Anti obstruction Ultrasonic sensor sytem

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Abstract. We here propose a model for sensing with the help of ultra sonic waves. Our model consists of cheap components and ore model can be easily built on a PCB without many efforts and less skills. Our model can be used in numbers of application.Our model provides audio out put with the help of APR9600 IC and LCD display as well. In our model transmitter, detector and disply units are controlled by microcontroller. Our controller will make transmitter circuit to emit ultrasonic waves and at same time timer will be on. and after striking back from obstruction waves are sensed by receiver and timer is stop.we know speed of light and times show the time so with help of this two we could find distance which is displayed on LCD and we get an audio output also.

Keywords: Ultra sonic transducer, microcontroller, transmitter and receiver circuit, audio output APR 9600, many applications

1. Introduction

Ultra sonic sensing technique is being used from a long time. But its circuitry is complex and its also expensive. There are lot of other sensing technique using IR and etc are used but they doses on provide the hi high rate off accuracy as we get from ultrasonic technique. Our model is based on embedded system and can be easily implemented. We can use same model in number of application for distance measurement,level indicator car obstruction detection etc.The audio out put feature of our system makes it a handy tool to be used in many application because the user can do some other work in parallel to sensing because he will get alerted the bye our oudio aut put time to time. and if he want see LCD is there for him to get display. Short range ultrasonic obstruction detection and distance measurement device. By employing an ultrasonic transducer pair for producing ultrasonic sounds and sensing the reflected sound waves, the obstructions are detected. The hardware interface uses an Atmel microcontroller to facilitate the generation of 40 KHz signal burst which is used in the transmitter circuit, and also to process the received signal for measuring the time of flight of reflected waves and exact distance of the obstruction. The program for this device is developed in WinAVR, and the code generated is dumped into microcontroller using AVR Studio. Educational aspects of this project include the mastery of a programming language and corresponding tools, the design of a functional and intuitive embedded application, and the development of appropriate hardware to build the device.here are several ways to measure distance without contact. Some products have infrared light emitters and receivers to determine an object's distance. Other devices have laser-based systems which have improved accuracy and precision. Presently, the detection techniques of laser, radar, infrared ray and ultrasonics have been widely applied at the aspect of obstruction detection and distance measurement. Because of the expensive price, the distance measurement system of laser and radar is only set on the minority of instruments. So the research of the distance measurement system backing up with high 50 ratio of capability to low price has ended at Ultrasonic Range Finder. Ultrasonic sounds are used in many ways,

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for various applications such as water level measurement, flaw detection in metals and other material malfunctions. In the current application, ultrasonic signals are used for obstruction detection by producing a burst, and detecting its reflections after they hit the obstruction. Basically this is the technique used by bats to travel in the night

2. Preliminaries

2.1. Use of Ultrasonic rays

Ultrasonic rays are used because of following reasons

1. They are functional at night time but not another ray like infra red rays.

2 Ultrasonic rays do not cause harm to human body as infra red rays do.

3 They are not affected by atmospheric conditions like temperature, pressure and humidity.

4 They are operated at the frequency of 40 to 50 kHz, which is the frequency of RF signals.

5 Ultrasonic rays travel at the speed of 330 m/s i.e. speed of light.

2.2. Ultrasonic sensor.

Ultrasonic sensors (also known as transducers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring: wind speed and **(anemometer),** fullness of a tank, and speed through air or water. For measuring speed ordirection a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms, and non-destructive testing. 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 the sound waves into electrical energy which can be measured and displayed.

3. Related Work

The combined ultrasonic transit time and optical pulse method described here is an improvement over the standard ultrasonic echo by providing a lower signal loss and more precise location of sensor reference points, specifically the transmitting and receiving transducers. The ultrasonic transit time sensor described here uses only a one-way ultrasonic pulse. The transit time, typically 0.5 to 50 ms, is proportional to the distance between the ultrasonic transmitter and receiver transducers. There are three advantages: (1) the ultrasonic signal loss is much less, (2) the location of the transducers is well defined, and (3) the phase and pulse shapes are controlled and reproducible. An optical pulse is used to synchronize the transmitter and receiver. In this version the optical pulse is sent from the ultrasonic receiver unit, initiated by its microcontroller, to the ultrasonic transmitter unit
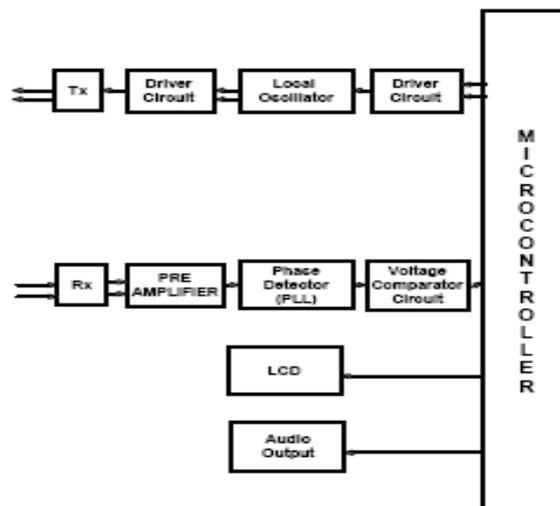
4. Model

Algorithm

1. Start; **2**. TX transducer emits ultrasonic Waves; **3**. Rx transducer receives ultrasonic Waves; **4**. Phase is controlled by the PLL; **5**. Check if desired frequency is obtained; **6**. Check if desired voltage is obtained; **7**. Calculate the distance; **8**. Show output on LCD; **9**. Give audio output; **10**. Stop.

Flowchart
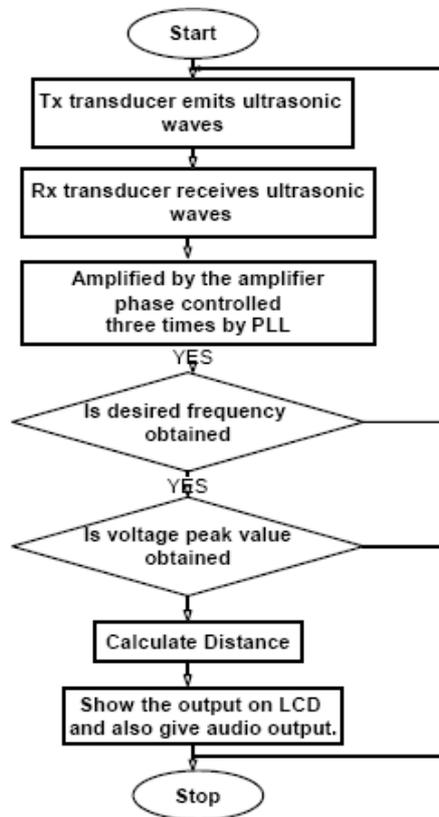
The whole controlling is been done by microcontroller. 0 to 5 volt pulse are been given to oscillator driver IC BC547 which is NPN transistor with common collector emitter follower an buffer is implemented with the help of this IC to provide required about of switching current to the oscillator which is 555timer. The base basing of the BC547 is also done and a pull up resister is also applied between the output of microcontroller and BC547.then the 555 timer resisters and capacitor values is set according to our required frequency. the we get oscillation of required frequency to BD139 which is used to drive the transmitter transducer.at the same time as the transmitter transmit the ultrasonic waves the timer is on then as the waves strikes and of the object it returns back to receiver transducer and the time is stop so we know the speed of light through which ultrasonic waves travels and also the time with the help of timer so if the received waves after senses from transducer amplified with LM741 IC and then compared three times at PLL and then passed through the comparator. then when e get the required amount of peak voltages the with the help of that distance I calculated which is been displayed in LCD and we get also an audio output with the help of APR9600.

microcontroller and BC547.then the 555 timer resisters and capacitor values is set according to our required frequency. the we get oscillation of required frequency to BD139 which is used to drive the transmitter transducer.at the same time as the transmitter transmit the ultrasonic waves the timer is on then as the waves strikes and of the object it returns back to receiver transducer and the time is stop so we know the speed of light through which ultrasonic waves travels. And also the time with the help of timer so if the received waves after senses from transducer amplified with LM741 IC and then compared three times at PLL and then passed through the comparator. Then when e get the required amount of peak voltages the with the help of that distance I calculated which is been displayed in LCD and we get also an audio output with the help of APR9600.

Different blocks are explained as follows:

- DRIVER IC (FOR OSCILLATOR)

NPN General Purpose Amplifier BC547, BC547A, BC547B, BC547C This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 10. See PN100A for characteristics. It has Low current (max. 100 mA) and Low voltage (max. 65 V).

- OSCILLATOR

The LM555 is a highly stable device for generating accurate time delays or oscillation. Additional terminals are provided for triggering or resetting if desired. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor. For astable operation as an oscillator, the free running frequency and duty cycle are accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output circuit can source or sink up to 200mA or drive TTL circuits. It operates in both astable and monostable modes, Adjustable duty cycle, Output can source or sink 200 mA,Output and supply TTL compatible, Temperature stability better than 0.005% per °C, Normally on and normally off output, Available in 8-pin MSOP package. It is used in Precision timing, Pulse generation, Sequential timing, Time delay generation Pulse width modulation, Pulse position modulation, Linear ramp generator

- DRIVER CIRCUIT FOR TRANSDUCER

The BD135 and BD139 are silicon Epitaxial Planar NPN transistors mounted in Jedec SOT- 32 plastic package, designed for audio amplifiers and drivers utilizing complementary or quasicomplementary circuits. The complementary PNP types are BD136 and BD140 respectively.

- RECIVER CIRCUIT AMPLIFIER

The LM741 series are general purpose operational amplifiers which feature improved performance over industry standards like the LM709. They are direct, plug-in replacements for the 709C, LM201, MC1439 and 748 in most applications. The amplifiers offer many features which make their application nearly foolproof: overload protection on the input and output, no latch-up when the common mode range is exceeded, as well as freedom from oscillations. The LM741C is identical to the LM741/LM741A except that the LM741C has their performance guaranted over a 0°C to +70°C temperature range, instead of −55°C to +125°C.

- 5. PHASE LOCK LOOP DETECTOR

The LM567 and LM567C are general purpose tone decoders designed to provide a saturated transistor switch to ground when an input signal is present within the passband. The circuit consists of an I and Q detector driven by a voltage controlled oscillator which determines the center frequency of the decoder. External components are used to independently set center frequency, bandwidth and output delay. It has 20 to 1 frequency range with an external resistor, Logic compatible output with 100 mA current sinking, capability, Bandwidth adjustable from 0 to 14%,High rejection of out of band signals and noise, Immunity to false signals, Highly stable center frequency which is adjustable from 0.01 Hz to 500 kHz. It is used in Touch tone decoding, Precision oscillator, Frequency monitoring and control, Wide band FSK demodulation, Ultrasonic controls, Carrier current remote controls Communications paging decoders

- COMPARATOR

The LM193 series consists of two independent precision voltage comparators with an offset voltage specification as low as 2.0 mV max. For two comparators which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible, and

the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common mode voltage range includes ground, even though operated from a single power supply voltage.The LM193 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, the LM193 series will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators. It has Wide single supply voltage range 2.0 VDC to 32 VDC,Very low supply current drain (0.8 mA) independent of supply,voltage (2.0 mW/comparator at 5.0 VDC),Low input biasing current 25 nA,Low input offset current J5 nA and offset voltage J2 mV,Input common-mode voltage range includes ground, Differential input voltage range equal to the power supply voltage, Low output 250 mV at 4 mA saturation voltage, Output voltage compatible with TTL, DTL, ECL, MOS and CMOS logic systems. It is used in A/D converters, Wide range VCO,MOS clock generator, High voltage logic gate, Multivibrators

- MICROCONTROLLER

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

- AUDIO OUTPUT

The APR9600 device offers true single-chip voice recording, on-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, microphone amplifier, and AGC circuits greatly simplify system design. the device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications. APLUS integrated achieves these high levels of storage capability by using its proprietary analog/multilevel storage technology implemented in an advanced Flash non-volatile memory process, where each memory cell can store 256 voltage levels. This technology enables the APR9600 device to reproduce voice signals in their natural form. It eliminates the need for encoding and compression, which often introduce distortion.

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