Voice-Controlled Smart Car Project Report

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1. Code Documentation

Arduino Code with Comments

```
#include <SoftwareSerial.h>  // Enables serial communication via Bluetooth
#include <Servo.h>           // Controls the servo motor
#include <DHT.h>             // Reads temperature and humidity from DHT11

#define DHTPIN 2             // DHT11 data pin
#define DHTTYPE DHT11        // Sensor type
DHT dht(DHTPIN, DHTTYPE);   // Initialize DHT sensor

Servo myServo;               // Servo object for ultrasonic sensor mounting
SoftwareSerial BT(10, 11);   // RX (Pin 10), TX (Pin 11) for HC-05

// Motor control pins (L298N driver)
#define IN1 4
#define IN2 5
#define IN3 6
#define IN4 7

// Ultrasonic sensor pins
#define TRIG 8
#define ECHO 9

// IR sensor pin
#define IR_SENSOR A0

void setup() {
   Serial.begin(9600);      // Initialize serial monitor
   BT.begin(9600);          // Start Bluetooth communication
   dht.begin();             // Start DHT sensor
   myServo.attach(3);       // Attach servo to Pin 3
   myServo.write(90);       // Center servo position
```

```
    // Set motor pins as outputs
    pinMode(IN1, OUTPUT);
    pinMode(IN2, OUTPUT);
    pinMode(IN3, OUTPUT);
    pinMode(IN4, OUTPUT);

    // Ultrasonic sensor setup
    pinMode(TRIG, OUTPUT);
    pinMode(ECHO, INPUT);

    // IR sensor setup
    pinMode(IR_SENSOR, INPUT);
}

void loop() {
    // Check for Bluetooth commands
    if (BT.available()) {
        char command = BT.read();
        processCommand(command);  // Execute voice command
    }

    checkObstacle();      // Detect obstacles via ultrasonic sensor
    monitorEnvironment(); // Log temperature/humidity data
}

// Function to process voice commands
void processCommand(char cmd) {
    switch (cmd) {
        case 'F': forward(); break;
        case 'B': backward(); break;
        case 'L': left(); break;
        case 'R': right(); break;
        case 'S': stopCar(); break;
        default: stopCar(); break;
    }
}

// Motor control functions (self-explanatory)
void forward() {
    digitalWrite(IN1, HIGH); digitalWrite(IN2, LOW);
```

```
  digitalWrite(IN3, HIGH); digitalWrite(IN4, LOW);
}
// ... (other motor functions omitted for brevity)
```

Key Features:

- **Bluetooth Control**: HC-05 module processes voice commands (e.g., ‘F’ for forward).
- **Obstacle Detection**: Ultrasonic sensor stops the car if distance < 20cm.
- **Environmental Monitoring**: DHT11 logs temperature/humidity data.

2. User Manual

Setup Instructions

1. **Hardware Assembly**:
    - Mount components on the acrylic chassis
    - Connect motors to L298N driver (IN1–IN4 → Arduino Pins 4–7).
    - Power the system with two 18650 batteries (7.4V).
2. **Software Setup**:
    - Install Arduino IDE and required libraries (`DHT.h`, `Servo.h`).
    - Upload the provided code to Arduino Uno.
3. **Bluetooth Pairing**:
    - Pair HC-05 with smartphone (default PIN: 1234).
    - Use a Bluetooth control app (e.g., "Arduino Bluetooth Controller") to send commands:
        - **Voice Commands**: "Forward" → ‘F’, "Stop" → ‘S’, etc.

Troubleshooting

Issue	Solution
Motors not responding	Check L298N connections and battery voltage.
Bluetooth fails to pair	Verify HC-05 is in pairing mode (LED blinking).

Sensor data inaccurate	Recalibrate DHT11/ultrasonic sensor connections.

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3. Testing and Modifications Log

Performance Observations:

- Motor response time: 0.5s delay after voice command.

Battery life: ~2 hours continuous use.

Demonstration: