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Smart SONAR System

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Abstract – *The paper describes a smart SONAR system which alerts the user when it spots objects within a specified range. The system detects the object by using an ultrasonic sensor which is connected to an Arduino UNO and is rotated 180 degrees throughout by using a servo motor. A wireless device which is used to send an alert email and message on the phone is a Bolt IoT WiFi module which gets input information in the form of values reported by Ultrasonic sensor. Current SONAR systems are pretty conventional and need continuous monitoring. The data collection and analysis requires constant supervision. The purpose of the project is to exchange real-time information to the user so that he/she can remotely monitor, configure, store and analyze data efficiently and conveniently.*

Key words: Ultrasonic sensor, Ardunio, Bolt Iot Wifi module, Servo motor.

1. INTRODUCTION

Sound Navigation and Ranging or SONAR for short is an old system developed for navigation purposes which date way back to the 1490s, times of great multitalented personality Leonardo da Vinci, who is believed to be the first person to make use of the technology. Passive SONAR systems developed in 1918, were successfully used during World War I by armies of various nations to counter the increasing threat of their enemy's submarine warfare [1]. This is one of the most significant uses of SONAR. After that SONAR System was developed more and more and to this time it is still developing. SONAR's soul principle is based on the sound, which is nothing but vibrations of the air column. The Smart Sonar System uses an Ultrasonic sensor for this purpose. An Ultrasonic sound is a higher frequency sound than the upper audible limit (≥ 20, 000 Hz) of human hearing. Other sensors such as microwave sensors, photoelectric sensors, Passive Infrared (PIR) Sensor, noise detectors, etc. can also be used for this purpose. This particular project is a take on integrating Automation which is modern technology and an old school technique such as sonar. The applications of SONAR are endless such as defence, underwater navigation, medical imaging, and metallurgy. But this project primarily focuses on detecting objects or enemies and alerting the user through a messaging app or an email when an object is within range.

2. BLOCK DIAGRAM

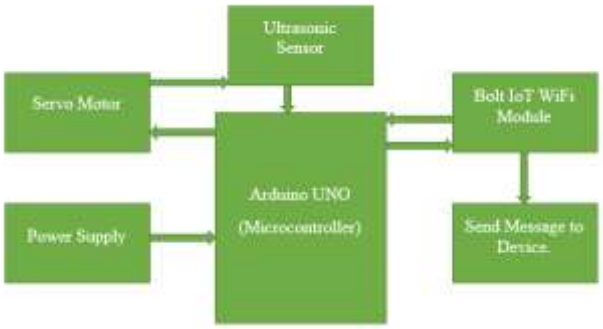

Fig -1: Block Diagram

The Fig – 1 shows the block diagram of the overall system. Arduino is connected with servo motor, which is used to rotate the ultrasonic sensor 180 degrees so that it spots an object within a specific range. 9V battery is connected to Arduino for power supply. Ultrasonic sensor sends the information of spots object to Arduino and Arduino send this message to Bolt IoT WiFi Module. By using this module alert message is send to the user device. The device can be a telegram, WhatsApp, Facebook and email.

3. BOLT IOT WIFI MODULE SARTUP

We can easily set-up the Bolt IoT WiFi module using the Bolt IoT WiFi application software which detects nearby device by using the WiFi technology which works on 2.4GHz frequency.

Fig -2: Bolt IoT WiFi Setup

3.1 SEND MESSAGE/ EMAIL TO USER DEVICES

WiFi module sends the alert message to the user device. The device can be a phone or Personal computer or smart-watch. Then the application software is Telegram, Whatsapp, Normal message or an Email.

Fig -3: Sensor values obtained

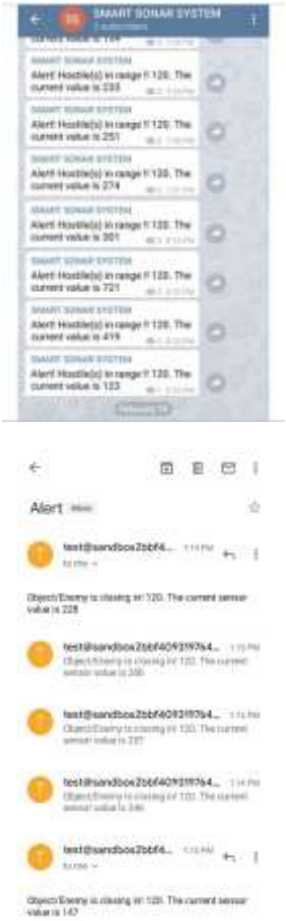

Fig -4: Alert message and email received

4. ULTRASONIC SENSOR CONNECTED TO ARDUINO

The Arduino UNO is interfaced with Ultrasonic Sensor to collect the values. For that, we have to connect the Echo pin and the trigger pin of the sensor to the digital (Pwm) pin of the Arduino UNO. It collects the data and sends to the Arduino UNO from where it forwards to the WiFi module. The data collected through the sensor is analysed deeply and a threshold limit is set accordingly. The threshold limit is set with reference to the sensor value collected after which the object starts to show up in the range. And, this is the initial step after which an alert is generated.

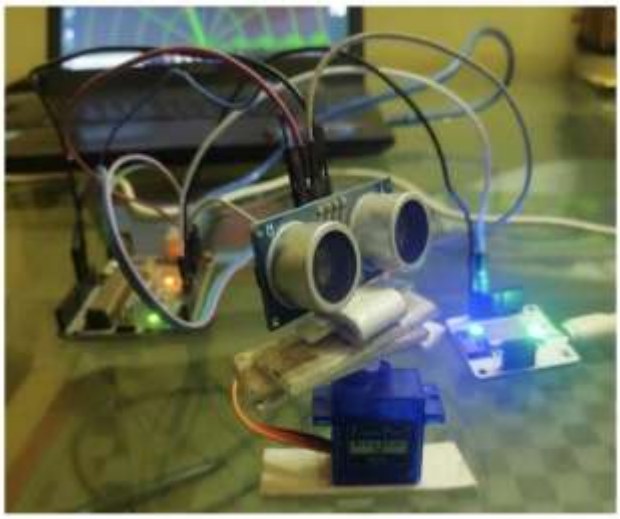

Fig -5: Ultrasonic connected to Arduino UNO

5. ARDUINO INTERFACE WITH WIFI MODULE

A serial communication has to be established between the Arduino UNO and WiFi module to ensure proper information exchange for that we have used library in Arduino UNO IDE which is called Software Serial. For this, we have connected the Tx and Rx pins of Arduino UNO to Rx and Tx pins of the WiFi module espectively.

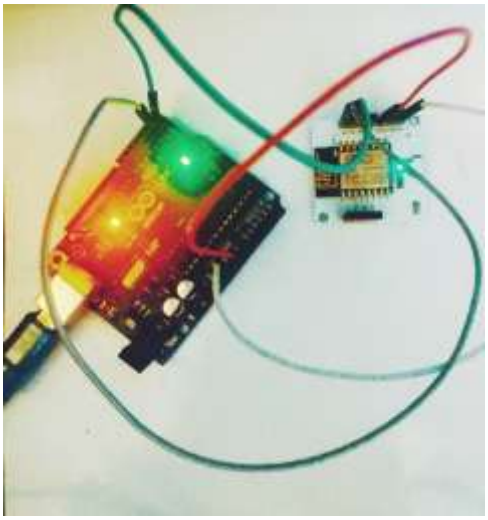

Fig -5: Arduino UNO connected to BOLT IoT WiFi Module

6. PROCESSING APP OUTPUT

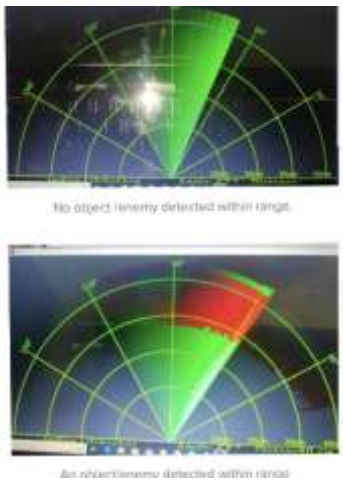

Fig-6 Output (No object detected & Object detected)

The data collected through the sensor is the plotted and graphical represented via the processing app. It shows the distance of the object from the system with reference to the sensor values [2]. The representation is based on the angle through which the sensor is rotated and the object it spots within this degree as the sensor sweeps equal area in equal intervals of time. Then, the corresponding distance from the object is calculated and represented in cms. This visualization technique helps us to better understand and analyze the set of data we are looking at.

7. CONCLUSION

This paper presents an innovative methodology and solution that enables a SONAR system with a generic configuration to provide real-time updates to its user and hence cancelling out the extra time taken for the communication. The combination of Hardware and Software together governed with a comprehensive algorithm allows the SONAR system to switch between conventional system and smart system with the help of automation which ultimately adds in the ability to establish remote communication without any additional motors or actuators and also saving some room for other features. This also makes the SONAR capable of graphically representing any object within its range. Additionally, the Processing app-based range feature helps to map the environment around the system. Furthermore, this data visualization technique saves time on understanding the collected data effectively. So that, proper methods can be devised to ease down the problems encountered.

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