

# IoT Platform 2<sup>nd</sup> Week

## - Raspberry Pi Platform -

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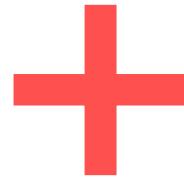
# 라즈베리 파이 소개

Introduction to Raspberry Pi

# 라즈베리 파이 Raspberry Pi



라즈베리 (Raspberry)



파이 (Pie)

# 라즈베리 파이 Raspberry Pi

## ■ 라즈베리 파이 (RPi)란?

- 영국 잉글랜드 '라즈베리 파이 재단'이 기초 컴퓨터 과학 교육을 위해 개발한 저가형 (5만원 이하) '**싱글 보드 컴퓨터**'

The screenshot shows the official website for the Raspberry Pi Foundation at <https://www.raspberrypi.org>. The page features a large image of a hand holding a Raspberry Pi Model B+ board. Below the image, there's a call-to-action button 'Buy a Raspberry Pi'. To the right, there's a photo of two children working on a laptop. The main text on the page reads: 'A small and affordable computer that you can use to learn programming'. A mission statement below says: 'Our mission is to put the power of computing and digital making into the hands of people all over the world.' At the bottom, there's a section showing various projects made with Raspberry Pi, including a Mario game and a birthday cake.

라즈베리 파이 재단 홈페이지  
[www.raspberrypi.org](https://www.raspberrypi.org)



라즈베리 파이 (RPi)



# 라즈베리 파이 특징

## ■ 범용 컴퓨터 장비

- 컴퓨터 일반 및 프로그래밍 교육에 적합



## ■ 피지컬 컴퓨팅 플랫폼

- 임베디드 시스템 애플리케이션
- 인터넷 연결 임베디드 애플리케이션 (**IoT, 사물인터넷**)

## ■ 리눅스 운영체제 구동

- 많은 오픈 소스 라이브러리와 애플리케이션 사용이 가능

## ■ 누구나 **다양한 프로젝트**에 활용이 가능

- 학생/예술가/전문가들이 예술 작품부터 고급 관리 시스템 개발까지 활용

## ■ 전통적 임베디드 시스템 (예, 아두이노)와의 비교

- 운영체제 (리눅스)의 능력 활용이 가능
  - ✓ 예, 웹 서버 (HTTP), 원격 셸 접근 (SSH), 고급 소프트웨어, 디바이스 드라이버 활용
- OS로 인한 **실시간 처리 능력에 한계** (분산 제어 시스템의 중앙 처리 장치)
- 상업적 프로젝트를 개발하기에 이상적지는 않음 (교육에 초점)

# 라즈베리 파이 모델과 규격

## ■ Raspberry Pi 3 Model B+<sup>1</sup>

- 1.4GHz 64-bit quad-core processor
  - ✓ Broadcom **BCM2837B0**, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz
- 1GB LPDDR2 SDRAM
- 2.4GHz and 5GHz IEEE 802.11.b/g/n/ac **WLAN**, Bluetooth 4.2/BLE
- Gigabit **Ethernet** over USB 2.0 (maximum throughput 300 Mbps)
- Interfaces
  - ✓ Extended **40-pin GPIO** header
  - ✓ Full-size **HDMI**
  - ✓ 4 **USB** 2.0 ports
  - ✓ CSI **camera** port for connecting a Raspberry Pi camera
  - ✓ DSI **display** port for connecting a Raspberry Pi touchscreen display
  - ✓ 4-pole **stereo output** and composite video port
  - ✓ **Micro SD** port for loading your operating system and storing data
- Power
  - ✓ **5V/2.5A DC** power input
  - ✓ Power-over-Ethernet support (with separate PoE HAT<sup>2</sup>)

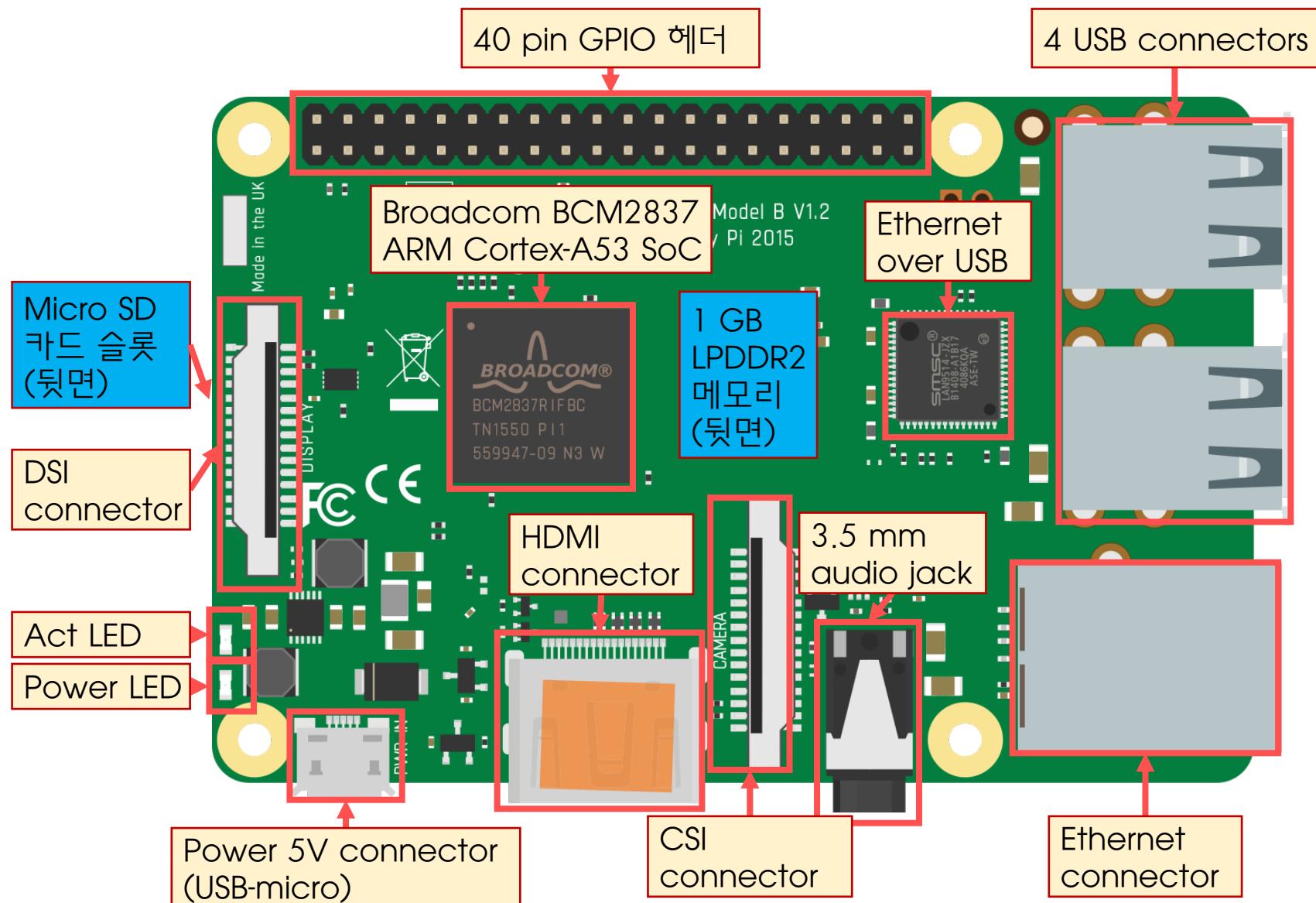


<sup>1</sup> <https://www.raspberrypi.org/products/raspberry-pi-3-model-b-plus/>

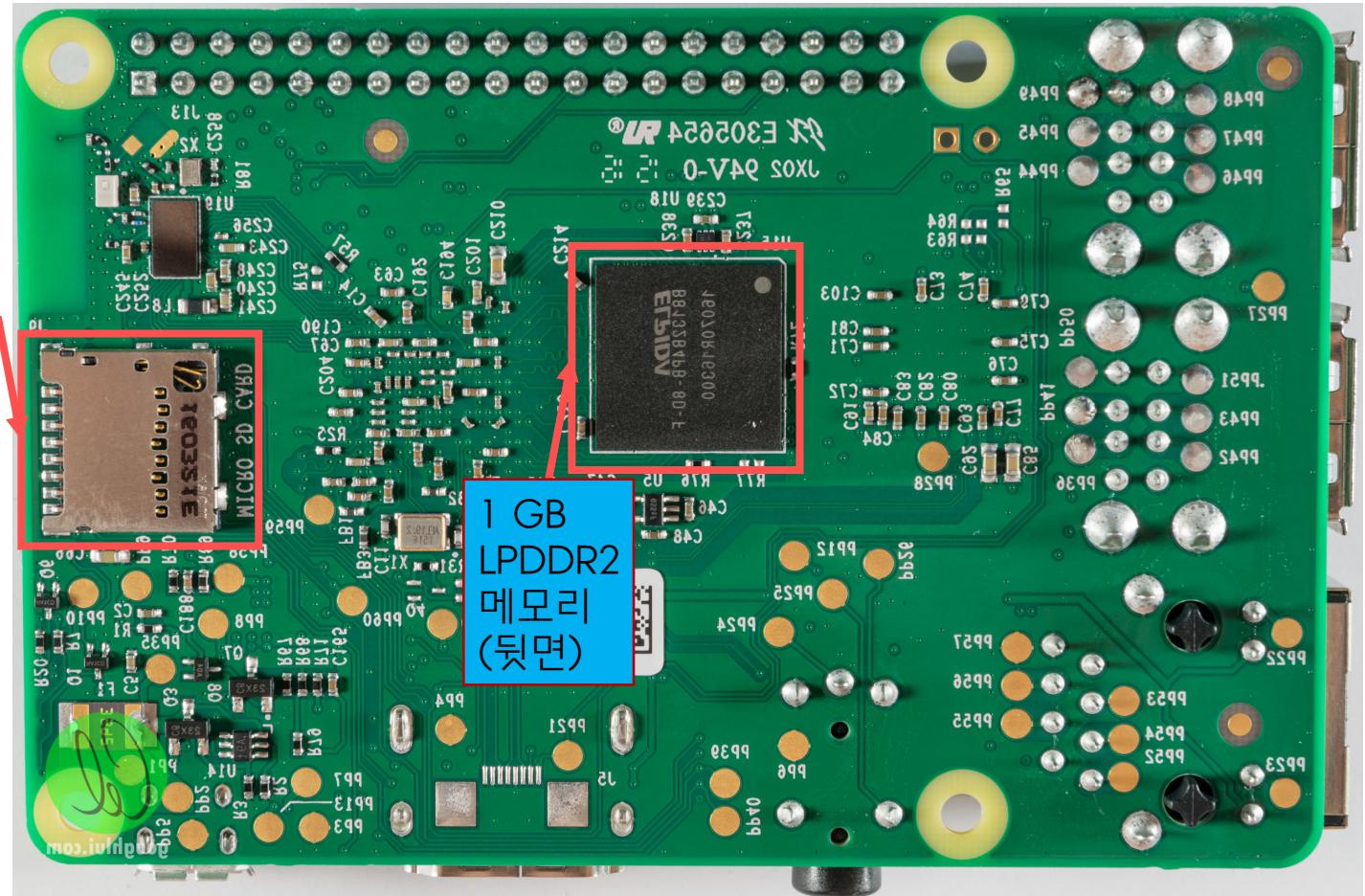
<sup>2</sup> HAT: hardware attached on top, 아두이노의 쉴드와 유사한 개념으로 RPi의 기능을 확장하는 하드웨어 보드

# 라즈베리 파이 하드웨어 보드 구성 앞면

• 실제 RPi 보드와 비교해 보기



# 라즈베리 파이 하드웨어 보드 구성 뒷면



# 하드웨어 주의 사항 아두이노와 비교

- 회로 쇼트 절대 주의
- GPIO 헤더는 아주 낮은 전류를 소스 또는 싱크
  - 소스 또는 싱크가 가능한 **최대 전류는 약 2-3 mA**
  - 아두이노는 40 mA의 입출력을 가짐
- GPIO 핀은 **3.3V 전압**을 허용
  - **타 전기 회로 5V 신호**를 라즈베리 파이 GPIO에 연결 해서는 안됨
  - 아두이노 우노의 경우 5V 사용

# RPi + 디스플레이 조립

(조립되었을 경우 건너 뛸)

# RPi + 디스플레이 조립 준비물

- RPi 박스
- 디스플레이 박스
- 디스플레이 케이스 박스

# RPi + 디스플레이 조립 조립하기

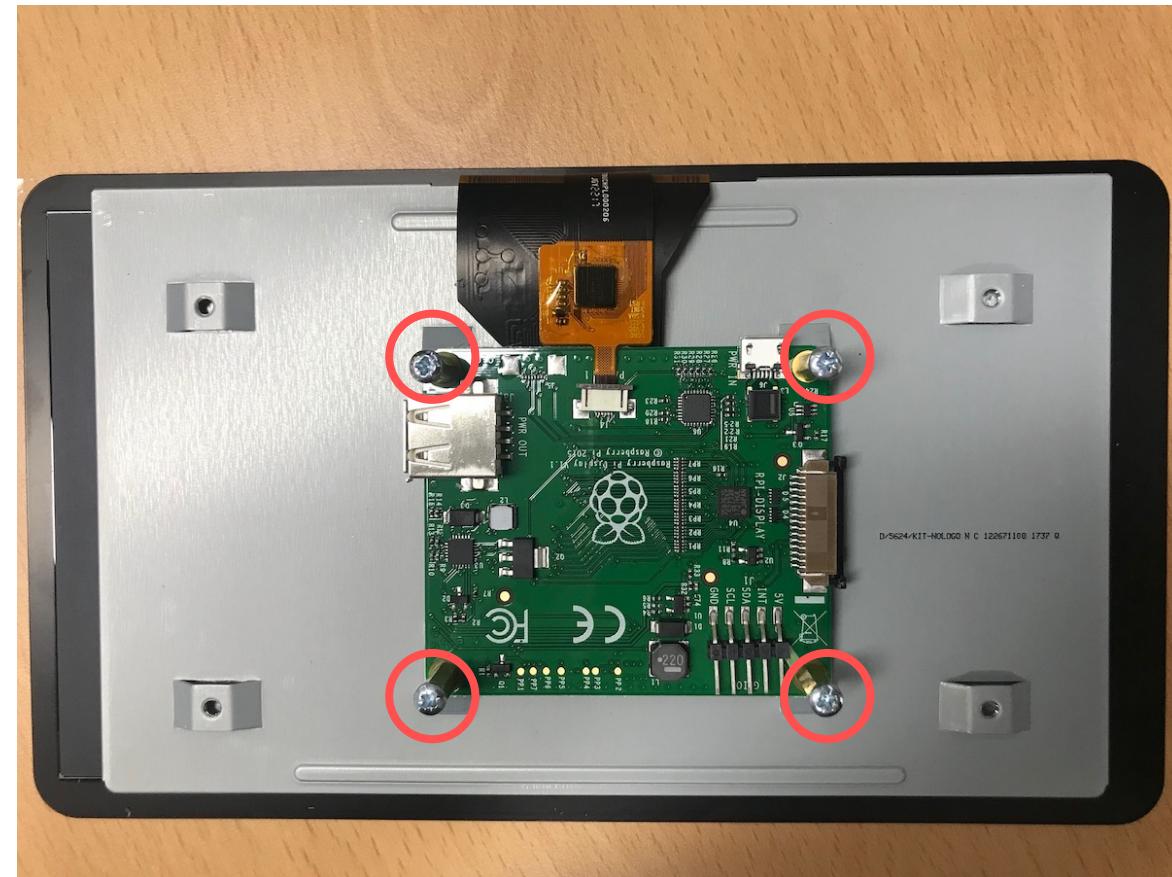
## ■ RPi 박스 열기

- HDMI 케이블 반납
- Ethernet 케이블 반납
- 라즈베리파이 3B
  - ✓ 보드 꺼내기
  - ✓ 박스 포함 내용물 버리기
- 라즈베리파이 케이스 반납
- 전원 어댑터
  - ✓ 어댑터 꺼내기
  - ✓ 박스 포함 내용물 버리기
- 메모리 비닐 케이스
  - ✓ 대기 (뒤에서 사용)

# RPi + 디스플레이 조립 조립하기

## ■ RPi와 디스플레이 결합

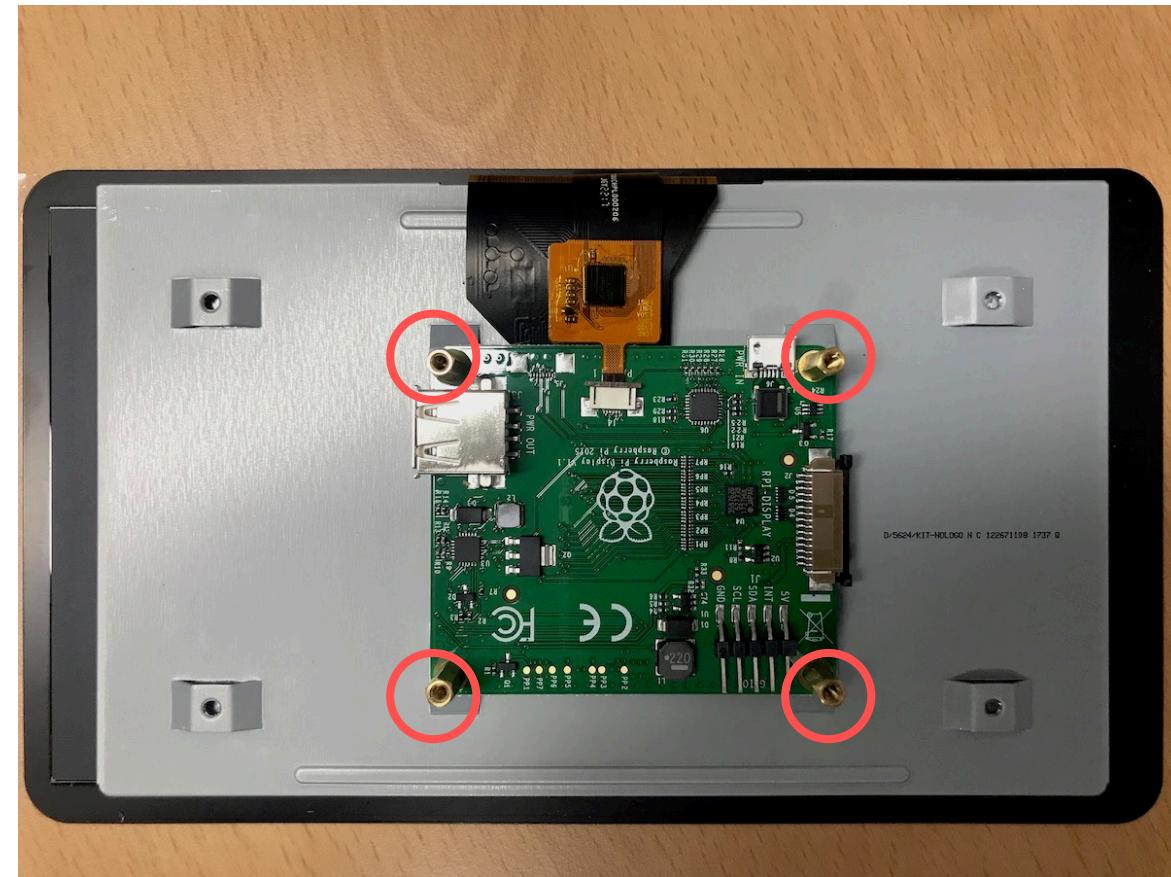
- 디스플레이 볼트 4개 제거 (십자 드라이버 필요)



# RPi + 디스플레이 조립 조립하기

## ■ RPi와 디스플레이 결합

- 디스플레이 볼트 4개 제거 (십자 드라이버 필요)



# RPi + 디스플레이 조립 조립하기

## ■ RPi와 디스플레이 결합

- RPi를 볼트 결합 자리를 맞추어 올린 후 볼트 고정



# RPi + 디스플레이 조립 조립하기

- 디스플레이 케이블 연결
  - 디스플레이 케이블 준비



디스플레이 리본 케이블



# RPi + 디스플레이 조립 조립하기

- 디스플레이 케이블 연결
  - RPi 'DISPLAY' 보호 필름 제거



디스플레이 리본 케이블



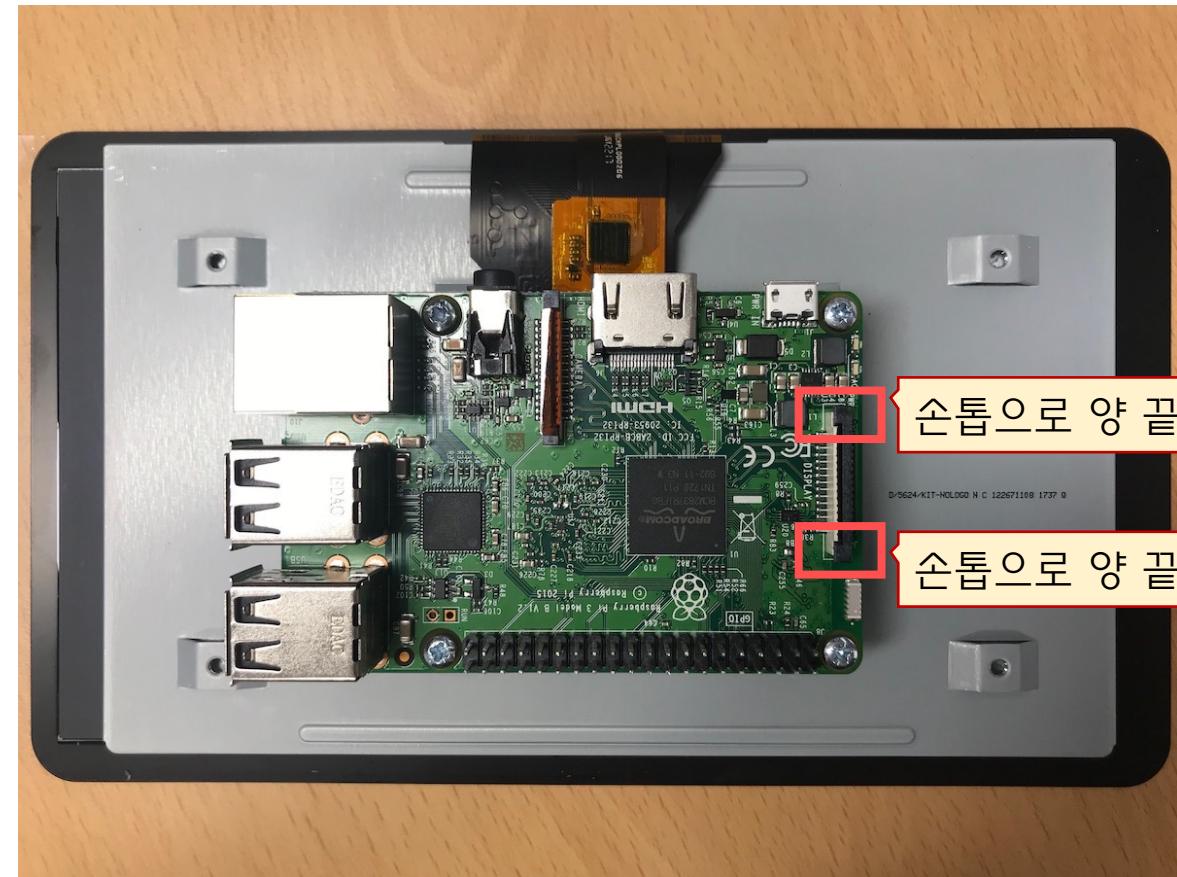
# RPi + 디스플레이 조립 조립하기

## ■ 디스플레이 케이블 연결

- RPi 'DISPLAY' 커넥터 하우징 클립 풀기 (당김)



디스플레이 리본 케이블



손톱으로 양 끝을 당김

손톱으로 양 끝을 당김

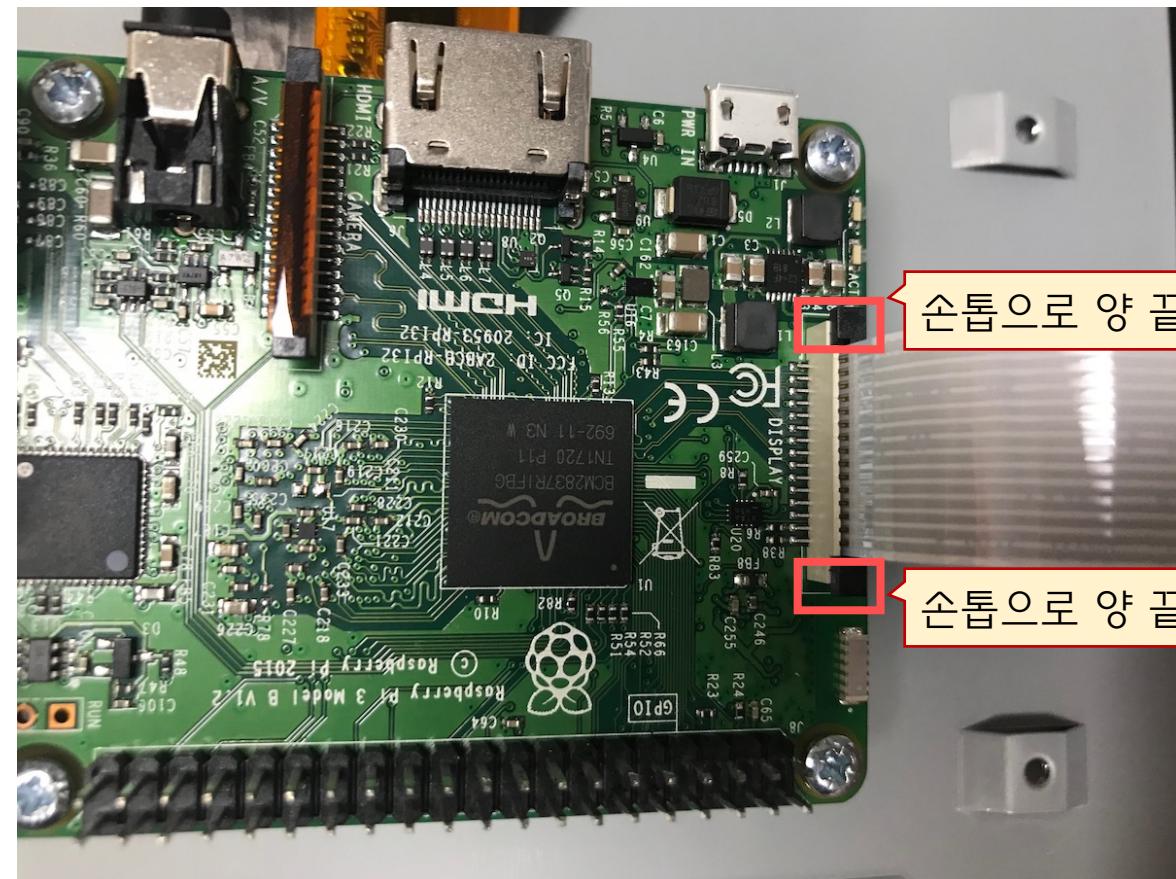
# RPI + 디스플레이 조립 조립하기

## ■ 디스플레이 케이블 연결

- 디스플레이 케이블 한쪽 (무색)을 RPI 'DISPLAY' 삽입 후 커넥터 고정 (양쪽 누르기)



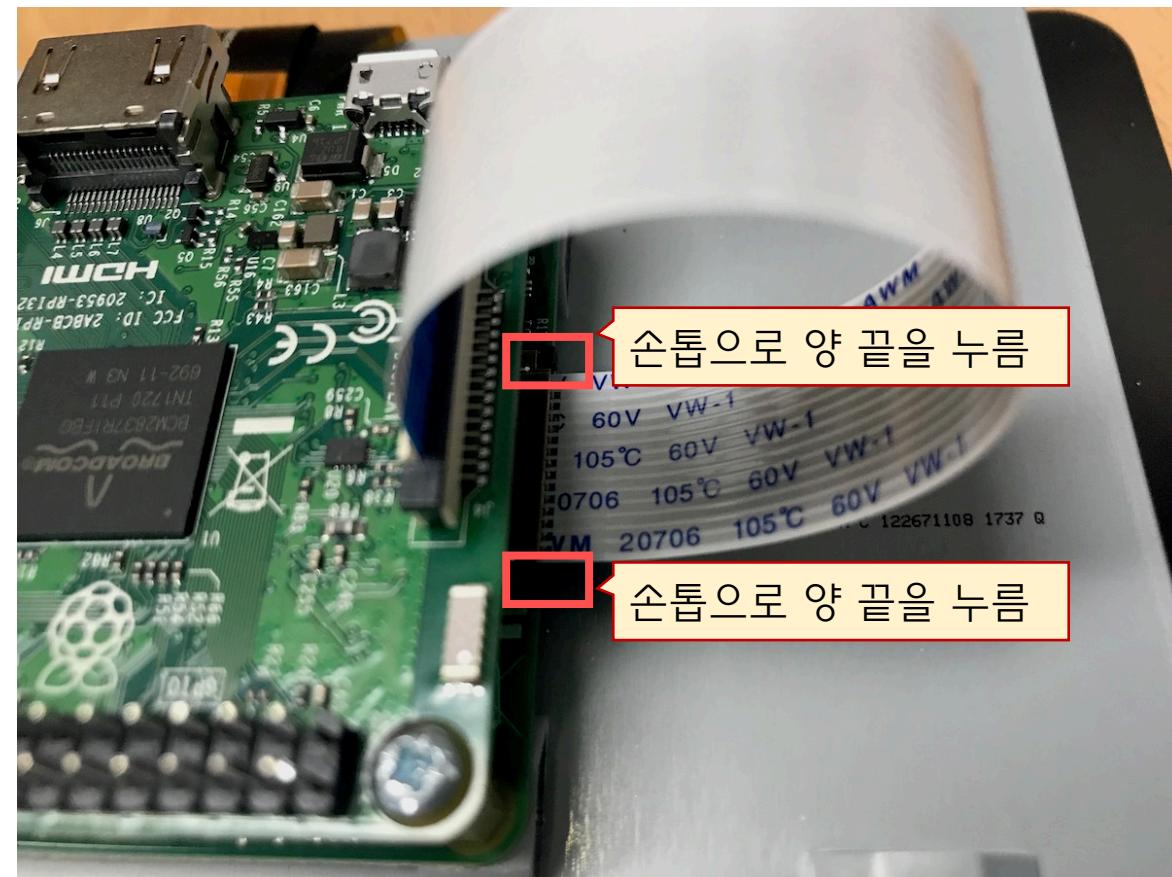
디스플레이 리본 케이블



# RPI + 디스플레이 조립 조립하기

## ■ 디스플레이 케이블 연결

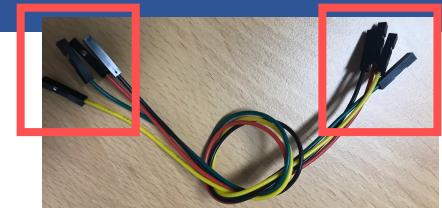
- 디스플레이 케이블 반대쪽 (청색)을  
**디스플레이 소켓 삽입** 후 커넥터 고정 (양쪽 누르기) 디스플레이 리본 케이블



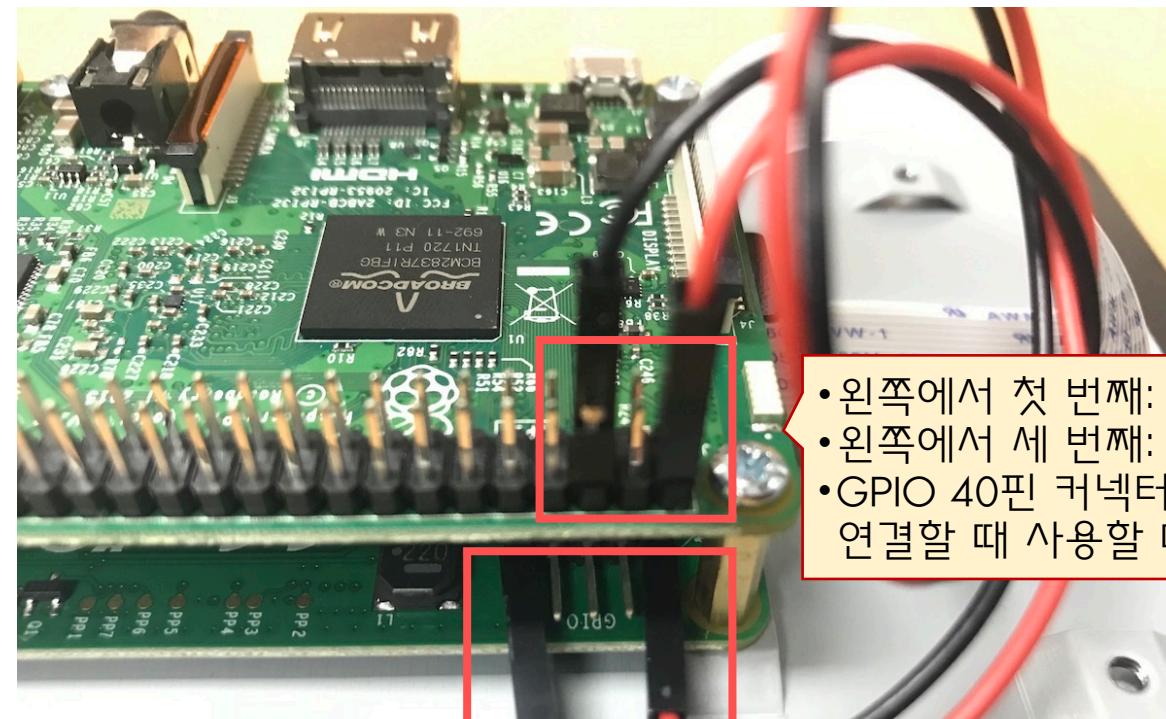
# RPi + 디스플레이 조립 조립하기

## ■ 전원 케이블 연결

- RPi (2, 8) 핀을 디스플레이 전원에 연결



전원 케이블



- 왼쪽에서 첫 번째: 빨간색
- 왼쪽에서 세 번째: 검은색
- GPIO 40핀 커넥터를 RPi에 연결할 때 사용할 때 제거

- 왼쪽에서 첫 번째: 빨간색
- 왼쪽에서 다섯 번째: 검은색

# RPi + 디스플레이 조립 조립하기

• RPi OS 설치 후 진행

## ■ 전원 어댑터 연결

- **디스플레이 쪽** 마이크로 USB-5핀 커넥터에 전원 어댑터 연결

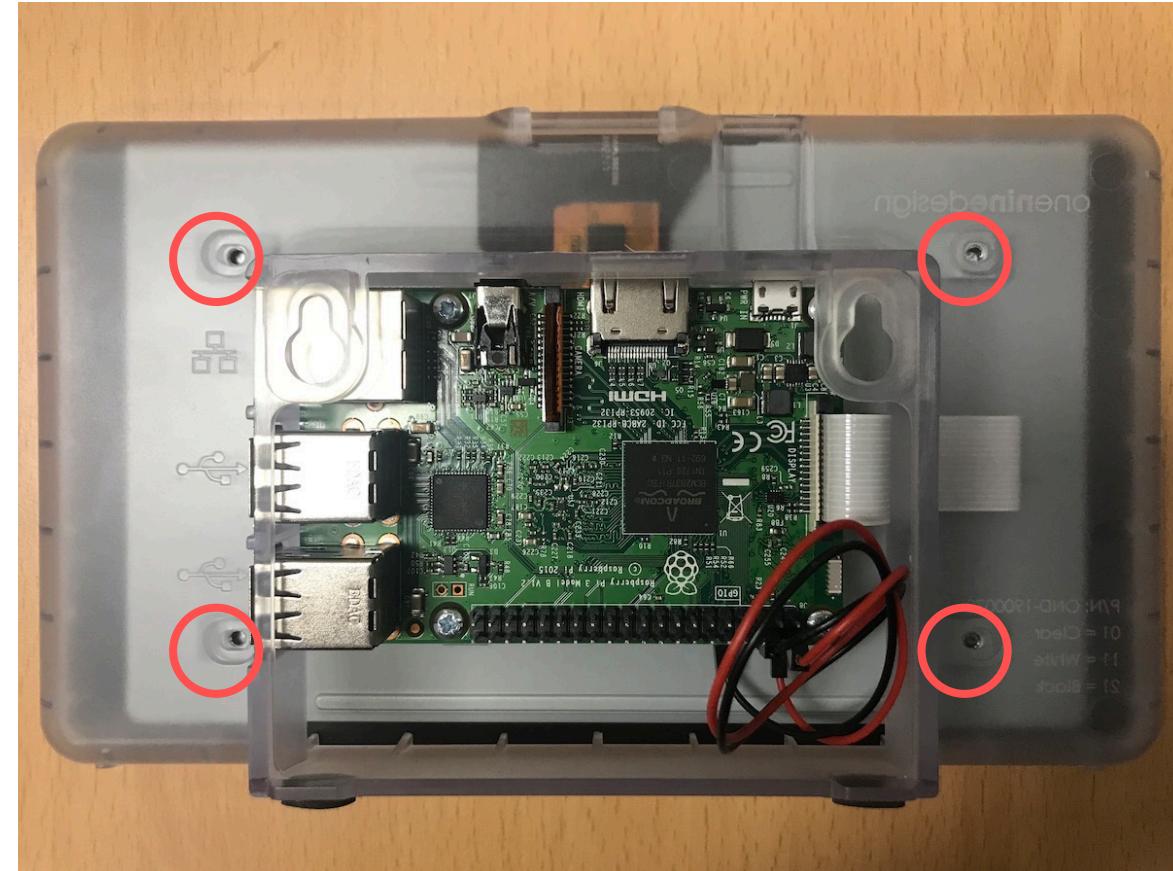


# RPi + 디스플레이 조립 조립하기

• RPi OS 설치 후 진행

## ■ 디스플레이 케이스 조립

- 볼트 결합 자리를 맞추어 디스플레이 케이스를 올린 후 볼트 고정

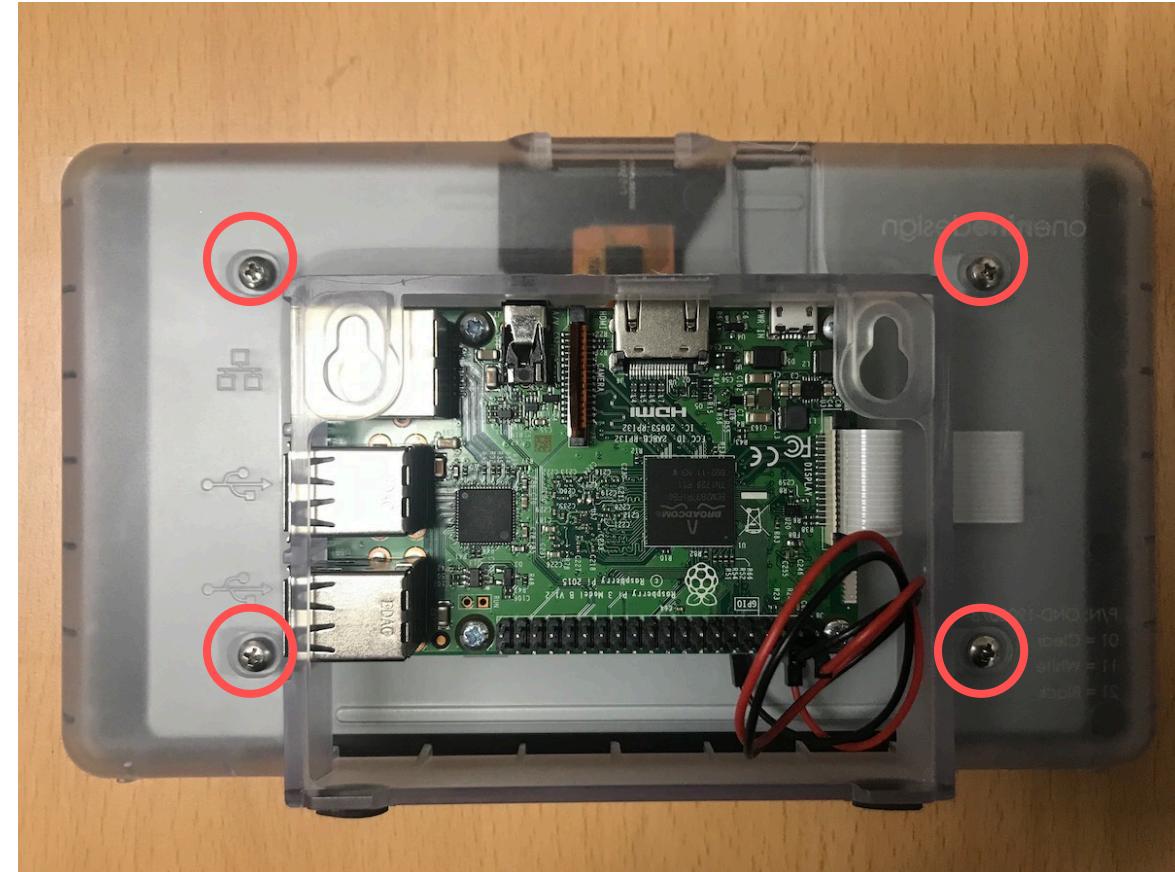


# RPi + 디스플레이 조립 조립하기

• RPi OS 설치 후 진행

## ■ 디스플레이 케이스 조립

- 볼트 결합 자리를 맞추어 디스플레이 케이스를 올린 후 볼트 고정



# RPi OS 설치

## 운영체제

# RPi 운영체제 (Raspberry Pi OS) 다운로드

- <https://www.raspberrypi.org/software/operating-systems/>

## Raspberry Pi OS

Compatible with:

[All Raspberry Pi models](#)



### Raspberry Pi OS with desktop and recommended software

Release date: January 11th 2021

Kernel version: 5.4

Size: 2,863MB

[Show SHA256 file integrity hash:](#)

[Release notes](#)

[Download](#)

[Download torrent](#)

### Raspberry Pi OS with desktop

Release date: January 11th 2021

Kernel version: 5.4

Size: 1,171MB

[Show SHA256 file integrity hash:](#)

[Release notes](#)

[Download](#)

클릭!

[Download torrent](#)

### Raspberry Pi OS Lite

Release date: January 11th 2021

Kernel version: 5.4

Size: 438MB

[Show SHA256 file integrity hash:](#)

[Release notes](#)

[Download](#)

[Download torrent](#)

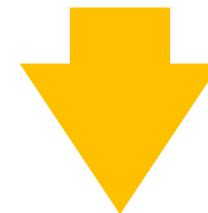
# RPi 운영체제 (Raspberry Pi OS) 다운로드

## ■ 다운로드 된 Raspberry Pi OS 압축 해제

1.6 GB



2021-01-11-rpios-buster-armhf.zip



압축 프로그램 (7-zip<sup>1</sup>, 반디집<sup>2</sup>) 등을 사용하여 압축해제

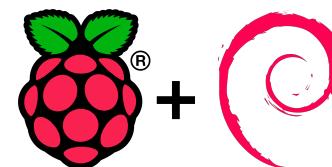
7-Zip is a file archiver with a high compression ratio.

**Download 7-Zip 19.00 (2019-02-21) for Windows:**

Link	Type	Windows	Size
<a href="#">Download</a>	.exe	32-bit x86	1.2 MB
<a href="#">Download</a>	.exe	64-bit x64	1.4 MB

4 GB  
이상

2021-01-11-rpios-buster-armhf.img



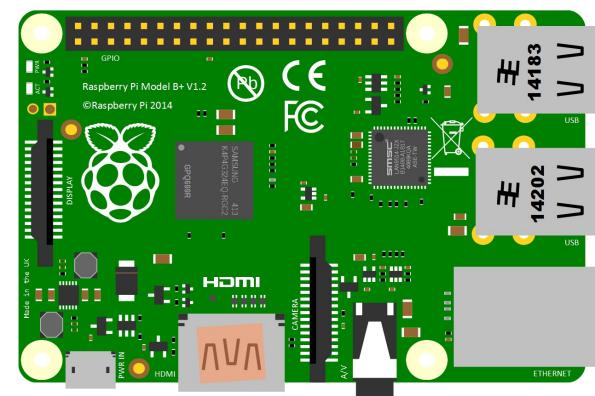
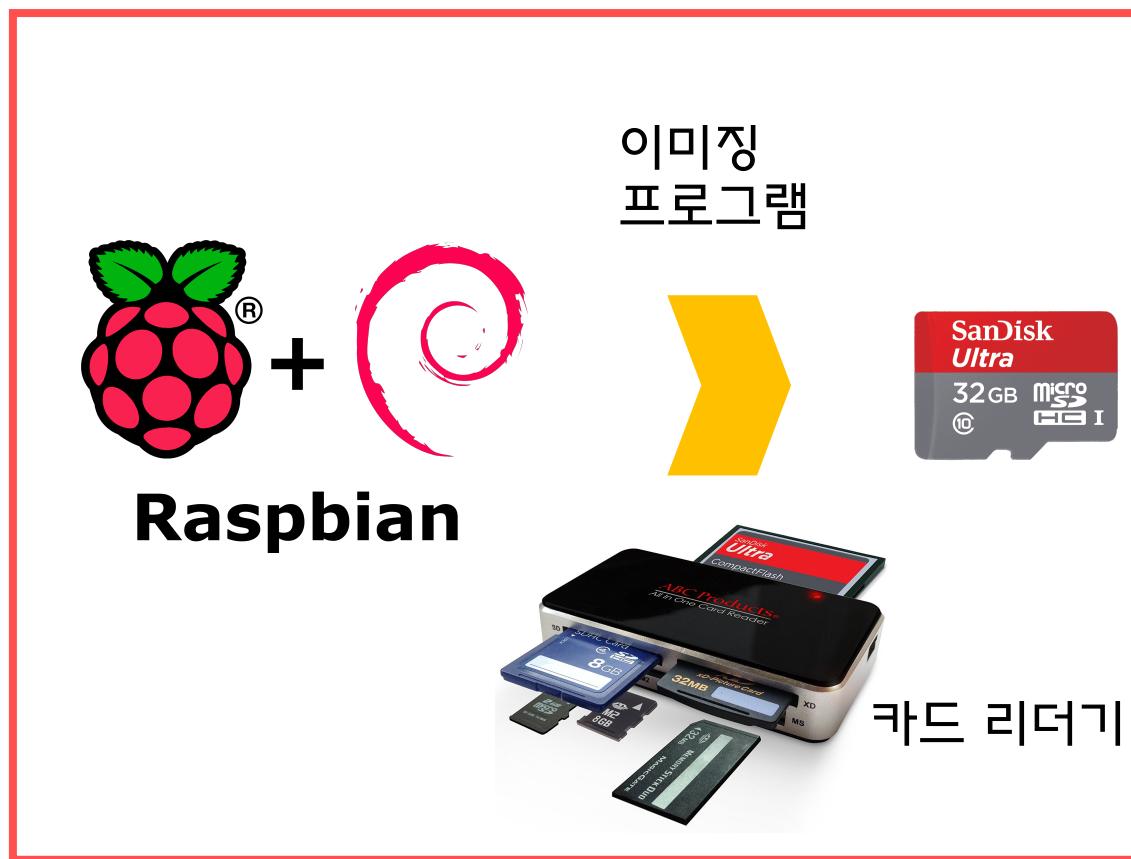
<sup>1</sup> <https://www.7-zip.org/>

<sup>2</sup> <https://en.bandisoft.com/bandizip/>

# RPi 운영체제 (Raspberry Pi OS) 설치

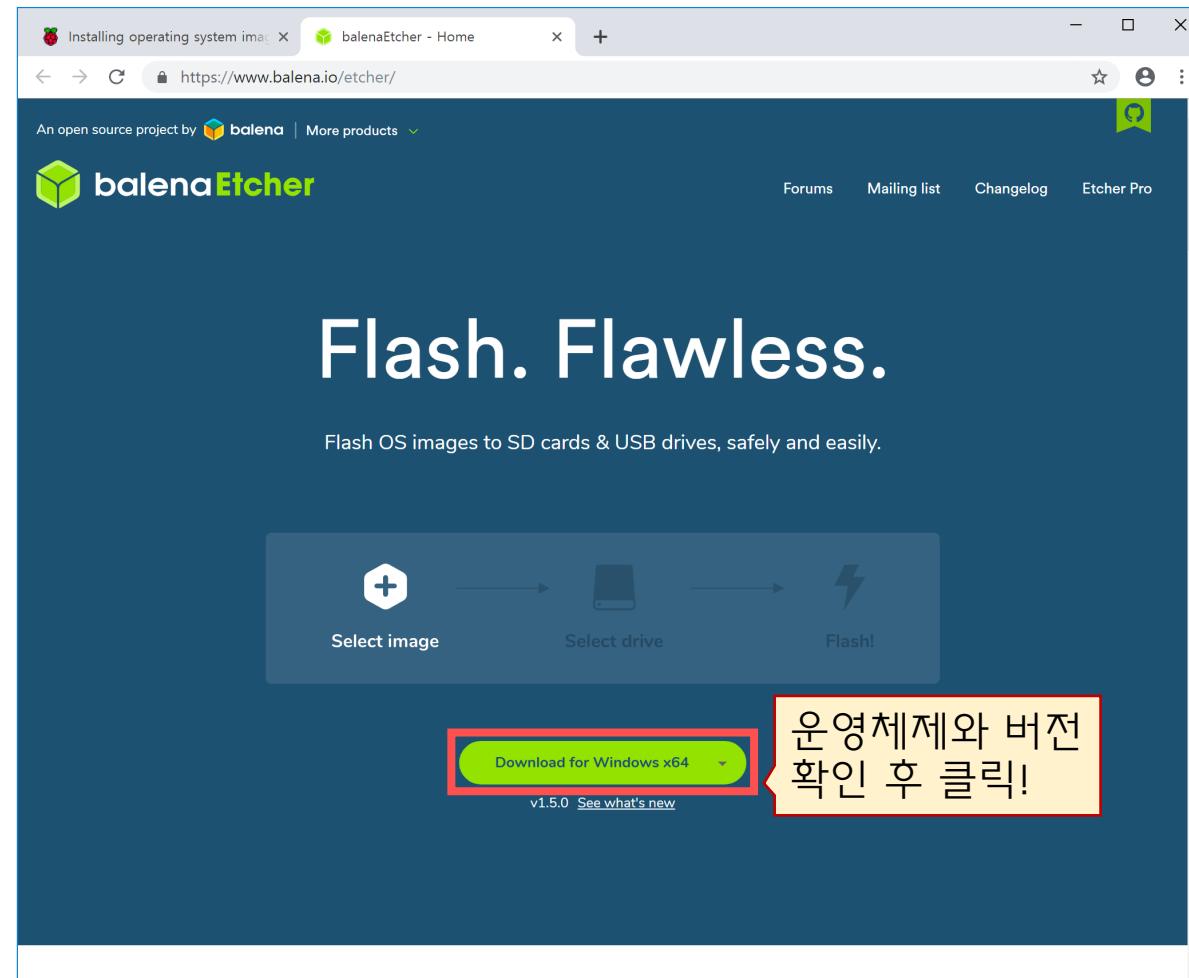
## ■ RPi 운영체제 설치 (윈도우 기준)

- 이미징 프로그램을 활용하여 Raspberry Pi OS를 라즈베리파이 SD카드에 설치



# RPi 운영체제 (Raspberry Pi OS) 설치

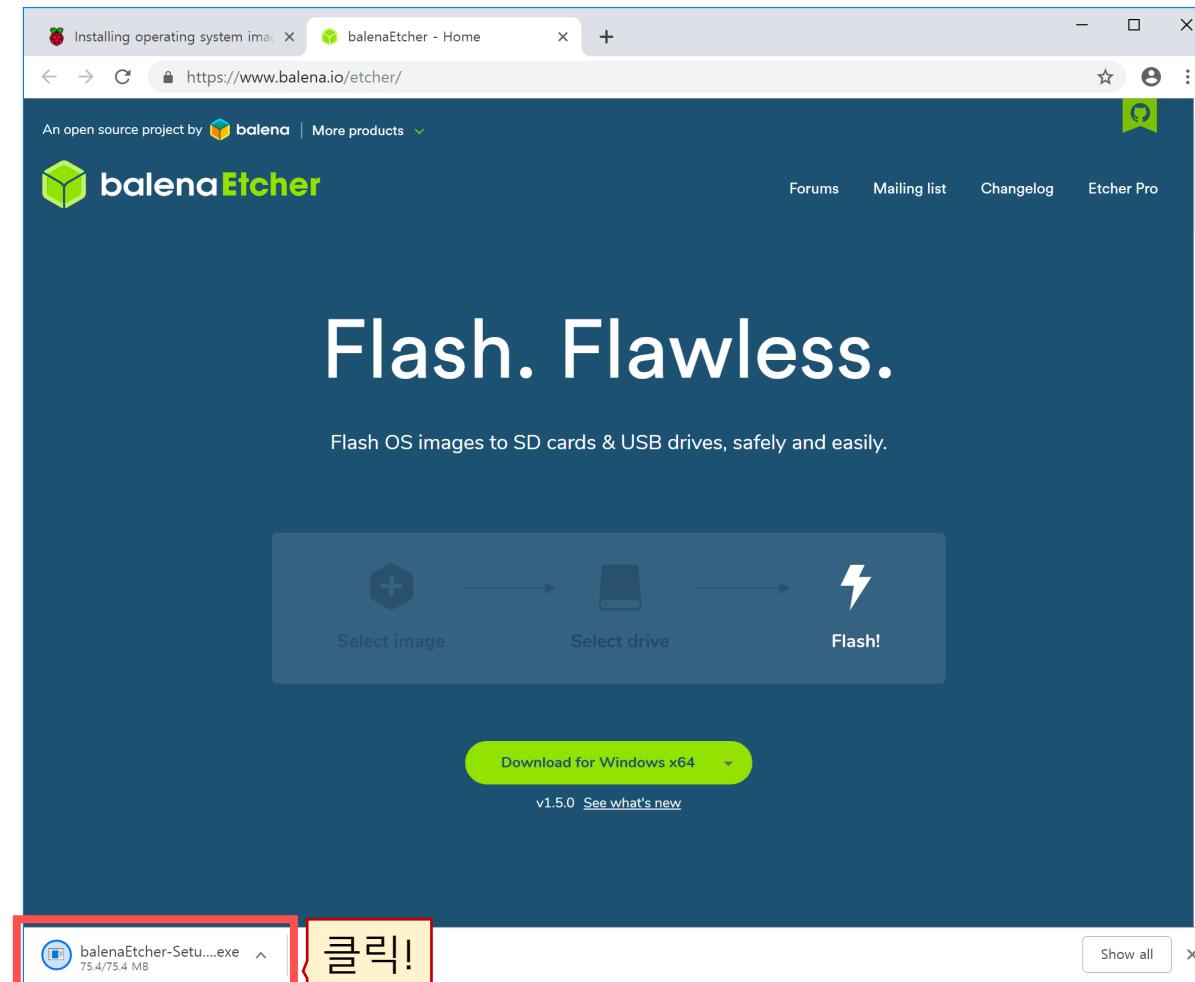
- 설치 가이드 페이지 → 이미징 프로그램 Etcher<sup>1</sup> 설치



<sup>1</sup> <https://www.balena.io/etcher/>

# RPi 운영체제 (Raspberry Pi OS) 설치

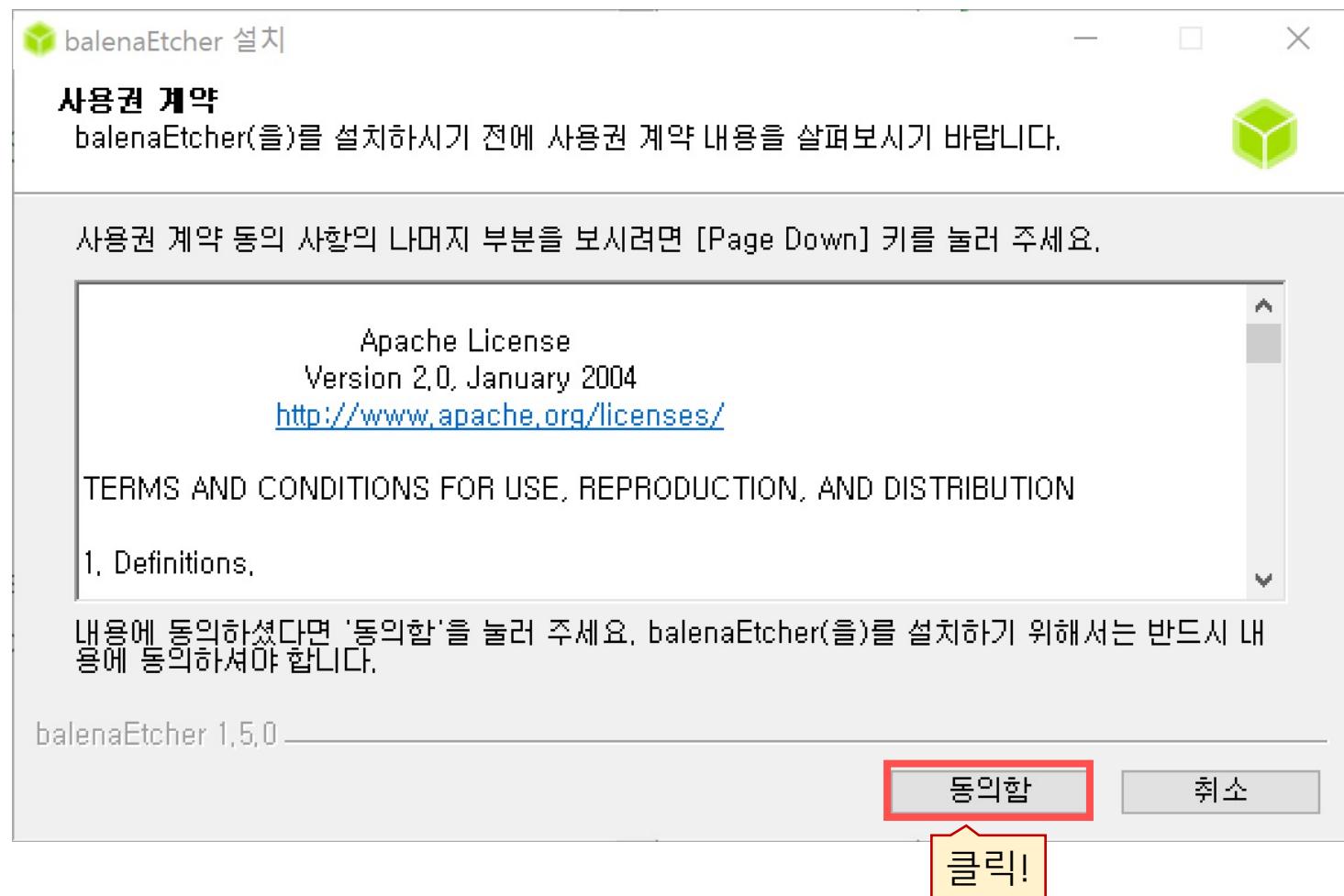
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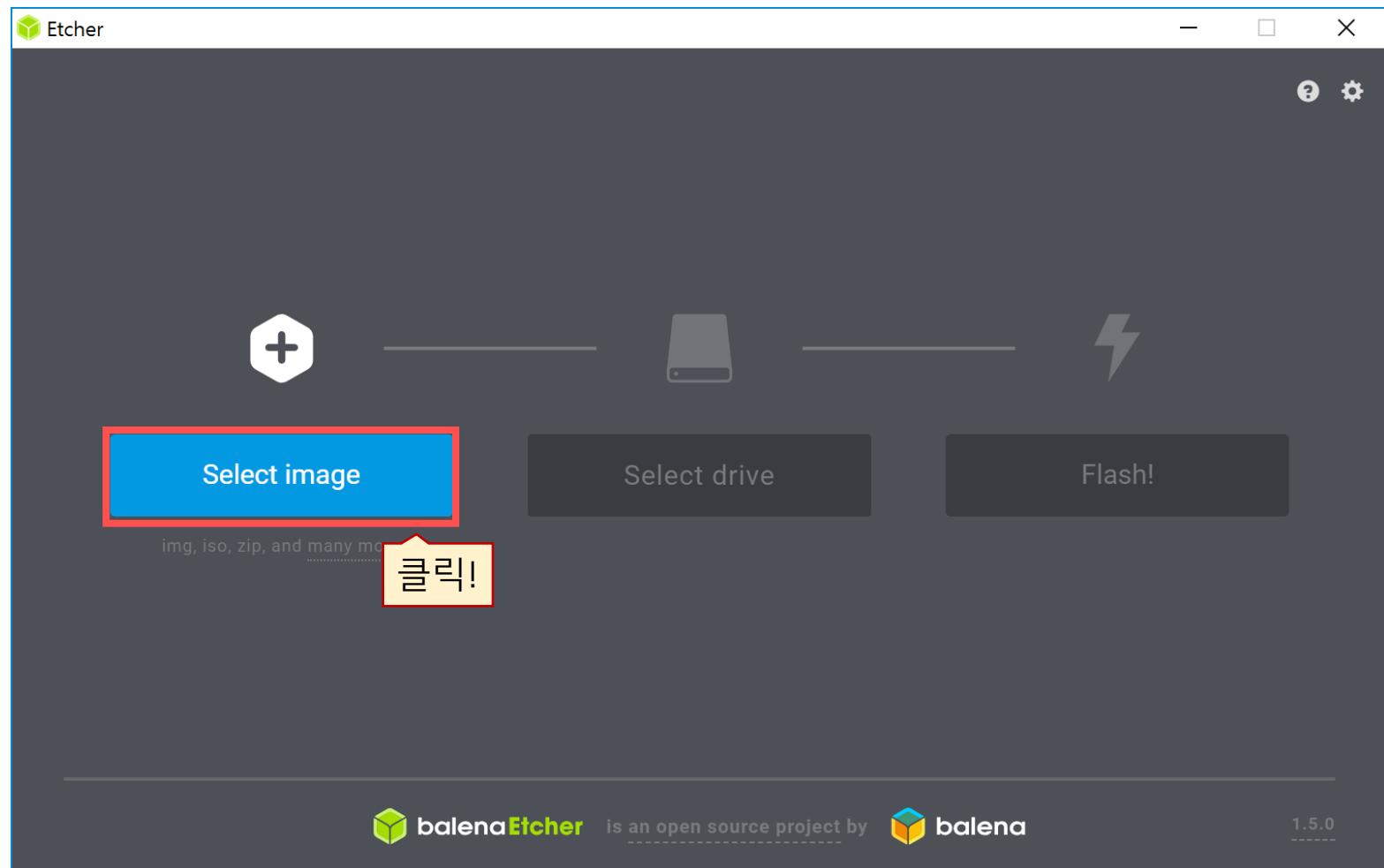
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## ■ 설치 가이드 페이지 → 이미징 프로그램 Etcher<sup>1</sup> 설치



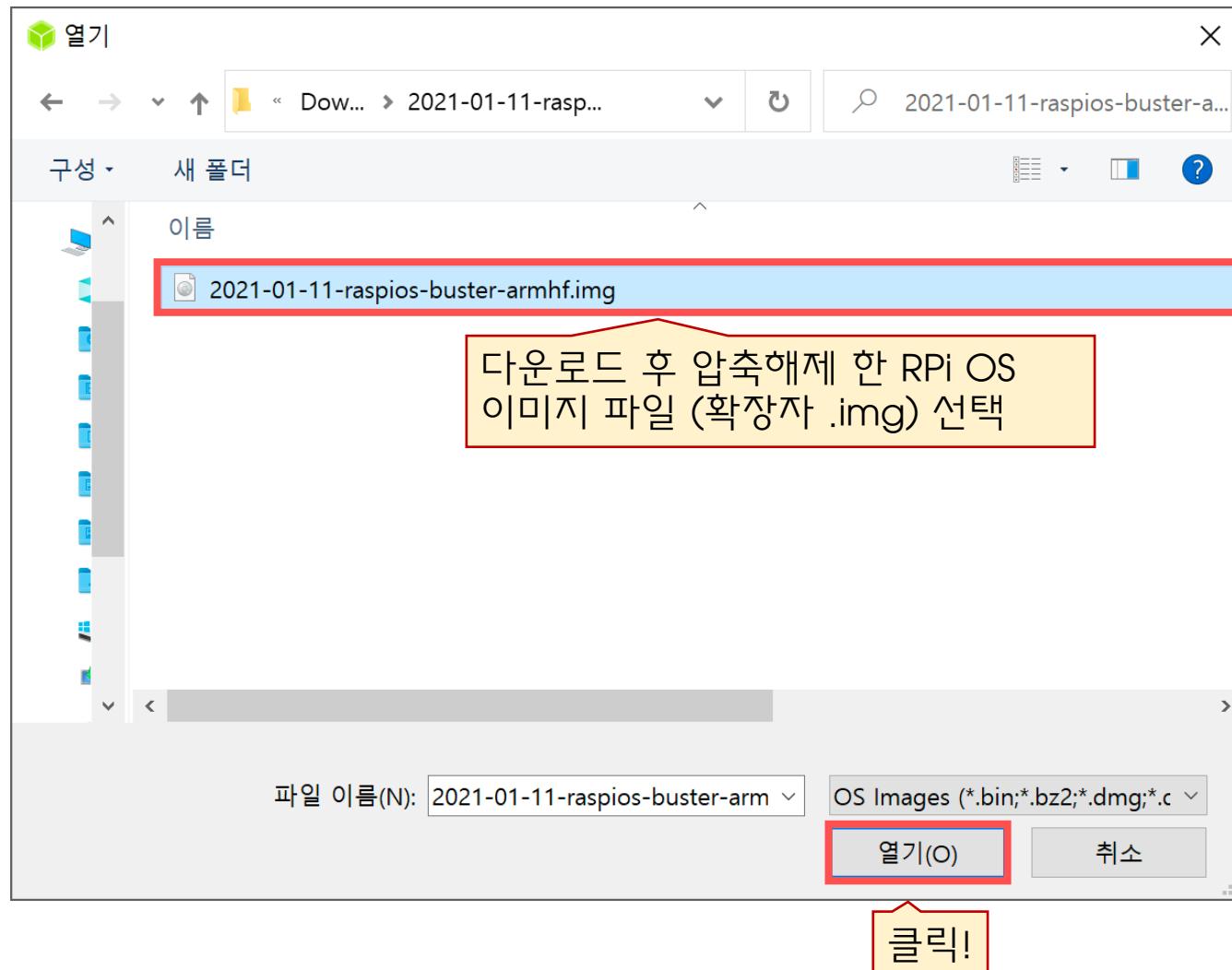
# RPi 운영체제 (Raspberry Pi OS) 설치

## ■ 이미징 프로그램 Etcher 실행



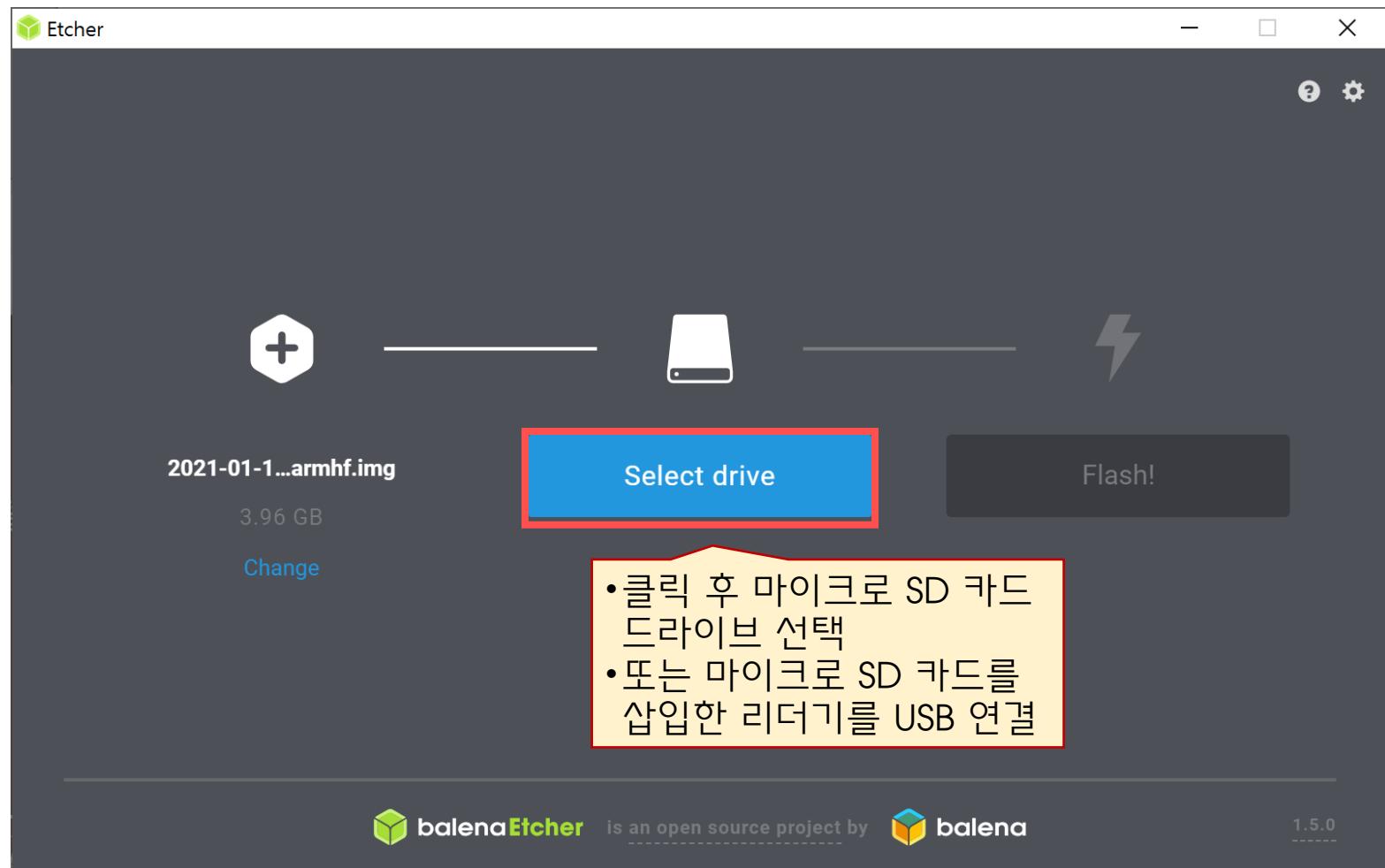
# RPi 운영체제 (Raspberry Pi OS) 설치

## ■ 이미징 프로그램 Etcher 실행



# RPi 운영체제 (Raspberry Pi OS) 설치

## ■ 이미징 프로그램 Etcher 실행



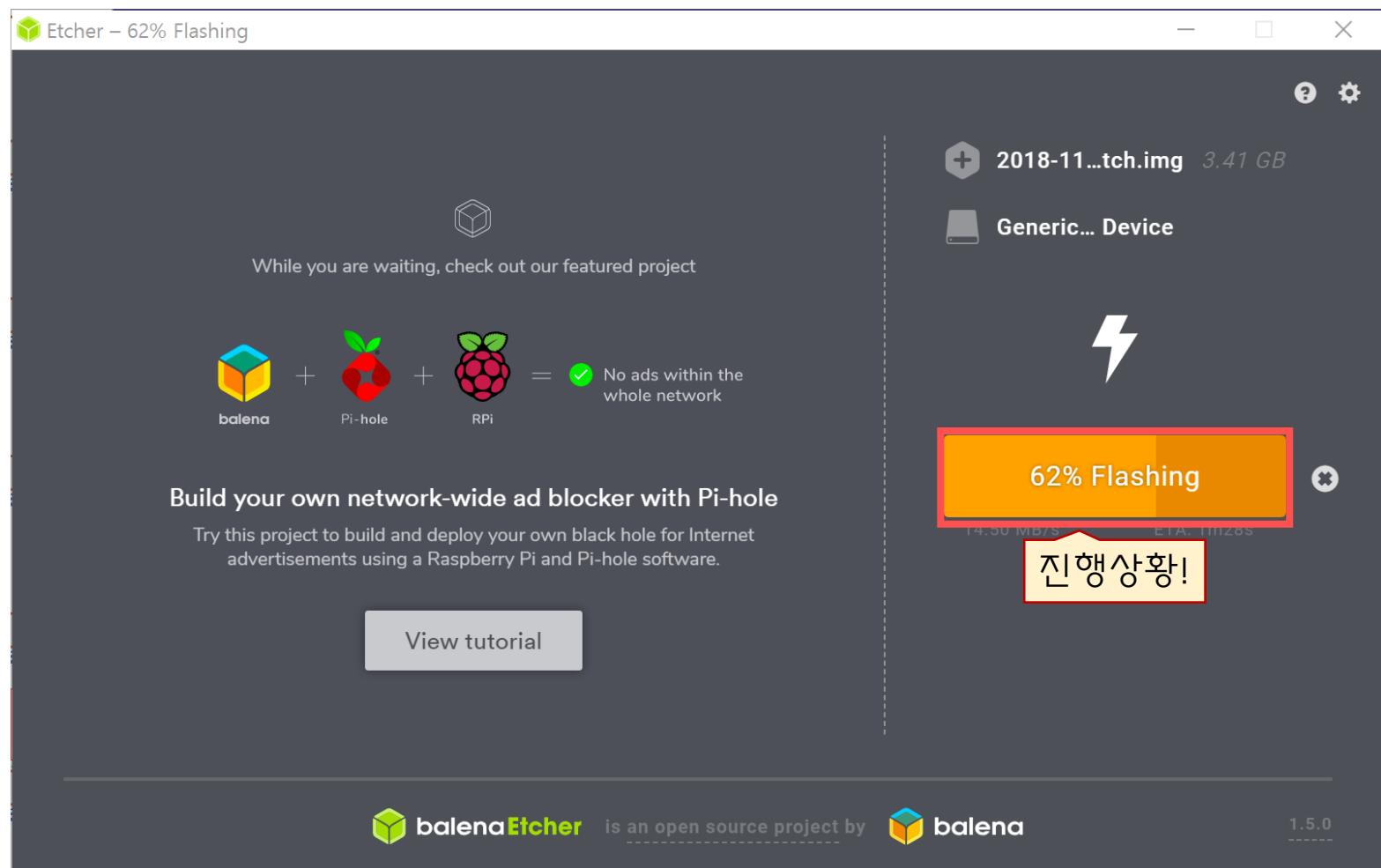
# RPi 운영체제 (Raspberry Pi OS) 설치

## ■ 이미징 프로그램 Etcher 실행



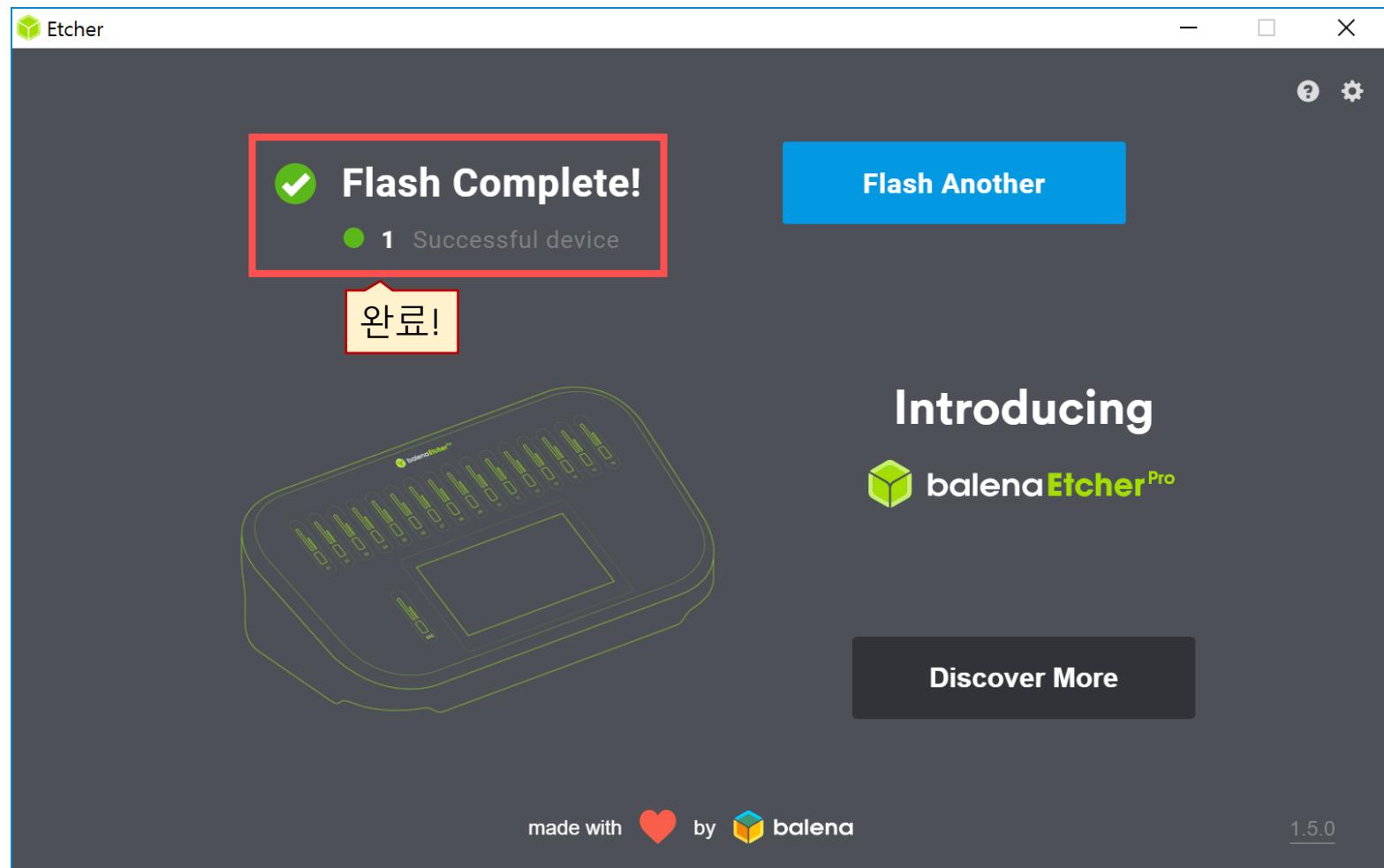
# RPi 운영체제 (Raspberry Pi OS) 설치

## ■ 이미징 프로그램 Etcher 실행



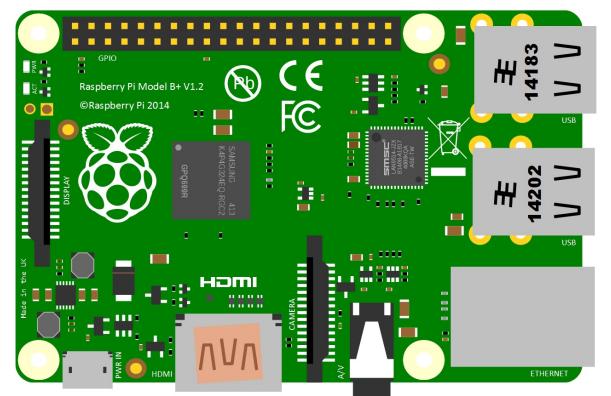
# RPi 운영체제 (Raspberry Pi OS) 설치

## ■ 이미징 프로그램 Etcher 실행



# RPi 운영체제 (Raspberry Pi OS) 설치

- RPi OS 이미지가 설치된 SD카드를 RPi에 결합
  - 반드시 전원이 연결 안된 상태에서 결합

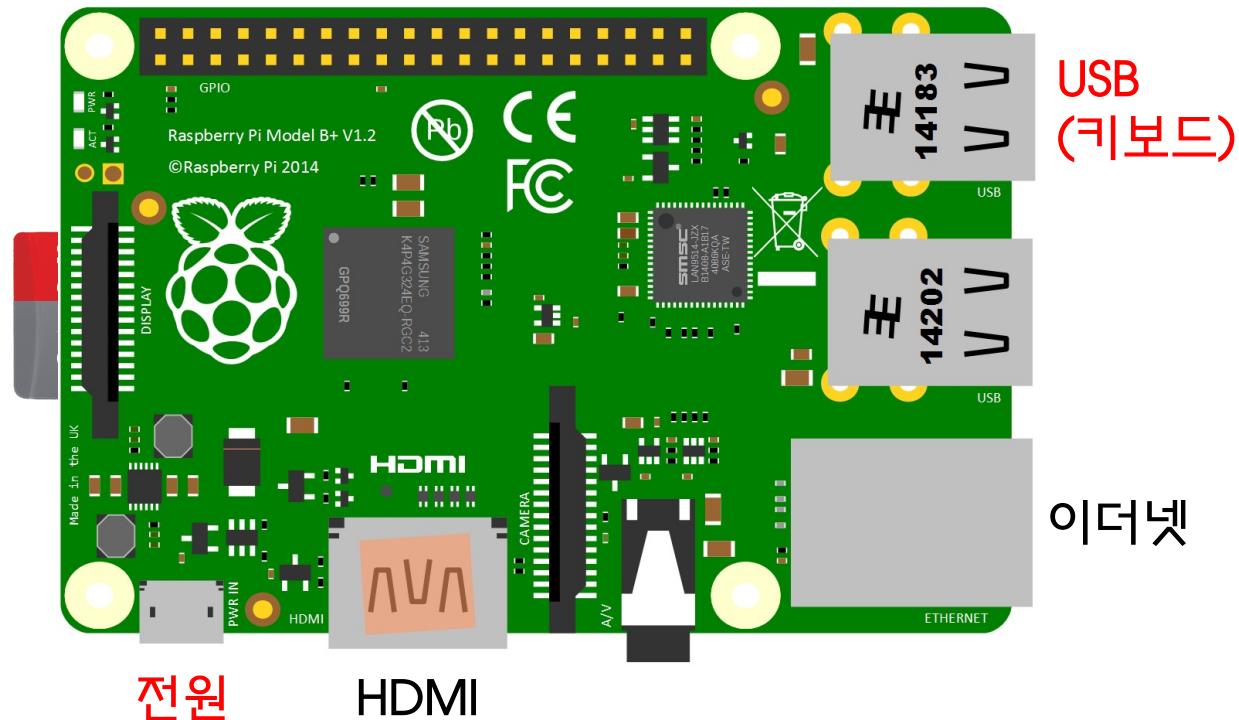


# RPi 운영체제 (Raspberry Pi OS) 설치

• 부팅 정상 확인 후 P24에  
나온 케이스 조립 마무리

## ■ RPi OS 설치 확인

- 키보드/마우스 (USB 소켓), 이더넷, 모니터 (HDMI) 연결
- RPi 전원과 연결 후 부팅 확인



# RPi 세팅

## GUI

# 셋업 위저드

## ■ RPi OS 설정하기



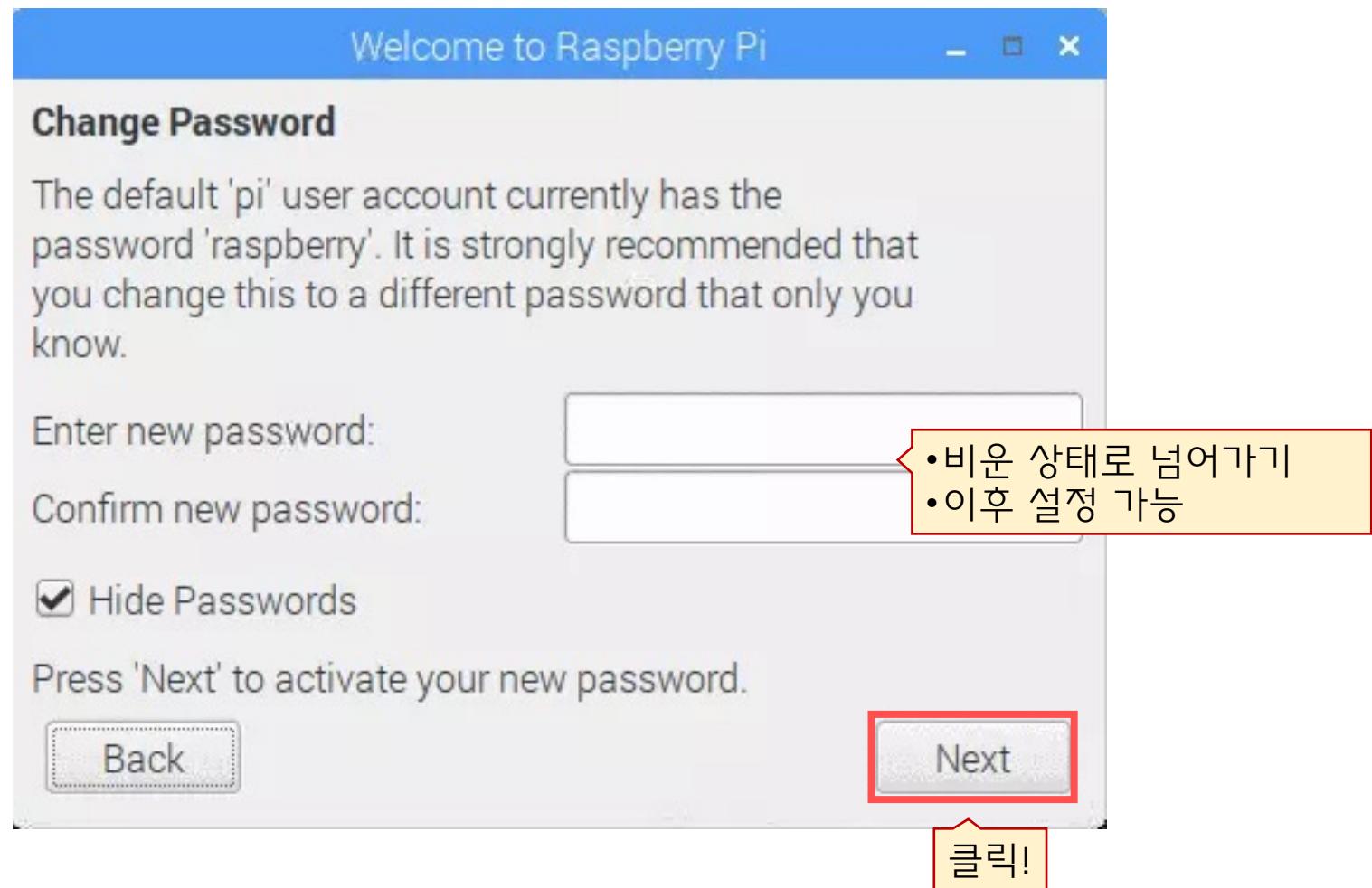
# 셋업 위저드

## ■ RPi OS 설정하기: 국가, 언어, 시간대



# 셋업 위저드

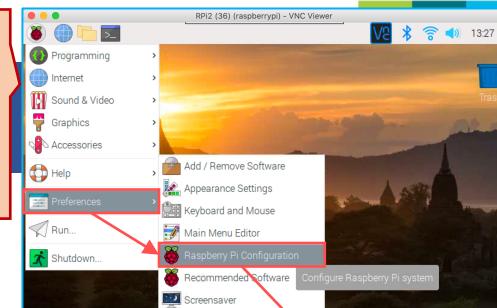
## ■ RPi OS 설정하기: 암호 바꾸기



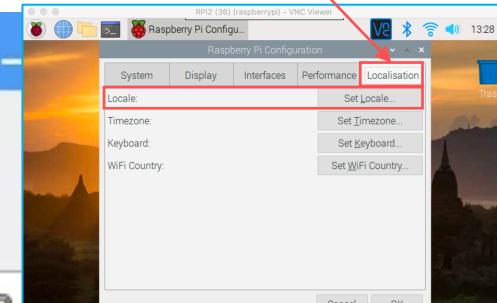
# 셋업 위저드

- WiFi 네트워크 (SSID)가 보이지 않으면 'Locale'을 US 또는 UK로 변경후 재시도
- RPi Preferences → Raspberry Pi Configuration → Localisation

## ■ RPi OS 설정하기: Wi-Fi 설정

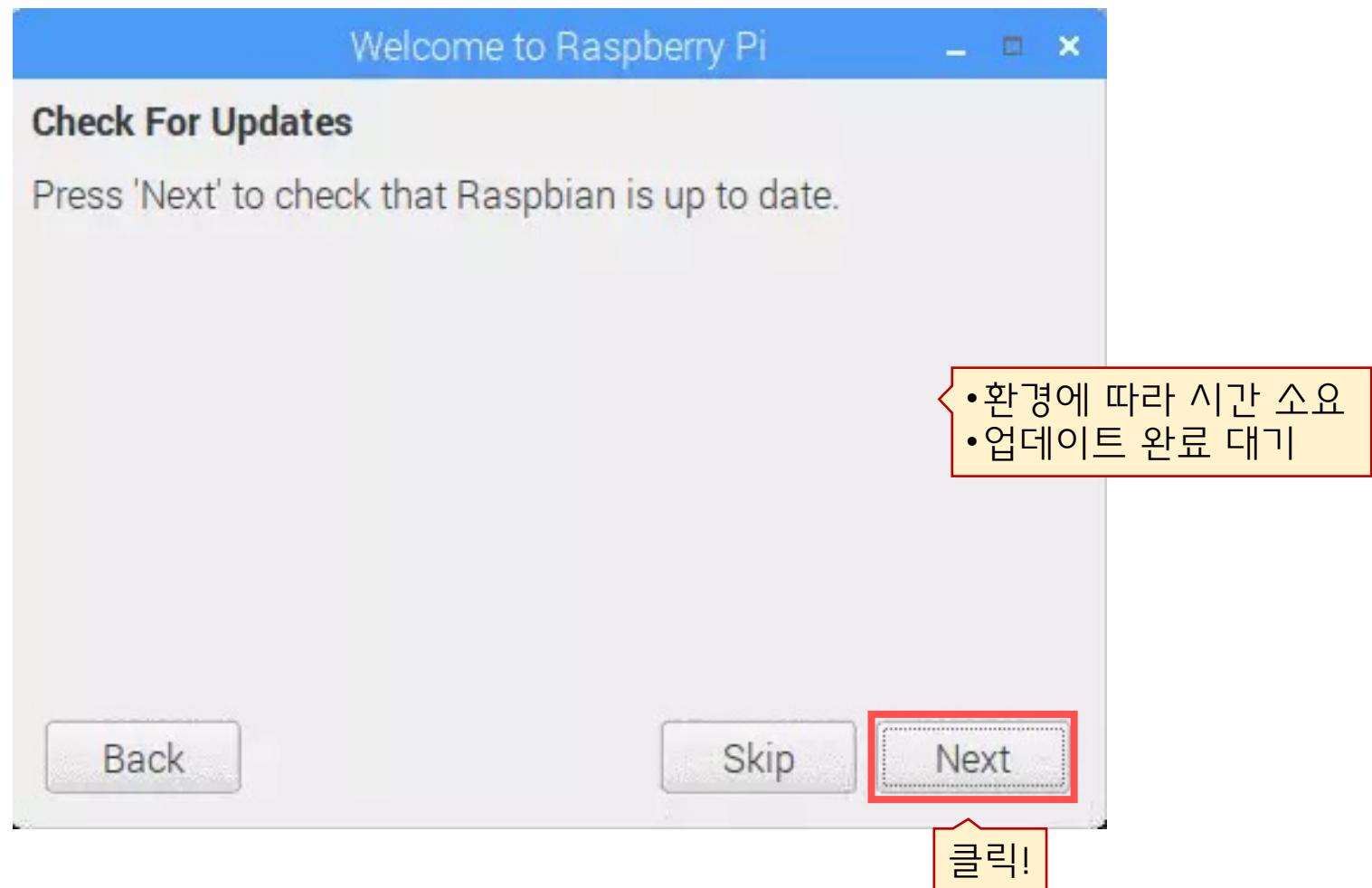


The screenshot shows the 'Welcome to Raspberry Pi' setup screen. The user is prompted to 'Select WiFi Network'. A list of available networks is shown on the left: BTHub6-M6TW, BTWifi-with-FON, MOHWLAN, SKY68786, and VM0366660. On the right, there is a list of icons representing different WiFi networks. A red callout box highlights the network 'BTHub6-M6TW' and the note: '• SSID 'IoT\_Platform' 선택 후 암호 입력' (Select after entering password). At the bottom, there are 'Back', 'Skip', and 'Next' buttons, with 'Next' being highlighted with a red border and a yellow callout box containing the Korean text '클릭!' (Click!).



# 셋업 위저드

## ■ RPi OS 설정하기: 업데이트 확인



# 셋업 위저드

## ■ RPi OS 설정하기: 리부트



# SSH와 PuTTY

# SSH 클라이언트 설치

## ■ SSH (Secure SHell)

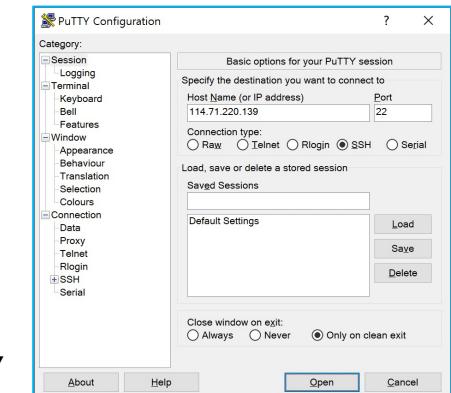
- (안전하지 않은) 네트워크로 컴퓨터를 관리자로서 안전하게 접근하고 싶을 때 사용하는 네트워크 프로토콜

## ■ 대표적인 SSH 클라이언트 'PuTTY' 설치

- <http://www.chiark.greenend.org.uk/~sgtatham/putty/>

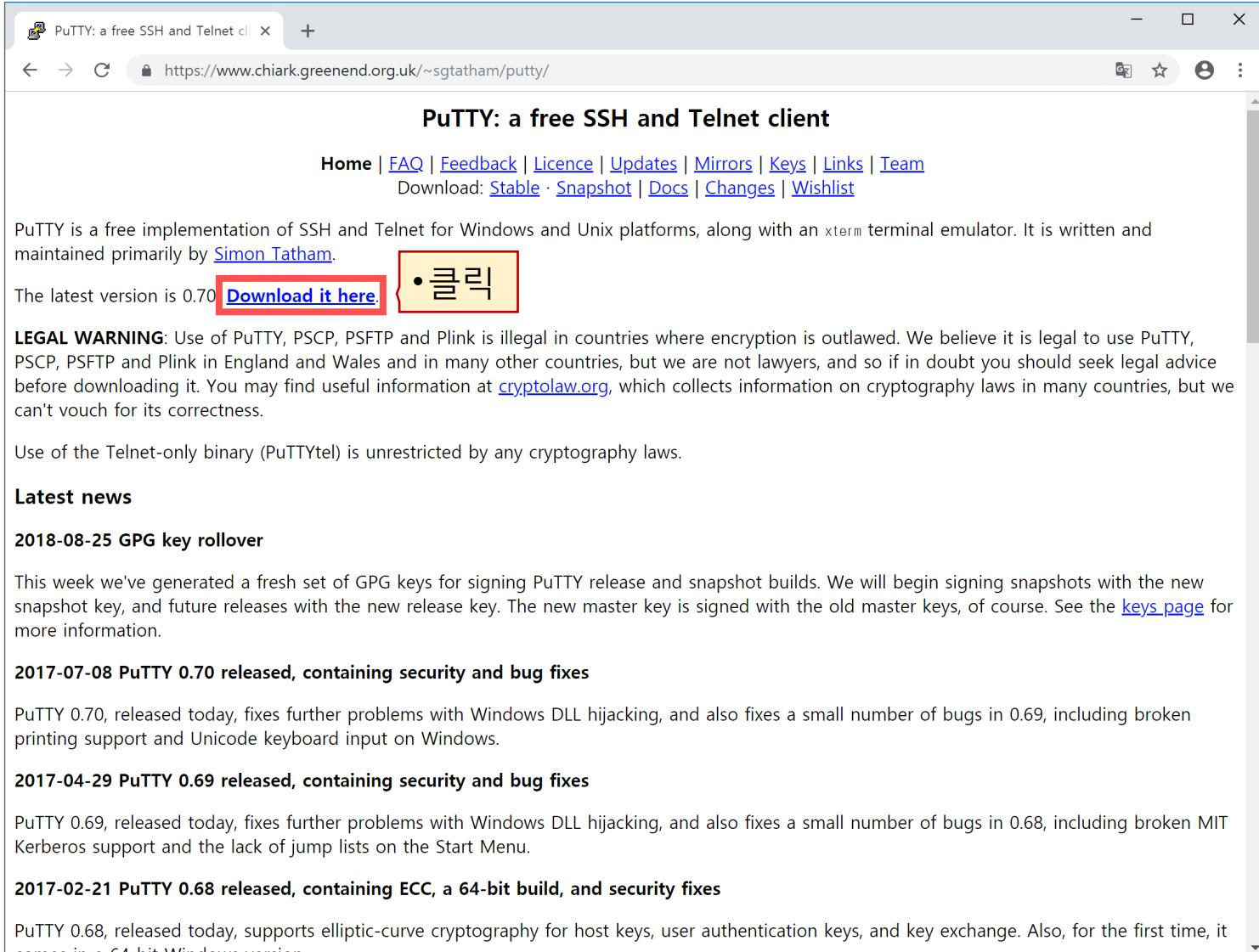
## ■ PuTTY 설정과 연결

- Run → Host Name (Raspberry-pi IP address) → Open
- Host Key confirm (Yes)
- Connected → ID : pi, PW : raspberry (Raspberry-pi default)



PuTTY

# SSH 클라이언트 PuTTY 다운로드 및 설치



The screenshot shows a web browser window displaying the official PuTTY website at <https://www.chiark.greenend.org.uk/~sgtatham/putty/>. The page title is "PuTTY: a free SSH and Telnet client". Below the title, there is a navigation menu with links to Home, FAQ, Feedback, Licence, Updates, Mirrors, Keys, Links, Team, Download (Stable, Snapshot, Docs, Changes, Wishlist), and a "Latest news" section. A prominent yellow button labeled "Download it here" is highlighted with a red box and a yellow box containing the Korean text "• 클릭" (Click). The main content area describes PuTTY as a free implementation of SSH and Telnet for Windows and Unix platforms, written and maintained by Simon Tatham. It also includes a "LEGAL WARNING" about the legal status of using PuTTY in certain countries. Below the warning, it states that use of the Telnet-only binary (PuTTYtel) is unrestricted by cryptography laws. The "Latest news" section lists several releases: "2018-08-25 GPG key rollover", "2017-07-08 PuTTY 0.70 released, containing security and bug fixes", "2017-04-29 PuTTY 0.69 released, containing security and bug fixes", and "2017-02-21 PuTTY 0.68 released, containing ECC, a 64-bit build, and security fixes". The bottom of the page notes that PuTTY 0.68 supports elliptic-curve cryptography and includes a 64-bit Windows version.

PuTTY: a free SSH and Telnet client

[Home](#) | [FAQ](#) | [Feedback](#) | [Licence](#) | [Updates](#) | [Mirrors](#) | [Keys](#) | [Links](#) | [Team](#)  
Download: [Stable](#) · [Snapshot](#) | [Docs](#) | [Changes](#) | [Wishlist](#)

PuTTY is a free implementation of SSH and Telnet for Windows and Unix platforms, along with an xterm terminal emulator. It is written and maintained primarily by [Simon Tatham](#).

The latest version is 0.70 [Download it here.](#) • 클릭

**LEGAL WARNING:** Use of PuTTY, PSCP, PSFTP and Plink is illegal in countries where encryption is outlawed. We believe it is legal to use PuTTY, PSCP, PSFTP and Plink in England and Wales and in many other countries, but we are not lawyers, and so if in doubt you should seek legal advice before downloading it. You may find useful information at [cryptolaw.org](#), which collects information on cryptography laws in many countries, but we can't vouch for its correctness.

Use of the Telnet-only binary (PuTTYtel) is unrestricted by any cryptography laws.

**Latest news**

**2018-08-25 GPG key rollover**

This week we've generated a fresh set of GPG keys for signing PuTTY release and snapshot builds. We will begin signing snapshots with the new snapshot key, and future releases with the new release key. The new master key is signed with the old master keys, of course. See the [keys page](#) for more information.

**2017-07-08 PuTTY 0.70 released, containing security and bug fixes**

PuTTY 0.70, released today, fixes further problems with Windows DLL hijacking, and also fixes a small number of bugs in 0.69, including broken printing support and Unicode keyboard input on Windows.

**2017-04-29 PuTTY 0.69 released, containing security and bug fixes**

PuTTY 0.69, released today, fixes further problems with Windows DLL hijacking, and also fixes a small number of bugs in 0.68, including broken MIT Kerberos support and the lack of jump lists on the Start Menu.

**2017-02-21 PuTTY 0.68 released, containing ECC, a 64-bit build, and security fixes**

PuTTY 0.68, released today, supports elliptic-curve cryptography for host keys, user authentication keys, and key exchange. Also, for the first time, it comes in a 64-bit Windows version.

# SSH 클라이언트 PuTTY 다운로드 및 설치

The screenshot shows a Microsoft Edge browser window displaying the official Putty download page at <https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>. The page title is "Download PuTTY: latest release (0.70)". It includes links for Home, FAQ, Feedback, Licence, Updates, Mirrors, Keys, Links, Team, and download options for Stable, Snapshot, Docs, Changes, and Wishlist. A note states that the page contains links for the latest released version of Putty (0.70, released on 2017-07-08). It also mentions permanent links to the 0.70 release and development snapshots. The "Package files" section is highlighted with a green background and contains instructions for selecting the appropriate Windows installer based on system architecture. The "Alternative binary files" section is also shown.

Download PuTTY: latest release (0.70)

[Home](#) | [FAQ](#) | [Feedback](#) | [Licence](#) | [Updates](#) | [Mirrors](#) | [Keys](#) | [Links](#) | [Team](#)  
Download: **Stable** · [Snapshot](#) | [Docs](#) | [Changes](#) | [Wishlist](#)

This page contains download links for the latest released version of PuTTY. Currently this is 0.70, released on 2017-07-08.

When new releases come out, this page will update to contain the latest, so this is a good page to bookmark or link to. Alternatively, here is a [permanent link to the 0.70 release](#).

Release versions of PuTTY are versions we think are reasonably likely to work well. However, they are often not the most up-to-date version of the code available. If you have a problem with this release, then it might be worth trying out the [development snapshots](#), to see if the problem has already been fixed in those versions.

### Package files

You probably want one of these. They include all the PuTTY utilities.

(Not sure whether you want the 32-bit or the 64-bit version? Read the [FAQ entry](#).)

**MSI ('Windows Installer')**

- 32-bit: [putty-0.70-installer.msi](#)
- 64-bit: [putty-64bit-0.70-installer.msi](#)

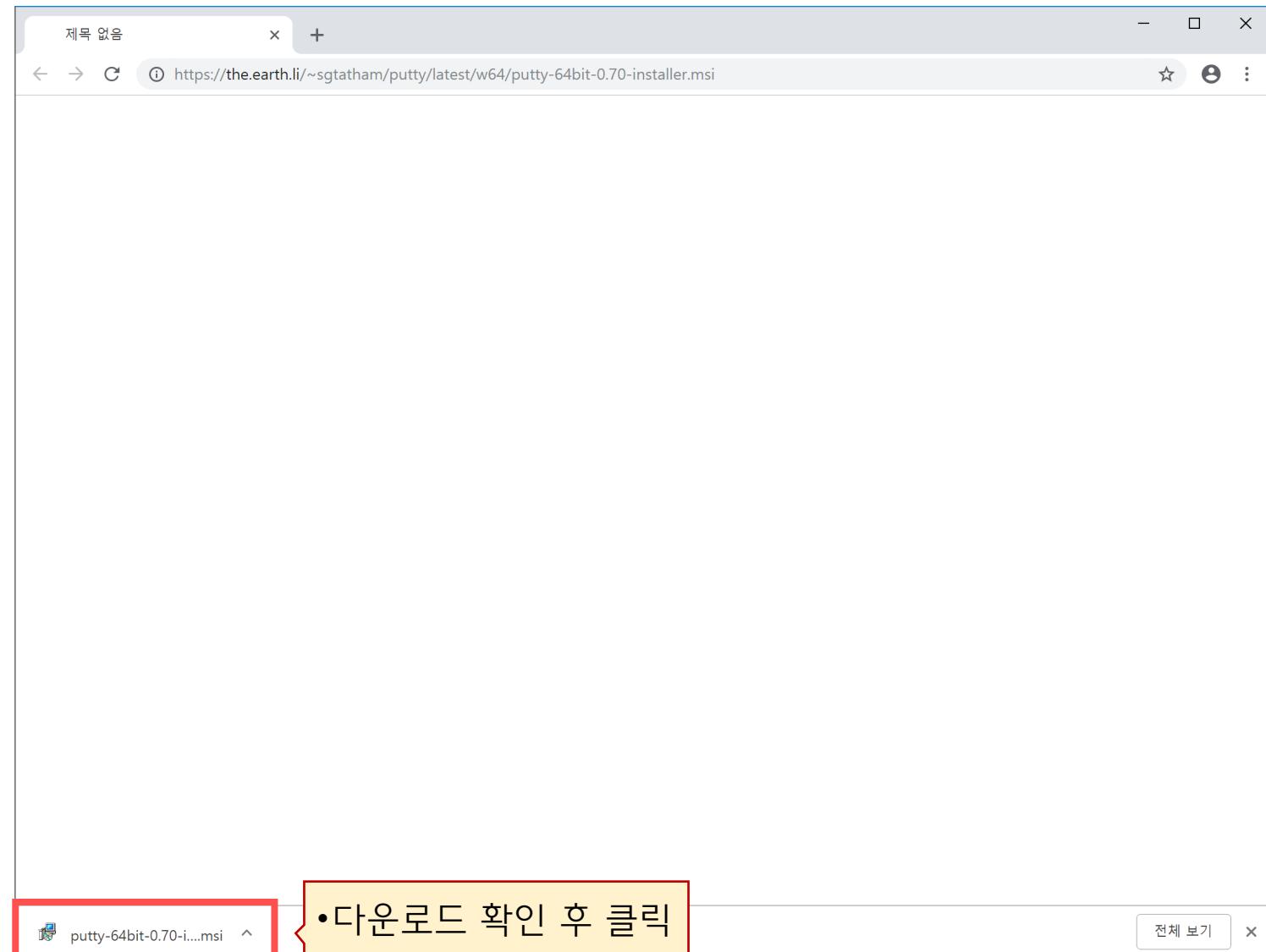
• 운영체제에 맞게 선택

**Unix source archive**

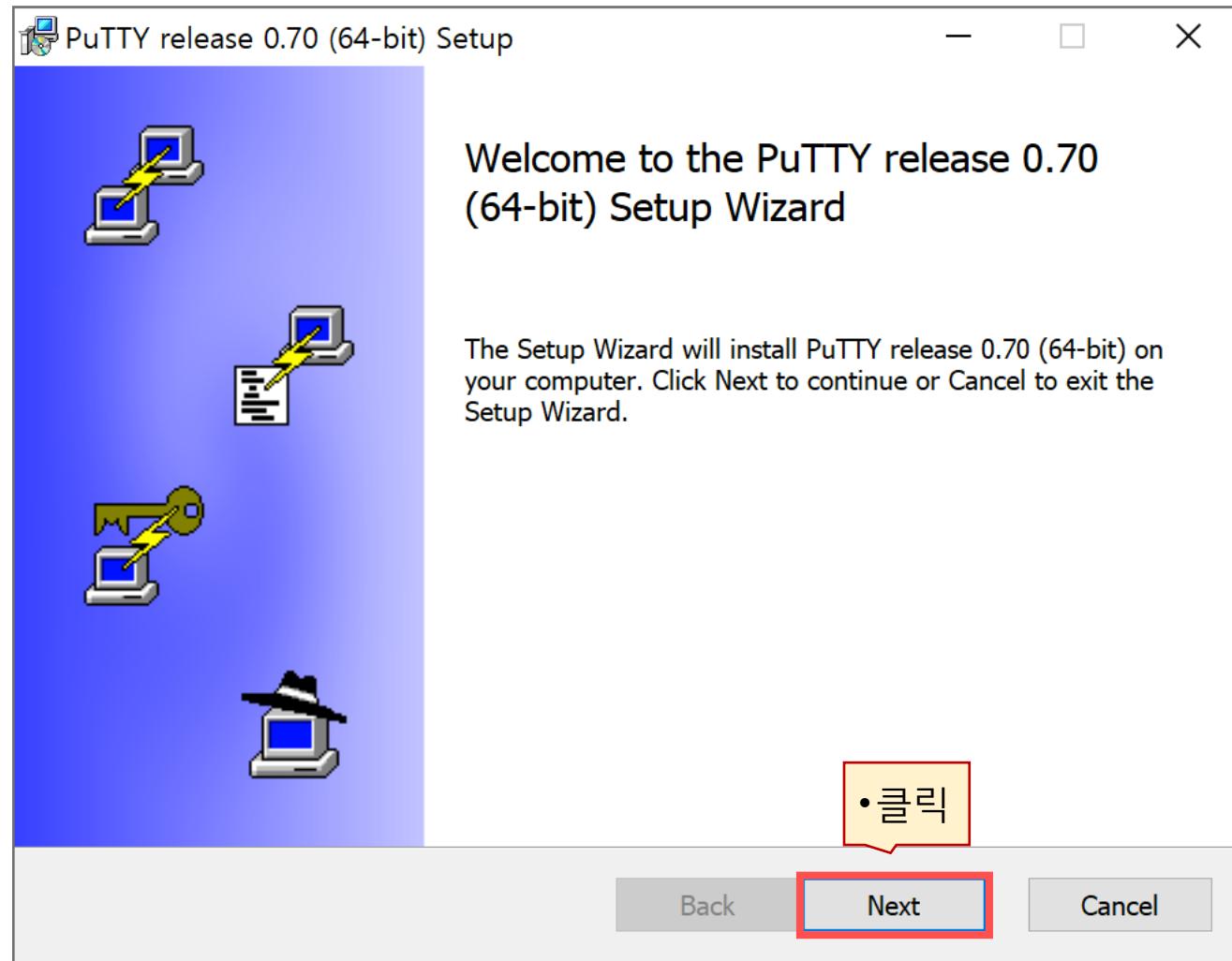
.tar.gz: [putty-0.70.tar.gz](#) (or by [FTP](#)) (signature)

### Alternative binary files

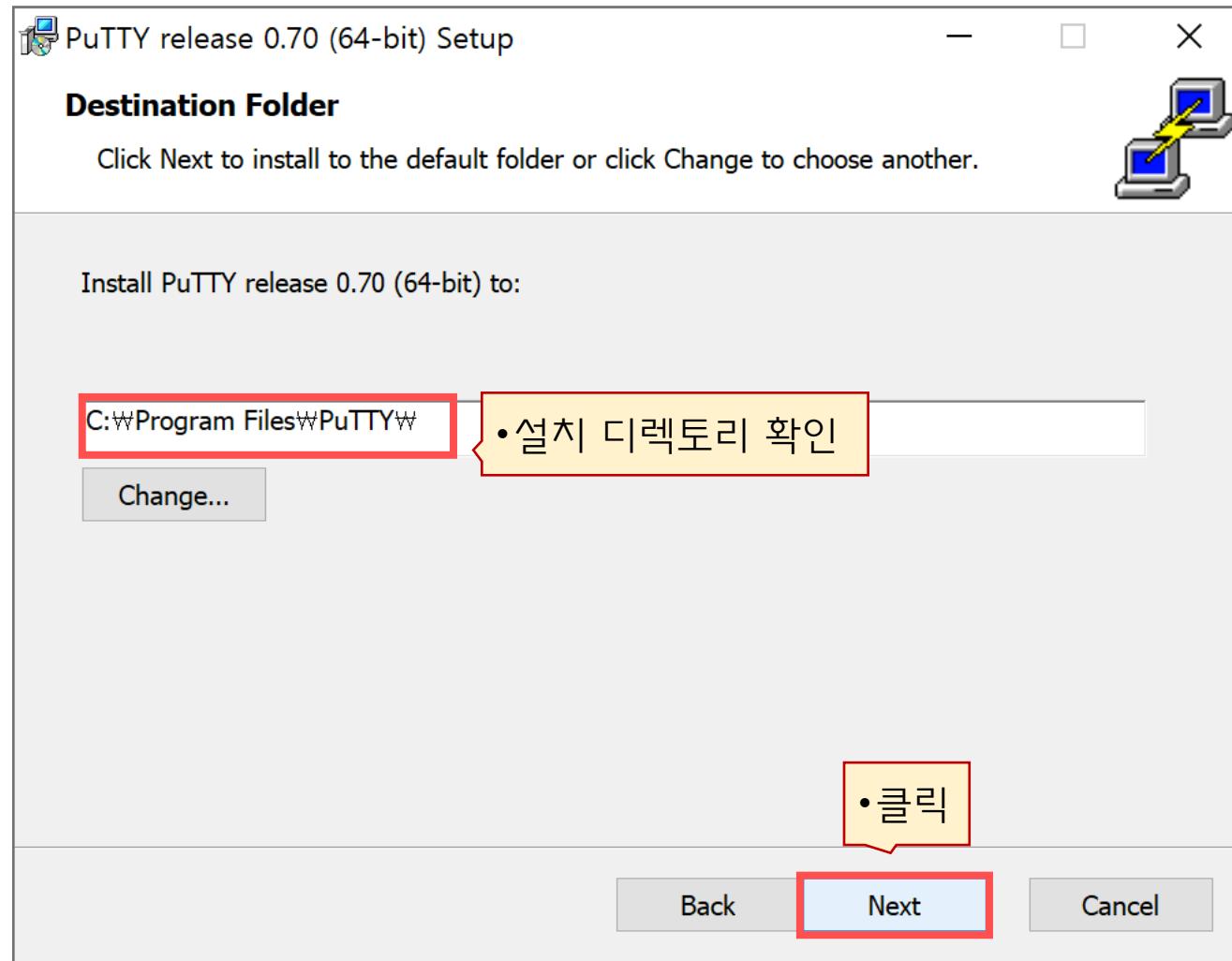
# SSH 클라이언트 PuTTY 다운로드 및 설치



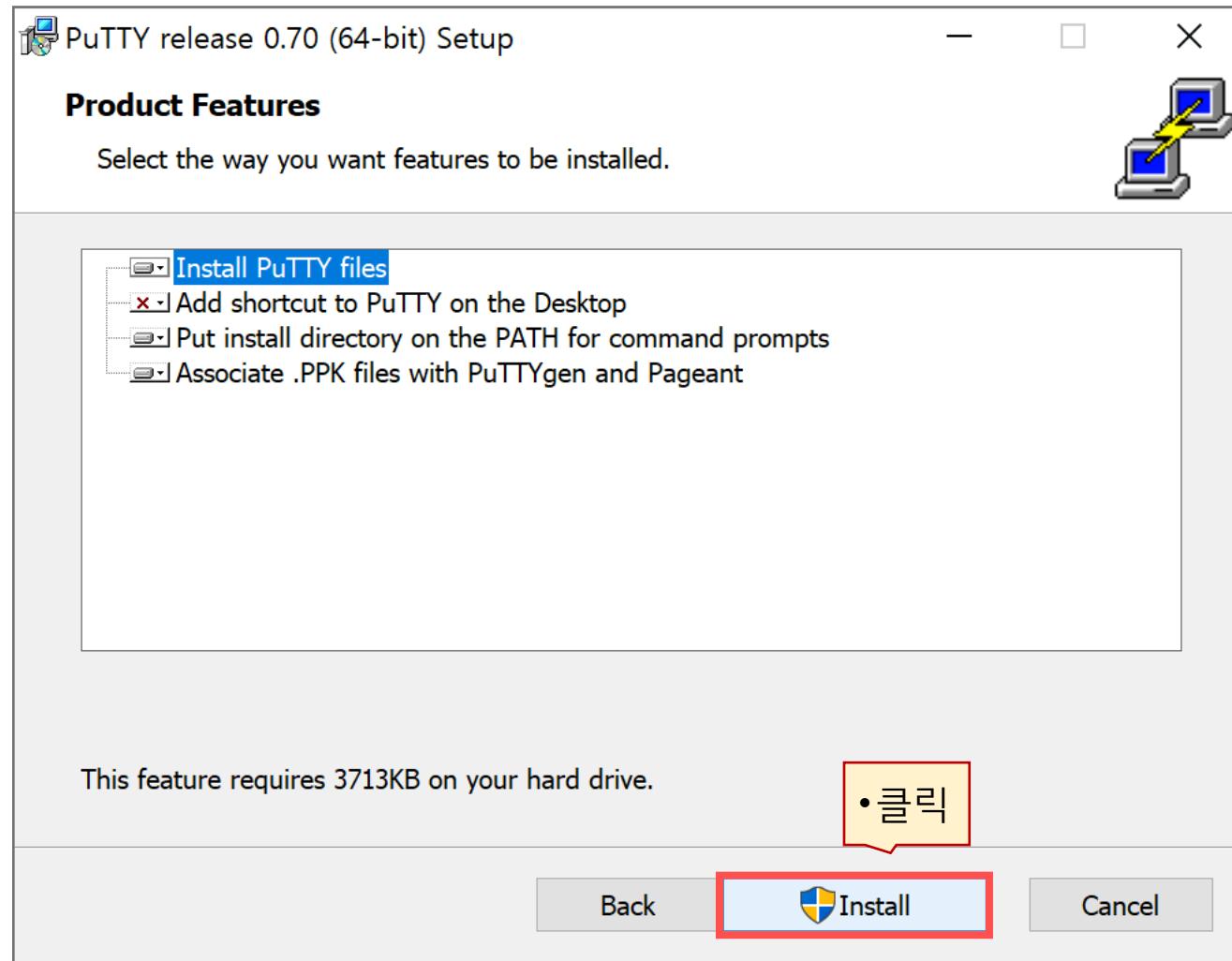
# SSH 클라이언트 PuTTY 다운로드 및 설치



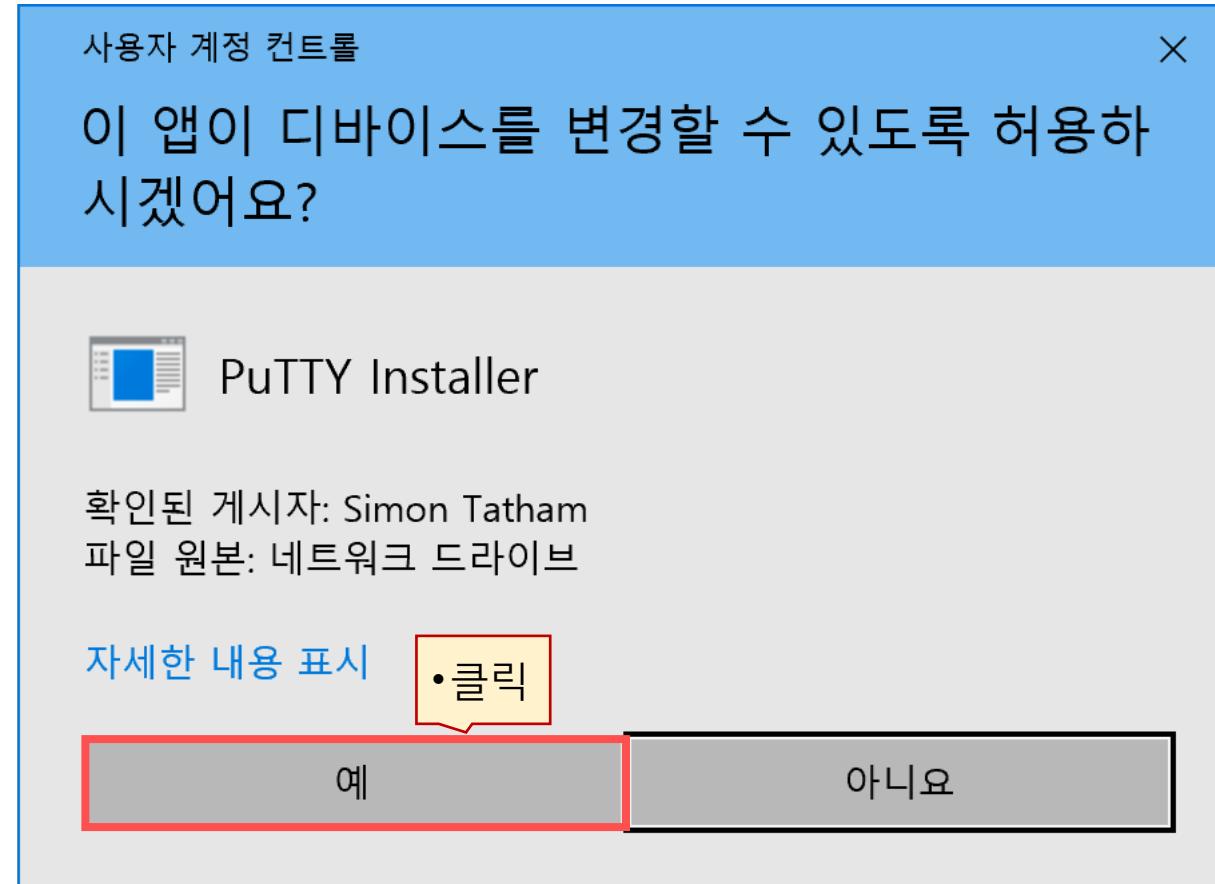
# SSH 클라이언트 PuTTY 다운로드 및 설치



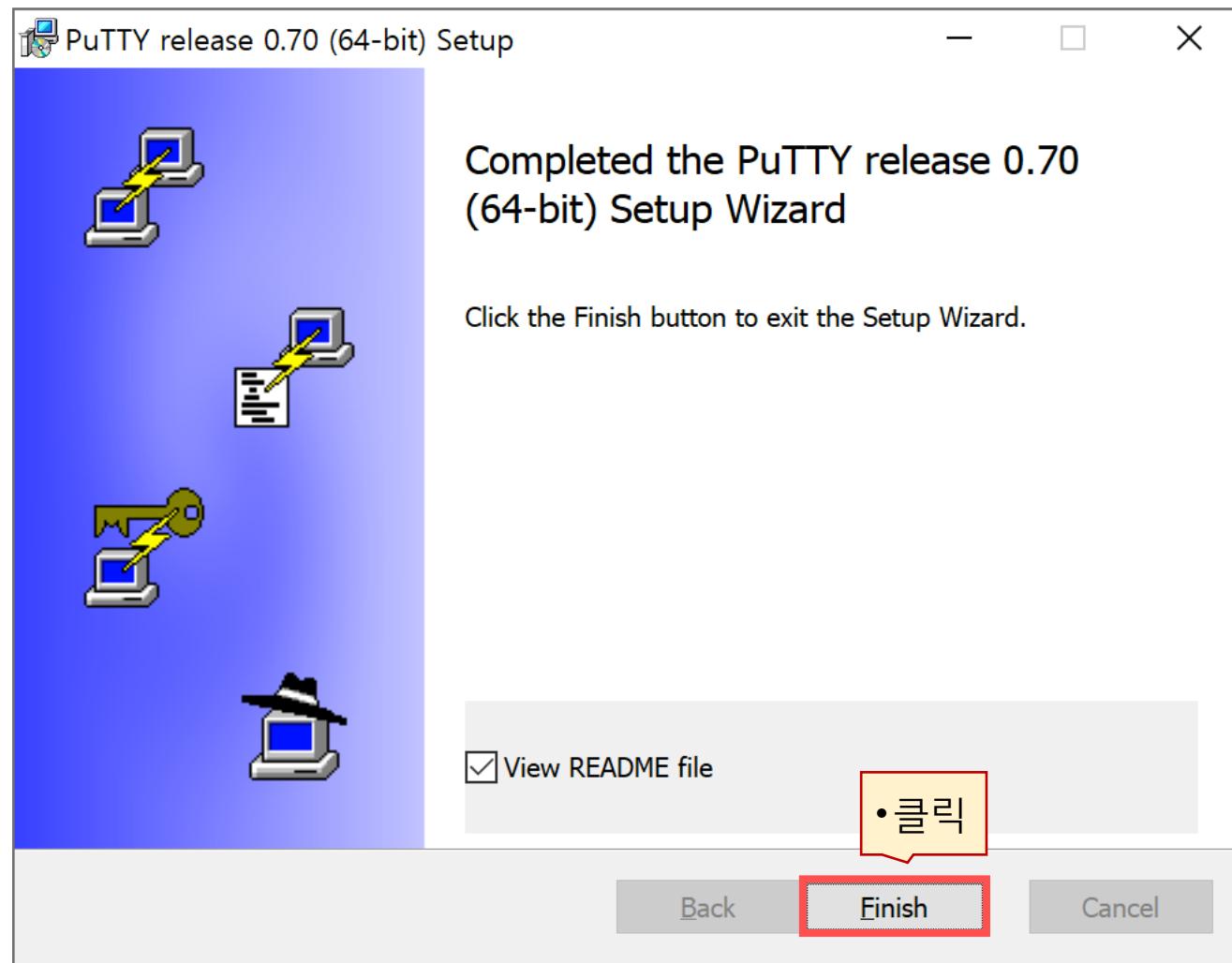
# SSH 클라이언트 PuTTY 다운로드 및 설치



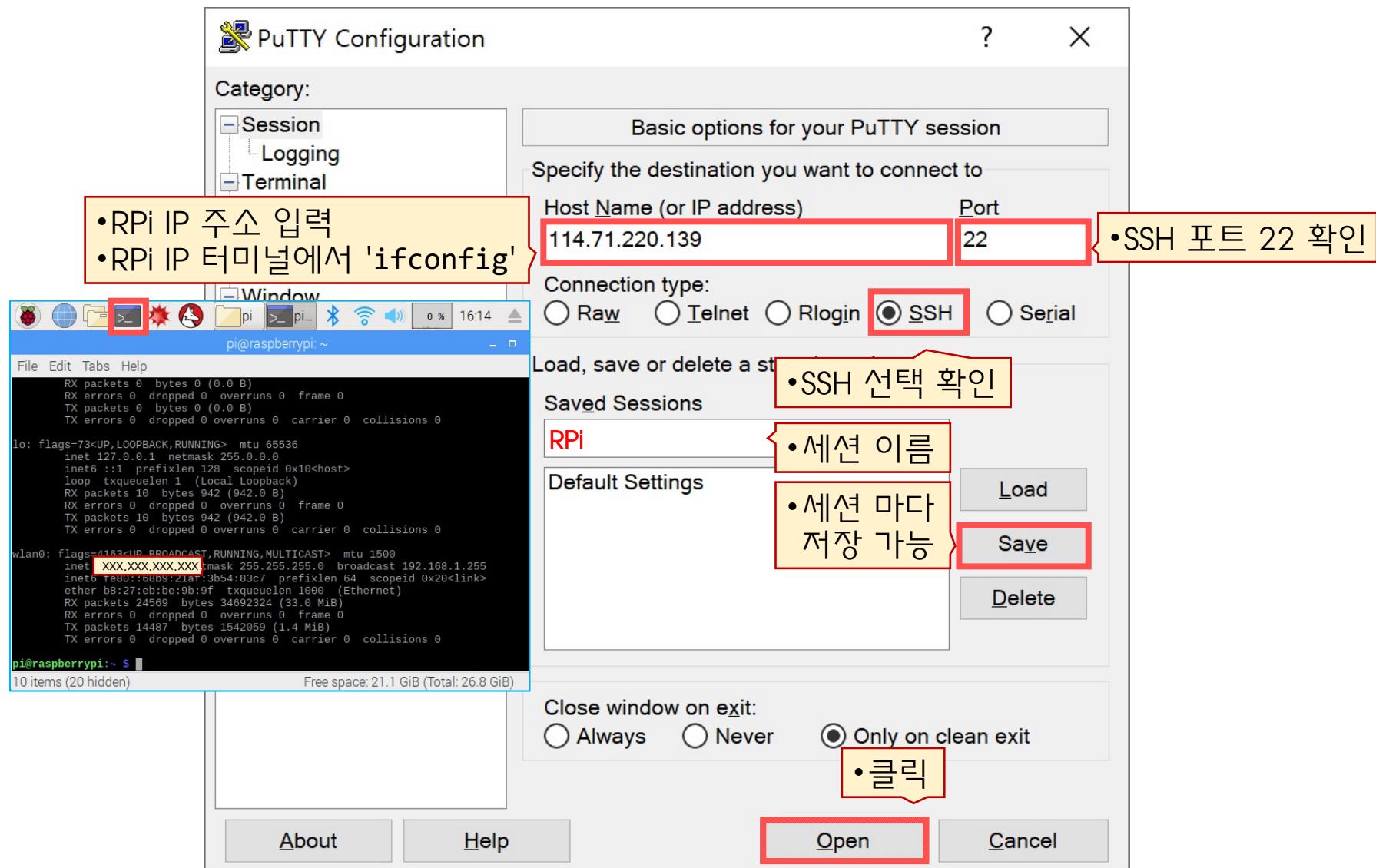
# SSH 클라이언트 PuTTY 다운로드 및 설치



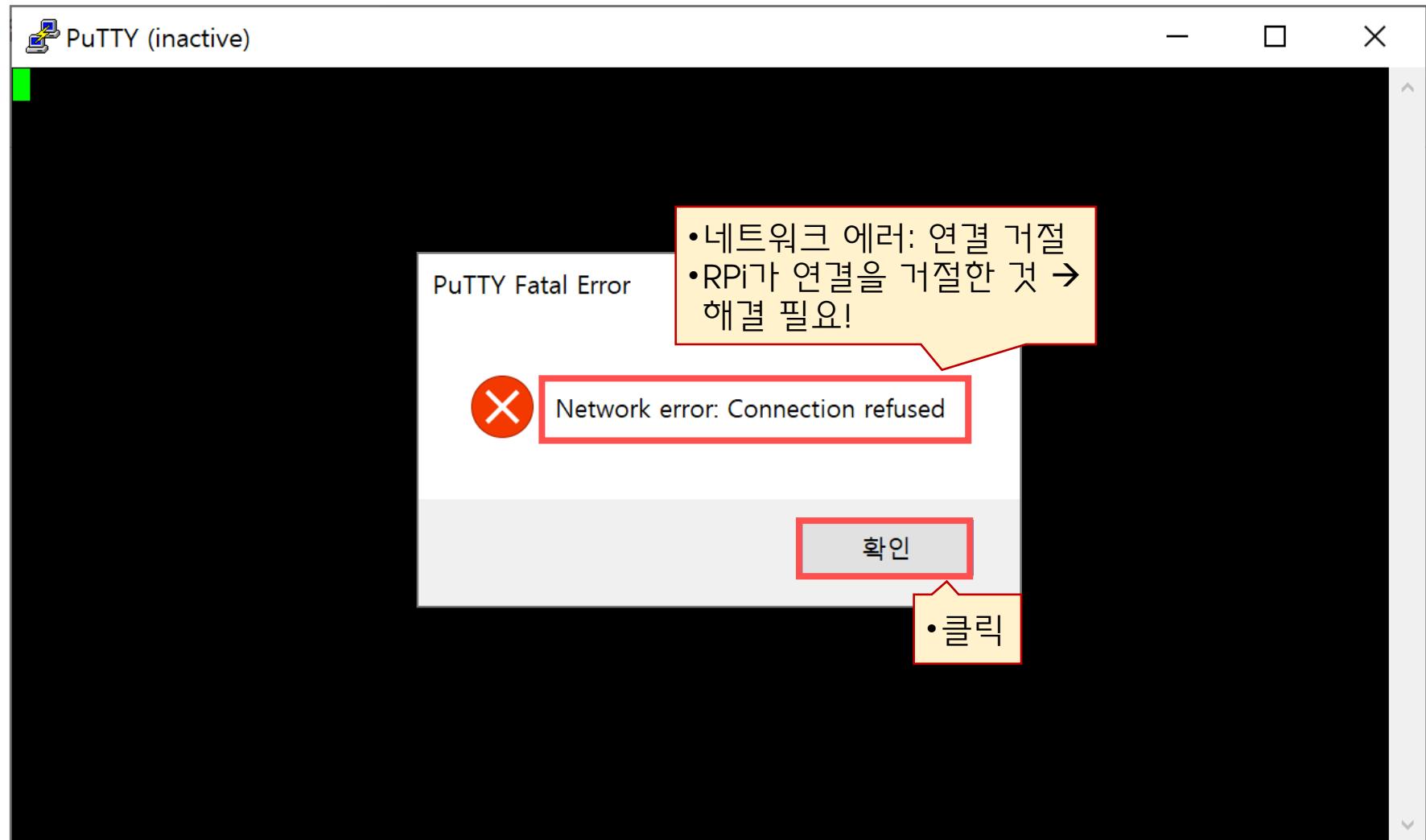
# SSH 클라이언트 PuTTY 다운로드 및 설치



# SSH 클라이언트 PuTTY 실행

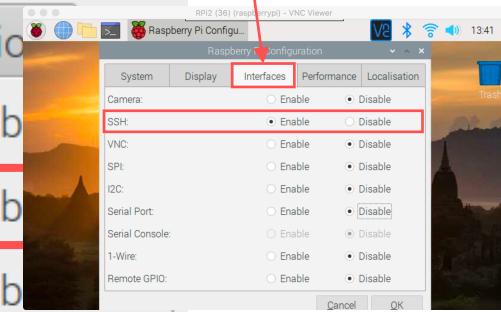
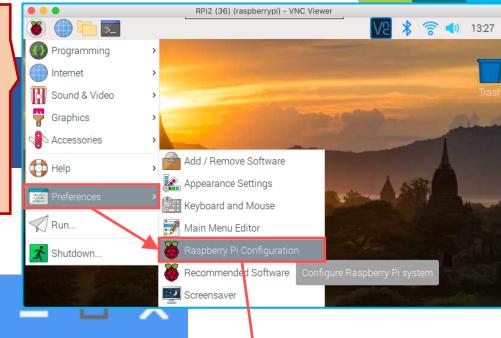
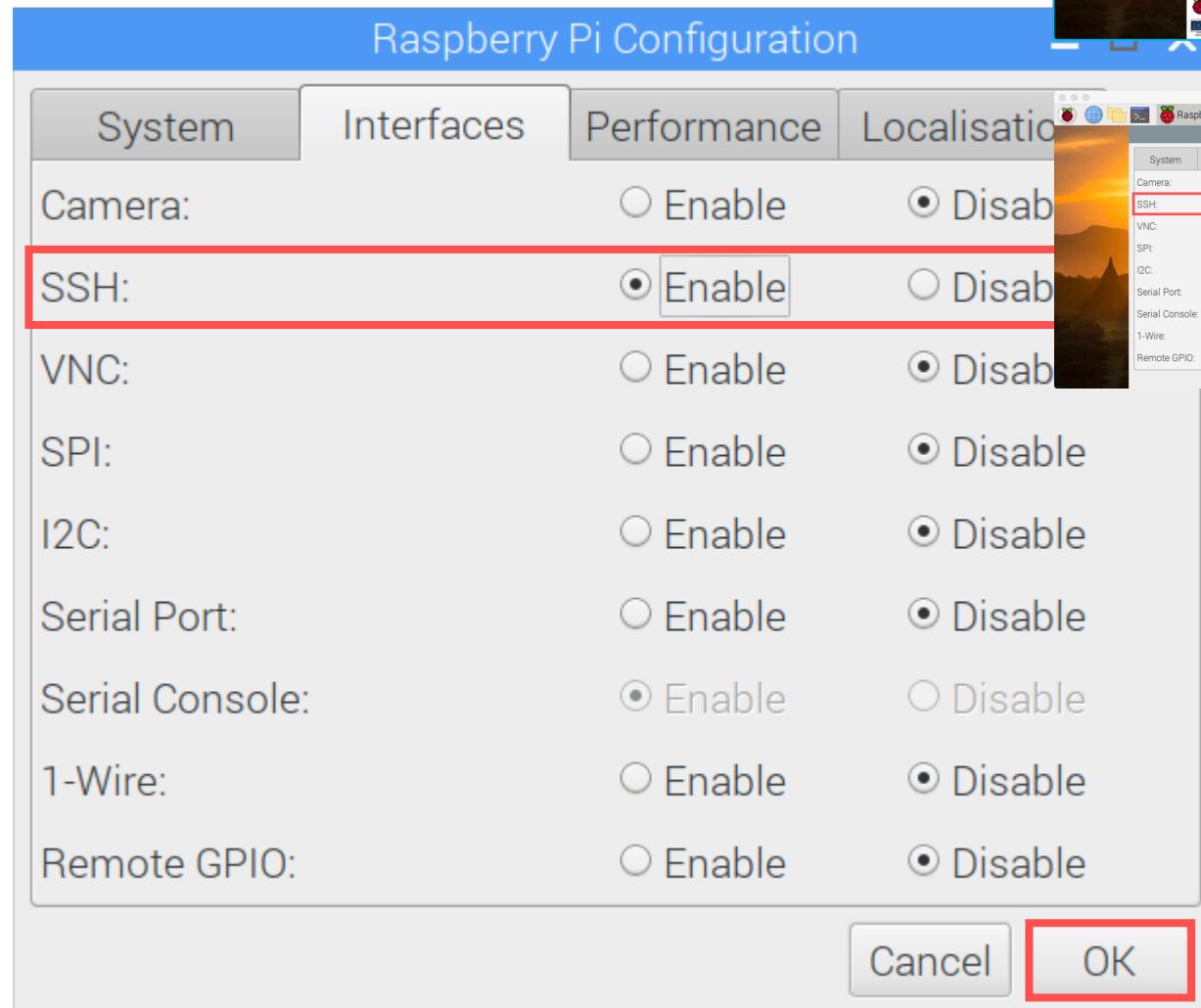


# SSH 클라이언트 PuTTY 실행



# SSH 클라이언트 PuTTY

- RPi Preferences → Raspberry Pi Configuration → Interfaces:  
SSH를 'Enable'로 설정  
• SSH 서비스 시작을 의미



# SSH 클라이언트 PuTTY 실행

- RPi의 호스트 키가 없음을 의미 (보안)
- '예'를 클릭하여 받아옴

PuTTY Security Alert



The server's host key is not cached in the registry. You have no guarantee that the server is the computer you think it is.

The server's ssh-ed25519 key fingerprint is:  
ssh-ed25519 256 f4:ed:fa:f8:d6:db:65:6b:d1:3a:05:09:ed:67:7d:13

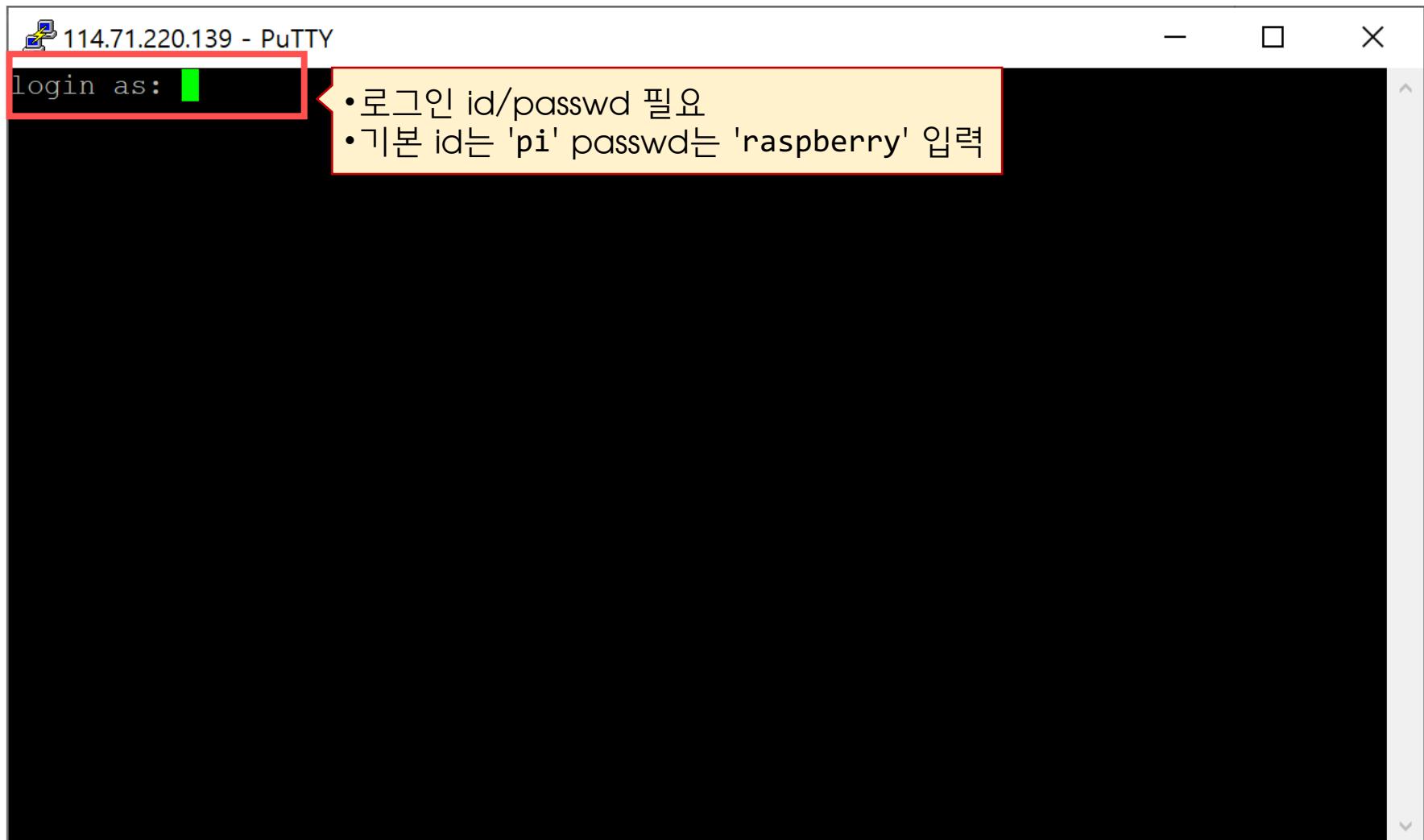
If you trust this host, hit Yes to add the key to PuTTY's cache and carry on connecting.

If you want to carry on connecting just once, without adding the key to the cache, hit No.

If you do not trust this host, hit Cancel to abandon the connection.

• 클릭

# SSH 클라이언트 PuTTY 실행



# SSH 클라이언트 PuTTY 실행

```
pi@raspberrypi: ~
-
-
X
login as: pi
pi@114.71.220.139's password:
Linux raspberrypi 4.14.79-v7+ #1159 SMP Sun Nov 4 17:50:20 GMT 2018 armv7l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sat Dec 29 03:00:43 2018

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
a new password.

pi@raspberrypi:~ $ █
```

•로그인 완료  
•원격으로 RPi 작업 수행 가능

# RPi 만져보기

SSH 원격 접속

# RPi 설정 도구 raspi-config

Practice

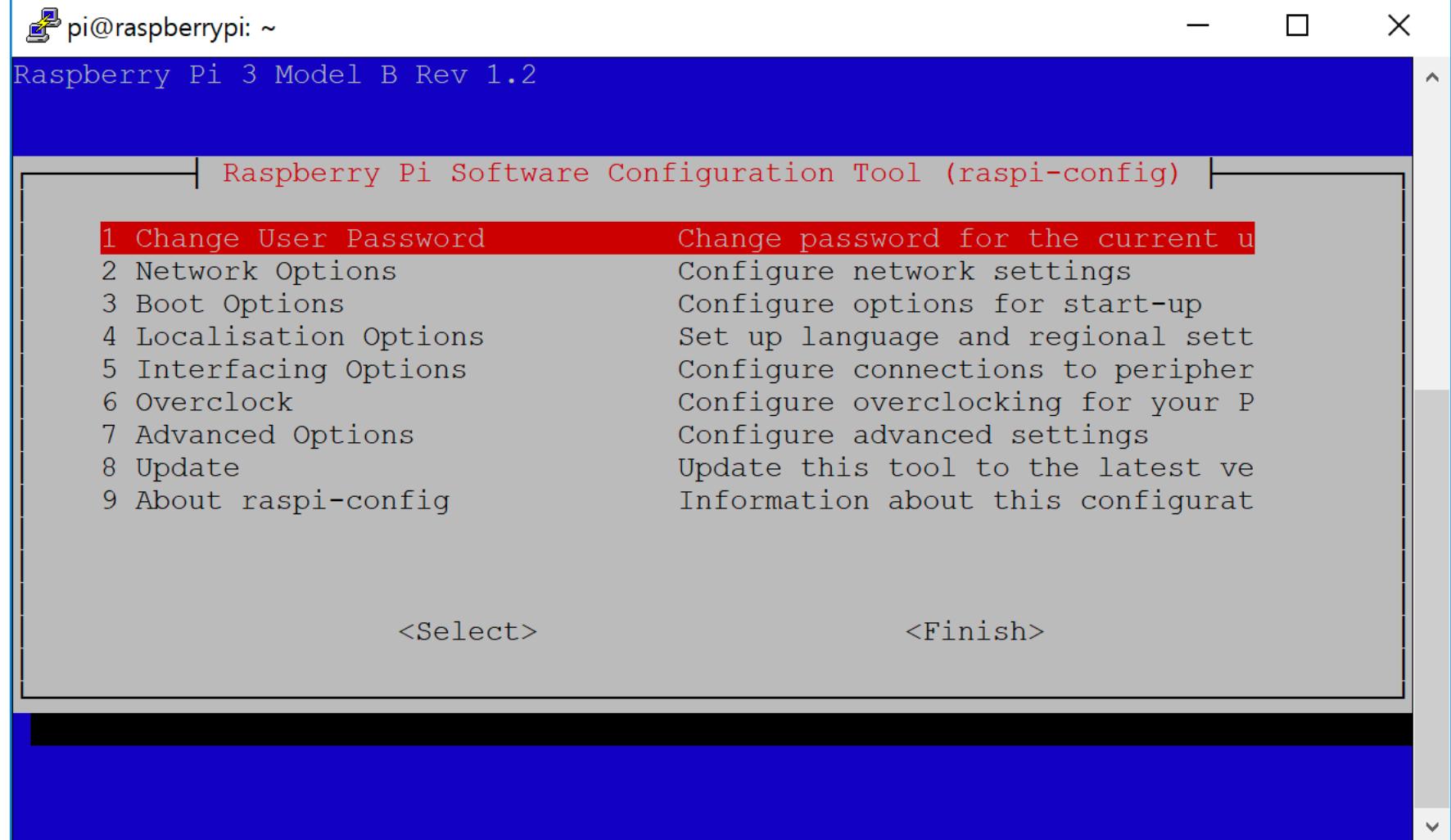
## ■ sudo raspi-config

•PuTTY  
창에서 실행

```
pi@raspberrypi ~
login as: pi
password:
Linux raspberrypi 4.14.79+ #1159 SMP Sun Nov 4 17:50:20 GMT 2018 armv7l
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sat Dec 29 03:00:43 2018
SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
a new password.

pi@raspberrypi: $
```



# RPi 종료와 재시작 reboot, shutdown

## ■ sudo **shutdown** -h now

- RPi를 바로 종료

## ■ sudo **shutdown** -h +5

- RPi를 5분 후에 종료

## ■ sudo **reboot**

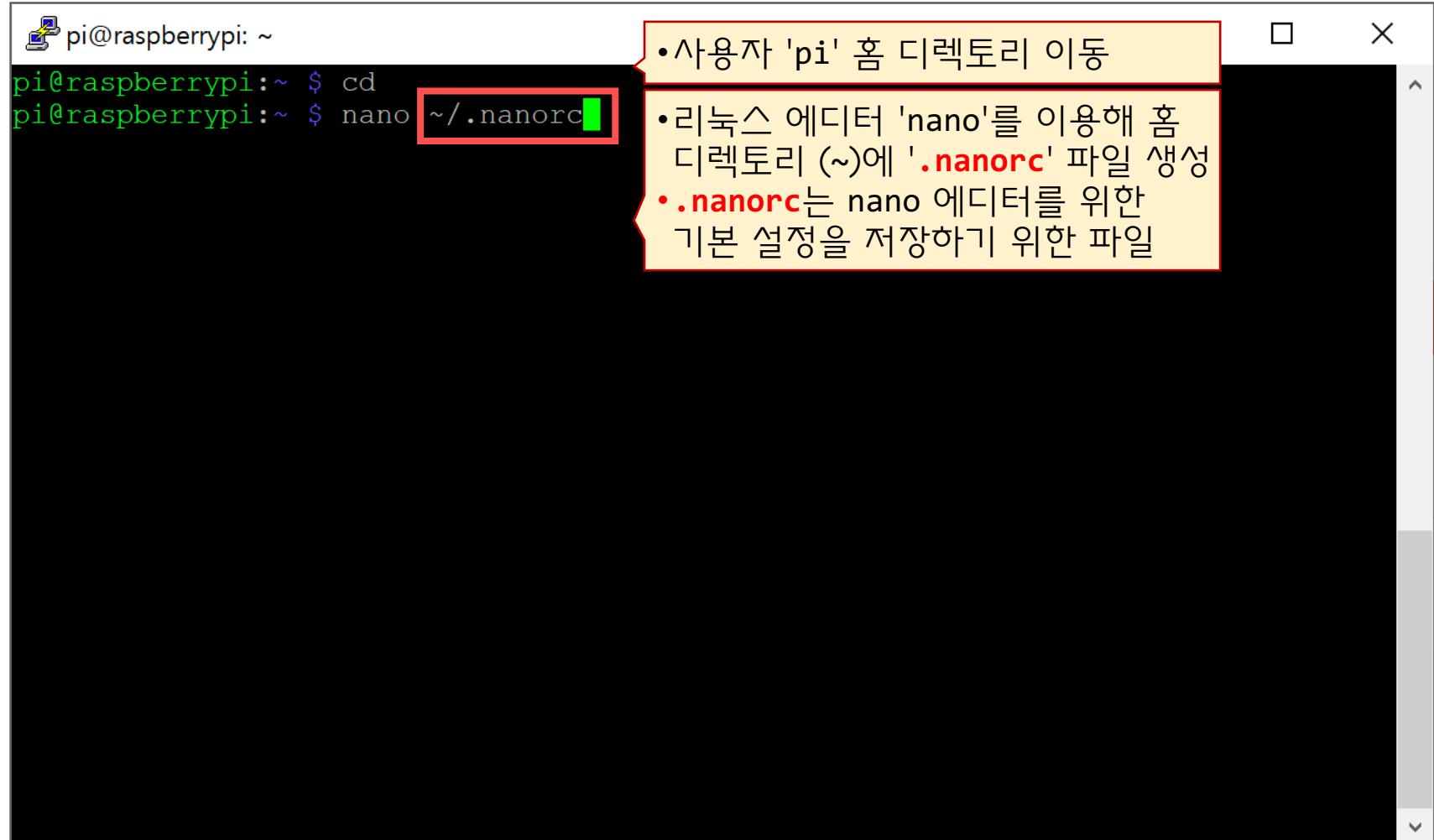
- RPi를 리셋 후 재시작

## ■ 반드시 **소프트웨어 명령으로 종료** 할 것!

# 에디터 nano<sup>1</sup>

Practice

## ■ nano ~/.nanorc



```
pi@raspberrypi: ~
pi@raspberrypi: ~ $ cd
pi@raspberrypi: ~ $ nano ~/.nanorc
```

• 사용자 'pi' 홈 디렉토리 이동  
• 리눅스 에디터 'nano'를 이용해 홈 디렉토리 (~)에 '.nanorc' 파일 생성  
.nanorc는 nano 에디터를 위한 기본 설정을 저장하기 위한 파일

# 에디터 nano<sup>1</sup>

Practice

## ■ set linenumbers

pi@raspberrypi: ~

GNU nano 2.7.4 File: /home/pi/.nanorc Modified

```
set linenumbers
```

•set linenumbers  
•위 명령어는 nano 에디터에서 줄 번호를 보여주는 기능 설정

•nano 종료를 위해 CTRL+X

•저장은 CTRL+O

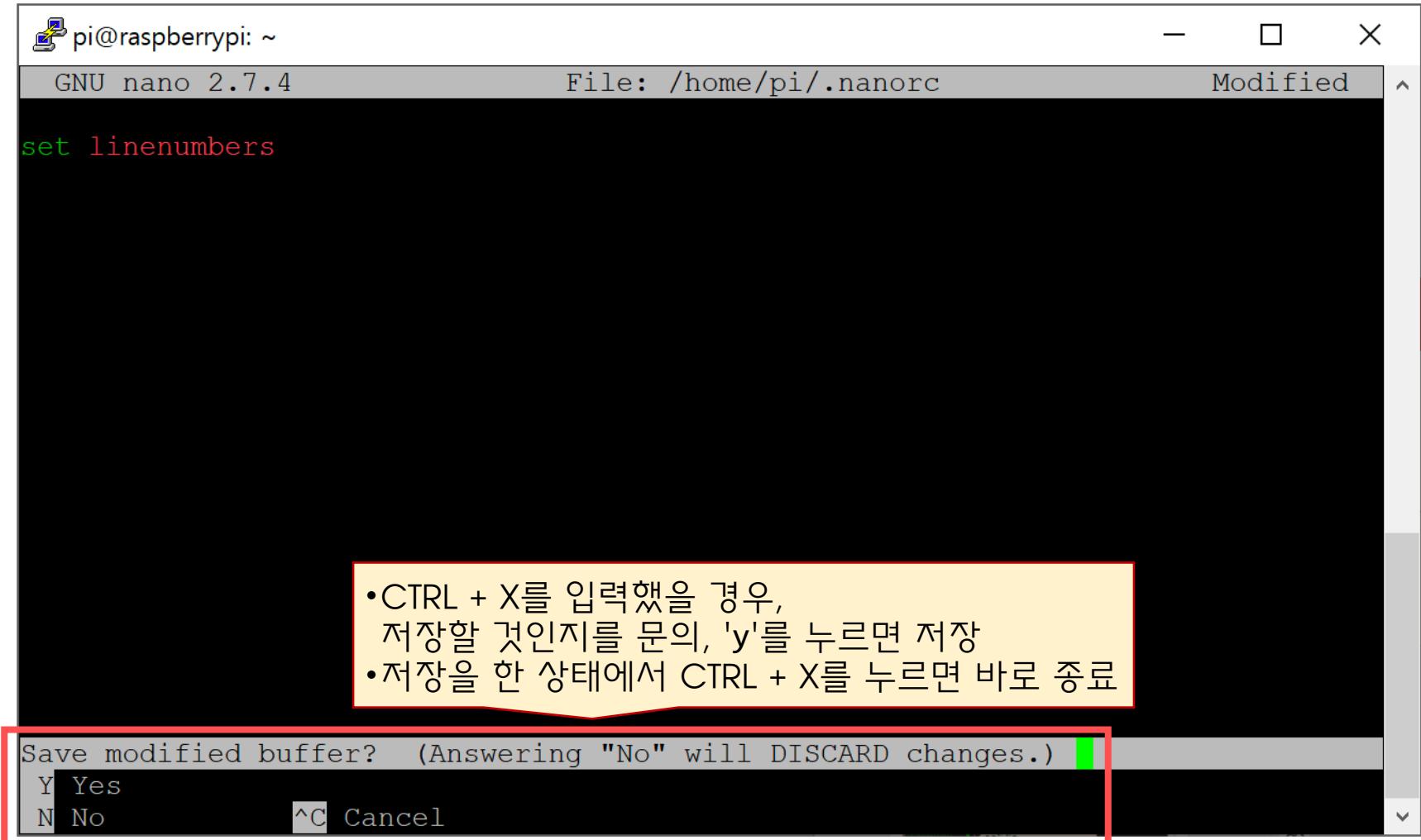
[ New File ]

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos  
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^ Go To Line

# 에디터 nano<sup>1</sup>

Practice

## ■ set linenumbers



The screenshot shows a terminal window titled "pi@raspberrypi: ~" running the "GNU nano 2.7.4" editor. The file being edited is "/home/pi/.nanorc". The text "Modified" is visible in the top right corner. Inside the editor, the command "set linenumbers" is written in green. A red box highlights the bottom status bar which asks "Save modified buffer? (Answering "No" will DISCARD changes.)" with options "Y Yes", "N No", and "^C Cancel". A yellow callout box contains Korean notes about the keyboard shortcut.

• CTRL + X를 입력했을 경우,  
저장할 것인지를 묻의, 'y'를 누르면 저장  
• 저장을 한 상태에서 CTRL + X를 누르면 바로 종료

Save modified buffer? (Answering "No" will DISCARD changes.)

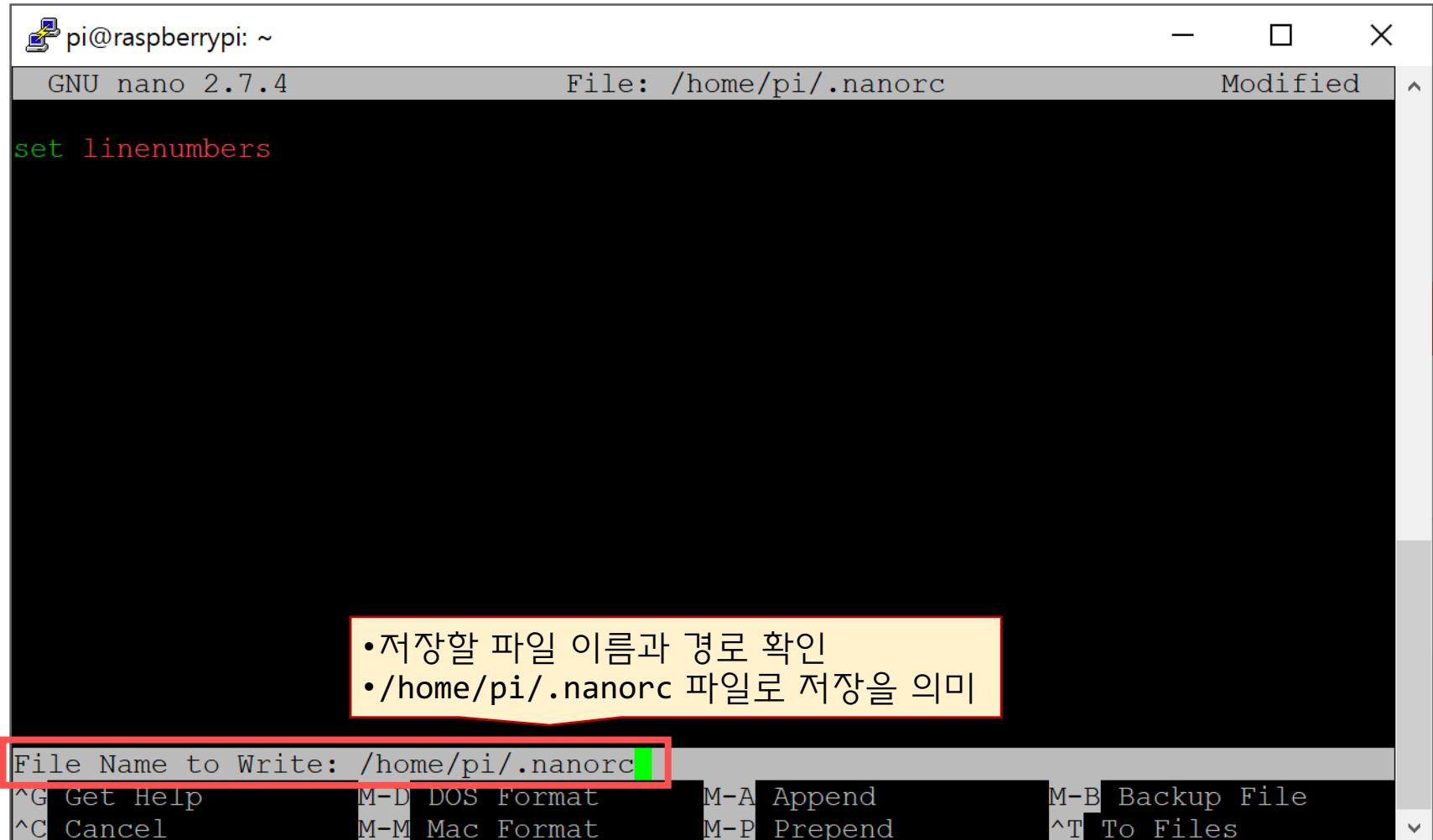
Y Yes      ^C Cancel

N No

# 에디터 nano<sup>1</sup>

Practice

## ■ set linenumbers



```
pi@raspberrypi: ~
GNU nano 2.7.4
File: /home/pi/.nanorc
Modified
set linenumbers
```

•저장할 파일 이름과 경로 확인  
•/home/pi/.nanorc 파일로 저장을 의미

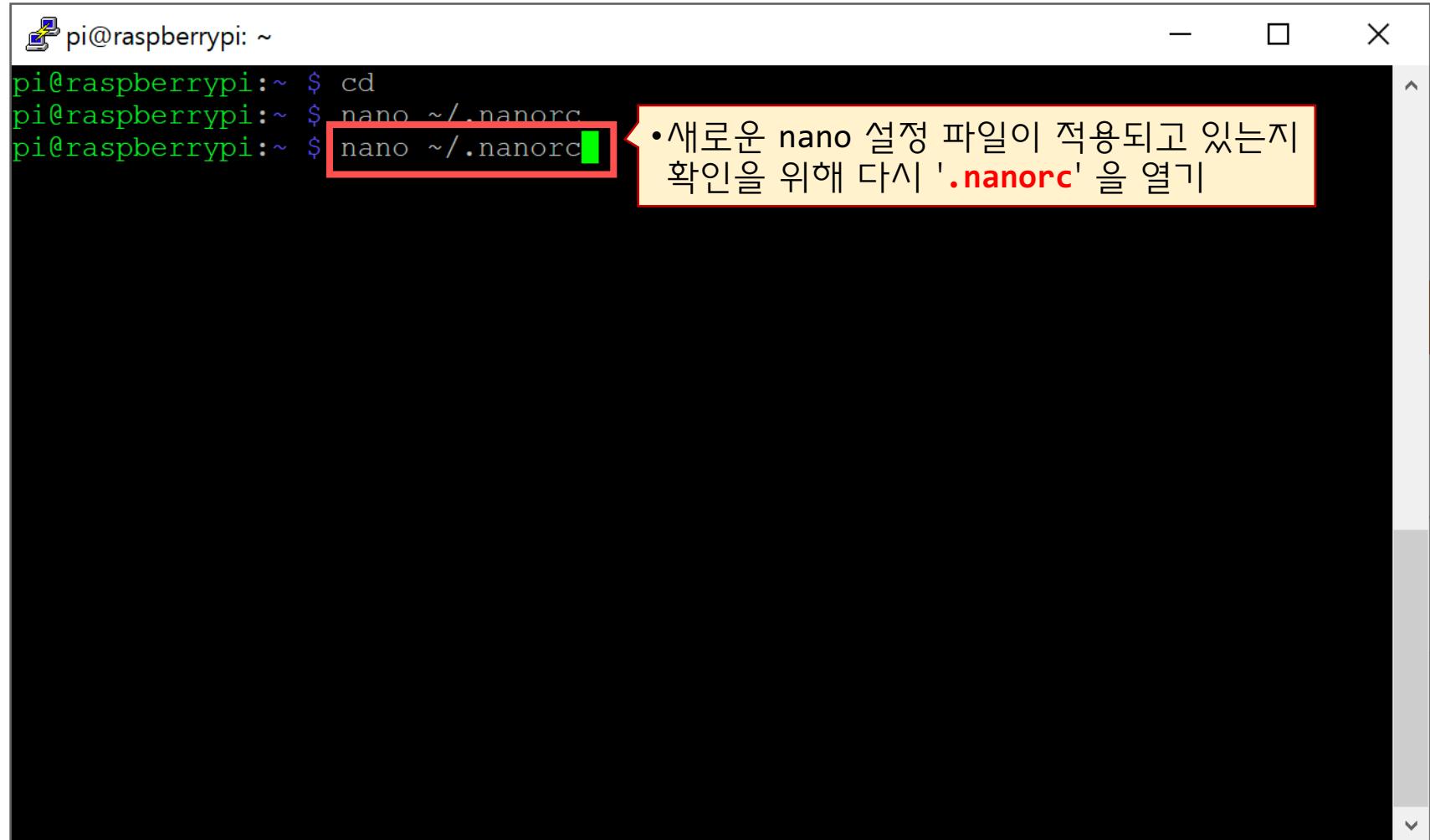
File Name to Write: /home/pi/.nanorc

^G Get Help M-D DOS Format M-A Append M-B Backup File  
^C Cancel M-M Mac Format M-P Prepend ^T To Files

# 에디터 nano<sup>1</sup>

Practice

## ■ set linenumbers



```
pi@raspberrypi: ~ $ cd  
pi@raspberrypi: ~ $ nano ~/.nanorc  
pi@raspberrypi: ~ $ nano ~/.nanorc
```

•새로운 nano 설정 파일이 적용되고 있는지 확인을 위해 다시 '.nanorc' 을 열기

# 에디터 nano<sup>1</sup>

Practice

## ■ set linenumbers

The screenshot shows a terminal window titled "pi@raspberrypi: ~" running the "GNU nano 2.7.4" editor. The file being edited is "/home/pi/.nanorc". The text in the editor is:

```
1 set linenumbers
```

A red box highlights the first two lines of code. A yellow callout box points to the first line with the Korean text "• 줄 번호 생성 확인". The bottom status bar of the editor shows various keyboard shortcuts.

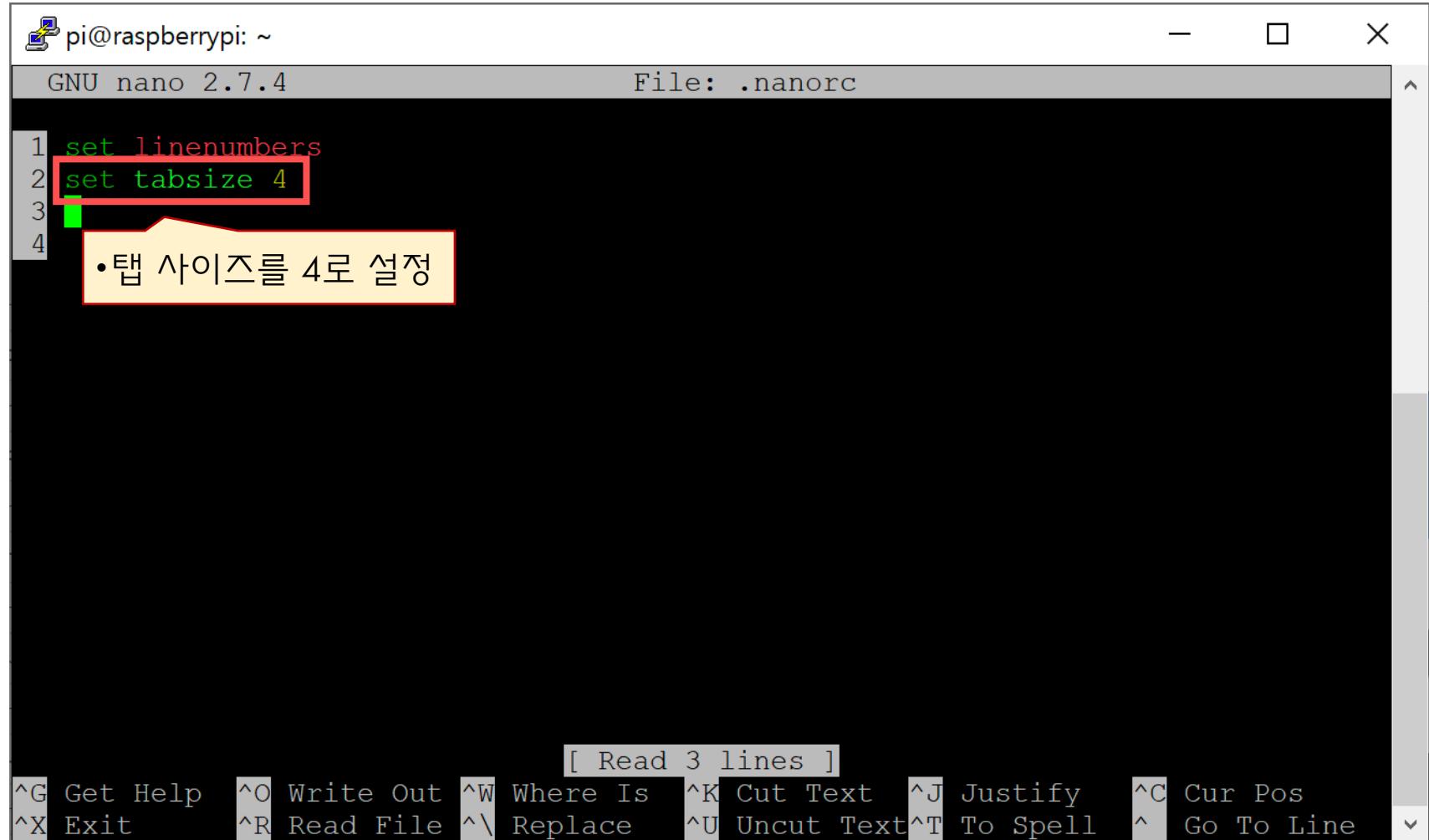
[ Read 1 line ]

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos  
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^ Go To Line

# 에디터 nano<sup>1</sup>

Practice

## ■ set tabsiz 4



The screenshot shows the nano text editor version 2.7.4 running on a Raspberry Pi. The file being edited is .nanorc. The terminal window title is "pi@raspberrypi: ~". The editor interface includes a menu bar with "File: .nanorc", standard window controls (minimize, maximize, close), and a status bar at the bottom with keyboard shortcuts for various functions like Get Help (^G), Write Out (^O), Where Is (^W), Cut Text (^K), Justify (^J), Cur Pos (^C), Exit (^X), Read File (^R), Replace (^\\), Uncut Text (^U), To Spell (^T), and Go To Line (^G). The main area displays the following configuration text:

```
1 set linenumbers
2 set tabsiz 4
3
4
```

A red box highlights the line "set tabsiz 4". A callout bubble with a red border and a green arrow points from the text "탭 사이즈를 4로 설정" (Set tab size to 4) to this line. The status bar at the bottom shows "[ Read 3 lines ]".

# 화면 위아래 바꾸기<sup>1</sup> config.txt

Practice

## ■ sudo nano /boot/config.txt

```
#hdmi_mode=1

# uncomment to force a HDMI mode rather than DVI. This can make audio work in
# DMT (computer monitor) modes
#hdmi_drive=2

# uncomment to increase signal to HDMI, if you have interference, blanking, or
# no display
#config_hdmi_boost=4

# uncomment for composite PAL
#sdtv_mode=2

#uncomment to overclock the arm. 700 MHz is the default.
#arm_freq=800

# Uncomment some or all of these to enable the optional hardware interfaces
#dtparam=i2c_arm=on
#dtparam=i2s=on
#dtparam=spi=on

# Uncomment this to enable the lirc-rpi module
#dtoverlay=lirc-rpi

# Additional overlays and parameters are documented /boot/overlays/README

# Enable audio (loads snd_bcm2835)
dtparam=audio=on

lcd_rotate=2
```

- 원래대로 하려면 주석 처리
- CTRL+X, 파일 저장
- sudo reboot, 리부트 필요

# '익스플로링 라즈베리파이' 소스코드 다운로드

## ■ 웹 브라우저

- <http://exploringrpi.com/>
- <https://github.com/derekmolloy/exploringrpi.git>

## ■ RPi 터미널 (**추천**)

- `git clone https://github.com/derekmolloy/exploringrpi.git`

- PuTTY 창에서 실행
- GitHub에서 소스코드 다운로드
- 다운로드 완료 후 RPi에서 'exploringrpi' 디렉토리 확인

```
pi@raspberrypi: ~
pi@raspberrypi: ~$ git clone https://github.com/derekmolloy/exploringrpi.git
Cloning into 'exploringrpi'...
remote: Counting objects: 100, done.
remote: Compressing objects: 100% (100/100), done.
remote: Total 100 (delta 0), reused 0 (delta 0), pack-reused 100
Receiving objects: 100% (100/100), 1.12 MiB | 0 bytes/s
Resolving deltas: 100% (100/100), done.
pi@raspberrypi: ~$
```

# Summary

- Raspberry Pi platform
- Install Raspbian on RPi
- Setup RPi
- SSH and PuTTY
- Remote access to RPi
- Control RPi LEDs

# Thank you

Questions?

Contact: [eclass.sch.ac.kr](http://eclass.sch.ac.kr)  
(순천향대학교 학습플랫폼 LMS)