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SOBOT – AN OBSTACLE DETECTING AND RANGE FINDING ROBOT

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ABSTRACT

SOBOT a Sonic robot is capable of obstacle detection and range finding. The obstacle detection and ranging is done using the ultrasonic range finders. SOBOT detects the obstacles in its path and displays them on a graphical user interface simultaneously. The strategy used by it to detect the obstacles is described and the mapping of these obstacles on a graphical user interface is explained.

KEYWORD:Sobot,Sonar, Ultrasonic rangefinders, ZigBee

1. INTRODUCTION

Obstacle finding has been the area of interest in robotic world for many years now. This area particularly is being evolved rapidly in past few years. SONAR is one of the most effective ways of detecting and ranging the obstacles. SONAR stands for sound navigation and ranging. This technology uses sound waves, majorly ultrasonic waves, to navigate, communicate with or detect objects on or under the water.

ULTRASONIC RANGEFINDERS

Ultrasonic rangefinders[2] play a major role in SONAR.Sonic rangefinders[1] detect obstacles which are present in their pathway when they receive an echo of the sound they emitted. The time taken by the echo to return is used to determine the distance of that obstacle from the sensor.They are popular in robotic applications due to their simplicity and relatively low cost. There is a very wide range of sensors[2] that we can choose from for a particular application depending upon the requirement.Typically, the range of a rangefinder varies from 3m- 3km.

2. LITERATURE SURVEY

A thorough search of existing technologies involving ultrasonic rangefinders and communication devices has been done to get an idea of the needed technology in surveillance system

Ricardo Gutierrez-Osuna and Jason A. Janet[2], have explained the use of ultrasonic rangefinders in localizing a robot in a real time world in detailed manner, but their work was limited only to determining the position of an autonomous robot in a real time environment.Shraga Shoval and Johann Borenstein's[1] work have helped in decreasing the disadvantage of low efficiency in ultrasonic rangefinders. Their research is based on the crosstalk between two sonic sensors which help in detecting the obstacle more accurately and efficiently.Alberto Elfes's[5] work mostly embraces the understanding of robotic perception and thus increases the possibilities of new applications.Dirk Bank[6] demonstrated the use of ultrasonic rangefinders as arrays, which help in detecting the obstacles with an increased resolution due to the additional information we get by the coinciding sonic cones emitted by the range finders.

3. PROPOSED SYSTEM

Despite having many obstacle finding techniques, which can detect a robot and find it's distance from the sensor, SOBOT offers a unique function of displaying these obstacles on a graphical user interface while detecting the obstacle around it. This proposed system is best suited for an isolated surveillance system, because the obstacle information is sent to a nearby computer using a ZigBee[9] protocol. As soon as the sensor detects an obstacle, it sends the angle and distance of that particular

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obstacle to the microcontroller, that is interfaced to the robot. This information is then sent to a nearby computer using a Zigbee module[10].

3.1 ARCHITECTURE

This block diagram figure(3.1.a) will explain the role of different modules in "SOBOT"

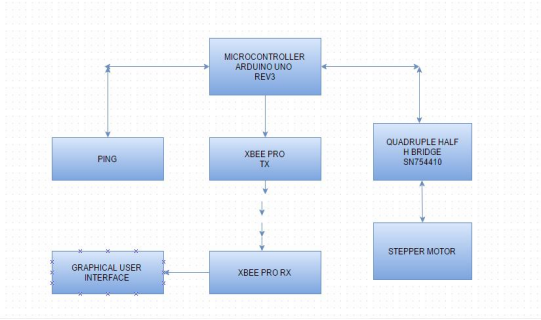


Figure :3.1.a

At the receiving end the other ZigBee module[8] will receive the information about the obstacle and displays that on a graphical user interface which is designed using the processing software. This display of the obstacles will help the user to understand the data sent by the sensor very easily.

3.2 WORKING PRINCIPLE OF SOBOT

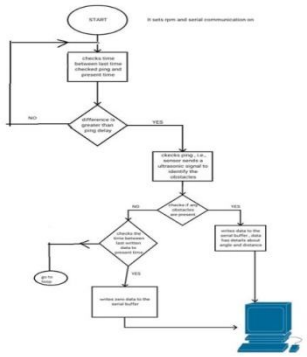
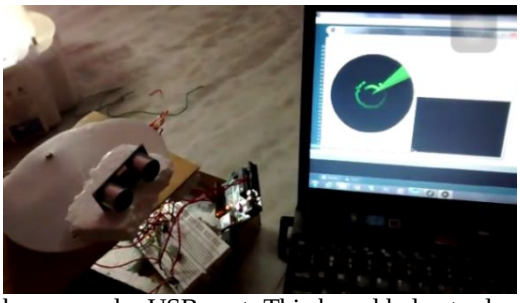


Figure 3.2:Working Principle

ARDUINO UNO (ATMEGA 328P): The ARDUINO UNO is a launch pad, which consists ATMEGA328P microcontroller, an ADC, power supply pins, a

3.3 HARDWARE IMPLEMENTATION



buzzer and a USB port. This board helps to dump the source code directly into the microcontroller using the ARDUINO IDE.

ULTRASONIC PING SENSOR: This is the rangefinder figure(3.3.a) which is used in this robot.Its range is 3m with a resolution of 1cm. The ping sensor[1][2][4] operates in the frequency range of 40khz with operating voltage of 5V.

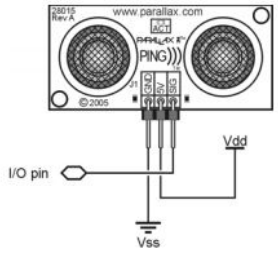


Figure 3.3.a: Ultra sonic sensor

The table below gives the time constraints of the pingsensor.

	Host Device	Input Trigger pulse	t_{out}	2 µ (min) ,5 µs typical
	PING))) SENSOR	Echo Hold off	$t_{HOLDOFF}$	750 µs
		Burst Frequency	t_{BURST}	200 µs @40kHz
		Echo Return Pulse Minimum	t_{IN-MIN}	115 µs
		Echo Return Pulse Maximum	t_{IN-MAX}	18.5 ms
		Delay Before Next Measurement		200 µs

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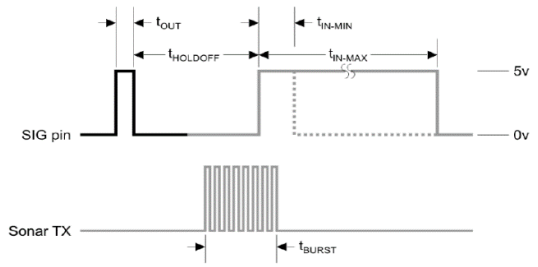

Fig:3.3.b :Graph representing the time constraints of ping sensor

MOTOR DRIVER (LM293D): LM293D is a dual H-bridge motor driver which controls the rotation of the stepper motor. This IC has 16 pins and can drive 2 motors at the same time.Its operating voltage is 5V. It has high current driving capability.

STEPPER MOTOR: The stepper motor is used to rotate the ultrasonic sensor in clockwise and anti-clockwise directions to complete one full rotation in one direction. This helps the sensor to detect objects which are present in any direction with respect to the robot. It's driving voltage is 9V.

ZigBeemodules: These modules use ZigBee[7] protocol for communication between to suchmodules. The maximum range of transmission is 100 meters. The transmitter which is placed at the robot sends the information to the receiver through this protocol.The receiver will make this data available to the processing software. This software will display the received information in such a way that will be easy to understand to the user. The architecture of the ZigBee is given Figure(3.3.d).

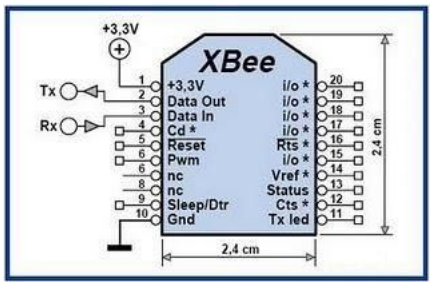

Figure 3.3.d: Architecture of the ZigBee

4. RESULTS

The figure(4.a) shows the COM PORT selection when the ZigBee and ARDUINO is connected to the computer

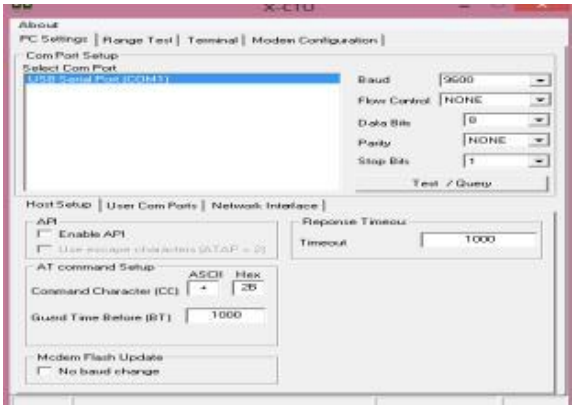

Figure 4.a:comport selection while configuring ZigBee

The figure shows the serial communication between the ZigBee modules[7] in figure(4.b).

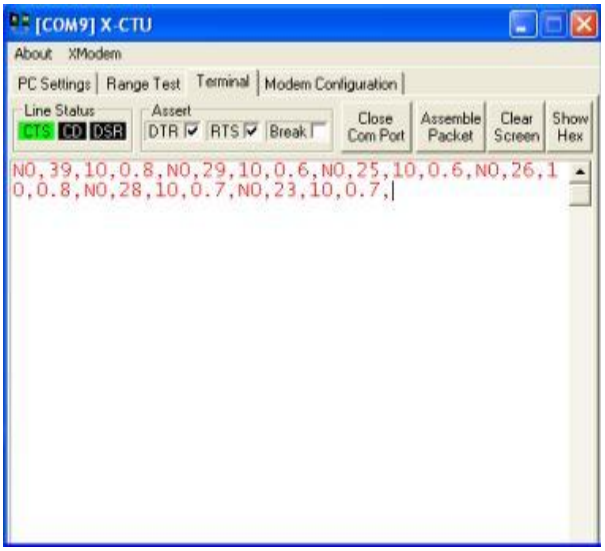

Figure 4.b:Serial Communication block of ZigBee

The figure(4.c) shows the graphical representation of the obstacles

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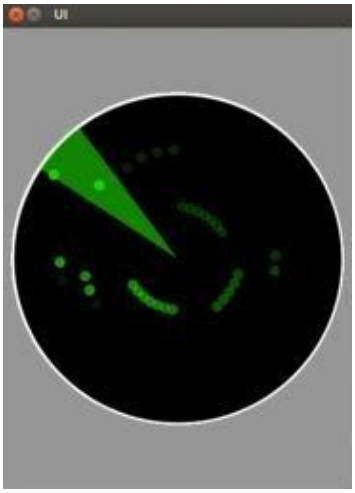

Fig 4.c :Output in the processing software

5. CONCLUSION

This robot helps in detecting and mapping obstacles around it on a graphical user interface using the processing software. The ultrasonic rangefinder used in this robot can be improved for the improvement of the range and resolution of the obstacles it finds.

The future work can be made in enabling this robot to send information to large distances using IOT.

6. ACKNOWLEDGEMENTS

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