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Intelligent Vehicle System for Driver Assistance

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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. The system is able to monitor Road lane violation, Drowsiness and Alcohol with the help of camera and sensors. The main objective of the system is to provide safety and to avoid road accidents. The system uses two ARM controllers i.e. Master for detection and Slave for controlling the parameters. The use of CAN protocol is used for communication between ARM controllers. A model is developed on which camera is mounted for lane detection, Sensor for alcohol and drowsiness detection and a GSM and GPS modules are mounted for tracking purpose. Whenever the lane is departed a warning is displayed to driver. A tracking system is also used to keep the track, which uses a GPS module. These detected data by controllers is displayed on the PC.

KEYWORDS: ARM (Advanced RISC Machines), Alcohol, Automobile, Control Area Network (CAN), Sensor.

I. INTRODUCTION

The traffic environment in India is very dynamic and it is this dynamicity which poses unique challenges for both mobility and safety. Poor infrastructural facilities results in motor vehicles being in conflict with people and other vehicles on roads.

On Indian roads, nearly 20 to 30 types of vehicles of different sizes, shapes and speeds compete for 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, disabilities and socio-economic losses in the country. The report Road accidents in India 2008 by the Transport Research Wing and the Ministry of Road Transport and Highways, Government of India show that driver fault is the single most important factor and accounted for 81% 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, road and vehicle related factors which can be seen in graph.1. 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 [2].

Driver errors due to being affected by fatigue, being drunk, or being reckless are the main factors responsible for most road accidents. In order to reduce the number of traffic accidents and to improve the safety and efficiency of the traffic, the researches and companies on Intelligent Transportation System (ITS) have been conducted worldwide for many years. Intelligent vehicle (IV) system is a component of the ITS system, which aims to assist drivers in perceiving any dangerous situations earlier to avoid the accidents through sensing and understanding of the environment around itself. Safety is the most important considerations in automotive. Many efforts are being taken in this regard. The important features of Intelligent Vehicles are to enhance road safety, decrease traffic jams and increase the efficiency of transportation. The goal of the Intelligent Vehicle Systems is mainly that of improving driving safety and reducing the driver's capacity and capability. Advance driver assistance system is used for increasing the safety of driving cars which construes traffic situations independently and support the driver. Hence there is a need to design a system which will overcome above problems [1].

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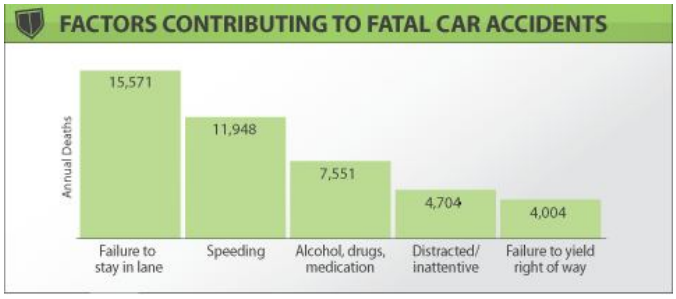

Graph.1.Vehicle crashes caused by driver errors.

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]. Objectives of proposed system are as follows,

1. To avoid road accidents.
2. To avoid violation of traffic rules.
3. To provide safety.
4. To detect the Alcohol and Drowsiness of the driver.
5. To detect Lane violation and avoid it.

The rest of the paper is organized as follows: In next Section II, different techniques used for detection of alcohol, drowsiness and lane detection. Section III describes the main system block diagram, its explanation and system design flow. Section IV presents Results that are obtained using the hardware and software platforms. Finally, Section V concludes the paper.

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 (Vehicular 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 behaviour are observed.

In [3], “Prevention of Accident Due To Drowsy By Using Eye Blink”, the authors have implemented a system using PIC microcontroller which is interfaced with eye-blink sensor for detection of drowsiness of the driver a alcohol sensor for detection of alcohol content and also a obstacle sensor. The system is implemented in such a way that when alcohol contents are detected the alarm is buzzard, same for obstacle sensor and when the eye blinks are detected the vehicle’s speed is reduced to avoid accidents.

In, “The automatic control system of anti drunk-driving” [4], 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 “Survey: Vision based Road Detection Techniques” [5] the author focuses on various approaches used to detect road region which is fundamental requirement in applications like intelligent vehicles, lane detection and tracking and driver assistance systems. Road detection is classified in three categories: activity driven, feature driven and model driven. This paper surveys development of vision based road region detection. Two major components discussed in this paper are methods for structured and unstructured road detection.

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In [6], the implementation of a lane detection system using Hough Transform is done. The proposed system can detect road lane markers in a video stream and departure from the lane. The input to the system is video streams recorded by the video camera mounted on the vehicle. The input is processed by using Hough Line and Hough Transform to detect lane marks. The detected lane marks and vehicle positions are used to determine whether the vehicle stays on its lane or stays out of lane. The system will produce an alarm message to the driver for lane departures.

In, "Study on the Embedded CAN Bus Control System in the Vehicle" [7], developed system uses an ARM controller as the main control unit and CAN bus within a car. ARM 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.

In [8], an efficient automotive security system is implemented for anti-theft using an embedded system occupied with a Global Positioning System (GPS) and a Global System of Mobile (GSM). The client interacts through this system with vehicles and determines their current locations and status using Google Earth. The user can track the position of targeted vehicles on Google Earth. Using GPS locator, the target current location is determined and sent, along with various parameters received by vehicle's data port, via Short Message Service (SMS) through GSM networks to a GSM modem that is connected to PC or laptop.

III. PROPOSED SYSTEM

3.1 System Block Diagram

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

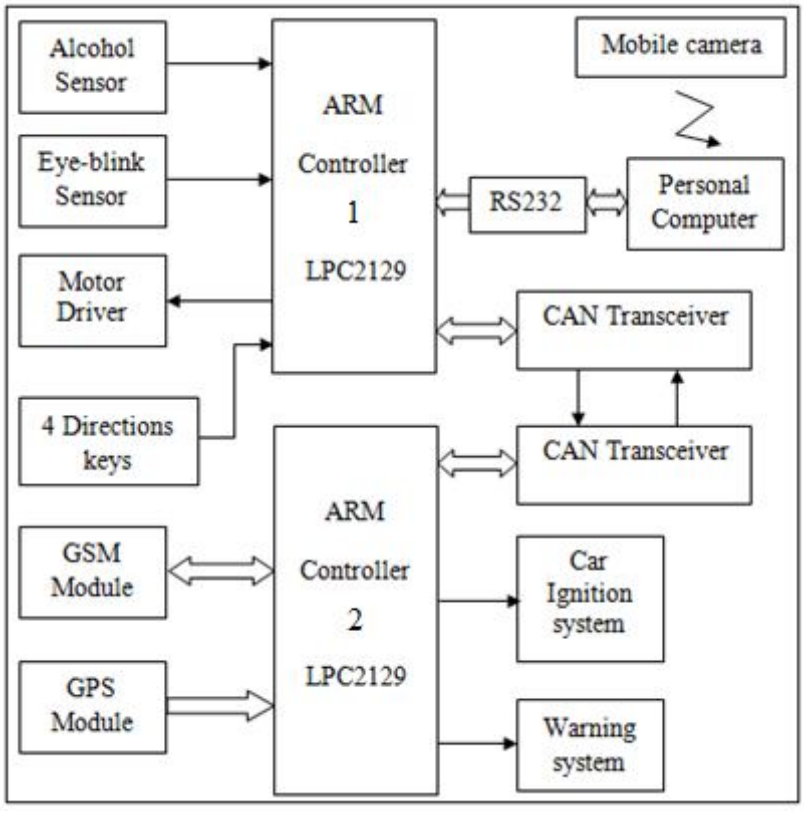

Fig.1. Proposed block diagram

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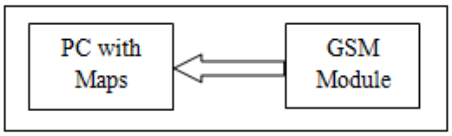

Fig.2. Tracking system

The proposed system is divided into three parts as Master, Slave and Tracking section.

Master section

The Master block is responsible for controlling unauthorized Lane shifting and monitoring alcohol and drowsiness. From the above figure 1 the master section is ARM controller 2. Whenever alcohol or drowsiness of a driver and lane shifting is detected the controller monitors and provides control action like interlocking the vehicles ignition system, alerting the driver and controlling unauthorized Lane shifting. The Master is connected with GPS and GSM module which are interfaced to the controller to keep the track of the vehicle and it sends the latitude and longitude information (location information) to the tracking section [6] [8].

Slave section

Slave section in figure 1 is ARM controller 1. The Slave block is responsible for detecting the Alcohol content and Drowsiness of the driver. The alcohol detection is carried out with the help of MQ303 alcohol sensor and drowsiness is carried out with eye-blink sensor. It is also interfaced with camera which is facing down the road, as it is monitoring the Lane detection for accident avoidance. Mobile camera is connected to Personal Computer wirelessly which is responsible for detecting and controlling of unauthorized Lane shifting. PC is connected to ARM controller via. RS232 [3] [4].

Tracking section

Tracking section in figure 2 consists of a Personal Computer and a GSM module. Personal Computer is installed with maps connected to internet. GSM module is responsible to get the SMS from the slave block's GSM module. The SMS contains the information of present latitude and longitude (location of vehicle) which is helpful to keep the track of vehicle [8].

Both the ARM controllers, Master and Slave are connected to CAN bus for exchanging the information and for communication. CAN is used for more faster and reliable communication [7].

A. Hardware

- ARM LPC2129 controller
- MQ303 Alcohol sensor
- Eye-blink sensor
- Camera
- Personal Computer
- GSM module
- GPS module
- CAN transceiver

B. Software

- Keil
- MATLAB
- Visual Basics

3.2 Logic flow for the system

The system logic flow is shown in figure 3. Whenever driver enters into the vehicle he is told to provide an alcohol sample which is taken with the help of sensor MQ303 and drowsiness detection is done by Eye-blink sensor (encoder). If the value of detected alcohol is reached above the threshold limit the ignition is interlocked i.e. the vehicle is unable to start. For drowsiness detection an encored circuit as an eye-blink sensor is used.

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If nothing is detected then the driver is able to start the vehicle. For detection of Road lane violation camera is used. Camera is continuously capturing the video of road and with the help of Hough Transform algorithm lane detection is carried out. Whenever vehicle is departed from the lane, departure message is show. When Left departure takes place then vehicle moves automatically to right and for Right departure it s moves to left side of the road, that warning message is displayed on the screen.

A continuous track of vehicle is carried out with tracking system which use GPS module for locations coordinated and GSM module for reception of locations coordinated from vehicle.

This process is carried out continuously due to which the road accidents can be minimized and track of vehicle is also kept.

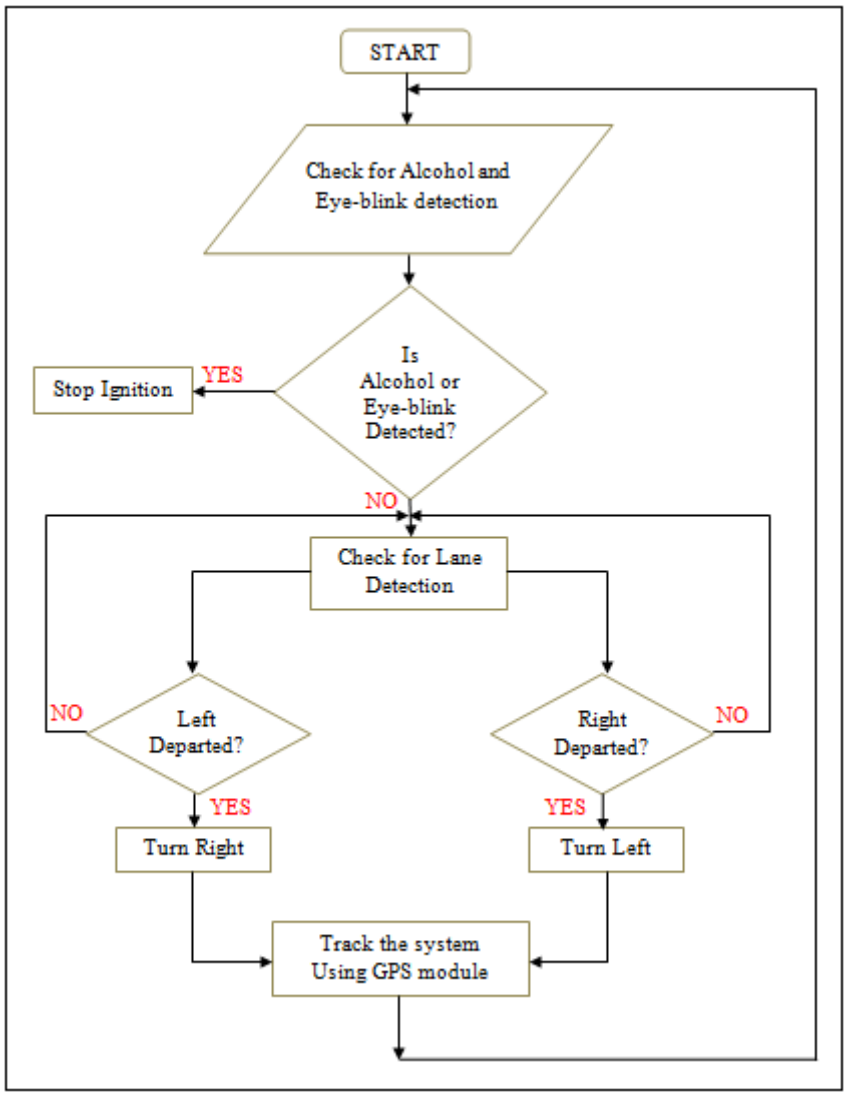

Fig.3. Logic flow for the system

VI. RESULTS AND DISCUSSIONS

In this section results are obtained using software and hardware platforms are presented.

Results obtained using hardware platform are discussed as follows,

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Initially when the driver is entered into the vehicle he is asked to provide his breath sample which is taken with the help of alcohol sensor MQ-303A. The contents of alcohol are continuously displayed on the LCD display. After a particular threshold level is reached which is above 70% the message is displayed "Alcohol Detected" on the LCD display as shown in figure 5. When alcohol is detected the system is interlocked. When the system gets interlocked the relay's LED is turned ON as shown in figure 6.

After detection of alcohol, Eye-blink detection is carried out. A simple encoder circuit is constructed with the help of IR transmitter and receiver. The IR transmitter is used to transmit the infrared rays in to the eye. If the eye is closed it means the output of IR receiver is high otherwise the IR receiver's output is low. According to that the eye-blink is detected and that message is displayed on LCD display as "Eye Blink Detect" shown in figure 4. This process is carried out continuously for drowsiness detection. When eye-blink is detected the relay's LED is turned ON as shown in figure 6.

Fig.4. Eye-blink detection

Fig.5. Alcohol detection

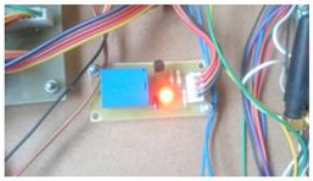

Fig.6. Relay output

Results obtained using software platform are discussed as follows,

The system uses two software platforms, one used is **MATLAB** software for lane detection and other is **Visual Basics** for tracking the vehicle.

The results obtained by **MATLAB** software for lane detection are as follows,

Hough Transform algorithm is used for lane detection which is applied to the road. The detection of road lane is carried out with the help of camera in order to detect lane marking. This information is used to determine whether the vehicle is moving within the lane of out off lane.

Initially when the vehicle is moving in normal position in between the road lanes no message or intimation is given to driver.

This is the detection phase of road lanes. For detection of lane particular Region of Interest is selected. Here only two lanes on the road are detected.

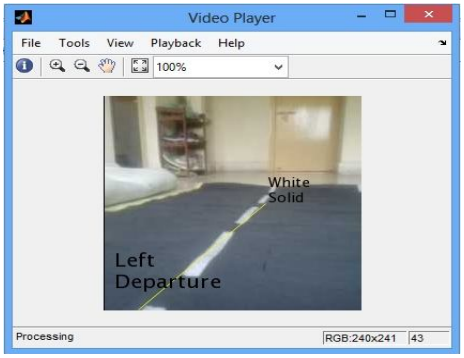

Fig.7. Warning Left departure

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After this phase when the vehicle moves away from the lane the warning is provided to driver and the vehicle is automatically shifted back into the lane. The warning message is displayed on the screen. For example when the vehicle departs to left the warning message is displayed as Left Departure as shown in figure 7 and vehicle is shifted back in the lane taking the opposite turn i.e. right.

When the vehicle departs to right the warning message is displayed as Right Departure as shown in figure 8 and vehicle is shifted back into the lane taking the opposite turn i.e. left.

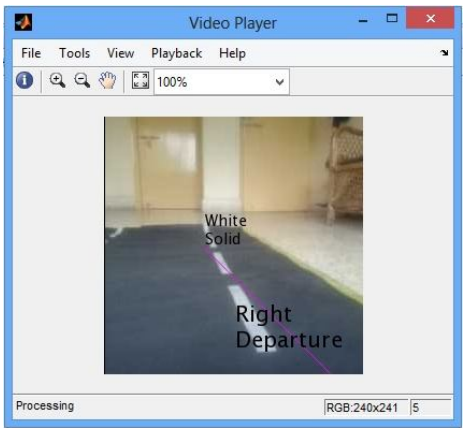

Fig.8. Warning Right departure

The results obtained by Visual Basics software for tracking the system is as follows

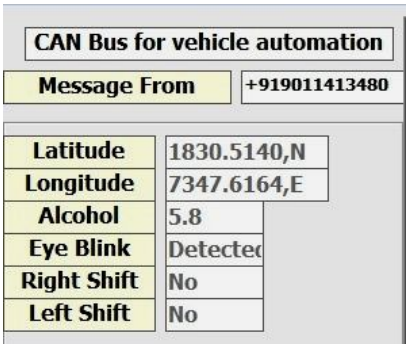

Fig.9. Output in Visual Basics

A Visual Basics software platform is used for tracking the system. The tracking system monitors the Alcohol detection content and Eye-blink detection of the driver, Left departure and Right departure of the vehicle and Location coordinates. This all data can be seen in the above figure 9.

V. CONCLUSION

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 behaviour which will control the accidents due to 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 camera, unauthorized Lane shifting is detected and avoided which minimizes road accidents. The track of vehicle is also kept as there is use of GPS and GSM modules.

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BIOGRAPHY

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