CEC Continuing Education Center

DesignNews

Raspberry Pi 5 Automation Lecture Series

Day 3:
Lights, Camera, Automation!

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Fred Eady

Visit ‘Lecturer Profile’ in your console for more details.

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AGENDA

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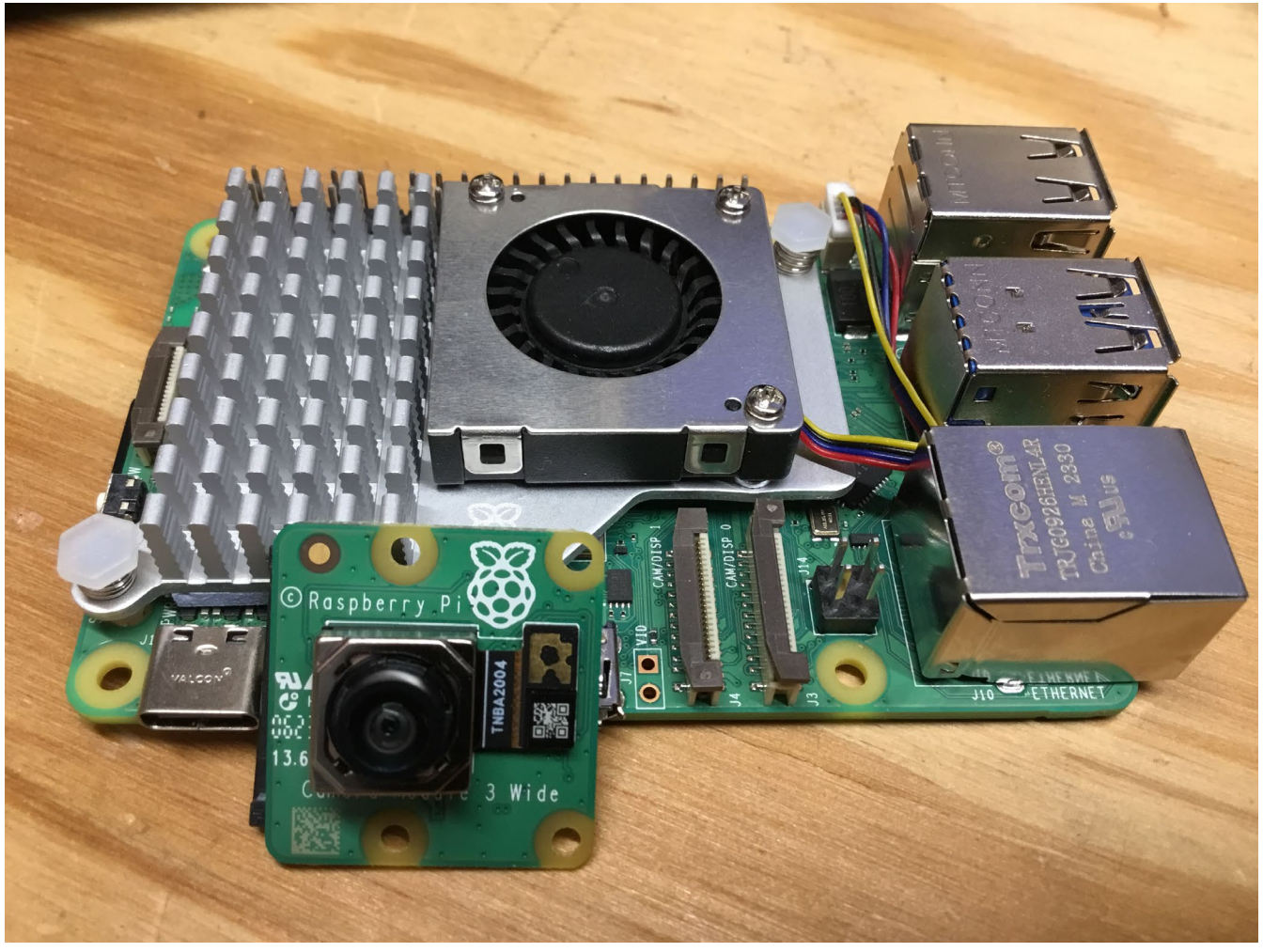
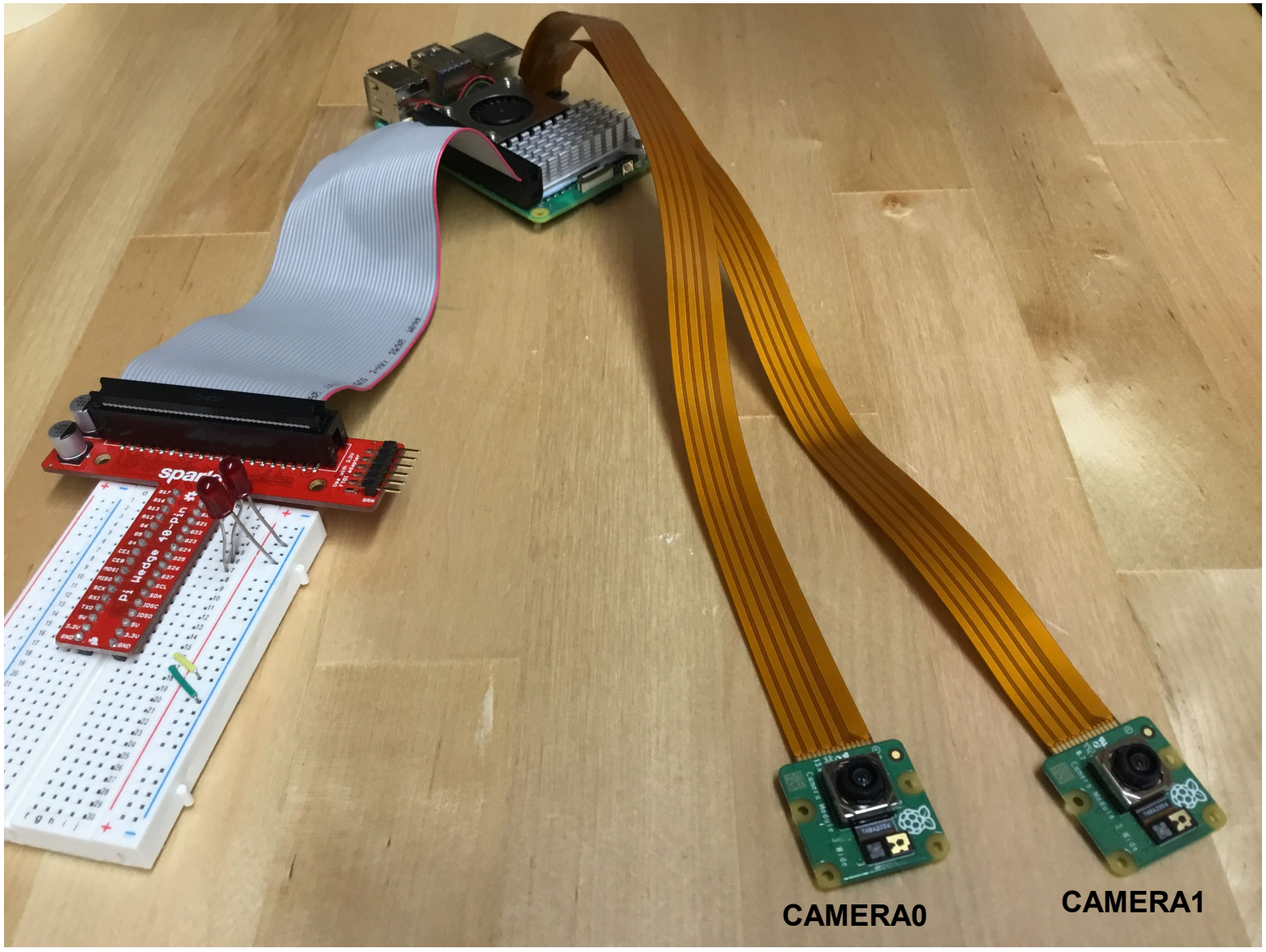
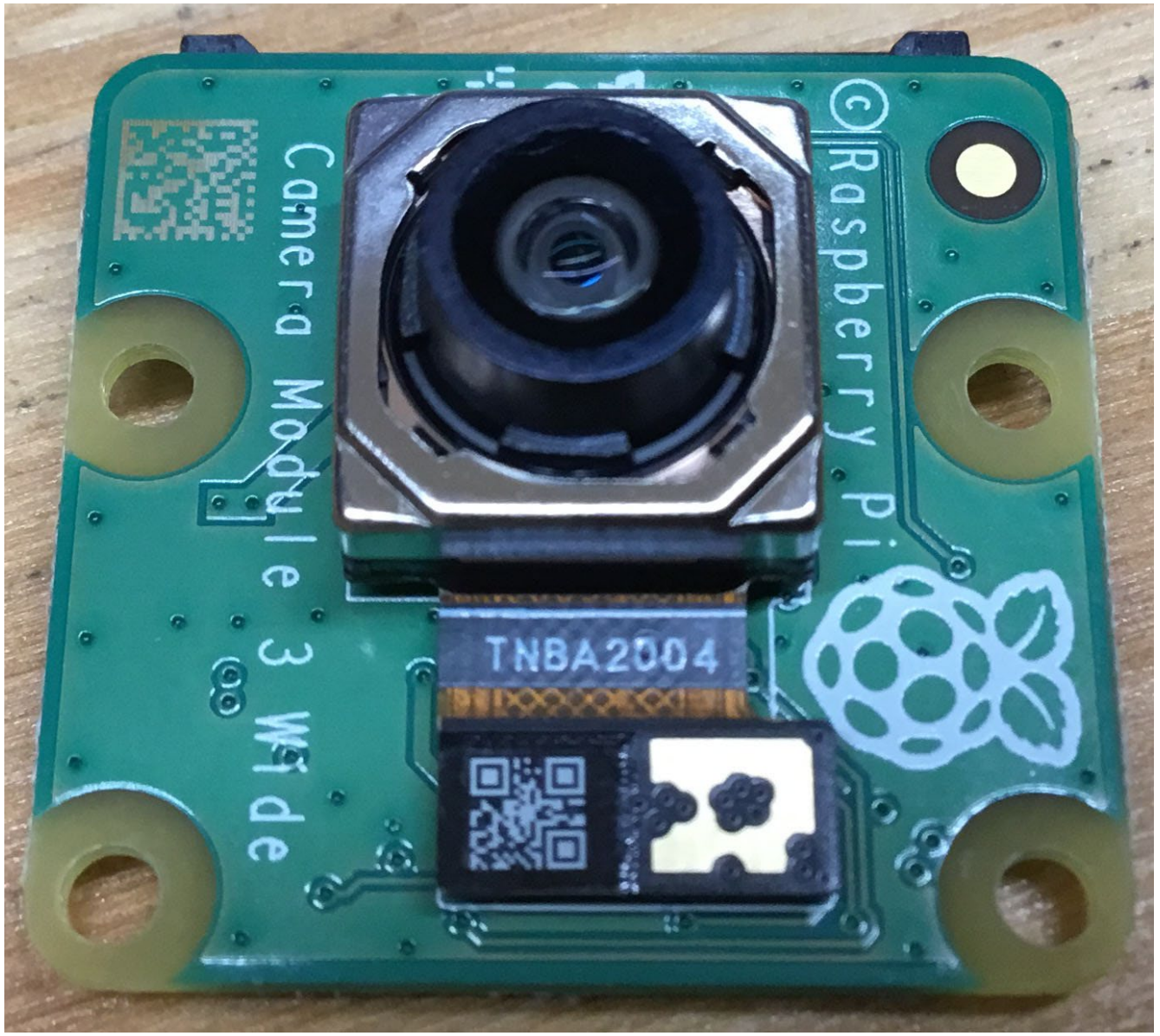
- **Raspberry Pi 5 Camera Basics**
- **Object Detection Using Raspberry Pi 5 Cameras**



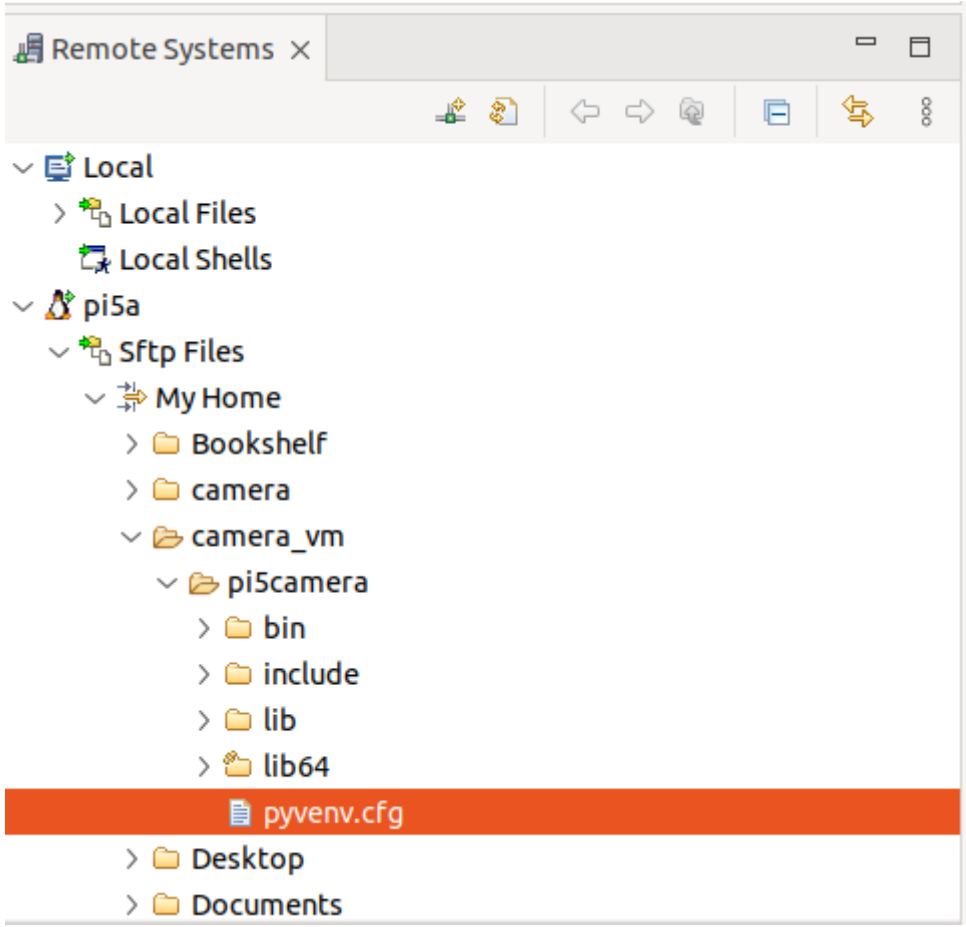
Raspberry Pi 5 Twin-Camera System



Raspberry Pi 5 Camera Module 3 Wide



Create a Camera Virtual Environment



pyvenv.cfg

```
1 home = /usr/bin
2 include-system-site-packages = false
3 version = 3.11.2
4 executable = /usr/bin/python3.11
5 command = /usr/bin/python3 -m venv /home/pi5user/camera_vm/pi5camera
```

pi5user@pi5a: ~/camera_vm/pi5camera

File Edit Tabs Help

```
pi5user@pi5a:~ $ mkdir camera_vm
pi5user@pi5a:~ $ cd camera_vm
pi5user@pi5a:~/camera_vm $ python3 -m venv pi5camera
pi5user@pi5a:~/camera_vm $ ls
pi5camera
pi5user@pi5a:~/camera_vm $ cd pi5camera
pi5user@pi5a:~/camera_vm/pi5camera $ ls
bin  include  lib  lib64  pyvenv.cfg
pi5user@pi5a:~/camera_vm/pi5camera $ cat pyvenv.cfg
home = /usr/bin
include-system-site-packages = true
version = 3.11.2
executable = /usr/bin/python3.11
command = /usr/bin/python3 -m venv /home/pi5user/camera_vm/pi5camera
pi5user@pi5a:~/camera_vm/pi5camera $ source ./bin/activate
(pi5camera) pi5user@pi5a:~/camera_vm/pi5camera $
```

Create a Camera Virtual Environment

```
pi5user@pi5a: ~/camera_vm/pi5camera
File  Edit  Tabs  Help
pi5user@pi5a:~ $ cd camera_vm
pi5user@pi5a:~/camera_vm $ cd pi5camera
pi5user@pi5a:~/camera_vm/pi5camera $ source ./bin/activate
(pi5camera) pi5user@pi5a:~/camera_vm/pi5camera $ sudo apt install libatlas-base-dev
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
libatlas-base-dev is already the newest version (3.10.3-13).
0 upgraded, 0 newly installed, 0 to remove and 54 not upgraded.
(pi5camera) pi5user@pi5a:~/camera_vm/pi5camera $ pip install tflite-runtime
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting tflite-runtime
  Using cached tflite_runtime-2.14.0-cp311-cp311-manylinux_2_34_aarch64.whl (2.3 MB)
Requirement already satisfied: numpy>=1.23.2 in /usr/lib/python3/dist-packages (from
tflite-runtime) (1.24.2)
Installing collected packages: tflite-runtime
Successfully installed tflite-runtime-2.14.0
(pi5camera) pi5user@pi5a:~/camera_vm/pi5camera $ pip install opencv-python
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting opencv-python
  Using cached opencv_python-4.9.0.80-cp37-abi3-manylinux_2_17_aarch64.manylinux2014_
aarch64.whl (41.3 MB)
Requirement already satisfied: numpy>=1.21.2 in /usr/lib/python3/dist-packages (from
opencv-python) (1.24.2)
Installing collected packages: opencv-python
Successfully installed opencv-python-4.9.0.80
(pi5camera) pi5user@pi5a:~/camera_vm/pi5camera $ pip install pillow
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Requirement already satisfied: pillow in /usr/lib/python3/dist-packages (9.4.0)
(pi5camera) pi5user@pi5a:~/camera_vm/pi5camera $ pip install numpy
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Requirement already satisfied: numpy in /usr/lib/python3/dist-packages (1.24.2)
(pi5camera) pi5user@pi5a:~/camera_vm/pi5camera $
```

Create a Camera Virtual Environment

https://github.com/raspberrypi/picamera2/tree/main/examples/tensorflow

Product Solutions Open Source Pricing

raspberrypi / picamera2 Public

Code Issues 128 Pull requests 5 Discussions Actions Projects

Files

main

Go to file

- .github
- apps
- examples
- tensorflow
  - images
  - coco_labels.txt
  - colours.txt
  - compositing.py
  - deeplab_labels.txt
  - deeplabv3.tflite
  - mobilenet_v2.tflite

picamera2 / examples / tensorflow /

chrisruk and davidplowman Formatting changes and ma

Name
..
images
coco_labels.txt
colours.txt
compositing.py
deeplab_labels.txt
deeplabv3.tflite
mobilenet_v2.tflite

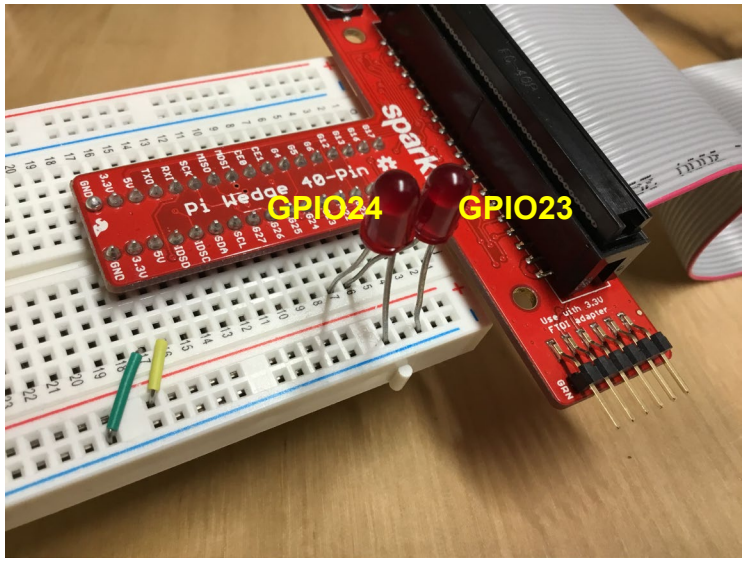
pi5user@pi5a: ~/camera_vm/pi5camera

File Edit Tabs Help

```
pi5user@pi5a:~ $ cd camera_vm
pi5user@pi5a:~/camera_vm $ cd pi5camera
pi5user@pi5a:~/camera_vm/pi5camera $ ls -l
total 6052
drwxr-xr-x 2 pi5user pi5user    4096 Feb  3 13:57 bin
-rw-r--r-- 1 pi5user pi5user     930 Jan  7 12:14 coco_labels.txt
drwxr-xr-x 3 pi5user pi5user    4096 Feb  3 13:57 include
drwxr-xr-x 3 pi5user pi5user    4096 Feb  3 13:57 lib
lrwxrwxrwx 1 pi5user pi5user       3 Feb  3 13:57 lib64 -> lib
-rw-r--r-- 1 pi5user pi5user 6175296 Jan  7 12:15 mobilenet_v2.tflite
-rw-r--r-- 1 pi5user pi5user     171 Feb  3 14:09 pyvenv.cfg
pi5user@pi5a:~/camera_vm/pi5camera $
```

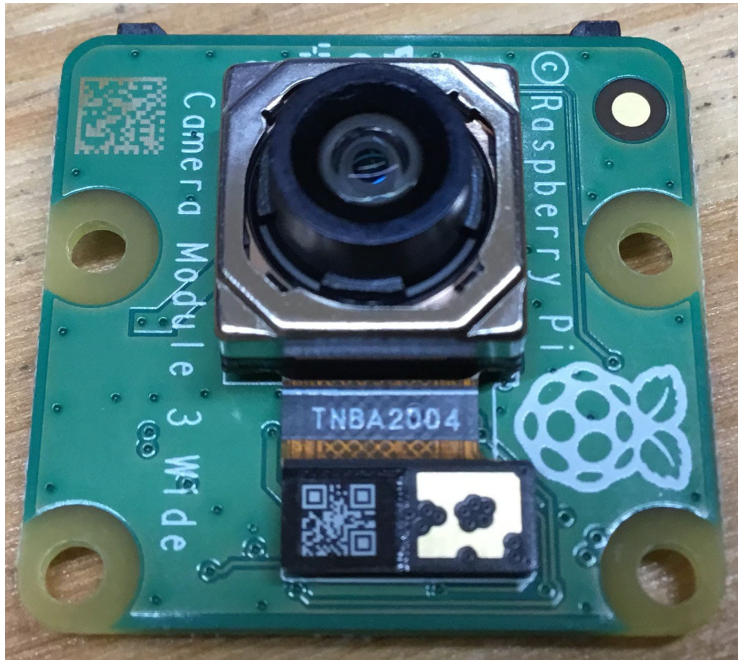
camera_detect.py – Configure Pi 5 Camera Output Pins

```
# start FE modification
import gpiod
DETECT8_PIN = 23 # camera0 output pin -> STM32F401RE GPIOB PIN 8
DETECT9_PIN = 24 # camera1 output pin -> STM32F401RE GPIOB PIN 9


chip = gpiod.Chip('gpiochip4')


detect8_out = chip.get_line(DETECT8_PIN)
detect8_out.request(consumer="detect8",type=gpiod.LINE_REQ_DIR_OUT)


detect9_out = chip.get_line(DETECT9_PIN)
detect9_out.request(consumer="detect9",type=gpiod.LINE_REQ_DIR_OUT)
# end FE modification
```



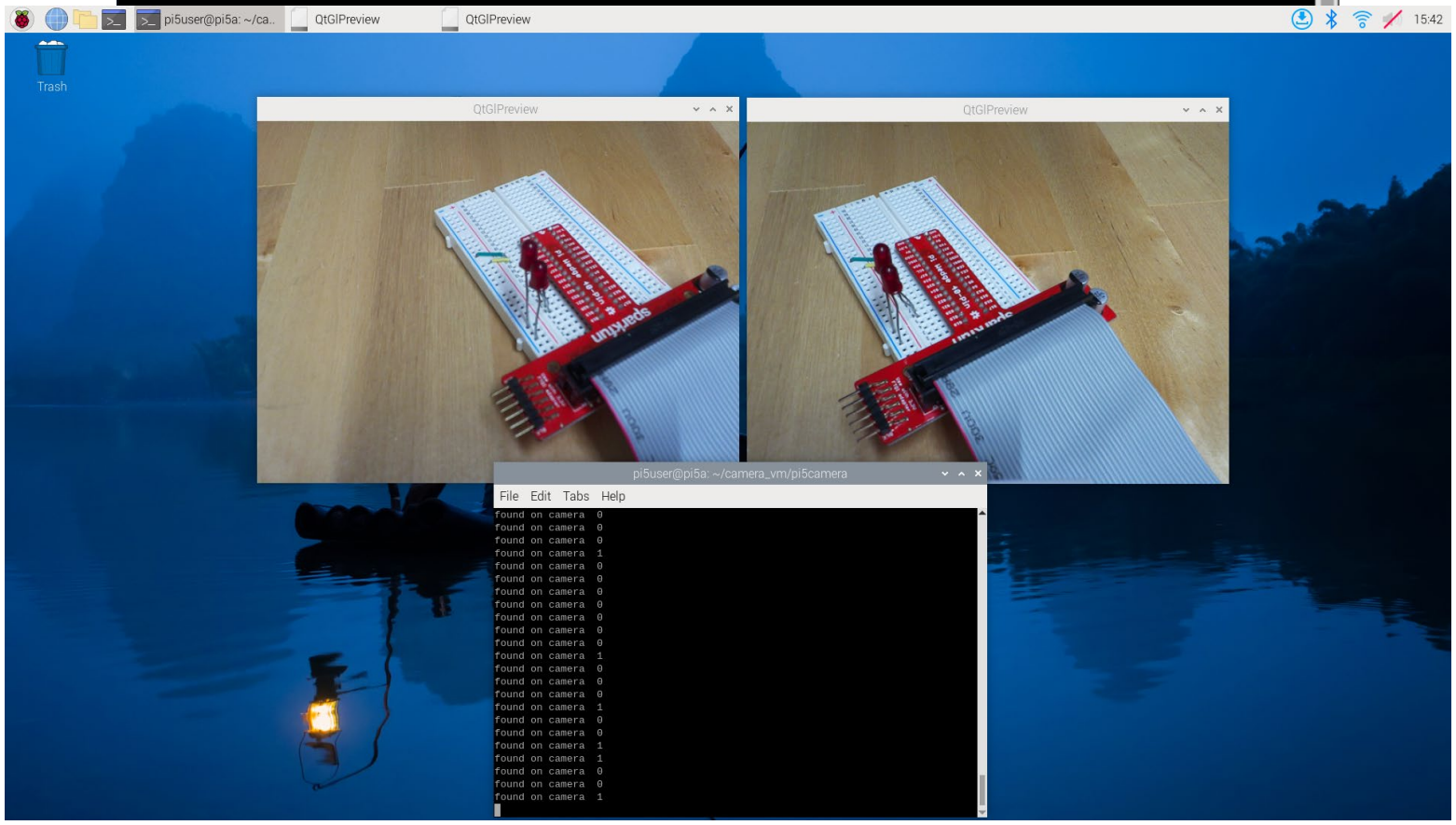
camera_detect.py – Configure Pi 5 Camera Output Pins

```
while True:
# start FE modification
buffer = picam0.capture_buffer("lores")
grey = buffer[:stride * lowresSize[1]].reshape((lowresSize[1], stride))
camera0 = InferenceTensorFlow(grey, args.model, output_file,0, label_file)

buffer = picam1.capture_buffer("lores")
grey = buffer[:stride * lowresSize[1]].reshape((lowresSize[1], stride))
camera1 = InferenceTensorFlow(grey, args.model, output_file,1, label_file)

detect8_out.set_value(camera0)
detect9_out.set_value(camera1)
# end FE modification
```

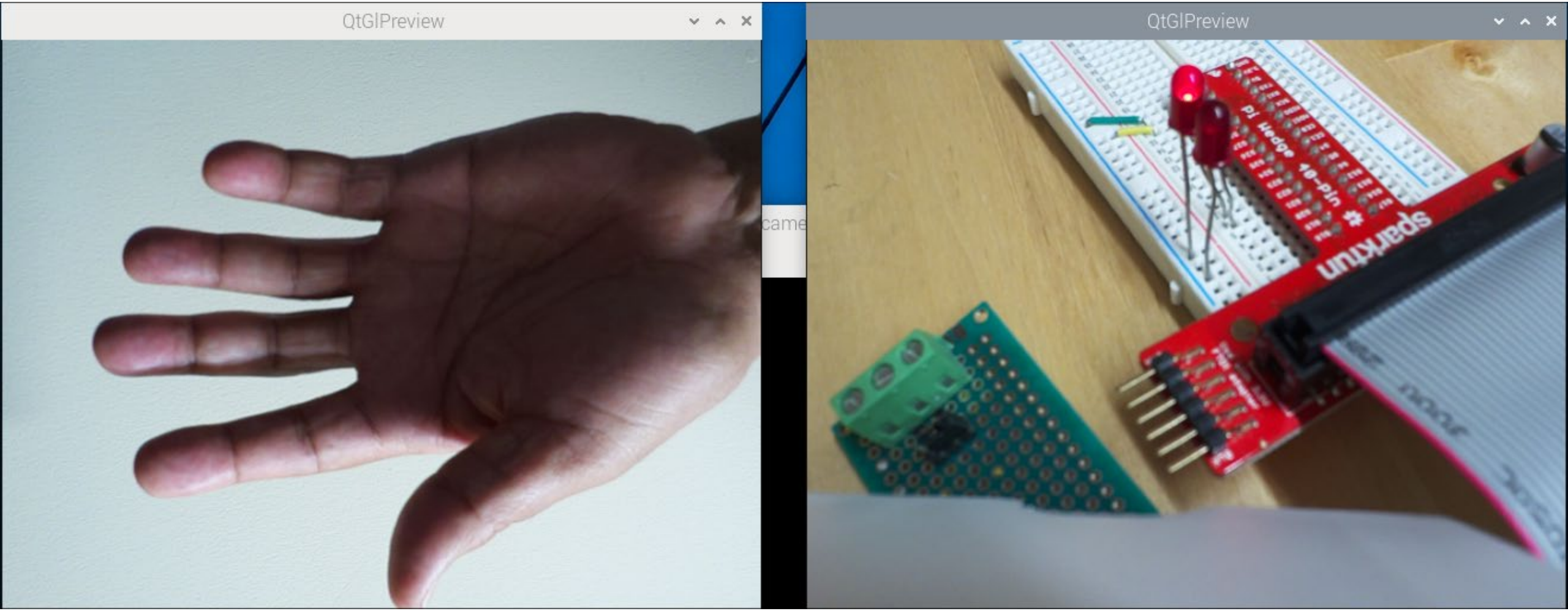


Run camera_detect.py – sense = "person"

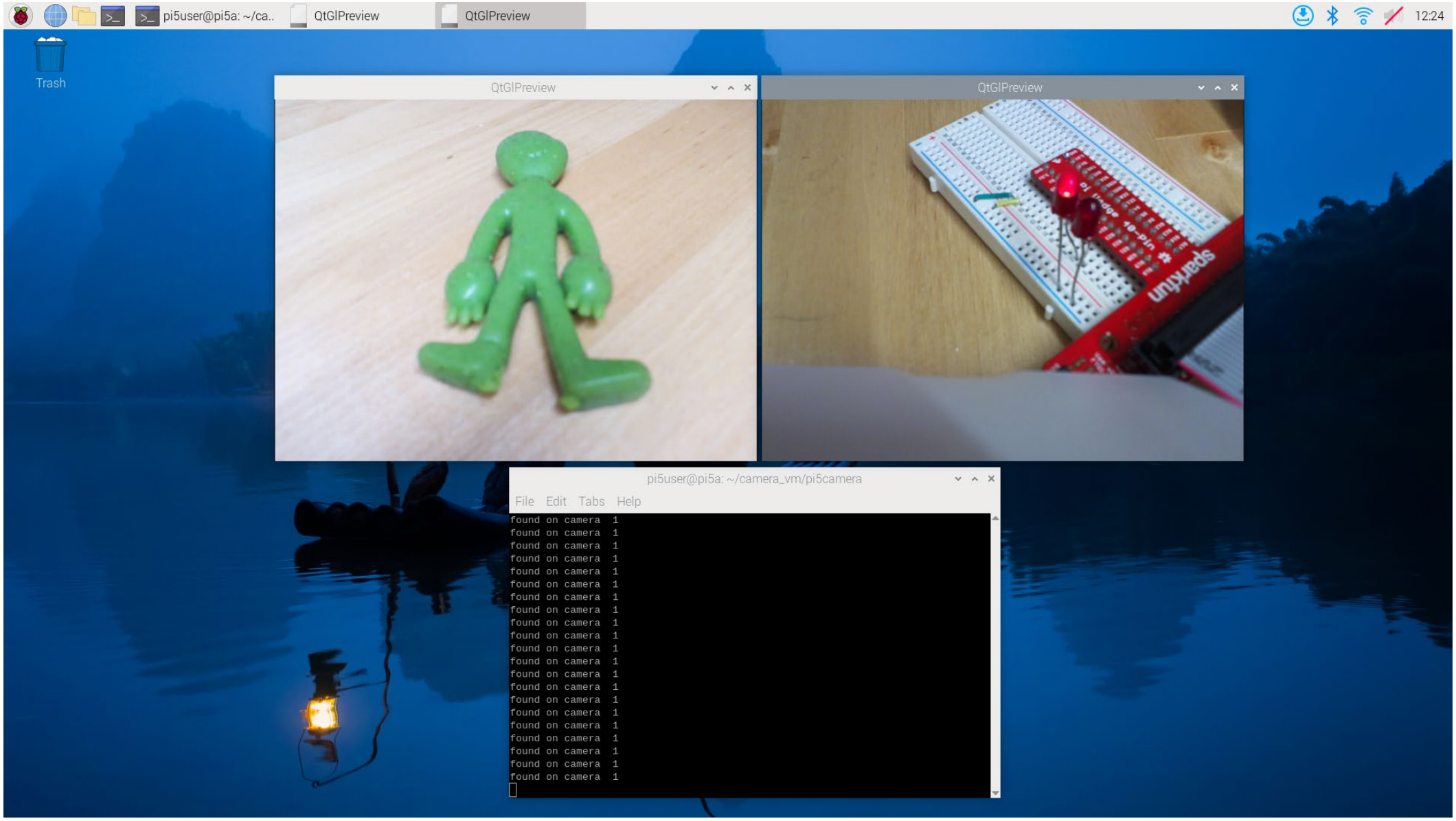
```
pi5user@pi5a: ~/camera_vm/pi5camera
File  Edit  Tabs  Help
pi5user@pi5a:~ $ cd camera_vm
pi5user@pi5a:~/camera_vm $ cd pi5camera
pi5user@pi5a:~/camera_vm/pi5camera $ source ./bin/activate
(pi5camera) pi5user@pi5a:~/camera_vm/pi5camera $ python3 camera_detect.py --mode
l mobilenet_v2.tflite --label coco_labels.txt
```



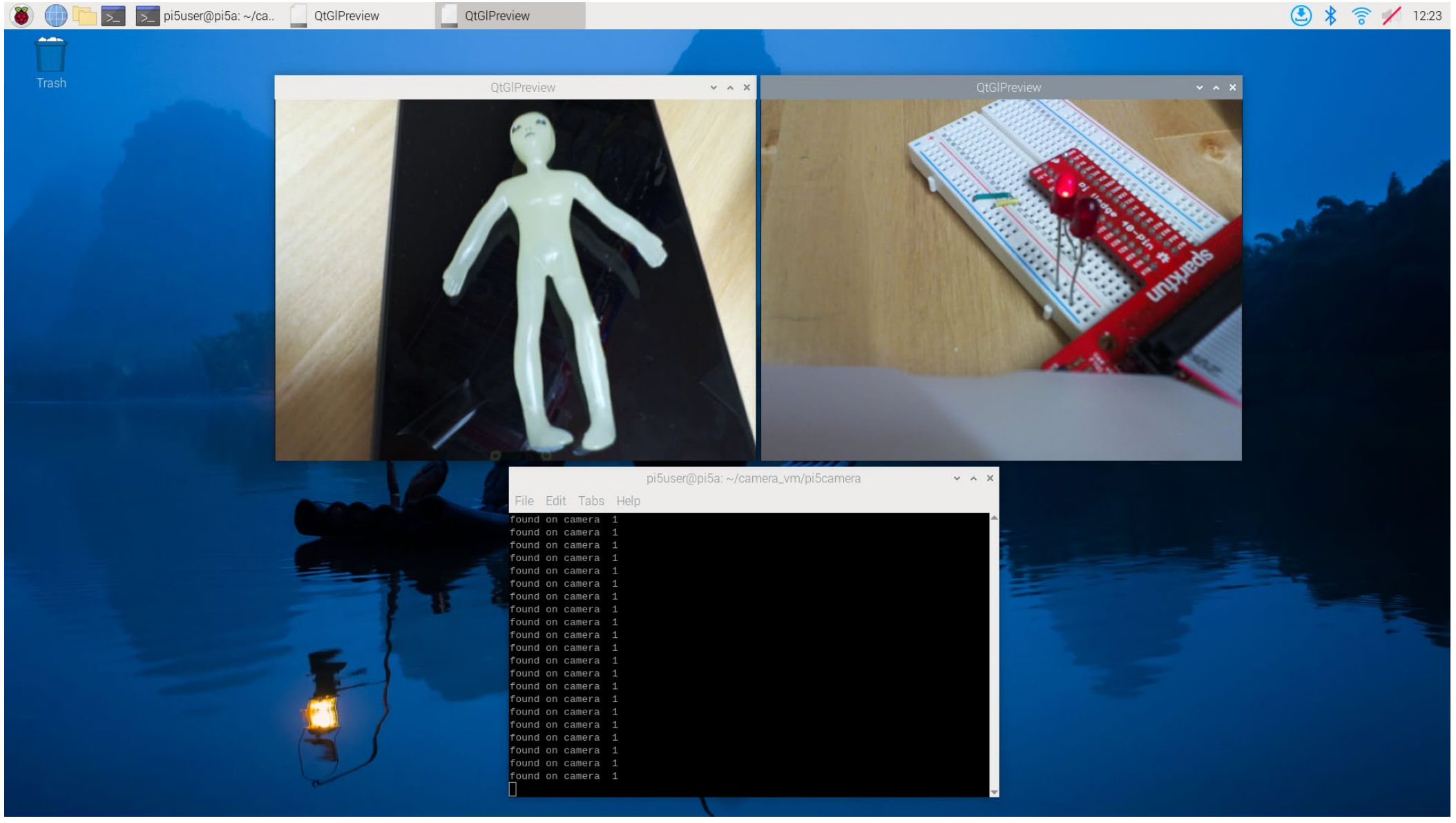
Run camera_detect.py – sense = "person"



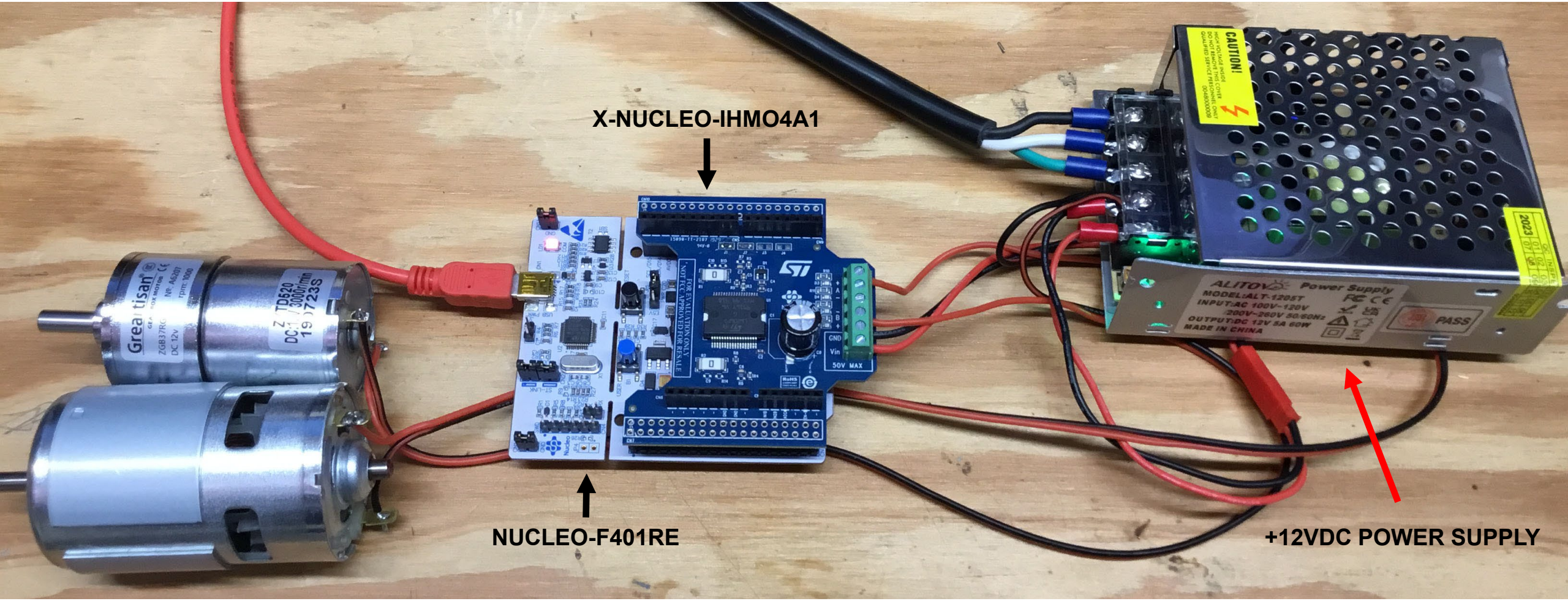
Run camera_detect.py – sense = "person"



Run camera_detect.py – sense = "person"

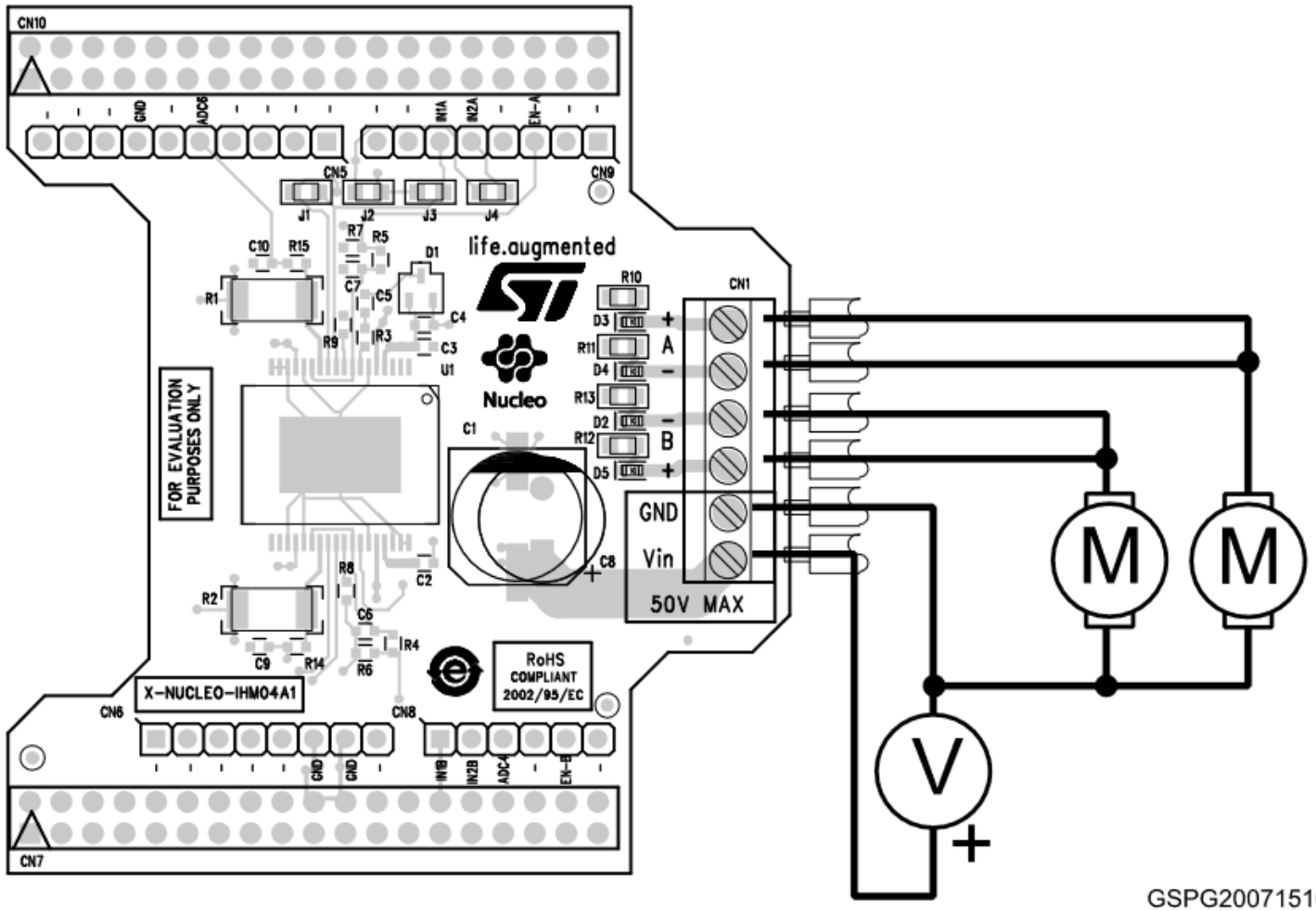


Driving Motors Using Object Detection



Driving Motors Using Object Detection

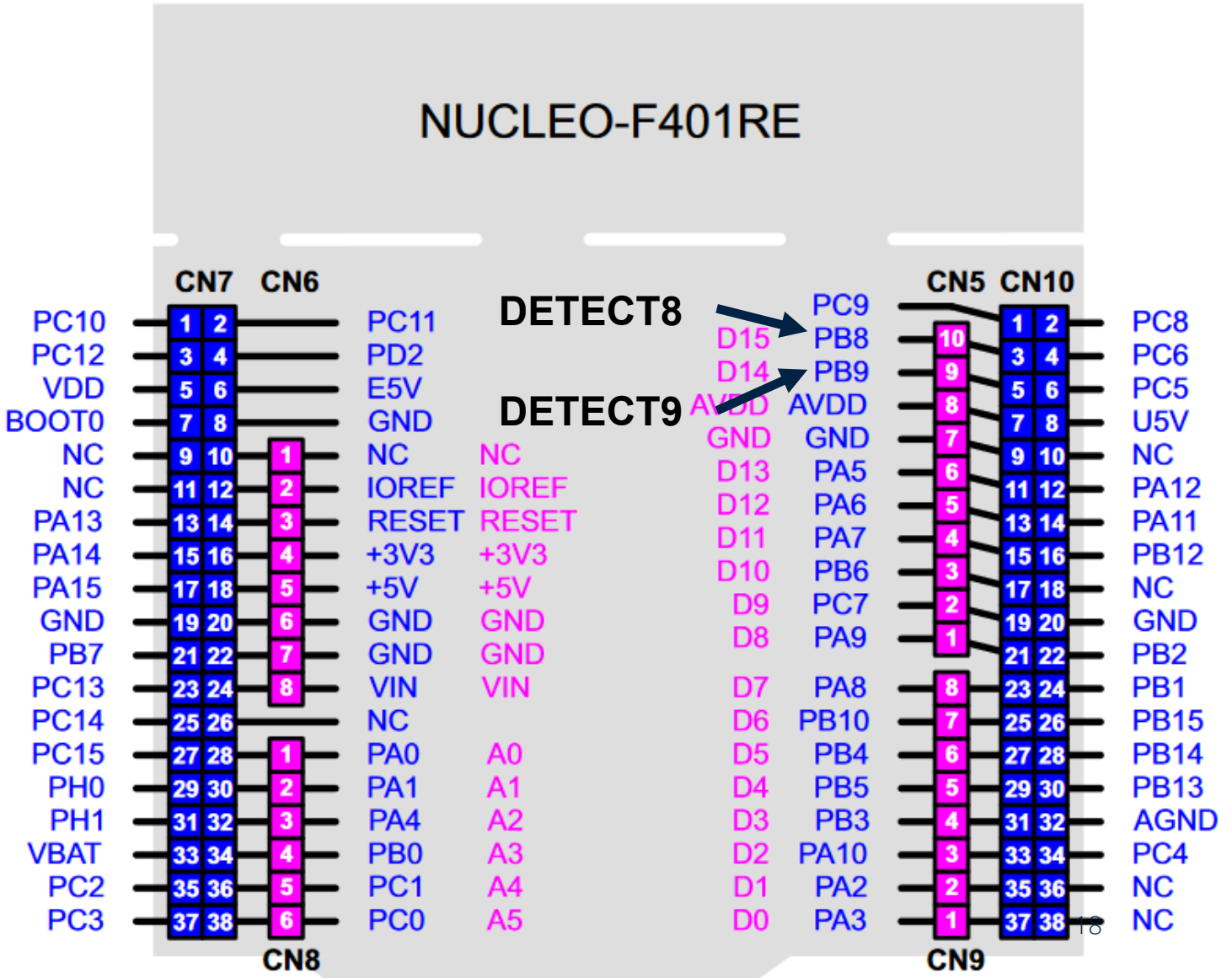
```
// start modification FE
 /* Select the configuration with bridge paralleling, 1 unidirectional motor on bridge A
    and one unidirectional motor on bridge B */
 BSP_MotorControl_SetDualFullBridgeConfig(PARALLELING_IN1A_IN2A__IN1B_IN2B__1_UNDIR_MOTOR_BRIDGE_A__1_UNDIR_MOTOR_BRIDGE_B);
 // end modification FE
```



GSPG2007151035SG

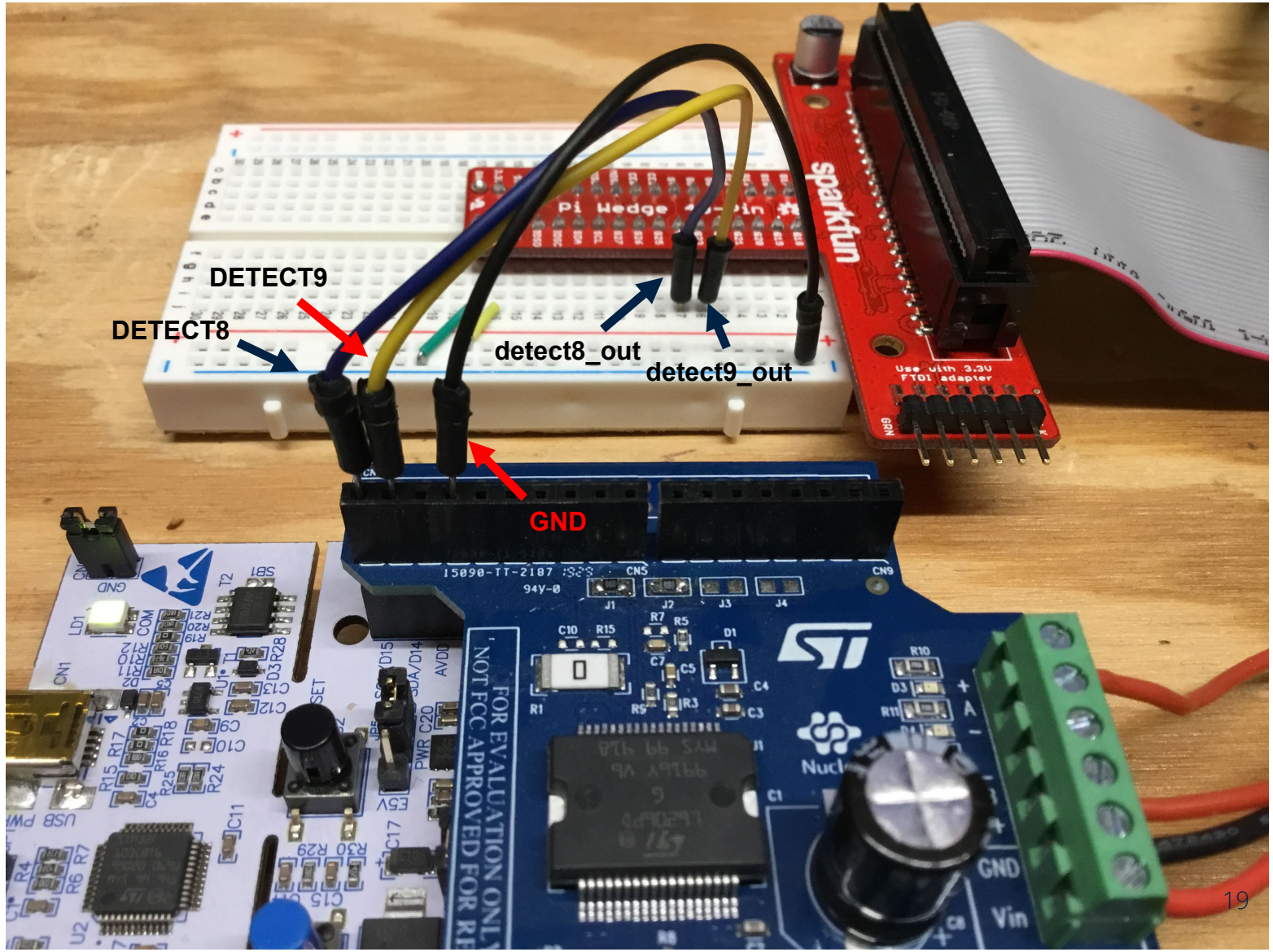
Driving Motors Using Object Detection

```
void L6206_Board_GpioInit(void)
{
   GPIO_InitTypeDef GPIO_InitStruct;

  /* GPIO Ports Clock Enable */
  __GPIOC_CLK_ENABLE();
  __GPIOA_CLK_ENABLE();
  __GPIOB_CLK_ENABLE();

  // begin modification FE
  /*Configure GPIO pins : PB8 PB9 */
  GPIO_InitStruct.Pin = DETECT8|DETECT9;
  GPIO_InitStruct.Mode = GPIO_MODE_INPUT;
  GPIO_InitStruct.Pull = GPIO_NOPULL;
  HAL_GPIO_Init(GPIOB, &GPIO_InitStruct);
  // end modification FE
```



Driving Motors Using Object Detection

```
// start modification FE
 /* Infinite loop */
 while(1)
 {
   detect8val = HAL_GPIO_ReadPin(GPIOB,DETECT8);
   detect9val = HAL_GPIO_ReadPin(GPIOB,DETECT9);

   switch (detect8val)
    {
       case 0:
           BSP_MotorControl_HardStop(0);
       break;
       case 1:
           BSP_MotorControl_SetMaxSpeed(0,10);
           BSP_MotorControl_Run(0, FORWARD);
       break;
    }

   switch (detect9val)
    {
       case 0:
           BSP_MotorControl_HardStop(1);
       break;
       case 1:
           BSP_MotorControl_SetMaxSpeed(1,50);
           BSP_MotorControl_Run(1, FORWARD);
       break;
    }
 }
```



Next Time…

MORE TO COME..

Thank you for attending!!!

Please consider the resources below:

- Today's Download Package
- raspberrypi.org – Raspberry Pi 5
- NUCLEO-F401RE – st.com
- X-NUCLEO-IHM04A1 – st.com

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