An Analysis of Automatic Breaking System and Car Speed Monitoring

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ABSTRACT: ***Internal Combustion (I.C.) Engines have progressed to the point where their speed has become a huge disaster. Vehicle braking tactics are improved by an advanced automated braking system. While driving there are obstacles in the path which sometimes results in accidents causing injury to the driver. An automatic braking system and speed monitoring system has been introduced which will detect If there is any obstacle present in the path of the vehicle. Whenever any obstacle is detected the speed of vehicle automatically decreases. In this project, the ultrasonic transmitter, ultrasonic receivers, Arduino UNO microcontroller, Direct Current (DC) gear motor and servo motor are installed. The ultrasonic sensor provides frequency signal 25.0-50.0 kHz. The ultrasonic receivers are utilized for receiving reflected wave that is placed in front of vehicle; the reflected wave is sent to generation units for the ultrasonic wave, wherein the incoming wave is amplified and compared with a reference signal to keep constant ratio. It may also be utilized for heavy-duty vehicles such as buses, camions, cranes, tractors, etc. We can certainly receive information on the detection of obstacles. The area of sense depends on the state of the vehicle. Accidents in large and urban cities will be avoided after implementation of this system. There is a potential of more research in this field for the advancement of the system by increasing the range for obstacle detection and designing an automatic parking brake system. This can be implemented by various automobile industries.***

KEYWORDS: ***Automatic Braking, Car, Obstacle, Speed Monitoring, Ultrasonic Sensor.***

1. INTRODUCTION

For most individuals, driving is a common business due to this there is huge increase in automobiles. The technology has now changed enormously a few days, which leads to speed increases. Speed has an important part in keeping time longer. However, high speed is also a big concern for road accidents. A common braking system is not enough when the driver is not active to prevent accidents. In a braking system, more enhancements need to be made if the conductor cannot break, i.e. automated braking systems may be needed. This braking technology enables the car to brake without the driver's help [1]. This study is primarily intended to create a speed control and automatic vehicle braking system. Electrical components such as sensors, microcontroller, relay, signal transmitters as well as signal recorder, peripheral interface controllers (PIC), are used as a speed control and automated braking system. We use the ability and experience to create electrical circuits for speed control and automated braking. To construct the circuit we utilize the Proteus computer software. The strategic control of an accident involving cars was the idea behind the design of the speed control and automated braking system. For the purpose of automated braking systems we will employ an ultrasonic sensor along with infrared sensor (IR) to identify the obstruction. Proposed system is design to avoid the accident on road between the vehicle [2], [3].

The fundamental objective of the ultrasonic braking system is that when the sensors feel an impediment, cars should immediately brake. This technique makes cars feel that another car or object is in impending front collision and the vehicle is braked by the braking circuit accordingly. In the front section of the automatic braking system vehicle, the ultrasonic wave emitter produces and emits ultrasonic wave in the preset distances. In front of vehicles, the wave receivers with ultrasonic reflected wave signal is also provided. The reflected wave is measured (detection pulse) to distance the vehicle from the obstacles. DC transmission engine is attached to car wheel, as well as electricity from the Arduino board is provided to it. The PIC microcontroller then operates the servo-motor on the basis of pulse detection information, as well as the servo engine regulates the vehicle brakes automatically. This innovative technology has thus been created to resolve the situation in which drivers cannot manually break at the appropriate time but automatically stop the car by sensing impediments to prevent the collision [4], [5].

There are various types of brake mechanism systems which can only be used mechanically, in addition to mechanical braking systems the automatic braking system becomes more deep and short. Number of cars

with innovative technology for human comfort and other conditions are now being produced. Automatic braking systems could meet the techniques of extension of technical existences in order to expand the philosophy in a more brief way and take a different step [6]. The proposed system aim is to develop an automated braking system to prevent the collision. To build an ultrasonic safety car braking technology and construct a vehicle with less human driving attention. It's mostly employed during the night driving of cars. The accident mostly happened during the night because of the driver's long journey. So the driver can get on the front car or on the side of the road. With the use of proposed system the car is stopped automatically by automatic braking. Hence, accidents are prevented using this system [7].

2. LITTERATURE REVIEW

Dhanya et al. suggested a technology of advanced automated braking system with sensor fusion idea. They utilize the ultrasonic sensors to identify the obstruction and to calculate the distances between the vehicles and obstacles, as well as the distances control system to ensure security is used in this measurement. In this system, the 32-bit microcontroller serves as the control unit. Automated retardation and automatic horn disabilities inside a restricted region are additional features incorporated in the system and this is done using radio frequency (RF) signal transmission. The RF transmitter is situated in a limited zone, with limited speed and a limited horn. A RF transmitter in traffic signal transfers a restricted speed value and a matching signal to disable a horn, and reduces speed automatically to a certain speed and the horn is disabled in this region [8].

Bhumkar et al. presented a technique for preventing and detecting road accidents. This method involves advanced automobile technology to make it smarter and more interactive for road accidents. Advance reduced instruction set computer machine (ARM7) is used to improve efficiency, reliability and effectiveness of this system. In this system, authors explained online security prototypes in real-time that controls speed of vehicles during driver tiredness. The proposed system designed so that accidents are prevented. Major element of the proposed system is the interface between the global positioning system (GPS) and Google maps, including a variety of real time sensor such as gas, eye blinking, alcohol, fuel impact sensor and software. By doing this research, they suggested an intelligent automobile system to prevent accidents and make the world a far safer and better place to live [9].

Vidyadhar et al. presented a system which can increase vehicle safety. This device can help driver by notifying driver of obstacle as well as vehicle access that could cause to collisions. In addition to this, the auto retarding system that helps to prevent accidents are also implemented. The motor driver as well as liquid crystal display (LCD) are utilized in this system along with ultrasonic sensors. Furthermore, an automated wiper speed control has been introduced, which controls wiper speed dependent on precipitation severity. The IR sensor is very susceptible in the wiper speed control system and can detect very low humidity. If even a small rainfall is triggered, the engine is faster and the wiper runs quicker in larger quantity of rain, and saves the driver from distraction, and ensures ease and security [10].

Research Question:

1. How to decrease the speed of vehicle automatically by sensing obstacle?
2. Components used for automatic braking of vehicle?

3. METHODOLOGY

3.1. Design:

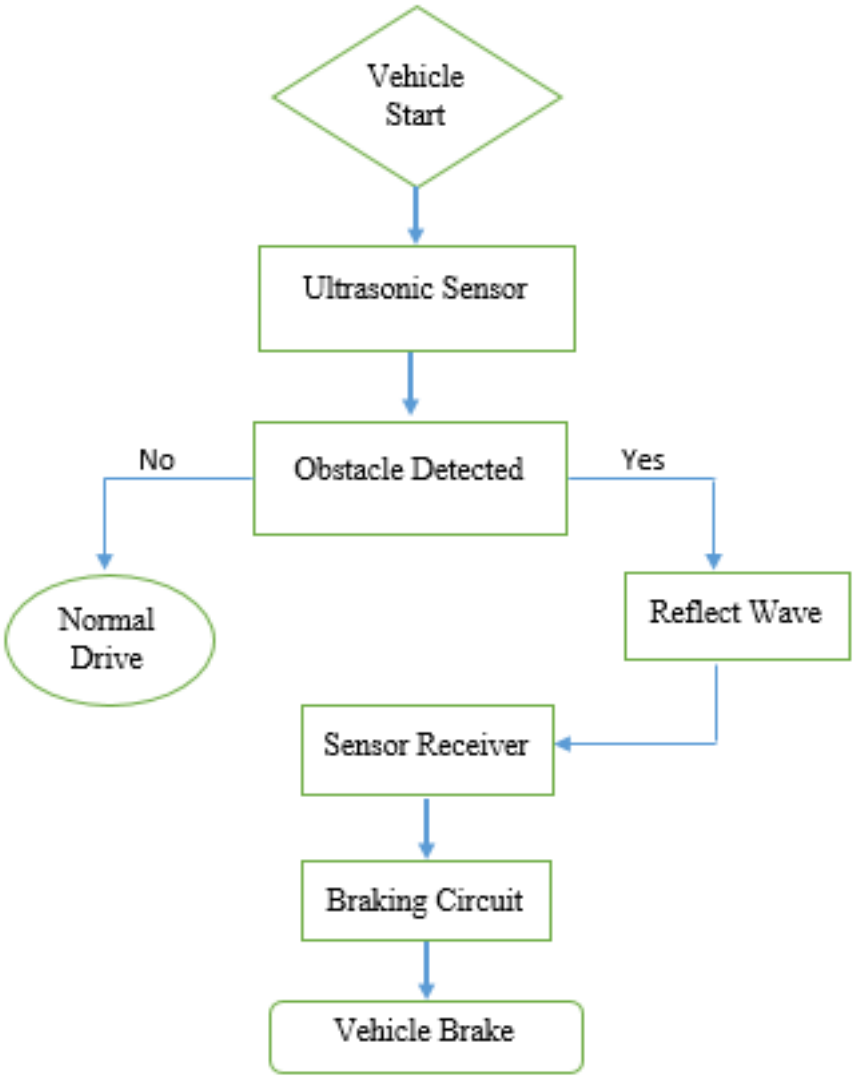

Figure 1: Illustrates the flow chart of the proposed automatic breaking and speed control system.

Figure 1 represents the flow chart of the algorithm on which the proposed system is working. As soon as the vehicle starts ultrasonic sensor is activated. When an object or obstacle is detected in the route of the vehicle its distance is measured through ultrasonic sensor. According to distance detected control system activates the braking circuit i.e., DC motor and servo motor for controlling the speed of the vehicle.

3.2. Instruments:

PROTEUS software is used to design the circuit diagram for the interconnection of Arduino UNO with the components used in the automatic breaking system. The code is executed on Arduino integrated development environment (IDE) and then uploaded to the Arduino UNO machine using the universal serial bus (USB) connection supplied to operate the Arduino UNO. The Arduino Open-Source Software enables code writing and uploading. The environment is built on processing and other open-source applications in Java. Following are the components used in the system:

3.2.1. Transducer:

A transducer is an energy transducer that transforms one energy type into another. In ultrasonic sensors, electrical energy is converted into ultrasonic power and vice-versa. The piezoelectric transducer uses vibrating material such as some kind crystal or ceramic polymer using piezoelectric materials. Operation of transducer depends on the piezoelectric effect.

3.2.2. Ultrasonic Sensor:

Specific ultrasonic range and detection devices employ sound waves known as ultrasonic waves to detect the presence and range of an item. The human ear's normal frequency range is around 25.0 to 50.0 kHz. The ultrasonic sound wave are the sound wave above a human ear range, and hence over 50 kHz in frequency. An ultrasonic sensor inevitably consists of a conversion transducer, a housing that includes the ultrasonic transducer, and an electrical interface.

When an obstruction is identified front of car, distance between the car and the obstruction is displayed instantaneously on the light emitting diode (LED) display. When there is a little gap between the car and the barrier, the car's speed is reduced as well. If accident is sensed by the IR sensor while there is a very small space between two automobiles or between the cars and objects, the automatic braking system is activated.

3.2.3. DC Motor:

DC transmission engine is somewhat basic gear motor which combines power, transmission and magnetic field to create the engine torque. At its simplest, the DC gear motor needs two opposing polarity magnets and an electric spiral that serves as electro magnet. Magnet's repelling as well as appealing electromagnetic force produce torque and turn DC gear motor. Only after the DC motor a gearbox is there and the rotary shaft is attached to it and the vehicle wheels may be turned with the assistance of this DC gear motor arrangement.

3.2.4. Servo Motor:

The output of the control unit is connected to the input of servomotor. The servo engine provides accurate angular position, speed and acceleration control. The engine is connected with a sensor providing feedback on the location. It therefore employs a closed loop system to regulate its travel and ultimate position using position feedback. The input is a signal which represents the location for the output shaft analogue or digital. Compared to the control position, the measured position of the output shaft. When output position differ from the one needed, there is error signals which cause engine to rotate, so that the output shaft is positioned in the desired way. The error signal is reduced to nil when the necessary location approaches and the engine stops.

3.3. Data Collection:

A USB connection or an outside power supply can power Arduino Uno. The power supply is automatically selected. Either an AC-to-DC converter or a battery can provide external power. Table 1 shows the technical characteristics of Arduino UNO.

Table 1: Shows the technical specification of Arduino UNO used in the automatic breaking system.

Parameters	Value
Brand name	Arduino
Height	25 Millimeters
Width	5.5 Centimeters
Weight	91 Grams
Dimensions	8 × 5.5 × 2.5 Centimeters
RAM Size	8 kb
Voltage	5 Volts
Digital Pins	14

HC-SR04 is an Ultrasonic Dimensions Module with a measuring function of 2cm-400cm, ranging precision up to 3mm. The modules are made up of ultrasonic transmitters, receivers and control systems. Technical specification of ultrasonic sensor is shown in Table 2.

Table 2: Shows the technical specifications of sensor used in automatic breaking system.

Parameters	Value
Operating Voltage	DC 5V
Operating Current	15mA
Frequency	40Hz
Maximum Range	4m
Minimum Range	2cm
Measure Angle	15 degree
Triggered I/P Signal	10µs transistor-transistor logic (TTL) pulse
Echo O/P Signal	Input TTL lever signal and the range in proportion
Dimensions	45 × 20 × 15mm

4. RESULT AND DISCUSSION

The proposed system will monitor the speed of the car and the braking system of automated format. It consists of three major phases:

1. Detection of object.
2. Controlling the vehicle speed.
3. Automatic breaking system.

By use of ultrasonic sensors the suggested system automatically informs about the obstacle along the vehicle's route. In the vehicle, ultrasonic sensors are attached to sensing the item and sending signals. Based on these indications, the controller takes various measures to provide safe environment for user. After the obstruction before the automobile is detected, the distance from the car to the obstacle will be seen directly in the light emitting diode (LED) display. If there is extremely little gap between two automobiles or between cars and obstruction, implies that the automatic braking system is engaged if accidents such as the situations are identified by an IR sensor.

4.1. Obstacle Detection:

The objective of this research of the proposed technique is to ensure driver and vehicle speed or safety against various obstacles. Ultrasonic sensors on the front of the vehicle are utilized to attain this goal of detecting the obstacle. The ultrasonic sensor transmitter transmits the signals constantly to the ultrasonic sensor receivers. If the signals hit with an object and reflect back, the sensor's receiver captures these signals as well as transfers them to microcontroller. Signal will be sent towards processing units through several port to find object's side. The power is directly proportional to the range of an ultrasonic sensors in an ultrasonic sensor.

4.2. Car Speed Monitoring System:

In this arrangement, the Microcontroller controls the velocity of the vehicle. Several commands are transmitted to controller ports in order to adjust the speed of the vehicle. The microcontroller gets orders to show the barrier to the vehicle and produces an 8-bit encoded value. The inputs from the ultrasonic sensor and infrared sensors in the car will be received. After evaluation of the inputs from the sensors, the controller maintains the speed of the car according to the distance.

4.3. Circuit for detecting Ultrasonic Hurdles:

The sound speed is 344 m/s in dry air. If a brief ultrasonic pulses of 200 kHz are sent into the air, the echo cannot be heard but a return pulses can be detected through an ultrasonic sensor. The distance will also be known if the time of the outward and back journey of the ultrasonic wave are determined. The range from the ultrasonic sensor to the first hurdle before is known if we split the distance by two. Here, the approach

presented also employs an ultrasonic piezo transmitter with its receptor, which is extremely efficient, simple to locate and rather economical. The pulse will initially be sent in this suggested study, and 20 kHz pulse may be easily obtained from PIC pulse width (PWM) output. We can directly drive from the PIC output an ultrasonic transmitter, however the sensor range does not exceed 50cm. The ultrasonic transmitter will create a pulsation of 200 kHz with a transistor and resonator circuit and increase the sensory range up to 75 feet.

4.4. Automatic Braking System Activation:

The distance between automobile and obstruction is shown instantly on the LED display once the impediment is detected in front of the car. If there is a minimal space between the automobile and the obstruction, the speed of the car likewise reduces. If there is extremely little distance between two cars or distance between the cars and obstacles, the automatic braking system is engaged if an accident such as scenario is recognized by the IR sensor. The distance of safety is calculated when the obstruction is recognized and the vehicle system is blocked. In this prototype, the range of precision of the ultrasonic sensor is around 2cm to 1m and operates efficiently within the limit set.

5. CONCLUSION

This research suggest that the use of proposed automatic braking system might provide safety benefits like as stress reduction, reduced lane change as well as longer distance for younger driver. Many driver, however are unaware of their system's restrictions which create safety issues. Drivers must be better advised of scenarios that are improbable for their system to react. More study needed assess the total safety impact of technologies, based on the possible safety advantages and concerns. The proposed system uses Arduino Uno, ultrasonic sensor which makes the system more compact and easy to install. The ultrasonic braking system aims primarily to instantly brake the automobiles when the sensors sense an obstruction. This technology allows automobiles to detect that another car or object is in imminent frontal collision and is braked accordingly by the braking circuit. There is a possibility for more study into advancing the system in future and numerous automotive industries can utilize this system.

REFERENCES

[1] A. Subramanyam, "High Way Vehicle Speed Control & Automatic Breaking System," *IOSR J. Electron. Commun. Eng.*, 2014, doi: 10.9790/2834-09350107.

[2] J. Ko, S. Ko, H. Son, B. Yoo, J. Cheon, and H. Kim, "Development of brake system and regenerative braking cooperative control algorithm for automatic-transmission-based hybrid electric vehicles," *IEEE Trans. Veh. Technol.*, 2015, doi: 10.1109/TVT.2014.2325056.

[3] F. TANIGUCHI, C. NAKAGAWA, A. SHINTANI, and T. ITO, "Experimental study of automatic braking properties using an ultrasonic sensor for inverted pendulum vehicles (Proposal of the safety system by using the TTC as the indicator)," *Trans. JSME (in Japanese)*, 2018, doi: 10.1299/transjsme.17-00534.

[4] A. Joukhadar, H. Issa, and Y. Kalaji, "Design and implementation of auto car driving system with collision avoidance," *Cogent Eng.*, 2018, doi: 10.1080/23311916.2018.1485458.

[5] Q. Chen, Y. Liu, and X. Li, "Stability control of vehicle emergency braking with tire blowout," *Int. J. Veh. Technol.*, 2014, doi: 10.1155/2014/436175.

[6] G. P. Gawande, S. V Gavhale, I. A. Zariye, and S. P. Ritpurkar, "Review of Speed Control and Automatic Braking System," *Int. J. Eng. Res. Technol.*, vol. 3, no. 2, pp. 474–476, 2014, [Online]. Available: http://www.ijert.org/view-pdf/7982/review-of-speed-control-and-automatic-braking-system.

[7] M. A. H. Ashari, A. Rusdinar, and P. Pangaribuan, "Sistem Monitoring Dan Manajemen Baterai Pada Mobil Listrik Electric Car Monitoring System and Battery Management," *e-Proceeding Eng.*, 2018.

[8] R. jeyanthi Dhanya K. R., "Automatic Braking System with Fusion Concept," *Int. J. Emerg. trends Eng. Dev.*, 2012.

[9] S. P. Bhumkar, V. V Deotare, and R. V Babar, "Accident Avoidance and Detection on Highways," *Int. J. Eng. Trends Technol.*, 2012.

[10] M. Vidyadhar, M. U. Reddy, and C. M. Vidhyapathi, "Anti-collision and auto retarding system along with a wiper speed control during rains using MPS 430 microcontroller," *Int. J. Eng. Technol.*, vol. 5, no. 3, pp. 2286–2291, 2013.