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Collision Prevention System using Ultrasonic Sensor

Rituraj Shinde[1], Naveen Tiwari[2], Ganesh Takale[3], Sandeep Lokhande[4], Prof. Mahesh Shinde[5]
Students, Department of Mechanical Engineering[1,2,3,4]
Assistant Professor, Department of Mechanical Engineering[5]
JSPM'S Jayawantrao Sawant College of Engineering, Hadapsar, Pune, Maharashtra, India

Abstract: *Now-a-days usage of automobiles is increasing. As Automobiles increasing the death rate due to road accidents is also rising. On an average, 450000 accidents take place every yearin our country. accidents are mostly caused by delay of the driver to late applying of brakes or by the negligence by the driver.Most of the accident occurs due to the delay of the driver to hit the brake, so in this project work braking system is developed such that when it is active it can apply brake depending upon the object sensed by the ultrasonic sensor and speed of vehicle. Ultrasonic emitter always emits the ultrasonic waves, whenever a obstacle is detected then wave gets reflected and receiver receives the signal. Reflected wave sends the signal to the Arduino UNO microcontroller from that based upon distance of object it actuates the brakes. in this modern era speed is a major factor and leads to catastrophic incidents. So, by using Ultrasonic braking system we can prevent the death rate of road accidents.*

Keywords: Ultrasonic Sensor, Arduino, Microcontroller, Mechatronic System, Braking System

I. INTRODUCTION

The main objective of this paper to design speed control & automatic braking system in the vehicle. This project describes an automatic braking system using ultrasonic sensors and controlled by ultrasonic sensors. The Arduino microcontroller controls the robot, which is loaded with the ultrasonic sensor. The forward end of the vehicle is equipped with an ultrasonic sensor. Sensors get data from the surrounding environment by placing sensors on the robot. An ultrasonic wave emitter installed on the front portion of a motorcycle that produces and emits ultrasonic waves forward to a predetermined distance is part of an intelligent system. using ultrasound Additionally, a receiver that actively receives reflective ultrasonic wave signals is mounted on the bike's front section. The reflected wave provides the distance between the barrier and the vehicle. A microprocessor is then utilised to push or pull the vehicle's speed based on the information from the detection pulse.The purpose of this vehicle is to detect obstacles and avoid collisions.

II. METHODOLOGY

An intelligent electro technical system includes an ultrasonic sensor which is provided on the front side of the bike which sends ultrasonic waves on the front side to a predetermined distance. An ultrasonic receiver is also placed on the front portion of the bike which is continuously receiving the reflected ultrasonic wave signal. The received signals give the exact distance between the obstacle and the vehicle. The function of the microcontroller is used to control the speed of the vehicle based on the detection pulse information to push or pull the brake and apply the brake to the bike spontaneously for safety purposes. The quick response time provided by the electronic control can be used for crucially shortening the braking distance by introducing advanced control of braking system operation such as complex task imposed to the control of the braking system can't be supported the driving force abilities and wish to be done operated independently of the driving force.

2.1 PRINCIPAL COMPONENTS OF BRAKING SYSTEM

2.1.1 ULTRASONICSENSOR

Ultrasonic ranging and detecting devices make use of high-frequency sound waves to detect the presence of an object and its range. These systems either measure the echo reflection of the sound waves from objects or detect the

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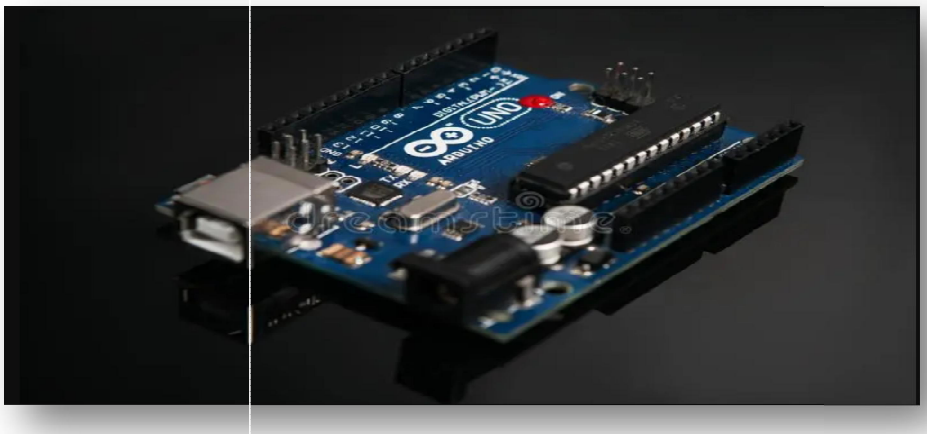
interruption of the sound beam as the objects pass between the transmitter and receiver. An ultrasonic sensor typically utilizes a transducer that produces an electrical output pulse in response to the received ultrasonic energy. In such case, the horizontal aperture angle must be at least 8 degrees for an inter-vehicle distance of 75meter. The vertical aperture is fixed to be 1 degree and is positioned in such a way to avoid faul treading due to the road conditions.

Test Distance = (high level time * Velocity of sound (340M/S)/2),
Summary
Working Voltage DC 5V
Working Current 15mA
Working Frequency 40Hz
Max Range 4m
Min Range 2cm
Measuring Angle 15 degree
Trigger Angle: Signal 10us TTL pulse
Echo Output: Signal Input TTL lever signal and the range in proportion
Dimension: 45*20*15mm

2.2.2 PROCESSOR(ARDUINO UNO)

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and are set button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions.



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FEATURES

Microcontroller	Atmega328
Operating	Voltage 5V
Input Voltage(recommended)	7-12V
Input Voltage(limits)	6-20V
Digital I/O	Pins 14(of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (Atmega328) of which 0.5KB used by boot loader.
SRAM	2 KB (Atmega328)
EEPROM	1 KB (Atmega328)
Clock Speed	16 Hz
Length	68.6 mm
Width	53.4 mm
Weight	25gm

2.2.3 DC Gear Motor

A DC gear motor may be a fairly simple electric gear motor that uses electricity, gearbox, and magnetic flux to supply torque, which turns the motor. At its most simple, the DC gear motor requires two magnets of opposite polarity and an electric coil, which acts as an electric magnet. The repellent and attractive electromagnetic forces of the magnets provide the torque and cause the DC gear motor to turn. A gearbox is present just after the DC motor and a rotary shaft are connected to it, with the help of this DC gear motor setup the vehicle wheels can be rotated in this project.

2.2 SYSTEM DESIGN

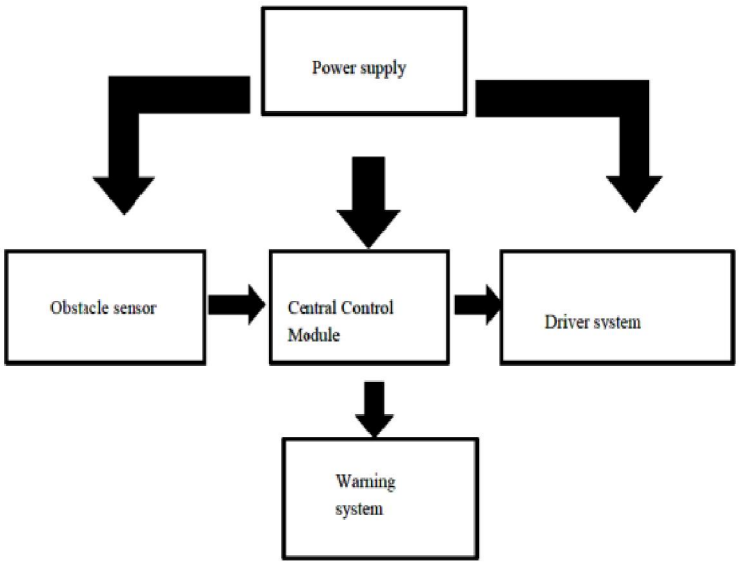

Figure no. 1: *Block diagram of control system*

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Both hardware and software components make up the collision warning system that was built in this work. Paper circuit structure makes up the hardware. The paper's programming section is covered under the software section. The power supply, the microcontroller, the obstacle sensor, the warning system, and the motor driver system are the five components that make up the research. The many units are depicted in the block diagram in Figure 1.

2.3 OBSTACLESENSING UNIT

To make a successful obstacle sensing unit, the block diagram shown in Figure 4 is used.

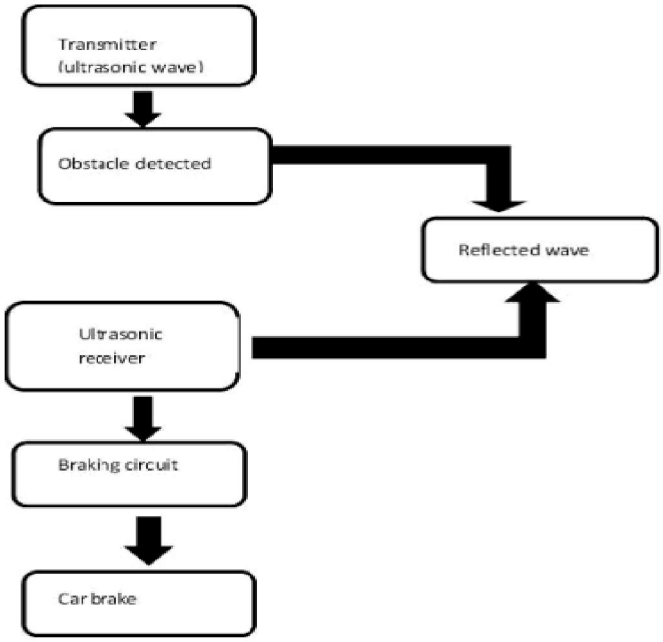

Figure no. 4: *Block diagram of ultrasonic sensor*

The sensor has four pins that is VCC, ground, echo and trigger pulse, VCC and ground are connected to the respective pins in the microcontroller. The trigger pulse is connected to pin 1 of Port D while the echo pin is connected to pin 3 of Port D. The operation of the sensing Unit is as follows:

Sends a short, but long enough 10µs pulse on the trigger pin (module automatically sends eight 40KHz Square wave);

Wait for the Echo line to go high;

Time the length of the pulse that stays high.

The length of the pulse is directly proportional to distance. The range is then calculated using the following formula:

Distance in Centimeters = µs/58

2.4 SIMULATION

Using a digital oscilloscope and a signal produced as illustrated in Figure, the ultrasonic sensor is emulated. The echo pin's incoming square wave is simulated by the signal generator simulator. The microcontroller receives an incoming square wave of roughly 5V. In an oscilloscope, the waves entering the trigger pin and echo pin are examined. When the frequency is high in the beginning, the motor is gradually raised, and the LED turns on to simulate a top distance warning. The buzzer activates to simulate a low level distance warning as the frequency is increased further. Finally, the motor's high-frequency rotation ceases to simulate a distance of less than 20 cm.

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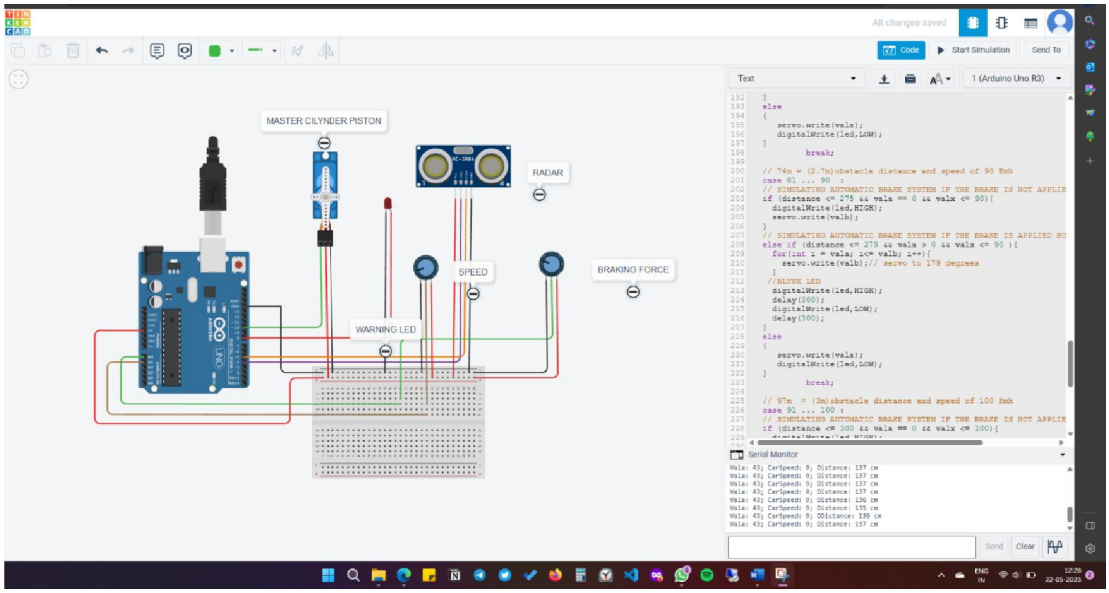

2.5 Advantages of Braking System

As was already said, even in slick circumstances, a brake system does not lock-up and skid. Braking system brakes have been shown repeatedly to save many lives by assisting drivers in maintaining control of a vehicle.

A BS shares some of the traction system's architecture, where modern technology helps ensure that each wheel has traction on the ground. Because of this, manufacturers may easily incorporate both of those qualities at the production.

In comparison to other types of sensors now in use, an ultrasonic sensor is less expensive and less in demand.

This technology can also avoid collisions between a vehicle and animals, or it can lessen the likelihood that injuries would occur, because ultrasonic sensors can detect any silent impediment.

III. CONCLUSION

A mechatronic braking system discussed in this paper is developed and designed in such a way that, when it is active it can apply break automatically encountered by any object sensed by the ultrasonic sensor. To demonstrate the system, a very straightforward and intelligible model with a rear end anti-collision warning system was built and put on it. The system was found to work as intended.Shorter-range distances might be reliably read by the sensor. Because there were instances when the microcontroller didn't get any feedback, the system wasn't real-time. This is brought on by outside noise. a vehicle-mounted object detector at a distance. It is therefore conceivable to improve its properties so that it may be utilised in automobiles if the appropriate materials are gathered. This model is a useful tool for demonstrating the effectiveness of anti-collision warning system.

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