

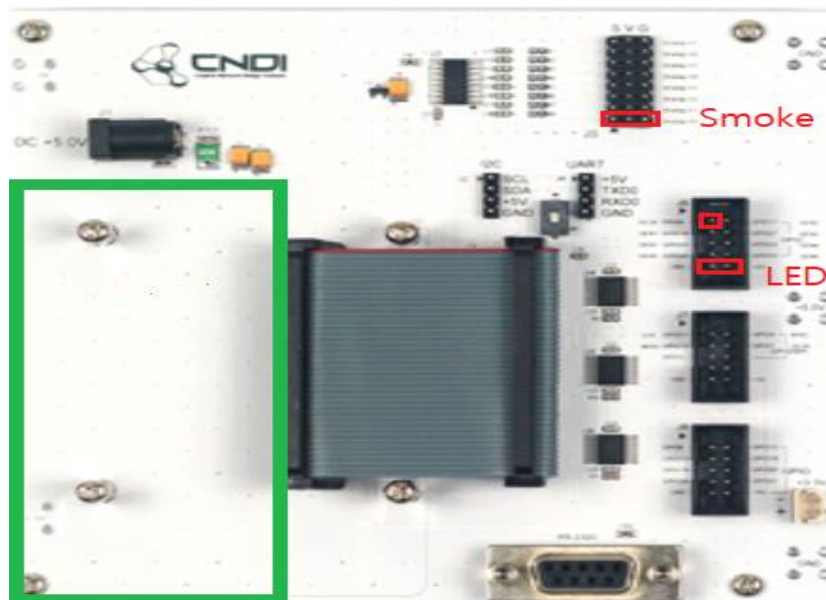
## 라즈베리파이 3 CO2 가스 센서 MQ-5(EF04029)

### (1) Raspberry Pi Smoke Sensor & LED 연결

Smoke 센서 S, V, G라고 적혀 있는 센서와 같은 S, V, G (Analog In0)

연결은 방법은 간단합니다. S->S, V->V, G->G

LED 센서 라즈베리파이와 연결 S->GPIO 04, V->VCC 5V, G->GND



5mm LED Brick



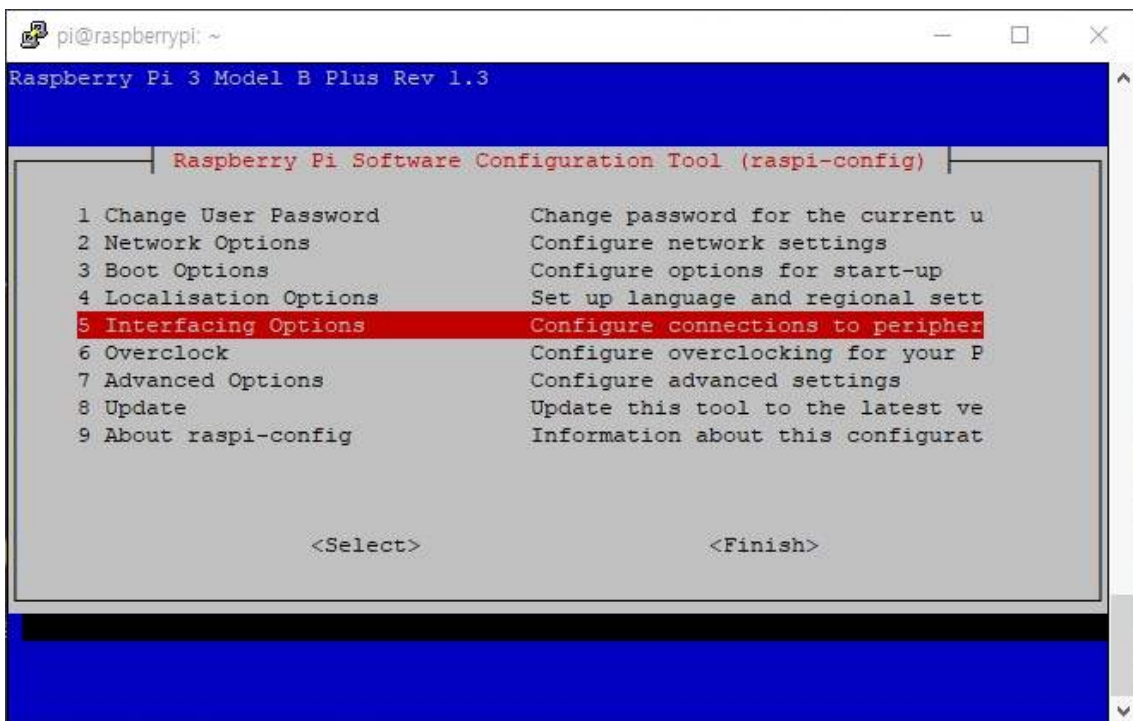
Smoke Sensor MQ-5  
Brick

Raspberry Pi에 설치 및 사용 참고  
<http://jjmoak.iwinv.net/wp/?p=12885>

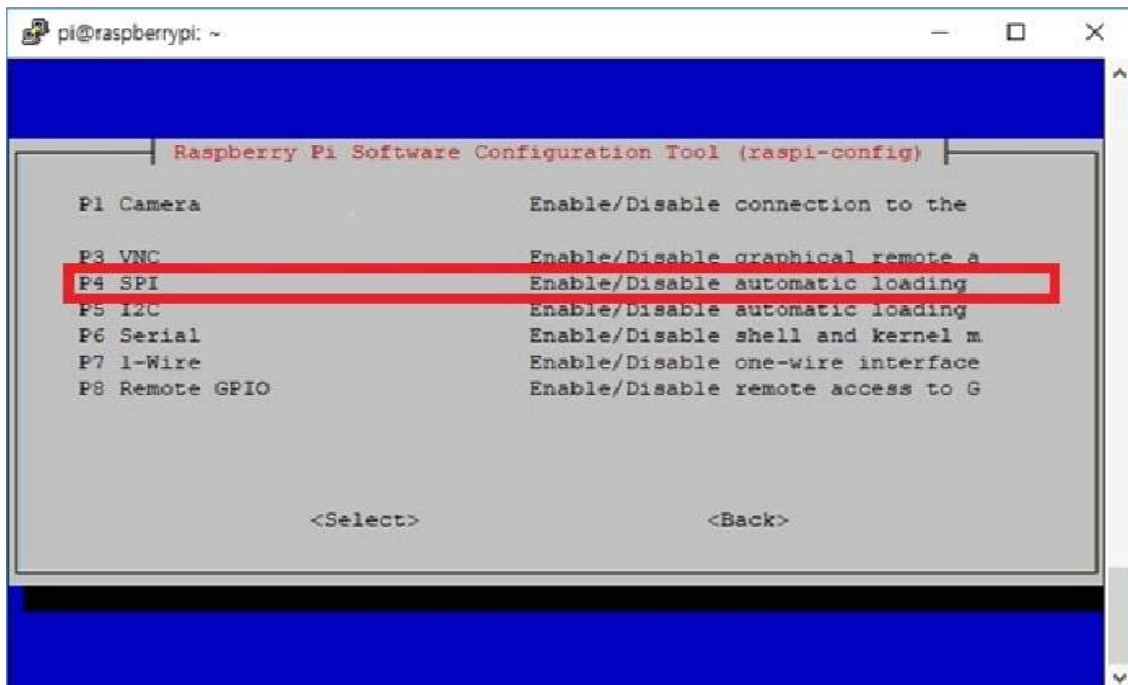
## (2) SPI 통신

```
1 pi@raspberrypi:~ $ sudo raspi-config
```

[putty] 화면



5번 <Select> 클릭



P4 SPI <Select> -> <Yes> -> <Finish>

```
1 | pi@raspberrypi:~ $ sudo nano /etc/modules
```

sudo nano /etc/modules 코드 수정  
파일 마지막에 아래에-> 'spide'를 추가

출처

<https://m.blog.naver.com/PostView.nhn?blogId=roboholic84&logNo=220367321777&proxyReferer=https:%2F%2Fwww.google.com%2F>

### (3) SPI 라이브러리 설치하기

```
1 sudo apt-get install python-dev
2 git clone git://github.com/Gadgetoid/py-spidev.git
3 cd py-spidev/
4 sudo python setup.py install
```

라즈베리파이 재부팅

### (4) 라즈베리파이에서 Smoke Sensor 작동 확인하기

[putty]에서 위와 같이 입력해서 밑에 코드로 작성해 봅시다.

```
1 import spidev, time
2
3 spi = spidev.SpiDev()
4 spi.open(0, 0)
5 spi.max_speed_hz = 1350000
6
7 def analog_read(channel):
8     r = spi.xfer2([1, (8 + channel) << 4, 0])
9     adc_out = ((r[1]&3) << 8) + r[2]
10    return adc_out
11
12 while True:
13     data = analog_read(0)
14     voltage = data * 3.3 / 1024
15     print("Data=%d\tVoltage=%f" % (data, voltage))
16     time.sleep(2)
```

작성후 센서가 시험 삼아 확인을 해봅니다.

```
1 pi@raspberrypi:~ $ python3 tryment.py
2
3 Data=310      Voltage=0.999023
4 Data=315      Voltage=1.015137
5 Data=316      Voltage=1.018359
6 Data=373      Voltage=1.202051
7 Data=441      Voltage=1.421191
8 Data=385      Voltage=1.240723
9 Data=345      Voltage=1.111816
10 Data=329      Voltage=1.060254
11 Data=321      Voltage=1.034473
12 Data=317      Voltage=1.021582
13 Data=316      Voltage=1.018359
14 Data=315      Voltage=1.015137
```

기본적으로 평균 310~316 이산화탄소(CO2)가 측정되었다.

여기서 입김을 한번 불었더니 441까지 올라가고 서서히 수치가 내려간다.

그래서 저는 CO2 센서 값이 400이 넘어가면 LED에 불이 들어오도록 코딩을 해보았습니다.

#### (4) Smoke Sensor 최종코드 작업

```
1 pi@raspberrypi:~ $ nano retryment.py
```

```
1 import spidev, time
2 import RPi.GPIO as gpio
3 import time
4 import sys
5 import warnings
6 import pymysql
7 import urllib.request
8
```

```

9 warnings.filterwarnings('ignore')
10 LED = 4
11 gpio.setmode(gpio.BCM)
12 gpio.setup(LED, gpio.OUT)
13
14 spi = spidev.SpiDev()
15 spi.open(0, 0)
16 spi.max_speed_hz = 1350000
17
18 def analog_read(channel):
19     r = spi.xfer2([1, (8 + channel) << 4, 0])
20     adc_out = ((r[1]&3) << 8) + r[2]
21     return adc_out
22 def insertDB(data):
23
24     conn = pymysql.connect(host='localhost',user='tryment',
25 password='123', db='smokedb', charset='utf8')
26     with conn.cursor() as cursor:
27         #sql = 'insert into testtable(pos, ppm) values("p777", 234);'
28         sql = 'insert into testtable(pos) values(%s);'
29         cnt = cursor.execute(sql, (data))
30         r = conn.commit()
31
32         if r == 0:
33             print("Failed")
34         else:
35             print("Save Ok")
36         conn.close()
37
38
39 def insertCloud(data):
40     api_key = 'YM4WRW72CMSN0531'
41     url = 'https://api.thingspeak.com/update'
42     url = url + '?api_key=%s' % api_key
43     url = url + '&field1=%s' % data
44
45     #print(url)
46     urllib.request.urlopen(url)
47
48 try:

```

```

49 while True:
50     data = analog_read(0)
51     voltage = data * 3.3 / 1024
52     print("Data=%d\tVoltage=%f" % (data, voltage))
53     insertDB(data)
54     insertCloud(data)
55     time.sleep(15)
56     if data>400:
57         gpio.output(LED, gpio.HIGH)
58
59 time.sleep(1)
60 except KeyboardInterrupt:
61     gpio.cleanup()
62     sys.exit()
63
64

```

22번~36 Maria DB에 접속하는 아이디 와 비번을 저장하고  
55번을 보시면 Maria DB 에 저장을 15초마다 하게 만들었습니다.

Save ok 라는 글이 출력되면서 값이 저장됩니다.

56~57번에서 만약 데이터 값이 400보다 높은 값이 나올 경우 LED가 켜진다.

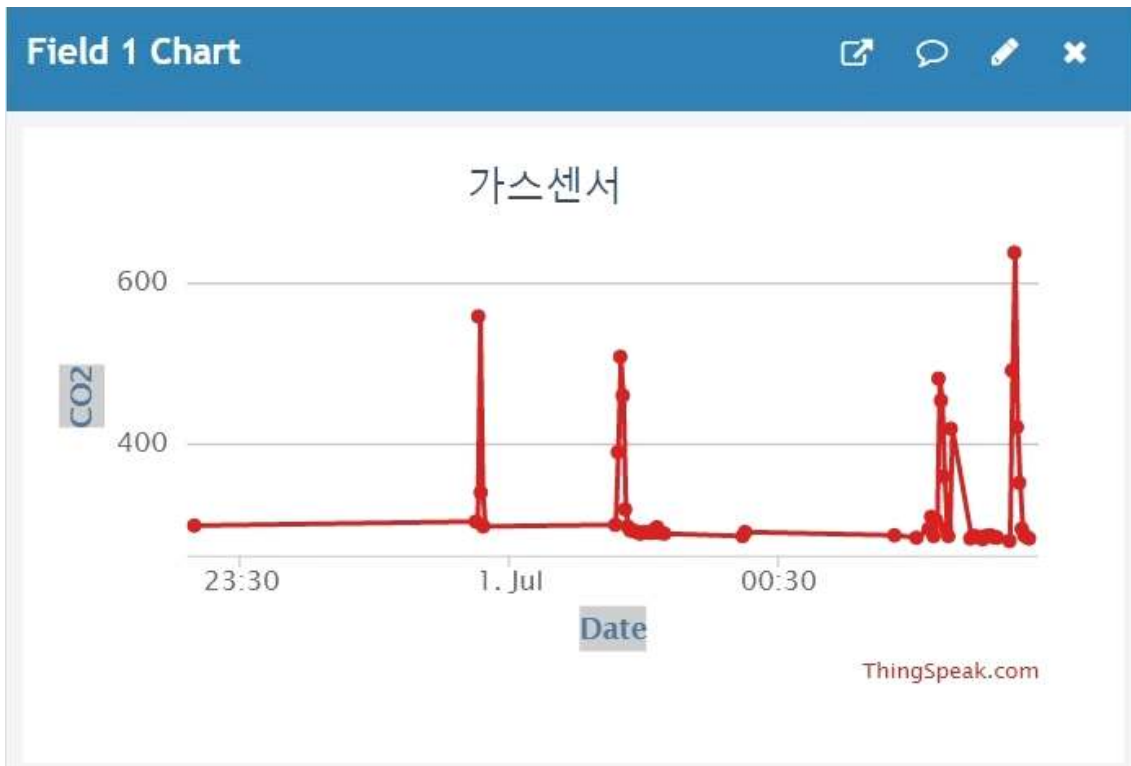
39~40번은처럼 'www.thingspeak.com'에 발급된 코드를 입력하면 그래프가 출력됩니다.

'python3 retryment.py' 입력하구 데이터가 전송되는 지 확인을 해봅시다.

```

1 pi@raspberrypi:~ $ python3 retryment.py
2
3 Data=299          Voltage=0.963574
4 Save Ok
5 Data=389          Voltage=1.253613
6 Save Ok
7 Data=507          Voltage=1.633887
8 Save Ok
9 Data=459          Voltage=1.479199
10 Save Ok
11 Data=318          Voltage=1.024805
12 Save Ok

```



(5) Maria DB : smokedb 만들기

Putty에서 Maria db가 설치되어 있을 경우 dustdb 예문 참고

<http://jjmoak.iwinv.net/wp/?p=14451>

```

1 pi@raspberrypi:~ $ sudo mysql -u root -p
2 Enter password:
3 Welcome to the MariaDB monitor.  Commands end with ; or \g.
4 Your MariaDB connection id is 47
5 Server version: 10.3.22-MariaDB-0+deb10u1 Raspbian 10
6
7 Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.
8 Type 'help;' or '\h' for help. Type '\c' to clear the current input
9 statement.
10 MariaDB [(none)]> show databases;
11 +-----+
12 | Database          |
13 +-----+
14 | dustdb            |
15 | information_schema|
16 | mysql              |

```



```

17 | performance_schema |
18 +-----+
19 4 rows in set (0.005 sec)
20
21 MariaDB [(none)]> CREATE DATABASE smokedb default CHARACTER SET
22 UTF8;
23
24 MariaDB [smokedb]> CREATE TABLE testtable(
25     -> _id INT PRIMARY KEY AUTO_INCREMENT,
26     -> pos VARCHAR(20) NOT NULL,
27     -> ppm INT);
28 Query OK, 0 rows affected (0.036 sec)
29
30 MariaDB [smokedb]> INSERT INTO testtable(pos,ppm) VALUES('p101', 400);
31 Query OK, 1 row affected (0.008 sec)
32
33 MariaDB [smokedb]> INSERT INTO testtable(pos,ppm) VALUES('p102', 420);
34 Query OK, 1 row affected (0.008 sec)
35
36 MariaDB [smokedb]> desc testtable:
37 +-----+-----+-----+-----+-----+-----+
38 | Field | Type          | Null | Key | Default | Extra          |
39 +-----+-----+-----+-----+-----+-----+
40 | _id   | int(11)       | NO   | PRI | NULL    | auto_increment |
41 | pos   | varchar(20)   | NO   |     | NULL    |                |
42 | ppm   | int(11)       | YES  |     | NULL    |                |
43 +-----+-----+-----+-----+-----+-----+
44 3 rows in set (0.011 sec)
45
46 MariaDB [smokedb]> SELECT * from testtable;
47 +-----+-----+-----+
48 | _id | pos  | ppm |
49 +-----+-----+-----+
50 | 1   | p101 | 400 |
51 | 2   | p102 | 420 |
52 +-----+-----+-----+
53 2 rows in set (0.001 sec)
54
55 MariaDB [smokedb]> exit
56 Bye

```

```

57
58 pi@raspberrypi:~ $ sudo mysql -u root -p
59
60
61 MariaDB [(none)]> use smokedb
62
63 Reading table information for completion of table and column names
64 You can turn off this feature to get a quicker startup with -A
65
66 Database changed
67 MariaDB [smokedb]> CREATE USER 'tryment'@'%' IDENTIFIED BY '123';
68 Query OK, 0 rows affected (0.001 sec)
69 MariaDB [smokedb]> GRANT ALL PRIVILEGES ON smokedb.* TO
70 'tryment'@'%';
71 Query OK, 0 rows affected (0.001 sec)
72
73 MariaDB [smokedb]> FLUSH privileges;
74 Query OK, 0 rows affected (0.001 sec)
75 Database changed
76 MariaDB [smokedb]> SELECT *from testtable;
77 +-----+-----+-----+
78 | _id | pos | ppm |
79 +-----+-----+-----+
80 | 1 | p101 | 400 |
81 | 2 | p102 | 420 |
82 | 3 | 299 | NULL |
83 | 4 | 389 | NULL |
84 | 5 | 507 | NULL |
85 | 6 | 459 | NULL |
86 | 7 | 318 | NULL |
87 | 8 | 297 | NULL |
88 | 9 | 292 | NULL |
89 | 10 | 292 | NULL |
90 | 11 | 291 | NULL |
91 | 12 | 290 | NULL |
92 | 13 | 288 | NULL |
93 | 14 | 289 | NULL |
94 | 15 | 290 | NULL |
95 | 16 | 290 | NULL |
96 | 17 | 289 | NULL |

```

|     |                            |
|-----|----------------------------|
| 97  |                            |
| 98  |                            |
| 99  | 18   289   NULL            |
| 100 | 19   293   NULL            |
| 101 | 20   296   NULL            |
| 102 | 21   289   NULL            |
| 103 | 22   289   NULL            |
| 104 | 23   288   NULL            |
| 105 | +-----+-----+-----+        |
| 106 | 23 rows in set (0.001 sec) |
| 107 |                            |
| 108 |                            |

Maria DB에 Data 값이 출력되는 것이 확인이 되면

```

pi@raspberrypi: ~
pi@raspberrypi:~ $ sudo mysql -u root -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 108
Server version: 10.3.22-MariaDB-0+deb10u1 Raspbian 10

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]> use smokedb
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
MariaDB [smokedb]> SELECT * from testtable;
+-----+-----+-----+
| _id | pos | ppm |
+-----+-----+-----+
| 1 | p101 | 400 |
| 2 | p102 | 420 |
| 3 | 299 | NULL |
| 4 | 389 | NULL |
| 5 | 507 | NULL |
| 6 | 459 | NULL |
| 7 | 318 | NULL |
| 8 | 297 | NULL |

```

CO2 가스 측정 센서가 정확하게 작동하구 DB 데이터를 전송하구 저장하는 것을 알 수 있습니다.

감사합니다.