

IMPLEMENTATION OF ULTRASONIC DISTANCE DETECTOR USING ARDUINO

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ABSTRACT

This project proposes the principle of implementation of Ultrasonic Distance Detector using Arduino. In this process, distance will be measured using an ultrasonic sensor. Ultrasonic sensor is a device which will measure distance of the target object. LCD display will also be used in the implementation to display the detection of object and also the distance at which the object is located. The main implementation will be done using Arduino, which will code data regarding the range of object detection. In the process of detecting the object using an ultrasonic sensor, if any object is found below that specific range of distance, then it will display as object detected and display the distance of the object. If the object comes further near below the range mentioned, then the buzzer will start beeping indicating the object. Finally, the main objective of ultrasonic distance detector in the project is to portray the experimental results of detecting the vehicle in night times and on curve roads and calculate the respective longitudinal and the horizontal distance to the preceding vehicle and give an indication if the distance is less than the specified

Keywords: Ultrasonic sensor, Arduino UNO, Ultrasonic bursts, distance detector, Obstacles.

1. INTRODUCTION

The project is about the working concept of calculation of distance of the nearby objects or obstacles with the help of an ultrasonic distance meter circuit using an ultrasonic sensor (HC-SR04) which is able to sense the obstacles in its way and the LCD display of configuration 16x2 to display the distance of the object from the ultrasonic sensor and the information regarding the object whether it is found or not. The Arduino UNO is a hardware as well as a software tool which is used all over in the progression of the project and the code to calculate the distance is run on the software Arduino IDE. The buzzer is also used in the project to indicate the existence of the object in a very close territory.

2. COMPONENTS

1. Arduino UNO:

The Arduino UNO is one of the major components used in the project which gives the power supply of 5V. It is a microcontroller board which is an open- source system. It is a microcontroller board which consists of both Analog and the digital pins. These Analog and the digital pins can be used as input/output pins to interface various circuits.



The specifications of the Arduino UNO are:

- i Microcontroller of ATmega328P Microchip.
- ii The operating voltage of 5V.
- iii The input voltage of around 7 to 20 Volts.
- iv The Flash memory of 32KB out of which 0.5KB is used by the bootloader.
- v A Clock speed of 16MHz.
- vi Length of 68.6mm.
- vii Width of 53.4mm.
- viii SRAM and EEPROM of 2KB and 1KB respectively.
- ix 6 Analog Input Pins
- x 20mA of DC Current per I/O pin and 50mA of DC Current for 3.3V Pin.

Any new code can be dumped into the Arduino hardware without any help of an external hardware programmer as ATmega328 on the board is programmed in advance as it is proficient of automating without any external protocol.

2. LCD Display

An LCD is an electronic display module which uses liquid crystal to produce a visible image. It has a wide range of applications. A 16x2 LCD display is a very basic module and is very commonly used in various devices and circuits. A 16x2 LCD displays characters in two lines, consisting of 16 characters per line. In this LCD, each character is displayed in a 5x7 pixel matrix. It is capable of displaying 224 different characters and symbols. It has two registers, namely Command registers and Data register.

Command registers stores various commands that will be given to the display. Data register stores the data that is to be displayed on the LCD Screen. The Contrast of the display can be adjusted by adjusting the potentiometer, which can be connected across the VEE pin.

3. Ultrasonic Sensor

The Ultrasonic sensor consists of two identical cylinders which are made of Aluminium and covered by a mesh which are known as the transmitter and the receiver which transmit and receive Ultrasonic waves. The Crystal Oscillator of frequency 4MHz is also present in Ultrasonic sensor which is useful in delivering the stable output for a required period of time which work on the principle called piezo electric effect.



The HC-SR04 Ultrasonic sensor commonly known as Ultrasonic distance detector is a sensor which has two transducers which are Ultrasonic. Among the two transducers one acts as a transmitter and the other acts as a receiver. The sensor which can convert an ultrasonic signal into an electrical signal or energy signal is known as an Ultrasonic sensor

The transmitter of the Ultrasonic sensor can convert an electrical into an ultrasonic sound pulses of the frequency 40KHz. The receiver of the sensor listens to the pulses which has been transmitted. If it is received then an output pulse is generated of a specified width whose width is helpful in calculating the distance.

The Ultrasonic Sensor consists of 4 pins. They are:

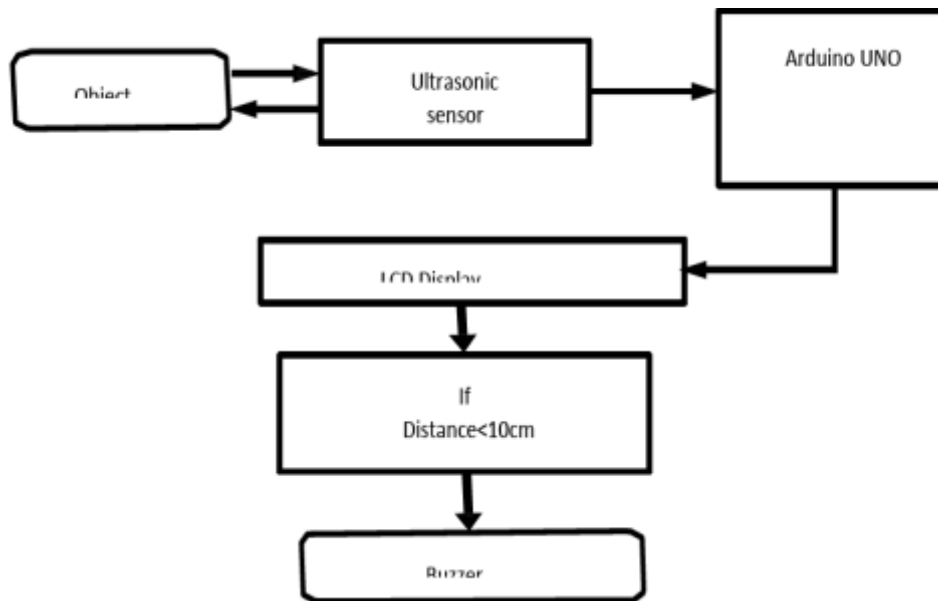
1. VCC
2. Trig
3. Echo
4. GND

4. Buzzer:



A Buzzer is an audio signalling device that generates sounds. These sounds are due to the oscillating circuit present inside it. This device is typically powered by a DC Supply. Buzzers are mainly categorized into piezoelectric buzzers and electromagnetic buzzers. Applications of buzzer include Alarm circuits, Automobile electronics, Printers, Computers etc. Based on its design and use, the buzzer can produce various sounds like siren, alarm, electric bell etc.

4. Block Diagram



The proposed block diagram consists of Arduino UNO, Ultrasonic sensor, LCD display and the buzzer. If the distance is below 10cm the buzzer starts beeping and the distance is displayed on the LCD display.

5. WORKING OF ULTRASONIC DISTANCE

Detector.

The main principle of the Ultrasonic sensor is that when it releases the ultrasonic sound waves which when hit by any obstacle or object gets reverted back. Firstly, a pulse of at least the duration of 10us (microseconds) should be enforced to the trigger pin of the Ultrasonic sensor. In accordance to the 10us pulse the sensor releases 8 pulses of sonar bursts at a frequency of 40KHz. The 8-pulse ultrasonic bursts form a unique pattern which makes it different from the transmitter waves and the noise.

The transmitter of the Ultrasonic sensor which has released 8 unique pulses are transmitted through air. And the signal of the Echo pin reaches HIGH in order to configure the formation of echo-back signal.

If the 8 pulses which are transmitted from the transmitter of the Ultrasonic module are not reflected back then after a period of 38mS the signal of the Echo goes timeout and the Echo signal becomes the low signal. So, a grace period of 38mS is given to see if the signal is reverted back or not and thus the pulse of 38mS is considered as no obstruction in the Ultrasonic module range.

The working of the Ultrasonic sensor as detector to detect the objects or obstacles and to calculate the distance involves 3 major steps. They are:

1. A sound wave of high frequency has been sent from the trigger pin of the transmitter of the Ultrasonic sensor.
2. If the high frequency signal detects any kind of object or obstacle then the signal is reflected back.
3. The reflected signal after hitting an obstacle is received by the echo pin of the transmitter of the Ultrasonic sensor.

6. CONCLUSION

The Ultrasonic sensors are the most determined and the low-cost devices amongst the other sensors. They are very precise in terms of the distance detection of the nearby objects or obstacles.

The Ultrasonic distance measurement is the most convenient approach to calculate the distance. The Ultrasonic distance detector device which has been proposed sense the object proximity in the range of 2cm to 400cm. And the project displays the distance and the detection of object if it is detected or not on the LCD display.

7. REFERENCES

- [1] Sungbok Kim and Hyunbin Kim, "Simple and Complex Obstacle Detection Using an Overlapped Ultrasonic Sensor Ring," 2012 12th International Conference on Control, Automation and Systems.
- [2] Jun Hou, Chengdong Wu, Zhongjia Yuan, Jiyuan Tan, Qiaoqiao Wang and Yun Zhou, "Research of Intelligent Home Security Surveillance System Based on ZigBee," International Symposium on Intelligent Information Technology Application Workshops, pp.554-557, 21-22 Dec. 2008
- [3] J. Borenstein, H. R. Everett, and L. Feng, "Where Am I?": Sensors and Methods for Mobile Robot Positioning, The University of Michigan, 1996.
- [4] J. L. Crowley, "World Modelling and Position Estimation for a Mobile Robot Using Ultrasonic Ranging," Proc. IEEE Int. Conf. Robotics and Automation, pp. 674-680, 1989.
- [5] H. Choset, K. Nagatani, and N. A. Lazar, "The Arc Traversal Median Algorithm: A Geometric Approach to Increase Ultrasonic Sensor Azimuth Accuracy," IEEE Trans. Robotics and Automation, vol. 19, no. 3, pp. 513-522, 2003.