Physical Computing with Sensors

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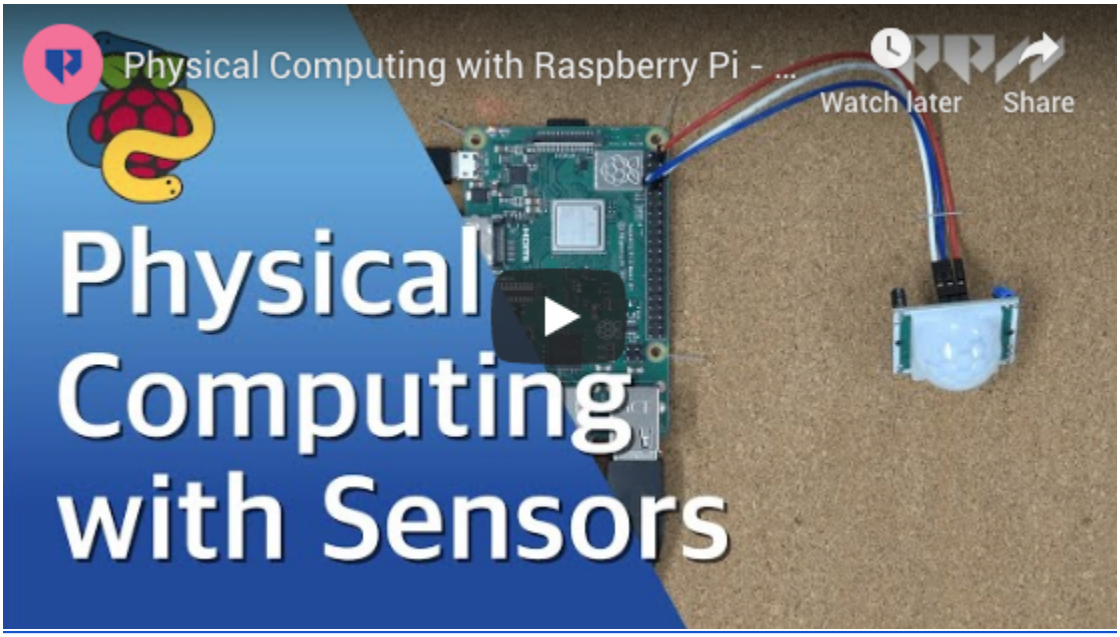


We are now going to explore the world of sensors. These components are great inputs for projects detecting the world around them. Think about the motion sensors used in the room to turn lights on or light sensors on porch lights to turn on when the sun goes down. These are all sensors that use code to instruct them to take and action based on their surrounding environment. These sensors can take any project you have been thinking about to the next level!

Materials

- Raspberry Pi Model 3 B+ 8GB
- Micro SD Card
- PIR Sensor
- Micro USB Power Supply

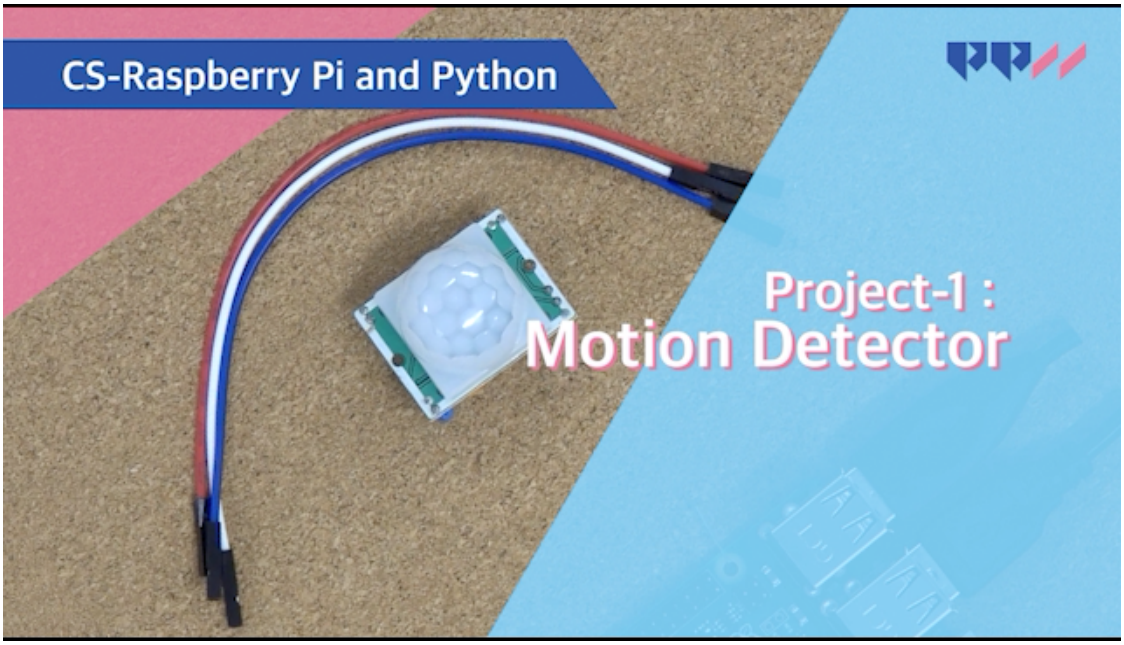
- Mouse
- Light Sensor
- HDMI Cord
- Keyboard
- Capacitor
- HDMI Monitor
- Computer
- Breadboard
- Jumper Wires

Key Concepts

- GPIO
- Time
- Sleep
- Motion Sensor
- Light Sensor

Physical Computing with Sensors - the hardware

The Hardware



PIR Sensor - The Motion Sensor

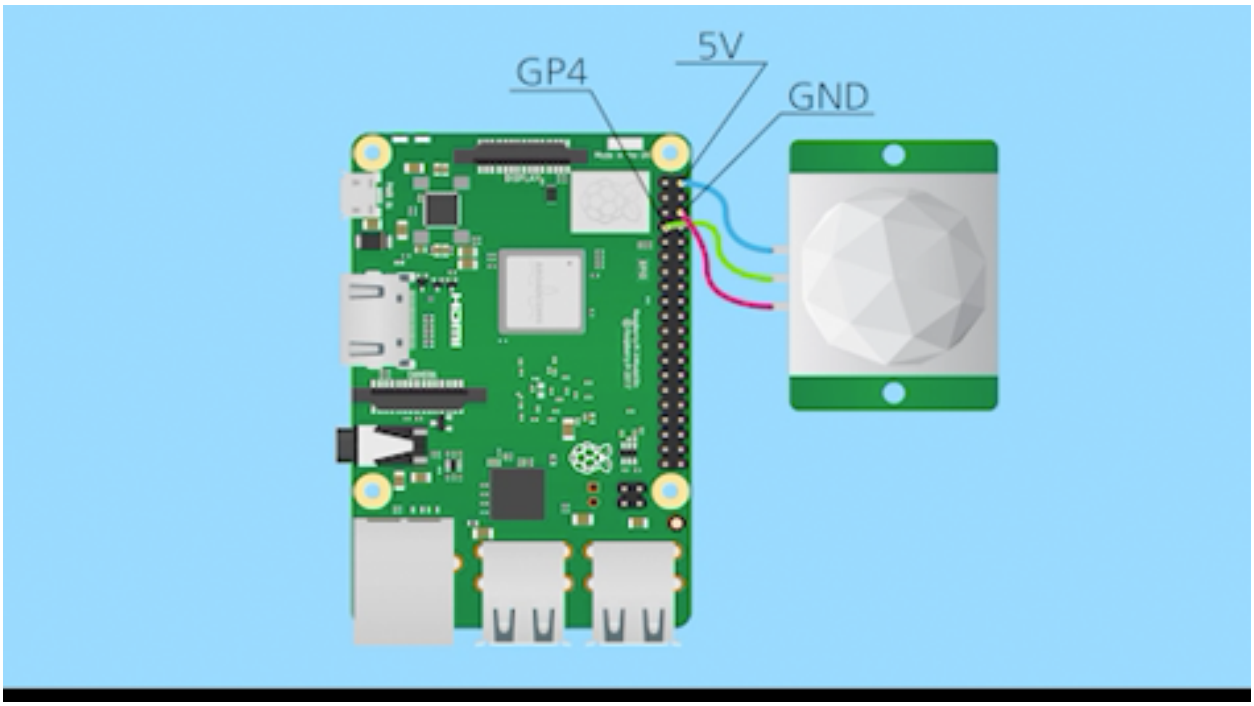
This is what a PIR motion sensor looks like,

You notice that there are three pins. We need to use extra power to run the sensor. It requires a 5V connection along with a connection to GRND and the GPIO pin. We can use three female/ female jumper wires to make our connections without the breadboard.

Steps

Hardware

1. Follow the diagram below to connect your motion sensor to the Pi
2. Open the sensor cap to check wires.
3. From left to right on the motion sensor, you want to connect the 5V, then the GPIO, and then the GRND. Make sure the connections are firm and get ready to run the code.



Physical Computing with Sensors - the code

Enter the following into a new Thonny file,

```
from gpiozero import MotionSensor
pir = MotionSensor(4)
pir.wait_for_motion()
print("Motion Detected!")
```

In this code, we just want the sensor to wait for motion and then print "Motion detected" when it senses motion. The sensor has a decent range, so keep that in mind when setting up a sensor for future projects.

1. You can also use **pir.wait_for_no_motion()** if you want the sensor to do the opposite and detect no motion.
2. To have the sensor constantly check for motion, you need to create a forever loop. Try that now.

Did you notice that it the shell prints over and over again when it detects motion? Try adding a pause after print using the sleep function

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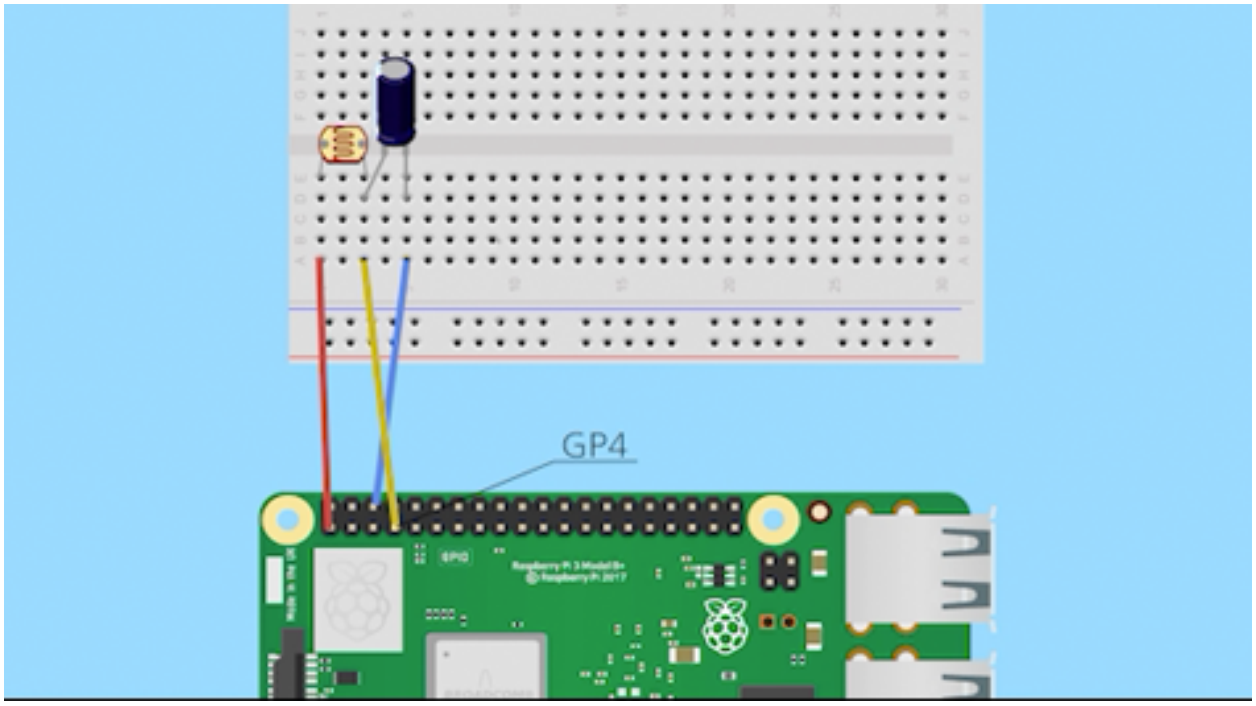
Project- Light sensor - the hardware

The Hardware

1. You can also use light or darkness to set off parts of your program with a light sensor. Here is a light sensor and a 1uF capacitor,

2. We are going to connect these components like we did the LED. Look at the diagram below,



3. Place the light sensor with one leg in the first column and the other leg in the third column.

4. Take the capacitor and place the long leg in front of the light sensor leg in column 3 and place the short leg in column 5.

5. Take a male/female jumper wire and connect the female to the 3V3 and the male end to the column with the first light sensor leg.

6. Take a male/female jumper wire and connect the female end to GRND pin and the male end to the 5th column that has the short leg of the capacitor.

7. Lastly, take a female/male jumper wire and connect the female end to GPIO 4 and the male end to the third column that has the legs of the sensor and capacitor.

8. These connections allow us to power the sensor and control it from the Pi.

Project- Light sensor - the code

We now need to enter the code for the Light Sensor. Copy the following code in a new Thonny file,

```
from gpiozero import LightSensor

ldr = LightSensor(4)

ldr.wait_for_light()

print("Let there be light")
```

This code works like the motion sensor. It waits for light and prints "Let there be light!" when it detects light. You can change it to `ldr.wait_for_dark()` if you want to detect dark instead of light.

The Challenge

- Can you add an LED so that it turns on when the room is dark?
- How would you use a loop to create this project?

Here is a site that gives you some tips on using the light sensor.