Collision Avoidance System for Vehicle Safety

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Abstract— Automobile safety can be improved by anticipating a crash before it occurs and thereby providing additional time to deploy safety technologies. By this project, the goal is to design a collision avoidance system which is reliable for drivers in traffic. The purpose of the automatic collision avoidance system is to keep drivers better informed with the environment surrounding them. Primarily Ultrasonic sensors, Microcontroller, Buzzer, LCD, Motors and a set of LEDS are used to implement the design. The success of the proposed system can reduce human suffering caused by injury and death. The financial burden will be reduced because maintenance and replacements of parts of vehicle are avoided. Ideally the system should be installed in every automobile on road. The project's ultimate aim thus finalized as, one to build a general, easy-to-use and versatile system that detect obstacles other vehicles on road , and give warning to the user accordingly.

Key words: Primarily Ultrasonic sensors, Arduino Uno, Ultrasonic Sensor

I. INTRODUCTION

Road accidents have earned India a dubious distinction. The major un-natural cause of accidental deaths in India is road accidents (34.3%).India is home to the world's largest no. of road deaths according to the world health organization's latest global road safety report with approx. 15 deaths per hour. In the last decades we witnessed a great progress in the fields of vehicle safety. For a great period of time the majority of automotive companies emphasized on developing passive safety systems, such as seatbelts, airbags, controlled deflection zones in the chassis of the car , etc. these techniques have dramatically reduced the rate of crash related injury severity and fatalities. So taking into consideration the huge loss of life and property due to road accidents vehicle collision avoidance system is a necessity in vehicles for safety. The main goal of such systems should be to prevent the accident from happening than ensure that the passengers will survive after the accident has occurred.

During the last decades, with the great spread and development of microelectronics, microprocessors, information technology and telecommunications systems, active safety systems have been developed to avoid collisions on the road. Today, collision avoidance systems represent the next significant leap in vehicle safety technology. For such systems to gain widespread acceptance by the general automotive consumer, they must be reasonably priced, provide highly reliable performance, and provide functionality. Most major automotive companies offer active safety systems, only on their advanced models though. Specialized collision avoidance systems are still considered luxury equipment.

In particular, a collision avoidance system is a system of sensors that is placed within a car to warn its driver of any dangers that may lie ahead on the road.. The system uses sensors that send and receive signals from things like, other cars, obstacles in the road, traffic lights, and even a central database are placed within the car and tell it of any weather or traffic precautions[1].

In this paper we propose Designing of a Collision Avoidance System using Arduino Uno and Ultrasonic Sensor as a cost effective alternative to existing technology which can be implemented in a modest man's vehicle. With the help of Ultrasonic sensor distance can be measured and this measured distance can be used to give audio visual alarm and also automatic control of system. This kind of system can be used in areas prone to high accident rates in vehicles and in heavy traffic zones.

II. RESEARCH BACKGROUND

There are many technologies that work in the area of obstacle detection & warning. The basic concept of detecting the distance & using that data to perform control operations is same in all techniques. The only difference lies in the type of sensors and its techniques in recognizing the obstacle & actions taken after sensing the obstacle.

The following are the different research works that were implemented for collision avoidance system:--

1) "Research on automotive rear end collision warning technology" IEEE paper published in 2012 talk about the automotive rear end collision warning technology(ARCWT) based on machine vision, ARCWT based on radar, Rear end collision warning technology(RCWT) based on Laser Radar, RCWT based on Ultrasonic sensor, RCWT based on Infrared Technology & RCWT based on Multi-sensor Information Fusion. All these technologies deal with the same common goal of detecting the obstacle and avoiding collision[2].
2) "A new collision warning system for lead vehicle in rear end collision" IEEE paper published in 2012 focused on two time –based measures that assess both front & rear collision threats. It directly quantifies the threat level of the current dynamic situation assuming that the required evasive action involves acceleration[3].
3) "A rear end collision avoidance system of connected vehicles" IEEE paper published in 2014 focuses on developing a collision avoidance system based on vehicle to vehicle communication. By using the connected vehicles the system can collect information & share message through the communication equipment[4].
4) "Collision Avoidance System in Heavy Traffic & Blind spot Assist Using Ultrasonic Sensor" paper published in International journal of Computer Science & Engineering Communications-IJCSEC in 2014 deals with a collision avoidance system based on Ultrasonic

sensor that will give sound & light warning to the driver[5].

III. PROPOSED MODEL

This proposed system uses an ultrasonic module interfaced to the microcontroller board Arduino Uno. An ultrasonic transducer comprising of a transmitter & receiver are used for the project. Arduino Uno sends a trigger pulse to the Ultrasonic sensor which then transmits ultrasonic waves. The transmitted waves are reflected back from the object & received by the transducer again. Ultrasonic sensor sends echo pulse to the Arduino Uno. Ultrasonic sensor converts sound signal to electrical signal which is processed in microcontroller to measure distance. The total time taken from sending the waves to receiving it is calculated by taking into consideration the velocity of sound. Then the distance is calculated by a program running on the microcontroller. The measured distance can be used as a control parameter by the user to generate audio visual warning as well as to trigger automatic control outputs for deceleration and automatic brakes depending on the threshold parameters set according to the software program.

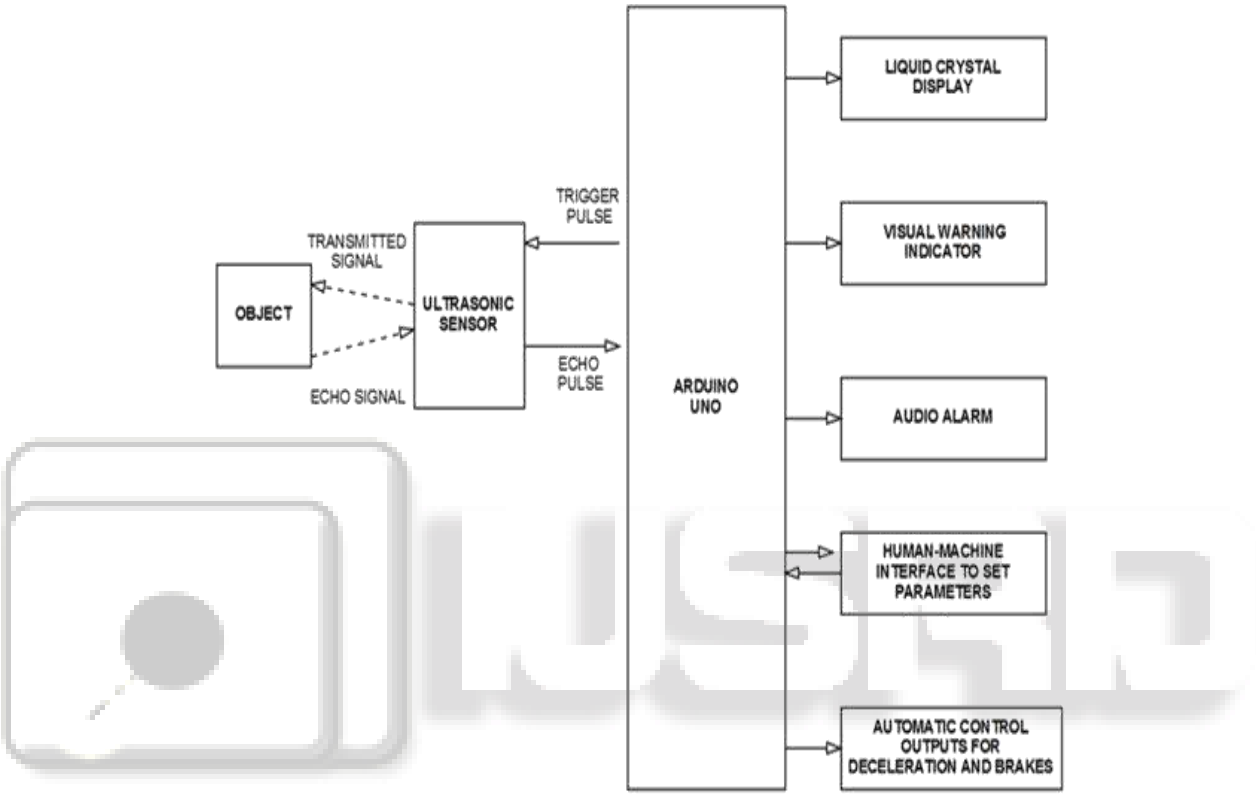

Fig. 1: Block Diagram of Proposed Model

IV. EQUATIONS

The distance to the object can be found out by formula given below.

$$D = 0.5 * C * (T1-T0)$$

- D = Distance to Object.
- C= Speed of sound
- T0 = Time at which sonic wave is transmitted
- T1 = Time at which sonic wave is received

V. 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 a reset button. Arduino is open source hardware board with many open source libraries to interface it on board microcontroller with many other external components like LED, motors, LCD, keypad, Bluetooth module, GSM module and many other things one want to interface with Arduino board. Arduino is basically make from a microcontroller but Arduino have all external socket to connect with other devices and it also have built in programmer which is used to program Arduino from computer. So Arduino is a complete board which include all things to connect with external peripheral and to program through computer.

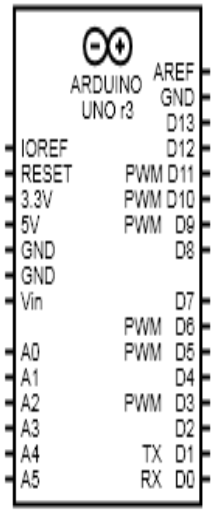

Fig. 2: Pin Diagram of Arduino Uno

VI. ULTRASONIC SENSOR

Ultrasonic sensor is a distance measurement sensor which uses ultrasonic sound waves to measure distance. Ultrasonic sensor use high frequency sound waves of 40 KHz. Ultrasonic sensor consists of two basic modules transmitter and receiver. Transmitter acts as speaker and receiver acts as a microphone. Speaker emits ultrasonic waves and Microphone detects ultrasonic waves which is produced by speaker. Basic functionality of ultrasonic sensor is shown in diagram below:

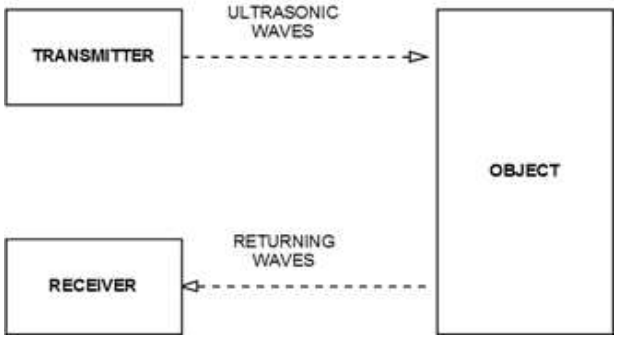

Fig. 3: Basic Block Description of Ultrasonic Sensor

VII. SOFTWARE IMPLEMENTATION

The basic idea of program is represented in flowchart which can be implemented by using Arduino software, MATLAB and Simulink.

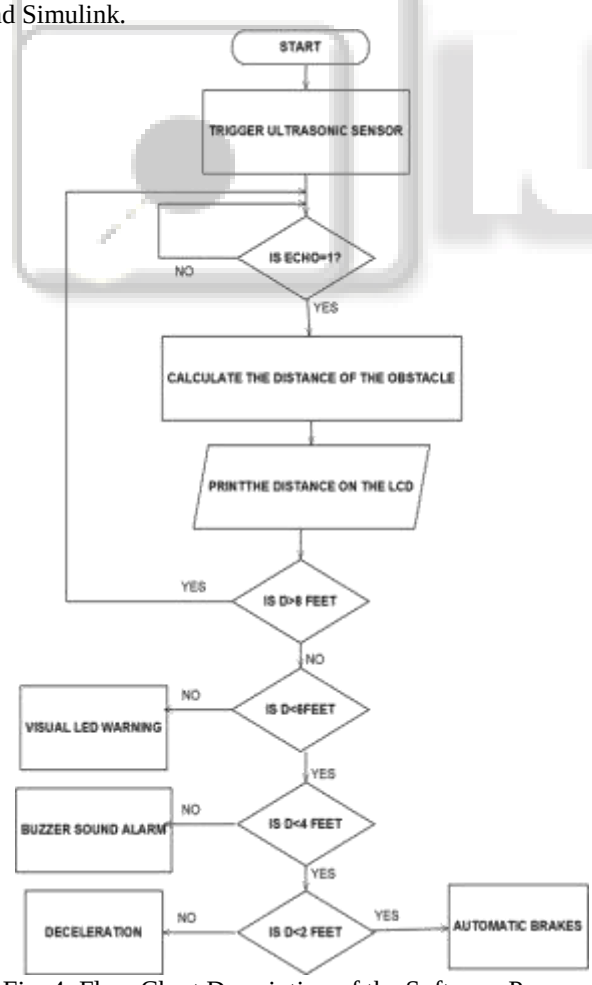

Fig. 4: Flow Chart Description of the Software Program

VIII. EXPECTED RESULTS

1) To develop a safety system that includes Ultrasonic sensor that detects objects and calculates distance of them and display on LCD.
2) To develop a suitable warning and alarm system to notify the driver when under threat.
3) To decelerate the speed of motors to slow down the vehicle.
4) To automatically apply brakes when the driver is not noticing the threat alarms.
5) To develop a cost effective alternative to the existing technology which can be implemented in a modest man's vehicle.

IX. CONCLUSION

An attempt has been made in this project to study and comprehend aspects of Ultrasonic sensor. The use of the collision avoidance system will help in saving human lives. The design presents a collision avoidance system which can be installed on the moving vehicles . The key idea incorporated in the detection of an obstacle using ultrasonic sensors .Such detection is accomplished by the generation of audio- visual alarm , deceleration in speed of vehicle and automatic brakes. We are confident that in coming years our project if used in proper and in efficient direction will become a boon and serve the mankind.

ACKNOWLEDGMENT

The authors wish to thank Er. Sanjay Singh, Project Engineer at NIELIT Gorakhpur, India, for his support and guidance in preparation of this paper.

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