Arduino Project Report
Light-Activated LED with PWM Control

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Project Objective

This project demonstrates how to use a photoresistor (LDR) with an Arduino to control an LED based on ambient light levels using Pulse Width Modulation (PWM). The LED behavior is:

- If the light level is **low**, the LED turns **fully on**.

- If the light level is **high**, the LED turns **off**.

- If the light level is **in between**, the LED glows at **50% brightness**.

Components Used

- Arduino Uno board

- Breadboard

- LED (Red)

- 220 resistor (for LED)

- LDR (Light Dependent Resistor)

- 10k resistor (pull-down for LDR)
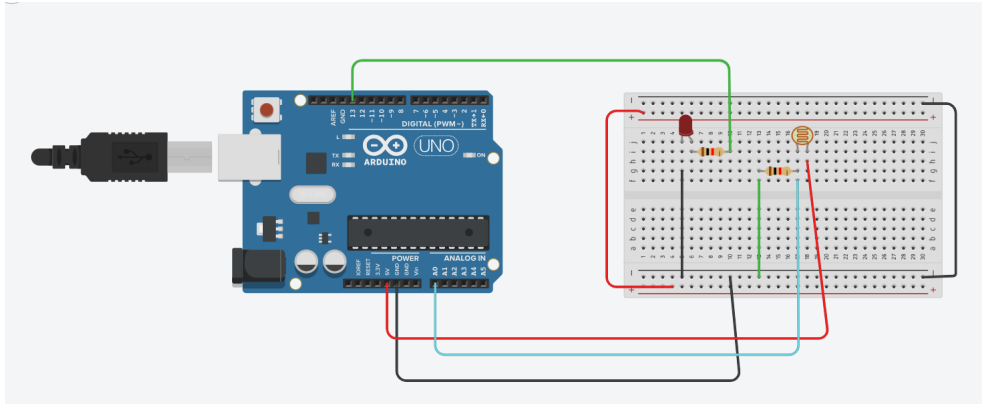
- Jumper wires

- USB Cable

Circuit Diagram

Figure 1: Arduino Circuit for LDR-Controlled LED

Wiring Explanation

- The LDR is connected in a voltage divider configuration between 5V and GND.

- The junction of the LDR and 10k resistor goes to analog pin A0 of the Arduino.

- The LED is connected to digital pin 13 via a 220 resistor.

Arduino Code

```
// set variables
int sensorValue = 0;

void setup() {
  // pin for LDR
  pinMode(A0, INPUT);
  // pin for LED
  pinMode(13, OUTPUT);
  // starts the serial monitor
```

```
  Serial.begin(9600);
}

void loop() {
  // read the value from the sensor (range: approx. 54 - 974)
  sensorValue = analogRead(A0);

  // print the sensor reading to Serial Monitor
  Serial.println(sensorValue);

  // map the sensor reading to LED brightness
  int fade = map(sensorValue, 54, 974, 0, 255);
  Serial.println(fade);

  analogWrite(13, fade);
  delay(100); // delay for stability
}
```

Tinkercad Simulation

You can simulate this circuit online using the link below:
https://www.tinkercad.com/things/5T32jPLbcHc-task3?sharecode=1FuUD7XkfRCc-Bpv675B8

How It Works

- The LDR senses ambient light. As light intensity increases, resistance decreases, causing a voltage change at A0.

- The Arduino reads this voltage and maps it to a PWM value (0-255).

- The LED brightness changes based on this value.

Extensions and Harder Versions

- Add an LCD screen to display light levels.

- Use multiple LEDs with different brightness levels.

- Add a real-time clock (RTC) to adjust brightness based on time.

- Use a relay to control AC appliances depending on light.

Similar Projects

- Automatic Street Lighting System

- Light-Sensitive Night Lamp

- Plant Growth Monitoring System

- Smart Window Blinds using LDR and Servo