Electronic cat's eye

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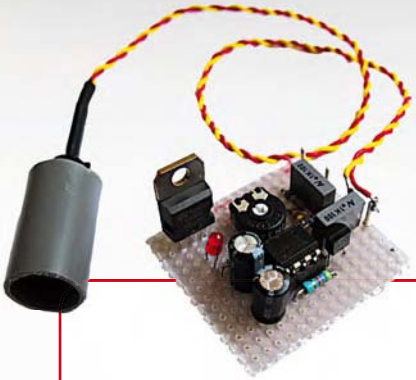
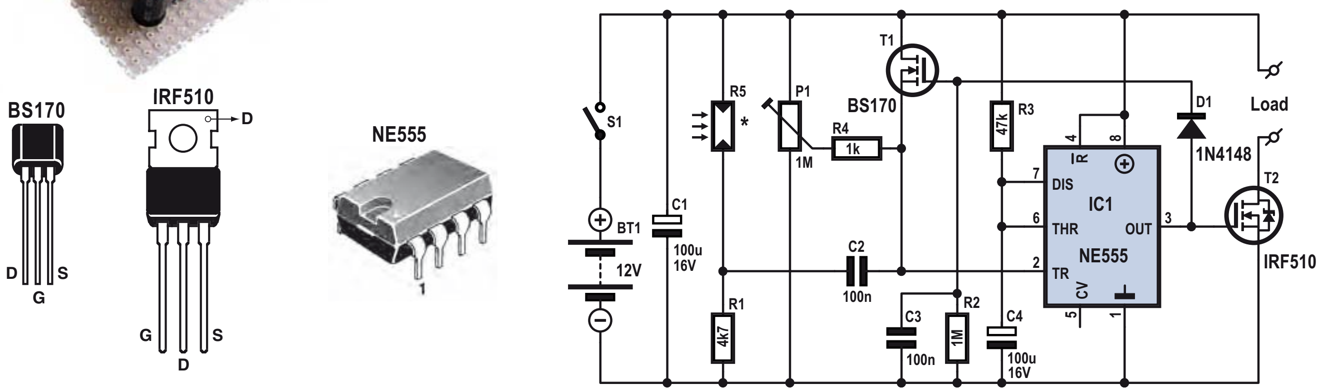
The eyes of almost all members of the cat family are much more sensitive at night than the human eye. At low light levels, cats not only see approximately twice as well as we do, but also notice practically every movement in their field of view – as many a small grey rodent has learned to its regret. This means that in theory a cat would make an excellent watchdog if (and there's the rub) the species *Felix catus* actually had any interest in intruders. If you use an electronic cat's eye as an intrusion detector, you can leave your feline companion to its favourite occupation (mousing).

When the author decided to develop an 'electronic cat's eye', what he had had in mind was a light sensor that was as simple and sensitive as possible. His 'all-seeing eye' is a passive sensor that detects changes in brightness. This means that even this sensor is blind in full darkness, so it needs an auxiliary light source for proper operation. However, the circuit works very well in a very dim environment. As it responds to changes in brightness, the e-eye is well suited to detecting cars passing a driveway entrance or recognising cautious intruders who avoid using a pocket-lamp and work by the light of a street lamp.
If the circuit is adjusted to for maximum sensitivity, the e-eye will respond to the interruption of a light beam in the same way as a conventional light barrier and can be used to secure a range of approximately 10 m. The basic sensor element is R5, a light-dependent resistor (LDR) with type number A 9060. If you fit the LDR in a piece of blackened tube (see photo), the circuit can detect shadows on a white wall at a distance of 2 metres. The range can be increased considerably by adding a collecting lens with a focal length corresponding to the distance to the LDR.





The circuit uses the CMOS version (TLC555) of the 555 timer IC as a threshold detector. The IC is wired as monostable multivibrator. When it is triggered by a signal on pin 2, it supplies a single positive pulse on pin 3. The pulse width is determined by R3 and C4 from
$t = 1.1 \times R3 \times C4 = 1.1 \times 47k \times 100\mu = 5.2$ s
The pulse is triggered when the voltage on pin 2 drops below one-third of the supply voltage.
Operation: The current through the illuminated LDR produces a voltage across R1. If less light falls on the LDR, the current decreases and the voltage across R1 drops. The change in the voltage across R1 is differentiated by the combination of C2, P1 and R4, with the result that only relatively fast changes in light level (and thus the voltage) reach the trigger input. The sensitivity, or in other words the amount of variation in the light level necessary to trigger a pulse, can be set with P1. The sensor thus responds to motion, as does a cat's eye, and it ignores slow changes in light level due to clouds, dawn or dusk.
Stable operation is ensured by the combination of C1, T1, R2 and C3. When the monostable is triggered, the positive output pulse drives T1 and D1 into conduction. Pin 2 is thus connected to the supply voltage to prevent detection of further light fluctuations. Due to the slow discharge of C1, IC1 remains blocked for around 0.1 second longer than the duration of the output pulse. These four components are not essential; the circuit will still work if they are omitted.
The output of IC1 switches the DMOS power FET T2, which in turn can drive a load. T2 can switch a current of up to 1 A at 12 V without a supplementary heat sink. The maximum current with a suitable heat sink is 5 A.

You can adjust the circuit for maximum sensitivity by rotating P1 until IC1 just stops being triggered automatically. R4 prevents shorting of the supply voltage via T1 when the wiper of P1 is at ground.
The quiescent current consumption is approximately 0.5 mA under dark conditions. It rises to as much as 2.5 mA under bright conditions. You can experiment with different values for C1 and R1 to see how they affect the behaviour of the circuit. To prevent triggering of the circuit immediately when it is switched on, you can connect the Reset input (pin 4) to the junction of a 1000-µF capacitor connected to ground and a 100-kΩ resistor connected to +12 V.