During my work with the Sonoffs I discovered strange behavior of the used motion detector. So, I had a closer look at its behavior and compared two different variants. And I discovered a behavior which can be used by burglers.

For the comparison, I use two different Passive Infrared or PIR motion sensors widely available for usage in our projects. Both consist of a sensor and some electronic parts which convert the sensor’s output to a digital signal.

The small HC-SR505 has no possibilities to influence its behavior and the lens in front of the sensor is very small. The bigger HC-SR501 has two potentiometers and a jumper to influence its behavior. The left potentiometer is for delay and the right is for sensitivity. And with a the jumper, you can influence its trigger behavior.

Because I want to use these sensors with microcontrollers, I put all the logic in my sketch and just want to get a signal as soon as motion is detected. So, I turn the sensitivity to “full”, which means, the sensitivity potentiometer to full left, and the delay to “shortest”, which is also full left. The jumper has to be on “retriggerable”. This means, that the output signal stays high as long as a movement is detected.

The small sensor is already preconfigured to these settings. So, both should behave similar now.

To test the behavior, I will test four different scenarios:

1. The angle of detection
2. The sensitivity for transverse movements
3. The sensitivity for longitudinal movements
4. The sensitivity for small movements in a certain distance

The test setup is quite simple: I mounted two sensors in parallel on a breadboard and connected them to 5 volts. The output is fed to an IRLZ44 FET. This FET switches then a LED on or off. Of course, this FET is way too big, but, because it is called IRL and not IRF, it is a so called “logic level” FET. This means, that it switches completely on below 3.3V at the gate. IRF types often need a higher voltage for that. The current through the LEDs is limited by resistors. So, as soon as a movement is detected, the LED will light up. With this setup, we can compare the behavior of the two sensors directly.

Let’s start with the angle of detection. For that, I just move in front of the sensors, always with the same distance of about 40 cm. Let’s check first the small sensor. I move from right to left and afterwards from right to left. This is the result.

Now the same thing with the big sensor. The results are comparable.

Now I do the same in a distance of about 3 meters. Both LEDs are connected that you see the difference between the behavior of the two sensors. You see, that the LED of the big sensor starts later than the LED of the small sensor. So, in both directions, the angle of the big sensor is smaller than the one of the small sensor.

The same applies in a distance of 4 meters.

Now I I change my direction and move from about 5 meters frontal towards the sensors. Interestingly, I am only detected if I am about 50 cm away. So, both sensors detect frontal movements much, much worse than lateral movements. And that is the fact, which is good to know, especially for burglars. The reason for that is shown in a video of bigclive. You find a link in the comment.

If you want to correct this misbehavior, it would be best to combine it with an ultrasonic distance meter, which you program to detect changes of distances.

The last test is a test of small movements in a 3-meter distance and lateral. This is the typical scenario in my lab, where I sit at the computer or bench and do not move too much. Here, you see, that the sensitivity is not equally distributed over the whole angle. Generally, it is better on the left and right side than in the middle, and the big sensor is more sensitive on the left side.

All-in-all, the two sensors are comparable if you use them with your microcontroller, if we chose the maximum sensitivity on the big sensor. The big sensor has more possibilities. For example, you can also connect an LDR to achieve, that it only switches the light on if it is dark. But it has also another difference: After it switched the alarm off, it cannot detect another movement during the next 3 seconds.

Let’s now quickly look behind the scenes: Both have very similar looking sensors. The bigger one seems to use the KP500B sensor. Unfortunately, the search for the number printed on the package of the small one does not lead to a result.

I hope, this video was useful or at least interesting for you. Bye