RAMAIAH
Institute of Technology

RAMAIAH INSTITUTE OF TECHNOLOGY

(Autonomous Institute Affiliated to VTU), Bangalore

Dept. of Electronics and Communication Engineering

IOT LAB ASSIGNMENT

REPORT ON
OBSTACLES DETECTION USING ULTRASONIC SENSOR

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INTRODUCTION

In this IoT (Internet of Things) project, we have harnessed the power of a Raspberry Pi and an ultrasonic distance sensor to create a versatile and interactive system with a multitude of practical applications. By continuously measuring distances in real-time, this project opens doors to innovations in various domains.

Whether it's ensuring the safety of autonomous robots through obstacle detection, enhancing security systems with proximity-based triggers, automating lighting to conserve energy, or crafting engaging interactive art installations, the possibilities are boundless. Additionally, applications span across monitoring liquid levels in tanks, environmental data collection, and smart parking assistance for vehicles

COMPONENTS:

1. Raspberry Pi: Raspberry Pi is a small, affordable, and versatile single-board computer that has gained popularity for a wide range of applications. It features GPIO (General-Purpose Input/Output) pins, making it suitable for hardware projects and IoT applications.

2. Ultrasonic Sensor: Ultrasonic sensors are used for non-contact distance measurement. They emit ultrasonic waves and measure the time it takes for the waves to bounce back, allowing precise distance calculations. They are commonly used in robotics and automation.

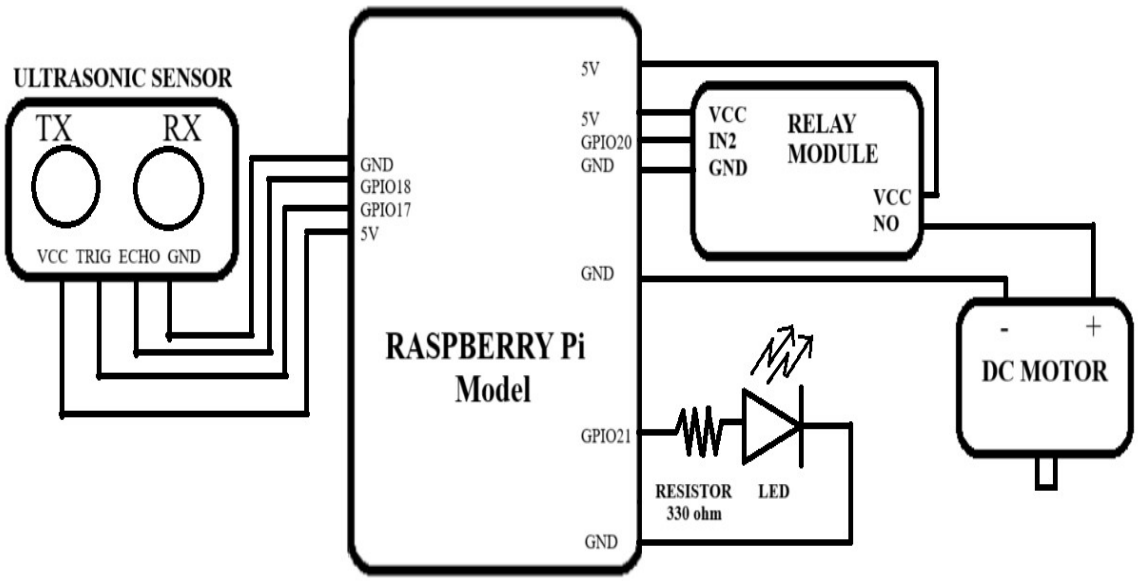
3. Relay Module: A relay module is an electrical switch that can be controlled electronically. It allows low-voltage microcontrollers like the Raspberry Pi to control high-voltage or high-current devices such as lights, appliances, or motors, making it a crucial component in automation and IoT projects.

4. DC Motor: A DC (Direct Current) motor is an electrical device that converts electrical energy into mechanical motion. It is commonly used in robotics and automation for controlling the movement of wheels, gears, and other mechanical components.

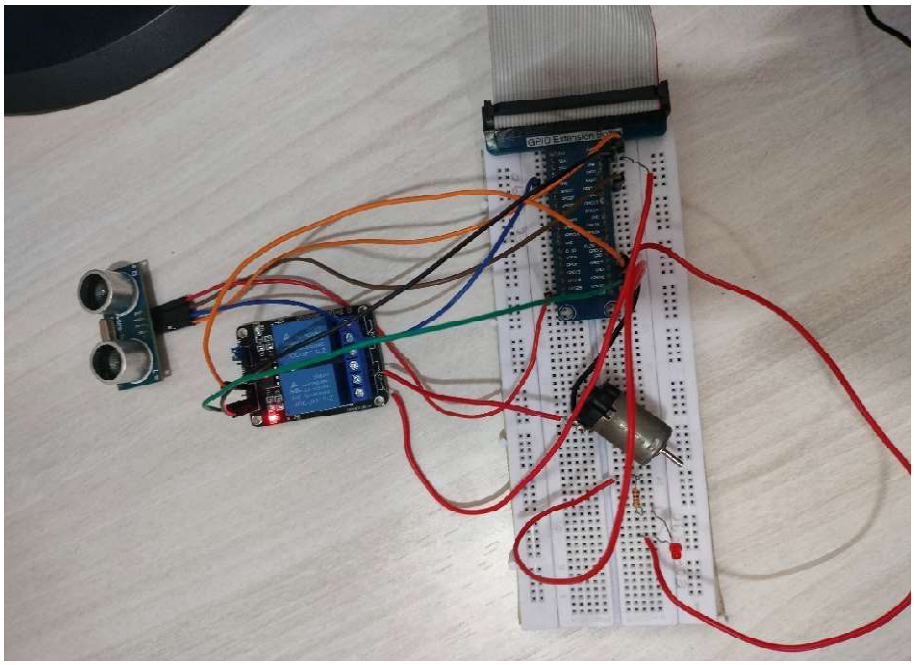
5. LED (Light Emitting Diode): LEDs are semiconductor devices that emit light when an electric current passes through them. They come in various colors and are often used for status indicators, display screens, and lighting in electronic projects.

6. Resistor: Resistors are passive electronic components that limit the flow of electrical current. They are used to control voltage levels, protect components from excessive current, and set specific values of resistance in electrical circuits, ensuring stable and safe operation.

BLOCK DIAGRAM:



CIRCUIT:



PROCEDURE:

1. As shown in the above block diagram Raspberry Pi is connected to Ultrasonic sensor, Rely module, DC motor and LED.
2. Ultrasonic sensor is used to measure the distance between the obstacle and it gives the data to Raspberry Pi model.
3. The Trigger pin in the sensor is used to generate and transmit ultrasonic waves and the Echo pin is used to collect the reflected waves.
4. The distance is calculated using the formula

   distance = (pulse_duration * 34300) / 2

   where,

   pulse_duration= pulse_end - pulse_start
5. Based on the distance of the obstacle from the sensor the Motor and the LED switches ON and OFF.
6. If the distance is less than or equal to 10cm the LED glows and Motor starts rotating.
7. The distance between the obstacle and the sensor is measured continuously and plotted in real time.

CODE:

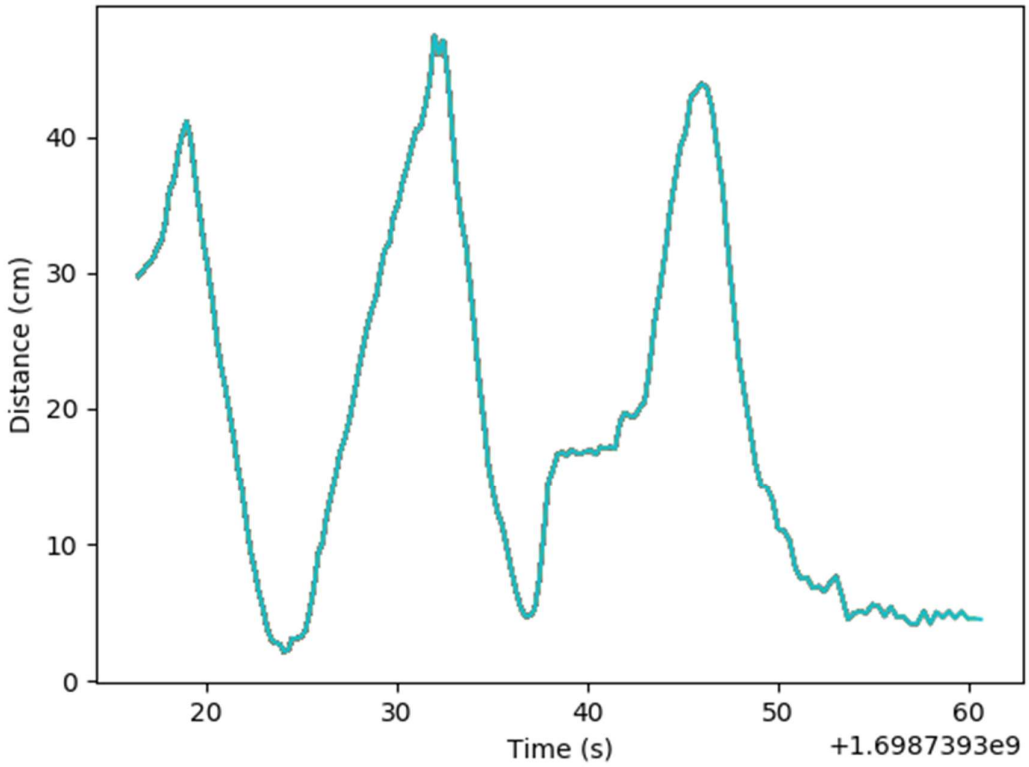
```
import RPi.GPIO as GPIO
import time
import matplotlib.pyplot as plt

# Set GPIO pin numbers
GPIO.setwarnings(False)
GPIO.setmode(GPIO.BCM)
TRIG = 17
ECHO = 18
LED_PIN = 21  # Choose a GPIO pin for the LED
MOTOR_PIN=20


# Set up GPIO pins
GPIO.setup(TRIG, GPIO.OUT)
GPIO.setup(ECHO, GPIO.IN)
GPIO.setup(LED_PIN, GPIO.OUT)  # Set the LED pin as an output
GPIO.setup(MOTOR_PIN, GPIO.OUT)

# Initialize lists to store data for plotting
distances = []
```

```
timestamps = []

try:
    while True:
        # Trigger the ultrasonic sensor
        GPIO.output(TRIG, True)
        time.sleep(0.001)
        GPIO.output(TRIG, False)

        while GPIO.input(ECHO) == 0:
            pulse_start = time.time()

        while GPIO.input(ECHO) == 1:
            pulse_end = time.time()

        pulse_duration = pulse_end - pulse_start

        # Calculate distance in centimeters
        distance = (pulse_duration * 34300) / 2

        print("Distance: {:.2f} cm".format(distance))

        # Store the data for plotting
        distances.append(distance)
        timestamps.append(time.time())

        # Create a real-time plot
        plt.plot(timestamps, distances)
        plt.xlabel('Time (s)')
        plt.ylabel('Distance (cm)')
        plt.pause(0.1)  # Update the plot every 0.1 seconds

        # Control the LED based on distance
        if distance <= 10:
            GPIO.output(LED_PIN, GPIO.HIGH)
            GPIO.output(MOTOR_PIN,True)
        else:
            GPIO.output(LED_PIN, GPIO.LOW)
            GPIO.output(MOTOR_PIN,False)

except KeyboardInterrupt:
    GPIO.cleanup()
```

RESULT:

Distance: 279.23 cm
Distance: 268.44 cm
Distance: 279.25 cm
Distance: 30.77 cm
Distance: 22.51 cm
Distance: 17.50 cm
Distance: 19.38 cm
Distance: 9.32 cm
Distance: 9.05 cm
Distance: 7.74 cm
Distance: 5.26 cm
Distance: 6.54 cm
Distance: 4.04 cm
Distance: 2.92 cm
Distance: 2.98 cm
Distance: 3.02 cm
Distance: 5.00 cm

PLOT:



APPLICATIONS:

1. Obstacle detection and avoidance
2. Security system
3. Automated lighting
4. Interactive art installation
5. Liquid level monitoring
6. Environmental monitoring
7. Parking assist system
8. Home automation

These are just a few examples of the many applications for this project. The flexibility of the Raspberry Pi, along with the sensor and control capabilities, allows for creative and practical use in a wide range of projects.

CONCLUSION:

This project reveals its extensive applicability by continuously measuring distances and dynamically controlling devices based on these measurements.
The project excels in diverse domains, including robotics, security, home automation, and beyond. The real-time data-driven decision-making demonstrates the profound influence of IoT in modern society.