International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 12 Issue 7, July-2023, Impact Factor: 7.957

A Study on Automatic Braking System

Pramod Kumar[1], Sachin[2]

[1]Assistant Professor, Department of Mechanical Engineering, Rattan Institute of Technology and Management, Haryana, India
[2]Research Scholar, Department of Mechanical Engineering, Rattan Institute of Technology and Management, Haryana, India

ABSTRACT

I C Engines have been advanced a lot such that its speed is becoming a major catastrophe Advanced automatic braking system improves braking techniques in vehicles It changes complete braking systems in an automotive and deals with the concept of Automatic Braking System giving the solution. This project is designed with ultrasonic transmitter, ultrasonic receiver, and Arduino UNO R3 board with PIC microcontroller, DC year motor, Servomotor and mechanical breaking arrangement. The Ultrasonic Sensor generates (0.020-20) KHz frequency signal. It is transmitted through ultrasonic transmitter. The ultrasonic receiver is used to receive the reflected wave present in front of the vehicle, then the reflected waves is given to the ultrasonic wave generator unit in which the incoming wave is amplified and compared with reference signals to maintain a constant ratio and this signal is given to microcontroller and through which the working of DC gear motor and Servomotor may takes place, which results in application of brakes. The prototype has been prepared depicting the technology and tested as per the simulated conditions In future the actual model may be developed depending on its feasibility.

INTRODUCTION

Driving is a common activity for most of the people. The number of vehicles is increasing day by day. Now days, the technology has got vast changes which leads increase in speed. The speed plays a vital role to maintain time for longer distances. But, this speed also getting a major problem for causes of road accidents. The common braking is not sufficient for avoidance of accidents when driver is not active. Further improvement has to done in braking system in order to brake a vehicle when driver is not able to brake i.e., it may need automatic braking system. This automatic braking system allows the vehicle to brake without support of the driver.

The main target of the ultrasonic braking system is that, vehicles should automatically brake when the sensors sense the obstacle. This is a technology for automobiles to sense an imminent forward collision with another vehicle or an obstacle, and to break the vehicle accordingly, which is done by the braking circuit. This system includes two ultrasonic sensors viz. ultrasonic wave emitter and ultrasonic wave receiver. The ultrasonic wave emitter provided in front portion of an automatic braking system vehicle, producing and emitting ultrasonic waves in a predetermined distance in front of the vehicle. Ultrasonic wave receiver is also provided in front portion of the vehicle, receiving the reflected ultrasonic wave signal from the obstacle. The reflected wave (detection pulse) is measured to get the distance between vehicle and the obstacle. The DC gear motor is connected to the wheels of vehicle and power input is given to it from Arduino board. Then PIC microcontroller is used to control the servo motor based on detection pulse information and the servo motor in turn automatically controls the braking of the vehicle. Thus, this new system is designed to solve the problem where drivers may not be able to brake manually exactly at the required time, but the vehicle can stop automatically by sensing the obstacles to avoid an accident.

In order to reduce the emission levels, more work is going on for the modification of engine work functions and all. There are several kinds of braking mechanism systems that would only can be applicable mechanically, to move the ideology more deep and brief the automatic braking system will be more sufficient and satisfactory in addition to mechanical braking system. In present generation, numbers of vehicles are coming into existence with newer technologies for implementation of human comfort and other conditioning. To extend the ideology in more brief manner and to take the step in different way, may automatic braking system would fulfill the methods of extension of technical existences.

The objective of this project is to design the automatic braking system in order to avoid the accident. To develop a safety vehicle braking system using ultrasonic sensor and to design a vehicle with less human attention to the driving. This project is necessary to be attached to every vehicle. Mainly it is used when drive the vehicles in night time. Mostly the accident occurred in the night time due to long travel the driver may get tired. So the driver may hit the front side vehicle or road side trees. By using this project the vehicle is stopped by automatic braking system. So we can avoid the accident.

The scope of this project is to develop an ultrasonic sensor to detect the obstacle and to process the output from the ultrasonic sensor to drive the servomotor as an actuator.

Vehicles can automatically brake due to obstacles when the sensor senses the obstacles. The focus of this project is designing an automatically braking system that can help us control the braking system of a vehicle. The automatically braking system also needs to work with an ultrasonic sensor, which produce sound pulse by a buzzer. The ultrasonic wave is generated from a transmitter and sends to a receiver.

LITERATURE REVIEW

The behavior of a vehicle following another vehicle determines, on the one hand, the capacity of a roadway section, while the reaction of drivers to unexpected events (or the lack thereof), on the other hand, determines the occurrence of collisions. The Intelligent Vehicle Initiative (IVI) provides vehicle-based tools that could assist drivers in reacting both more rapidly and effectively to a range of external stimuli. Intelligent or adaptive cruise control systems (ICC or ACC), for example, attempt to assist drivers in better maintaining a safe headway under normal driving conditions. In addition, automatic braking systems may provide additional safety benefits by assisting drivers to respond more quickly to unexpected events. The focus of this chapter is to describe the research that has been conducted to date in order to evaluate the safety impacts of ACC type of control. Initially, the various types of ICC systems that have been described in the literature to date are presented. The intent of this overview is to demonstrate that the term ICC or ACC may differ depending on the source of information. For example, some ACC systems have no braking capabilities while others do. Consequently, results need to be interpreted within this context. Following a description of the various types of ACC applications, this chapter synthesizes the results of evaluation studies of these ACC systems. The intent of this synthesis is to describe what has been done so far in the area of evaluating ACC type of control in order to set the stage for the subsequent chapters that describe how ACC was evaluated in this thesis.

As mentioned earlier ACC systems can alter vehicle car-following behavior in addition to the potential for an accident. Consequently, this chapter also synthesizes the literature of car-following models in order to demonstrate how the work that is presented in this thesis differs from what has been done to date. Furthermore, this chapter describes the state-of-the-art work in the area of safety impacts of ACC type of control. 2.1 Intelligent/Adaptive Cruise Control Systems As indicated in the introduction, the focus of this chapter is the impact of ICC vehicle control. It is important to understand what ICC is and how ICC is different from vehicles currently operated on the road. The first topics of this section, therefore, are conventional cruise control (CCC) usage and a contrast of CCC and ICC capabilities. The remaining sub-sections describe general configurations of developed ICC systems as well as provide additional information on three components of ICC systems: target sensor, vehicle control strategies and the vehicle-driver interface.

Intelligent and Conventional Cruise Control Operation As indicated above, the purpose of the following paragraphs is to describe CCC usage as well as compare CCC and ICC capabilities. Figure 2-1 illustrates a cruise control layout.

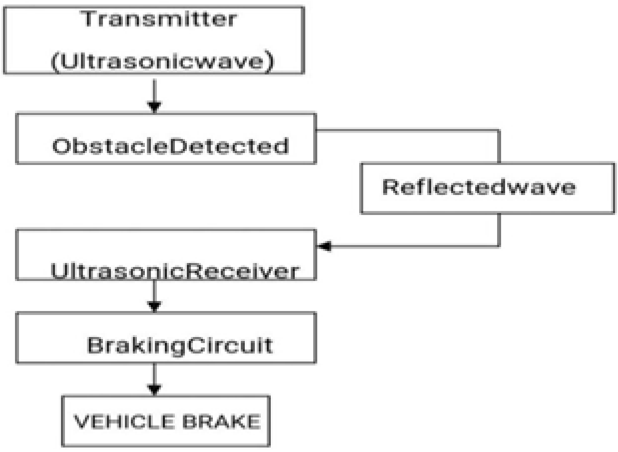
Conventional Cruise Control. Conventional cruise control takes over the accelerator operation at speeds over 48 km/h (30 mph) when it is engaged. Activation requires that the ON button is pressed and the desired speed set. The driver has to press the ON button to activate the system each time the engine is started. Once the cruise control is ON, the driver can set a speed by driving at the desired speed and then pressing the SET button.

In order to deactivate the system while maintaining the set speed in memory, the driver has the choice to either make a soft tap on the brake pedal or press the CANCEL button. Pressing the OFF button or turning off the ignition turns the speed control system off and erases the memory. In order to resume to a previously set speed, the driver needs only to press the RESUME button as long as the speed exceeds 40 km/h (25 mph). The driver can also vary the speed setting by either pressing and holding the ACCEL button and releasing the button when the new set speed is established, or by tapping the ACCEL button. Each tapping of the ACCEL button results in a 3.2 km/h (2 mph) increase in the vehicle speed. In order to decrease the speed while the speed control is ON, the driver needs to hold the COAST button and release it when the desired speed is reached.

It must be noted that pressing the accelerator does not alter the set speed. Consequently, when the accelerator pedal is released, the vehicle returns to the previously set speed. In addition, the conventional cruise control can downshift to third gear if it is necessary to maintain the vehicles set speed. Intelligent Cruise Control. While conventional cruise control (CCC) maintains a fixed vehicle speed during operation, the idea of the ICC system is to maintain a chosen headway distance (Martin 1995, 83). The operation of ICC is not always different, however, from CCC. While not in traffic, the ICC system acts as a CCC system (Koziol and Inman 1997, 146). The ICC system can downshift in order to maintain a selected headway or to maintain a set speed as is the case of conventional cruise control. The intent of the

ICC system is that the number of times that a driver engages disengages or changes the cruise control settings while in traffic decreases compared to CCC (Koziol and Inman 1997, 145).

METHODOLOGY



Ultrasonic Sensor signals	Range
Maximum	1 meter
Minimum	2 centimeters

Principal Components of Automatic Braking System

- Sensor
- Transduser
- Ultrasonic Sensor
- Operational Amplifier And Adc
- Braking Circiut
- Dc Gear Motor
- Servo Motor

Sensor:
A sensor is an electrical device that maps an environmental attribute to a quantitative measurement. Each sensor is based on transduction principle which is conversion of energy. A sensor is an electrical device that maps an environmental attribute to a quantitative measurement. Each sensor is based on transduction principle which is conversion of energy from one form to another form. There are two important terms related to any sensor

Beam Spread – This term refers to the maximum angular spread of the ultrasonic waves as they leave the transducer.

Transducer:
A transducer is an energy conversion device which converts one form of energy into another. In the ultrasonic sensors they are used to convert electrical energy into ultrasonic energy and vice-versa. In this system piezoelectric transducers are used, which create ultrasonic vibration through use of piezoelectric materials such as certain forms of crystals or ceramic polymers. Their working is based on the piezoelectric effect.

This effect refers to the voltage produced between surfaces of a solid, (non-conducting substance) when a mechanical stress is applied to it. Conversely, when a voltage is applied across surfaces of a solid that exhibits piezoelectric effect, the solid undergoes mechanical distortion.

Ultrasonic Sensor:
Ultrasonic ranging and detecting devices use high frequency sound waves called ultrasonic waves to detect presence of an object and its range. Normal frequency range of human ear is roughly 20Hz to 20,000Hz. Ultrasonic sound waves are sound waves that are above the range of human ear, and thus have frequency above 20,000Hz. An ultrasonic sensor necessarily consists of a transducer for conversion of one form of energy to another, a housing enclosing the ultrasonic transducer and an electrical connection.

These sensors are of two types:

1) Ultrasonic Transmitter
2) Ultrasonic Receiver

Ultrasonic Sensor:
Ultrasonic ranging and detecting devices use high-frequency sound waves to detect the presence of an object and its range. The systems either measure the echo reflection of the sound from objects or detect the interruption of the sound beam as the objects pass between the transmitter and receiver.

An ultrasonic sensor typically utilizes a transducer that produces an electrical output in response to received ultrasonic energy. The normal frequency range for human hearing is roughly 20 to 20,000 hertz. Ultrasonic sound waves are sound waves that are above the range of human hearing and thus, have a frequency above about 20,000 hertz. Any frequency above 20,000 hertz may be considered ultrasonic. Most industrial processes, including almost all source of friction, create some ultrasonic noise. The ultrasonic transducer produces ultrasonic signals. These signals are propagated through a sensing medium and the same transducer can be used to detect returning signals.

Ultrasonic sensors typically have a piezoelectric ceramic transducer that converts an excitation electrical signal into ultrasonic energy bursts. The energy bursts travel from the ultrasonic sensor, bounce off objects, and are returned toward the sensor as echoes. Transducers are devices that convert electrical energy to mechanical energy, or vice versa.

The transducer converts received echoes into Analog electrical signals that are output from the transducer. The piezoelectric effect refers to the voltage produced between surfaces of a solid dielectric (non-conducting substance) when a mechanical stress is applied to it. Conversely when a voltage is applied across certain surfaces of a solid that exhibits the piezoelectric effect, the solid undergoes a mechanical distortion. Such solids typically resonate within narrow frequency ranges. Piezoelectric materials are used in transducers e.g., phonograph cartridges, microphones, and strain gauges that produce an electrical output from a mechanical input. They are also used in earphones and ultrasonic transmitters that produce a mechanical output from an electrical input. Ultrasonic transducers operate to radiate ultrasonic waves through a medium such as air. Transducers generally create ultrasonic vibrations through the use of piezoelectric materials such as certain forms of crystal or ceramic polymers.

CONCLUSION

We have successfully completed the fabrication of automatic braking system model prototype and this project presents the implementation of an Automatic Braking System for Forward Collision Avoidance, intended to use in vehicles where the drivers may not brake manually, but the speed of the vehicle can be reduced automatically due to the sensing of the obstacles. It reduces the accident levels and tends to save the lives of so many people. By doing this project practically we gained the knowledge about working of automatic braking system and with this future study and research, we hope to develop the system into an even more advanced speed control system for automobile safety, while realizing that this certainly requires tons of work and learning, like the programming and operation of microcontrollers and the automobile structure. Hence we believe that the incorporation of all components in Automatic Braking System will maximize safety and also give such system a bigger market space and a competitive edge in the market.

REFERENCES

[1]. http://members.rennlist.com/pbanders/ecu.htm. This link refers to technical document that contains information about electronic control unit.
[2]. http://www.aa1car.com/ this website contains technical articles, books and manuals that help us find what’s wrong with our vehicle and what needed to fix it.
[3]. David Epsilon, An embedded software premier, Pearson education, 1999.
[4]. Joshua Pérez, Fernando Saco, Vicente MI lanes, Antonio Jiménez, Julio C. Diaz and Teresa de Pedro, an RFID based Intelligent Vehicle speed controller using active traffic signals, SENSORS 2010, 15872 5888; doi: 10.3390/s100605872.
[5]. Van NE’s. N; Houtenbos. M; van SC Hagen. I: Improving Speed behavior: The Potential of In-Car Speed Assistance and Speed Limit Credibility. IET Intel. Transp. Syst. 2008, 2, 323-330.
[6]. MI lanes, V. Onieva, E. Perez, J. De Pedro, T. Gonzalez, C. Control of Velocidad Adaptativo para Entornos Urbanos Congestion dos. Rev. Iberoam, automat. Informat. Ind.2009, 66-73.