Project Report

Course Title : Big Data and IoT Lab

Course Code: CSE413

Submitted To:

Md. Asif Mahmud Ridoy

Lecturer

Department of Computer Science and Engineering

Daffodil International University

Submitted By:

Name	ID	Section
Md. Fahmid Bin Mostafa	212-15-4233	59_A2
Jubayer Ahmed	201-15-3372	59_A2

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Project Title: Smart Car Parking System and Temperature Monitoring System

1. Project Description: The smart car parking system and temperature monitoring system utilizes an Arduino microcontroller to monitor distances using ultrasonic sensors and temperature using an analog temperature sensor. The project integrate servo motors and buzzer also. Ultrasonic sensor measure the distance and control the servo motor by its distance. Temperature sensor measure the temperature of environment. The temp and open/closed servo shows on LCD display.

2. Equipment's:

Ultrasonic Sensors:

- **Function:** Measure the distance to an object using sound waves.
- **Components:** Trigger pin to send sound waves, Echo pin to receive them.
- **Range:** 2cm to 400cm with an accuracy of 3mm

Temperature Sensor (TMP36):

- **Function:** Measures the ambient temperature.
- **Components:** Analog sensor with a voltage output that varies linearly with temperature.
- **Range:** -40°C to +125°C.

Servos (SG90):

- **Function:** Actuate based on control signals to move objects.
- **Components:** Small motor with control circuitry to position the shaft.

Buzzer:

- **Function:** Produce sound alerts.
- **Components:** Piezoelectric component that generates sound when voltage is applied.

Liquid Crystal Display (LCD 16x2):

- **Function:** Display text information.
- **Components:** 16 columns and 2 rows of characters, controlled via I2C communication.

.3. Environment Setup:

Use tinkercad online simulation for this project. Run the project on tinkercad.com. Three setup the all components sequentially and connect with each other.

4. Circuit Diagram:

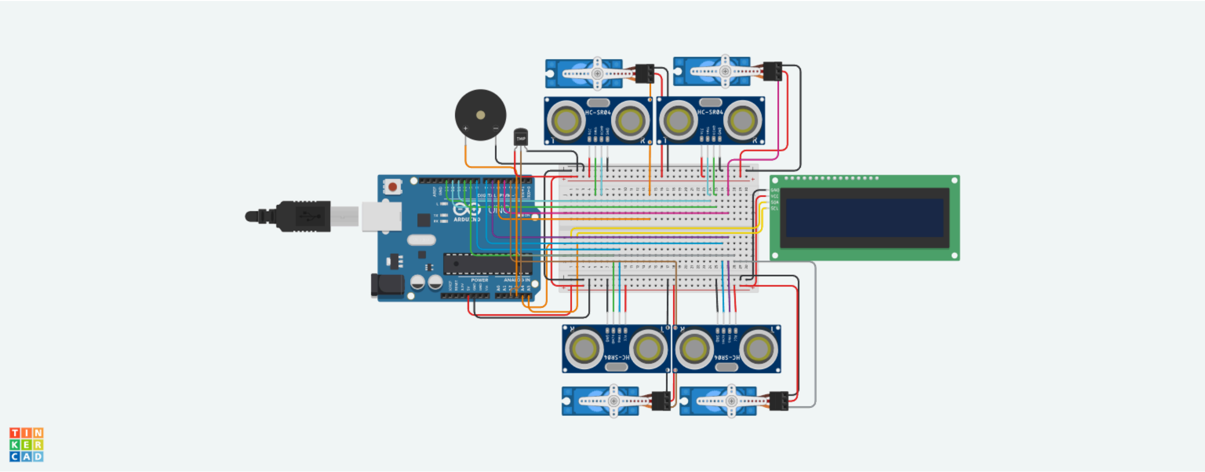

Fig: Report.1

5. Data Collection Procedure:

Data Collection:

- Ultrasonic Sensors: Measure the time taken for sound waves to travel to an object and back. Convert this time into distance.
- Temperature Sensor: Read analog voltage and convert it to temperature.

Data Preprocessing:

- Distance Data: Filter noise by averaging multiple readings.
- Temperature Data: Convert analog readings to voltage and then to temperature using a linear transformation.

Visualization:

- LCD Display: Real-time display of temperature and status of servos (opened/closed).

6. Project Implementations:

- **Code:**

```
#include<LiquidCrystal_I2C.h>
#include<Servo.h>

const int servoPins[4] = {5, 4, 3, 2};
Servo servos[4];

int buzzer = A3;
int sensorValue;
int sensorPin = A2;
float temp;

const int trigPins[4] = {13, 11, 8, 6};
const int echoPins[4] = {12, 10, 9, 7};

long duration;
int distance;

LiquidCrystal_I2C lcd(32,16,2);

long measureDistance(int trigPin, int echoPin) {
  long duration, distance;
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = (duration / 2) / 29.1;
  return distance;
}

void setup() {
  Serial.begin(9600);
  lcd.init();
  lcd.backlight();
  pinMode(buzzer, OUTPUT);

  for (int i = 0; i < 4; i++) {
    pinMode(trigPins[i], OUTPUT);
    pinMode(echoPins[i], INPUT);
  }
  for (int i = 0; i < 4; i++) {
    servos[i].attach(servoPins[i]);
  }
}

void loop() {
  lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Servos Open:");

for (int i = 0; i < 4; i++) {
  long distance = measureDistance(trigPins[i], echoPins[i]);
  Serial.print("Distance for sensor ");
  Serial.print(i);
  Serial.print(": ");
  Serial.println(distance);

  if (distance < 200) {
    digitalWrite(buzzer, HIGH);
    servos[i].write(90);
    lcd.setCursor(0, 1);
    lcd.print("Servo ");
    lcd.print(i + 1);
    lcd.print(" Open");
  } else {
    digitalWrite(buzzer, LOW);
    servos[i].write(0);
    lcd.setCursor(0, 1);
    lcd.print("No Servo Opened");
  }
}
```

```
  sensorValue = analogRead(sensorPin);

  float voltage = sensorValue * (5.0 / 1023.0);

  temp = (voltage - 0.5) * 100.0;


  lcd.clear();

  lcd.setCursor(0, 0);

  lcd.print("Temperature: ");

  lcd.setCursor(0, 1);

  lcd.print(temp);


  delay(1000);

}
```

7. Conclusion:

The Smart Car Parking System and Temperature Monitoring System successfully integrates ultrasonic sensors, a temperature sensor, servos, a buzzer, and an LCD display with an Arduino microcontroller. It effectively measures distances and temperature, activating servos and a buzzer based on the distance to objects. The project demonstrates the practical application of IoT devices in real-time monitoring and control systems.

8. Reference:

- Arduino Documentation: https://www.arduino.cc/en/Reference/HomePage
- LiquidCrystal_I2C Library: https://github.com/johnrickman/LiquidCrystal_I2C
- Servo Library: https://www.arduino.cc/en/Reference/Servo
- Ultrasonic Sensor HC-SR04: https://www.sparkfun.com/products/15569
- Temperature Sensor TMP36: https://www.analog.com/en/products/tmp36.html