

Problem 1.2

For yellow LEDs

the forward voltage is typically around 2V to 2.2V.

Assuming a forward voltage of 2V, we'll recalculate the values with a 220Ω resistor.

Recalculation with Yellow LED (2V Forward Voltage):

1. Calculate the current through each LED and resistor:

$$V_{\text{supply}} = 5V$$

$$V_{\text{LED}} = 2V$$

$$V_{\text{resistor}} = V_{\text{supply}} - V_{\text{LED}} = 5V - 2V = 3V$$

The current through the resistor is:

$$I = V_{\text{resistor}} \times R = 3V \times 220\Omega \approx 0.0136A = 13.6mA$$

2. Power consumption of each LED and resistor combination:

- Power consumed by the resistor (P_{resistor})

$$P_{\text{resistor}} = (I^2) \times R = ((0.0136A)^2) \times 220\Omega \approx 0.0408W = 40.8mW$$

- Power consumed by the LED (P_{LED})

$$P_{\text{LED}} = V_{\text{LED}} \times I = 2V \times 0.0136A \approx 0.0272W = 27.2mW$$

$$P_{\text{total}} = P_{\text{resistor}} + P_{\text{LED}} = 40.8mW + 27.2mW = 68mW$$

3. Determine the number of LEDs that can be supported by the power budget:

Given the total power budget $P_{\text{budget}} = 1440W$

$$\text{Number of LEDs} = P_{\text{budget}} \div P_{\text{total}} = 1440W \div 0.068W \approx 21176$$