Automatic Light Control and Monitoring System

Project Description

This project automatically controls and monitors light based on ambient lighting conditions using an LDR (Light Dependent Resistor). It includes two core parts:

- Basic Light Switching System using discrete electronics.

- Smart Monitoring System using Arduino and a SIM module.

Components Used

LDR (Light Sensor) (2) - Detects ambient light levels

Resistors (4) - 10k, 1k, 330 resistors for biasing and LEDs

BC547 Transistor (1) - Controls the relay based on LDR output

Relay (12V) (1) - Switches the AC light based on control signal

Arduino UNO (1) - Microcontroller for digital light monitoring

SIM800L Module (1) - (Optional) Sends SMS for monitoring

LED (Green) (1) - Indicator for light status

Diode (D1) (1) - Protects the circuit from back-EMF from relay

AC Bulb (L1) (1) - Load (Light Bulb - 230V)

Power Supply (1) - +5V and +12V for circuit

PCB Board (1) - For final implementation and compact design

Circuit Description

1. Basic Light Control (Discrete Circuit)

Function:

- Uses LDR to sense light.

- In dark conditions (high resistance), the transistor conducts.

- This activates the relay and turns ON the AC bulb.

Circuit Flow:

1. LDR + R2 forms a voltage divider.

2. In darkness, LDR resistance increases, base voltage to Q1 (BC547) increases.

3. Q1 turns ON -> Relay energizes -> Bulb ON.

4. In bright light, LDR resistance drops -> Q1 OFF -> Bulb OFF.

2. Smart Light Monitor (Arduino-Based)

Function:

- Uses another LDR to read light levels.

- Displays info via serial terminal.

- Blinks LED if light is below a threshold.

- Can be extended to send SMS using SIM module.

Arduino Logic (Pseudocode):

```
int lightValue = analogRead(A0);
if (lightValue < threshold) {
  digitalWrite(LED_PIN, HIGH); // LED ON
  Serial.println("Dark Environment");
} else {
  digitalWrite(LED_PIN, LOW);  // LED OFF
  Serial.println("Bright Environment");
}
```

PCB Design Overview

- Includes key components: LDR, Resistors, Relay module, LED.

- Routes are optimized for minimal interference.

- Compact layout ideal for enclosure and real-world deployment.

Applications

- Home or office automatic lighting.

- Smart energy-saving system.

- Can be integrated into IoT platforms.