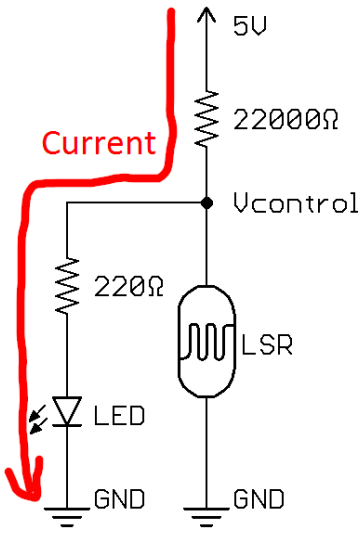
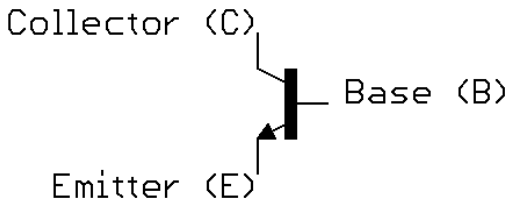
HIMALAYAN MAKERS GUILD

Activity 10 – Transistor Controlled Night-Light

In Activity 9, we looked at using a Light Sensitive Resistor (LSR) in a voltage-divider to turn an LED on automatically when the room becomes dark. However, the LED was very **dim** because the current needed to flow through a **big resistance** in the voltage divider.



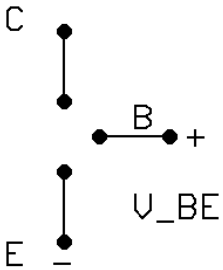
Instead, we can connect the LED and small 220 ohm resistor to 5V, and control it using a switch that opens and closes depending on the control voltage (Vcontrol). This voltage-controlled switch is called a **transistor**. We are going to use a common type of transistor called a NPN Bipolar Junction Transistor, or **BJT** for short.



The transistor has 3 pins.

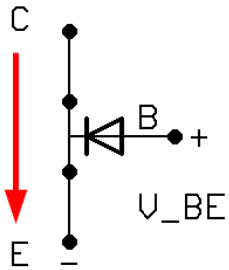
We use the voltage between the Base and Emitter (V_BE) to control current flowing from C to E.

OFF



If **V_BE is below 0.6V**, the BJT is like an open switch. Current will not flow from C to E.

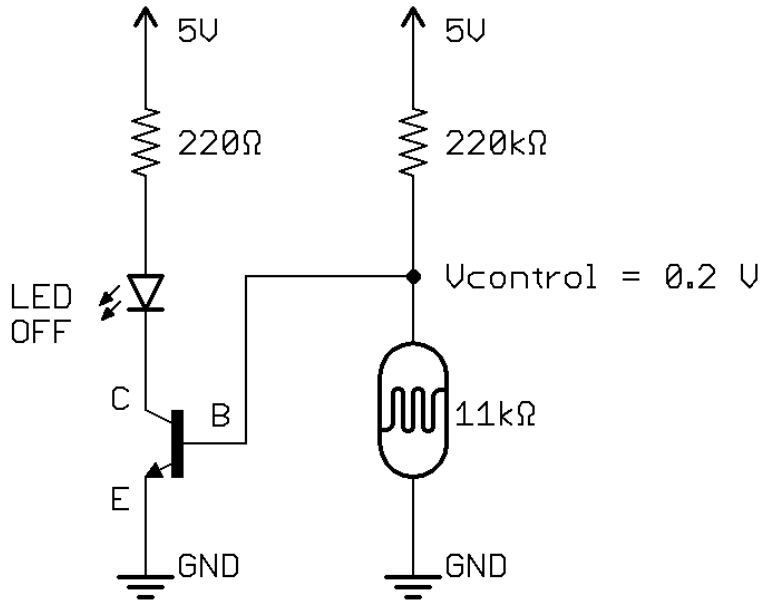
ON



If **V_BE is above 0.6V**, the BJT is like a closed switch. Current will flow from C to E.

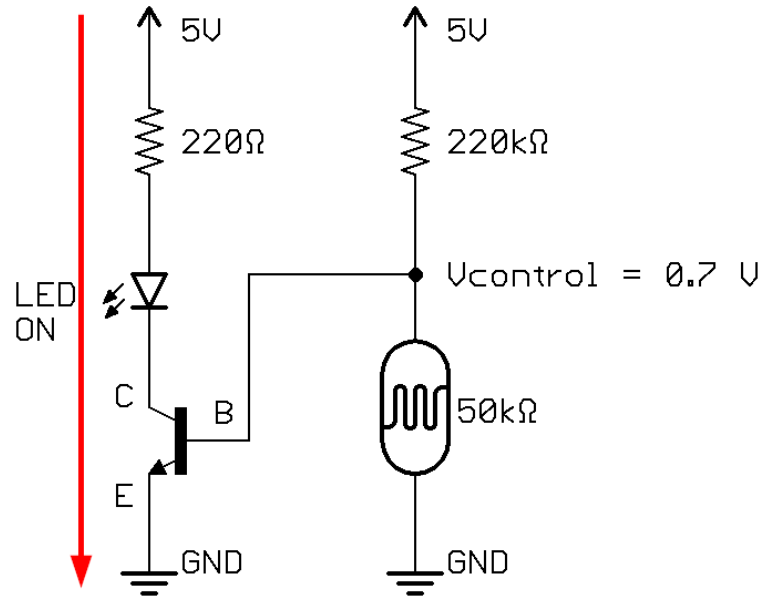
When the BJT is **ON**, some current will also flow from B to E and V_BE will stay constant at about 0.7V, like the voltage across a **diode**. Just like a diode, we need to use a **resistor** to limit the current going from B to E so that the BJT doesn't burn out; in this circuit, the 220 kΩ resistor limits the current.

Note: In the diagrams below, "k" is short for "thousand." So 220 kΩ is the same as 220 000 Ω. The resistance values are chosen for use in a lit room, at night.



When there is light, the LSR has a small resistance.

The LSR becomes much **less than** 220k Ω, so Vcontrol drops **below** 0.6 V, the transistor turns **OFF** and no current flows through the LED.



When it is dark, the LSR has a big resistance.

The LSR much **greater than** 220k Ω, so Vcontrol rises **above** 0.6 V, the transistor turns **ON** and current flows through the LED.

When building the circuit, the BJT we are using looks like this: