Supporting Material

Photo-Diode is a photoelectric sensor that converts optical signals into electrical signals. The photodiode is under the action of reverse voltage work, no light, the reverse current is extremely weak, called dark current; When there is light, the reverse current rapidly increases to tens of microamperes, known as the photocurrent. The greater the intensity of the light, the greater the reverse current.

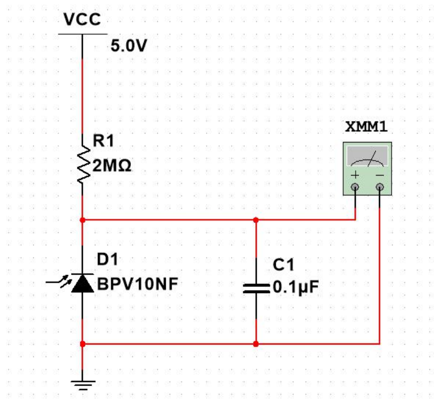

Figure 1. Design of photodiode measurement circuit

The curve between current and illuminance is shown as follows:

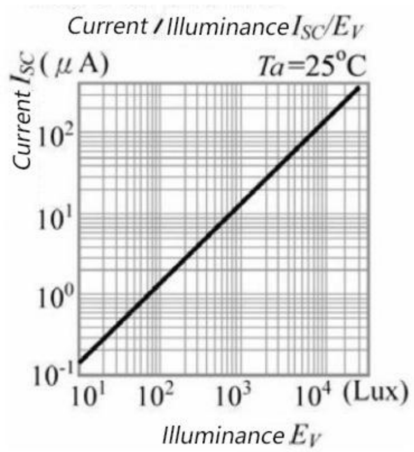

Figure 2. Curve between current and illumination

It can be seen that the current is proportional to the light intensity, that is:

$$I = k \times E_V \ (k \in R_+)$$

As the current of photosensitive diode is the proportional to the light intensity, the resistance value of resistor R1 is fixed, so the voltage of resistor R1 is proportional to the light intensity, that is:

$$V_{R1} = R_1 \times I_{D1} = R_1 \times k \times E_V (k \in R_+)$$

Since the microcontroller detects the voltage on both sides of the light spot diode, that is:

$$V_{\text{examine}} = 5v - V_{R1} = 5v - R_1 \times I_{D1} = 5v - R_1 \times k \times E_V \ (k \in R_+)$$

Accordingly, we can firm that $(5v - V_{examine})$ is proportional to the light intensity.

The sensitivity of circuit monitoring is related to the resistance value, and the higher the resistance value, the higher the detection accuracy. To achieve the accuracy of distinguishing tiny fluorescence intensity, we set the resistance value of the resistor as 2MΩ through experiments. Of course, if we want to adjust the sensitivity of the circuit, we can directly change the resistance value.

Because the sensitivity of the photodiode is adjusted to be extremely sensitive, any fluctuations in the displayed value will also become extremely noticeable. To solve this problem, a capacitor was used as a voltage regulator.

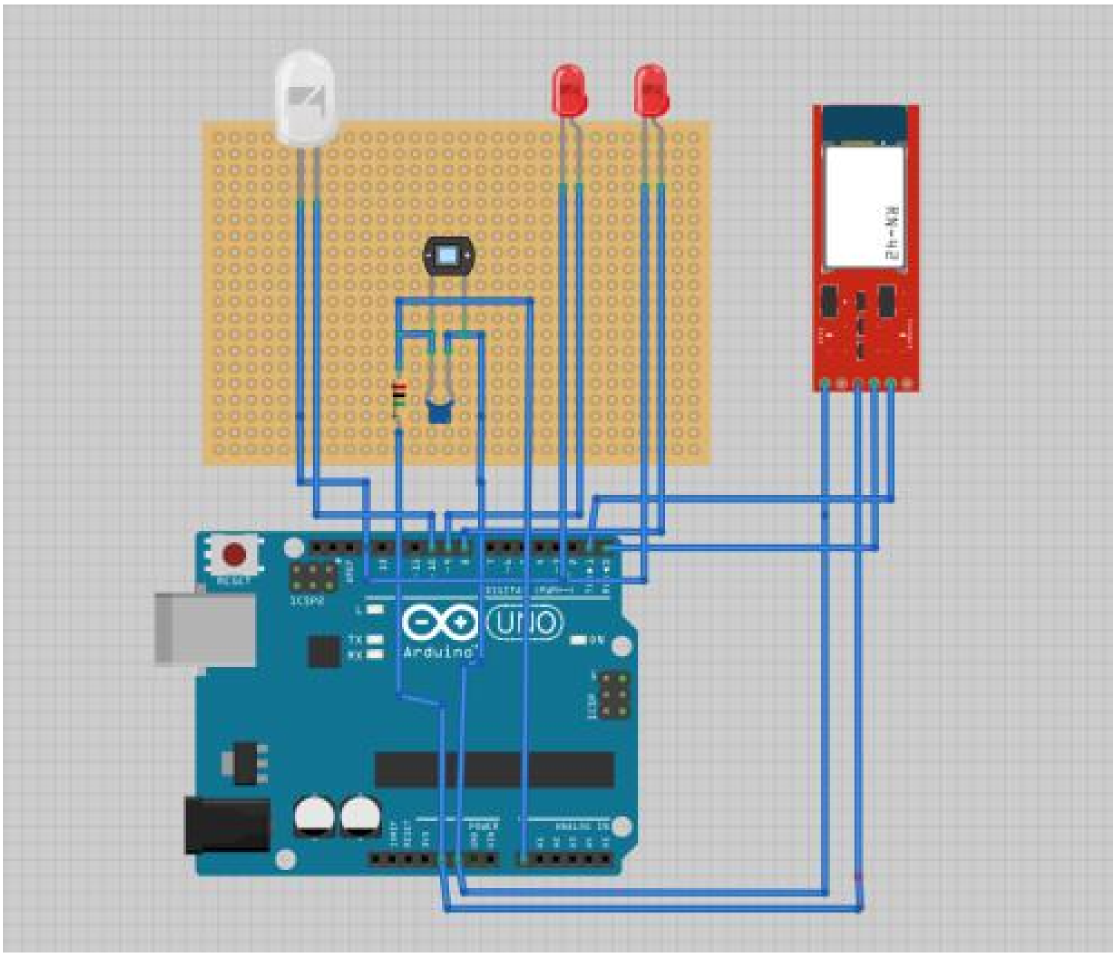

Figure 3. Device circuit connection diagram.