# ALLEN'S HALLOWEEN PAGE

## Light Beam Sensor

http://softlyspokenmagicspells.com/halloween

A light beam sensor doesn't have to use a laser. A beam of light concentrated by cheap lenses can be effective over at least 25 feet. Unlike a visible laser, this diffuse beam of light will be non-obvious when it strikes people's legs, and you won't have to worry about blinding anybody! A light beam is most appropriate for effects which must be triggered when a person is at a specific point, or for locations where a mat switch is impossible. It can also cover large areas for security. This sensor can be constructed for about $13 (or for nothing since it's made of common, easily salvaged parts). It can be used under any ambient light level, although light level changes within the field of view of the detector must be avoided.

The sensor has two parts: a transmitter and a detector. They can be placed on opposite sides of your victim's path, or they can both be on the same side using a mirror to reflect the beam back. They should be placed 6 to 12 inches from the floor/ground to prevent their being seen.

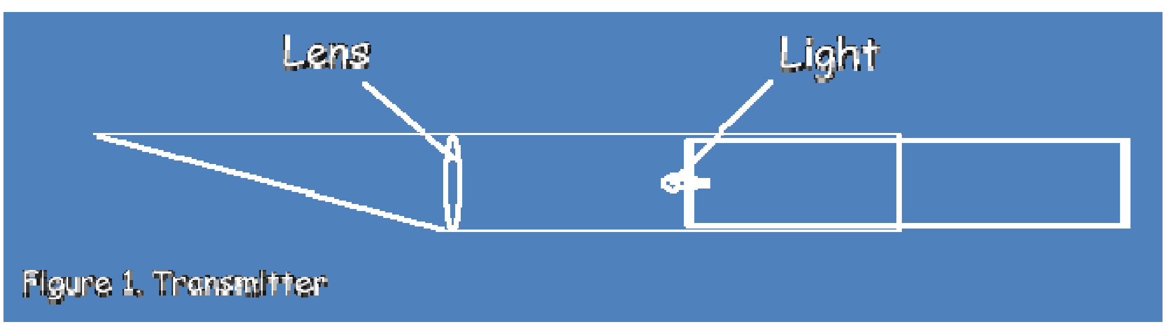

Figure 1. Transmitter

The transmitter is simply a light behind a 1 to 3 inch diameter cheap plastic lens. I used a toy magnifying glass. See figure 1. Make a tube the size of your lens out of rolled up poster board or stiff paper. Cut one end at an angle to form a hood which will conceal the light from view. Paint the inside flat black. Glue the lens in the tube. Build a cylinder which will slide inside the tube by cutting out two circles of corrugated cardboard and gluing them into the ends of another tube. Mount your light in the center of one end of the slider, and run the wires out the other end. A pen light bulb (Radio Shack #272-1141 $1.19) or "super bright" LED (Radio Shack #276-087A $2.50) is sufficient. To focus the transmitter, put a white screen of some sort where the detector will be. Adjust the slider to get the brightest spot possible on the screen. Depending on your lens and the distance, the spot may be large. That's okay. Experiment with your lens beforehand and be sure to build the tube long enough to allow the beam to be focused.

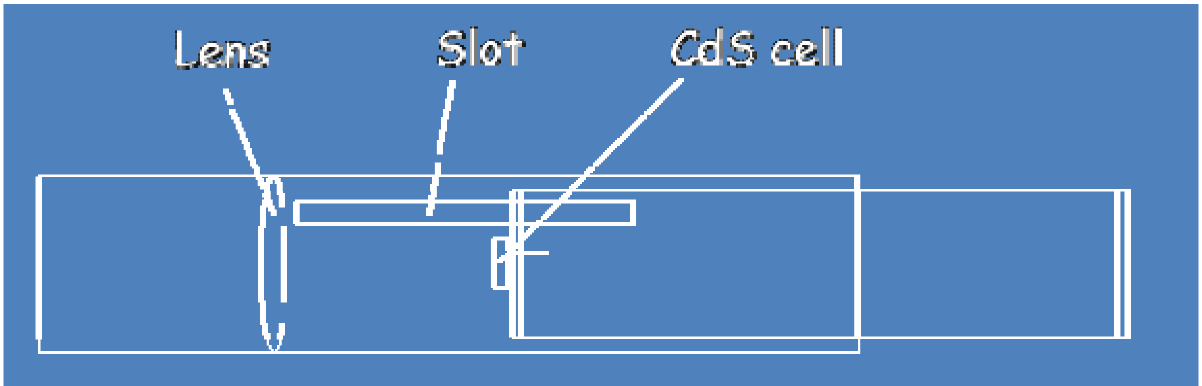

Figure 2. Detector

The detector is similar to the transmitter except the light is replaced by a cadmium sulfide (CdS) cell (Radio Shack #276-1657 $2.29 for 5). See figure 2. The tube extends beyond the lens and the inside is painted flat black to reduce sensitivity to light coming from the side. The detector lens focuses the light beam into a bright spot on the surface of the CdS cell. If a colored LED is used in the transmitter, a piece of glass or transparent plastic of the same color can be placed on the CdS cell to block extraneous light of the wrong color. The detector needs to be focusable and aimable so the bright spot of light from the lens can be made to fall exactly on the CdS cell. To adjust the aim and focus you'll need to be able to see the CdS cell. Cut a slot in the tube to look through, and cover it with duct tape after adjustment.

The mounting of the detector needs to be fairly rigid. Even a small turn can move the bright spot off the CdS cell. Figure 3 shows a simple aimable mounting made of plywood which can be screwed to a wall, beam, or stake in the ground. Notice that the screws loosely slide through the first piece of wood so they can tighten it against the second. Drilling a pilot hole in the second piece of wood is a good idea.

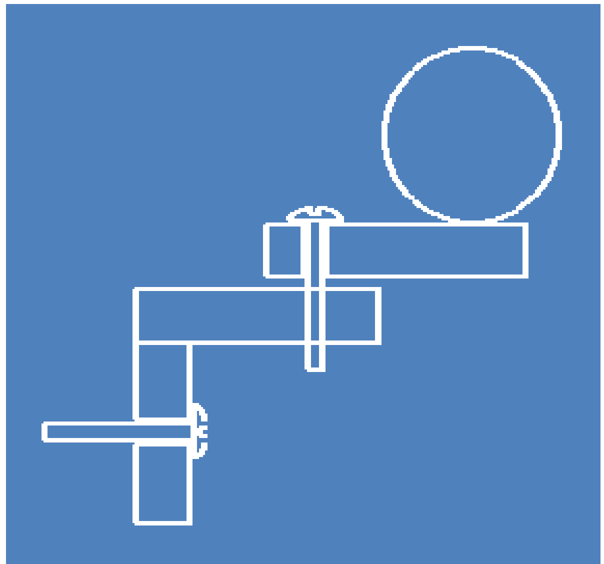

Figure 3. Adjustable mounting

The mounting of the detector needs to be fairly rigid. Even a small turn can move the bright spot off the CdS cell. Figure 3 shows a simple aimable mounting made of plywood which can be screwed to a wall, beam, or stake in the ground.

Notice that the screws loosely slide through the first piece of wood so they can tighten it against the second. Drilling a pilot hole in the second piece of wood is a good idea.

Figure 4 shows the circuit to detect the light beam. Note that wires which cross each other in the schematic are not connected unless there is a circle at the crossing. Q1 is a common NPN bi-polar junction transistor such as Radio Shack's "switching transistors" (#276-1617 $2.29 for 15). Potentiometer R1 turns the transistor on just enough to activate the relay (Radio Shack #275-249A $4). The voltage passed by the CdS cell when it's illuminated (when light falls on a CdS cell, its resistance drops) turns the transistor back off just enough to deactivate the relay. When the beam is broken, the relay turns on, activating your effect and the LED. (Radio Shack sells a 12v LED with R4 built in, #276-209 $1.) R1 will need to be adjusted to match the lighting conditions around the detector. With the transmitter on, adjust R1 slowly until the LED goes off. Wave your hand in front of the detector and the LED should go on and off.

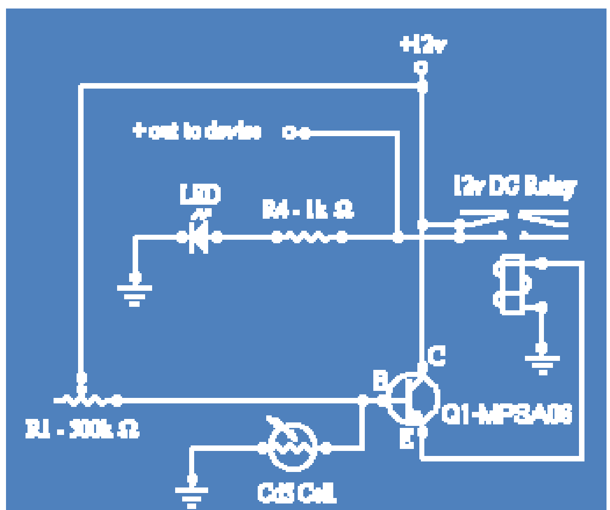


Figure 4.

Figure 5 shows a more complex detector circuit which turns the relay on for an adjustable period of time. When the beam is broken, the LED goes on, your effect is powered, and capacitor C1 begins charging. As C1 is charging, the transistor will be kept on. Once C1 is charged, the CdS cell will be able to turn Q1 off again. Then C1 will be discharged through R5 by the relay. Opening switch S1 will disable the time period to allow you to adjust R1.

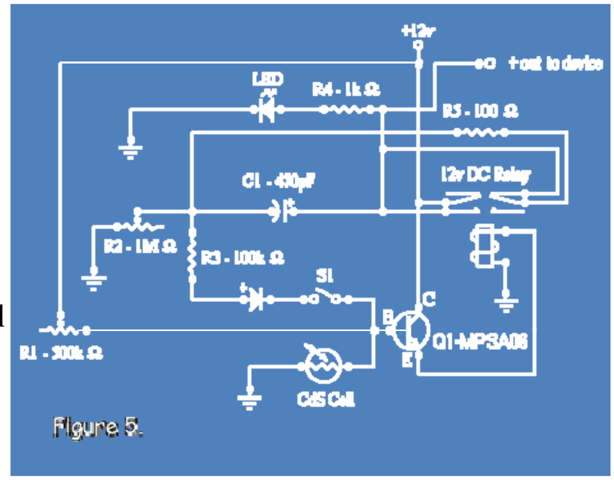

Figure 5.

Adjust the time period with R2 (Radio Shack #271-211 $1.50) which shortens the time period by charging C1 faster, or leave out R2 and simply change the size of C1. A 470uF capacitor (Radio Shack #272-1018 $1) can give up to 60 seconds, but that will vary depending on the transistor. The time period is sensitive to the adjustment of R1, so adjust R1 before adjusting the time period.

R3 extends the time period by slowing the charging of C1. The time period can be maximized by adjusting R3. As R3's resistance goes up, the time period will lengthen to a maximum, and then shorten to zero. The maximum depends on the characteristics of the transistor. 100k ohms should work well with most transistors.

If the detector misses brief beam breaks, then it's probably on the edge of its range. Larger lenses and/or a brighter light will increase the range. I achieved a range of 25 ft with a "super bright" LED and a 1" lens in the transmitter, and a 3" lens in the receiver.

Possible enhancements: Send a modulated signal from the transmitter and detect only that signal to prevent interference from other light sources. Use an infrared LED and photo transistor pair to make the beam invisible.

An edited version of this page appeared as an article in Haunted Attraction Magazine in 1998.