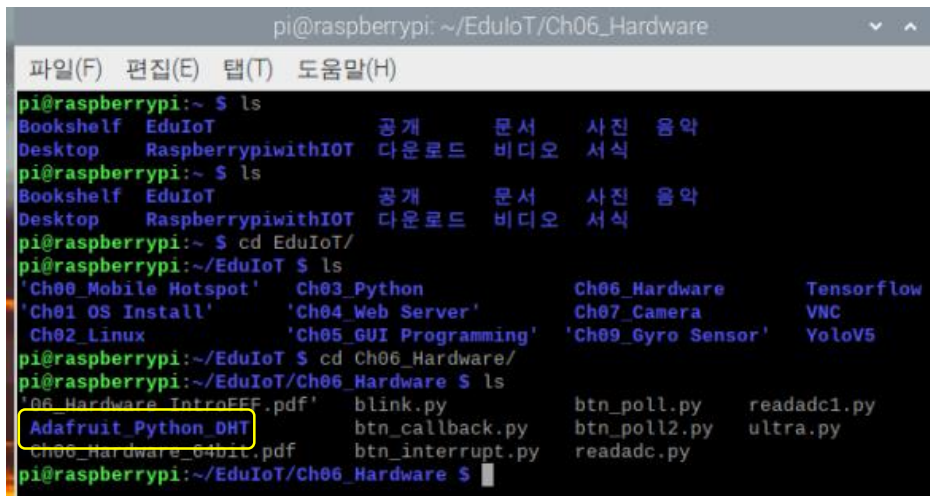


1. Programming the DHT11(교재 p. 334) with Python (Raspberrypi 4, Bullseye 용)

```
$ cd EduIoT/Ch06_Hardware
```

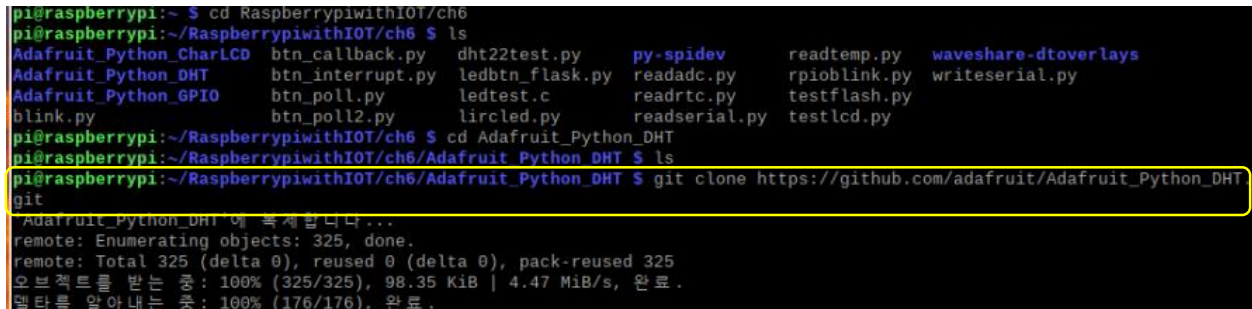
```
$ ls
```



```
pi@raspberrypi: ~/EduIoT/Ch06_Hardware
파일(F) 편집(E) 탭(T) 도움말(H)
pi@raspberrypi:~ $ ls
Bookshelf  EduIoT      공개      문서      사진      음악
Desktop    RaspberrypiwithIoT 다운로드 비디오 서식
pi@raspberrypi:~ $ ls
Bookshelf  EduIoT      공개      문서      사진      음악
Desktop    RaspberrypiwithIoT 다운로드 비디오 서식
pi@raspberrypi:~ $ cd EduIoT/
pi@raspberrypi:~/EduIoT $ ls
'Ch00_Mobile Hotspot'  Ch03_Python      Ch06_Hardware      Tensorflow
'Ch01_OS Install'     'Ch04_Web Server' Ch07_Camera        VNC
Ch02_Linux            'Ch05_GUI Programming' 'Ch09_Gyro Sensor' YoloV5
pi@raspberrypi:~/EduIoT $ cd Ch06_Hardware/
pi@raspberrypi:~/EduIoT/Ch06_Hardware $ ls
'Ch06_Hardware_IntroFFF.pdf'  blink.py      btn_poll.py      readadc1.py
Adafruit_Python_DHT          btn_callback.py btn_poll2.py      ultra.py
Ch06_Hardware_04bit.pdf      btn_interrupt.py readadc.py
pi@raspberrypi:~/EduIoT/Ch06_Hardware $
```

* 위와 같이 'Adafruit_Python_DHT' 폴더(폴더는 하늘색)가 보이면 다음 줄의 명령을 skip

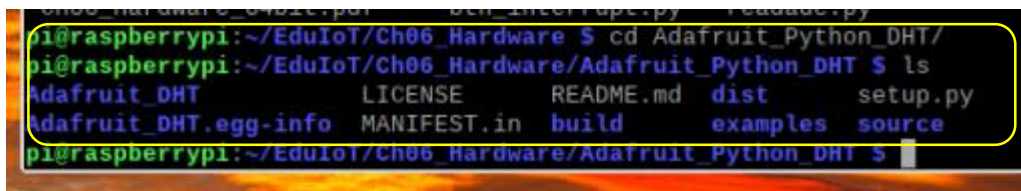
```
$ git clone https://github.com/adafruit/Adafruit_Python_DHT.git
```



```
pi@raspberrypi:~ $ cd RaspberrypiwithIoT/ch6
pi@raspberrypi:~/RaspberrypiwithIoT/ch6 $ ls
Adafruit_Python_CharLCD  btn_callback.py  dht22test.py  py-spidev  readtemp.py  waveshare-dtoverlays
Adafruit_Python_DHT      btn_interrupt.py ledbtn_flask.py readadc.py  rpioblink.py  writeserial.py
Adafruit_Python_GPIO     btn_poll.py      ledtest.c     readrtc.py  testflash.py
blink.py                 btn_poll2.py     lircled.py    readserial.py  testlcd.py
pi@raspberrypi:~/RaspberrypiwithIoT/ch6 $ cd Adafruit_Python_DHT
pi@raspberrypi:~/RaspberrypiwithIoT/ch6/Adafruit_Python_DHT $ ls
pi@raspberrypi:~/RaspberrypiwithIoT/ch6/Adafruit_Python_DHT $ git clone https://github.com/adafruit/Adafruit_Python_DHT.git
git
Adafruit_Python_DHT 에 복제합니다...
remote: Enumerating objects: 325, done.
remote: Total 325 (delta 0), reused 0 (delta 0), pack-reused 325
오브젝트를 받는 중: 100% (325/325), 98.35 KiB | 4.47 MiB/s, 완료.
델타를 알아내는 중: 100% (176/176), 완료.
```

```
$ cd Adafruit_Python_DHT
```

```
$ ls
```



```
pi@raspberrypi:~/EduIoT/Ch06_Hardware $ cd Adafruit_Python_DHT/
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT $ ls
Adafruit_DHT      LICENSE      README.md    dist      setup.py
Adafruit_DHT.egg-info MANIFEST.in  build        examples  source
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT $
```

\$ sudo python3 setup.py install

```
pi@raspberrypi:~/RaspberrypiwithIoT/ch6/Adafruit_Python_DHT/Adafruit_Python_DHT $ ls
Adafruit_DHT LICENSE MANIFEST.in README.md examples setup.py source
pi@raspberrypi:~/RaspberrypiwithIoT/ch6/Adafruit_Python_DHT/Adafruit_Python_DHT $ sudo python3 setup.py install
[running install
running bdist_egg
running egg_info
creating Adafruit_DHT.egg-info
writing Adafruit_DHT.egg-info/PKG-INFO
writing dependency_links to Adafruit_DHT.egg-info/dependency_links.txt
```

(중략)

```
zip_safe flag not set; analyzing archive contents...
Adafruit_DHT.__pycache__.Raspberrypi_2_Driver.cpython-39: module references __file__
creating dist
creating 'dist/Adafruit_DHT-1.4.0-py3.9-linux-aarch64.egg' and adding 'build/bdist.linux-aarch64/egg' to it
removing 'build/bdist.linux-aarch64/egg' (and everything under it)
Processing Adafruit_DHT-1.4.0-py3.9-linux-aarch64.egg
creating /usr/local/lib/python3.9/dist-packages/Adafruit_DHT-1.4.0-py3.9-linux-aarch64.egg
Extracting Adafruit_DHT-1.4.0-py3.9-linux-aarch64.egg to /usr/local/lib/python3.9/dist-packages
Adding Adafruit-DHT 1.4.0 to easy-install.pth file

Installed /usr/local/lib/python3.9/dist-packages/Adafruit_DHT-1.4.0-py3.9-linux-aarch64.egg
Processing dependencies for Adafruit-DHT==1.4.0
Finished processing dependencies for Adafruit-DHT==1.4.0
pi@raspberrypi:~/RaspberrypiwithIoT/ch6/Adafruit_Python_DHT/Adafruit_Python_DHT $ cd ..
```

\$ cd examples

\$ ls

\$ cp simpletest.py test.py

```
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT $ cd examples
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT/examples $ ls
AdafruitDHT.py google_spreadsheet.py simpletest.py test.py test.py.save
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT/examples $
```

\$ nano test.py

```
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT/examples $ nano test.py
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT/examples $
```

```
#!/usr/bin/env python3
import Adafruit_DHT

#sensor = Adafruit_DHT.DHT22
sensor = Adafruit_DHT.DHT11
pin=18

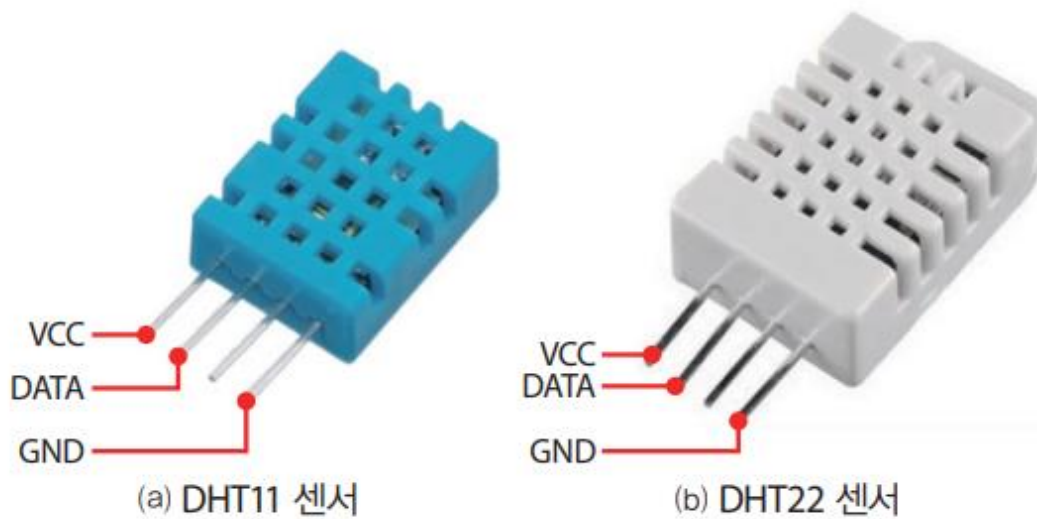
humidity, temperature = Adafruit_DHT.read_retry(sensor, pin)
if humidity is not None and temperature is not None:
    # print 'Temp={0:0.1f}*C Humidity={1:0.1f}%'.format(temperature, humidity)
```

```
print('Temp={0:0.1f}*C Humidity={1:0.1f}%'.format(temperature, humidity))
else:
#   print 'Failed to get reading. Try again!'
print('Failed to get reading. Try again!')
```

(위와 같이 수정. 불필요한 comment 삭제)

\$ python3 test.py

```
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT/examples $ python3 test.py
Temp=24.0°C Humidity=59.0%
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT/examples $
```



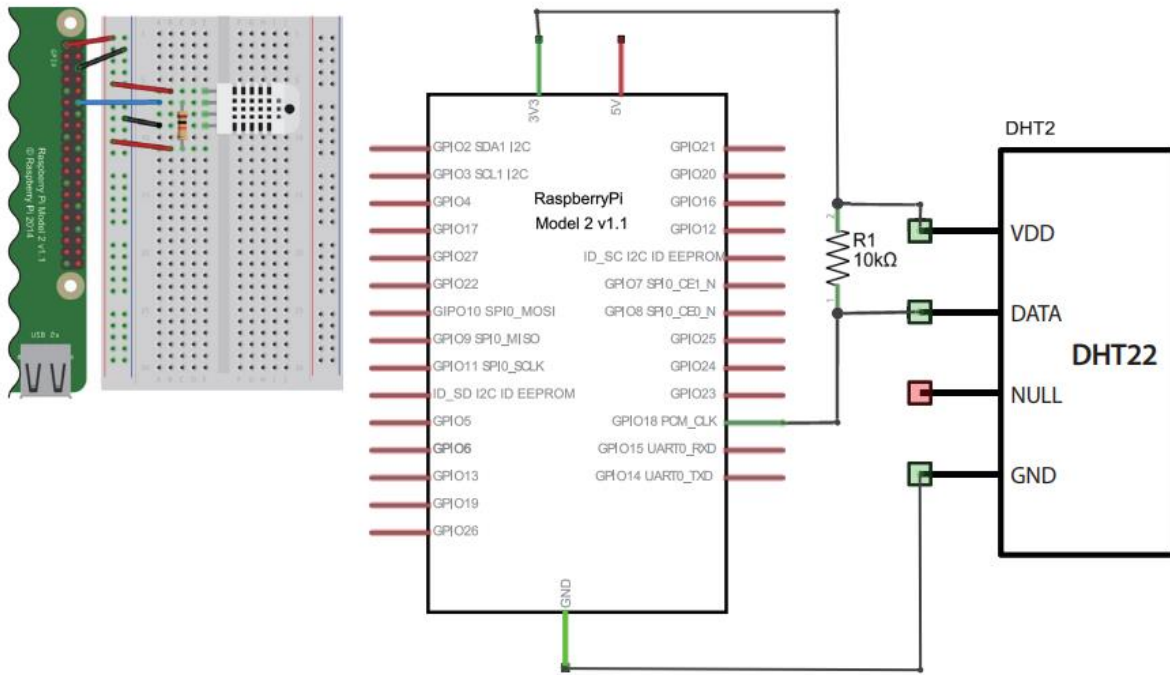


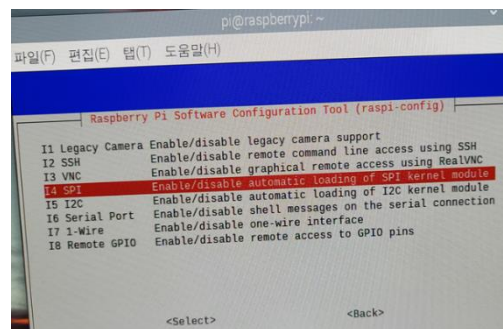
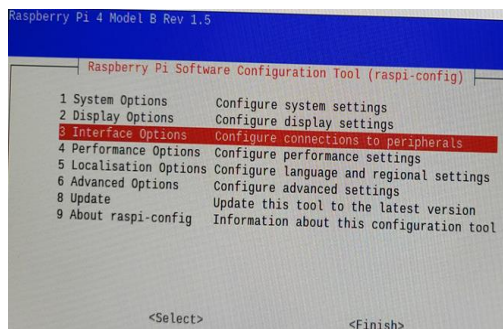
그림 6-30 DHT22 센서 연결

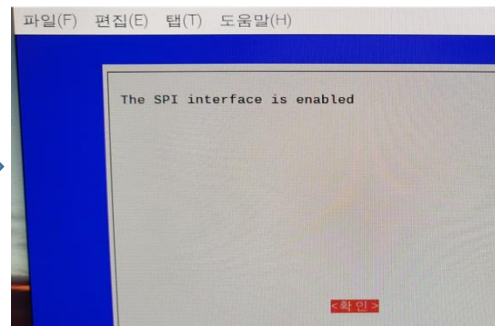
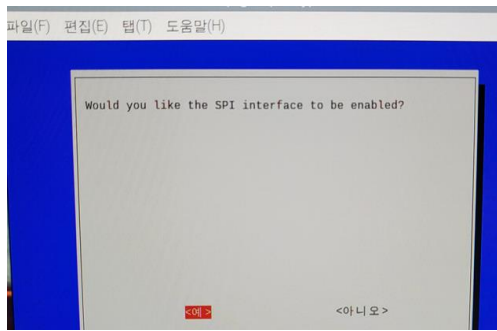
Q: 1 초간격으로 온도가 표시되도록 프로그램 수정

2. ADC 장치 실습 (교재 p.327)

. SPI Enable 확인

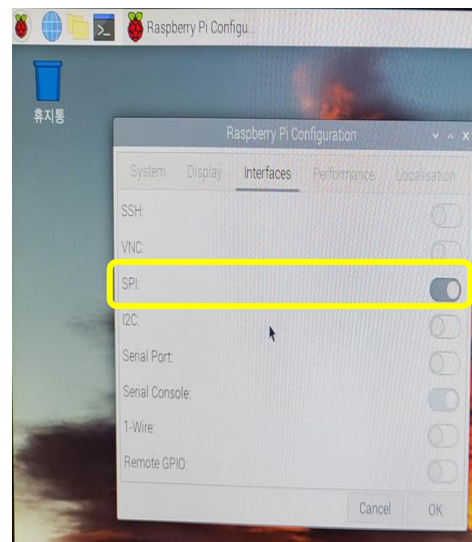
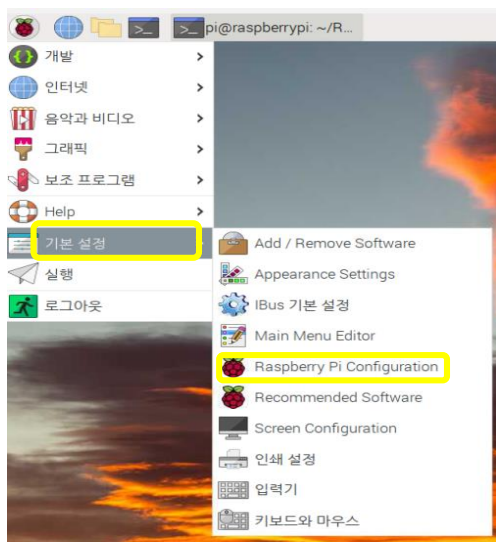
\$ sudo raspi-config





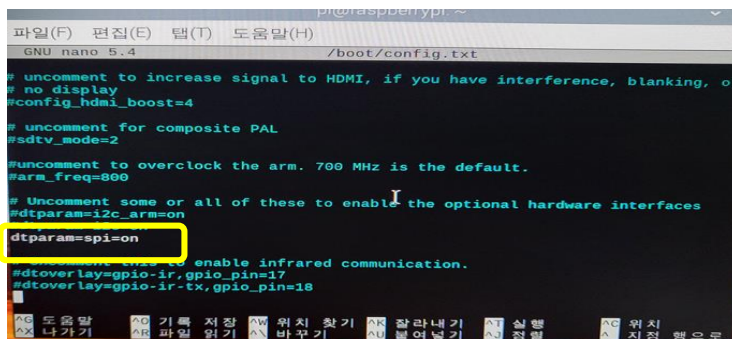
. Tab, Tab, Enter 로 빠져 나옴

또는



\$ sudo nano /boot/config.txt

* dtparam=spi=on 체크



(위와 같이 되어 있으면 빠져 나옴(^X, Y, Enter. 수정사항이 없으면 ^X))

```
$ cd ../../
```

```
$ ls
```

```
pi@raspberrypi:~/EduIoT/Ch06_Hardware/Adafruit_Python_DHT/examples $ cd ../../
pi@raspberrypi:~/EduIoT/Ch06_Hardware $ ls
'06_Hardware IntroFF.pdf'  Ch06_Hardware_64bit.pdf  btn_callback.py  btn_poll.py  readadc.py  ultra.py
Adafruit_Python_DHT      blink.py                 btn_interrupt.py  btn_poll2.py  readadc1.py
pi@raspberrypi:~/EduIoT/Ch06_Hardware $
```

```
$ sudo apt-get install python3-dev
```

```
pi@raspberrypi:~/EduIoT/Ch06_Hardware $ sudo apt-get install python3-dev
패키지 목록을 읽는 중입니다... 완료
의존성 트리를 만드는 중입니다... 완료
상태 정보를 읽는 중입니다... 완료
python3-dev is already the newest version (3.9.2-3).
다음 패키지가 자동으로 설치되었지만 더 이상 필요하지 않습니다:
libfuse2
Use 'sudo apt autoremove' to remove it.
0개 업그레이드, 0개 새로 설치, 0개 제거 및 15개 업그레이드 안 함.
pi@raspberrypi:~/EduIoT/Ch06_Hardware $
```

\$ git clone git://github.com/doceme/py-spidev (여기서 cloning(복제)이 아래와 같이 에러가 나서, 2.1 GPIO Zero 방법(인터넷) 이용. 따라서 다음 2 line 은 실행 안됨.)

```
$ cd py-spidev/
```

```
$ sudo python3 setup.py install
```

```
파일(F) 편집(E) 탭(T) 도움말(H)
pi@raspberrypi:~ $ cd RaspberrypiwithIOT/ch6
pi@raspberrypi:~/RaspberrypiwithIOT/ch6 $ git clone git://github.com/doceme/py-spidev
'py-spidev'에 복제합니다...
fatal: unable to connect to github.com:
github.com[0: 20.200.245.247]: errno=연결 시간 초과
```

2.1 Installing GPIO Zero (교재, p.325. spi 설치가 불가하여 GPIO Zero 를 사용)

Installing GPIO Zero

참고:<https://gpiozero.readthedocs.io/en/stable/installing.html>

. GPIO Zero가default로설치

. Upgrade (apt, pip, ...)

```
$ sudo apt-get update
```

```

pi@raspberrypi:~/EduIoT/Ch06_Hardware $ sudo apt-get update
기존:1 http://deb.debian.org/debian bullseye InRelease
기존:2 http://deb.debian.org/debian bullseye-updates InRelease
기존:3 http://security.debian.org/debian-security bullseye-security InRelease
기존:4 http://archive.raspberrypi.org/debian bullseye InRelease
패키지 목록을 읽는 중입니다... 완료
pi@raspberrypi:~/EduIoT/Ch06_Hardware $

```

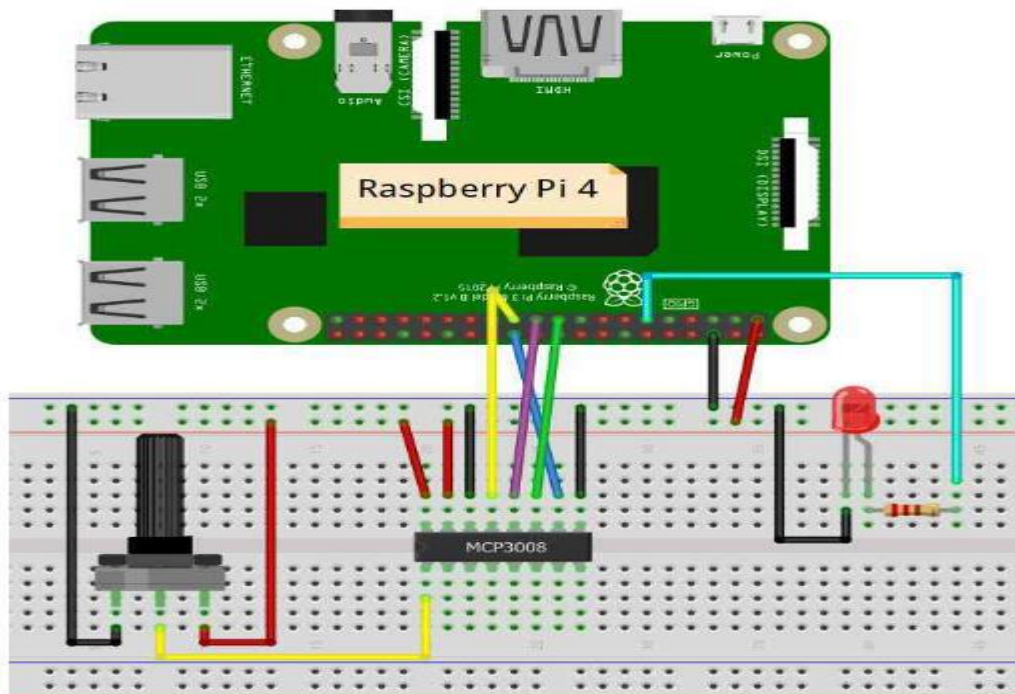
\$ sudo apt install python3-gpiozero

```

pi@raspberrypi:~/EduIoT/Ch06_Hardware $ sudo apt install python3-gpiozero
패키지 목록을 읽는 중입니다... 완료
의존성 트리를 만드는 중입니다... 완료
상태 정보를 읽는 중입니다... 완료
python3-gpiozero is already the newest version (1.6.2-1).
다음 패키지가 자동으로 설치되었지만 더 이상 필요하지 않습니다:
  libfuse2
Use 'sudo apt autoremove' to remove it.
0개 업그레이드, 0개 새로 설치, 0개 제거 및 15개 업그레이드 안 함.
pi@raspberrypi:~/EduIoT/Ch06_Hardware $

```

참고:<https://roboticadiy.com/potentiometer-analog-input-for-the-raspberry-pi-4/>



\$ nano readadc.py

```

import spidev, time
spi = spidev.SpiDev()
spi.open(0, 0)

def analog_read(channel):
    r = spi.xfer2([1, (8 + channel) << 4, 0])
    adc_out = ((r[1]&3) << 8) + r[2]

    return adc_out

```

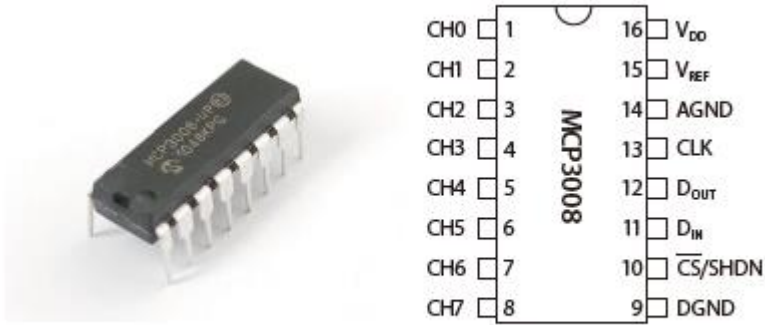


그림 6-21 MCP3008 칩 구성

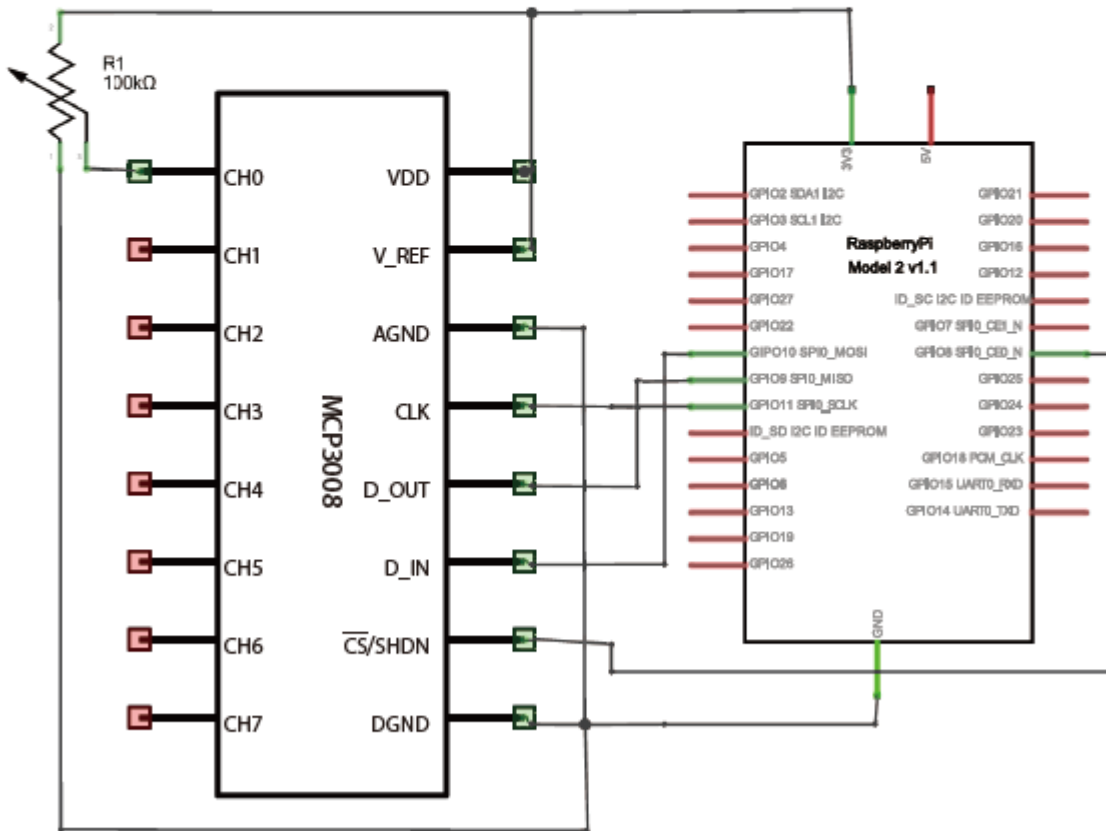
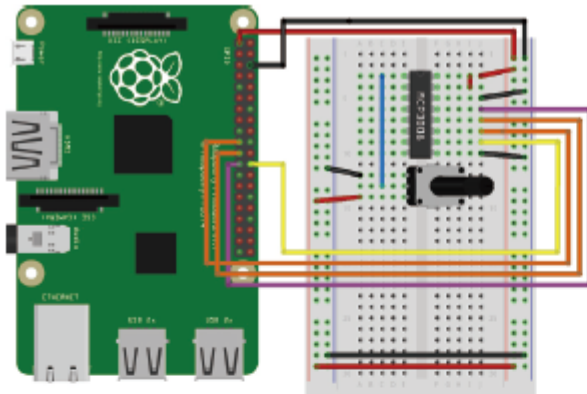


그림 6-22 MCP3008 회로 연결

2.2 ADC test

참고:

https://gpiozero.readthedocs.io/en/v1.6.2/api_spi.html?highlight=#module-gpiozero.spi_devices

\$ nano readadc1.py

\$ python3 readadc1.py

(readadc.py 는 정상작동하지 않음.)

```
from gpiozero import MCP3008
import time

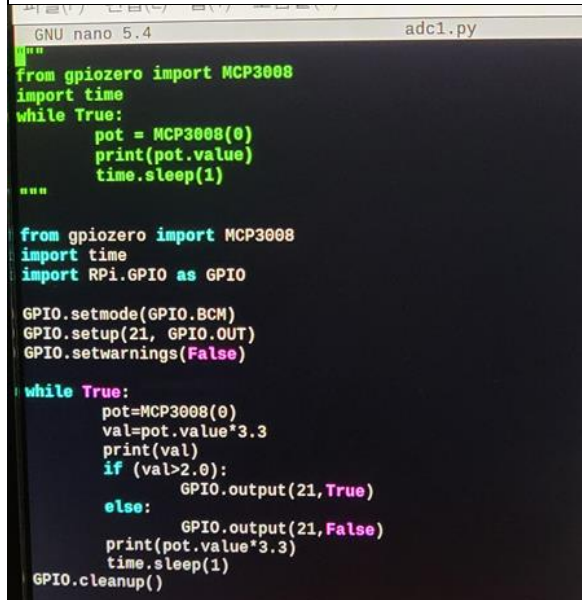
while True:
    pot = MCP3008(0)
    print(pot.value)
    time.sleep(1)
```

```
from gpiozero import MCP3008
import time
import RPi.GPIO as GPIO

GPIO.setmode(GPIO.BCM)
GPIO.setup(21, GPIO.OUT)
GPIO.setwarnings(False)

while True:
    pot=MCP3008(0)
    val=pot.value*3.3
    print(val)
    if (val>2.0):
        GPIO.output(21,True)
    else:
        GPIO.output(21,False)

    #print(pot.value*3.3)
    time.sleep(1)
GPIO.cleanup()
```



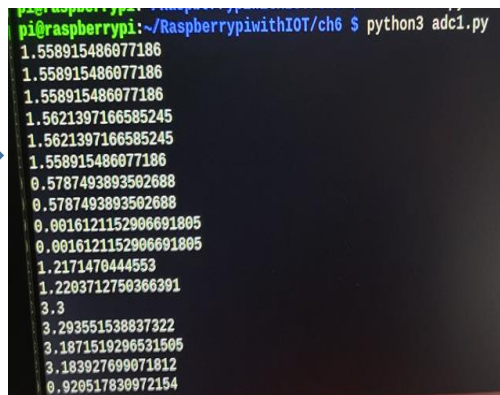
GNU nano 5.4 readadc1.py

```
"""
from gpiozero import MCP3008
import time
while True:
    pot = MCP3008(0)
    print(pot.value)
    time.sleep(1)
"""

from gpiozero import MCP3008
import time
import RPi.GPIO as GPIO

GPIO.setmode(GPIO.BCM)
GPIO.setup(21, GPIO.OUT)
GPIO.setwarnings(False)

while True:
    pot=MCP3008(0)
    val=pot.value*3.3
    print(val)
    if (val>2.0):
        GPIO.output(21,True)
    else:
        GPIO.output(21,False)
    print(pot.value*3.3)
    time.sleep(1)
GPIO.cleanup()
```



```
pi@raspberrypi:~/RaspberrypiwithIOT/ch6 $ python3 adc1.py
1.558915486077186
1.558915486077186
1.558915486077186
1.5621397166585245
1.5621397166585245
1.558915486077186
0.5787493893502688
0.5787493893502688
0.0016121152906691805
0.0016121152906691805
1.2171470444553
1.2203712750366391
3.3
3.293551538837322
3.1871519290531505
3.183927699071812
0.920517830972154
```

