Spy Camera Detector

Reflections give away the position

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Although some people don't seem to mind revealing their innermost thoughts online, we know from recent revelations about the NSA activities that we can also be victims of unwelcome surveillance. Help is at hand!

in memoriam: Antonio Prohias

As electronic equipment is getting ever smaller, tracking down devices such as hidden cameras becomes almost impossible. These spy cameras are freely available from online auction sites and are available hidden inside lighters, pens, sugar cubes etc. With this project you can build a device for detecting such hidden cameras using just a handful of standard components and a little craftwork.

Red, red, red... all the spies are red

All surveillance and spy cameras have one thing in common: a lens, which must be directed into a room to make recordings. How is it then possible to detect a small hidden or sometimes camouflaged camera lens? Well it really is simple: the detector shown in the **title photo** uses LEDs to emit pulses of red light which then get reflected by the spy camera lens. To see these reflected glints the user records the scene using a camera in the detector unit with a red filter (the red filter helps reduce the Purkinje effect [1], also the reason why submarines use red lights inside). The glint of red light bouncing back from the lens can now be seen. The LEDs are flashed so it's easy to spot the reflection when scanning the room. A similar system is used to locate astronomical comets by superimposing and comparing two photos of the same area of sky.

The two most important things to consider for a successful spy camera detector are firstly the LEDs which should be

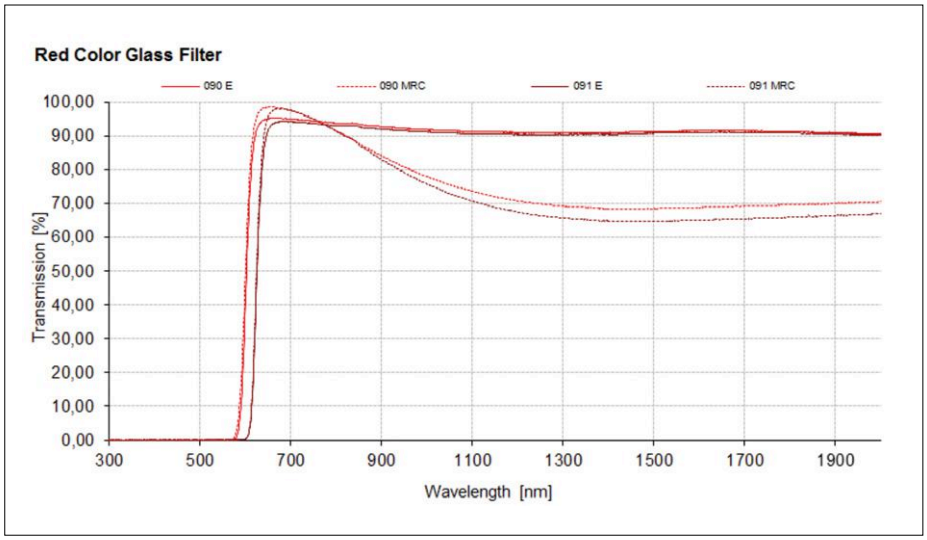

Figure 1. Photographic red filter frequency response (picture: Jos. Schneider Optische Werke).

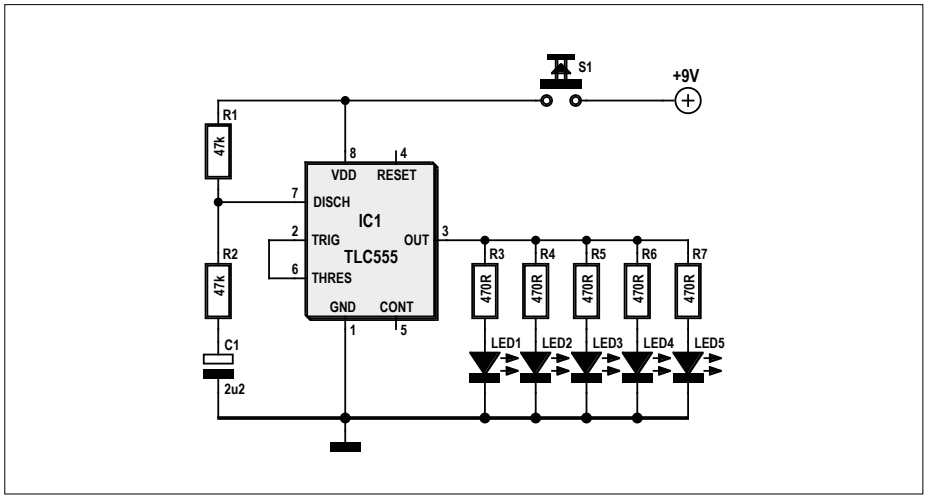

Figure 2. The circuit: a 555 plus a few components.

ultra-bright types and secondly the filter color. The brighter the LEDs the more likely you are to detect the glint from the spy camera. The color pass band of the transparent red or red/orange filter should correspond closely with the peak wavelength of the LED light. When there is a mismatch in their properties there will be little or no chance of detecting the spy camera.

When the detector is used together with an SLR-type camera, a red filter can be fitted to the filter mount on the front of the lens. The well-known manufacturer of photo filters, Schneider Optics (B + W filter), offers two different red filters (IF090 and IF091) with two different coatings (E and MRC). **Figure 1** shows that the transmission characteristics of these red filters are surprisingly similar to the frequency response of a low-pass filter made with electrical components. The corner wavelengths are 600 nm and 625 nm, respectively, showing a transmission percentage of less than 1% for higher frequency light waves! In the filter's pass band the transmission is nearly constant for the filter with the E-coating, whereas with the MRC-coating it decreases by about 30%. There are also specialist narrowband band pass filters but these are normally not offered through conventional hobby photo outlets (and are also not so well suited, because LED color is not constant, but slightly influenced by the LED's operating current).

This brings us to the second component in the circuit: the red LEDs. Looking at the transmission characteristic of the filter its peak response should of course coincide with the LED's transmitting wavelength, the closer to the cutoff frequency the better. The color must of course also lie in the visible part of the spectrum. When choosing an LED don't pay too much attention to the maximum brightness value given in the data sheet, the LEDs will be used here with a current of less than 20 mA. The most important parameters are the LED color, forward current (depends on forward conduction voltage), brightness, package outline. You can enter these parameters into a component selection filter available at many online component distributors and get a list of suitable LEDs.

A touch of electronics

At the heart of the circuit in **Figure 2** is the tried-and-tested timer module type 555, which is configured as a multivibrator. The RC values are calculated in such a way that the LEDs flash at approximately 250-ms intervals when the pushbutton is pressed. In order to achieve best possible room illumination, five ultra-bright red LEDs are used. The LED series resistors are calculated at 470 Ω which results in a total current of about 75 mA divided between the LEDs at an operating voltage of 9 volts. The TLC555 timer module used can drive up to 100 mA, so there is no need for a driver transistor.

The plastic case used here needs a large hole at the front and rear surface, the diameter of which is determined by the size of the camera lens. If you are not using an SLR with a screwed-on filter with this detector housing, you should ensure that any light leaking from the sides of the LEDs cannot enter the camera lens directly. It may be necessary to fit a black cardboard tube through the two holes in order to avoid this.

The electronics can be easily built up on a small square of perfboard, fitted inside the case and wired to the operating pushbutton S1 and the battery holder. The LEDs are fitted using reflector mountings so that the light is concentrated in a forward direction, these can then be wired to the 555 board. With the circuit wired up and a 9 V battery connected, the five LEDs should flash at quarter second intervals when the pushbutton is pressed. If everything is working as it should the search for a

hidden camera can begin. The scan can be carried out in normal, but diffuse daylight conditions, so that slight differences in brightness are more easily detected. Now you can start out on the trail for the hidden camera. Fit the spy camera detector to the camera lens (**Figure 3**), start recording in video mode and slowly scan around the whole room preferably at three different heights (for example, 60 cm, 120 cm and 180 cm). The recorded video material can then be studied more closely later and evaluated using a PC. **Figure 4** shows in two individual images how a spy camera gives its position away.

Figure 3. The detector flashes, the camera records the video evidence.

Do's and don'ts

The system has a few limitations that you can't really do much about and some that you can. The camera detector works perfectly when the spy camera lens is spherical and also reflective. If it has a planar lens, a successful detection is only possible at certain angles between the lens and the illuminating LEDs. When the lens does not reflect, the detector will not work.
You can stick to certain guidelines to improve your chances of discovering a spy camera:

- The distance between the two cameras should be small; the smaller the distance, the better is the chance of detection. You are less likely to find it by standing in the middle of a room and turning through 360°, it's better to get up close to suspicious areas.
- Shade any direct sunlight from behind! When the spy camera has a bright background it is more difficult to see than when the background is diffusely lit.
- Shade any direct sunlight from the front! When the detecting camera has bright coming from behind it is more difficult to see the glint from the spy camera lens. Try to avoid any direct light.
- Look closely at highly reflective surfaces. The reflection from the spy camera lens can be easily missed.
- And finally the most important don't… do not stare directly into the LEDs when the detector is working!

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Web Links

[1] https://en.wikipedia.org/wiki/Purkinje_effect

[2] www.schneiderkreuznach.com/industrial-solutions/industriefilter/produkte/filtertypen/colorfilter/

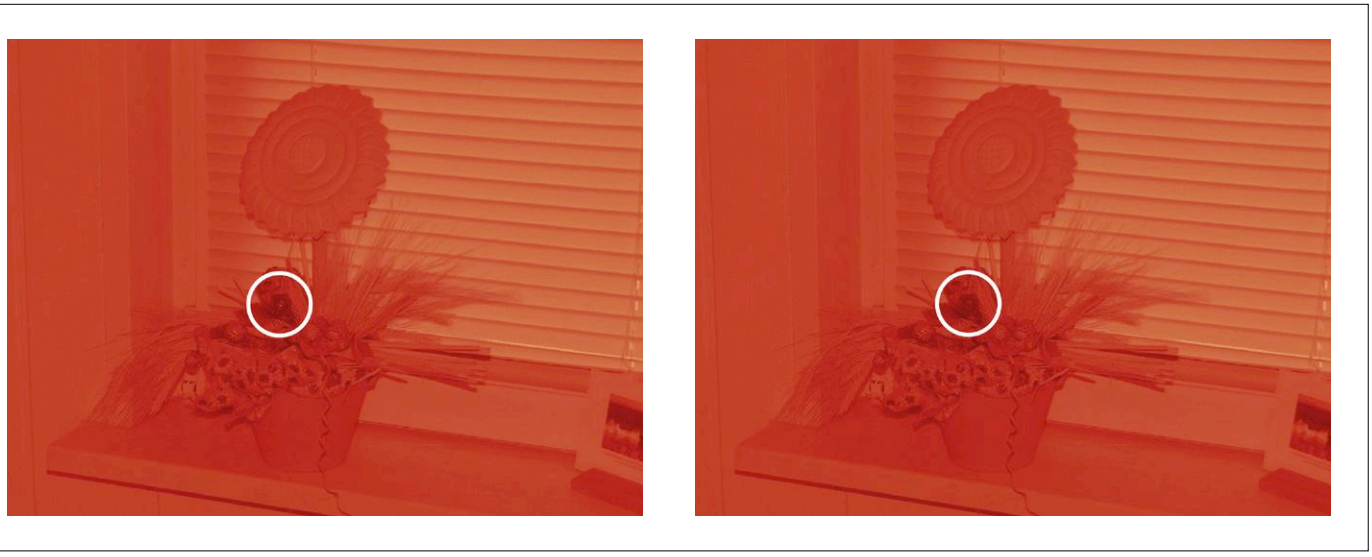

Figure 4. The small but distinct giveaway: A spy camera hidden in the plant pot is given away by a glint!