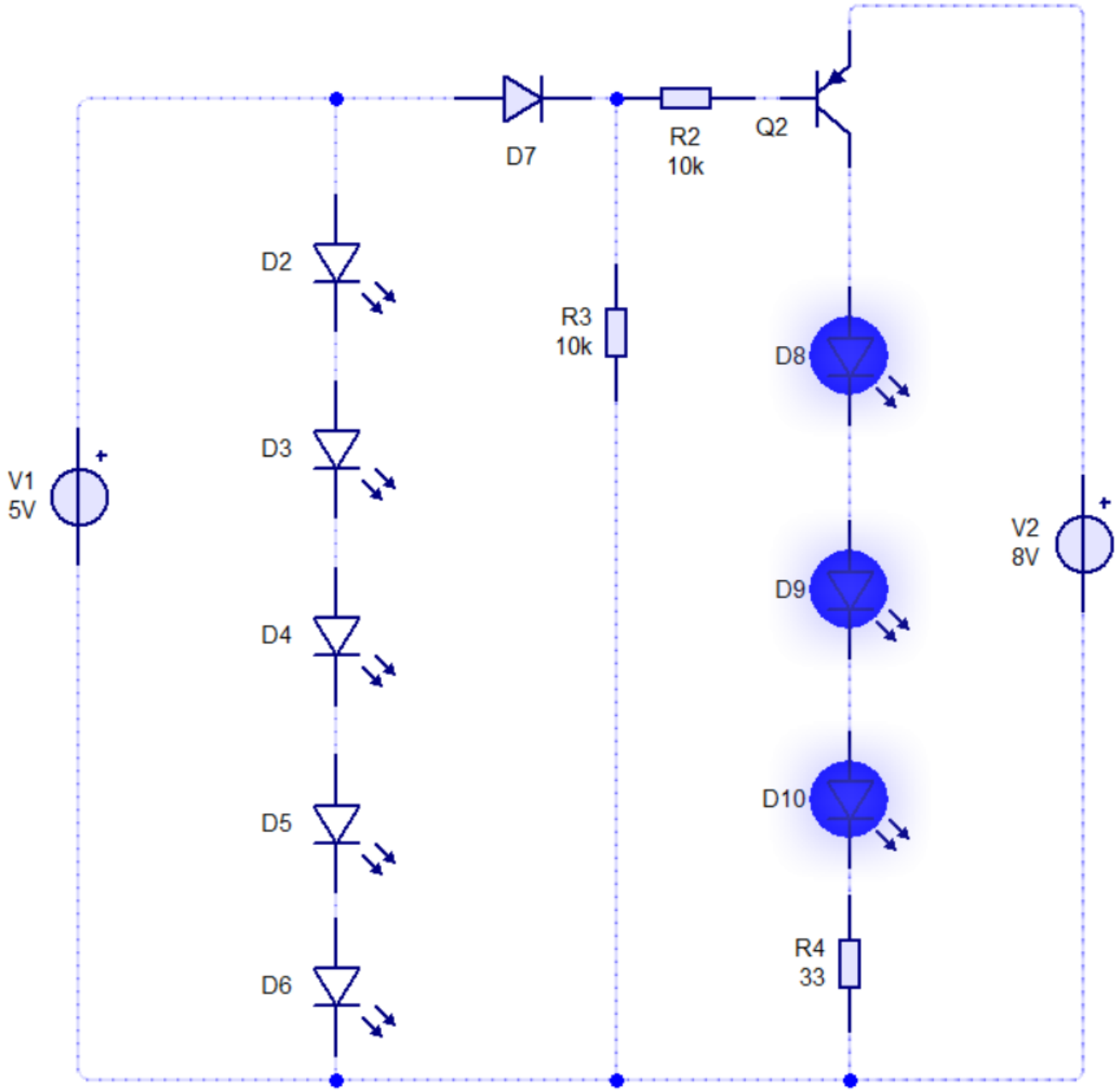
# Dual-Source Automatic Day/Night LED Control Using Zener Reference and BJT Switching

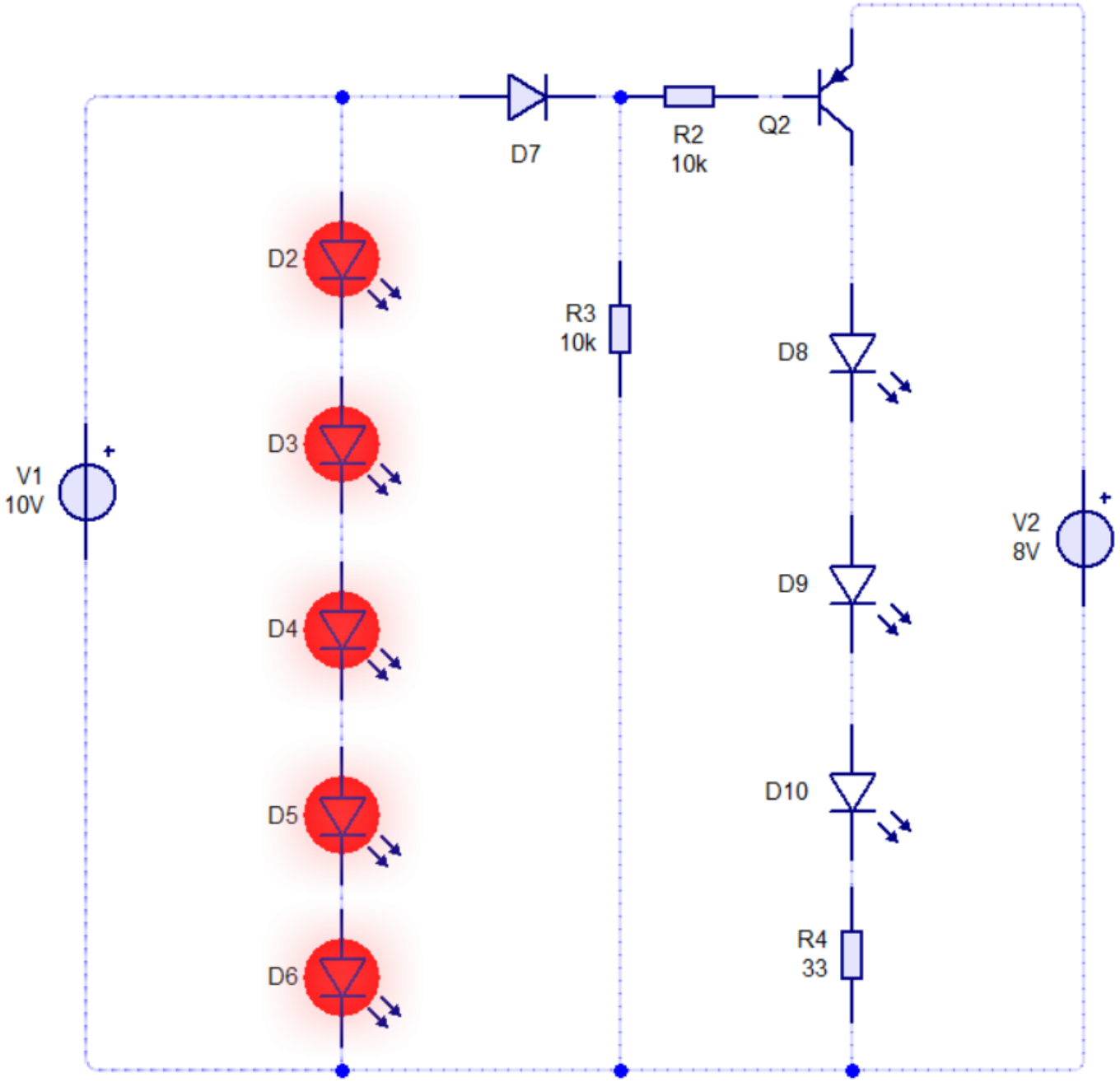
## How It Works

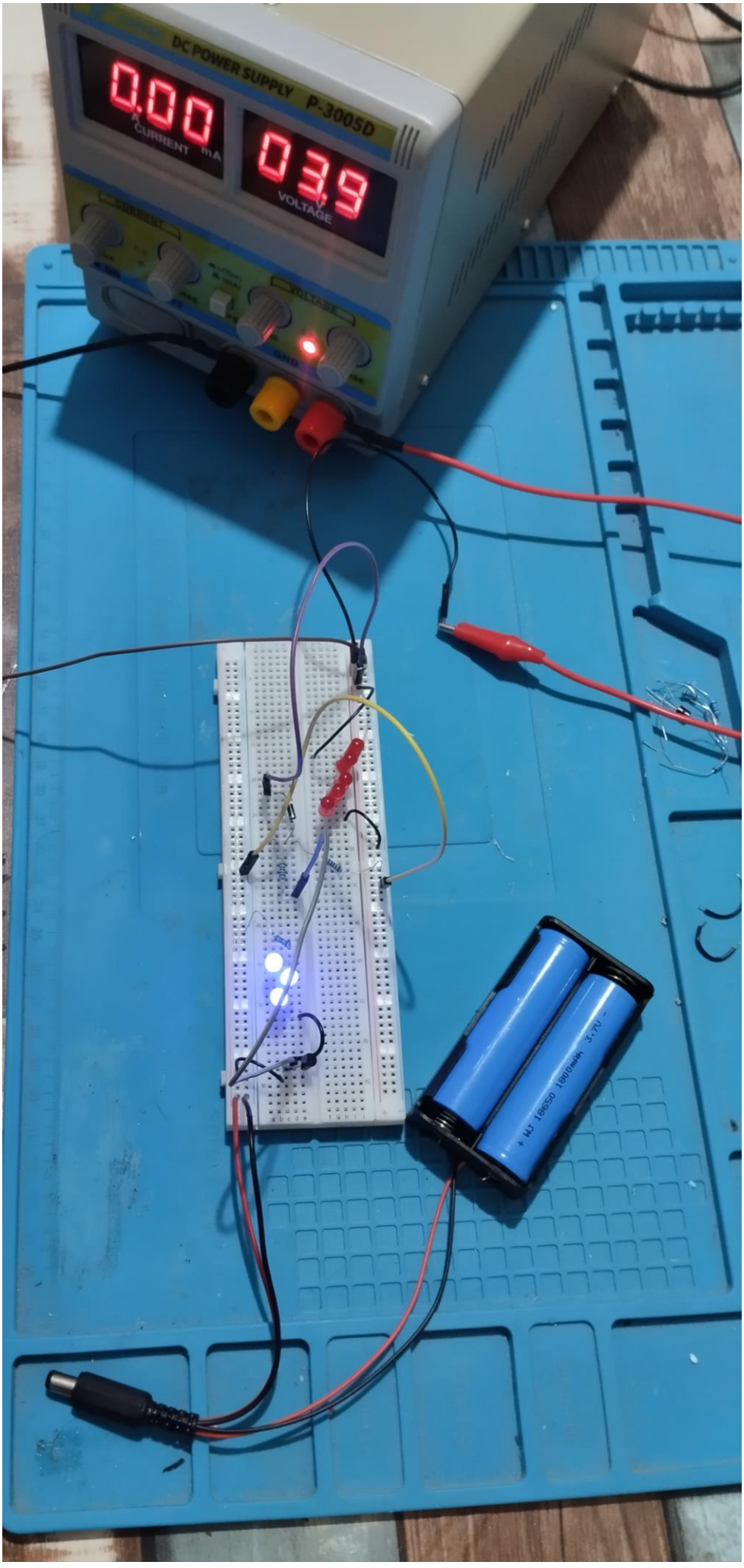
This project is an automatic lighting control system that simulates a solar-powered day/night switching circuit using discrete components.

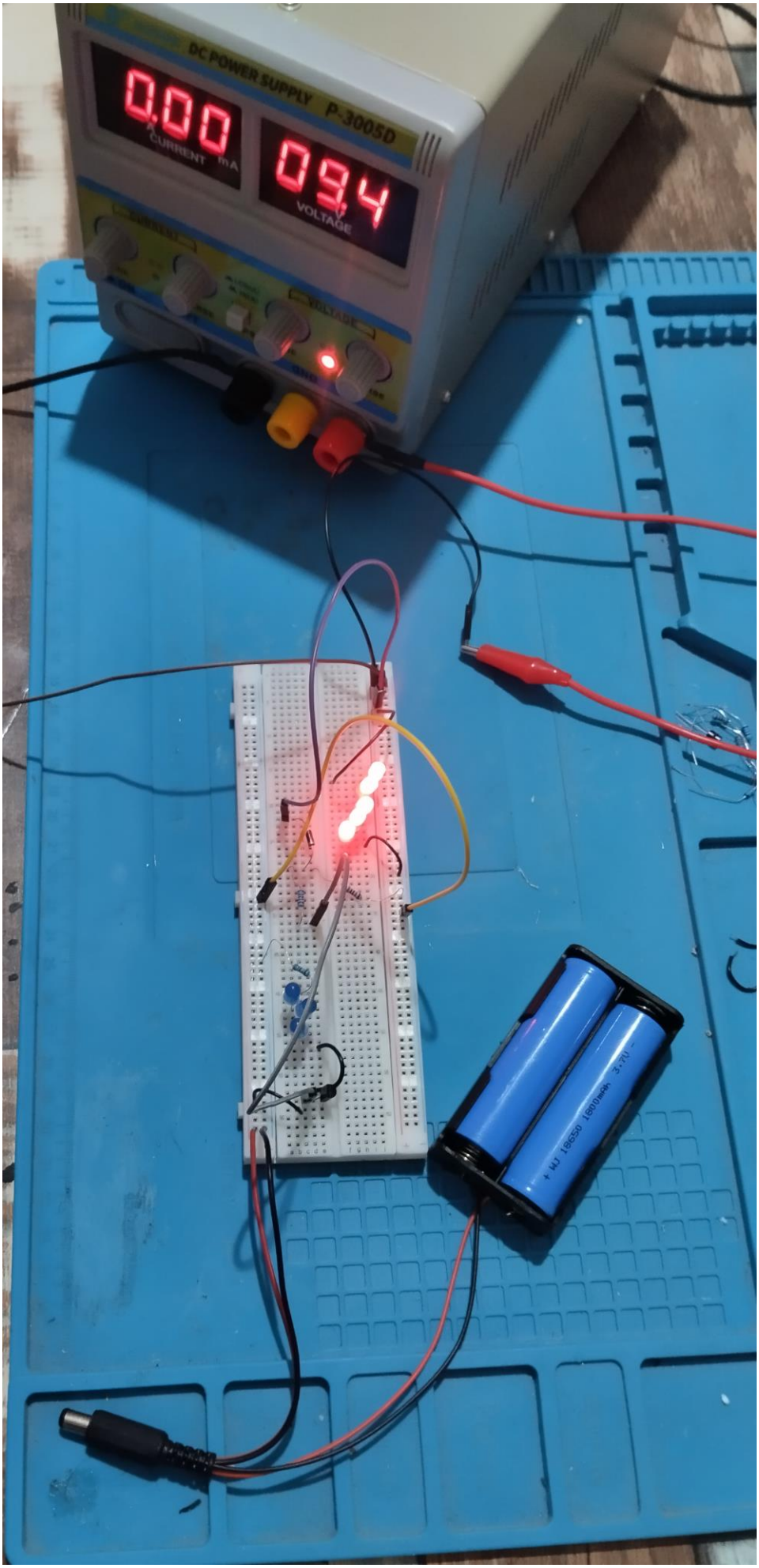
The left DC source represents a solar panel. Instead of using a real panel, I used a variable DC power supply to simulate sunlight intensity.

I first used this circuit of a maximum 10V solar panel source

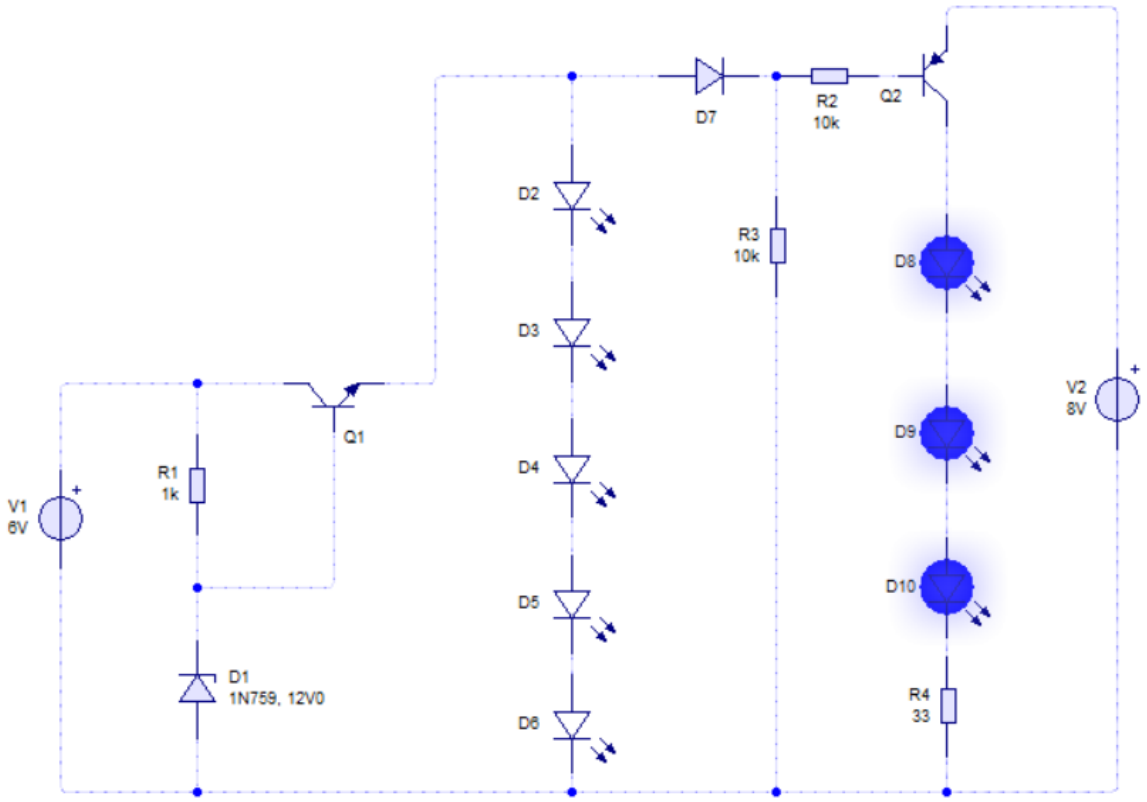


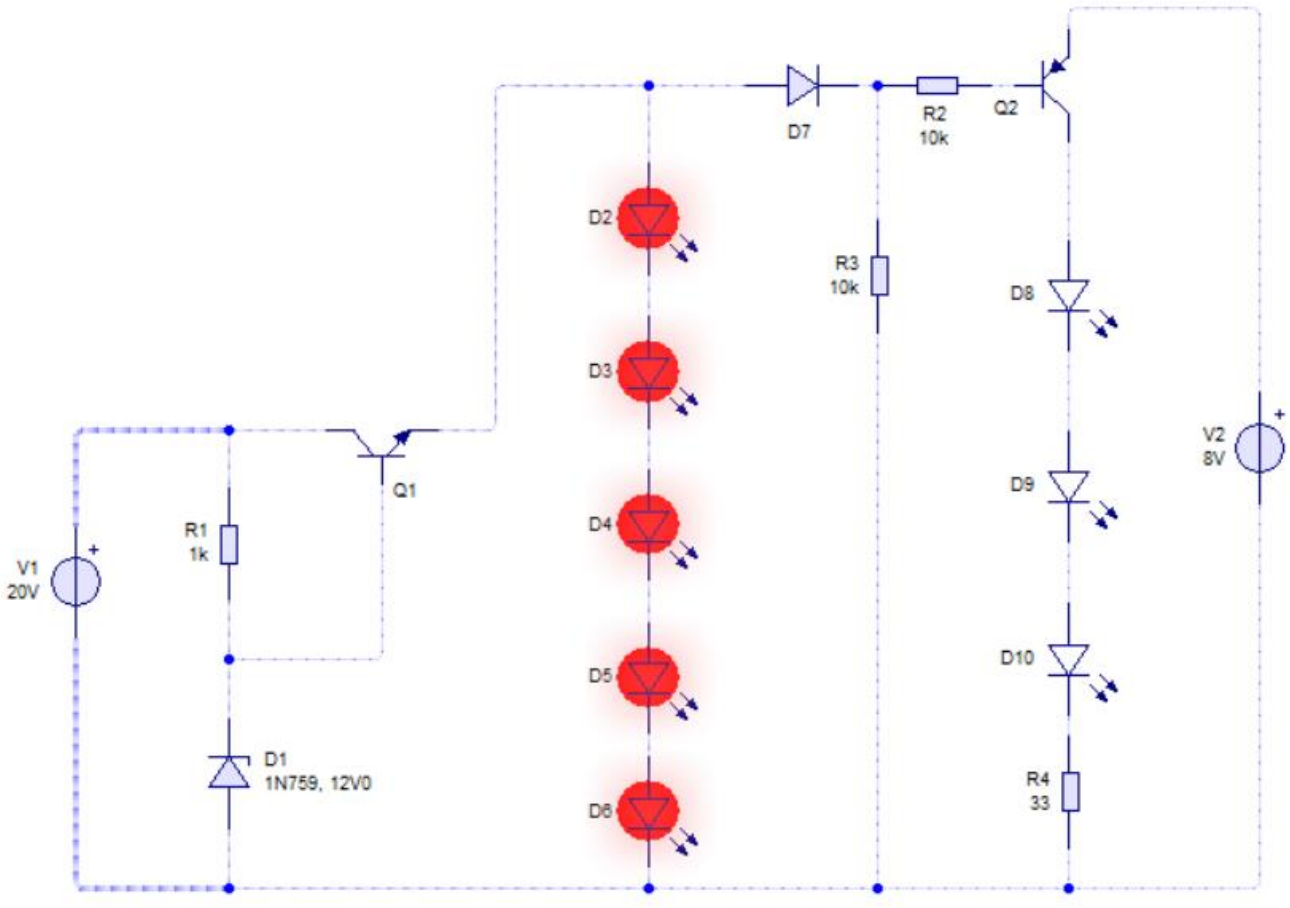

D7
R2
10k
Q2
D2
R3
10k
D8
V1
10V
D3
V2
8V
D4
D9
D5
D10
D6
R4
33

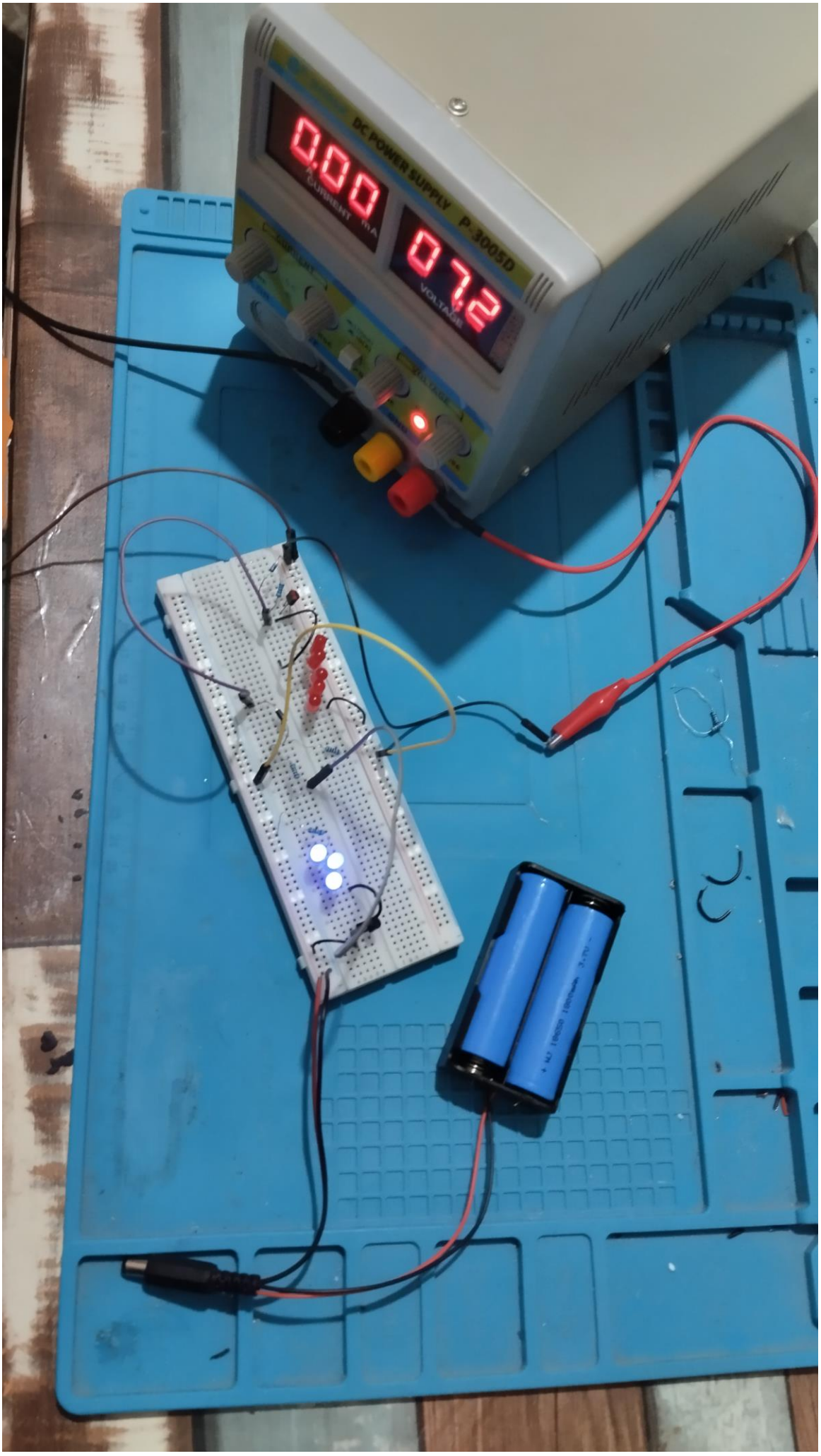

DC POWER SUPPLY P-3005D
0.00
CURRENT
mA
03.9
VOLTAGE
18650 1800mAh 3.7V

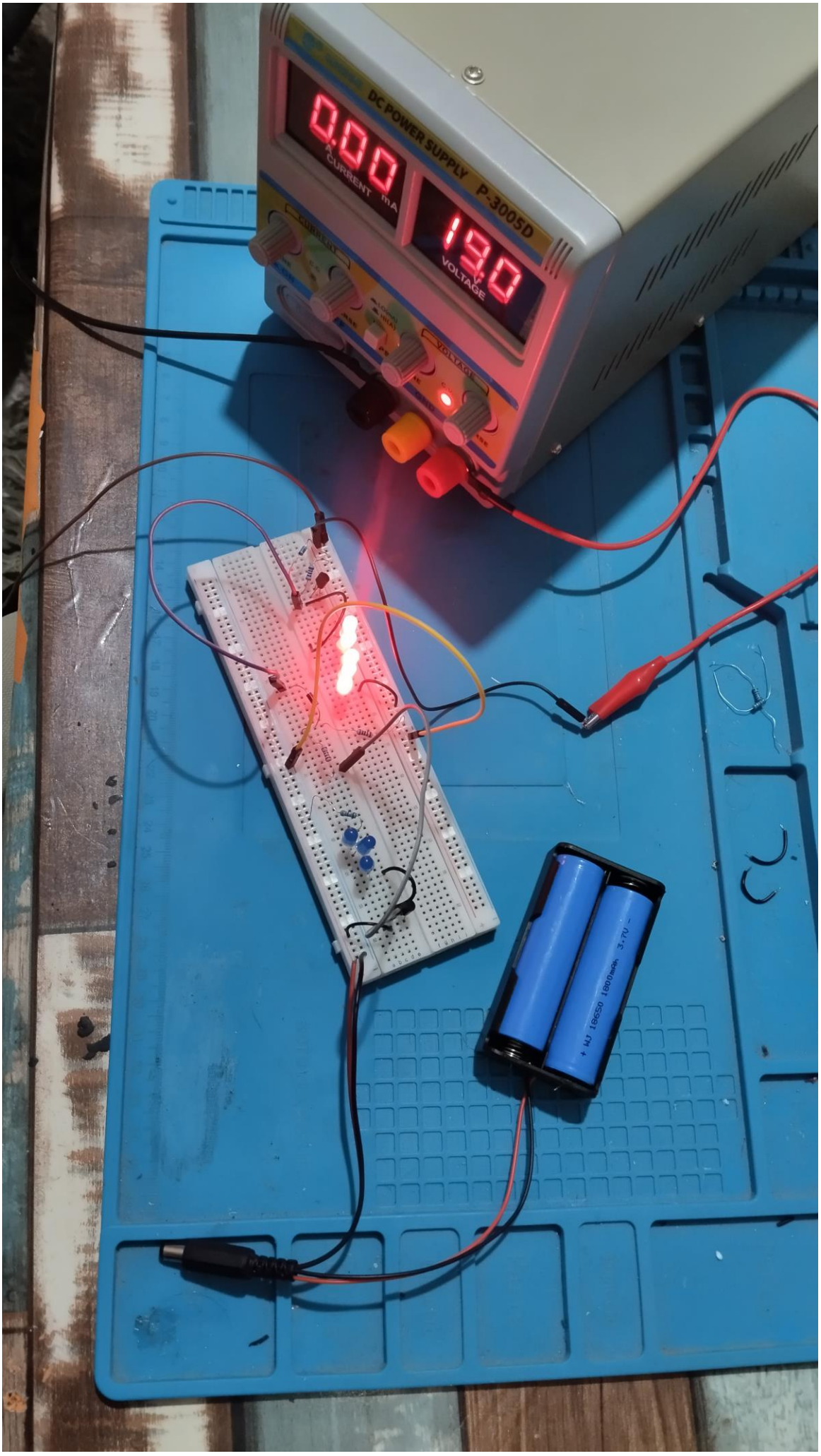

DC POWER SUPPLY P-3005D
0.00
CURRENT mA
09.4
VOLTAGE

Then I improved it with a zener diode so even if voltage source is up of 10v the led don’t blow up with a npn transistor so it will takes the power dissipation instead of the zened diode.




DC POWER SUPPLY
P-3005D
0.00
CURRENT mA
07.2
VOLTAGE


DC POWER SUPPLY P-3005D
0.00
A CURRENT mA
19.0
V VOLTAGE

**Day Mode (High Voltage – Above ~7V)**

- When the left source voltage increases (simulating strong sunlight),
- The Zener diode (1N759 – 12V) creates a voltage reference.
- The PNP transistor (2N5401) turns ON.
- The red LED string (D2–D6) lights up.
- The right-side transistor stage remains OFF.
- Blue LEDs are OFF.
- This simulates daytime operation.

**Night Mode (Low Voltage – Below ~7V)**

- When the left source voltage drops (simulating sunset),
- The Zener no longer maintains conduction.
- The PNP transistor turns OFF.
- The control voltage through D7 and R2 activates the NPN transistor (2N2222A).
- The blue LED string (D8–D10) starts lighting.
- As voltage decreases further, brightness increases gradually.
- This simulates automatic night lighting powered by a battery (8V source on the right).

**What I Learned From This Project**

- How to use a Zener diode as a voltage reference
- Using diodes for isolation and signal steering
- Voltage threshold detection and automatic switching

**Key Components Used**

- PNP Transistor: 2N5401
- NPN Transistor: 2N2222A
- Zener Diode: 1N759 (12V)
- Standard Silicon Diodes
- Series LED arrays
- Current limiting resistors
- Dual DC sources (Solar simulation + Battery)

**Real-World Applications**

- Solar garden lighting
- Automatic street lighting
- Battery backup systems
- Voltage threshold indicators
- Renewable energy switching systems