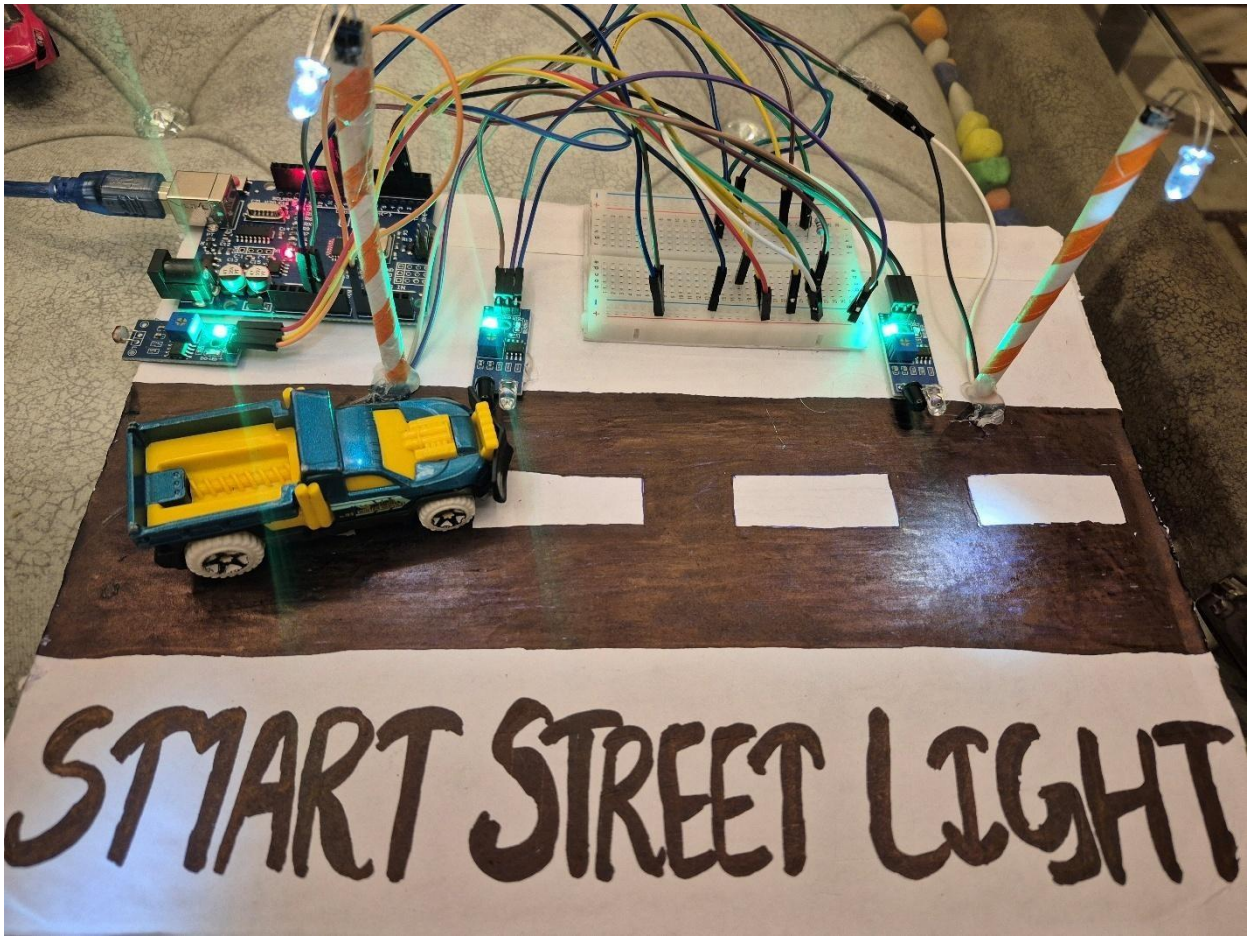
Smart Automatic Street Lighting System

Team No. 5

The Smart Automatic Street Lighting System is a modern solution aimed at conserving electrical energy and enhancing road safety. This project automates street lights using an Arduino microcontroller, a Light Dependent Resistor (LDR) to detect daylight, and Infrared (IR) sensors to detect motion of vehicles or pedestrians. The system ensures that street lights operate only when necessary — turning off during daytime, glowing dimly during nighttime when no activity is detected, and becoming bright upon detecting motion.

MODEL:



Objective :

The Smart Automatic Street Lighting System improves energy efficiency and safety by automatically controlling street lights based on ambient light and motion detection. Main objectives:

1. **Minimize power wastage** by automating street light control
2. **Ensure lighting operates only when needed** (day/night detection)
3. **Provide brighter illumination** when motion is detected at night

4. **Demonstrate an affordable, scalable solution** using Arduino technology

Hardware & Software Requirements:

Hardware:

- Arduino UNO : Microcontroller for processing sensor data and controlling LEDs.
- LDR sensor module: Detects the ambient light intensity (day/night detection).
- 2x IR sensor modules:Detect motion of vehicles or pedestrians near each light.
- 2x LEDs(5mm):Represent street lights; brightness controlled via PWM pins.
- 2x Resistors (220Ω): Limit current through LEDs.
- Breadboard and jumper wires (MM/MF/FF): For connecting all components.

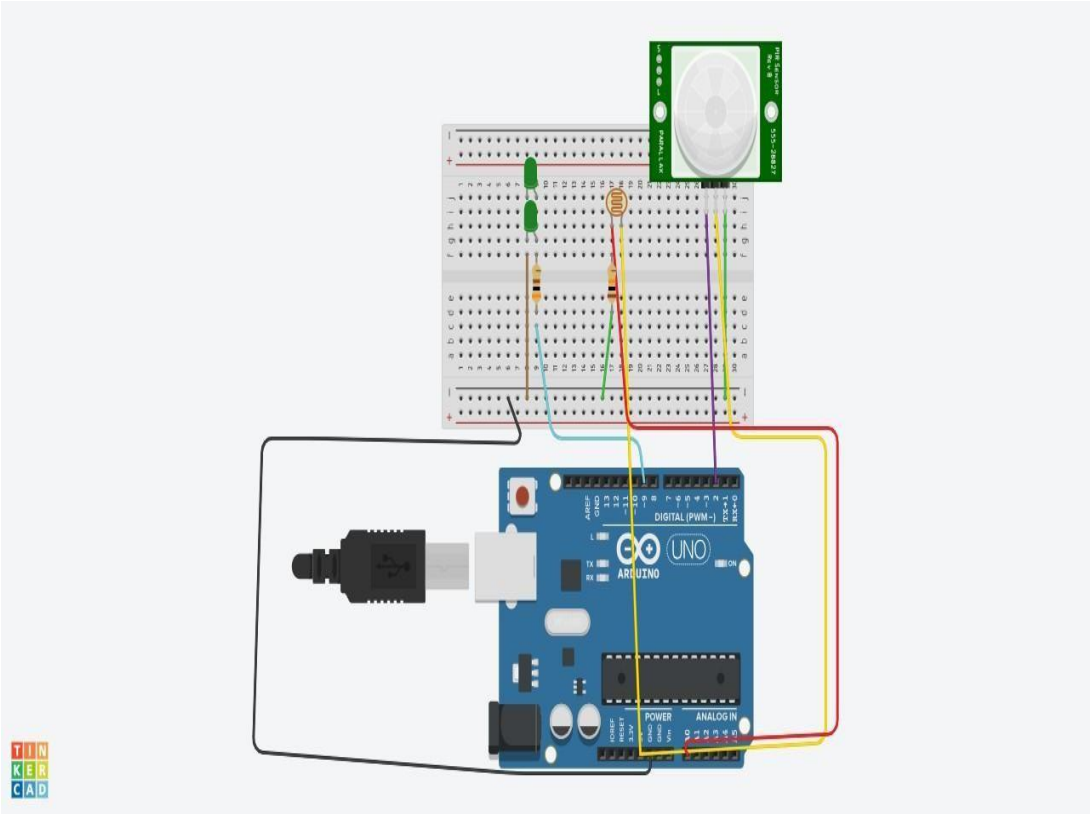
Software:

.Arduino IDE

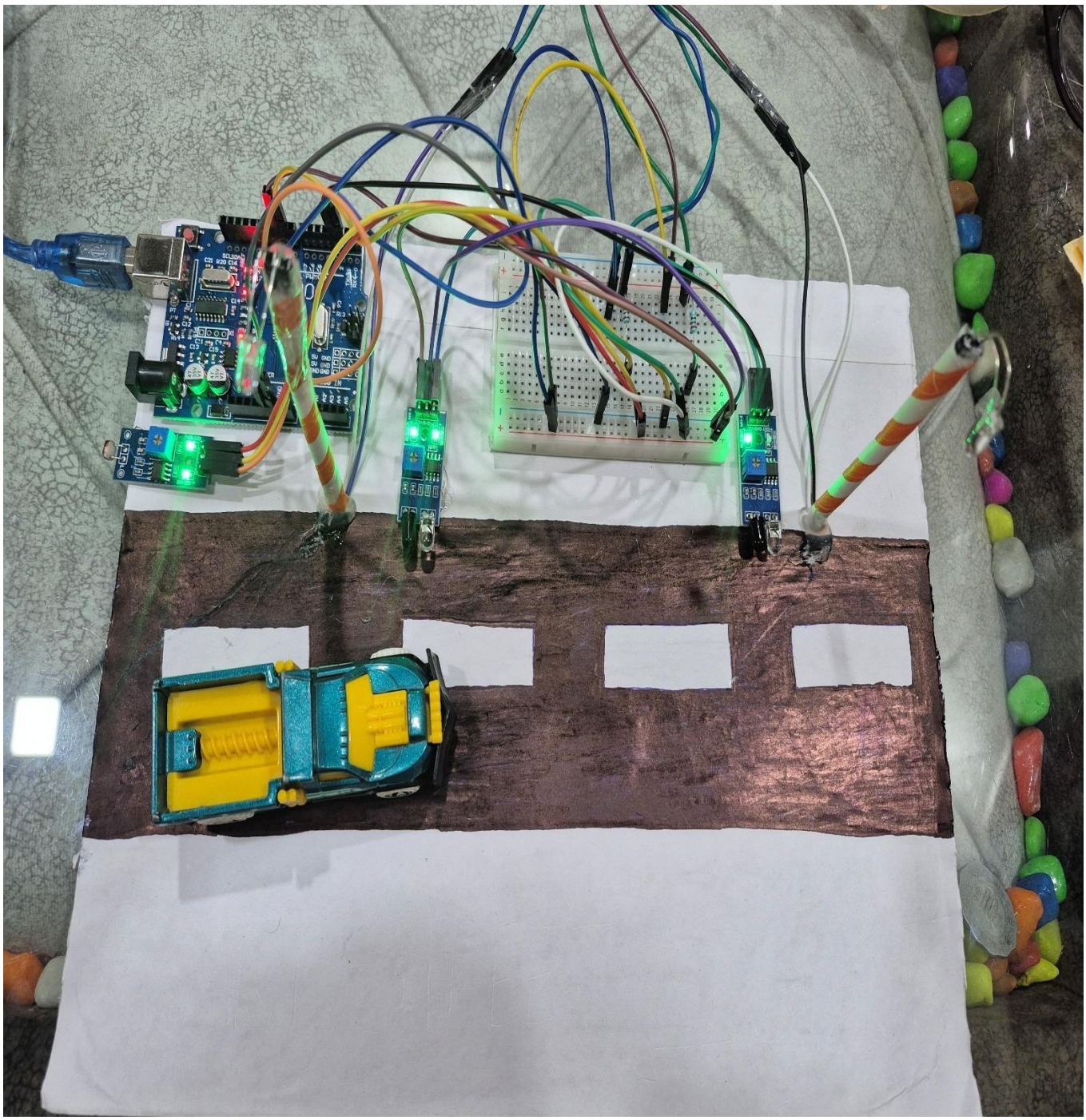
.Tinkercad

Circuit Diagram :

Tinkercad Simulation :

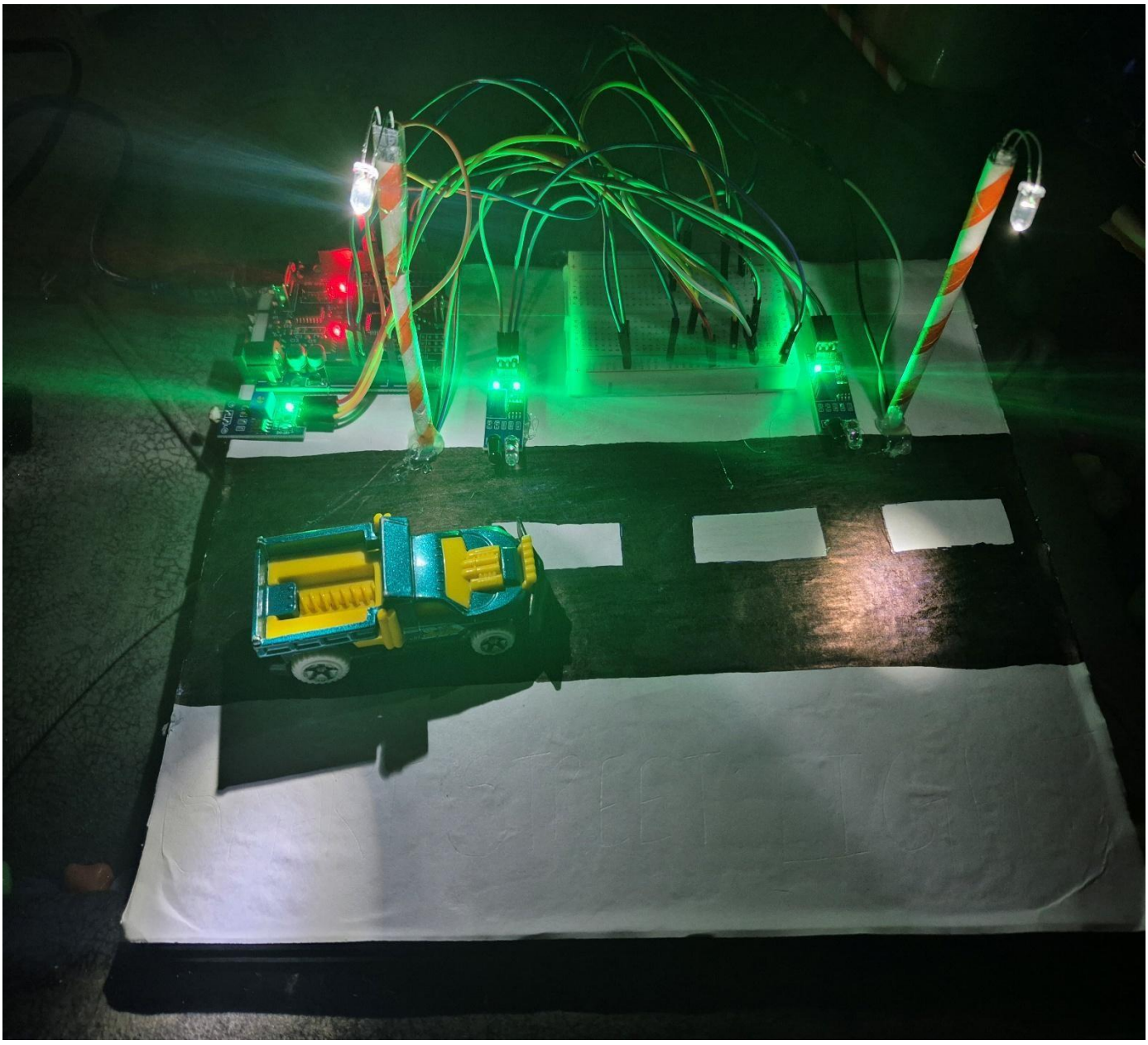


During DAY time: LIGHT OFF



<u>During NIGHT time</u>: DIM LIGHT when no motion is detected

BRIGHT LIGHT when motion is detected



<u>Pin Connections:</u>

Component	Arduino Pin	Description

LDR Sensor	A0	Analog input for light detection
IR Sensor 1	D2	Motion detection for LED 1
IR Sensor 2	D3	Motion detection for LED 2
LED 1	D9	PWM output (with resistor)
LED 2	D10	PWM output (with resistor)

Working Principle :

Day Operation: LDR detects high light → All LEDs OFF
Night Operation: Low light detected → LEDs at dim level
Motion Detection: IR sensor triggered → LED brightens for 2 seconds

The system uses PWM for smooth brightness control and efficient energy usage.

ARDUINO CODE:

```
// --- Pin Configuration ---
const int LDR_PIN  = A0;
const int IR1_PIN  = 2;
const int IR2_PIN  = 3;
const int LED1_PIN = 9;
const int LED2_PIN = 10;

// --- Parameters ---
int ldrThreshold = 600;   // LDR value above which it's considered dark
int dimLevel     = 50;    // LED dim brightness
int brightLevel  = 255;   // LED full brightness
unsigned long duration = 100; // Time LED stays bright after motion (ms)

// --- State Variables ---
unsigned long motionTime1 = 0;
unsigned long motionTime2 = 0;

void setup() {
  pinMode(IR1_PIN, INPUT);
  pinMode(IR2_PIN, INPUT);
  pinMode(LED1_PIN, OUTPUT);
  pinMode(LED2_PIN, OUTPUT);

  Serial.begin(9600);
}

void loop() {
  int ldrVal  = analogRead(LDR_PIN);
  int ir1Val  = digitalRead(IR1_PIN);
  int ir2Val  = digitalRead(IR2_PIN);

  bool isNight = (ldrVal > ldrThreshold);
```

```
  if (!isNight) {
    // Daytime → Turn off LEDs
    analogWrite(LED1_PIN, 0);
    analogWrite(LED2_PIN, 0);
  }
  else {
    // --- LED 1 Control ---
    if (ir1Val == LOW) {
      analogWrite(LED1_PIN, brightLevel);
      motionTime1 = millis();
    }
    else if (millis() - motionTime1 < duration) {
      analogWrite(LED1_PIN, brightLevel);
    }
    else {
      analogWrite(LED1_PIN, dimLevel);
    }

    // --- LED 2 Control ---
    if (ir2Val == LOW) {
      analogWrite(LED2_PIN, brightLevel);
      motionTime2 = millis();
    }
    else if (millis() - motionTime2 < duration) {
      analogWrite(LED2_PIN, brightLevel);
    }
    else {
      analogWrite(LED2_PIN, dimLevel);
    }
  }

  delay(100);
}
```

Conclusion & Future Scope :

Conclusion:

Successfully demonstrates automated street lighting that saves energy while maintaining safety through motionresponsive illumination.

Key Benefits:

- Energy efficient operation
- Automatic day/night detection
- Motion-responsive lighting
- Cost-effective Arduino implementation

Future Enhancements:

- IoT integration for remote monitoring
- Solar power integration
- Mobile app control
- Smart city network integration
- Weather-based adjustments