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Design of Hybrid RFID & Ultrasound Based 2D Indoor Positioning System

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ABSTRACT

This project presents the indoor positioning system based on Radio frequency identification (RFID) and make the system uses the electromagnetic fields to automatically identify the objects on purpose of guaranteeing the rapid response and accurate positioning to achieve a low cost and low energy consumption. The ultrasonic positioning module by receiving ultrasonic signal measures the target signals. It presents the influence of different ultrasonic sensor and the ultrasonic positioning module and the test result for the ultrasonic range finder probe.

Keywords: *RFID, Electromagnetic fields, Ultrasonic probe.*

I. INTRODUCTION

Recently we use localization of objects and tracking of moving objects are essential to many location such as WIFI,wireless sensor networks (WSNs), ultrasonic, Infrared and video camera, have been proposed or used as the mechanism for tracking. We have chosen positioning system using RFID as the base due to its simplicity, of cost effectiveness as well as forimproved performance .The RFID TAG design has led to immensely low power consumption and thereby lowering the cost of the system and RFID Tags are used as independent electromagnetic sensors or energy harvesting and data transmission interface of sensor models for different measurement. The radio frequency signals, sound waves, optical signals or magnetic field have been used to determine location.

II. COMPONENTS AND WORKING

Components:

RFID modules
Ultrasonic range finder probe
Arduino Nano board
Ultrasonic Transducer

Working of materials

We have used RFID module is RC522 which falls under High frequency passive RFID system. RC522 has a capability of reading the data from a tag as well as writing the desired info into the tag.Shown in [Fig 1]

The RC522 is a 13.56MHZ RFID modules that is based on the MFRC522 controller from NXP semiconductors.

Fig.1 RFID Module RC522

Ultrasonic range finder probe:

The ultrasonic sensor we used in the project is called LV-Max Sonar-EZ1 High performance Sonar Range Finder MB1010.shown in [Fig 2].

The ultrasonic sensor provides a long range detection is a very short time. The sensor detects objects from 0 m to 6.45 m .The interface output formats include pulse width output, analog voltage output, and serial digital output.F

Ultrasonic range finder measure distance by emitting a pulse of ultrasonic sound that travels through the air until it hits an object**.**

Fig 2 LV – Max Sonar MB1010

Arduino Nano board :

It is microcontroller board developed by Arduino. The Arduino board are widely used in robotics, embedded systems, and electronic projects where automation is an essential part of the system.[Fig.3]represented.

Arduino nano is a small, compatible, flexible and breadboard friendly microcontroller board, developed by arduino. Cc in Italy, based on ATmega328p (Arduino nano V3,x) /Atmega168 (Arduino nano V3.x).

It comes with an operating voltage of 5V, however, the input voltage can very from 7 to 12 V.

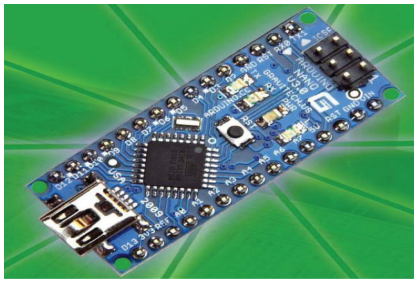

Fig. 3:Arduino Nano

2.5 ULTRASONIC TRANSDUCER :

From the Ultrasonic transducer is one type of sound- related sensor. These transducers send their electrical signals to the object and once the signal strikes the object then it reverts to the transducer.Shown In [Fig.4].

When an electrical signal is applied to this transducer, it vibrate around the specific frequency range and generates a sound wave.

The frequency range of ultrasonic waves is above 20 kHZ. These are mainly used in measuring distance applications.

Fig.4Ultrasonic Transducer

View of RFID Reader

Ultrasonic transducer UTT4016 and UTR4016 This ultrasonic transducer UTT/R4016 has 40 kHz center frequency which is commonly used in distance measuring aspects. The transducer diameter is 16 mm and it has high sensitivity in -65dB, high sound pressure level in 100dB, shock and water resistance and excellent vibration, and the capacity is 2000 pF.shown in Fig[5]. It can operate in big a range, therefore it has been wildly used as a remote control of electronic appliance, back/level meter sensor, or range detecting sensor. UTT4016 is ultrasonic transmitting probe and UTR4016 is ultrasonic receiving probe, Figure 4.2-5 shows a view of ultrasonic transducer, where the transmitting probe and receiving probe look the same, more details can be found in reference [23].

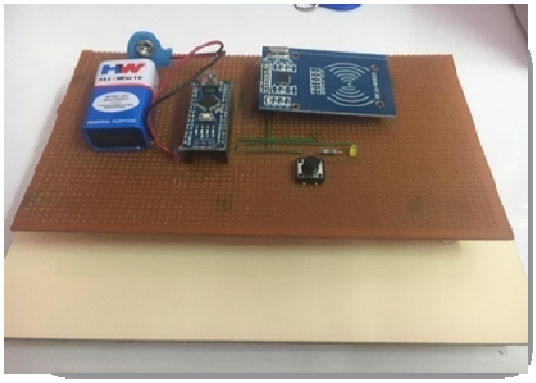

Fig.5 RFID reader

WORKING:

From the above figure we can see the 9v battery is separately connected to Arduino nano board. By using to sense the RFID TAG in RFID reader to push the button for input. The RFID tag transmits the input to the RFID reader with the help of Arduino Nano controller. The output given by the reader it indicates by LEDs.

III. RESULT AND DISCUSSION

In experiment, we found that the RFID has some drawbacks: the transmitting device cannot work for a long time. It may relate to some private issues because of the changeable data information. Once the tag reaches to the RFID reader, it will automatically send messages. Also it may cause some interference when the RF device meets the metal and water

environment. We also noticed that the central frequency for the ultrasonic transducers is 40 kHz regarding to the datasheet and this frequency is also consistent with indoor positioning requirements. In the perspective of sustainable development, the ultrasonic transducer probes can operate perfectly in the low energy consumption, and it sends the signal in pulse, where the signal is generated from Arduino Nano board, amplified by the non-inverting amplifier circuit and sent out through the TX probe..

Testing for ultrasonic range finder:

We connected the ultrasonic range finder with Arduino nano board the fixed range detection, We put small LEDs as the prompt the device. When the object comes from range we have to fix the program, the LEDs will lights up in the range.

Discussion:

The programming for microcontroller is also an important part because the whole system operation depends on the uploaded program, and C programming language is used for this microcontroller, and it is easy to understand the meaning of the program codes and the troubleshooting as well when errors occur. It not only occupies less memory in the microcontroller but also has a wide range of applications..

Program code:

// // Demo test codes Ver5.0.c // Demo test codes Ver 5.0 // // Created by ShiLei on 13-10-9. // // /* Demo test codes Ver 5.1 This codes is work for 2 Maxsonar sensors 1 for signal receiver, 1 for signal sender Using PW pin mode From the datasheet of the The LV-MaxSonar-EZ1, the output PWM with a scaling factor of (147us/inch). http://www.maxbotix.com/documents/MB1010_Datasheet.pdf */ //receiver //Digital pin 7 for reading in the pulse width from the Max

Sonar device.
//This variable is a constant because the pin will not change
throughout execution of this code.
intledPin = 3 ; //set led output pin D3
constintpwPin = 7; //variables needed to store values long pulse,
inches, cm;
void setup()
{
//This opens up a serial connection to shoot the results back to the PC
console Serial.begin(9600);
pinMode(pwPin, INPUT); //Used to read in the pulse that is being
sent by the MaxSonar device.
pinMode(ledPin, OUTPUT); //setup LED output }
void loop()
{
Serial.println(" Loading ... "); 52 //Pulse Width representation with
a scale factor of 147 uS per Inch.
pulse = pulseIn(pwPin, HIGH); //147uS per inch inches = pulse/147;
//change inches to centimetres cm = inches * 2.54;
Serial.print(inches);
Serial.print("in, ");
Serial.print(cm);
Serial.print("cm");
Serial.println();
delay(500);
if(cm<=50)
{
digitalWrite(ledPin,HIGH);
}
else { digitalWrite(ledPin,LOW);
}
delay(500);
}.

IV. CONCLUSION:

We have designed a hybrid RFID and ultrasound based 2D indoor positioning system. In accordance with the result of testing and analyses, we achieved better understanding of the roles of ultrasonic distance measuring modules in the system. Through testing and analyses on different ultrasonic sensors, we found that transducer sensors were more suitable for application in robot navigation and indoor detection for fixed objects. Moreover, the test results showed that the ultrasonic distance measuring modules had a high accuracy and stability in theindoor environment, and the Arduino Nano microcontroller was proved to be of excellent operability and reliability.

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