Critical Design Review

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Project: ThermoLight Alert System

Figure 1: Simulating the circuit

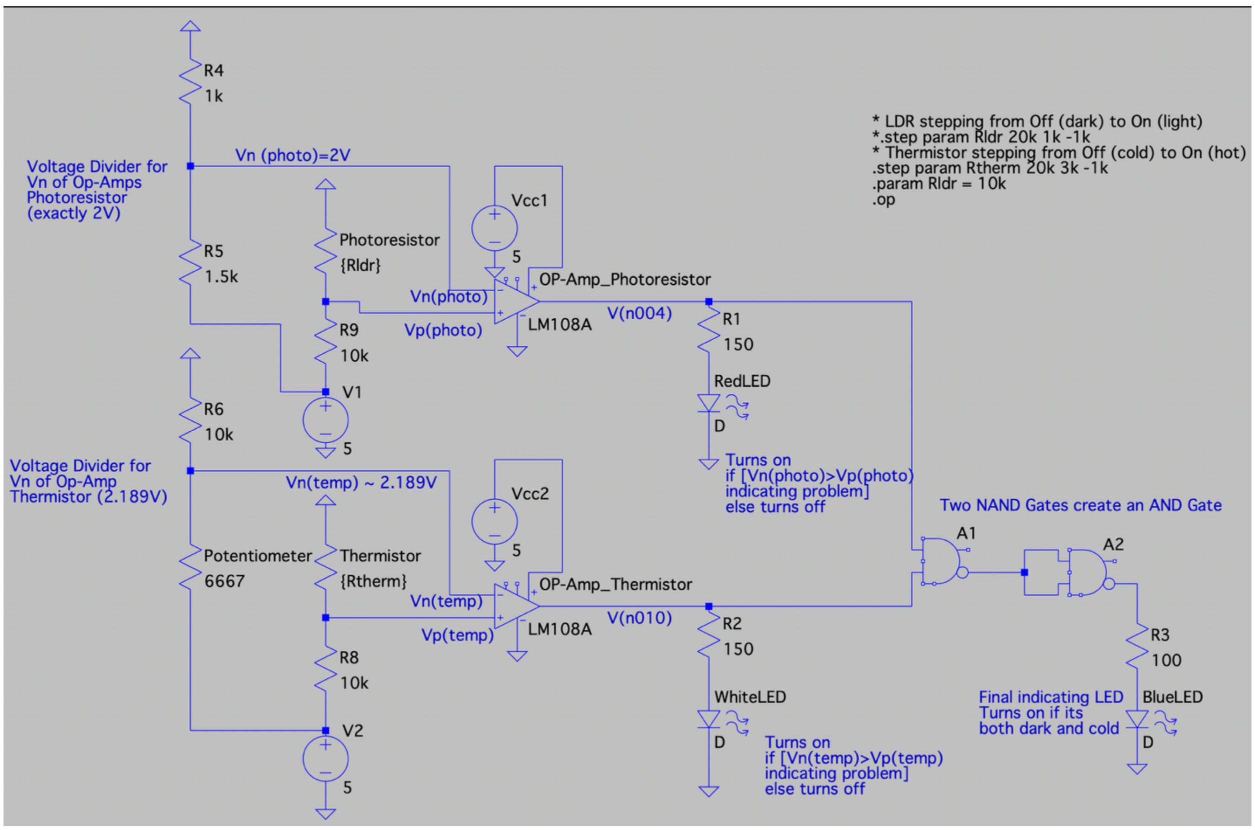

Figure 1a: The Vout of Op-Amp_Photoresistor from dark to light

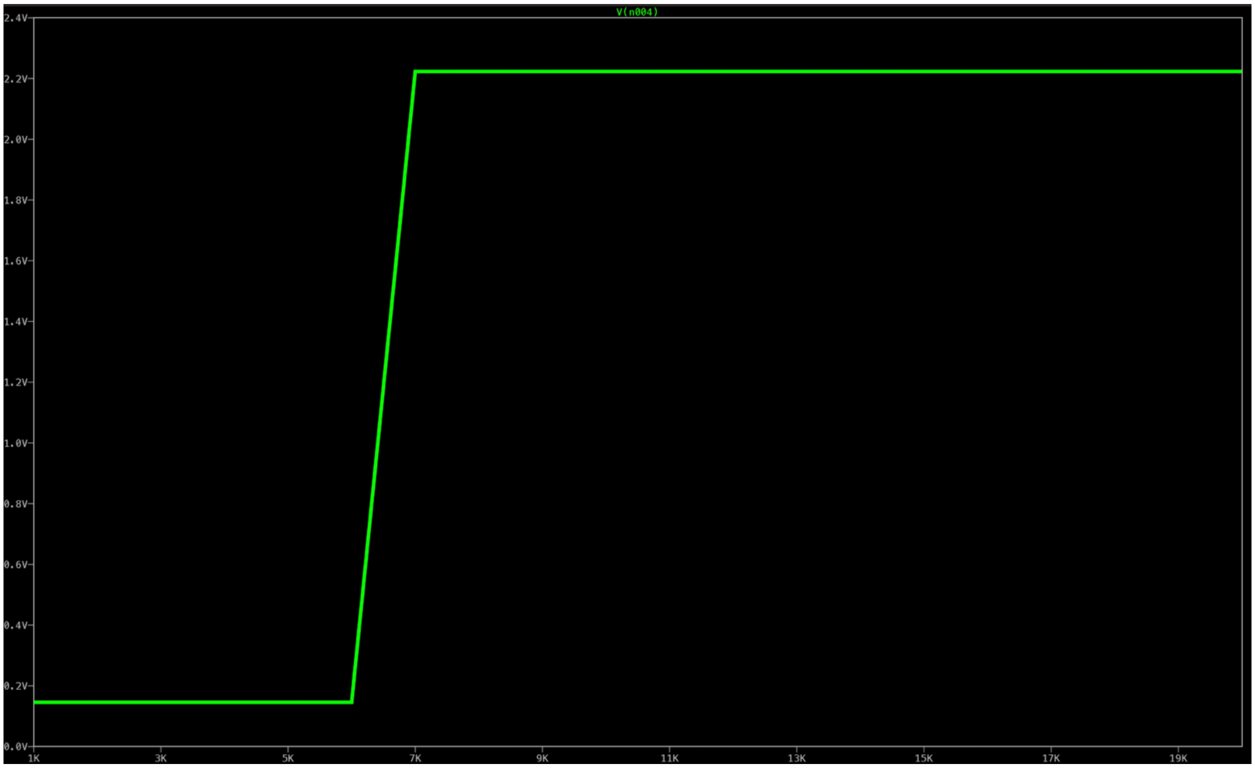

Figure 1b: The Vout of Op-Amp_Thermistor from cold to warm

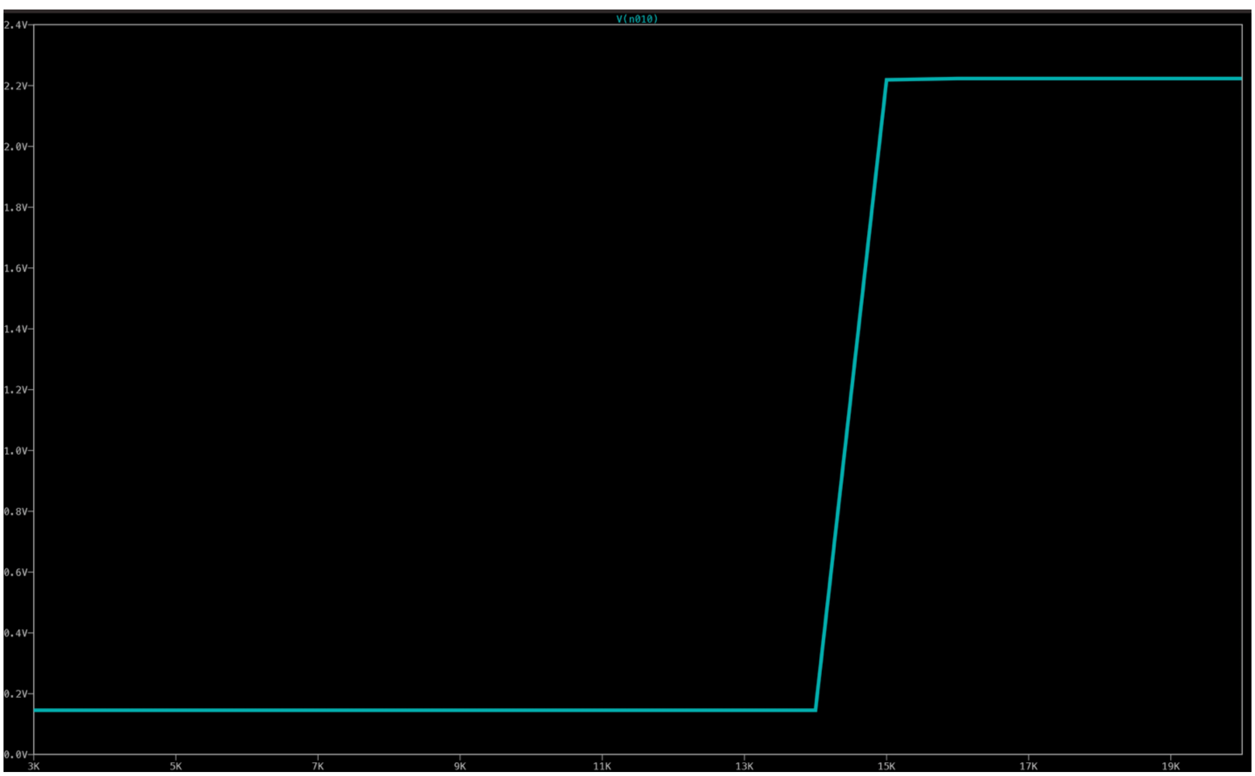

Figure 1 shows the complete circuit simulation, which includes two op-amp comparators—one for the photoresistor and one for the thermistor. Each sensor is connected through a voltage divider to the non-inverting input (Vp) of its respective op-amp, while the inverting input (Vn) is fixed at 2V for the photoresistor, and between 1.9~2.1 for the thermistor. As shown in Figure 1a, the photoresistor responds to changing light levels: under bright light, its resistance remains below 6 kΩ, and Vout stays low (below 0.2V). However, as darkness sets in and the resistance increases from 6 kΩ to around 7 kΩ, Vp rises and eventually exceeds Vn. As a result, at 7 kΩ photoresistor, Vout reaches approximately 2.2V, triggering the red LED to turn on, indicating a low-light condition. Similarly, Figure 1b shows the thermistor's behavior. Under cold conditions, the thermistor's resistance increases above 15 kΩ, causing Vp to exceed Vn and pushing Vout to 2.2V, which turns on the white LED, indicating a low-temperature alert. However, when the thermistor is exposed to warmth, such as from a finger, its resistance drops below 14 kΩ. This causes Vp to fall below Vn, resulting in Vout dropping below 0.2V and turning off the white LED, indicating that the temperature is within the normal range. Lastly, the outputs of both comparators are fed into two NAND gates configured to implement an AND logic function. The blue LED connected to this logic circuit will turn on only when both comparator outputs are high (1 AND 1 = 1), signaling that the environment is both dark and cold, indicating a potential problem. In all other cases, the blue LED remains off.