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ARDUINO BASED ADVANCE OBJECT DETECTION USING SENSORS

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Abstract: The project work keep distance warning system is designed for Automobiles, any vehicle ranging from motor cycle to heavy duty truck can adopt this system. The main purpose of this system is to alert the came very following vehicle whenever it close to the ahead vehicle; thereby to some extent accidents can be avoided. Many accidents at High-ways are taking place due to the close running of vehicles, all of sudden, if the in front vehicle driver reduces the speed or applied breaks, then it is quite difficult to the following vehicle driver to control his vehicle, resulting accident. To avoid this kind of accident, the warning system, which contains alarm and display system can arrange at rearside of each and every vehicle.

I. INTRIDUCTION

In the past (during the World Wars), it was difficult to detect, identify, and track objects manually.

It was hard for an ordinary person to anticipate the weather, too. The vastness of the aquatic bodies made it impossible for humanity to go or explore beyond them. Consequently, Radio Detection and Ranging (RADAR) was developed as a solution to these and other issues. It is used in the military to direct missiles or to detect and identify targets or enemies. In the field of aviation, it may manage air traffic by determining the location of the aircraft and directing it to land or fly safely even in inclement weather. With the use of remote sensing, one may track satellites, monitor planetary locations in orbit, direct ships through water bodies, find items lying under them, anticipate the weather, and take required action in the event of a natural catastrophe. Police officers utilize it in ground traffic control to gauge a vehicle's speed, identify impediments, etc.

The RADAR is made up of an antenna that radiates an electromagnetic signal into space from a transmitter. This signal is reflected in several directions when it hits any object. The radar antenna picks up this reflected or echo signal and sends it to the receiver, where it is analyzed to ascertain the object's geographic information. The time it takes for a signal to go from a radar to a target and back is used to calculate the range. The antenna points in the direction of the largest amplitude echo signal, and this is how the target's position is calculated in angles. The Doppler Effect may be used to determine an object's position and range. Fig. 1 illustrates how RADAR operates: Due to its broad range, flexibility, and use of electromagnetic waves rather than a medium for transmission, radio waves may be used to detect objects in a variety of weather conditions. Its enormous range makes it non-target specific, it is expensive, difficult to set up and operate, and interferes with the receiver when things are too near. However, there is a superior handling and financing option accessible. Ultrasonic sensors use sound waves that are higher than 20 kHz, which is the human auditory range, to detect distance. The target reflects an ultrasonic wave that the sensor sends out and receives back. Ultrasonic sensors use the time interval between emission and reception to calculate the target's distance. The benefits of ultrasonic sensors include their low cost, ease of handling and setup, high frequency, sensitivity, penetrating power, great accuracy, and ability

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to sense an object's nature, shape, and orientation without the need for light, smoke, color, dust, or other obstructions. As a result, they are used in almost all RADAR applications, including distance measuring, liquid level management, and parking systems. As a result, the HC-SR04 ultrasonic sensor, designed to function as RADAR, is employed in the proposed study. Figure 2 illustrates how the HC-SR04: object functions. A high-frequency sound signal is sent by the transmitter (trig pin), reflected off an object, and then received by the transmitter (echo pin). Servo motor SG90 is utilized for movement/rotation similar to RADAR. SIM808 may be used to alert the object detection by SMS/message together with its position. As can be shown, the RADAR may be changed and even then, the whole program can be managed using these low-cost, lightweight, simple to set up, and manage modules.

II. LITERATURE SURVEY

In [2], Shih-An Li et al., several servo motors are used to regulate the manipulators that govern the motion of robotic arms. The ultrasonic sensor that is connected to the servo motor is similarly controlled by the servo motor.

Every sector needs security as a fundamental component. According to author Pooja Yadav, it is a difficult challenge to identify items or intruders using low-cost methods [1]. Ultrasonic sensors, servo motors, and other inexpensive IoT components are excellent tools for object detection.

A Patkar et al. employed a horizontal array of ultrasonic sensors for object detection [3] since they are inexpensive equipment. Alternatively, a servo motor and a single ultrasonic sensor might be used.

Radar and ultrasonic signals are used by Alexander Bystrov et al. [4] to recognize road surfaces. The various objects and their distances may also be discovered using a single ultrasonic sensor in a similar manner.

Since there is less signal loss when using ultrasonic sensors to estimate distance, Aleksandr Bystrov et al. We can determine the object's distance as ultrasonic sensors may be used to measure distances.

Eugin Hyun et al. developed short-range ground surveillance radar that uses FMCW (Frequency Modulated Continuous Wave) to identify moving objects [6]. This radar is expensive. Thus, items may be detected using Internet of Things components like servo motors and ultrasonic sensors. Shao Y et al. have devised a system that uses an ultrasonic sensor to compute the parking space based on the width of the car [7]. Vehicles and their distance from the sensor may also be detected using an ultrasonic sensor. In order to identify an object and its distance inside a 180-degree angle, ultrasonic sensors were used in the development of radar (Paulet, M.V. et al., 2008). Using SIM808, it is also possible to send a message to the admin mobile with the object's distance and angle. While all the articles talk about using RADAR rather than ultrasonic sensors with information-sending modules like SIM808, the suggested approach offers a simple and cost-effective option.

III. METHODOLOGY

This section gives brief explanation on the description of software and hardware, detailed connections setup, workflow.

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A. Experimental Setup

The objective at hand is far object identification; so, instead of using RADAR, an ultrasonic sensor (HC-SR04) is used since it is less expensive and simpler to operate. It generates sound waves, which are reflected back and detect objects when they strike them. Servo motor (SG90) is utilized in 1800 to rotate the ultrasonic sensor. The Arduino Uno is now used to process this data, i.e., to convert analog data to digital data. Using SIM808, a device linked to Uno, messages are sent to notify the recipient of the object detection. Although the data has already been sensed and processed, a Raspberry Pi 3 is utilized for monitoring and access. Thus, every piece of hardware, including the servo motor, SIM808, and ultrasonic sensor, is linked to an Uno board that is then connected to a Pi3. Pi3 is linked to input devices like as keyboards, mice, and monitors; jumper wires are used to connect all the devices. Results are impossible without software to monitor the output, even with all the hardware and physical devices connected. Initially, in order to engage or interface, the Raspberry Pi3 has to have Raspbian or Noobs OS loaded. To program the code in C/C++, install the Arduino IDE software. The Processing IDE is another piece of software used to create a java-based graphical user interface. The code is used to run the devices in order to carry out the suggested task and to monitor the output or outcomes, i.e., to send SMS messages from the SIM808 and to see the object that has been identified in the Java-based GUI with the assistance of HC-SR04.

B. Hardware Analogy

Initially, the Pi3 is fitted with an SD card for storage that has Noobs or Raspbian OS. Keyboards, mice, and monitors are linked to the Pi3. Put a 4G SIM card into the SIM808 that has the internet and SMS features activated. Attach the GSM and GPS antennas. Presently, link the GND (Power/Analog In) of Uno to SIM808 GND, (Digital In) Tx (8) of Uno to Rx of SIM808, Rx (7) of Uno to Tx of SIM808, GND of HC-SR04 to GND (Power/Analog In) of Uno, Trig of HC-SR04 to 11 of Uno, echo of HC-SR04 to 12 of Uno, Vcc of HC-SR04 to 5v(Power/Analog In) of Uno, and each servo motor's wire to 9, 5v, and GND of Uno, separately. Jumper wires are used to link the Uno, servo motor, ultrasonic sensor, and SIM808. Now use a USB cord to link the Pi3 and Arduino. Next, connect the SIM808 and Pi3 to an adaptor to turn them on. The intricate linkages are shown graphically in Fig. 3:

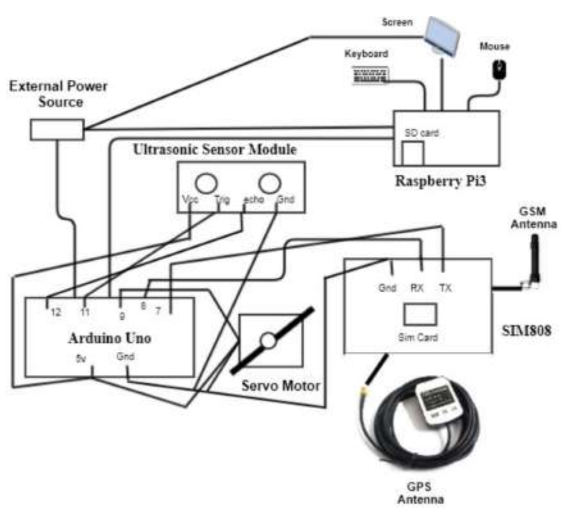

Fig. : Hardware Connection Setup

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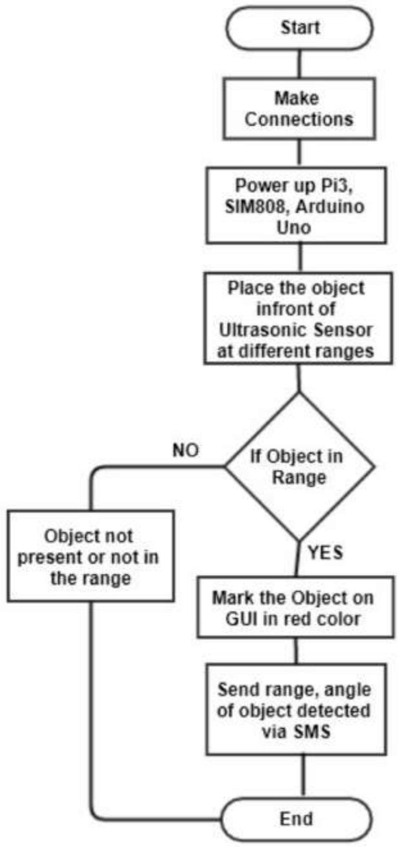
C. Workflow

After the connections are made, the code for object detection is run on the software Uno. Algorithm of the code is explained and mentioned below.



The trig pin and echo pin of the ultrasonic sensor attached to pins 11 and 12 of the Arduino are declared (initialized) prior to the setup procedure. Trigpin's pinmode is set as output and echopin's as input as part of the setup procedure. identifying the pin (at 9) that the servo motor is connected to. Next, set the baud rate to 9600 and initialize the SIM808 for operation using a sequence of AT instructions, such as AT+CMGF=1 and AT+CGNSPWR=1. The loop function is used to execute a section of the code n times. Here, a for loop is used to rotate the servo from 15 to 165 and 165 to 15 degrees with a 30-millisecond delay. thereafter using the calculate Distance method to get the distance that the ultrasonic sensor recorded for every degree. The trigpin in this function is initially low for two microseconds. Next, to transmit high-frequency sound waves, trigpin is set to high for 10 microseconds, and then it is set to low for 2 milliseconds. When the echopin is set high, it reads the signals and functions as a transmitter, returning the sound wave travel time in microseconds to the variable duration. This is why there are delays. The distance is then computed as follows: duration * 0.034/2. The AT command AT+CMGS = number, range, and angle of the item detected is delivered by message/SMS if the object is within the detection range. Finding the item is the main focus of this section. The processing of the RADAR GUI to observe object detection is covered in the next section of the Java code. The code includes

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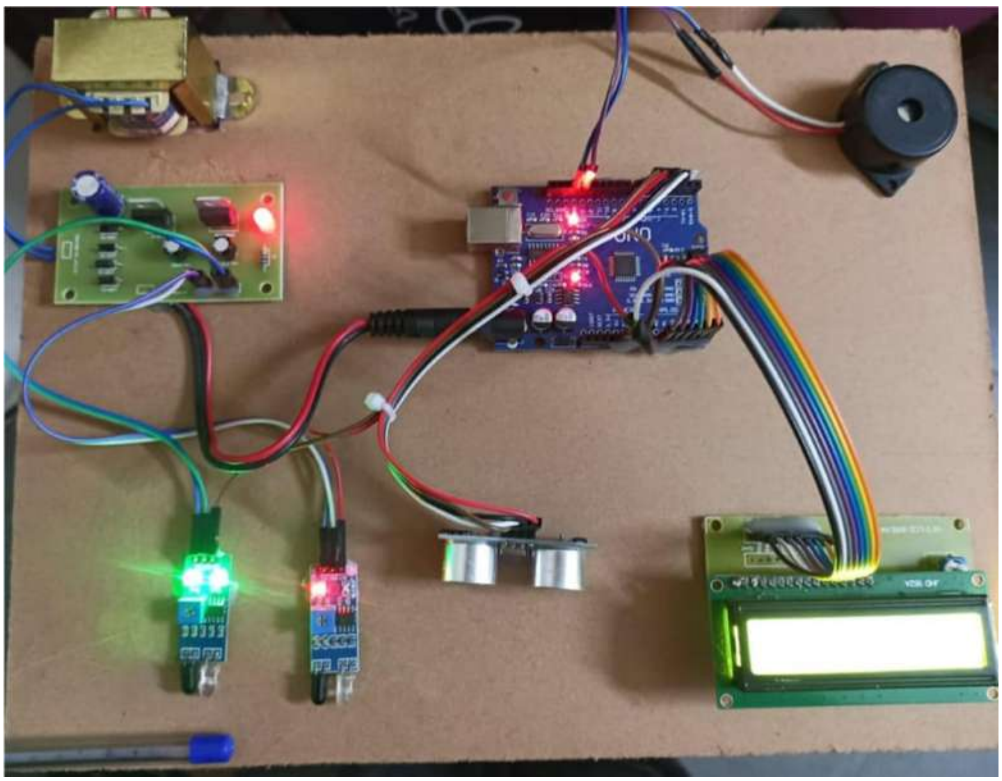
importing the libraries needed for reading data from the serial port and for serial communication. Next, provide the variables for determining angle, distance, and object detection in the serial object. Now, specify the GUI's pixel size in the setup function, declare the COM port that the Arduino is attached to, initiate serial communication, and read data from the serial port. Use the draw function to call the drawRadar, drawLine, drawText, and drawObject methods as well as to mimic motion blur and slow down the line's movement. Angle lines and arc lines are produced using the drawRadar function. Use the drawObject method to configure the sensor's range for object detection, compute the object's distance and angle, mark any detected objects in red, fade them to black, and mark any empty space in green. DrawText provides the necessary texts for showing angles in degrees, range in centimeters, and object recognition. DrawLine draws lines at certain angles.

IV. RESULT ANALYSIS

This section provides an explanation of the work's results. Figure 6 displays screenshots of several RADAR-based graphical user interfaces. The green lines in the first picture indicate that nothing is maintained in front of the sensor or that it could be outside of the range at the angle of 56 degrees. The item spotted in the second picture has a red hue, an angle of 65 degrees, and a range of 8 cm. The item identified in the third picture is shown in red hue, which fades to black as the arcs move (servo motor spins) at an angle of 100 degrees and a range of 40 cm.



Hardware Model

Result Display

V. CONCLUSION

The study, which is a RADAR-based object detector employing an ultrasonic sensor, has been completed successfully and is presented in this publication. It provides a simple way to identify objects utilizing ultrasonic technology, which functions similarly to RADAR, in place of real RADAR, which is difficult to use and expensive. The majority of other authors' writing focuses on one or both of these topics. IoT hardware and connectivity software were part of the project. The Arduino Uno board and Raspberry Pi 3 computer processed the data. The distance, angle, and timestamp of the item identified were communicated to the specified number via SMS/message using the SIM808 module. item detection was accomplished using the ultrasonic sensor and servo motor coupled to the boards. Sample test scenarios to verify the object detection's range were included in the findings. The images displayed a snapshot of the RADAR-like object detection GUI, with green shown when no object was identified using angles and red when there was. Since ultrasonic has several benefits over RADAR, as was described in the introductory section, the work offers an easy-to-setup and manage object identification system.

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