

Design of Smart Emergency Braking system in Automobile - A Review

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ABSTRACT

The braking system is applied on the vehicle to form driving safe using proper system design. Accident occur on the road due to technical problem of system or mistake of driver. Sometimes driver lose control over vehicle and doing rash driving on roads. In most urban areas of the world especially in India accidents associated with transportation and automobiles cause an enormous number of fatalities. This can be comes up with poor infrastructure, lack of road protocols and almost nonexistence of measures to enforce laws of the road. On average, 1199 accidents take place every day in the country. The intelligent braking system plays the main role in reducing the number of accidents on roads and control the vehicle speed. This intelligent braking system has an ultrasonic sensor which detect the obstacles on road ,the reflected signal gets received by receiver which results in activation of braking circuit and brakes are applied.

Keywords:-*Ultrasonic sensor, microcontroller, intelligent braking system*

INTRODUCTION

Braking system and its design in car and utility vehicle have the higher priorities for the safety concern. Inaccurate braking design may leads to loss of lives and damage to vehicle. The vehicle with conventional braking system have some faults such as longer braking distance, low pressure in hydraulic system and the major problem is the vehicle without ABS when all the wheels get locked the driver may lose the control over vehicle and results in accident.

Everyday technology changes, various improvement are done by various researchers and scientists. Intelligent braking system has lot potential when automobile industry adopting a future technology such as artificial intelligence, autonomous vehicles should say driverless car, smart highways, automatic throttling system etc. When this system is unified

with electronic stability control system, electronic throttle control and adaptive cruise control results in formation perfect autonomous vehicle. At the day last, the driver will become passenger and their safety is highest priority of car manufacturing industries. This will enhance their journey in the sense of safety, comfort, cost, efficiency etc. The impact of such style and development can cater for the necessity of up to date society that aspires quality drive yet on accommodate the advancement of technology particularly within the space of sensible sensing element and mechanism.

In this review paper, we analyse the proposed system of Intelligent braking of various researchers and car manufacturers. The proposed system of Intelligent braking system contain pneumatic braking followed by ultrasonic sensor and Arduino uno microcontroller. The ultrasonic sensor

emits the wave signal from transmitter. This wave detects the obstacles in front of the vehicle, the reflected wave gets falls on the receiver. Under required condition, microcontroller sends signal to pneumatic valve which actuate the pneumatic system which results in braking.

LITERATURE REVIEW

Over the last several years many car manufacturing industries have started working on idea of intelligent braking system and have launched different versions of IBS in market with the goal of improving the current safety standards.

Mercedes Benz- Mercedes Benz introduce “Pre safe system” in 2003 and later it upgraded to “BAS PLUS with Cross traffic assist” in 2017. This system uses a combination of stereo camera and radar sensors to detect the traffic on roads. BAS PLUS Cross traffic assist is capable up to speed of 72 km/h to slow down speed of vehicle and warn the driver before it’s too late.

Volvo- In 2006 Volvo introduced “Collision Warning with Auto Brake”, This system is powered by a radar camera and sensor fusion. This collision system detect pedestrian on road and warn the driver potentially with red alarm. If the risk of collision is increased, the brake support activated and brake is applied quickly.

The disadvantage of this system is “Volvo’s laser assisted braking could not work effectively in rainfall and snowfall, and the laser is easily affected by weather conditions.”

AUDI - In 2010 AUDI introduced the “PRE SENSE” autonomous emergency braking system using radar sensor and front camera in car bumper. This system is able to detect the vehicle up to speed of 250 km/h. This system based on multistage warning concept. If the collision is imminent, the

system warns the driver with light and buzzer alarm. If the required action is not taken then it reduce the speed of vehicle and pretension the seatbelt and glass sunroof get closed.

The drawback of this system are this system can be disable by driver, if it disable it cannot any obstacles in path and it doesn’t get on by default on new journey. Also this is affected by weather conditions like snowfall, heavy rain.

The review is carried out to know the initiatives and research carried out by researchers in field of automobile engineering to ensure safety of passengers and drivers while driving. Many researchers as well as academic researchers contribute to develop the intelligent safety along with braking system. The review of various researchers carried out in this area is as follows:

Abhay Bendekar, Abhijit Samanta, Arif Upletawala, Anup Chavan [1], proposed a system consists of opto sensor, control valve with power supply, solenoid valve, control valve, air tank. Opto sensor transmit the pulse if the obstacles is present in path of vehicle, the pulse gets reflected back and falls on receiver. The signal is then sent to control circuit and the solenoid valve get activated. This solenoid valve passes the compressed air in pneumatic cylinder which pushes the piston forward. The car brakes apply by determining the speed of vehicle.

M. Rajyalakshmi, B. Kranthi Kumar, A. Krishna Vaibhav, Md Arief Khan, B. V. V. Siva Sai [2], proposed a safety system with the use of ultrasonic sensors and Arduino uno microcontroller for governing the speed of a vehicle which they referred as ‘intelligent mechatronic braking system’. It consists an ultrasonic wave emitter and receiver allocated on the front section of a car emitting and receiving ultrasonic waves

frontward in a fixed distance. For governing the speed of the vehicle a microcontroller is utilised based on the sensing pulse information to push the brake pedal and apply brake for safety purpose.

Venkatesh Babu, R. Hariharan [3], introduced a system electronically controlled automotive braking system termed as 'automatic reverse braking system'. They used an IR sensor to transmit the infra-red rays. IR transmitter transmit infra-red rays this ray detects the obstacle in path. If obstacle is present in path, reflected rays received by IR receiver. IR sensor sent signal to control circuit, control circuit activate the solenoid valve. The solenoid valve passes compressed air in double acting pneumatic cylinder. Pneumatic pushes a piston forward and brakes are applied gradually and suddenly due to piston movement. The braking speed is controlled by 'flow control valve'

Ashwin Francis, Abel Antoo, Jerald John, Augustin Sagar, Sreejith [4], proposed 'intelligent braking system' for automotive vehicles to decrease the number of accidents by an easy solution of controlling the speed of the vehicles. This system uses GPS coordinates to find the present zones that are the most accident vulnerable like schools and hospital areas. When the vehicle enter to this zone, system automatically limit the speed by applying a brake. The system was equipped with Electronic Brake Control Module (EBCM), Arduino (microcontroller), Bluetooth module, and a GPS module.

Rajanikantha. M. A, Basavaraj. G. Kudamble [5], introduced an Advanced Adaptive Cruise Control System for an automobile for the governs speeds and distances typical in city traffic. This gives support to the driver in the task of longitudinal control of their vehicle during motorway driving by using ultrasonic sensor. In this research paper, the implementation of hardware and the results

obtained had been discussed. The research also included vehicle tracking system typically GPS (Global Positioning System) for providing longitude and latitude information of the location of vehicle, and GSM modem which is used to send out warning message to the pre-registered number of the user when the vehicle reaches the particular distance set by the driver.

Aniruddha Deshmukh, Sagar Lande, Amit Korde, Mahesh Mahale, Prof. Pravin Darade.[6],proposed an The Braking system that can stop or reduce number of accident on road caused by loss of control over a vehicle, drunken driving, rash driving. In their research, they use hall sensor to determine an obstacle and speed of vehicle along with the help of microcontroller to calculate proper distance for stopping a vehicle. Application of such systems can be made mandatory as seat belts and helmets. This system provide a glance into automobile safety and how much more advanced this individual system that enhances a power of braking system when implement with another system.

METHODOLOGY

The intelligent braking system utilities ultrasonic sensor mounted on the front of the vehicle which detect the obstacle and braking distance .The ultrasonic sensor continuously radiate signal ,if the obstruction present in the path vehicle the signal gets reflected and falls on the receiver. This signal along with speed of vehicle input is send to the microcontroller. The microcontroller uses the binary code provided and two information signals to decide whether to applied brake or not if the driver does not apply. The work flow chart for intelligent braking system is shown in Figure 1:

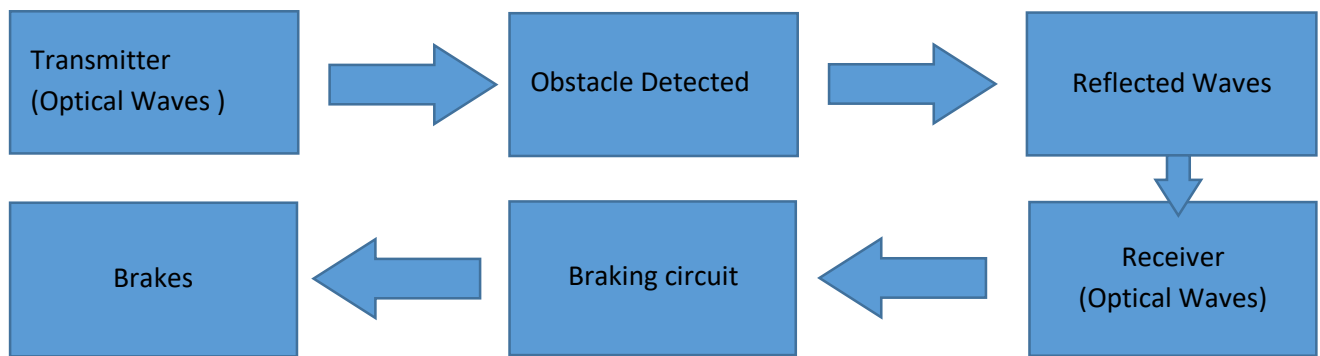


Fig.1:-Work flow chart

SYSTEM ARCHITECTURE

Ultrasonic sensor: Ultrasonic ranging and detecting devices of high-frequency sound waves used to detect the presence of an object and detecting its distance from vehicle. By emitting ultrasonic waves it converts the reflected sounds in electrical signal. An ultrasonic sensor usually contain two main components transmitter which transmits sound using piezoelectric crystal and other is receiver which receives a signal coming from a target end. It can able to detect an obstacle from 2 m to 5 m.

Arduino uno (Microcontroller): Arduino is an open-source microcontroller based on ATmega328P microchip. Arduino consists a microcontroller and can be programmable with IDE (Integrated Development Environment) that runs on your computer via USB B cable, normally write and upload a programme to the physical board. The Arduino doesn't require a special software or programmer you have to only connects to computer via a USB cable and it need simplified version of C++ to load a programme.

Features:

- 1) Microcontroller: ATmega328
- 2) Operating: Voltage 5V
- 3) Input Voltage (recommended): 7-12V
- 4) Input Voltage (limits): 6-20V
- 5) Digital I/O: Pins 14 (of which 6 provide PWM output)

Pneumatic cylinder: Pneumatic cylinders referred as air cylinders are mechanical devices. It use the ability of propellant and compressed gas to produce a force in a reciprocal linear motion like hydraulic cylinders, something forces a piston to maneuver within a forward direction. The air flow valve passes a compressed air in cylinder and it pushes a piston forward. Piston is disk or cylinders and piston rod transfers a force to object to be moved. It is much quieter, cleaner and does not require large amount of space and fluid storage.

Pneumatic valve: Pneumatic control valves are one of the most basic parts in hydraulic machines as well and pneumatic machines. The main function of control valve is to switch airflow. It usually contains a spool inside a cylinder which is operated mechanically or electrically. The spool moves to and fro this movement restricts and allow the air to pass. The spool consists of flat surface and groove. The flat surface restricts oil flow through the valve body. The grooves permits oil or gas to flow around the spool and through the valve body. There are mainly 2 position of control valve where normal position when there is removal of actuating force and other is functioning position when actuating force is applied to control the air flow. There is another class of valves with 3 or more position which can spring centered with 2 working position and a usual position.

CONCLUSION

A lot of research has been done for reviewing this paper to make sure a safety of passengers in automobile system. The Intelligent Braking system, if implemented can avoid many severe accidents and might save many human lives and public property. Implementation of such systems are made compulsory like wearing helmets and seatbelts that reduce number of accidents on road at some extent. Implementation braking system gives a glance into the long run of automotive safety, these systems are even more advanced and powerful when it comes with another system. The world is adopting a new technology in automobile industry and this infrared braking system has lot capability than conventional braking system.

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