International Journal of Research in Advent Technology (IJRAT) Special Issue
E-ISSN: 2321-9637
Sharadchandra Pawar college of Engineering, Dumbarwadi, Pune 410504,
Organizes
National Conference "MOMENTUM-17", 14th & 15th February 2017
Available online at www.ijrat.org

ULTRASONIC RADAR FOR OBJECT DETECTION, DISTANCE AND SPEED MEASUREMENT

Mr. Deshmukh GouravV[1], Miss. Nalavade Dhanashri N.[2], Mr. Salve Krushna H.[3], Miss. D. A. Shaikh[4]
[1,2,3,4]*Department of Electronic and Telecommunication*
Pravara Rural Engineering College Loni. Rahara, Ahmednagar
Email ID:- gourav3275@gmail.com[1], nalavadedhanashri@gmail.com[2]
salvekrushna91@gmail.com[3],diba27@gmail.com[4].

ABSTRACT

The proposed system "ultrasonic radar for the object detection,distance and the speed measurement" employs an ultrasonic module that includes an ultrasonic transmitter and receiver along with the 89c52 microcontroller. It operated by transmitting 40 kHz frequency pulse which is not audible to the human ear. Module rotate with step angle of the stepper motor with specific angle for a specific time interval, microcontroller receive an echo signal back as response of the transmitted signal by transmitter and the distance between the object and system is measured by calculating time interval taken by the signal to transmit and the echo reception. Whereas the detected signal is shifted toward the module or away from the module which give the information about the speed of that detected object which is shown on PPI DISPLAY.

KEYWORD: Ultrasonic sensor, Microcontroller, distance Measurement, Communication equipment.

I. INTRODUCTION

Radar is an object detection system that uses electromagnetic waves to recognize the range, elevation, path, or speediness of both moving and fixed objects such as aircraft, ships, motor Vehicles, weather formations, and terrain and when instead of electromagnetic waves, we use Ultrasonic waves, it is called an ultrasonic radar**.** In the moving object required a more no. of data to tracking its actual setting such as location, distance, speed. Technologies are used to tracking system mainly comprise microcontroller 89c51, ultrasonic module and microwave distance meter. Distance detector is Device capable to measuring the distance between transmitter and the receiver. The techniques to measuring the distance between using ultrasonic of an object include the pulse echo method. In that technique burst pulse is send the 40 kHz Signal through transmission medium and is reflected by an object kept at specific distance from the ultrasonic module .the time interval between echoes reflected from object to the module is proportional to the distance of object.

The main drawback of the ultrasonic module is it is a short range communication; it fails to measure the long distance communication. It tracks the object with in the several range of the module.

Valentin Magori et.al[1] proposes ultrasonic radar in air.

Ultrasonic Sensors in Air are Intelligent Sensors, which use wave-propagation phenomena in air to measure physical or chemical variables. With accordance to the influence principle, two main types of ultrasonic sensors can be differentiated.

Propagation Path Sensors decode changes on propagation to get a fast measurement of temperature, pressure variations or gas concentration. Most important are ultrasonic flowsensor .e.g. for engine intake air or for air gas measurement. Distance-Sensorsdetect echoes from objects and evaluate their propagation time and amplitude. Examples are distance meters and presence detectors. By intelligent algorithms based on signal theory models or heuristic approaches (synthetic aperture, pulse holography, fuzzy or neural network etc.) the resolution and detection range were increased, the radial and lateral resolution significantly enhanced and objects recognized. With piezoelectric PVDF-foils efficient and versatile transducers arrays were realized. Robust transducers for operation in ad-verse environment (dirt, moisture, abrasion) were developed using rugged matching layers or a special composite-transducer technology.

Chetanasingh et. Al [2] was discovered that

Radio detection and Ranging (RADAR) are remote sensing system with military, scientific and commercial applications. E M waves are sends by the Radio detection and ranging in which we use the radio waves to find "the distance metallic objects".

Rajan P Thomas et.all. [3] Proposed Range Detection Based On Ultrasonic Principle. The proposed system, Ultrasonic Range Detector employs an ultrasonic module that consists of an ultrasonic transmitter and receiver along with anATmega16a microcontroller. It works by transmitting a short pulse of sound at a frequency inaudible to the ear (ultrasonic sound or ultrasound). Afterwards the microcontroller listens for an echo. The time elapsed during transmission to echo reception gives information on the distance to the object. We aimed at designing rangefinder free from the conventional problems arising from the undesirable direct waves, wherein a signal level for detecting a right signal due to the reflection waves from a ranging object is automatically varied and the detection of the right signal is made inaccurate by the time-dependent signal level.

A. K. Shrivasta vaet. all[4] proposed the Distance Measurement of an Object or Obstacle by Ultrasound Sensors using P89C51RD2 Here the results for measured distance is satisfying for use in the sewer inspection system being developed. It can also be used for other devices requiring distance measurement of an object or obstacle. As shown, the system is implementable in the robotic sewer blockage detection system. The distance of the blockage from a specified entry point in the sewer pipeline can be calculated by adding travelled distance by the robotic vehicle and the distance of the blockage from the robotic vehicle. The accuracy of distance of blockage will be sufficient for normal practical uses. The system can be easily implemented in other devices and systems requiring the measurement of distance of an object or an obstacle from stationary or moving observation point where the ultrasonic sensor will be located.

I.1. Basic principle of ultrasonic radar:

The key mechanisms in any Ultrasonic radar are the Ultrasonic Sensors. Ultrasonic sensors work on a principle similar to radar or sonar which estimates qualities of a target bytaking the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and estimate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine thedistance to an object. This technology can be used for measuring: object, speed and direction (anemometer), fullness of a tank and speed through air or water. Further applicationsinclude: humidifiers, sonar, medical ultra pornography, burglar alarms and non-destructivetesting. Systems typically use a transducer which generates sound waves in the ultrasonic range,above 20,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn thesound waves into electrical energy which can be measured and displayed.

Aim of the system:

The Ultrasonic RADAR for object detection, distance and speed measurement, aim of this project is to sense any fixed or moving object which is in the range of ultrasonic sensor and to calculate the distance of that object from the system, also measure the speed of the moving object. The speed and distance will be showed on the real time LCD display.

Objectives:

1. To develop an ultrasonic RADAR.
2. To detect the fixed or moving object.

3. To measure the distance of the object from the system.
4. To measure the speed of the moving object.

II. system structure:

II.1. Transducer:

Transducers are distinct as essentials which is change one energy form to alternative energy form. TheUltrasonic transducers change electrical energy into the sound waves and vice versa. There areessentially two kinds of transducers used here, one to convert the electrical waves into the soundwaves which is called Ultrasonic Transmitter and the other to convert the sound waves into theelectrical waves or energy called Ultrasonic Receiver. A measurement arrangement which uses ultrasonic transmitter and receiver units mounted at a small distance between them. Calculate speed of the moving object.

II.2 Transmitter section

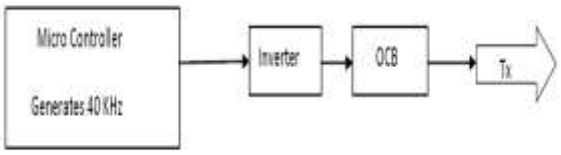

Fig.2.1:-block diagram of the transmitter section

1. Microcontroller: The 40 KHz signal is produced in the Microcontroller (uc). We use 89c52 as the microcontroller. 89c52 has a feature of timers which has been exploited to generate 40 kHz. This was a major challenge as we required exact 40 kHz for our circuit. This is then amplified before it is fed into the Transmitter. The output of Microcontroller is amplified using an Open Collector Buffer (OCB) Circuit.

2. Open Collector Buffer (OCB): The open collector buffer is an inverter with the open collector at the output. We connect 10K resistor from the output pin to 15V. To maintain the signal polarity the same as the input .we place an inverter before the open collector buffer.
We have used the Inverter IC 7406 to achieve the operation of open collector buffer and the IC 7404 to invert the Output of Micro Controller. The motive for not using outdated ways for amplifying like the Operation Amplifier (say LM741) because Op Amps like LM741 will not have the bandwidth to output a decent square wave at 40 kHz and the output becomes triangular.

II.3. Receiver Section
The Ultrasonic Receiver receives the sound waves if any present and converts them into electrical pulses which are frequently sinusoids. The amplitude of the received signal is about 40 mv to 50 mv which is fairly less to carry out any kind of processing with. The signal hence is amplified using to about 100 times so that it comes in the range of few volts. Here we can use an Op Amp because we are not concerned with the shape of the pulses; we just measure the amplitude to produce an interrupt.

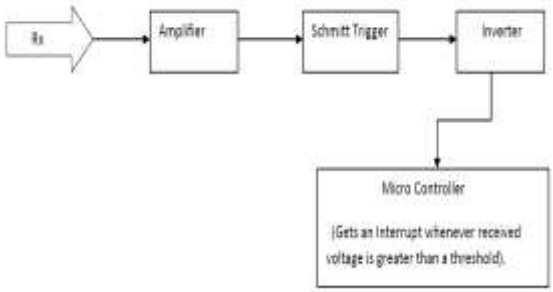

Fig.2.2:-block diagram of receiver

II.4 INTERRUPT GENERATOR
In order to make the Microcontroller conscious about the detection of any object an interrupt must be given to it. Interrupt generator circuit comprises of a Schmitt trigger which gives a high output whenever its input is above a threshold value or else it remains at low value (0v). The output of the Schmitt trigger is inverted with respect to the input signal, hence in order to reinstate the phase we invert the output of Schmitt trigger and then give it to the Microcontroller. The Microcontroller then bargains the distance of the object from the sensor by manipulating the delay between the time of sending pulses and the interrupt produced.

International Journal of Research in Advent Technology (IJRAT) Special Issue
E-ISSN: 2321-9637
Sharadchandra Pawar college of Engineering, Dumbarwadi, Pune 410504,
Organizes
National Conference "MOMENTUM-17", 14th & 15th February 2017
Available online at www.ijrat.org

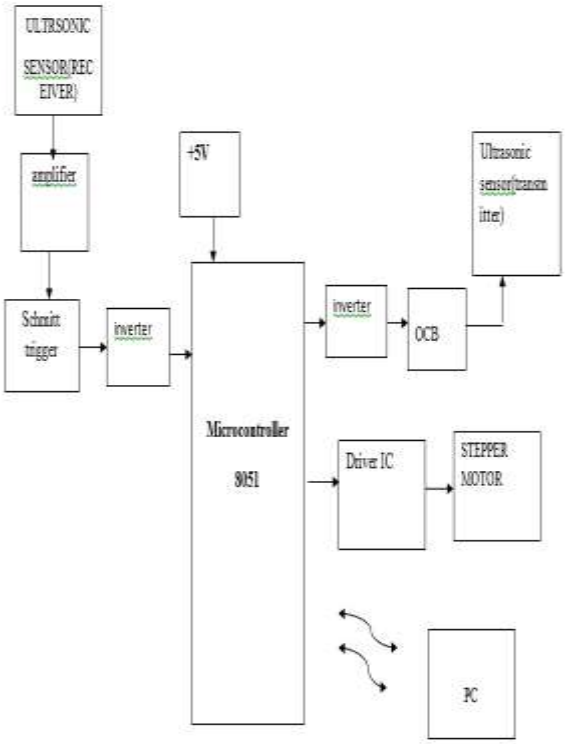

FIG2.3 –OVERALL STRUCTURE OF ULTRASONIC RADAR

II.5 STEPPER MOTOR

The stepper motor used in the system has a step angle of about 1.8 degrees. The sequences of the motor are controlled by the Microcontroller. To supply quantity of current to the motor a motor driver IC is used. The Stepper motor takes a 14.4degree step angle and then assessment is done at that point.(Gets an Interrupt whenever received Voltage is greater than a threshold). Microcontroller Driver IC Stepper Motor.

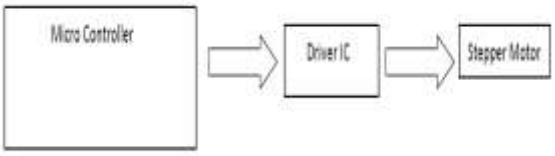

Fig.2.4:-block diagram of stepper motor

II.6 DISPLAY

Desktop display has been used to display the output. The output is like the one we see in radar systems. The scan is shown by a line and it moves from 0 to 180 as stepper moves. Whenever a object is detected LCD glows at that point.
This display is used for show the detected object in the form of latitude and longitude

FIG 2.4- OUTCOME OF THE SYSTM

III. Principle Of The Distance Measurement

Ultrasonic transducer uses the physical characteristics and various other effects of ultrasound of a specific frequency. It may transmit or receive the ultrasonic signal of a particular strength. These are available in piezoelectric or electromagnetic versions. The piezoelectric type is generally preferred due to its lower cost and simplicity to use. The Ultrasonic wave propagation velocity in the air is approximately 340 m/s at 15°C of air or atmospheric temperature, the same as sonic velocity. To be precise, the ultrasound velocity is governed by the medium and its temperature hence the velocity in the air is calculated using the formula below (1).

$V=340+0.6(T-15)$m/s ……. (1)

T: temperature, °C.

The measured distance is calculated on the basis of travel time .which is finding transmitting and receiving signal of the ultrasonic signal as measuring distance display on PPI DISPLAY.

The formula is to calculate the distance is shown below

Distance(cm) = (travel time *10^6* 34300)/2
……. (2)
OR

The time delay between the corresponding edges of the transmitted and received pulses is measured by microcontroller; this gives the time of flight. Substituting the time delay and the velocity of ultrasound in air (330 meters/second) in the following formula we can determine the distance between the transmitter and the target. Fig.2 shows the transmitted and received pulses.

Distance = Velocity X Elapsed time …….. (3)

II.1 Flow chart of the system:

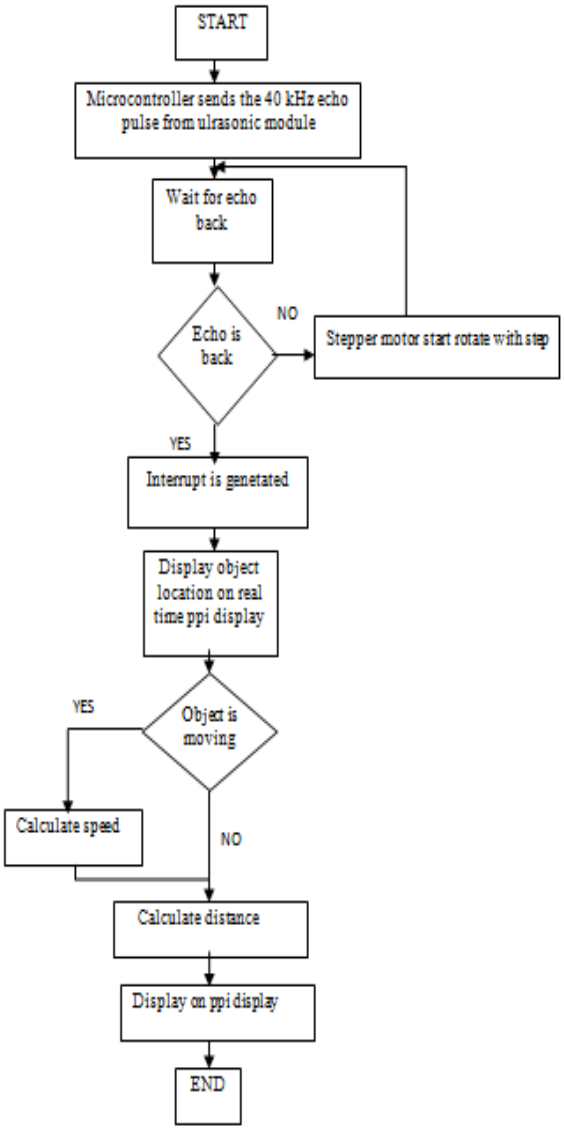

fig-flow chart of system

IV. CONCLUSION

In this system we have detect any moving and fixed object/ person by using transmitting a ultrasonic echo sound .Also to calculate a distance of that object, if this object is moving then to calculate the

speed of the that moving object which is thenshow on real time PPI display on desktop.

References

1. Chetana Singh1, AbhaAgnihotri2,Pallavi Patel3 " Development Of Radar Using Ultrasonic Sensor" in .International Journal Of Advance Research In Science And Engineering.

2. Rajan P Thomas1, Jithin K K2, Hareesh K S3, Habeeburahman C A4,Jithin Abraham5 "Range Detection based on Ultrasonic Principle" in International journal of advanced research in Electrical, Electronics and Instrumentation engineering in Vol. 3, Issue 2, February 2014.

3. A. K. Shrivastava, A. Verma, and S. P. Singh "Distance Measurement of an Object or Obstacle by Ultrasound Sensors using P89C51RD2" in International Journal of Computer Theory and Engineering, Vol. 2, No. 1 February, 2010.

4. Md. Shamsul Arefin, Tajrian Mollick "Design of an Ultrasonic Distance Meter" in International Journal of Scientific & Engineering Research Volume 4, Issue3, March-2013.

5.damei fu and zhihong zhao,"moving object tracking method based on using ultrasonic automatic detection algorithm" in 2016 ieee.

6. K. Audenaert, H. Peremans, Y. Kawahara and J. Van Campenhout,"Accurate Ranging of Multiple Objects using Ultrasonic Sensors"in may-1992 ieee.