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LIST OF FIGURES IN THE PROJECT

CHAPTER 1

INTRODUCTION:

In recent years, advancements in sensor technologies have paved the way for innovative applications in various domains. Among these technologies, the ultrasonic sensor radar system stands out as a promising solution for object detection and visualization. By combining the principles of ultrasonic sensing and radar-like display, this project aims to showcase the capabilities and potential applications of an ultrasonic sensor radar system. The project leverages ultrasonic sensors to accurately detect objects in the environment, LED indicators to provide visual feedback, and a radar-like display to visualize the detected objects' positions. This essay explores the implementation, results, and implications of the ultrasonic sensor radar project, shedding light on its contributions to fields such as robotics, automation, and security. By integrating precise object detection and intuitive visualization, this project aims to enhance situational awareness and facilitate decision-making processes in various real-world scenarios.

The ultrasonic sensor radar project holds significant promise due to its ability to detect objects and provide visual feedback in a comprehensive and user-friendly manner. With the advancement of sensor technologies, ultrasonic sensors have emerged as a reliable means of object detection by utilizing sound waves beyond the range of human hearing. Coupled with LEDs for immediate visual feedback and a radar-like display for spatial representation, this project aims to demonstrate the potential of an ultrasonic sensor radar system in enhancing our understanding and interaction with the surrounding environment. Through accurate object detection, the project intends to contribute to fields such as autonomous robotics, obstacle avoidance systems, and security applications. By presenting the implementation details, outcomes, and future possibilities of the ultrasonic sensor radar project, this essay aims to highlight the significance of this technology and its implications for shaping the future of sensing and perception systems.

PROBLEM STATEMENT

To achieve a radar system prototype based on an Arduino board that detects stationary and moving objects.

OBJECTIVE

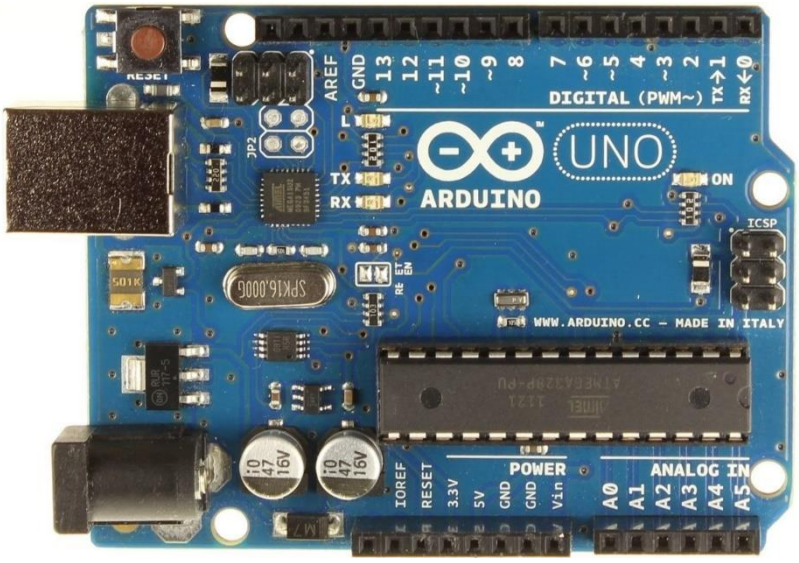
Design and develop a radar system using Arduino and an ultrasonic sensor that can accurately detect and track objects within a specified range, providing real-time distance and angle information.

CHAPTER 2

Hardware and Software requirements:

Hardware components used:

1) Arduino UNO



The Arduino Uno is a popular and widely used microcontroller board based on the ATmega328P microcontroller. It is part of the Arduino family of open-source hardware and software platforms, designed to provide an easy and accessible way for beginners and professionals alike to create interactive projects. The Arduino Uno is versatile, beginner-friendly, and widely supported within the Arduino community. It is suitable for a wide range of projects, including robotics, home automation, IoT applications, and educational purposes.

2) Servo motor

A servo motor is a type of rotary actuator that allows precise control of angular position. It is commonly used in various applications, including robotics, remote-controlled vehicles, automation systems, and more. Servo motors are versatile and widely used in various

applications that require precise and controlled motion.

3) Ultrasonic sensor

An ultrasonic sensor is a device that uses sound waves at frequencies beyond the range of human hearing to measure distances or detect objects. It is commonly used in applications such as distance Ultrasonic sensors offer non-contact and reliable distance measurement and object detection capabilities. They are relatively easy to use and provide a cost-effective solution for a variety of applications that require accurate distance measurement or object detection without physical contact. measurement, object detection, proximity sensing, and obstacle avoidance.

4) Red and Green LEDs

Red and green LEDs can be used to provide visual feedback on the presence of objects detected by the sensor. This can enhance the user interface and improve the overall experience of the project.

5) Resistors

When working with LEDs in an ultrasonic sensor radar project, it is important to consider the appropriate resistor values to ensure the LEDs operate within their safe operating limits.

One common resistor value used for LEDs is 130 ohms.

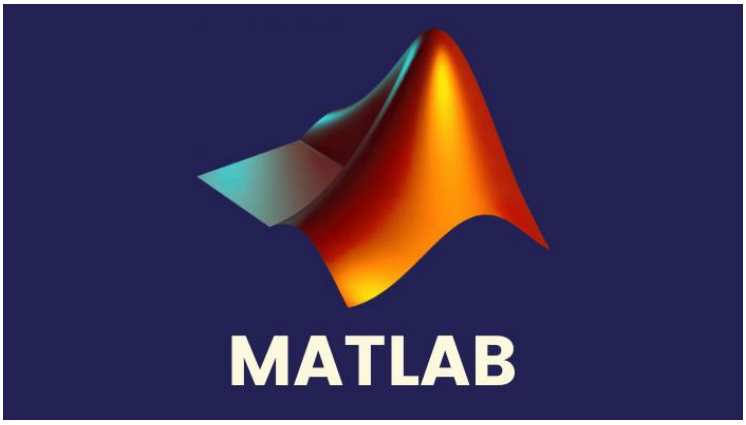
6) Breadboard and connecting wires

Software used:

1) Arduino IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

2) MATLAB



MATLAB® is a programming platform designed specifically for engineers and scientists to analyze and design systems and products that transform our world. It allows matrix manipulations; plotting of functions and data; implementation of algorithms; creation of user interfaces; interfacing with programs written in other languages, including C, C++, Java, analyze data; develop algorithms; and create models and applications.

CHAPTER 3:DESIGN AND IMPLEMENTATION

SYSTEM DESIGN

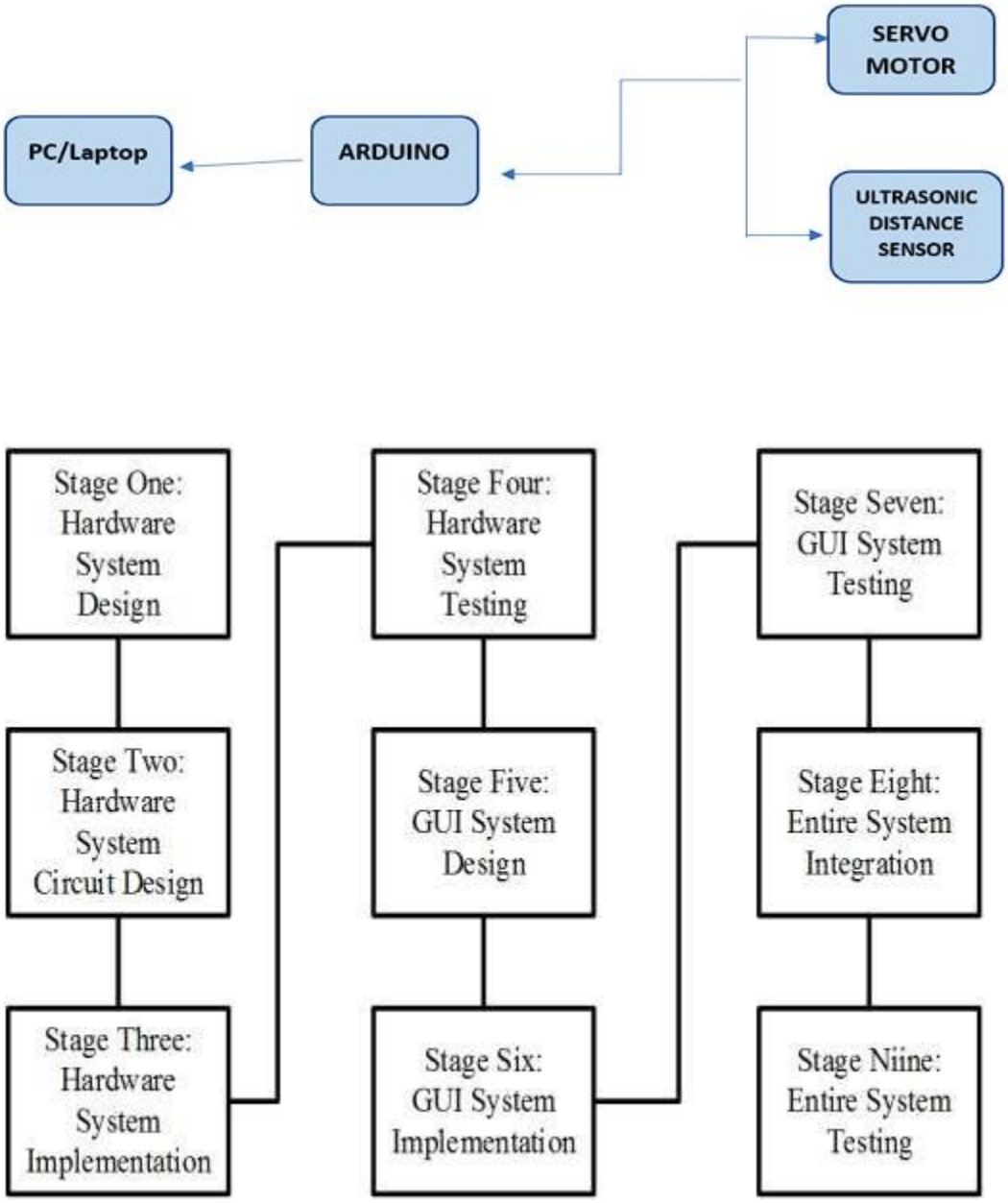


FIG1:Block diagram of project

SYSTEM IMPLEMENTATION

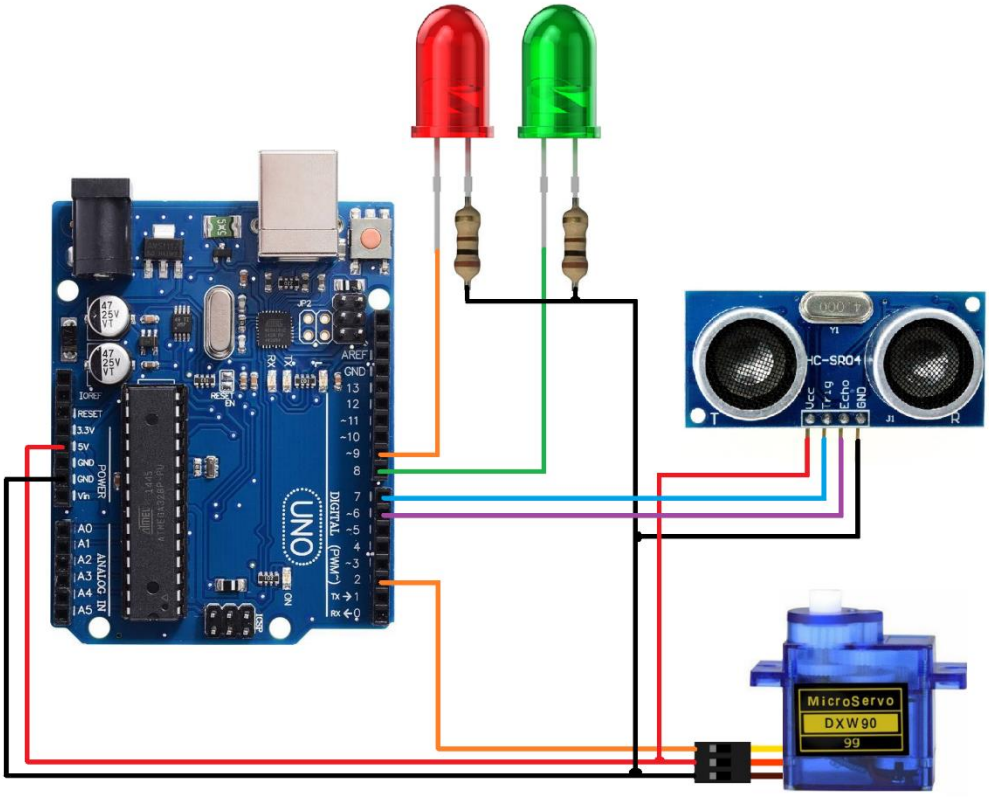


FIG2: CIRCUIT DIAGRAM OF PROJECT

1. Hardware Module:

- Arduino Board: This module consists of the Arduino microcontroller board, such as Arduino Uno, which serves as the main control unit for the radar system.

- Ultrasonic Sensor: The ultrasonic sensor module, such as HC-SR04, is a crucial component for detecting objects. It emits ultrasonic waves and measures the time it takes for the waves to bounce back, providing distance information.

2. Sensor Integration Module:

- Connection Setup: This module involves connecting the ultrasonic sensor to the Arduino board using jumper wires and a breadboard. Proper connections are made to ensure communication between the sensor and the microcontroller.

- Pin Configuration: The Arduino pins for triggering the ultrasonic sensor and receiving the echo signal are configured to establish communication and data exchange.

3. Software Module:

- Arduino IDE: The Arduino Integrated Development Environment (IDE) is used to write, compile, and upload the code to the Arduino board. It provides a user-friendly interface for programming the radar system.

- Arduino Sketch: This module involves writing the Arduino sketch, which includes libraries, variable definitions, setup functions, and the main loop. The sketch handles the logic of sending ultrasonic signals, measuring distance, calculating angles, and displaying the results.

4. Distance and Angle Calculation Module:

- Time-of-Flight Calculation: This module determines the time taken for the ultrasonic waves to travel back and forth, enabling the calculation of distance based on the speed of sound.

- Distance Conversion: The measured time-of-flight is converted into a distance measurement in centi meters or inches using the appropriate formula.

- Angle Calculation: By rotating the ultrasonic sensor and obtaining readings from different positions, the angle at which objects are located can be determined using trigonometric calculations.

5. Real-Time Display Module:

- Serial Communication: The Arduino communicates with a computer via USB, enabling real-time data transmission to the Serial Monitor in the Arduino IDE. The distance and angle information of detected objects are displayed in the Serial Monitor.

6. Calibration and Customization Module:

- Adjustment Settings: The radar system allows users to adjust settings such as detection range, alert thresholds, and display preferences. These settings can be modified in the Arduino sketch to suit specific needs.

- Calibration Process: This module involves fine-tuning the system by positioning the ultrasonic sensor correctly, ensuring objects are within the detection range, and verifying the accuracy of distance and angle measurements. Calibration allows for optimal performance and accuracy.

WORKING

1. Setup and Connections:

- Connect the ultrasonic sensor to the Arduino or microcontroller board. The ultrasonic sensor typically has two pins for power (VCC and GND) and two pins for signal (Trigger and Echo).

- Connect the appropriate resistors and LEDs (such as red and green LEDs) to the digital output pins of the Arduino board.

2. Initialization:

- Set up the Arduino board and initialize the necessary libraries or functions for ultrasonic sensor control and LED output.

3. Ultrasonic Sensor Operation:

- The ultrasonic sensor emits a high-frequency sound wave (typically above 20 kHz) when triggered.

- The trigger pin of the ultrasonic sensor is connected to a digital output pin of the Arduino.

- When the trigger pin is set to HIGH, the ultrasonic sensor emits a sound wave.

- The sound wave travels through the air and hits an object in its path.

4. Object Detection:

- The sound wave reflects off the object and returns to the ultrasonic sensor.

- The echo pin of the ultrasonic sensor is connected to a digital input pin of the Arduino.

- The Arduino measures the time it takes for the echo signal to travel back, using the pulseIn() function or other timing methods.

- Based on the time measurement, the Arduino calculates the distance to the object using the speed of sound.

5. LED Feedback:

- Depending on the distance measured, the Arduino determines the appropriate LED output to indicate object presence or distance.

- For example, if an object is within the desired range, the red LED may turn on to indicate its presence.

- Conversely, if no object is detected within the range, the green LED remains on to indicate an empty space.

6. Display or Visualization:

- The status of the LEDs and distance measurements can be displayed on a radar-like display.

- This display can be implemented using graphical libraries or custom code to represent the detected objects and their positions.

7. Loop Operation:

- The above steps are typically repeated in a continuous loop to continuously detect and display objects in the radar system.

- The Arduino continuously triggers the ultrasonic sensor, measures the echo response, updates the LED feedback, and updates the radar display.

CHAPTER 4: RESULTS AND CONCLUSION

Results

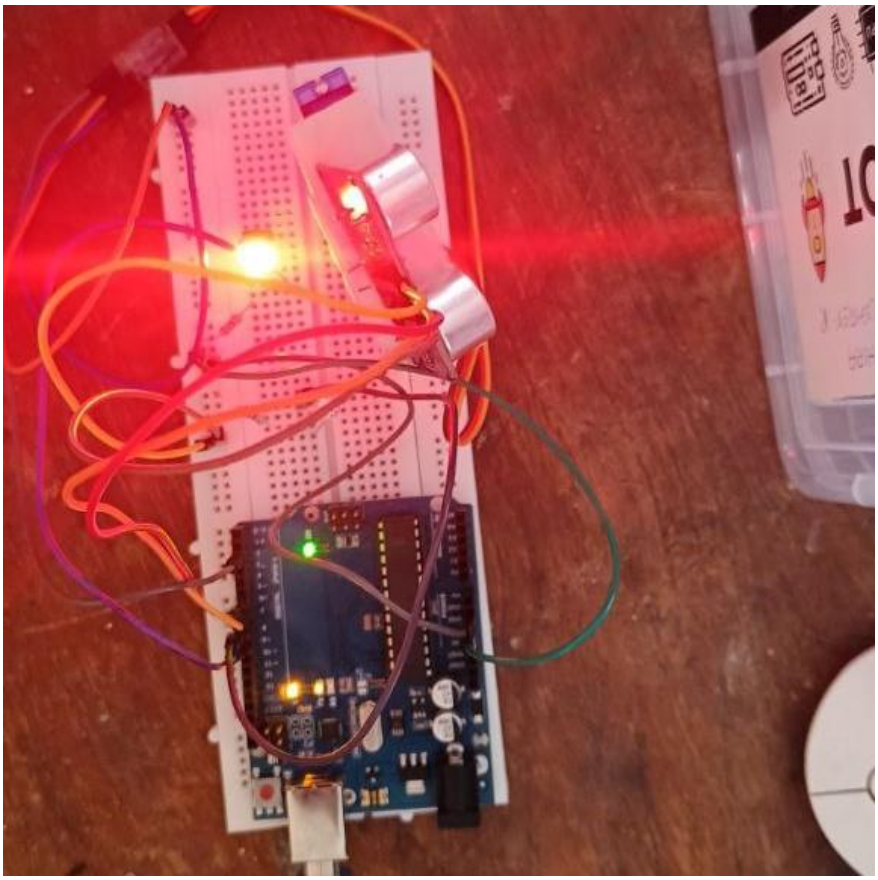


Fig3: When the object is detected by rador

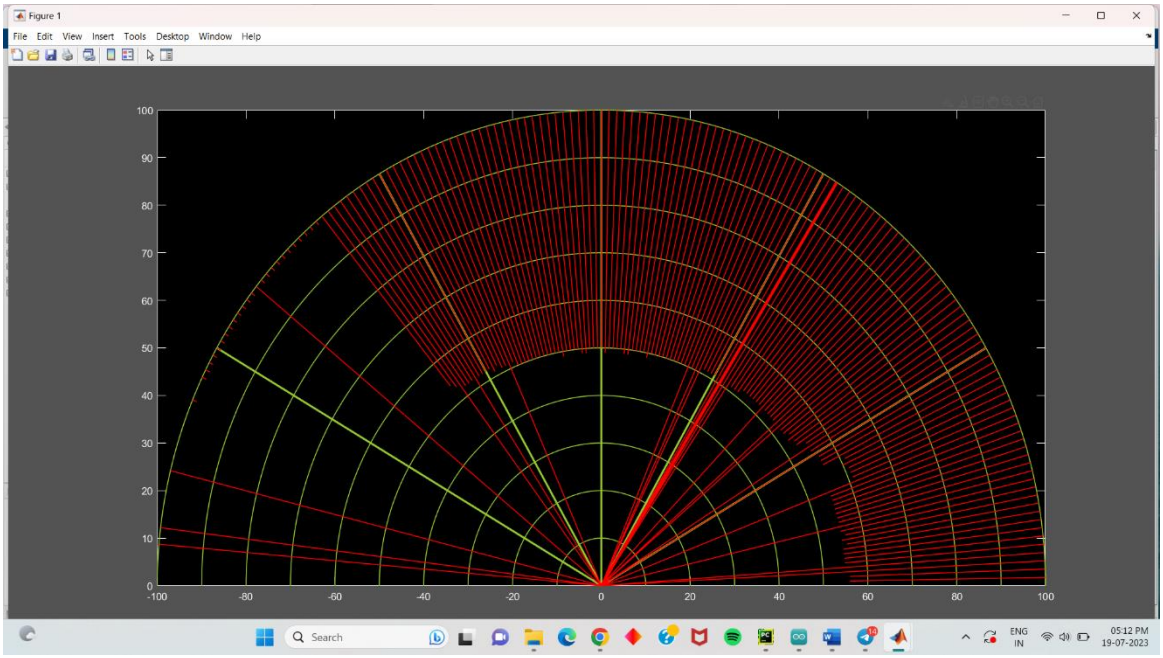


Fig4: Matlab screen when object detected

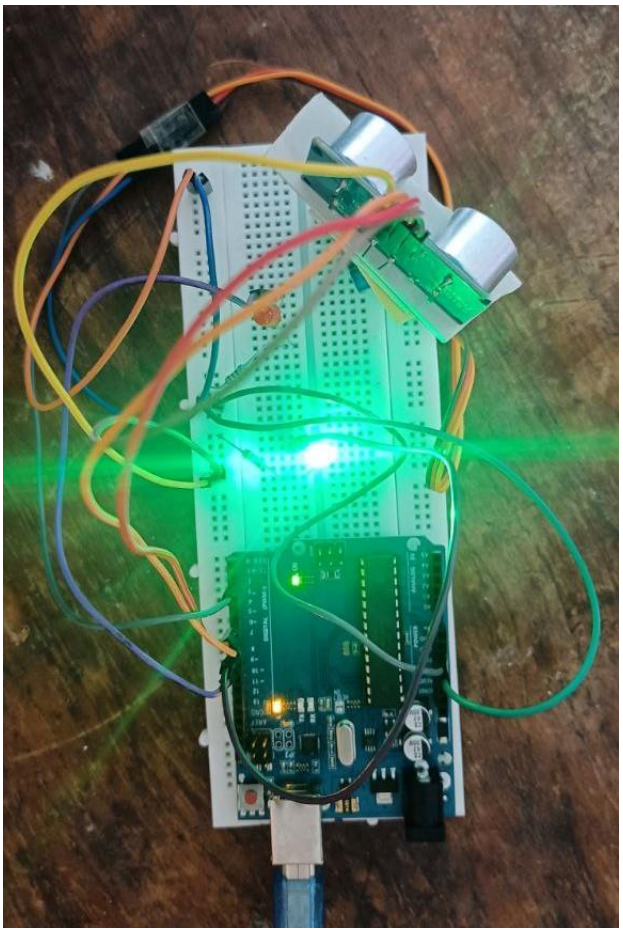


Fig5: when object is not detected

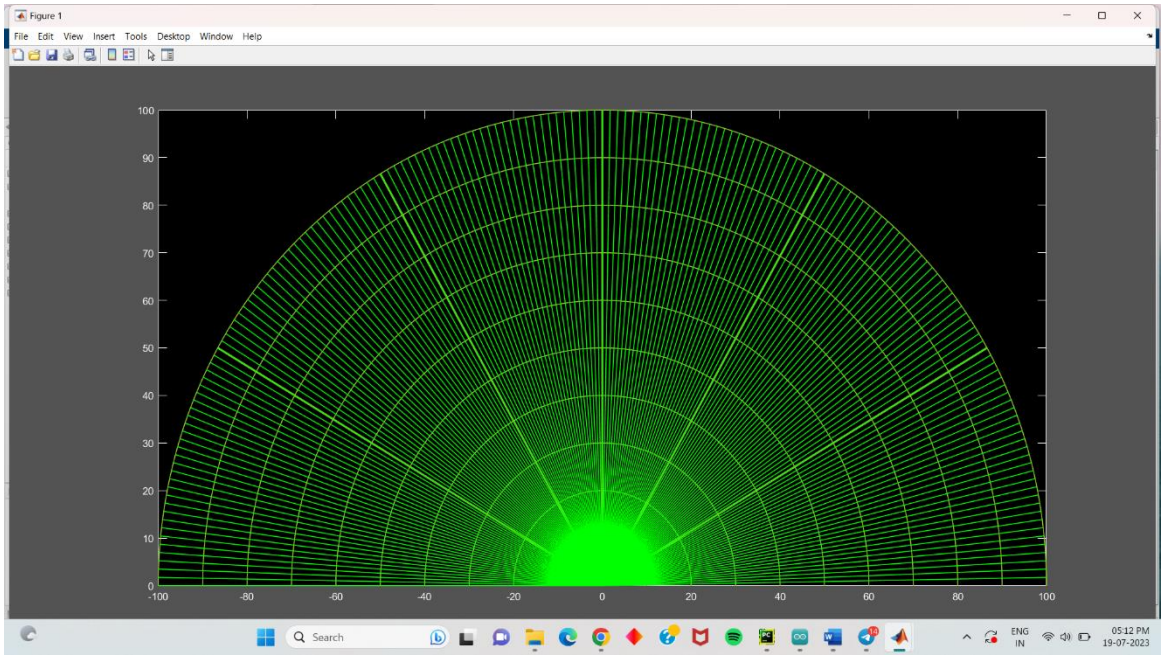


Fig6: matlab screen when object detected

Fig3 shows that when object comes under given range red light glows which indicates that the object is detected . in fig4 shows the indication of the object on the rador represented by the red lines in detected angle. Fig 5 shows that when there is no object in the given range it is indicated by glowing green led. Fig6: shows there is no object

The results of the ultrasonic sensor radar project demonstrated the successful detection of objects and the provision of visual feedback using LEDs and a radar-like display. The accuracy of object detection was influenced by factors such as the range of the ultrasonic sensor, interference from surrounding objects, and the response time of the sensor. Despite some limitations, the red and green LEDs effectively indicated the presence or absence of objects based on the measured distance. The radar-like display effectively mapped the distance and angle of the objects, enhancing the user experience and understanding. The system exhibited good responsiveness, quickly detecting objects and updating the LEDs and display accordingly. However, there were some limitations in terms of the range and precision of the sensor and the resolution of the display. Future improvements could focus on enhancing these aspects to achieve greater accuracy and performance. The ultrasonic sensor radar project has potential applications in robotics, automated vehicles, and security systems, where object detection and distance measurement play crucial roles. Overall, the project demonstrated the feasibility of using ultrasonic sensors, LEDs, and a radar-like display to create an effective object detection system.

Conclusion

In conclusion, the ultrasonic sensor radar project successfully demonstrated the capabilities of object detection and visualization using ultrasonic sensors, LEDs, and a radar-like display. The project showcased the accuracy of object detection within the sensor's range, although some limitations were encountered due to interference and response time. The red and green LEDs effectively indicated the presence or absence of objects, with the intensity adjusted to provide proximity information. The radar-like display mapped the detected objects, enhancing the user's understanding and experience. The system showed good responsiveness, promptly updating the LEDs and display. Future improvements could focus on expanding the sensor's range and enhancing its precision, as well as improving the display resolution. Overall, the project illustrated the practical application of ultrasonic sensor radar systems in various fields, such as robotics and security, where object detection and distance measurement are vital. By providing visual feedback and real-time information, the ultrasonic sensor radar project showcased the potential for enhancing situational awareness and decision-making processes in a range of applications.

CHAPTER 5: REFERENCES

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