A Review on Ultrasonic Radar Sensor for Security system

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Abstract—**The basic consequences of this project is 100% efficient security system based on ultrasonic sensor technology as the customer require simple, reliable and high performance core system. The ultrasonic sensor module includes a transmitter and a receiver mounted on a rotating motor. A motor is used to allow the sensor to cover 360 degree. The ultrasonic sound energy is transmitted from transmitting device into an area of interest and this further reacts to a change in the reflected energy pattern. Basically it works on the principle of echo. The microcontroller accepts this signal and continuously monitors the receiver output of the ultrasonic transmitter. Once the distance is calculated the microcontroller checks whether the object is within the range specified within microcontroller for initiating the alert. If the object is within the minimum range the microcontroller initiates a sound alarm and also the GSM modem to send a SMS to the concerned person and camera will capture the image of object to the storage element.**

Keyword: **GSM module, Ultrasonic sensor, Microcontroller unit, Rotating motor.**

I. Introduction

Ultrasonic is a distance level measurement technique and when it detect a distance such as any obstacles creates any disturbance is its path than it does not refraction it create reflection on that instants time and it turn on the controller kit.

Ultrasonic echo frequency transmitted and received at very less time as sound velocity works on 344.8m/s so it takes to less efficient time to move or detect. Ultrasonic wave can be transferred through any medium such like air, liquid and gas and when it collides with any solid body then it starts reflecting at such instant time so it can be

used in distance measurement, as sonar principle also works on to find the depth level of sea measurement, ultrasonic sound can also be used in find the flow of velocity , sound /air used.

In this project ATMEGA16 8 bit AVR microcontroller are used to control all the attach periphery devices across such external electronics equipment as they are GSM kit, relay, camera and buzzer. All these periphery devices are combined to make a surrounding environment secure for unknown objects. Security is a essential part for home, office and other secure region and GSM sends the detail of alertness and with camera we can find the detail of any object either it is human or material.

II. Literature Survey

The basic need of this project is home security, and for security some project also implemented previous different method as they such are PIC motion sensor based security system, arduino based security system. In our project a new advancement simple technique is used, in this project a digital photo camera is interfacing through microcontroller and for operating camera shutter basically two relays are used. In which one relay is used for when object is within 20-30 cm range then it capture the image and that other instant other relay will stops the dc motor and whole moving equipment will stop.

In 1790, Lazzaro Spallanzo was first whose discovered the BAT movement with the help of hearing for movement not seeing forward. Jean-Dawel Col- ultrasonic security system discovered sonography 1826 using an underwater bell, and determine the speed of sound in liquid.

Therefore further study and research work proceed slowly on time to time. In 1881, when Pierce Curie's design the modern ultrasound transducer and he concluded that the relationship between electrical voltage and pressure on any crystalline material, and on that time TITANIC tragedy influences to take more interest to work in this field and as a consequences Paul Langevin search the hydrophone to detect the iceberg and that device was the first ultrasonic transducer.

III. Methodology

The primary objective of this project is to determine an objects position on a coordinate axis using ultrasonic sensors. In fig.1 an ultrasonic sensor is used to send out a high frequency sound waves and record the time it takes for the reflected sound to return. The sensor then uses the time to calculate the distance the object is from the sensor.

Speed of sound = distance traveled / time

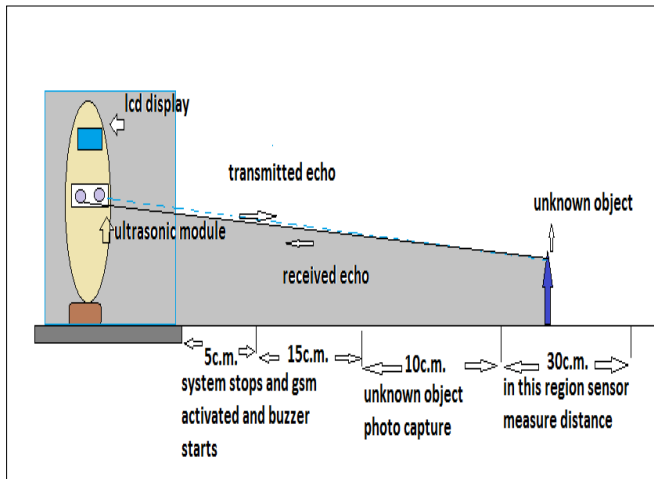**Fig. 1 – object detection by ultrasonic module**
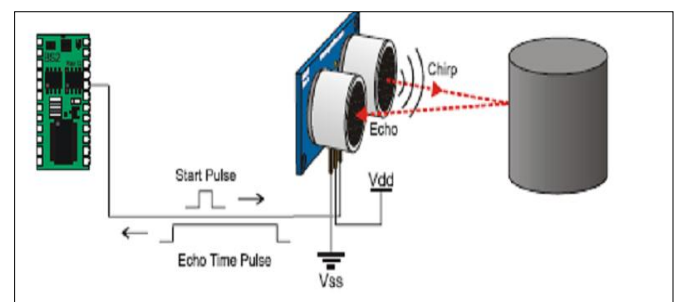
Fig. 2 –module distance measurement level

Fig. 3 – hardware design of project

There are many practical reasons why you would use sensors to locate an object. Most GPS (global positioning systems) use sensors to track objects on the ground. The object may be car, a package, a ship at sea, etc. The Ping ultrasonic sensor uses sound wave to find the distance of an object. When the sound wave hits an object, it reflects off the object. The object may be directly in front of the object or at an angle for the signal to be received. long it takes for a wave to travel to an object and reflect back to the starting position, then the distance the wave traveled is

Distance traveled = time elapsed*speed of sound

$$D = \Delta t * v$$

IV. Equipment List

The primary pieces of equipment are listed below:

1) ULTRASONIC MODULE
2) Board of Education circuit boards
3) 8 BIT AVR MICROCONTROLLER
4) Wood Stand
5) CROUZET MOTOR
6) GSM (SIM 900)Module
7) KODAK CX7300 3.2 MP DIGITAL CAMERA
8) TWO RELAY
9) VOLTAGE REGULATOR

The base stands were constructed out of wood located in the ULTRASONIC MODULE (HC-SR04) The BASIC stamp microcontroller is used to emit a short ultrasonic burst (40kHz for 2μs). **The speed of sound is 344.8m/s.**
Using equation 1,

D= (344.8m/s)*Δt

Converting micro-seconds into seconds and meters into centimeters, the distance equation become

D (cm) = .03448*Δt

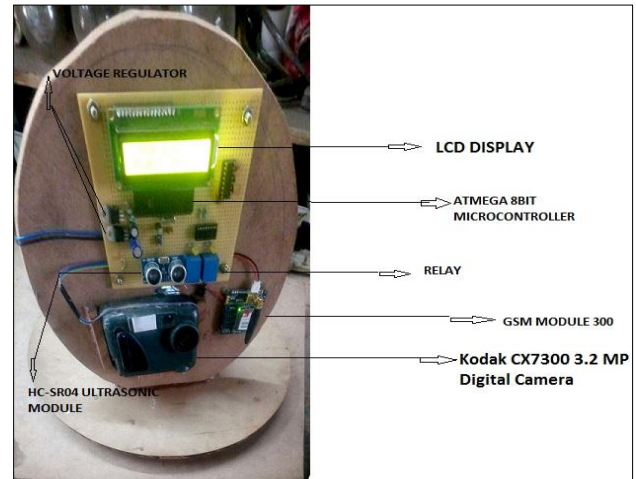The ultrasonic sensor cannot detect object more than three meters away.

Ultrasonic HC-SR04 pin description

The ultrasonic sensor is placed on a dc motor that rotates in a 360 span. When the object is detected the dc motor stops moving, and the ultrasonic sensor measure the distance from the object.

The supporting circuits fabricated on the module makes it almost stand alone and what the programmer need to do is to send a trigger signal to it for initiating transmission and receive the echo signal from it for distance calculation. The HC-SR04 has four pins namely V_{CC}, Trigger, Echo GND and they are explained in detail below.

VCC: 5V DC supply voltage is connected to this pin.

Trigger: The trigger signal for starting the transmission is given to this pin. The trigger signal must be a pulse with 10uS high time. When the module receives a valid trigger signal it issues 8 pulses of 40 KHz Ultrasonic sound from the transmitter. The echo of this sound is picked by the receiver.

Echo: At this pin, the module outputs a waveform with high time proportional to the distance.

GND: Ground is connected to this pin.

Fig. 4 – Ultrasonic echo clock pulse
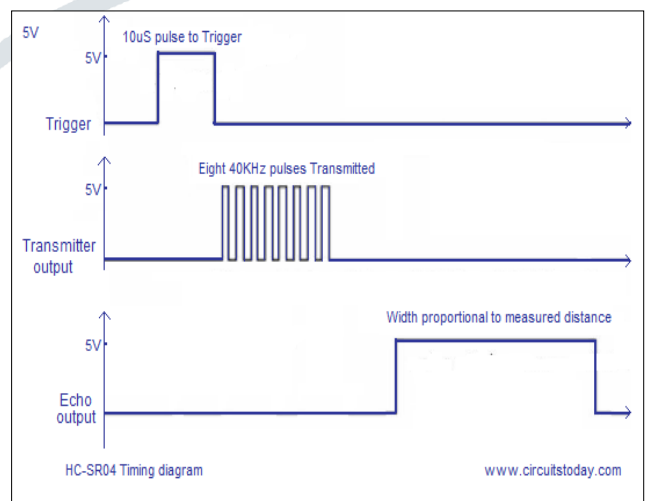
Speed of detection:-

It takes maximum three second for the system newly present detect the object and then turn to the alarm. This is because of

crouzet motor covers 360º range. However user can configure the unknown object within a second without any disturbance.

Observation accuracy:-

Throughout test**,** we believe our system is capable of detecting intruder 95% of the time, provided that ultrasonic radar is placed at appropriate position.

Message notifications:-

Upon message notification, we successfully receive email that contain the exact time when the security was triggered. This is a standard message delivery, therefore it could take a minute or two to reach your inbox panel, when the object is continuous in this way of detecting then it continuously send the notification. So far we have not find any error in this methodology. According to fig. 4 shows that when it detect any object then it send a notification through on mobile
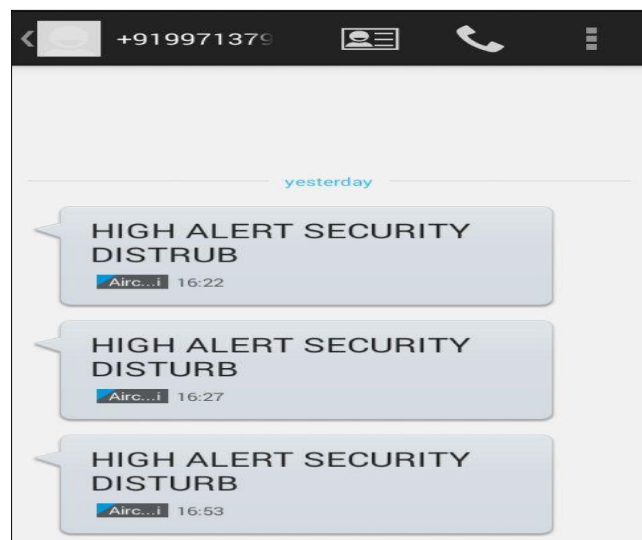

Fig. 5 - SMS deliver to the mobile

Role of camera:-

When the unknown object is in the position of ultrasonic module and the object is coming through equipment than warning system to be alerted and on first it will warns the person that don't move forward through it more and if the object avoid his command than our equipment will capture the photo.

In this a KODAK camera 3.2 mp is used and it interfaces through AVR ATMEGA 16 bit microcontroller. ATMEGA microcontroller pin interface with Kodak CX7300 3.2 MP digital camera through pin D7 with the operating feature by a relay. Relay handles the functioning of the shutter of the camera and then camera takes the picture of that unknown obstacle.

In this project we take relay as a 4N33 optoisolator. The optoisolator is a semiconductor device that uses a short

Optical transmission path to transfer an electric signal between circuits and elements of a circuit, while keeping them electrically isolated. In the camera contains a default memory storage device with display unit. Camera can store 5 pictures. The stored capacity can be increase according the need of the project by attaching some removable storage SDHC chip on camera thus we can add a large number of pictures.

V. Application

It can be used in many applications such like they are following as below:

On border defense line: It can be easily implemented in border line and when any interrupt created through across this range than it alert to soldiers and protection from attackers.

Target detecting and tracking: It can be used in targeting any obstacles or unknown material without creating any disturbance.

Vehicle parking system: For the reducing the traffic on the road, this sensor can be useful on vehicle parking system.

Find the depth or level of any medium: By the use of ultrasonic wave we can find the level of any medium it works on where sonar principle.

Conclusion

We have reported on the outcomes of a research and demonstration project on ultrasonic radar sensor for security system for human or object interference in a small space. By Using a GSM and camera it quality can be making better for any security purpose. The result in this project is genuine and is a product of sincerity and hard work. The system has been successfully implemented and the aim is achieved without any deviation. There is a lot of future scope for this project because of its security capacity. It can be used in many applications. The product can also be developed or modified according to the rising needs and demand.

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