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Control Area Network (CAN) Based Driver Assistance System to Avoid Collision of Vehicles

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Abstract— Driving can be dangerous and it may lead to serious human and economic consequences. Accidents happen due to degradation in driver performance, which is caused by factors such as fatigue, drowsiness or lack of attention. To prevent accidents several advanced assistance systems have been proposed over the years to improve vehicle lateral control. The digital driving system serves as driver-vehicle interface and helps in vehicle information system. The recommended system presents the implementation of a digital system for a semi-autonomous vehicle. Eye blinking sensor, Gas sensor, Ultrasonic sensor are used to detect driver and vehicle behavior. The prototype is designed with ARM controller and CAN controller.

Keywords— ARM (Advanced RISC Machines), CAN (Controller area network), Sensor and Semi-autonomous.

I. INTRODUCTION

The major constraint to human development includes increasing risks associated with our uncertain lives. The number of accidents that occur in our country is more and this demands immediate public attention. Road accidents, deaths and injuries lead to deaths, hospitalizations, disabilities which in turn affects the socioeconomic losses of a 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 important factor and accounted for 81 percent of total accidents.

Accidents occur due to reasons such as failure in following road rules, fatigue, insomnia, usage of cell phones, weather conditions such as fog or rain etc., alcohol, other road and vehicle related factors. The graph 1 bellow shows accidents caused by driver errors. Some experts say that 95 percent of accidents are caused by driver errors.

The system presents the development and implementation of a digital driving system for a semi-autonomous vehicle to improve the driver vehicle interface and can provide technological development for future applications in vehicle's information system [1]. System that uses ARM as the main controller and double gateway in a control computer is present within the car. This system makes full use of the high-performance of ARM, high-speed reduction of CAN bus communication control networks [2].

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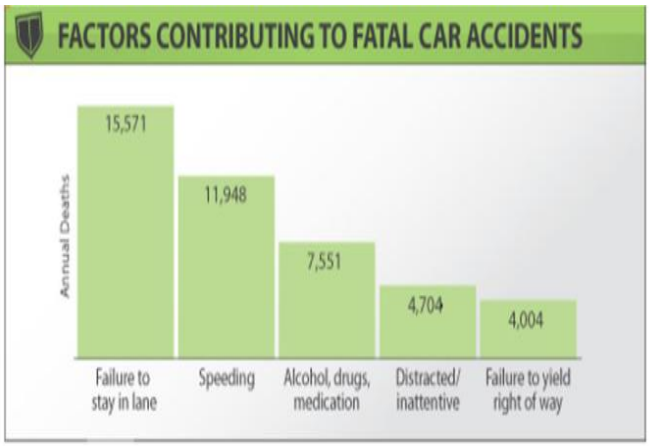

Graph.1. Vehicle crashes caused by driver errors

This study proposes an automated steering control system for passenger cars. Feasibility of a control strategy based on a front sensor and a Global Positioning System (GPS) has been evaluated using computer simulations [4]. Serious phenomenon of drunk driving in modern society, a MCU electronic circuit board is used in the system. With alcohol sensor MQ303A, the alcohol concentration is detected [4].

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.

II. PROPOSED METHODOLOGY

The overall block diagram of the proposed system is given in figure 1. The system mainly consists of front-end-sub-system and rear-end-sub-system. A front-end-sub-system consists of an Ultrasonic Sensor, PIC 18F458, CAN transceivers, Home-mode switch, highway-mode switch, LCD Display and DC motor. Ultrasonic sensor is used to find out obstacles from a particular distance. PWM technique to control the speed of the vehicle. If there are no obstacles PWM will allow maximum speed depending on the user. If there is an obstacle depending upon the distance PWM technique will allow speed to the vehicle. Home mode switch is used to de-activate the working of Ultrasonic sensor. Highway mode switch is used to activate the working of Ultrasonic sensor. Rear-end sub-system consists of Ultrasonic sensor, PIC 18F458, gas sensor, eye-blink sensor and buzzer. Rear-end sub-system is used to find out the distance of the

following vehicles and it will intimate the driver using CAN technology. Buzzer will alert the driver if any of the following vehicles come near the vehicle.

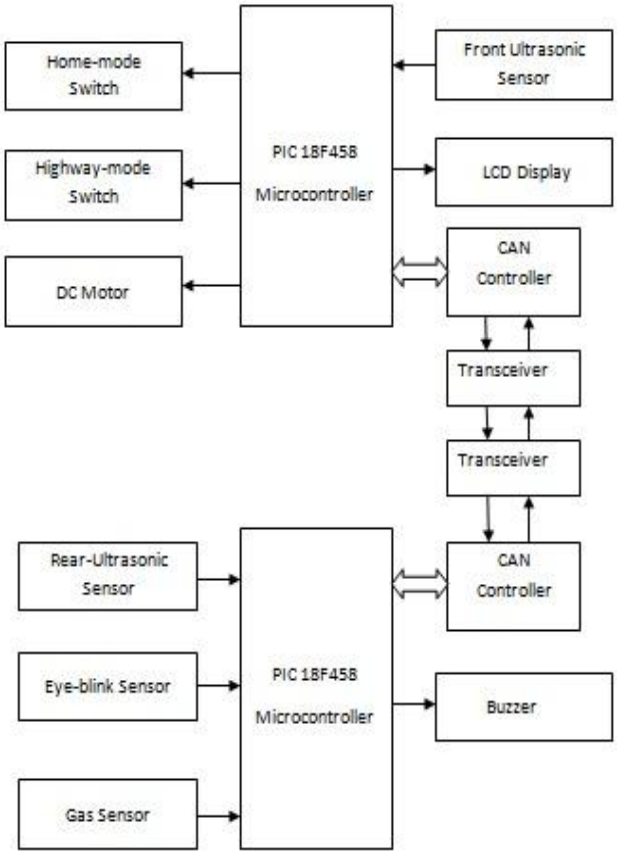

Fig.1. Proposed block diagram

A. Microcontroller

In this paper, PIC18F458 which is a 8-bit microcontroller .The proposed system is divided into two parts as Master and slave section as shown in figure 1. Slave block is responsible for detection various parameters such as of driver drowsiness, driver's alcohol content and unauthorized Lane shifting. Master block is responsible for collecting all the data received from the slave and to provide control action such as alerting the driver and to control lane shifting. Both the PIC controllers, 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.

B. Ultrasonic Sensor

Ultrasonic ranging module HC - SR04 provides 2cm - 40cm the ranging accuracy can reach to 3mm. The modules include ultrasonic transmitter, receiver and control circuit. The basic principle of work:

1. Using IO trigger for at least 10us high level signal.

2. The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

3. If the signal back, through high level, time of high output, IO duration is the time from sending ultrasonic to returning. Test distance = (high level time x velocity of sound (340M/S) / 2.

Fig.2. Ultrasonic sensor

C. Eye Blink Sensor

This Eye Blinking 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 is known 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.

Fig.3. Eye blink sensor

D. Gas Sensor

The MQ-303A is a tin dioxide semiconductor gas sensor which has a high sensitivity to alcohol with quick response speed. This model is suitable for alcohol detection such as portable breath alcohol checker or ignition locking system in automobiles.

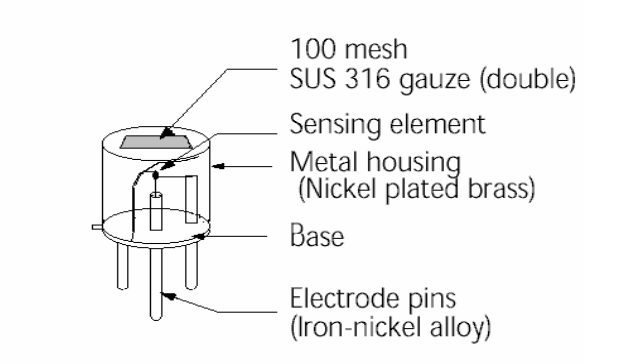

Fig.4. Configuration

Gas sensitive semiconductor material is a mini bead type and a heater coil and electrode wire is embedded in the element. The sensing element is installed in the metal housing which uses double stainless steel mesh (100 mesh) in the path of gas flow. The mesh is an anti-explosion feature.

The change of the sensor resistance (R_S) is obtained as the change of the output voltage across the fixed or variable resistor (R_L). In order to obtain the best performance and specified characteristics, the values of the heater voltage (V_H) circuit voltage (V_C) and load resistance (R_L) must be within the range of values given in the standard operating conditions shown in the Specification table on the next page. Generally, the sensor enters into normal working conditions after several minutes' preheating, If you connect the sensor heater with a high voltage 2.2 ± 0.20V for 5-10 sec before normal testing , the sensor shall stabilize and enter into normal working conditions quickly.

III. CONCLUSION

Monitoring and detecting the driver's behavior 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 ultrasonic sensor, unauthorized Lane shifting is detected and avoided which minimizes road accidents.

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