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 BUILD A CAMERA WITH
 RASPBERRY PI

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PARTS	QUANTITY
PiTop CEED	1
Raspberry Pi 3 Model B	2*
Pi camera board - 8 megapixel V2.1	1
Capacitive touchscreen - Model B+/Pi 2	1
Portable Power Bank, 1 USB Port - 4000mAh - 5V @1A	1
USB Optical Mouse/Keyboard combo	1
SanDisk 16GB Mobile MicroSDHC Class 4 Flash Memory Card with Adapter- SDSAQM-016G-B35A	1
Pi case/cover, specific to Model B	1
2" strip of masking tape	1
USB flash drive	1

CODING ACTIVITY

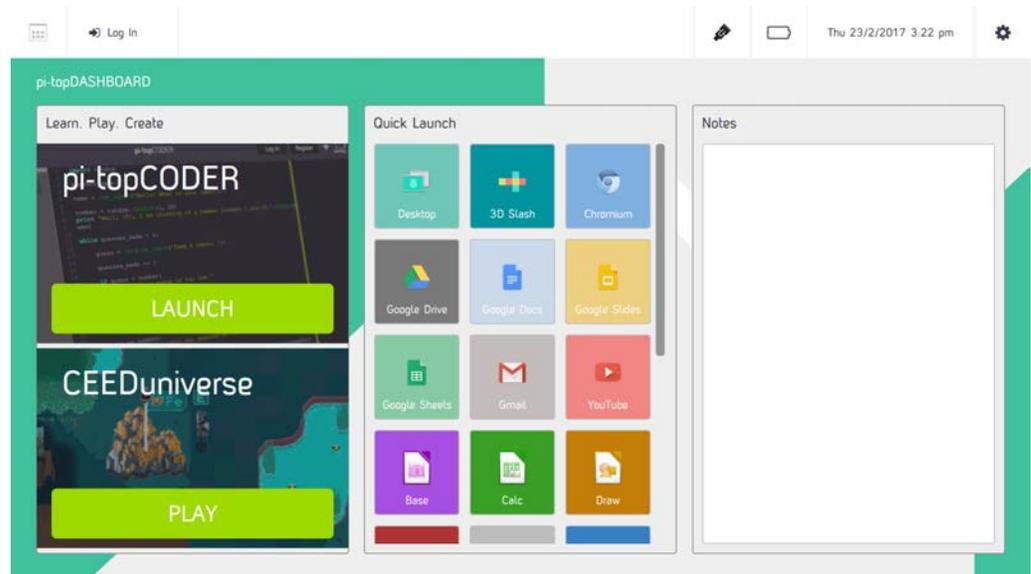
1. ASSEMBLE THE CEED COMPUTER

- Insert the (preformatted) Pi Top CEED SD card into the Raspberry Pi.
- Attach the 4 magnets (found inside the CEED box) to the Raspberry Pi, then attach to the silver bars inside the CEED. This keeps the Pi attached inside the CEED.
- Attach the long black bar cable with the red wire towards the SD card side.
- Attach the HDMI cable to the bottom HDMI port of the Raspberry Pi.
- Attach a keyboard and a mouse to the USB ports on the side of the Raspberry Pi. These should be accessible from the right side of the CEED.

- Attach the camera cable to the Raspberry Pi.
 - A. The port is marked CAMERA, and it is beside the HDMI port. It will have a small plastic covering on it. Peel off this covering.
 - B. Open the camera slot by lifting from the two short edges. You will feel the black plastic piece come up.
 - C. Insert the camera cable with the blue tab facing the right side of the CEED (toward the ethernet port).
 - D. Press the black plastic on the camera port back down until it snaps tight.
- Insert the power cord in the left side of the CEED.
- Leave the black sliding front off of the CEED.
- Plug the Pi-Top CEED into the wall, press the power button on the left side for 2-3 seconds to power on. A colorful square will appear, followed by the boot-up text. A "Get Started" screen will appear.
- Follow the on-screen instructions (these are UK defaults, so change them based on location).

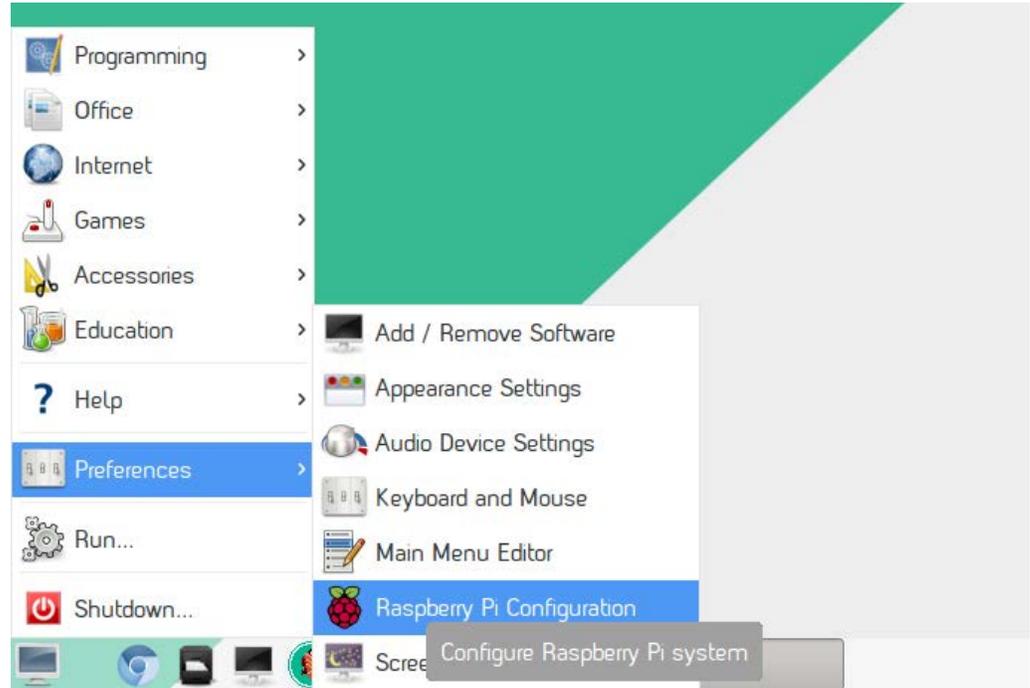
2. ENABLE CAMERA ON CEED

- When the CEED starts, an interface that looks like this will appear:

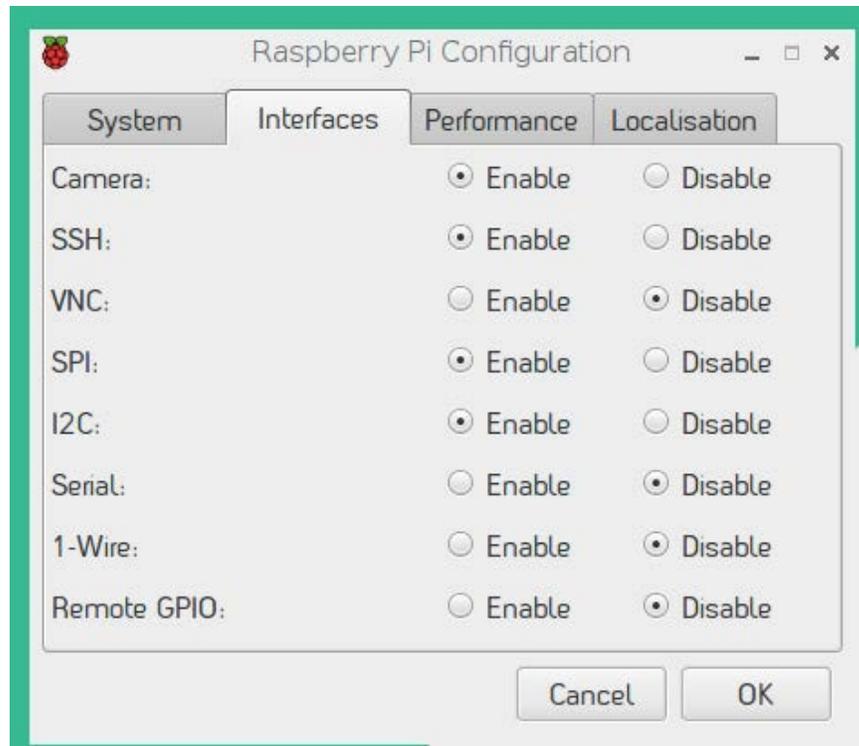


- Scroll down in the "Quick Launch" section in the middle, click "Python 3."
- The Python window will open on a more familiar-looking desktop. The camera will need to be enabled before writing code.

- Click the terminal icon in the lower left corner, then Preferences > Raspberry Pi Configuration:



- In the Raspberry Pi Configuration window, click the Interfaces tab. Select Enable by Camera, and click OK.



- You will be prompted to reboot the CEED. Click OK. Once the system reboots, you will be ready to try some Python code for the camera.

3. LEARN TO USE THE PI CAMERA ON THE CEED:

Use the following instructions to:

A. Write a basic script for taking a photo with a 5-second delay

B. Try out a live feed

First, click the same Python 3 button you found before we enabled the camera. Click it to open the Python 3 IDLE.

WRITE A BASIC SCRIPT FOR TAKING A PHOTO

- Click File > New File. Save this file as camera.py
- Type the following code. You will see some of the text change colors as you're typing. That's OK. Be sure to type exactly what you see below.

```
from picamera import PiCamera
from time import sleep

camera = PiCamera()
camera.start_preview()
sleep(5)
camera.stop_preview()
```

- Press Ctrl + S to save the file.
- Press F5 to run the script. The camera preview will appear for 5 seconds and then close. You can move the camera around during this time. If you do not see the camera preview, there is an error in your script. Be sure that you typed it exactly as you see above.
- To capture a photo, we need one more line of code. Add this line after sleep(5):

```
camera .
capture( '/home/pi/Desktop/image.jpg' )
```

- Ctrl + S to save, and press F5 to run it again. The camera will preview for 5 seconds before it takes a photo.
- Your photo will be saved to the desktop. You can double-click it to open it.

TRY OUT A LIVE FEED

- The Pi camera also captures video. To start, delete the last three lines of your file. It should now end with camera.start_preview()
- Add these four lines to replace them:

```
camera.start_recording('/home/pi/video.h264')
sleep(10)
camera.stop_recording()
camera.stop_preview()
```

- Ctrl + S to save, and press F5 to run the code. It will record ten seconds of video and then close. If it doesn't, double check your typing.

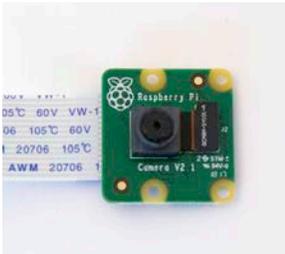
- Use the command line to play the video. Click the Terminal button in the taskbar:



- Type `omxplayer video.h264` in the terminal and press Enter. The video should open and play. It may be at a faster speed than you expected.

(Instructions based on project at: <https://projects.raspberrypi.org/en/projects/getting-started-with-picamera>)

MAKE YOUR OWN RASPBERRY PI CAMERA



- Carefully remove the camera cable from the Raspberry Pi in the CEED. Lift the black plastic piece on the camera port and remove the cable.
- Insert the camera into the new Raspberry Pi just as you placed it in the CEED. Remember, the blue strip faces the ethernet and USB ports.
- Attach the TFT touchscreen onto the GPIO pins. Pay attention to not bending the pins.
- Insert the microSD card.
- Insert the Pi camera into the camera case; leave the lid off.
- Insert a USB flash drive into the USB port. This will allow you to save the photos to the USB drive versus the SD card. This must be inserted prior to powering on the camera. If not, pictures will save to the SD card.
- Plug the battery pack into both ends (USB into the power pack, microUSB into the Pi). Press the power button on the battery pack. Rubber band the battery pack around the camera case.
- The Pi camera should power on.
- Tape the camera strip to the Pi case to hold the lens in place.
- Test that you can tap the screen on the camera to take a photo.

TAKE PHOTOS AND SHARE WHAT YOU'VE MADE

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