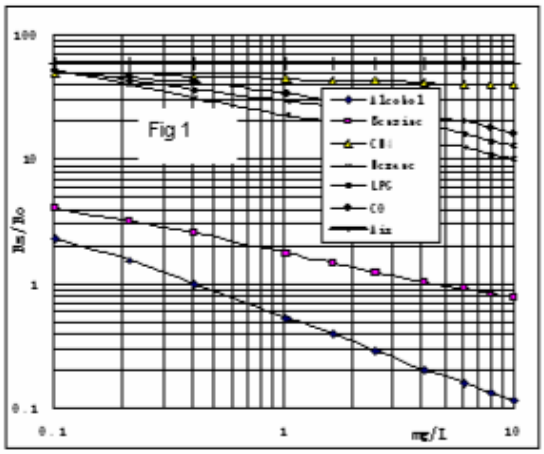
Fig 4: Alcohol sensor

Alcohol breath analyzer is fitted inside the vehicle. The sensor could be used to detect alcohol with different concentration .It is with low cost and suitable for different application.

Sensitivity characteristics of the MQ-3, ordinate means resistance ratio of the sensor (Rs/Ro)**,** abscissa is concentration of gases. Rs means resistance in different gases, Ro means resistance of sensor in 0. 4mg/l alcohol. All test are under standard test conditions.
Sensitivity to smoke is ignite 10 pcs cigarettes in $8m^3$ Room and the output equals to 0.1mg/I alcohol

Ordinate means resistance ratio of the sensor (Rs/Ro), Rs means resistance of sensor in 0.4mg/l alcohol under different tem. and humidity. Ro means resistance of the sensor in environment of 0.4mg/l alcohol, 20 ^{0}C/65%RH.

Sensitivity Characteristics



Eye-Blink Sensor

Fig 7: Eye –Blink Sensor

Scope:

We can't take care of ours while in running by less conscious. If we done all the vehicles with automated security system that provides high security to driver, also gives alarm.

Function:

This Eye Blink sensor is IR based , . The Variation Across the eye will vary as per eye blink . If the eye is closed means the output is high otherwise output is low. This to know the eye is closing or opening position. This output is give to logic circuit to indicate the alarm This can be used for project involves controlling accident due to unconscious through Eye blink.

It is placed near the eye to sense the blink count.The information to compare with normal eye blink programmed .If any abnormal situation arises give alert to the driver.

IR Sensor

Fig 8: IR Sensor

IR sensor consists of Transmitter and receiver. It is used to detect the obstacles. An IR sensor can measure the heat of an object as well as detect the motion.

Vibration Sensor

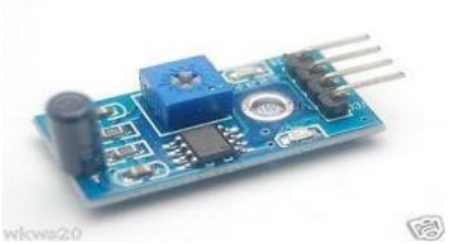


Fig 9 : Vibration Sensor

This sensor detects When a car collides with a hard objects like another car,wall etc. This sensor can installed on any size vehicle for greater accuracy.For example : Simple vibration and motion sensors can be made using a pendulum switch, mercury switch or one of many other methods. The Vibration Sensor Kit uses no moving parts to detect vibration. Instead, a piezo speaker element is used as a sensitive vibration.

Fig10:VibrationsensorKit

L293D

It is an Motor Driver Integrated Circuit. It can control two dc motors simultaneously in both clockwise and anticlockwise direction.

GSM Module

GSM (Global System for Mobile) / GPRS (General Packet Radio Service) TTL –Modem is SIM900 Quad-band GSM / GPRS device, works on frequencies 850 MHZ, 900 MHZ, 1800 MHZ and 1900 MHZ. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with 3V3 and 5V DC TTL interfacing circuitry, which allows User to directly interface with 5V Microcontrollers (PIC, AVR, Arduino, 8051, etc.) as well as 3V3 Microcontrollers (ARM, ARM Cortex XX, etc.). The baud rate can be configurable from 9600115200 bps through AT (Attention) commands. This GSM/GPRS TTL Modem has internal TCP/IP stack to enable User to connect with internet through GPRS feature. It is suitable for SMS as well as DATA transfer application in mobile phone to mobile phone interface.

The modem can be interfaced with a Microcontroller using USART (UniversalSynchronous Asynchronous Receiver and Transmitter) feature (serial communication).

Features:

· Quad Band GSM/GPRS : 850 / 900 / 1800 / 1900 MHz

· Built in RS232 to TTL or viceversa Logic Converter (MAX232)

· Configurable Baud Rate

· SMA (SubMiniature version A) connector with GSM L Type Antenna

· Built in SIM (Subscriber Identity Module) Card holder

Fig11:GSM Board

Function: It is used to communicate over the mobile network.It can be used for sending and receiving sms The Gsm module is interfaced using the serial port of the arduino board. Communication is done by AT command.

GPS Module

Fig 12: GPS module

Global positioning system modem requires minimum 3 satellites to calculate the exact location. It accurately calculates geographical location by receiving information from Gps satellite. It is used to determine the latitude and longitude position of the vehicle.GPS receivers receive data from the satellite It updates about vehicle location by sending Sms through Gsm modem.

Fig13: GPS receiver

Fig 14: Tracking image

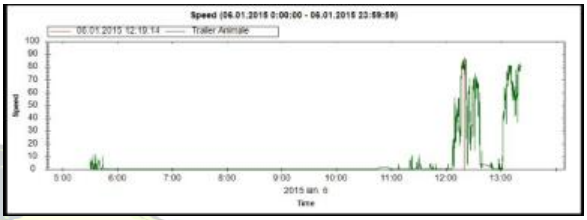


Fig 15: Vehicle speed Characteristics

Enables the viewing of the car mode parameters as graphs (speed, no. of satellites, power-supply voltage, altitude, state of the existent sensors, CAN bus information); numerous zoom (personalisation/graph export options are available.

The user to create zones (geofencing), groups of vehicles and rules. When combined, they trigger alarms that can be sent, according to preferences, either to a warning console, together with the route of the vehicle, either by email, sms, etc. The user to receive/ send sms to the fitted **GARMIN** devices (sms text, new destination, estimated time of arrival).

IV EXPERIMENTAL RESULTS

Tracking systems are mostly used by fleet operators for tracking a vehicle location, routing and others. This is a very good method for preventing our vehicles from stolen. This tracking system sends us the geographical coordinates and by using these coordinates we can track our vehicle position on electronic maps using internet. By using these tacking systems we can share real time information about transportations. And also can be share real time information or position of trains and buses with passengers. Means passengers can see the real time of arriving busses or trains at the platforms on LCD or on Mobiles.

Fig 16: Vehicle Tracking system

Fig 17:Vechicle Tracking system (received sms) Output

Here in this system we are using the GSM module for sending the coordinates of vehicle on mobile phone via message. GPS is sends the coordinates continuously in form of string. After reading this string using Arduino extract the required data from string and then sends it to mobile phone using GSM module via SMS. This information is called latitude and longitude. GPS used 3 or 4 satellite for tracking the location of any vehicle.

IV. CONCLUSIONS

Driver behaviour is affected by many factors that are related to the vehicle, the environment and over the course of driving. Monitoring and detecting the driver's behaviour to ensure road safety is important because road accidents take place. Hence it is important to capture driver behavior which will control the accidents and after effects caused by rash driving under the influence of alcohol. The proposed system deals with detection of Alcohol and Drowsiness using sensors and accordingly precautions are taken. Due to use of image processing by webcam, unauthorized Lane shiftings is detected and avoided which minimizes road accidents. The track of vehicle is also kept as there is use of GPS and GSMmodules.

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