Wi-Fi Settings

SSID: AcroboticGuest

Password: 13meetup37

Class: Intro to IoT with Raspberry Pi!

http://makerden.io

November 23, 2015

Cisco ‘MakerBro’ Zabala

About Makerden

We're an Educational Makerspace where we combine the necessary tools, equipment, and instruction for hands-on learning through building things.

Members of our group vary both widely and wildly in terms of skill level and age range (10 to 68).

About Makerden

Events organized at our Educational Makerspace:

[DIY] These events include show-and-tells by our members followed by a work-on-your-project(s) and ask-for-help sessions.

[Workshop] An instructor leads a hands-on workshop for learning or polishing a practical skill useful for Makers (including schematic-drawing, PCB design, 3D-Printing, soldering).

[Class] An instructor leads a formal lecture featuring instructor-led activities that allow participants to learn, develop, or refine a technical skill.

About ACROBOTIC

Makerden's Educational Electronics partner

Small, bootstrapped Open-Source electronics startup dedicated to the design of hardware and software products for use in education, DIY, hobby, arts, science, and more!

- Online store: **https://acrobotic.com**
- Develops online tutorials: **http://learn.acrobotic.com**
- Supplies all the electronic components for this class!
- Helps Makerden members take their ideas from concept to implementation

Downloading this presentation

MakerdenIO/Intro_IoT_RPi

GitHub, Inc. [US] https://github.com/MakerdenIO/Intro_IoT_RPi

MakerdenIO / Intro_IoT_RPi

Unwatch 3 | Star 1 | Fork 0

Navigate to:

https://github.com/makerdenio/Intro_IoT_RPi

Code, wiring diagrams, and presentation slides for an IoT Wireless Alarm System using a Raspberry Pi. Edit

16 commits | 1 branch | 0 releases | 1 contributor

Branch: master ▾ Intro_IoT_RPi / +

themakerbro re-adding .key presentation file — Latest commit 8acf8b1 22 days ago

activity_01	done	2 months ago
activity_02	done	2 months ago
activity_03a	updating	a month ago
activity_03b	updating	a month ago
activity_04	adding activities 3 and 4	2 months ago
activity_05	activities completed	2 months ago
activity_06	activities completed	2 months ago
activity_07	activities completed	2 months ago
activity_08a	updating	a month ago
activity_08b	updating	a month ago
presentation	re-adding .key presentation file	22 days ago

Help people interested in this repository understand your project by adding a README. Add a README

Code
Issues 0
Pull requests 0
Wiki
Pulse
Graphs
Settings

HTTPS clone URL

https://github.com

You can clone with HTTPS, SSH, or Subversion.

Clone in Desktop

Download ZIP

Class outline

Duration: 4–5 hrs; Difficulty: Intermediate

Intro and Fundamental Concepts

Overview of IoT and Raspberry Pi

Project description

Setting Up the Hardware

Access to the GPIO with Python

Controlling an LED, motion sensor, and buzzer

Using Python to capture images from a USB camera

Configuring the Backend

Raspbian and system administration basics

Running a webserver using Python and Flask

Building an API with Flask for LED control

Building a User Interface (Frontend)

Building a User Interface (UI) with HTML, CSS, and JavaScript

Piecing Everything Together

Building a Wireless Alarm System

Future Enhancements (discussion)

Backend communication via WebSockets

Headless access to your Raspberry

PiRemote access to the system

Intro

Overview of IoT and Raspberry Pi

Project description

What is *the* Internet?

The Internet is a global system of interconnected computer networks that communicate with one another to link **billions** of devices worldwide.

Facebook's Map of World 'Friendship'

What devices are found on *the* Internet?

"interconnected computer networks…"

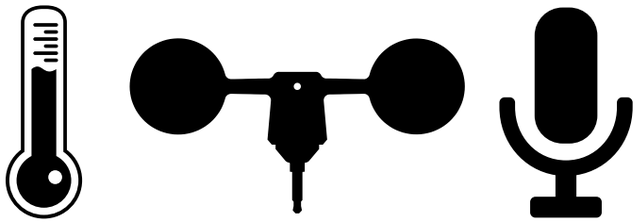
What is the goal *the* IoT?

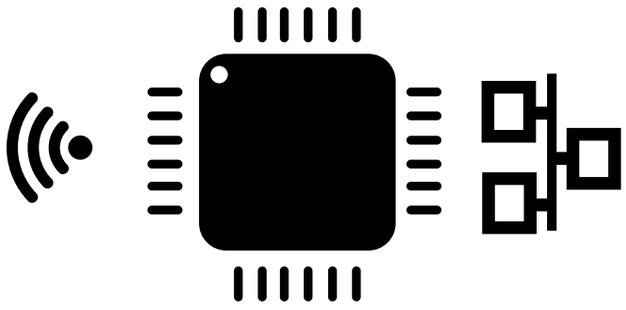
Extending the internet to include “everyday objects”.

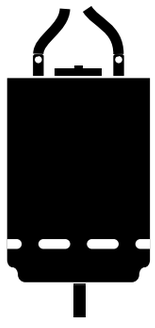
System Overview

Most IoT devices are comprised by 3 components:

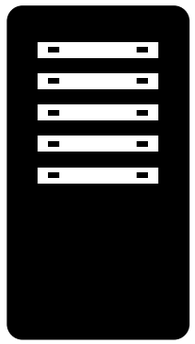
THING



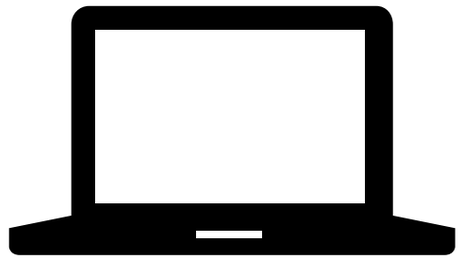


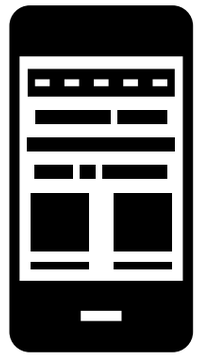


WEB



USER(S)





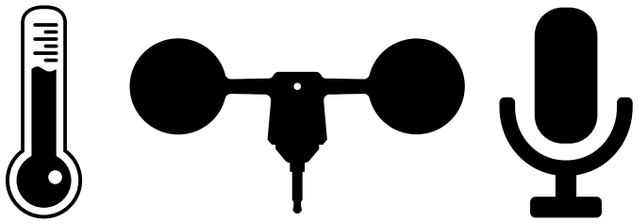
System Overview

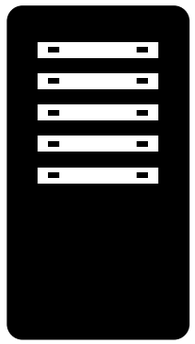
The Web component of an IoT system is comprised by a few sub-components:

THING

WEB

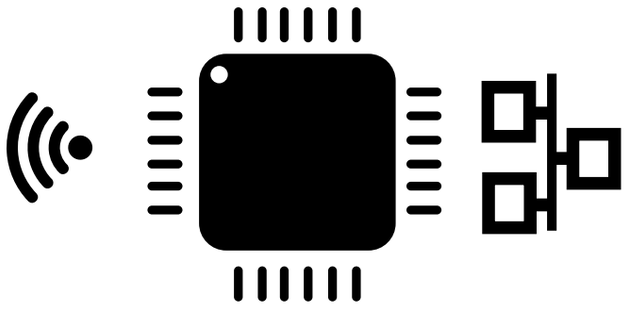
USER(S)



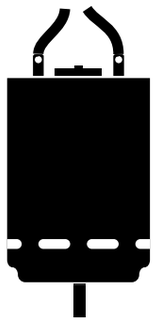


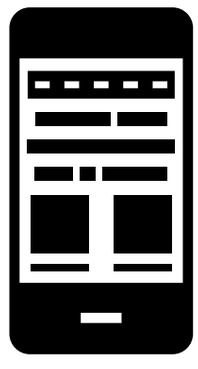
BACKEND
(API)

FRONTEND
(GUI)



DATABASE





Fundamental Concepts

Hardware prototyping

Linux basic usage

Electronic Fundamentals

How the solderless breadboard works:

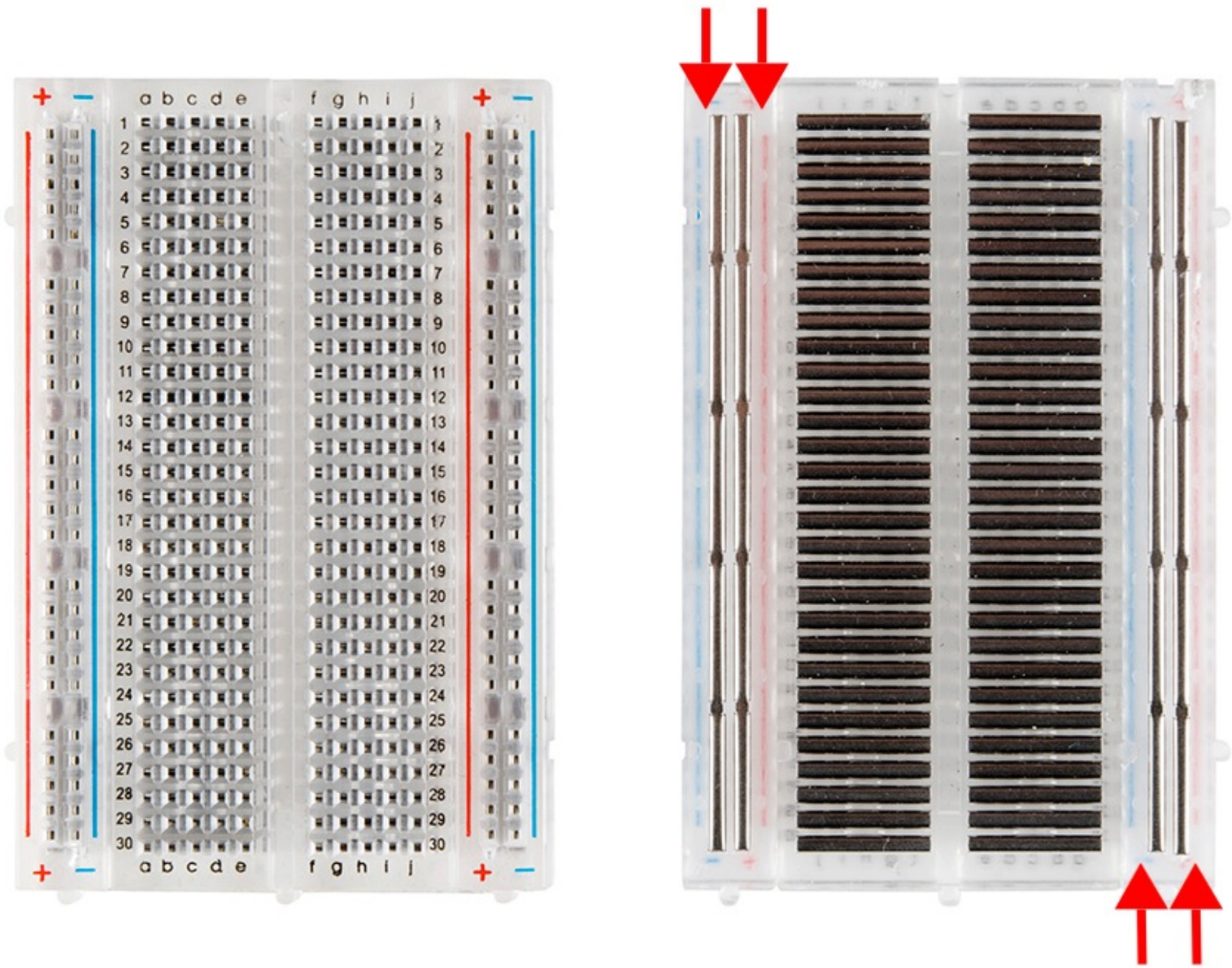


Photo credit: Sparkfun Electronics, Inc.

Electronic Fundamentals

Reading Resistor Codes:

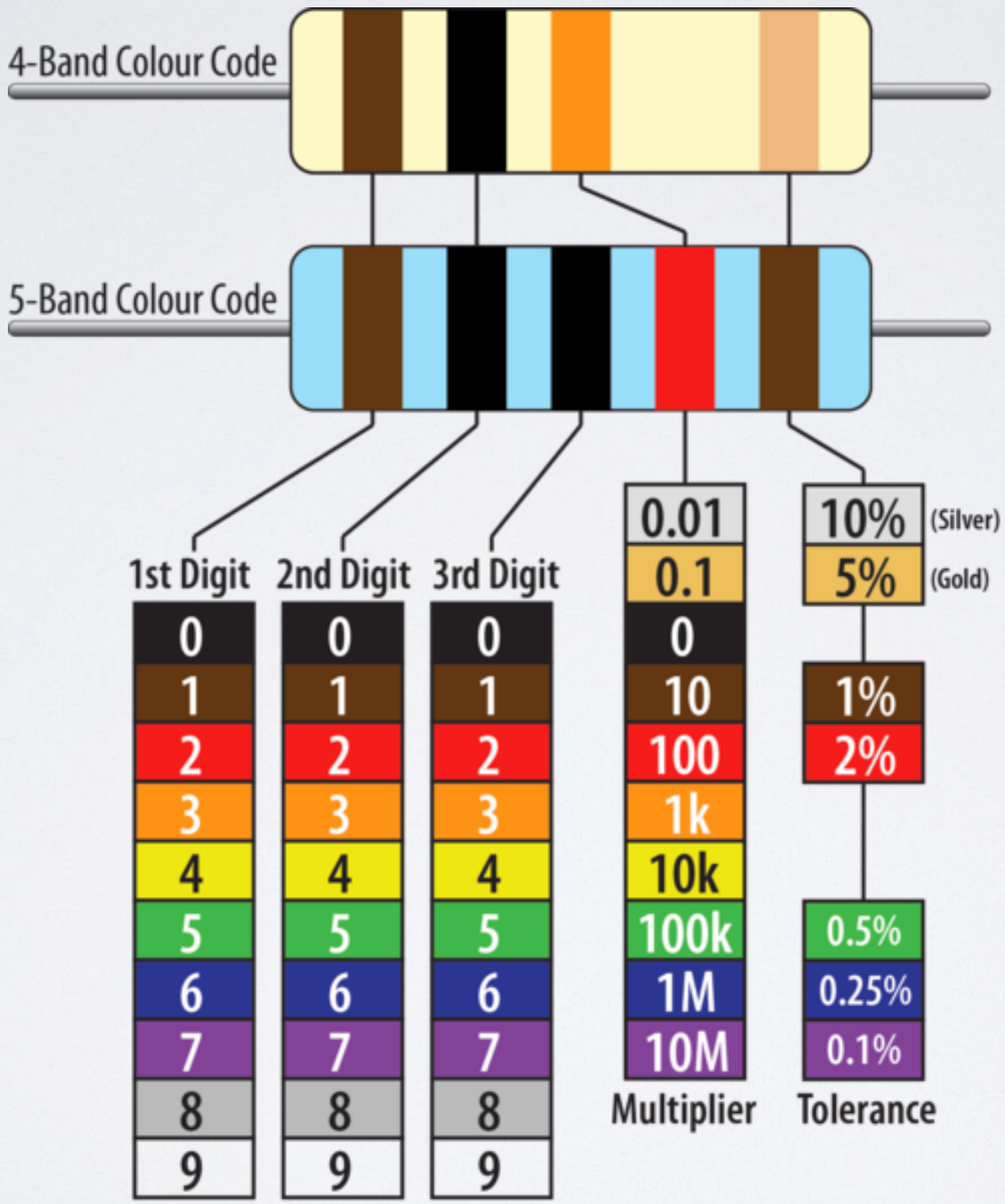
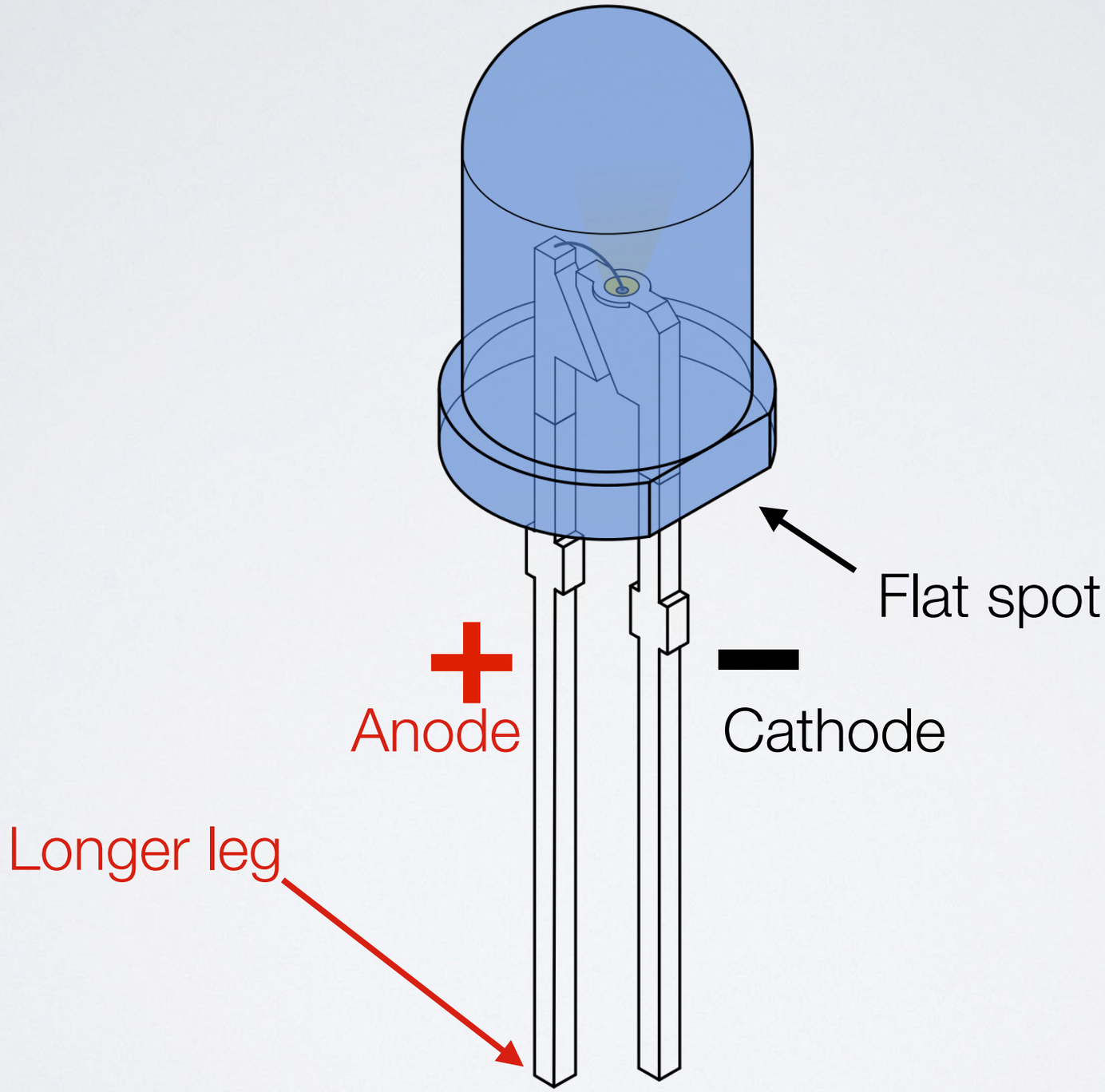


Photo credit: www.freetronics.com

Electronic Fundamentals

Reading LED polarity:



Raspberry Pi Fundamentals

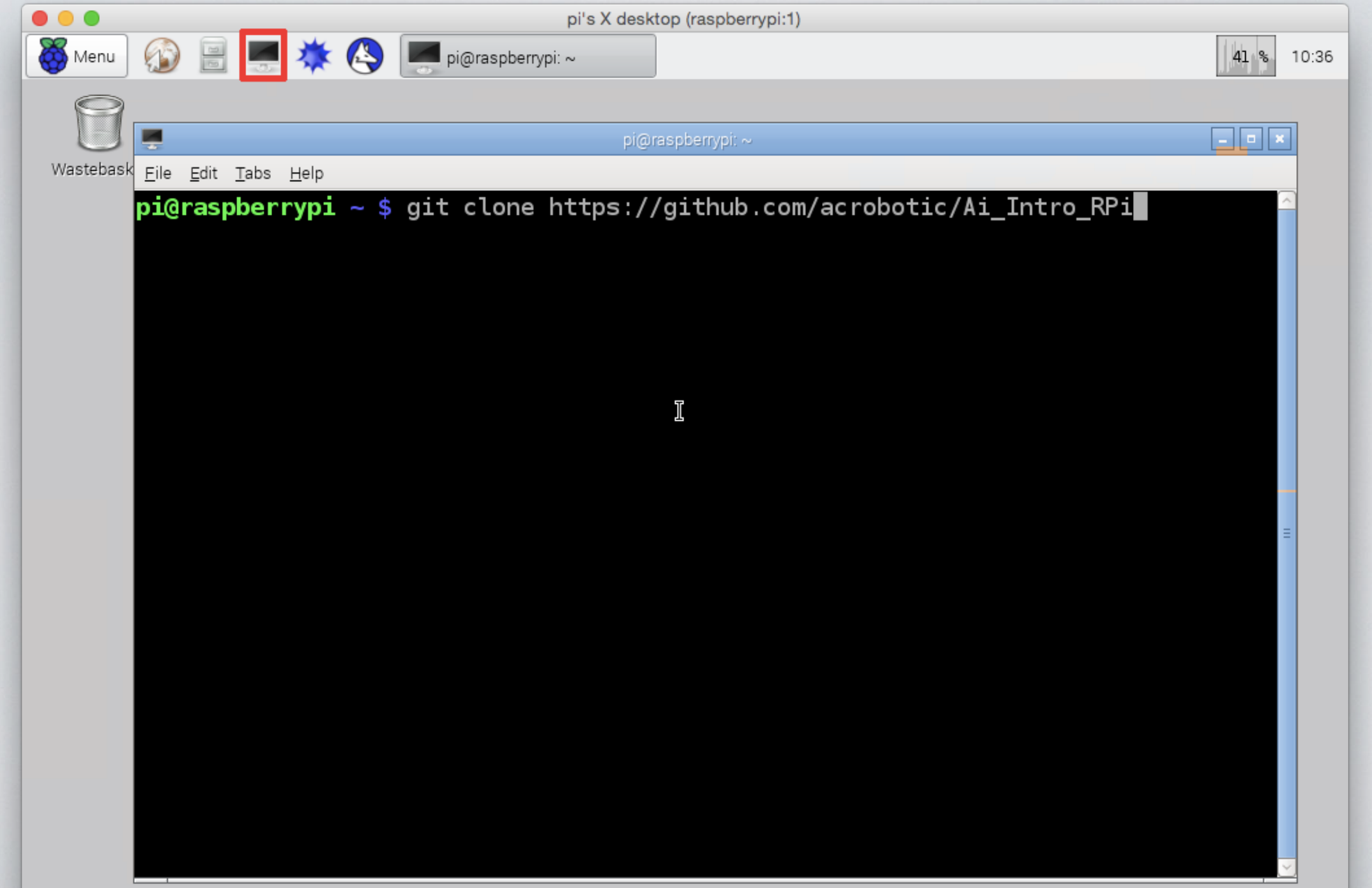
Getting Started with Raspberry Pi:

http://learn.acrobotic.com

https://www.youtube.com/watch?v=ZJU7mns3juc

Linux Fundamentals

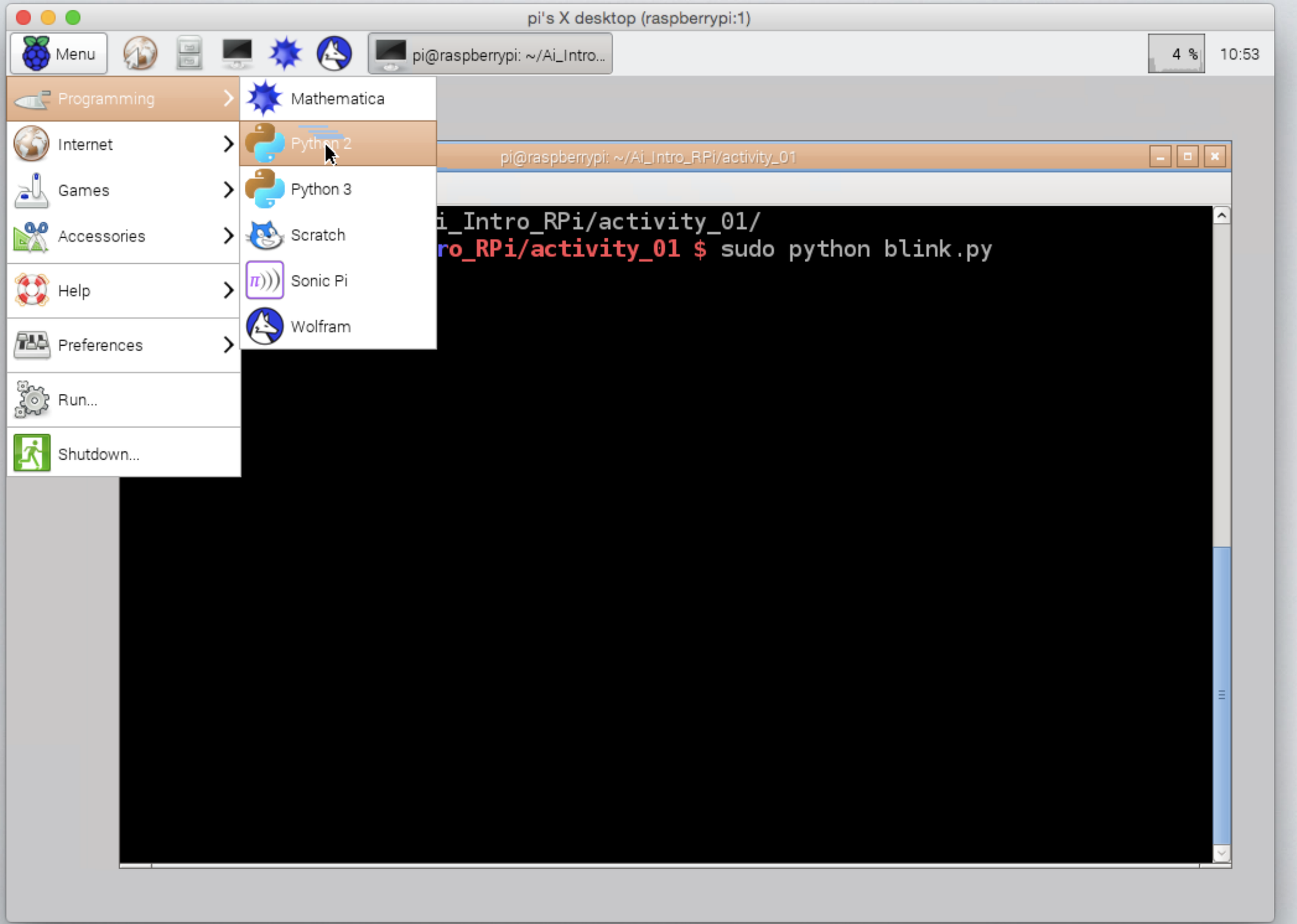
Accessing the Terminal and getting the activities code



git clone https://github.com/makerdenio/Intro_IoT_RPi

Linux Fundamentals

Opening scripts in Python's "Integrated DeveLopment Environment"



Setting Up the Hardware

Access to the GPIO with Python

Wiring an LED and motion sensor

Using Python to control a USB camera

Completing the Hardware Activities

Instructions for completing activities 1 through 4

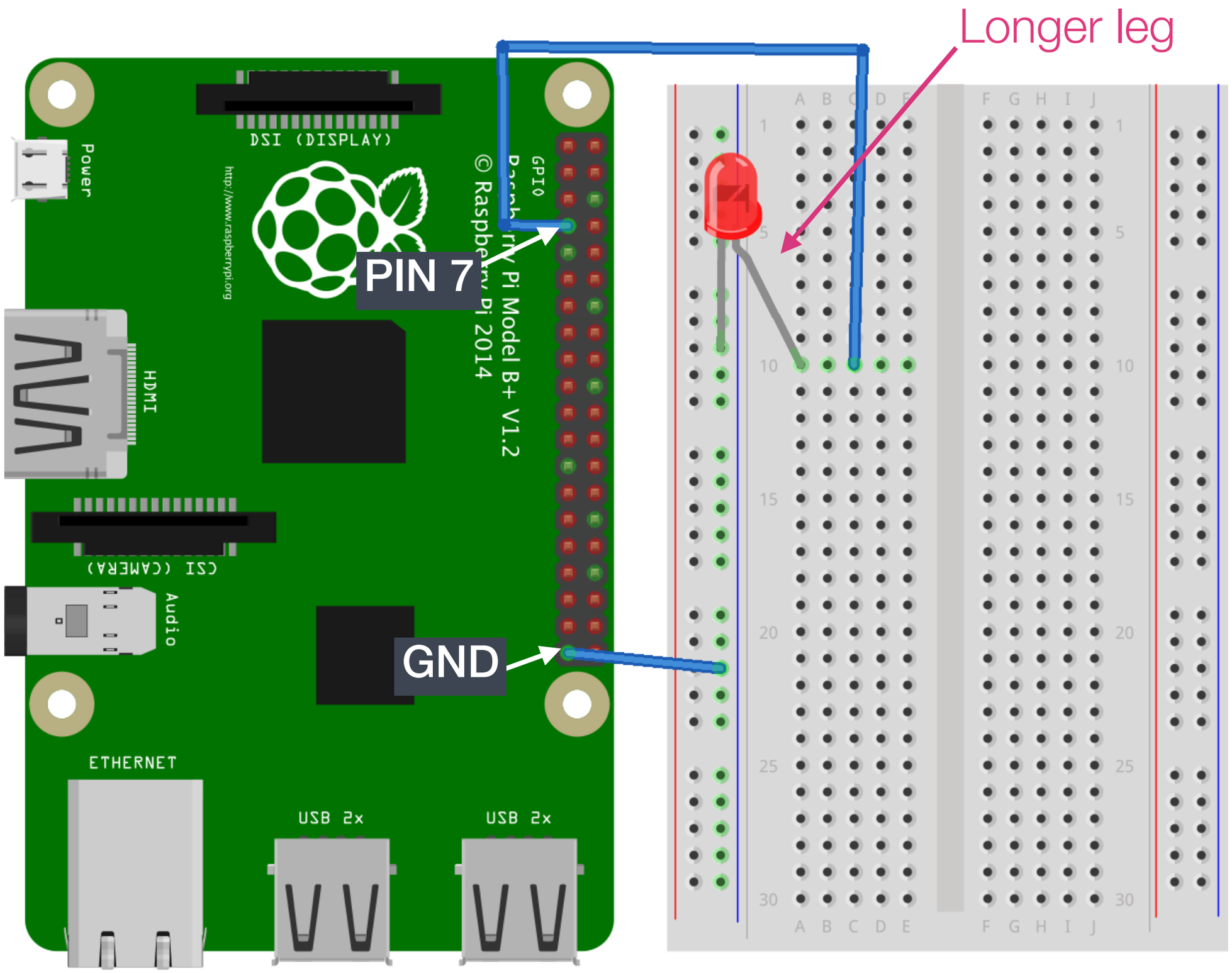
- Follow the diagram on the **Wiring** to connect components to the solderless breadboard

- Run the commands at the top of the **Programming** slide

- Compare the output you get with what's shown on the **Results** slide

Setting Up the Hardware

Activity 1: Blinking an LED [Wiring]

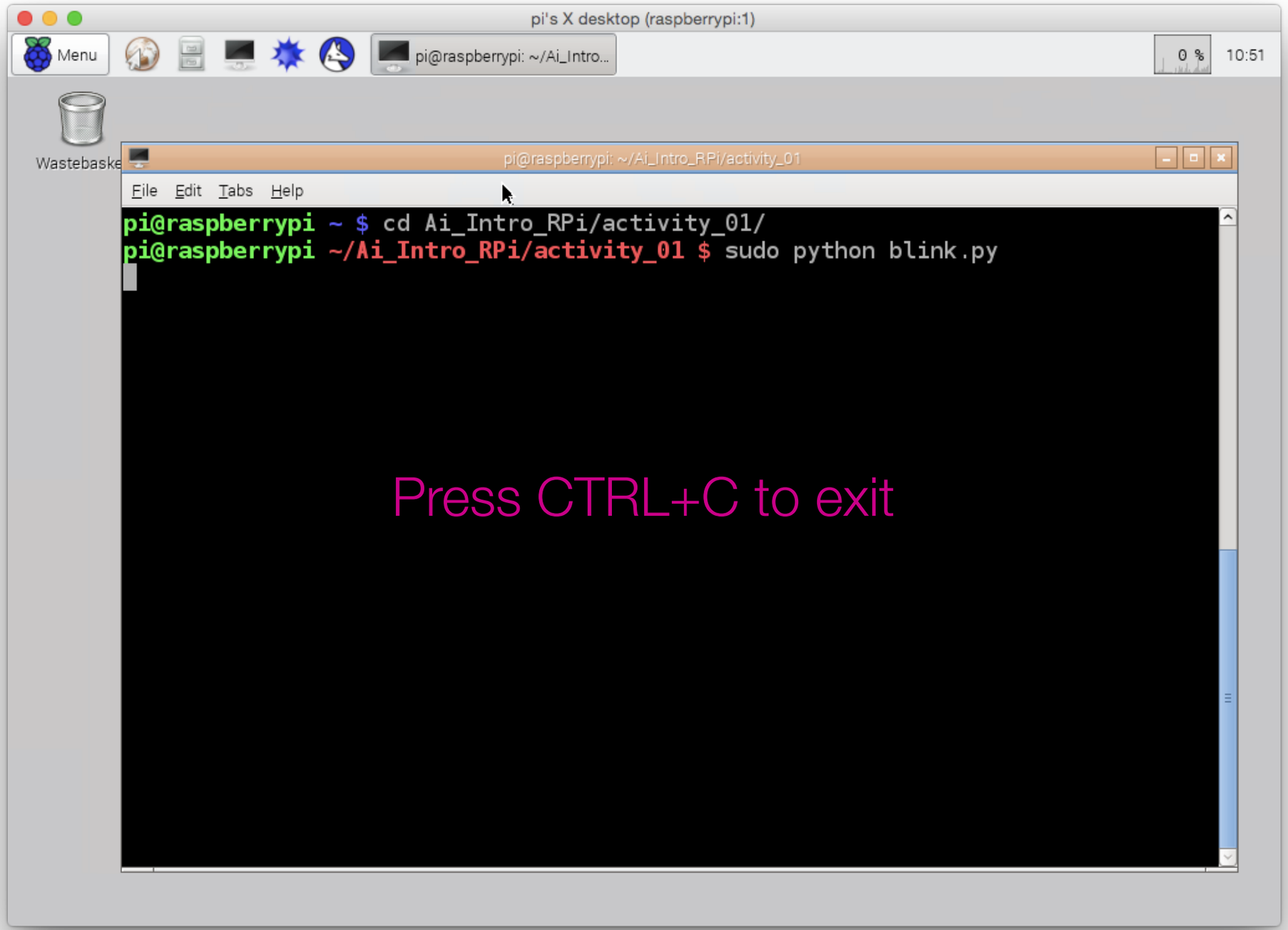


Setting Up the Hardware

Activity 1: Blinking an LED [Programming]

```
cd ~/Intro_IoT_RPi/activity_01
```

```
python blink.py
```

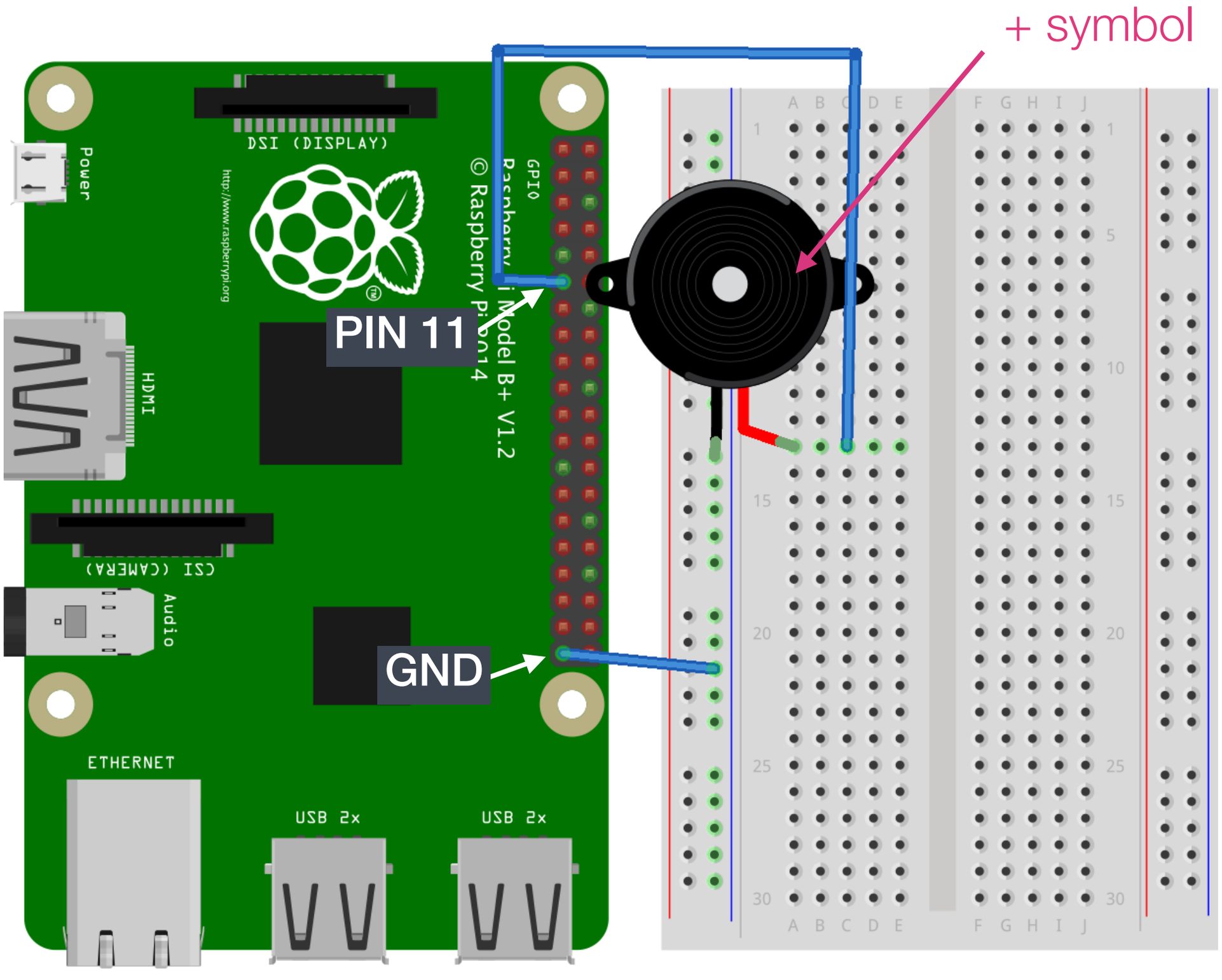


Setting Up the Hardware

Activity 1: Blinking an LED [Results]

Setting Up the Hardware

Activity 2: Generating sound with PWM [sound.py]

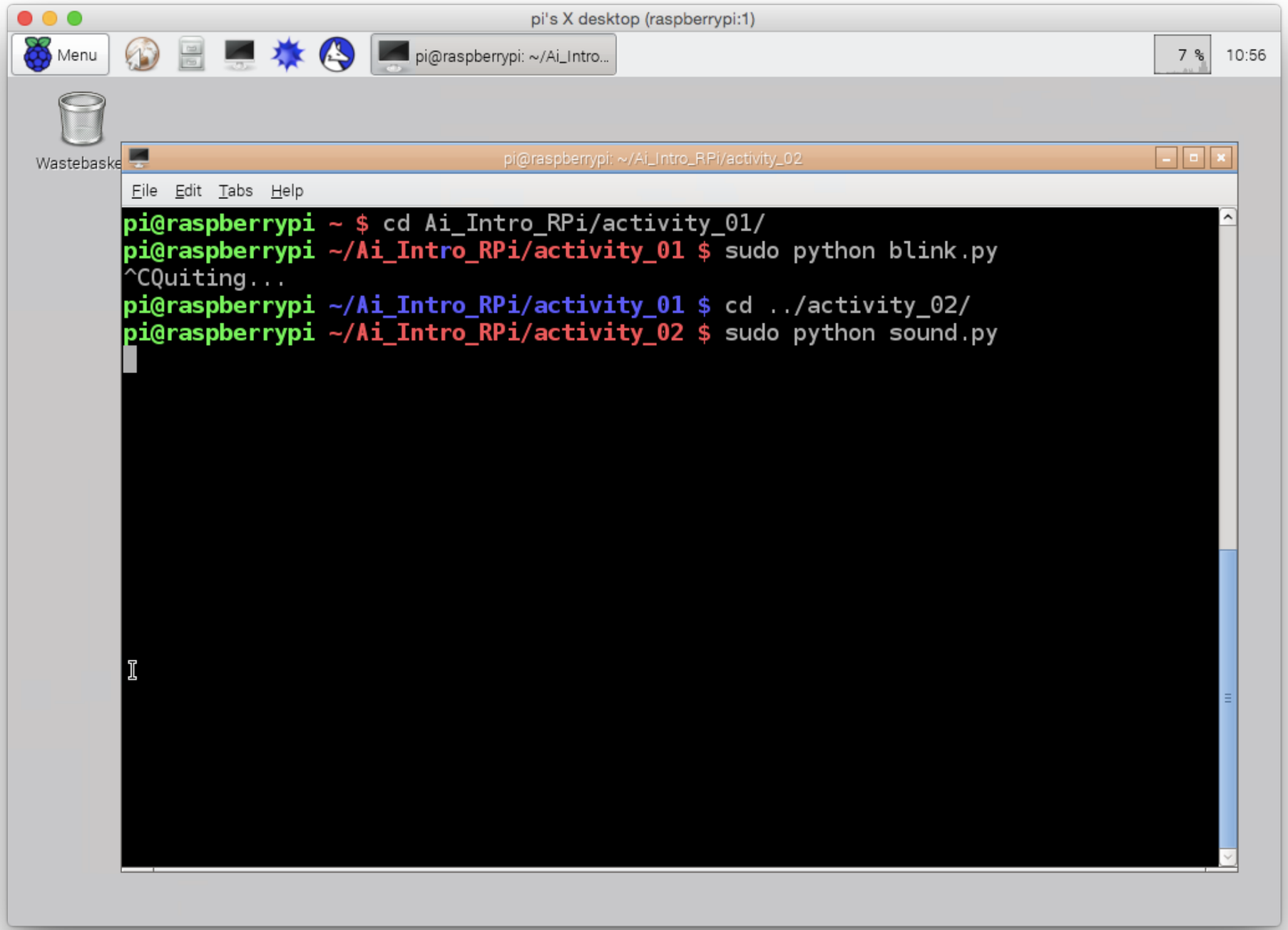


Running the Code

Activity 2: Generating sound with PWM [sound.py]

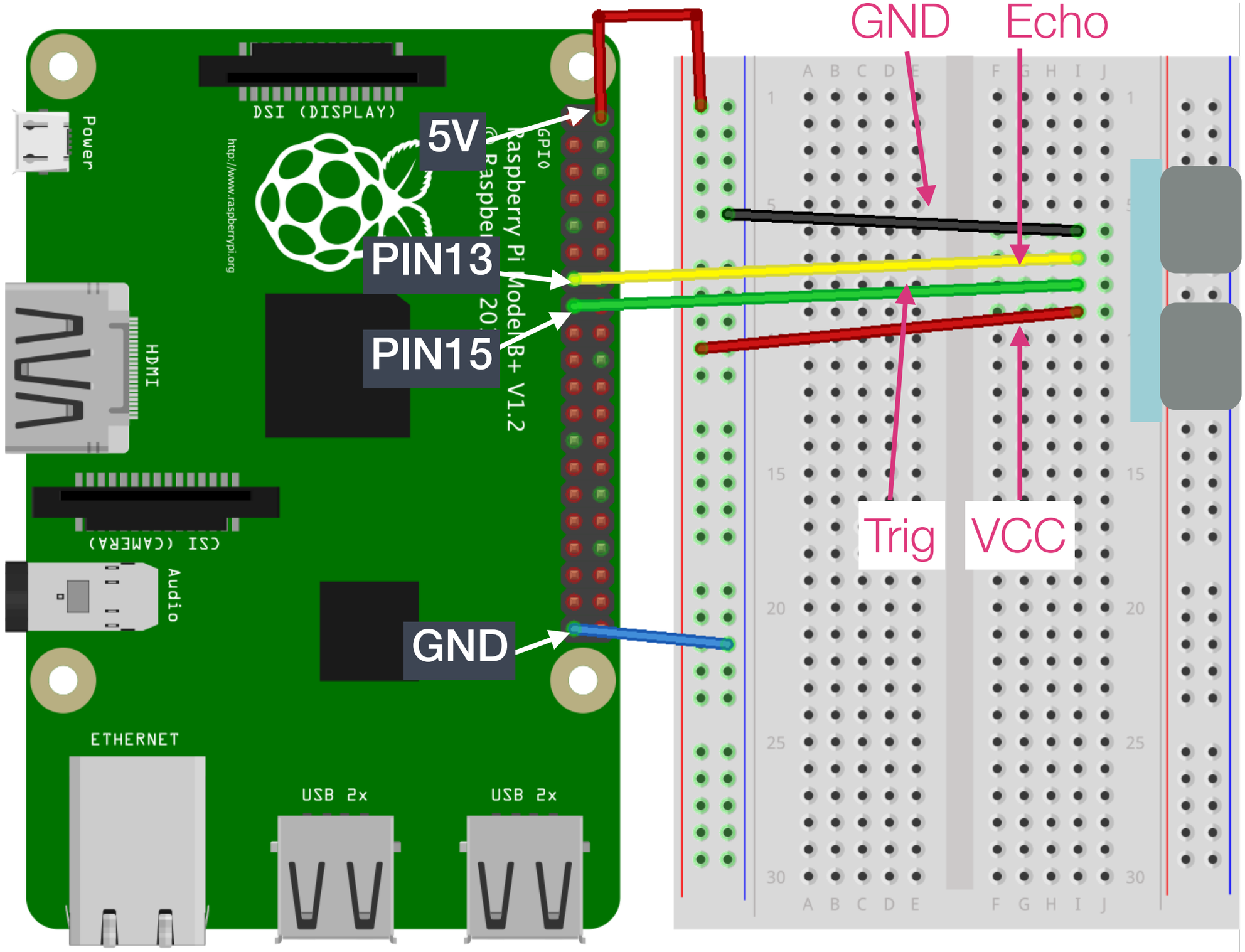
```
cd ../activity_02
```

```
python sound.py
```



Setting Up the Hardware

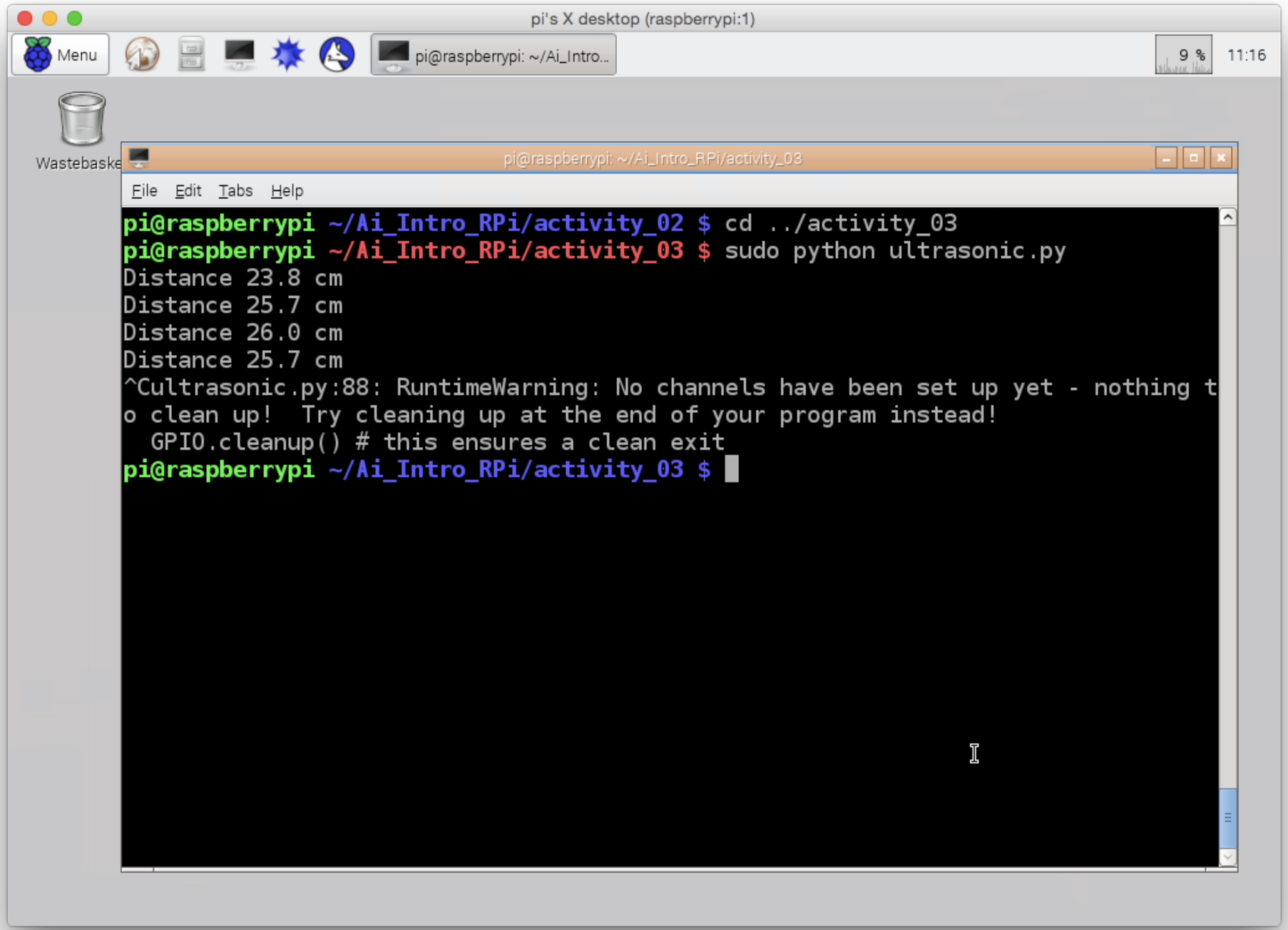
Activity 3a: Detecting Motion with an Ultrasonic sensor [ultrasonic.py]



Running the Code

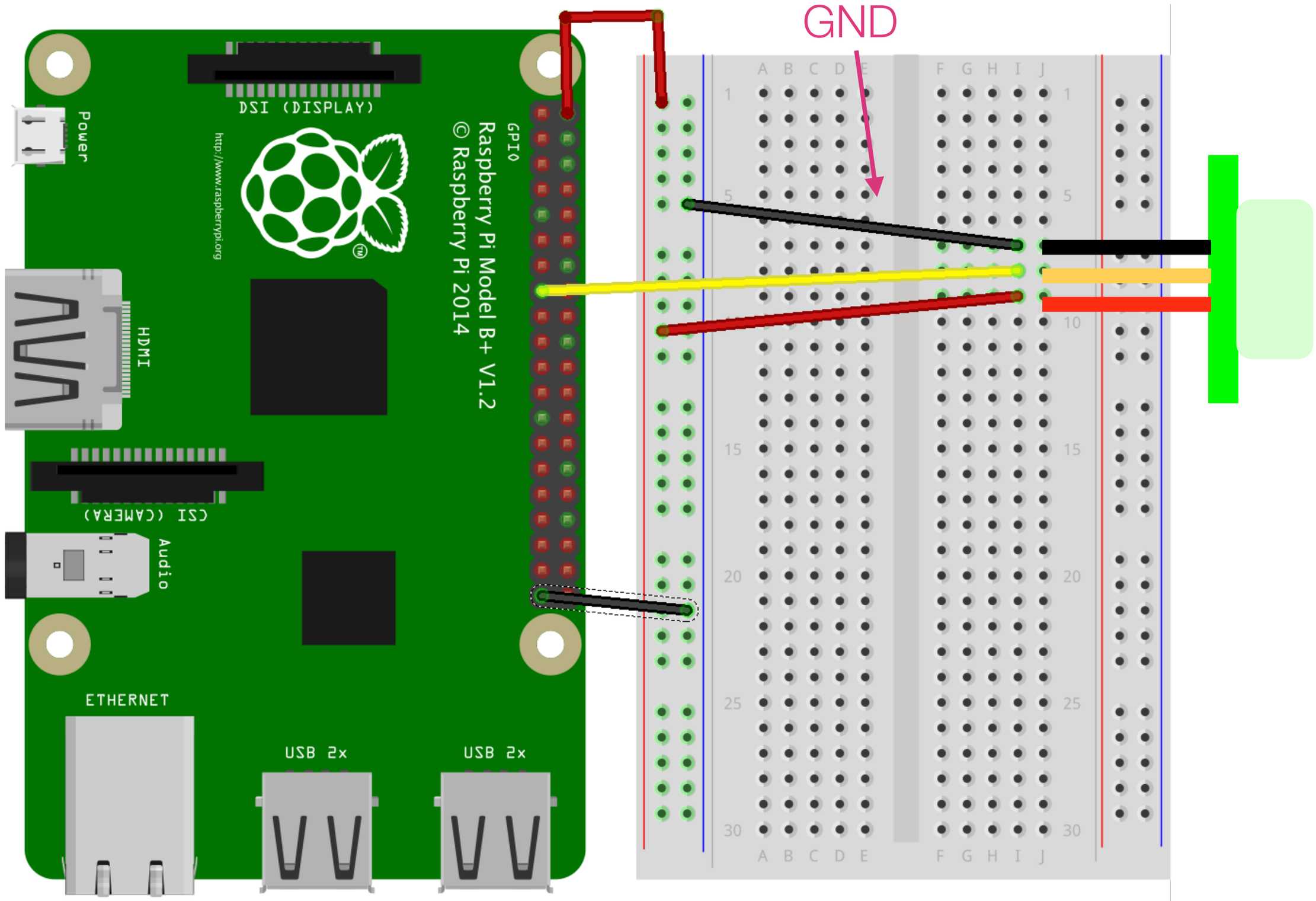
Activity 3a: Detecting Motion with an Ultrasonic sensor [ultrasonic.py]

```
cd ../activity_03a

python ultrasonic.py
```



Setting Up the Hardware

Activity 3b: Detecting Motion with a Motion sensor [ultrasonic.py]

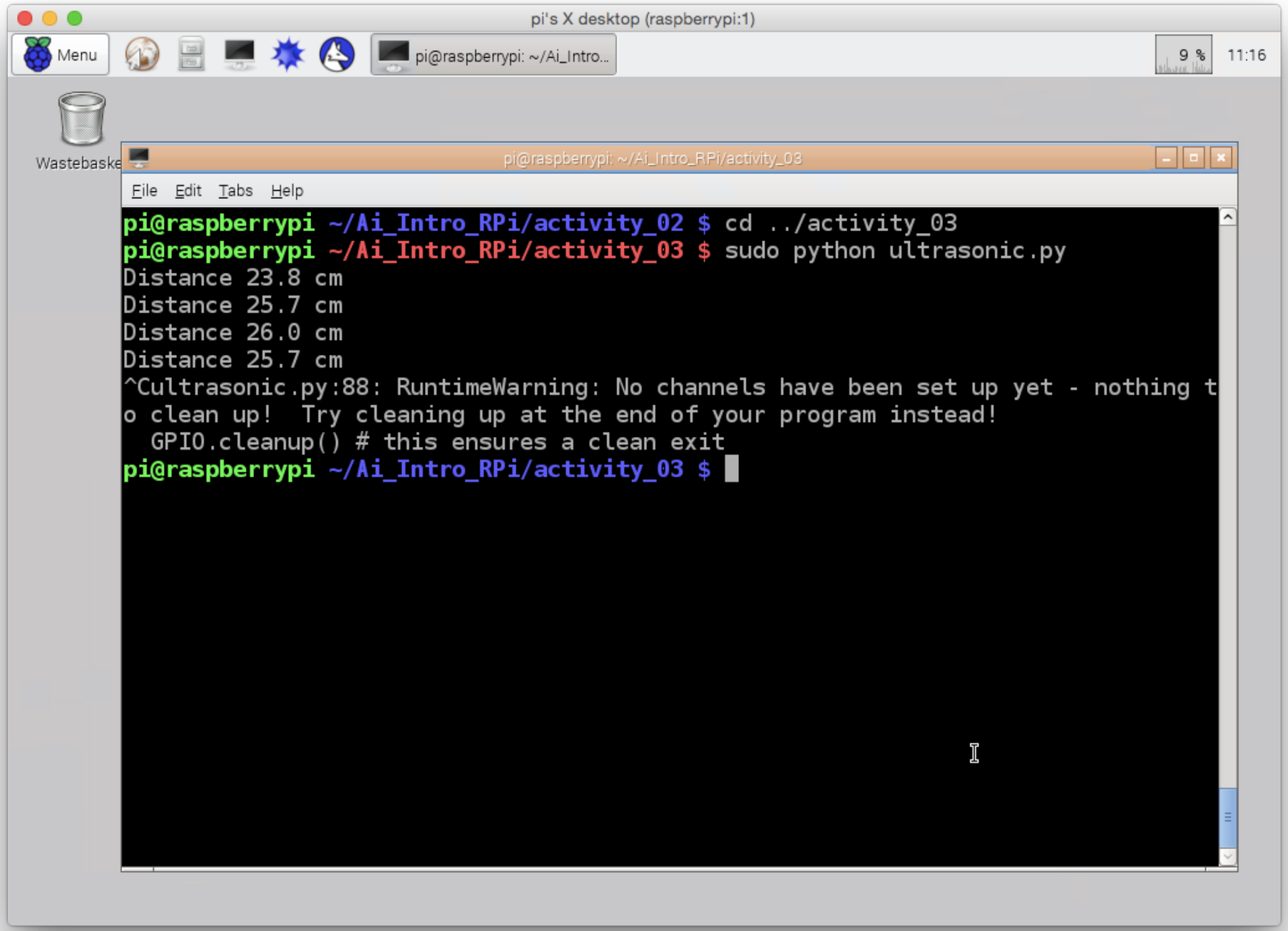


Running the Code

Activity 3b: Detecting Motion with an IR Motion sensor [motion.py]

```
cd ../activity_03b
```

```
python motion.py
```

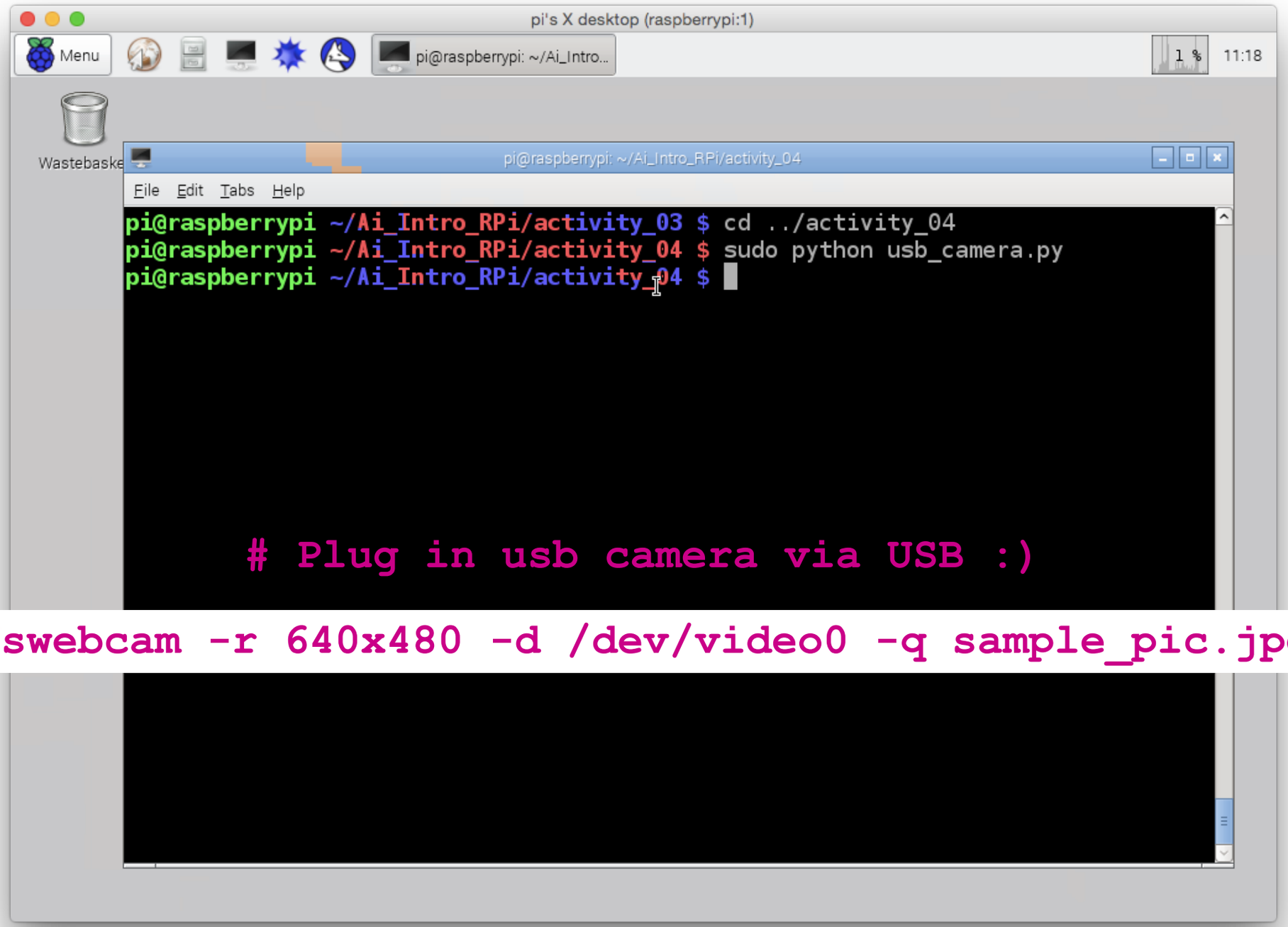


Setting Up the Hardware

Activity 4: Capturing an Image from a USB camera [usb_camera.py]

```
sudo apt-get update
```

```
sudo apt-get install fswebcam python-flask
```

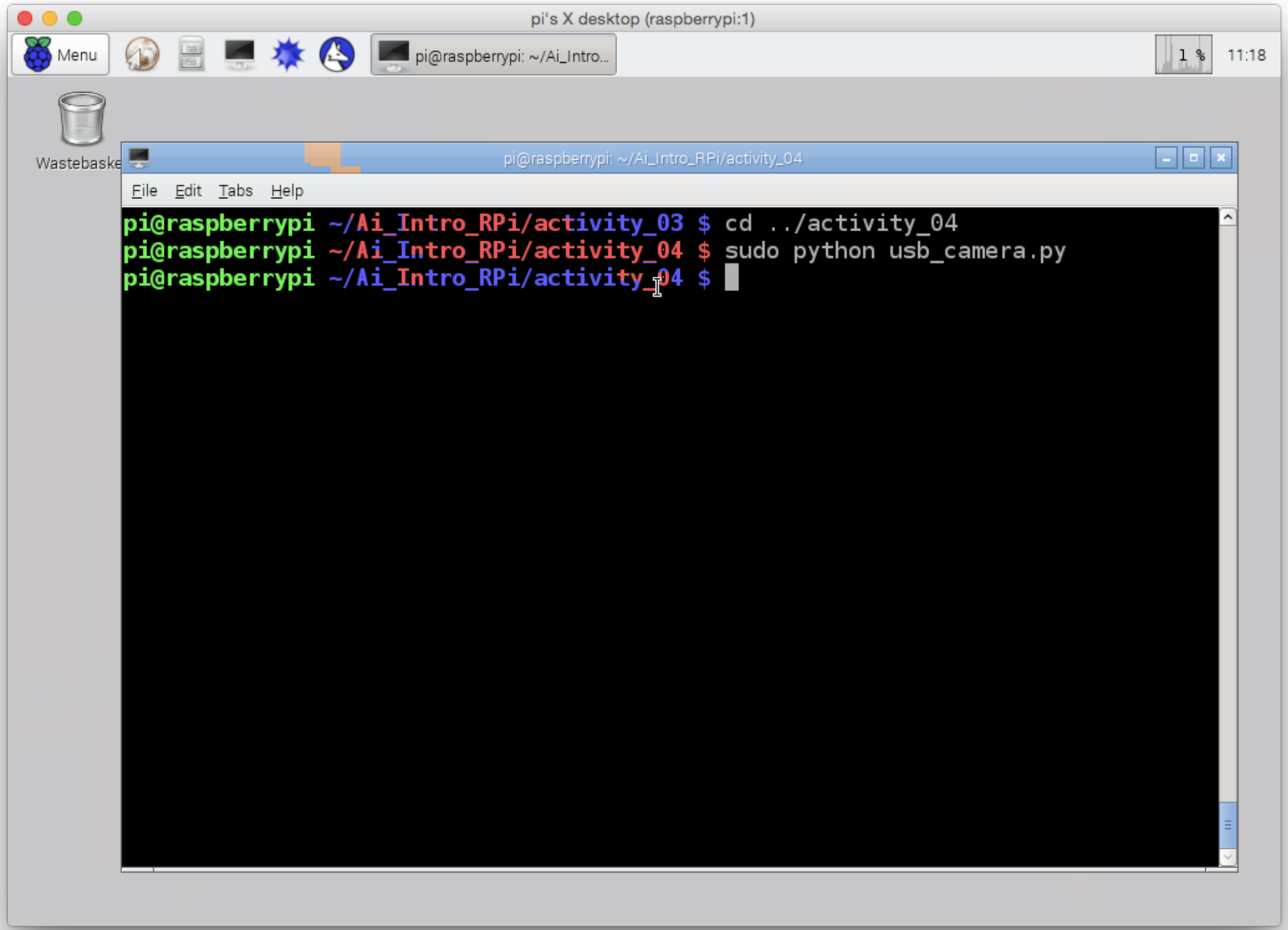


Running the Code

Activity 4: Capturing an Image from a USB camera [usb_camera.py]

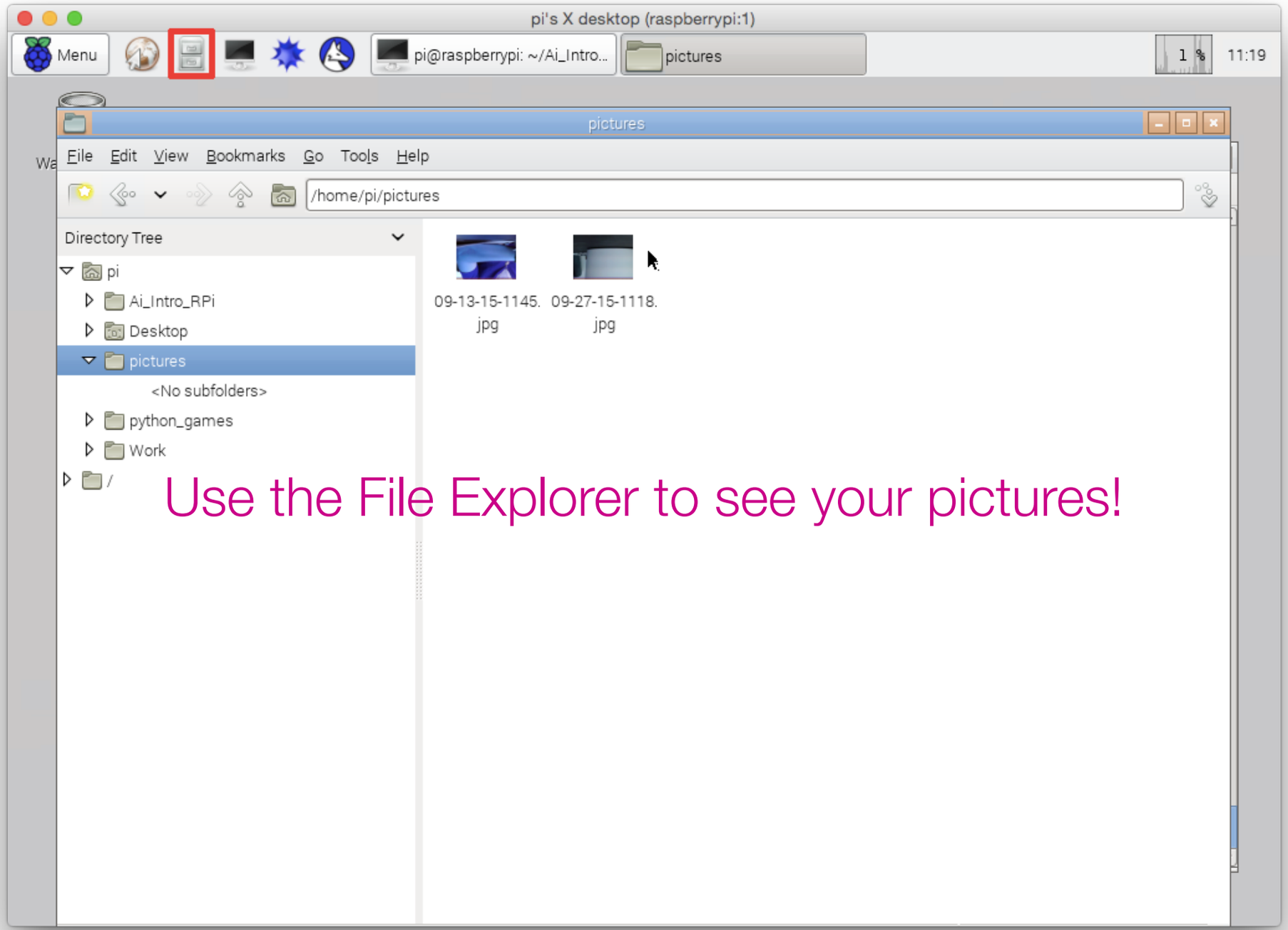
```
cd ../activity_04
```

```
sudo python usb_camera.py
```



Running the Code

Activity 4: Capturing an Image from a USB camera [usb_camera.py]



Configuring the Backend

Raspbian and system administration basics

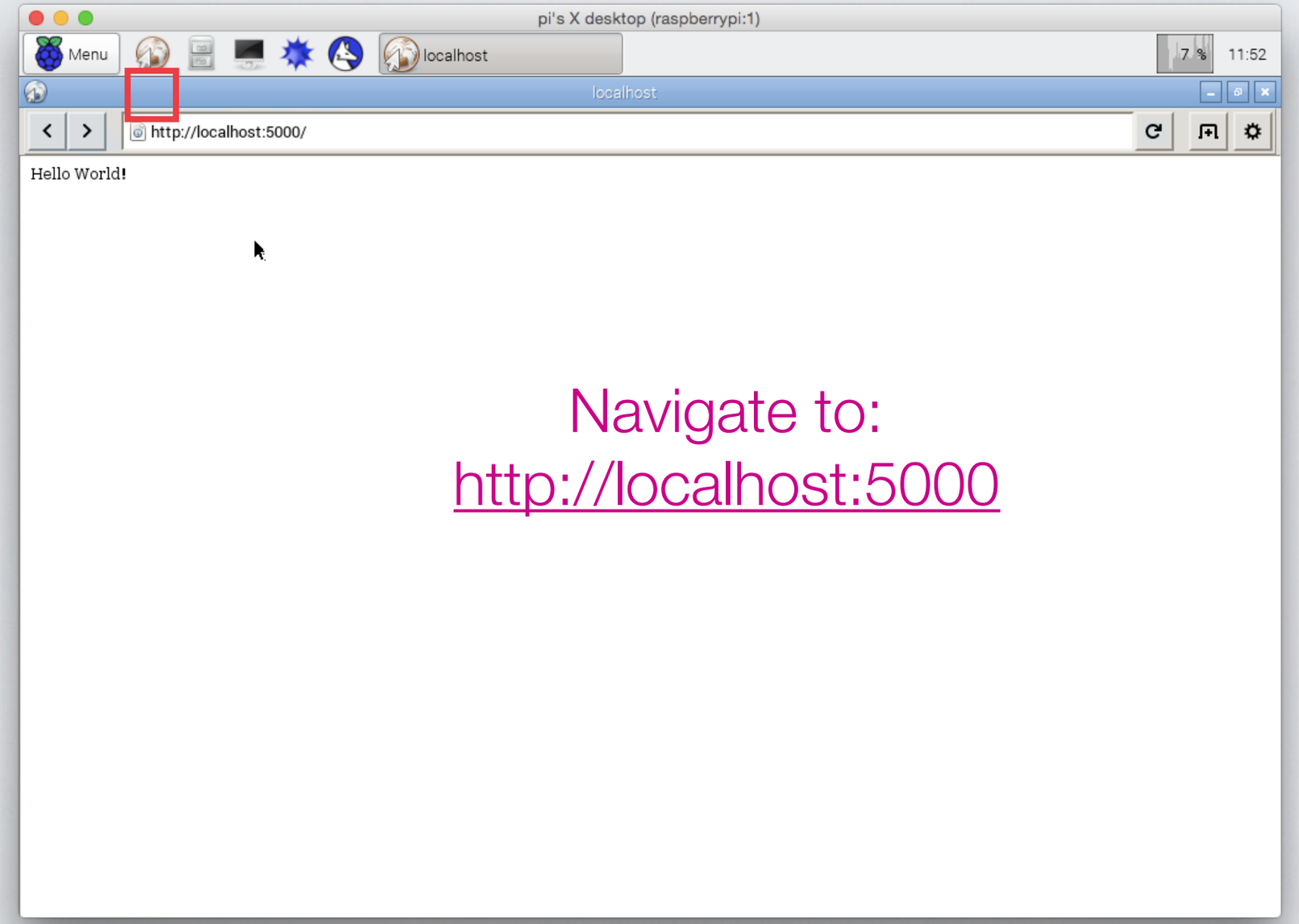
Running a webserver using Python and Flask

Building an API with Flask for LED control

Configuring the Backend

Activity 5: Getting started with web frameworks [application.py]

```
cd ../activity_05/simple

python application.py
```



Navigate to:
http://localhost:5000

Configuring the Backend

Activity 5: Getting started with web frameworks [application.py]

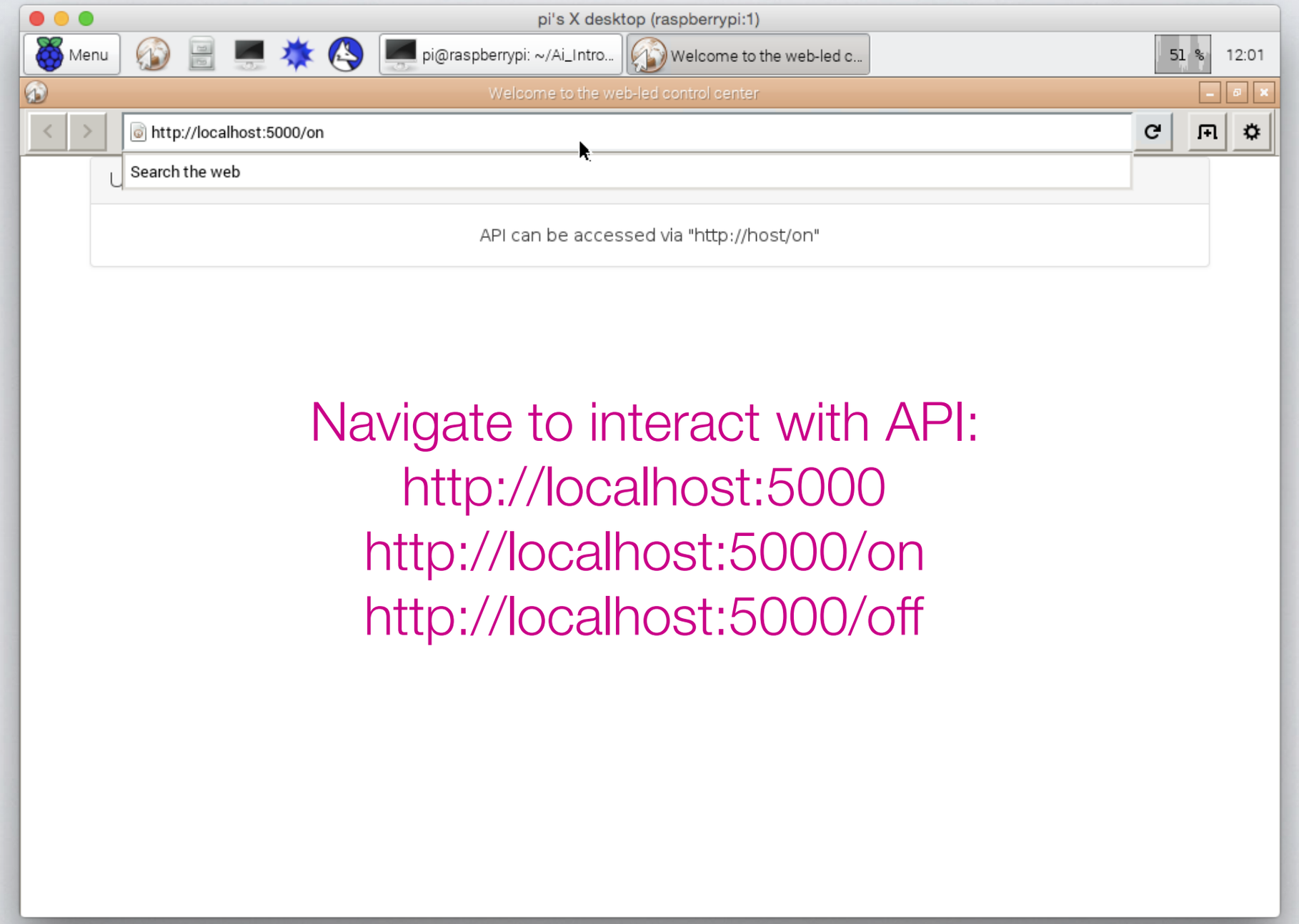
Q&A

Configuring the Backend

Activity 6: Building a simple API for LED control [application.py]

```
cd ../../activity_06
```

```
python application.py
```

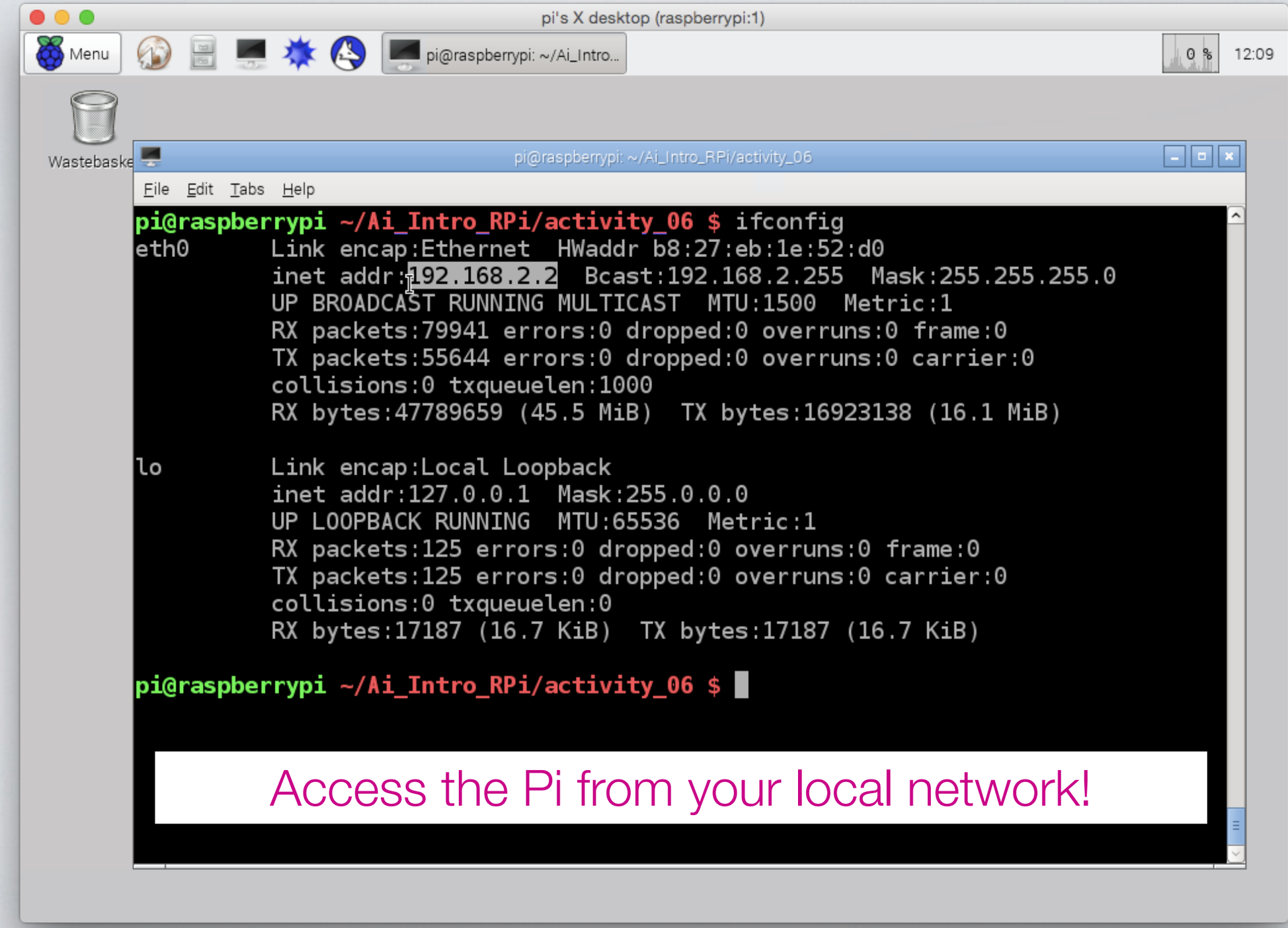


Navigate to interact with API:
http://localhost:5000
http://localhost:5000/on
http://localhost:5000/off

Configuring the Backend

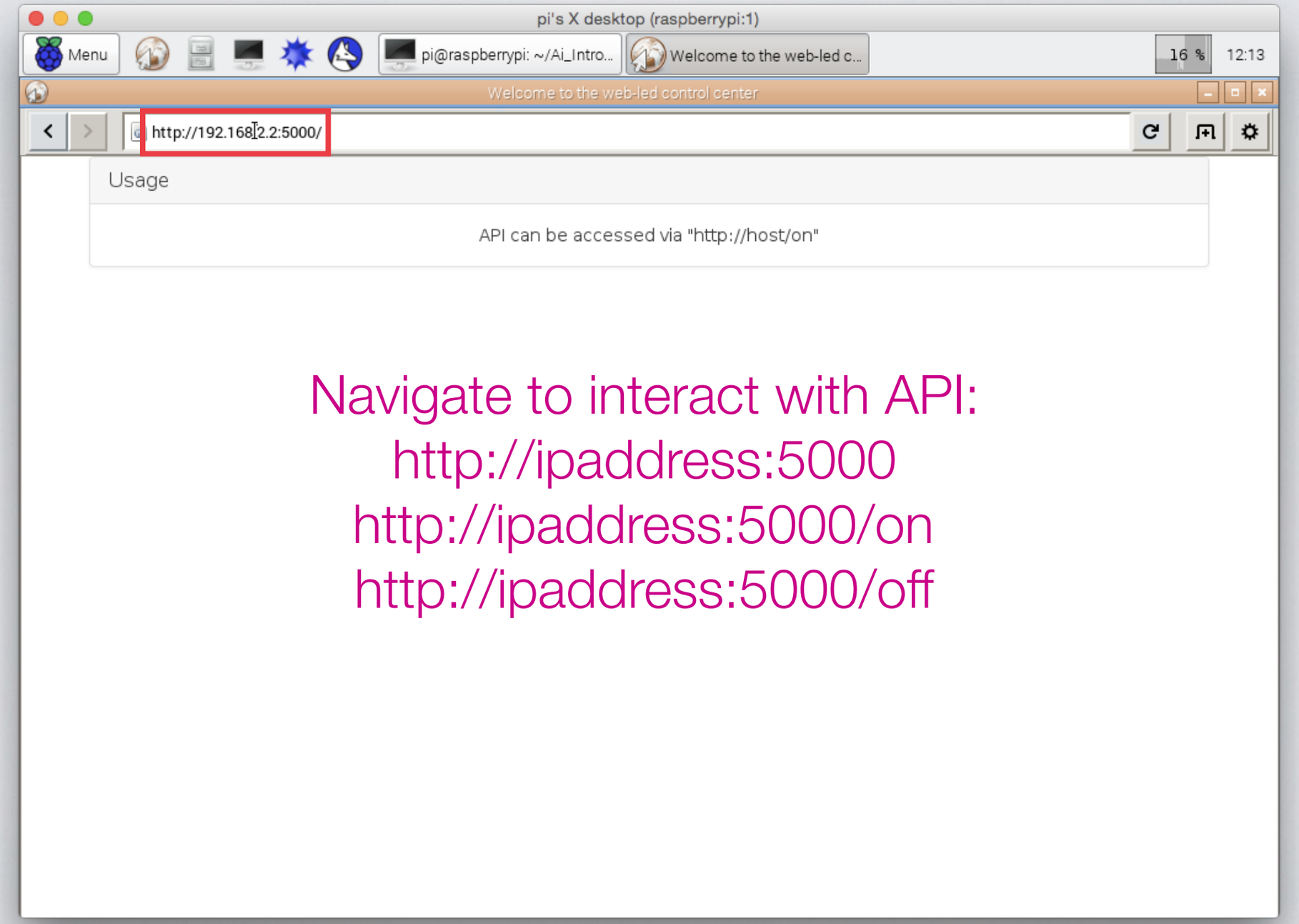
Activity 6: Building a simple API for LED control [application.py]

`ifconfig`



Configuring the Backend

Activity 6: Building a simple API for LED control [application.py]



Navigate to interact with API:
http://ipaddress:5000
http://ipaddress:5000/on
http://ipaddress:5000/off

Configuring the Backend

Activity 6: Building a simple API for LED control [application.py]

```
cd ../../activity_06

python application.py
```

Q&A

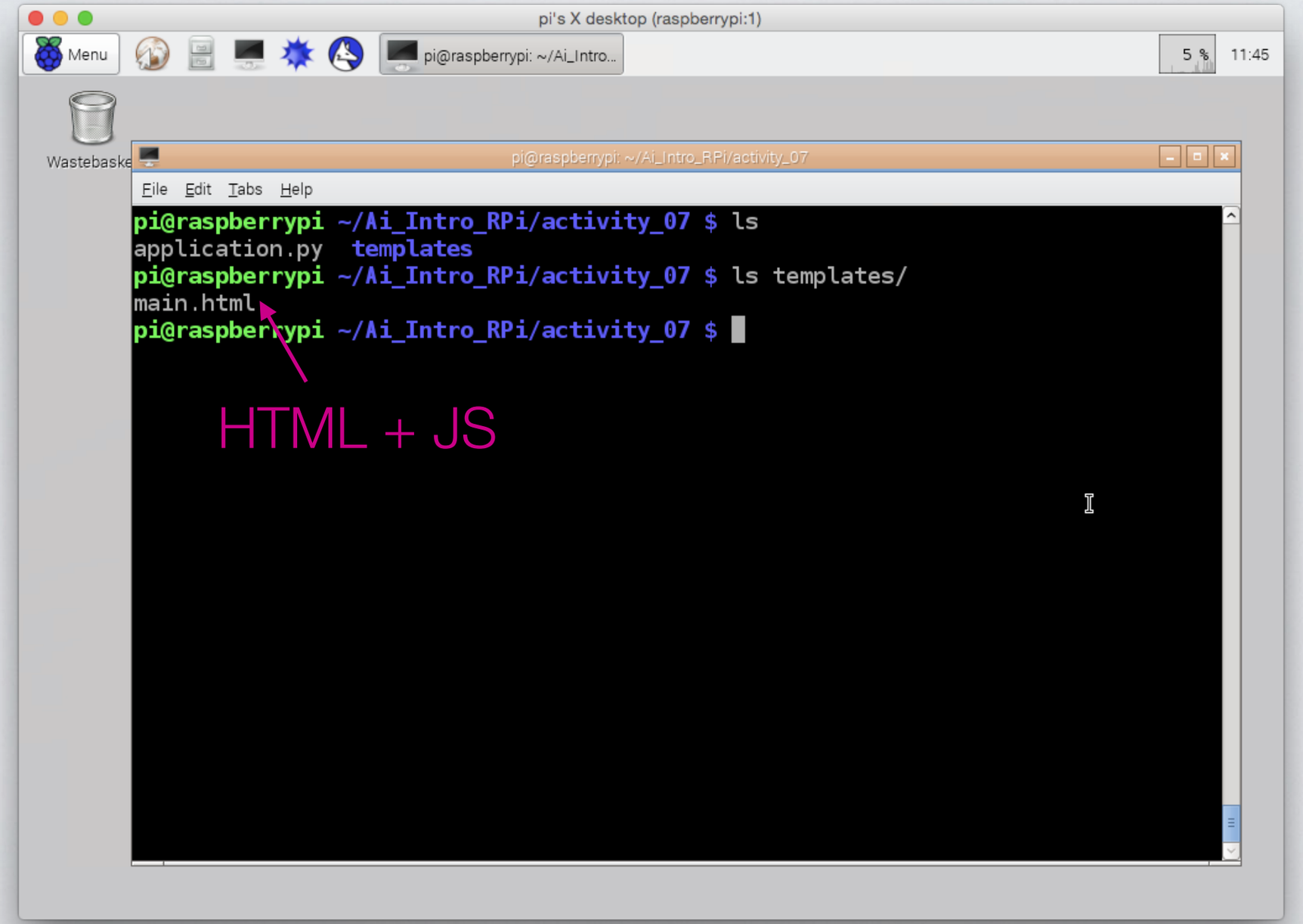
Building a User Interface (Frontend)

Building a User Interface (UI) with HTML, CSS, and JavaScript

Building a User Interface

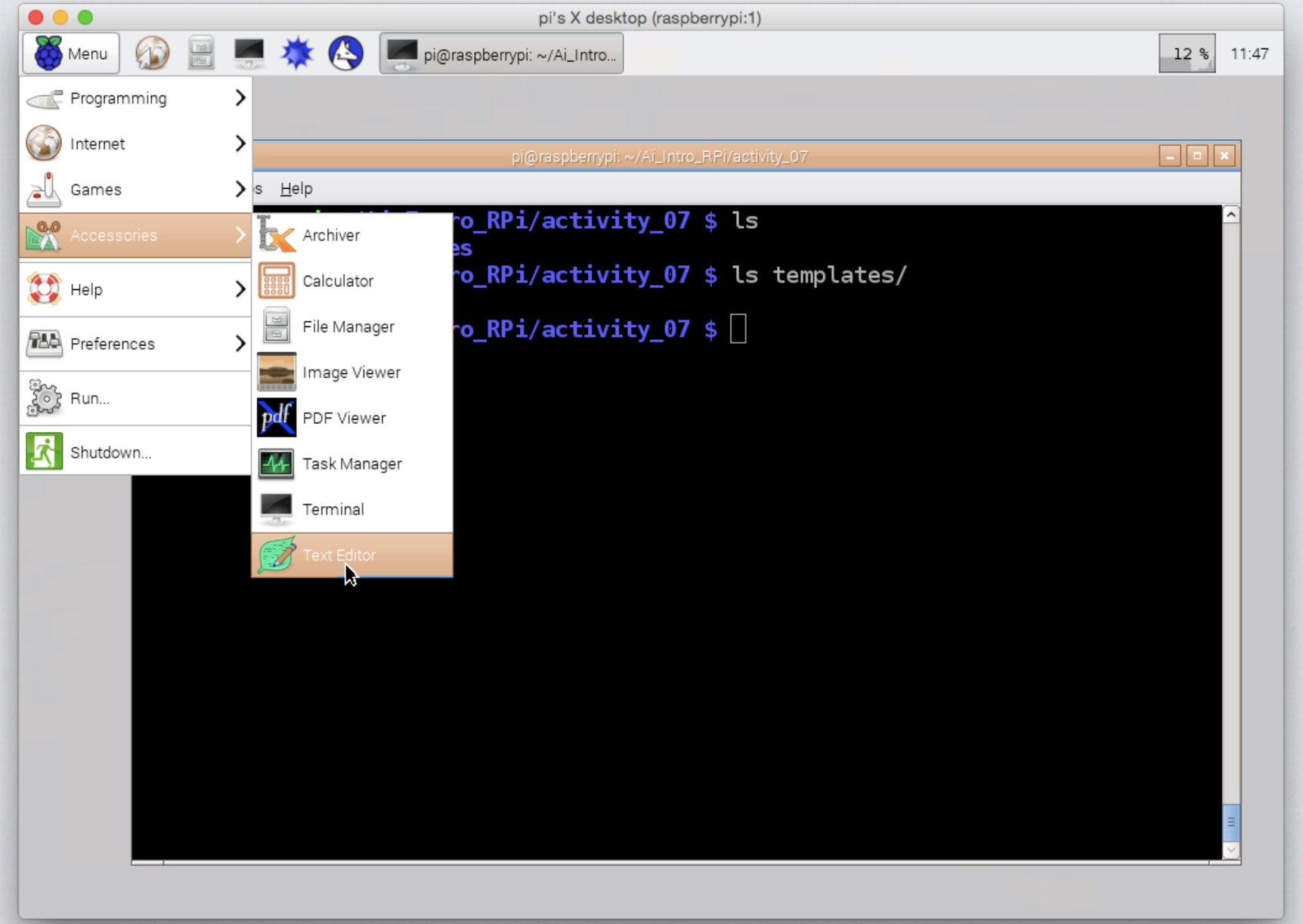
Activity 7: Creating a simple UI for LED control [application.py]

```
cd ../activity_07
```



Building a User Interface

Activity 7: Creating a simple UI for LED control [application.py]



Building a User Interface

Activity 7: Creating a simple UI for LED control [application.py]

Q&A

pi's X desktop (raspberrypi:1)

Menu | pi@raspberrypi: ~/Ai_Intro... | main.html | 6 % | 11:50

main.html

File Edit Search Options Help

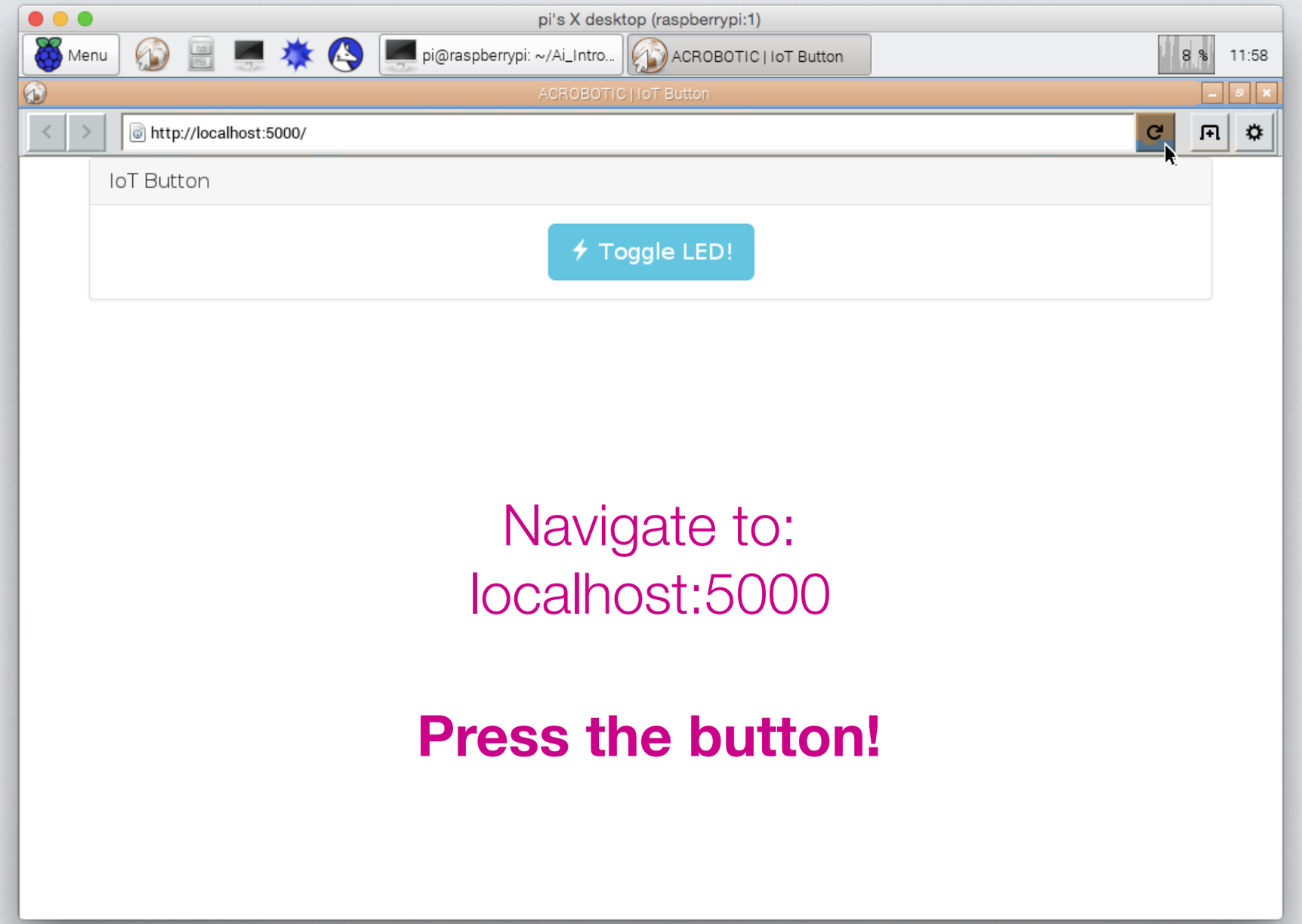
```
<!DOCTYPE html>
<html lang="en">
  <head>
    <title>ACROBOTIC | IoT Button</title>
    <link rel="stylesheet" href="//maxcdn.bootstrapcdn.com/bootstrap/3.3.5/css/bootstrap.min.css">
  </head>
  <body>
    <div class="container">
      <div class="col-lg-4 col-lg-offset-4">
        <div class="panel panel-default">
          <div class="panel-heading">
            <h3 class="panel-title">IoT Button</h3>
          </div>
          <div class="panel-body text-center">
            <button type="button" class="btn btn-info btn-lg">
              <span class="glyphicon glyphicon-flash" aria-hidden="true"></span>
              Blink!
            </button>
          </div>
        </div>
      </div>
    </div>
    <script src="//code.jquery.com/jquery-1.11.2.min.js"></script>

    <script type="text/javascript">
      // Using AJAX requests to avoid refresing the page
      // We encode the data (0 for OFF, 1 for ON) in JSON format
      function setLedStatus(stat) {
        $.ajax({
          url: '/status',
          dataType: 'json',
          type: 'post',
          contentType: 'application/json',
          data: JSON.stringify( stat ),
          processData: false
        });
      }
      // We associate an anonymous function with the 'click' event
      // of the button in the page
      $('.btn').on('click',function(){
        var getLedStatus = $.ajax({
            url: '/status',
```

AJAX post to API sets LED status

Building a User Interface

Activity 7: Creating a simple UI for LED control [application.py]

```
sudo python application.py
```



Navigate to:
localhost:5000

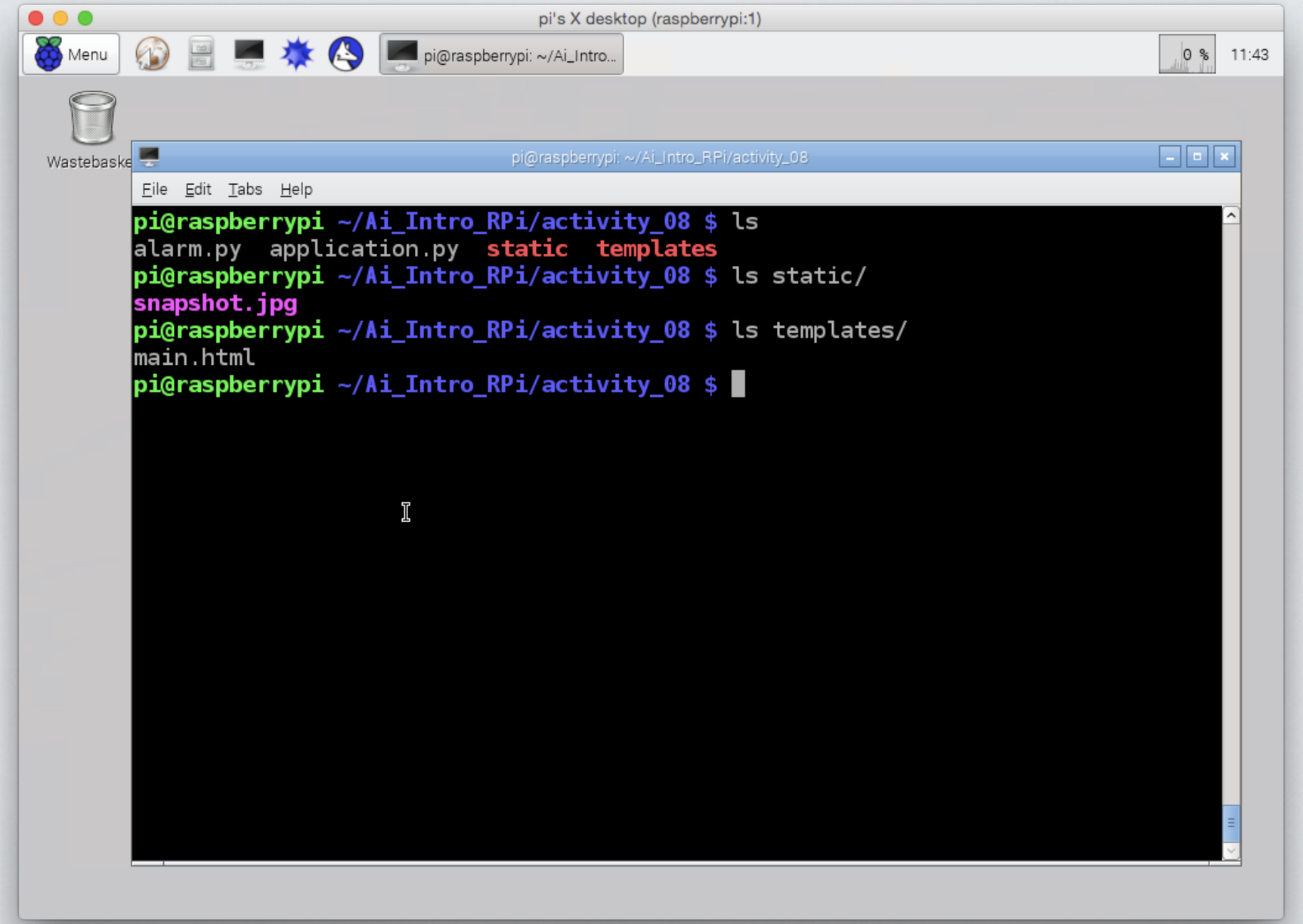
Press the button!

Building a User Interface

Activity 8: Creating a simple UI for an Alarm System [application.py]

```
cd ../activity_08
```

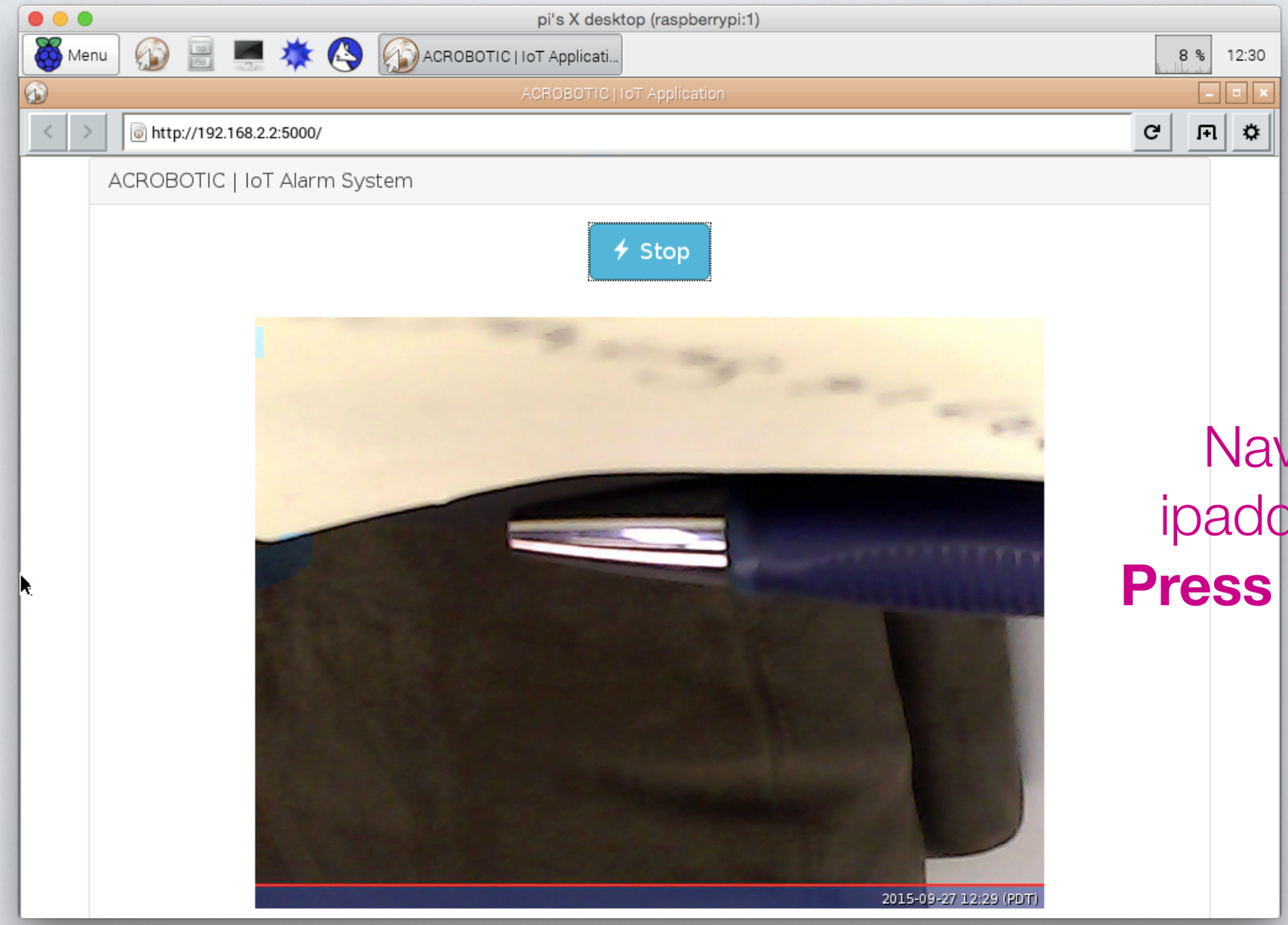
```
sudo python application.py
```



Building a User Interface

Activity 8: Creating a simple UI for an Alarm System [application.py]

```
cd ../activity_08

python application.py
```



Navigate to:
ipaddress:5000

Press the button!