Companion Technology

with 라즈베리 파이로 구현하는 사물인터넷 프로젝트

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Agenda

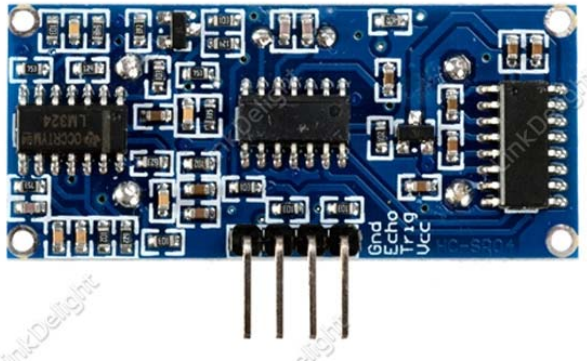
- *Ultrasonic Ranging Module*
- *PIR Motion Sensor*

Ultrasonic

- Ultrasonic Ranging Module: HC-SR04

Ultrasonic

- HC-SR04
  - 2cm~400cm 범위의 거리 측정 가능 (3mm 오차)
  - Basic principle of work:
    - Using IO trigger for at least 10us high level signal
    - Module automatically sends eight 40kHz and detect whether there is a pulse signal back
    - If the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning
  - Test distance = (high level time X velocity of sound (340M/S) / 2



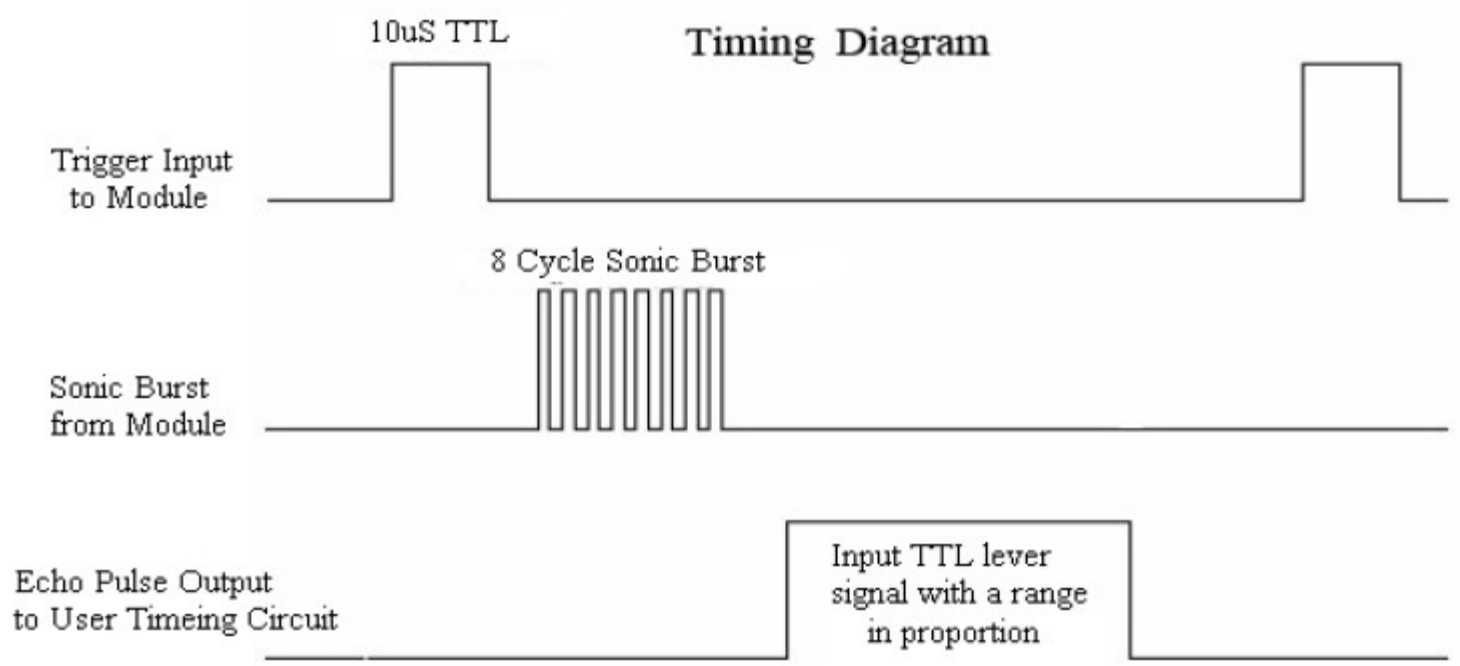
Ultrasonic

- HC-SR04
  - Electronic Parameters

Working Voltage	**DC 5 V**
Working Current	**15mA**
Working Frequency	**40Hz**
Max Range	**4m**
Min Range	**2cm**
MeasuringAngle	**15 degree**
Trigger Input Signal	**10uS TTL pulse**
Echo Output Signal	**Input TTL lever signal and the range in proportion**
Dimension	**45*20*15mm**

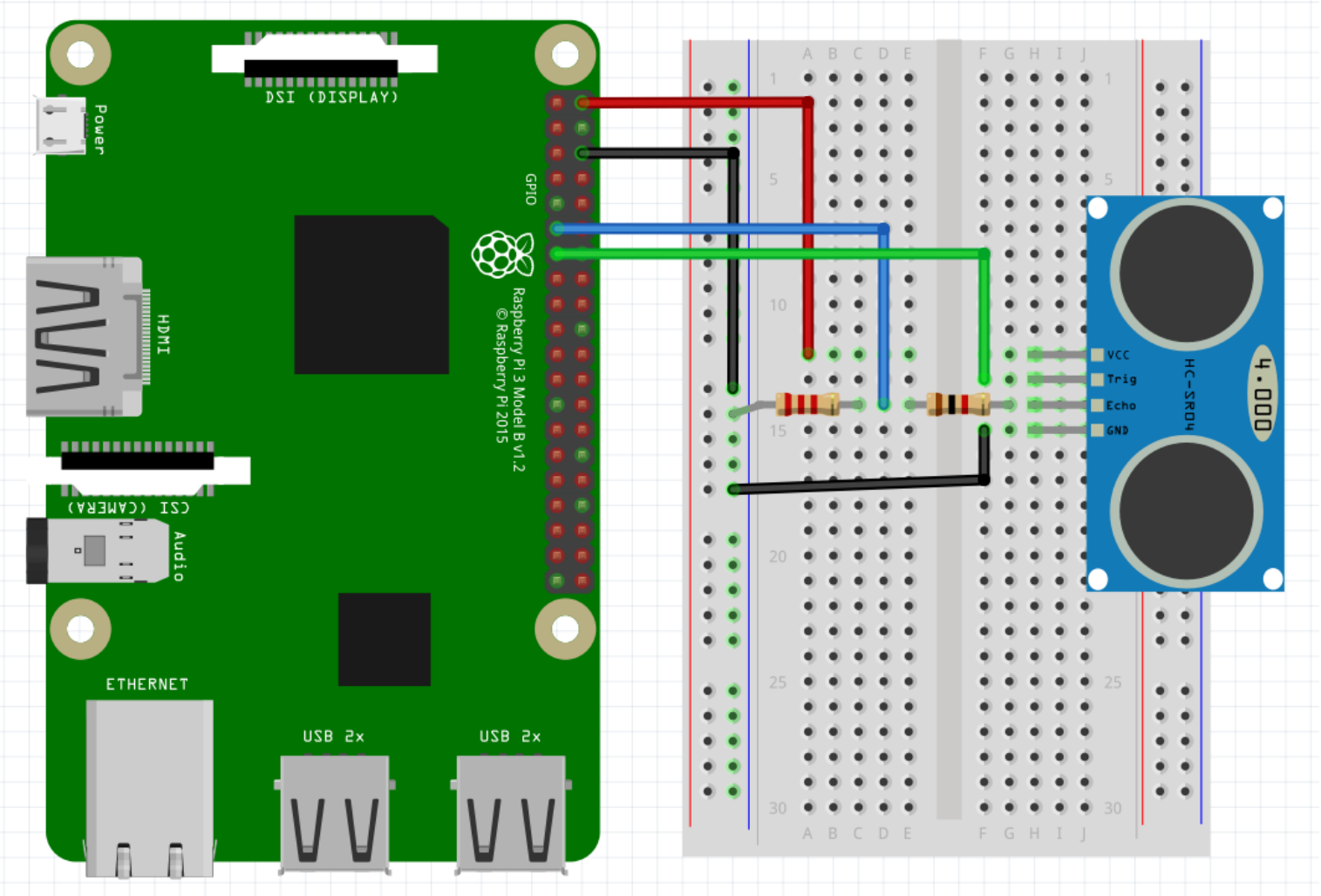
Ultrasonic

- HC-SR04
  - Timing Diagram



Ultrasonic

- HC-SR04
  - Schematic



Ultrasonic

- Python Example: ranging.py (1/3)

```
import RPi.GPIO as GPIO
import time

GPIO.setmode(GPIO.BOARD)

trig = 13
echo = 11

GPIO.setup(trig, GPIO.OUT)
GPIO.setup(echo, GPIO.IN)
```

Ultrasonic

- Python Example: ranging.py (2/3)

```
try:
        while True:
                GPIO.output(trig, False)
                time.sleep(0.5)

                GPIO.output(trig, True)
                time.sleep(0.00001)
                GPIO.output(trig, False)

                while GPIO.input(echo) == 0:
                        pulse_start = time.time()

                while GPIO.input(echo) == 1:
                        pulse_end = time.time()
```

Ultrasonic

- Python Example: ranging.py (3/3)

```
                    pulse_duration = pulse_end - pulse_start
                    distance = pulse_duration * 17000
                    distance = round(distance, 2)

                    print "Distance: ", distance, "cm"

except KeyboardInterrupt:
          GPIO.cleanup()
```

Ultrasonic

- Python Example: Running
  - $ sudo python ranging.py

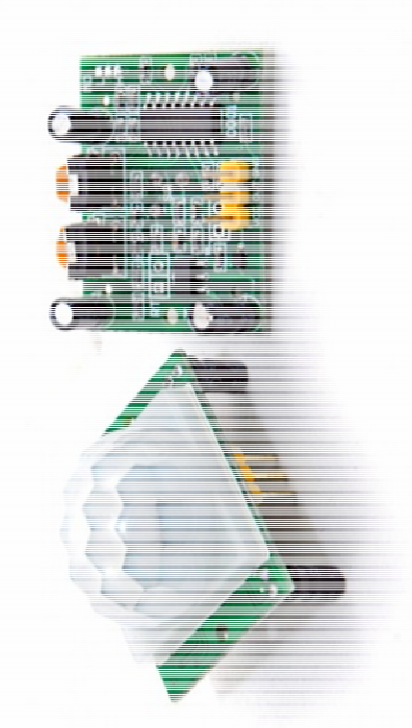
```
pi@raspberrypi:~/Ultrasonic $ ls
ranging.py
pi@raspberrypi:~/Ultrasonic $
pi@raspberrypi:~/Ultrasonic $ sudo python ranging.py
Distance:  65.82 cm
Distance:  140.05 cm
Distance:  33.28 cm
Distance:  3.04 cm
Distance:  2.67 cm
Distance:  2.48 cm
```

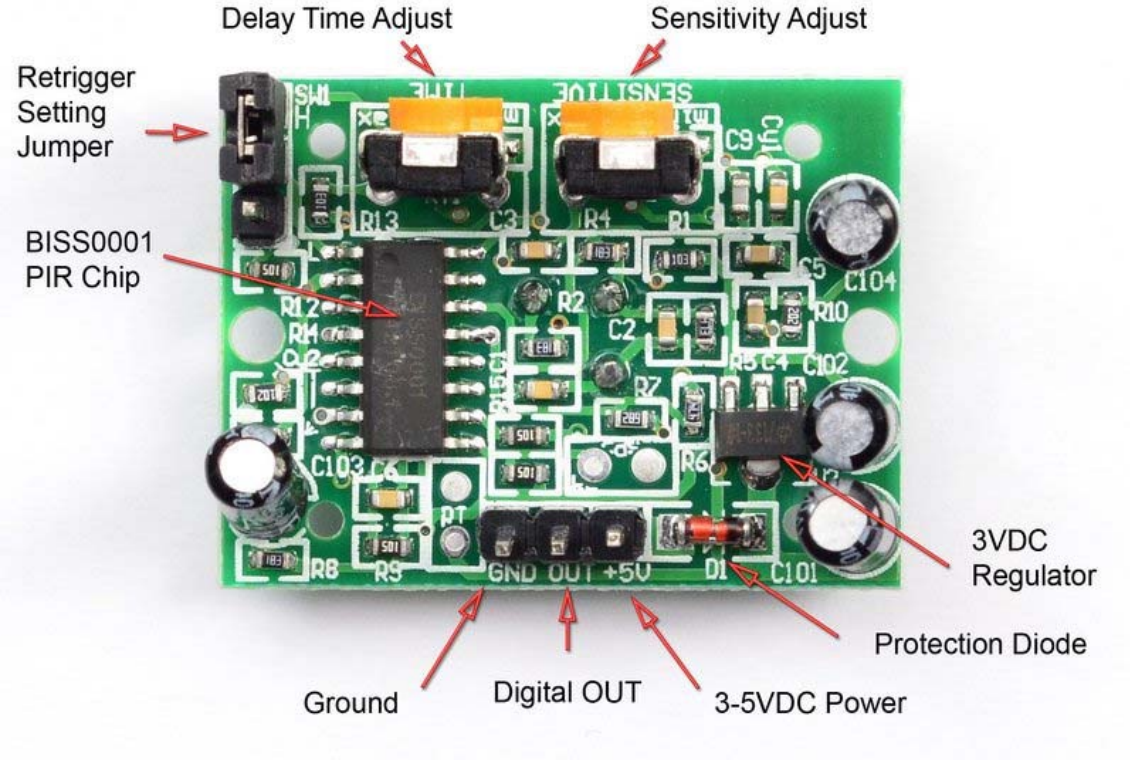
PIR Motion Sensor

- PIR Motion Sensor: HC-SR501

PIR Motion Sensor

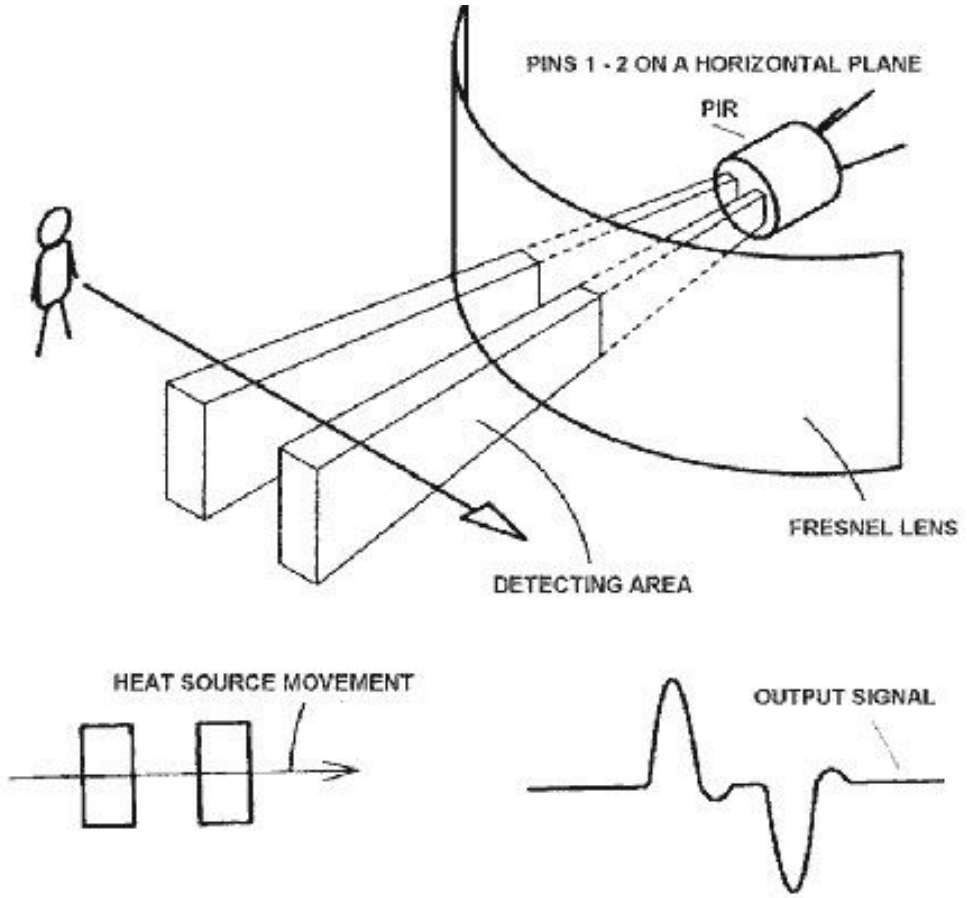
- Passive Infrared Sensor: HC-SR501
  - Design





PIR Motion Sensor

- Passive Infrared Sensor: HC-SR501
  - Operation



PIR Motion Sensor

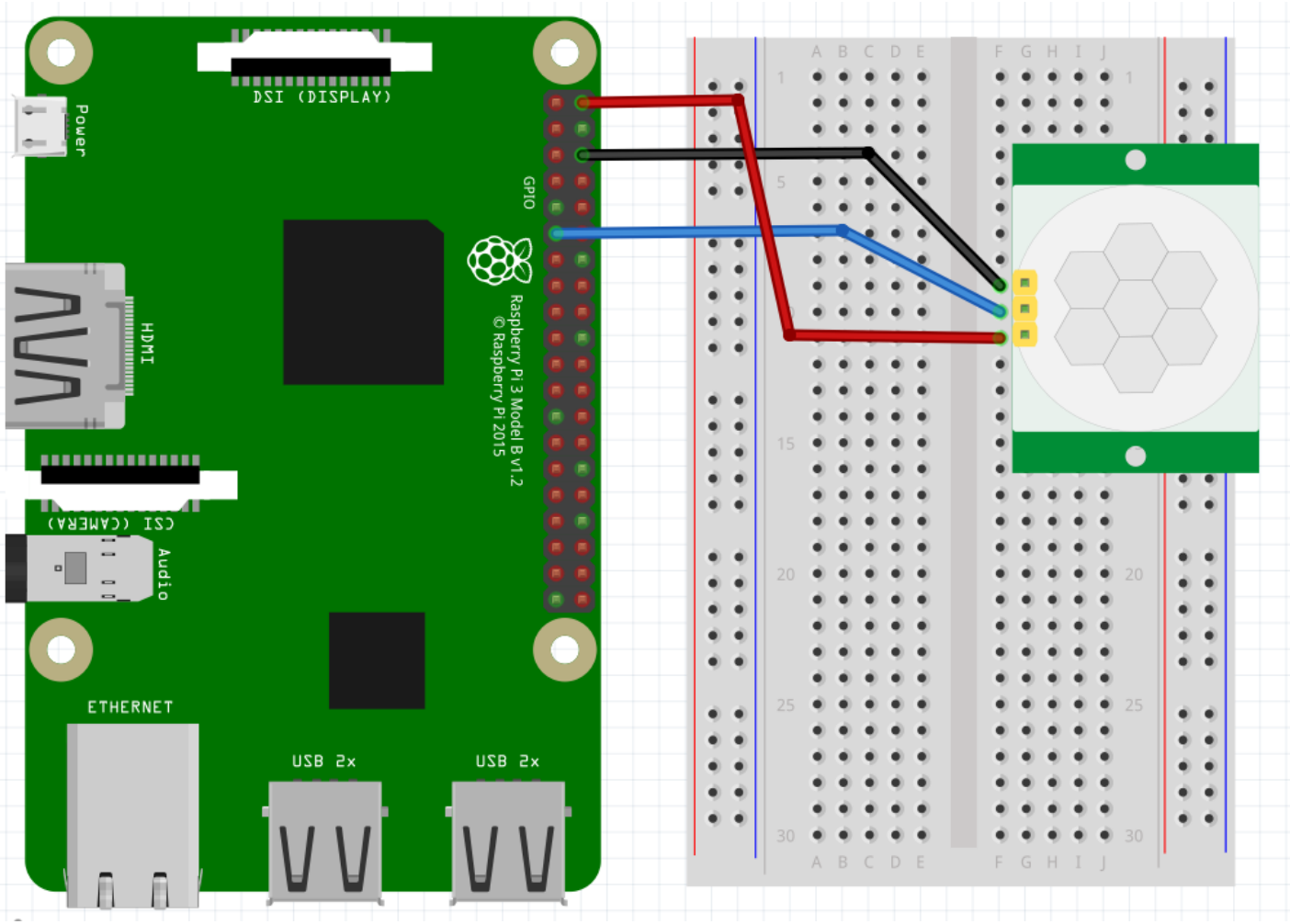
- HC-SR501 Specification
  - Voltage: 5V ~ 20V
  - Power Consumption: 65mA
  - TTL output: 3.3V, 0V
  - Delay time: Adjustable (0.3 ~ 5 min)
  - Lock time: 0.2 sec
  - Trigger methods: L-disable repeat trigger, H-enable repeat trigger (default)
  - Sensing range: less than 120 degree, within 7 meters
  - Temperature: -15 ~ +70
  - Dimension: 32 x 24 mm

PIR Motion Sensor

- HC-SR501
  - Instructions for Use
    - Sensor module is powered up after a minute, in this initialization time intervals during this module will output 0~3 times, a minute later enters the standby state
    - Should try to avoid the lights and other sources of interference close direct module surface of the lens, in order to avoid the introduction of interference siganl malfunction; environment should avoid the wind flow, the wind will cause interference on the sensor
    - Sensor module with dual probe, the probe window is rectangular, dual (A B) in both ends of the longitudinal direction
    - The dual direction of sensor should be installed parallel as far as possible in inline with human movement. In order to increase the sensor angle range, the module using a circular lens also makes the probe surrounded induction, but the left and right sides still up and down in both directions sensing range, sensitivity, still need to try to install the above requirements

PIR Motion Sensor

- HC-SR501
  - Schematic



PIR Motion Sensor

- Python Example: motion.py (1/2)

```
import RPi.GPIO as GPIO
import time

GPIO.setmode(GPIO.BOARD)

signal = 13

GPIO.setup(signal, GPIO.IN)
print "Waiting for Motion Sensor Initialized"

time.sleep(2)
print "Detecting Motion"
```

PIR Motion Sensor

- Python Example: motion.py (2/2)

```
try:
        while True:
                if GPIO.input(signal):
                        print "Motion Detected!"
                        time.sleep(0.5)

                time.sleep(1)

except KeyboardInterrupt:
        GPIO.cleanup()
```

PIR Motion Sensor

- Python Example: Running
  - $ sudo python motion.py

```
pi@raspberrypi:~/PIR $ sudo python motion.py
Waiting for Motion Sensor Initialized
Detecting Motion
Motion Detected!
Motion Detected!
Motion Detected!
Motion Detected!
Motion Detected!
```