UNITED INTERNATIONAL UNIVERSITY

Lab Task 3

Course Name: Microprocessors and Microcontrollers Laboratory

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Section: D

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Lab Task 3

Ultrasonic Distance Measurement and RF Transmission

Objective:

Measure distance using an Ultrasonic Sensor and transmit the measured distance using an RF transmitter-receiver pair.

Equipment:

- Arduino Uno R3
- Arduino IDE (Compiler)
- Proteus (Simulator)

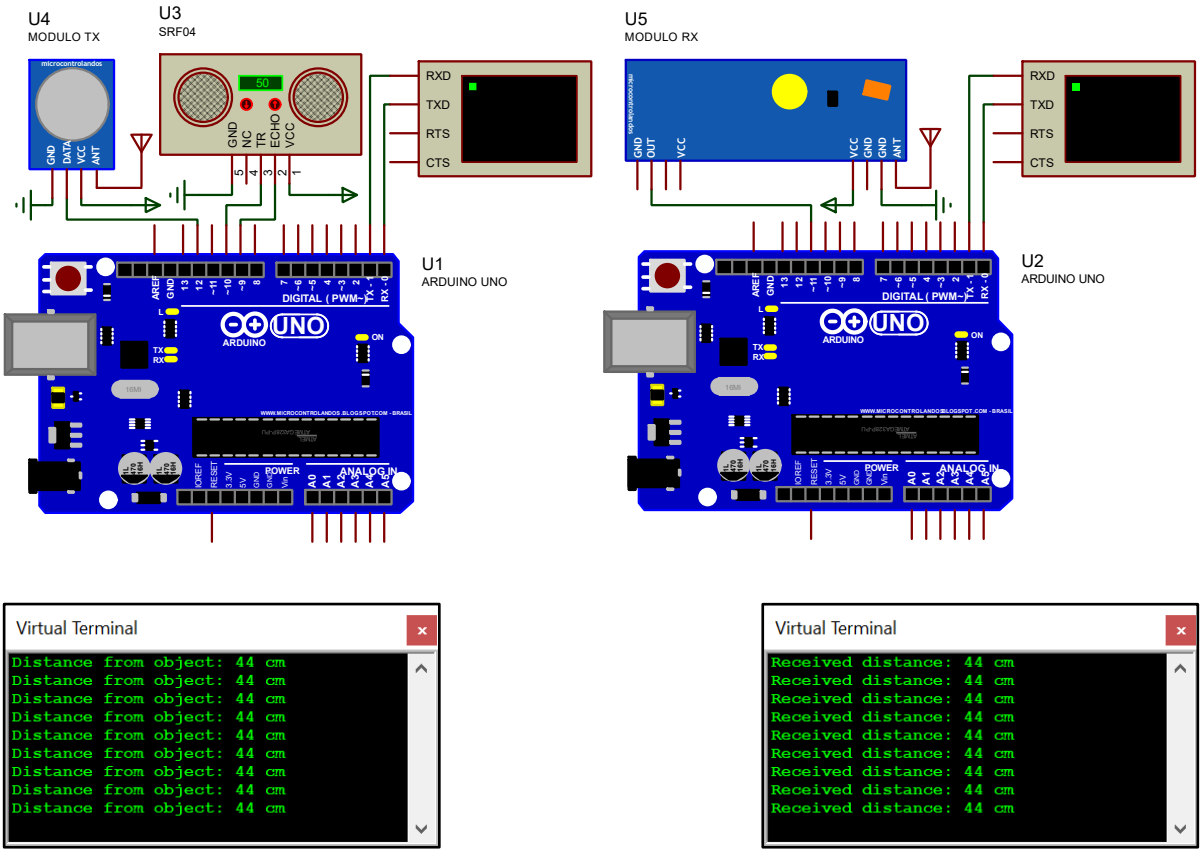
Introduction:

This experiment focuses on the measurement of distance using an ultrasonic sensor and the transmission of the measured distance using an RF (Radio Frequency) transmitter-receiver pair. The ultrasonic sensor utilizes sound waves to calculate the distance to an object, while the RF modules enable wireless transmission of the measured distance. By combining these components, the experiment aims to demonstrate the integration of distance sensing and wireless communication technologies, showcasing their practical applications in various fields such as robotics, automation, and remote monitoring.

Components and its Functions:

1. **Arduino Uno:** The Arduino board serves as the main control unit for the experiment, responsible for running the code, processing sensor data, and transmitting/receiving data using the RF modules.
2. **Ultrasonic Sensor:** The ultrasonic sensor is used to measure the distance to an object. It emits ultrasonic pulses and measures the time it takes for the pulses to bounce back after hitting an object. This information is used to calculate the distance.
3. **RF Transmitter Module:** The RF transmitter module is responsible for wirelessly transmitting data from the Arduino to the RF receiver module. It converts the data into radio frequency signals that can be transmitted over the air.
4. **RF Receiver Module:** The RF receiver module receives the transmitted data from the RF transmitter module. It converts the received radio frequency signals back into digital data, which can be processed by the Arduino.

Circuit Diagram:



Discussion:

This experiment successfully demonstrates the integration of an ultrasonic sensor, RF transmitter-receiver pair, and Arduino to measure distance and transmit the data wirelessly. The ultrasonic sensor accurately measures the distance to an object using sound waves, while the RF modules enable convenient wireless communication between the transmitter and receiver. This setup offers advantages such as flexibility, remote operation, and reduced wiring complexity. The experiment showcases the potential applications of such a system in fields such as robotics, automation, and remote monitoring, where distance measurement and wireless data transmission are crucial.

Transmitter Arduino Code:

```
#include <VirtualWire.h>

char msg[4];

void setup() {
  Serial.begin(9600);
  vw_set_ptt_inverted(true);
  vw_setup(2000);
  vw_set_tx_pin(12);
  pinMode(10, OUTPUT);
  pinMode(9, INPUT);
}

void loop() {
  digitalWrite(10, LOW);
  delayMicroseconds(10);
  digitalWrite(10, HIGH);
  delayMicroseconds(10);
  digitalWrite(10, LOW);

  long duration = pulseIn(9, HIGH);
  long distance = (duration * 0.034) / 2;

  Serial.print("Distance from object: ");
  Serial.print(distance);
  Serial.println(" cm");
  delay(100);

  itoa(distance, msg, 10);

  vw_send((uint8_t*)msg, sizeof(distance));
  delay(100);
}
```

Receiver Arduino Code:

```
#include <VirtualWire.h>

int i;

void setup() {
  Serial.begin(9600);
  vw_set_ptt_inverted(true);
  vw_setup(2000);
  vw_set_rx_pin(11);
  vw_rx_start();
}

void loop() {
  uint8_t buf[VW_MAX_MESSAGE_LEN];
  uint8_t buflen = VW_MAX_MESSAGE_LEN;

  if (vw_get_message(buf, &buflen)) {
    Serial.print("Received distance: ");

    for (i = 0; i < buflen; i++) {
      char ch = buf[i];
      Serial.print(ch);
    }

    Serial.println(" cm");
  }
}
```