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Sonar Based Architectural Instrumentation and Security System- A Review Paper

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ABSTRACT-
In this project, we introduce a new Architectural Instrumentation device, which is controlled and operated by the microcontroller. This device is SONAR based Instrumentation device that can be used to calculate the dimensions of any rectangular shaped enclosure, typically used by architects to compute the dimensions of a room and provides advanced security through laser shooting and GSM Calling.
Proposed Concept-We propose to create a device containing an Ultrasonic SONAR module that computes distance of the entity straight ahead of it. We plan to fix this ultrasonic module on a 360 deg panning capable fixture. This allows the device to rotate 360 degrees around the room or enclosure. While doing so, we fire the ultrasonic wave multiple times at consistent periodic intervals, thus collecting multiple readings of the walls of the room.
In this project we demonstrate the idea of advance security also, according to the distance it measures, it takes appropriate decision (according to valid region or valid person) on basis of distance checking and sense the obstacle that it shoots out with the help of laser shooter and weep the buzzer. In this project we give the set value of critical region with the help of switch.

Keywords- SONAR, Architectural Instrumentation, Security System using SONAR, Region Checker

I.INTRODUCTION

In this project we demonstrate the idea of advance security and dimension measurement system. In this project we make a circuit that is controlled by embedded technology where we interface the radar with the help of ultrasonic sensor that sense the distance and display it on the LCD. Afterwards, according to distance it measures, it also works as a security system where, a valid or safe region is defined and if any substance is identified in this region the safety measures are started.

This system (radar) rotates with help of a motor. Those rotate in clockwise direction andante-clockwise direction. And sense and obstacle that shoot out with the help of lesser shooter. And weep the buzzer. in this project we give the set value of critical region with the help of switch.

MODE OF PROJECT:

There are three modes of this project:

Circuit rotation: In this mode we operate the motor to rotate the device with the help microcontroller.
To design radar concept: In this mode we use the ultra sonic sensor that sense the obstacle and measure the distance and display in LCD.

Region checker mode: In this mode we use the switch for setting the critical distance and it can be change.
The project Ultrasonic Distance Meter is a new concept and has many industrial applications. In this project we are using ultrasonic waves to determine the distance in between two points. The project is based on the principal of the speed of ultrasonic waves in open air. Here we are using a microcontroller AT89S51 for transmitting and receiving ultrasonic waves through 40 KHz ultrasonic transmitters and receivers. The microcontroller measures the time between the transmitted and received ultrasonic waves in free0 air using which we can find out the distance between two points, which is then displayed on a LCD display. This process of transmission & reception of ultrasonic waves in free air is very complex in nature therefore, we are using very sophisticated methods and applications to process these waves. We have placed a combination of amplifier and filters for this purpose. Temperature also has a major impact on the measurement as the pace of ultrasonic waves is depends on the temperature. So before using ultrasonic waves in any application we need to readjust and fine tune the speed of ultrasonic waves with the residing atmospheric temperature. Thus to calibrate the speed of the Ultrasonic wave we have implemented a special method to calibrate the speed of ultrasonic waves through a known distance of 100 Cm.
There are a large number of applications of ultrasonic waves in instrumentation and control. Ultrasonic Waves are used for the measurement of distance, speed, flow etc. Ultrasonic also find many application in medical instrumentation.

II. OVERVIEW OF THE TECHNOLOGY USED

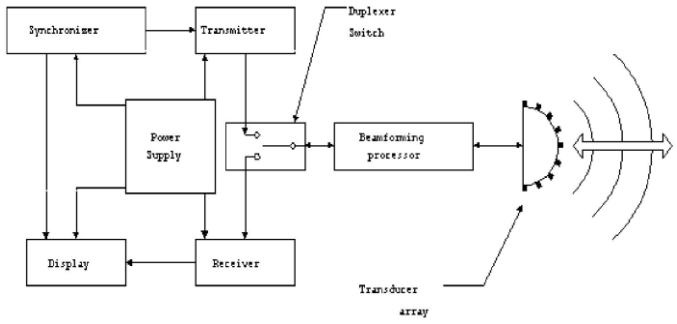
BASIC SONAR

SONAR is the short form or acronym for Sound Navigation and Ranging. Sonar technology is similar to other technologies such as: RADAR = Radio Detection and Ranging or LIDAR Light Detection and Ranging. In that light was used to sense the other object, also in radar we use radio waves but in sonar instead of light or radio waves we use ultrasound or ultrasonic waves. The word Sonar is an American term first used in World War II; it is an acronym for Sound, Navigation and Ranging. The British also call Sonar, ASDICS, which stands for Anti-Submarine Detection Investigation Committee. Later developments of Sonar included the echo sounder, or depth detector, rapid-scanning Sonar, side-scan Sonar and WPESS (withinplus electronic-sector-scanning).
A Sonar system makes use of transmitted and reflected underwater objects to determine the distances of underwater objects and features. It is mainly used for depth measurement, submarine and mine detection, diving safety measurements, commercial fishing and communication at sea. The Sonar device will emit a subsurface sound wave and then monitors the returning echoes, then this data is transmitted to the human operators by a loudspeaker or by being displayed on a monitor.

The very first SONAR type listening device was invented by Lewis Nixon in 1906 for detecting icebergs. By 1918, both the countries Britain and the U.S. had built active systems, wherein ultrasonic wave are transmitted with the help of a transmitter then this wave strikes the desired object and is reflected back from that object towards the receiver and then observer gives decision according to the received data. Whereas, the first sonar type device for detecting submarines called an "echo location to detect submarines" using the piezoelectric properties of the quartz was developed by Paul Langévin in 1915.

III. FRAMEWORK OF THE SYSTEM

Basic block diagram



The basic concept of SONAR is when a sound gets emitted, and then you 'see' your surroundings based on the sound coming echoing back. This is because sound takes time to travel distances. Farther the distance, the longer it takes for the sound to come back.

3.1.1 Ultrasonic transmitter

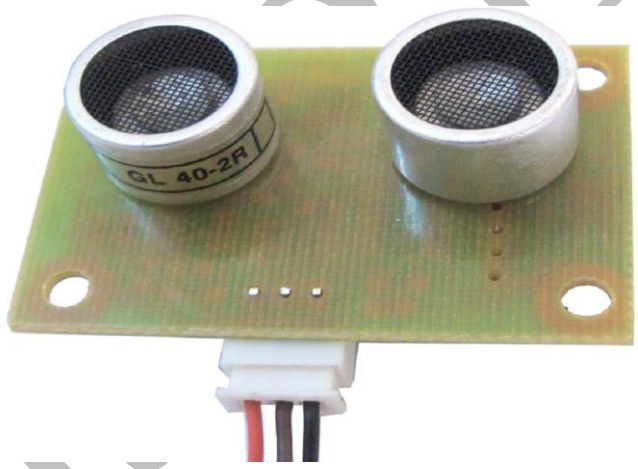
Ultrasonic transmitter is a transmitter which produces emissions in the ultrasonic range, at a frequency too high for the human ear to detect. Ultrasonic transmitters should not be confused with ultrasonic transceivers, which are capable of transmitting and receiving information in the same unit. In order to receive information, a separate ultrasonic receiver is needed with an ultrasonic transmitter.

3.1.2 NAVIGATION

The ability to navigate is the most essential and important capability of a mobile robot. The ability to stay operational by avoiding obstacles and dangerous situations such as collisions and staying within safe operating condition also comes as very essential and important, but navigation takes a higher priority because it is a must to perform tasks related to specific places in the robot's environment.

3.1.3 TRANSMITTER

The transmitter initiates the outgoing pulse which decides pulse width, PRF, modulation (optional), and carrier frequency. The output power is controlled by the operator. .



3.1.4 RECEIVER

Receiver collects the received energy. The receiver compares the power level to noise with a threshold SNR (DT) in order to determine if the signal will be displayed in a particular beam. If the DT is set too low, there will many false alarms. If it is too high, some detection capability will be lost. The receiver may also demodulate the return if frequency modulation is used on transmission. Sonar systems often use pulse compression techniques to improve range resolution.

3.1.5 DUPLEXER

The duplexer protects the receiver from receiving the full wave back i.e. full transmitter power while the pulse is transmitted It functions like that of a switch which toggles between the transmitter and receiver.

3.1.6 SYNCHRONIZER

In this device, Synchronizer is quite similar to that in radar. It ascertains proper coordination and timing of the system and resets the display for every new pulse so that range measurements proper and accurate.

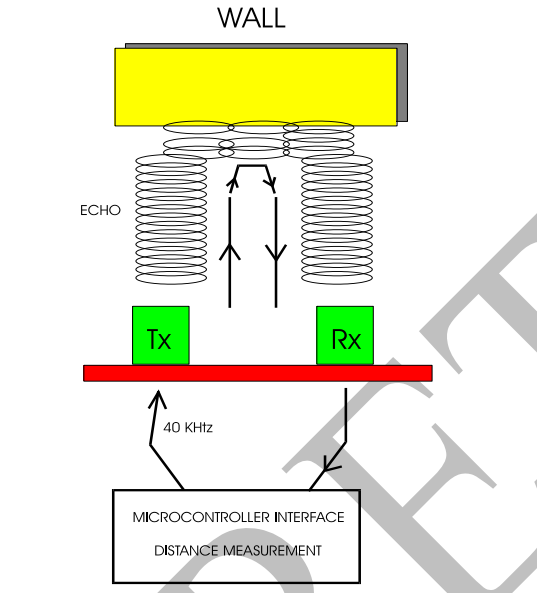
3.1.7 DISPLAY

Display puts all of the detection information into a visual format.

3.1.8 DC MOTOR

This section begins with an overview of the basic operation of DC motors. Then we describe how to interface a DC motor to the 8051. Finally we use assembly and C language programs to demonstrate the concept of pulse width modulation (PWM) and show how to control the aped and direction of a DC motor.

A direct current motor is another widely used device that translates electrical pulses into mechanical movement. In the DC motor we have only + and – leads. Connecting them to a DC voltage source for moving the motor



ULTRA- SONIC DISTANCE MEASUREMENT

IV. APPLICATIONS AND FUTURE SCOPE

A. Architects and civil engineers can use it for structural Instrumentation (measuring Dimensions) of already existing structures.
B. For Structural Dimensions Instrumentation of Historical Buildings and structures, engineering plans of which do not exist.
C. For Structural Instrumentation of Natural structures like caves, ridges, and other naturally occurring structures.
D. Government officials can use it for verification of structural construction against sanctioned structural plans and drawings.

V. CONCLUSION

We propose to create a device containing an Ultrasonic SONAR module that computes distance of the entity straight ahead of it. We plan to fix this ultrasonic module on a 360 deg panning capable fixture. This allows the device to rotate 360 degrees around the room or enclosure.

While doing so, we fire the ultrasonic wave multiple times at consistent periodic intervals, thus collecting multiple readings of the walls of the room.

By developing this SONAR Based Architectural System with its multi-tasking feature, we have overcome the drawback of Old methods in which there is a lot of discrepancy and gives minimized accuracy despite of large man power needed. Considering all the situations, this SONAR based system with different sub modules can also be used for redemption, security purpose and various other objectives with manipulation in the circuitry as discussed in the earlier section.

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