![SGS-THOMSON MICROELECTRONICS logo]

APPLICATION NOTE

MOVEMENT DETECTOR
CONCEPTS FOR NOISY ENVIRONMENTS

Herbert SAX

INTRODUCTION

The sales of movement detectors, which react to human-body temperature, are increasing at a fantastic rate.

No Do-it-Yourself shop proposes less than 4 models for sale if it is serious about its image, however the majority of clients are novices who wish to install the system themselves. This installation often causes frustration, partly caused by a lack of knowledge of the operation of the system, but also by the weakness of the products. This weakness can be improved by the use of microcontrollers.

MOVEMENT DETECTORS

Most movement detectors available, whether using discrete components or integrated circuits, have a circuit concept as shown in Figure 1.

The movement of a source of heat is projected onto the sensor by a array of Fresnel lenses mounted on the detector. This induces a Chopper effect which generates an alternating voltage in the sensor. The frequency is dependent on the number of Lens segments, the distance and the speed of the heat source.

The array of lenses is positioned so that it provides, at a detection distance of around 10m and normal movement, a frequency between 0.1 and 3Hz, which corresponds to the maximum sensitivity of the sensor.

The output level of the sensors is in the order of mV which requires an amplification of more than 60dB. The amplifier also acts as a band-pass filter to eliminate parasitic signals.

A window comparator follows which digitalises the alternating voltage. This monostable removes parasitic pulses providing also a high immunity to noise. A pulse longer than the monostable delay time starts a second monostable which, in general, is externally programmable between 10 seconds and several minutes. This then triggers the interface which drives the Triac in place of a relay.

Figure 1. Discrete Components System Overview

VR001813
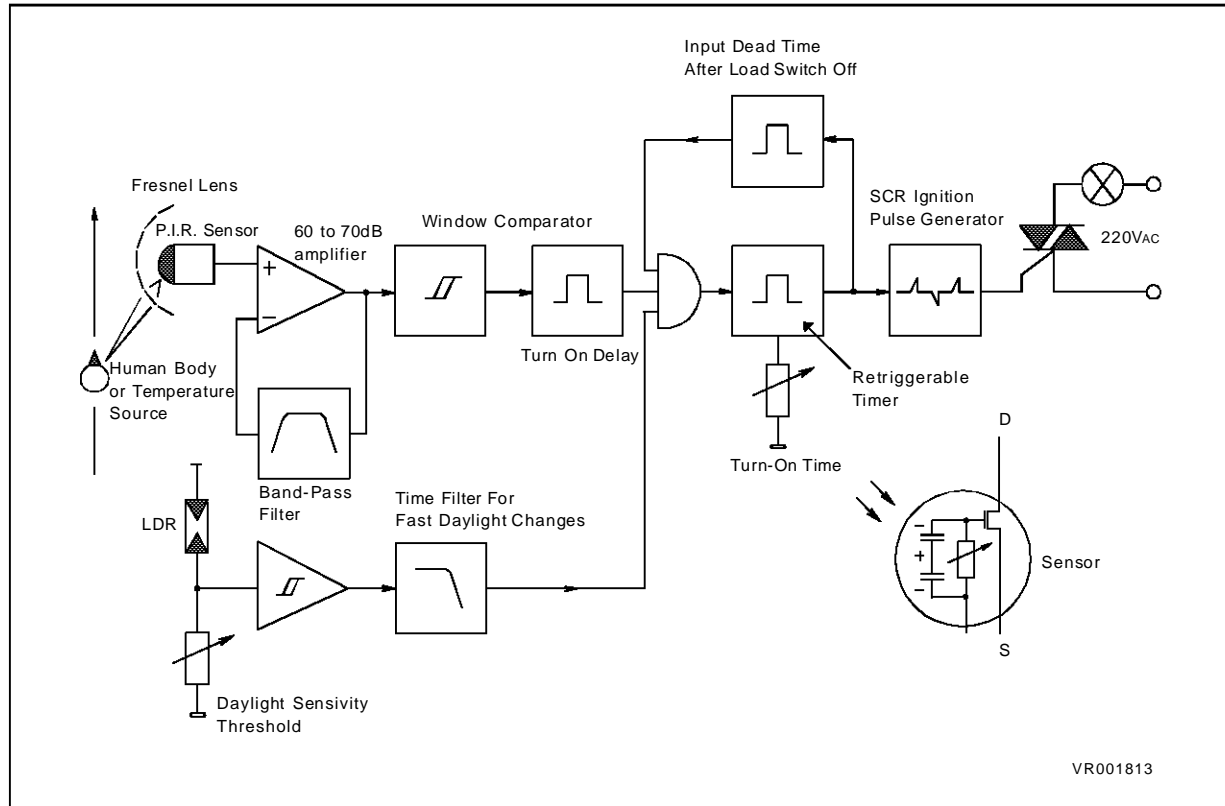
Two other functions are equally as important:

1. A photosensitive resistor prevents the lamp from being triggered by daylight, the level of activation can be adjusted to function in the diverse number of mounting conditions. The filter which follows the resistor to ignore transient changes in light level.

2. After the turn-off of the lamp by the timer, the function of the timer can be inhibited for several 100mS. This is needed for environments where the lamp is situated in the movement detector. There is a danger that the movement of the filaments of the lamp on cooling, themselves a source of heat, can be interpreted in an erroneous fashion by the sensor as a moving source of heat. This is followed by a further operation of the lamp which appears as a fault.

This is the type of malfunction that is found experimentally as the most frequent reason which prevents a movement detector from working in a satisfactory way. Badly positioned sensors or lamps can increase these problems despite the delay in retriggering. These malfunctions are found, in particular, by halogen lamps, the preferred lighting source, and are not resolved.

One additional problem is the switching on of the halogen lamps, this often requires more current than either the triac in the detector or the fuses can support. The solution lies only in a motion detector which presents more flexibility and more intelligence than the concept shown in Figure 1.
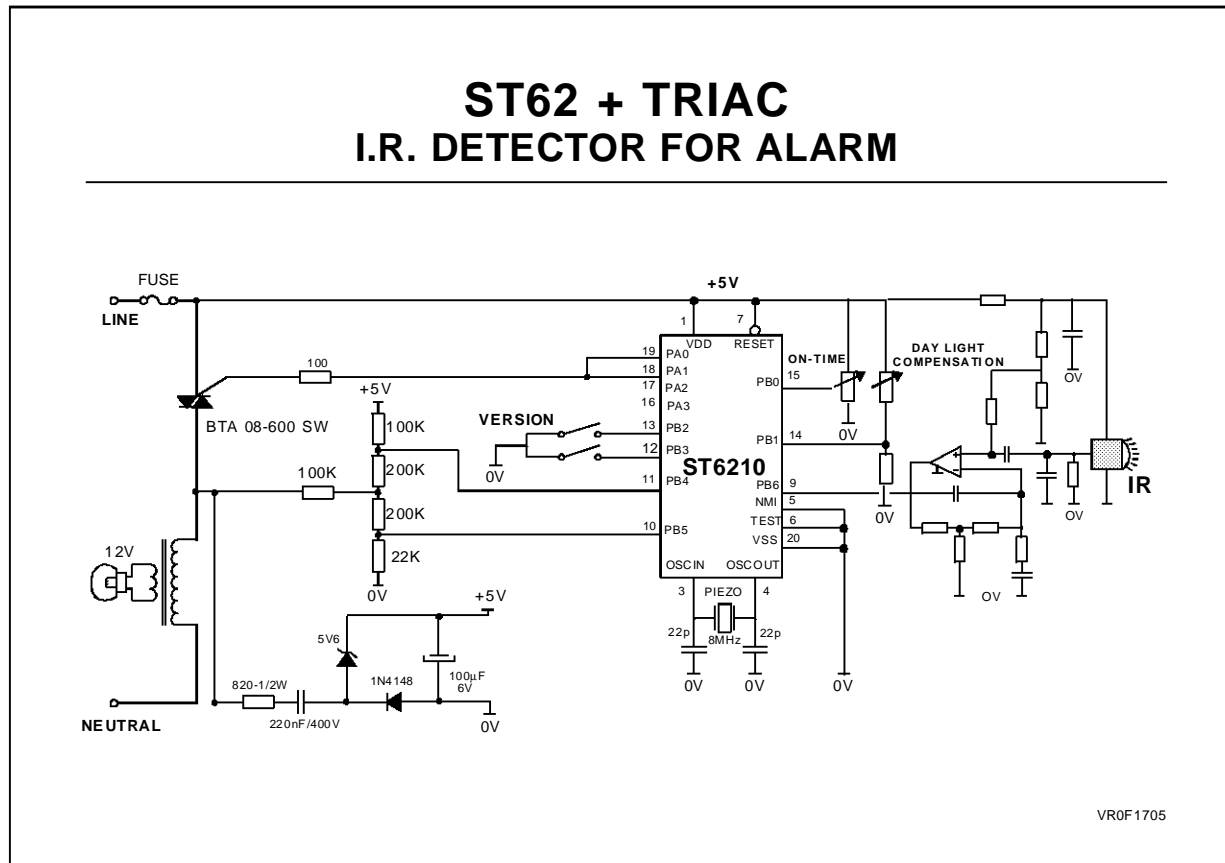
Why not a microcontroller?

Figure 2 shows that, apart from the window comparator, all the signals are largely read as digital by means of inputs to Analog inputs of a microcontroller.

The modern CMOS microcontroller, with low power consumption, can be powered without difficulty directly by the mains power supply. For protection against extended voltage input, a low cost and simple Zener diode is used as show in Figure 2.

The power capacity of 2 I/O pins mounted in parallel is sufficient to drive "sensitive gate" triacs by themselves. An operational amplifier is necessary for its high signal amplification capability.

Figure 2. Microcontroller System Overview.

Cost is not an essential factor, but carries a high prejudice against this concept. The decision to use a Microcontroller with analog inputs carries a series of advantages, together with its logical functionality.

SGS-THOMSON
MICROELECTRONICS