CSCI 3907:
IoT using Raspberry Pi

Week 1: Introduction

Instruction Team

Jack Umina

- Office Hours:
  - *Meet in Tompkins 409 or Zoom*
  - **Tuesdays:** 2:15-3:15pm
  - **Wednesdays:** 11am-12pm

Jon Terry

- Office Hours:
  - *Meet in Tompkins 409 or Zoom*
  - **Fridays:** 1:15-3:15pm

Faculty Advisors:

- Prof. Kartik Bulusu, MAE Department
- Prof. Gabe Parmer, CS Department

Schedule & Expectations

Weeks 2-5: Assignments

- *Each assignment worth 10% for a total of 40%*
- Small, in-class assignments
- Intended to allow you to practice using the sensor(s) we lecture on that week
- Graded mostly on effort and participation

Week 6 and on: Final Project

- *60% of grade*
- Can be completed individually or in pairs
- No specific guidelines, projects will be approved on case by case basis
- Must be complex enough such that it will take roughly 8 weeks to complete

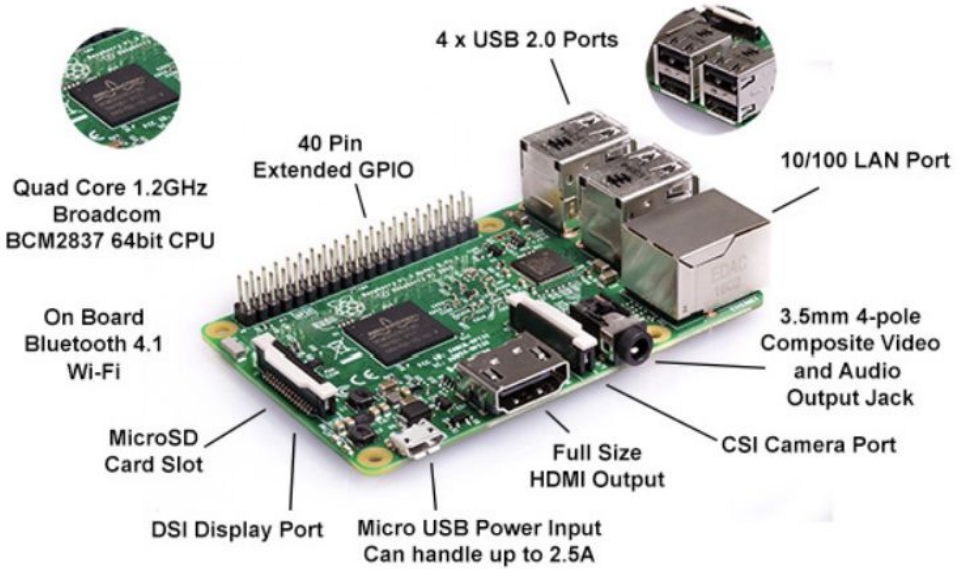
Project Deliverables:

1. Project proposal presentation in week 6 (February 18)
2. Mid-semester presentation in week 11 (March 25)
3. Final presentation and demo in week 15 (April 22)

Working With Raspberry Pi

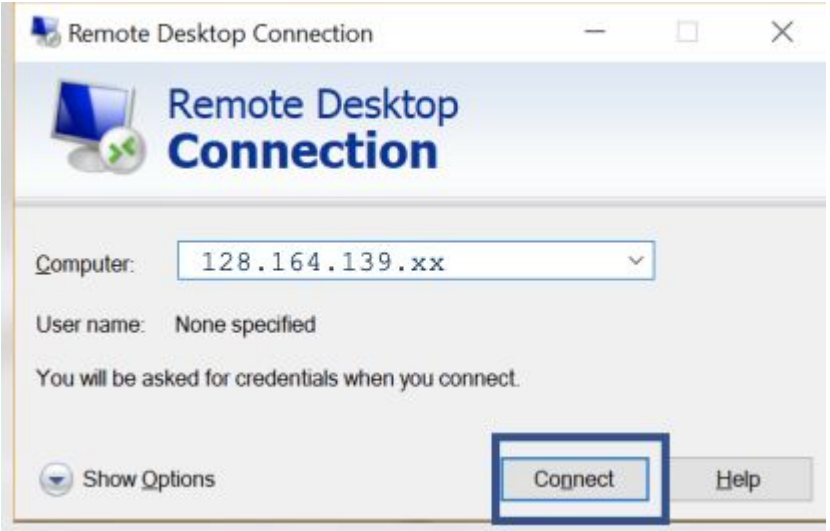
The Basics

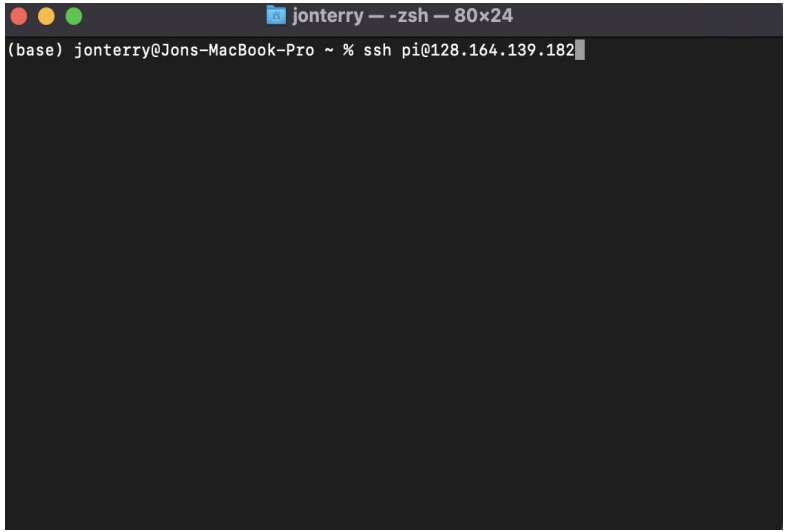
- We will use model 3B+
- Will distribute kits next week in class
- No need to purchase your own (although you can if you want)



Source: https://opensensorhub.org/2019/05/19/kinect-support-on-raspberrypi-3b/

Working on Raspberry Pi: Remotely (recommended)





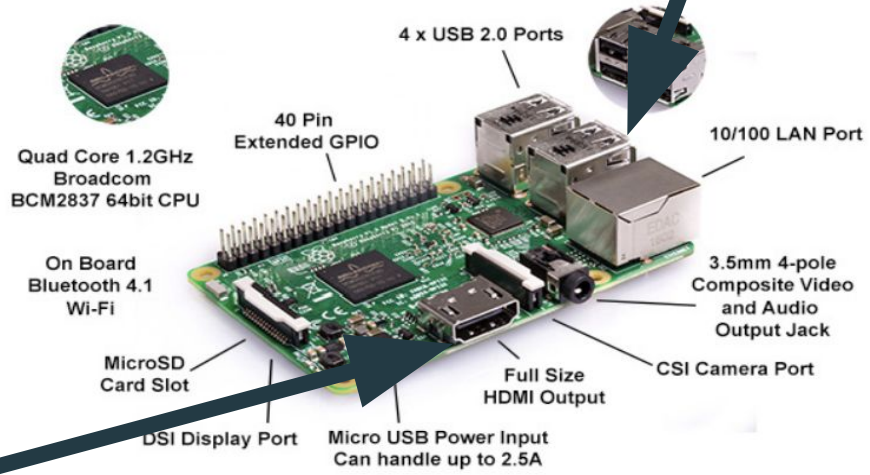
HostName: Pi

Password: raspberry

Getting IP:

- Will be given IP for Pi connected in SEH
- At home: ‘ping raspberrypi.local’ returns IP of pi on local network

Working on Raspberry Pi: Directly

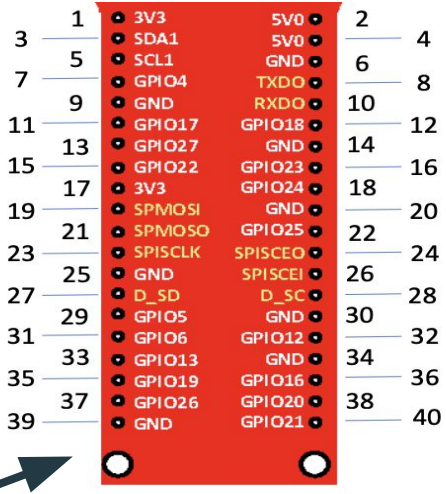


Source: https://opensensorhub.org/2019/05/19/kinect-support-on-raspberrypi-3b/

Using GPIO pins

RPi.GPIO 0.7.0

```
pip install RPi.GPIO
```



Setup:

```
import RPi.GPIO as GPIO
GPIO.setmode(GPIO.BOARD) #(not necessary, but makes pin numbers more intuitively set up)
GPIO.setup(<Pin Number>, GPIO.OUT) / GPIO.setup(<Pin Number>, GPIO.IN)
```

RPi.GPIO: https://pypi.org/project/RPi.GPIO/

RPi.GPIO

Using Pins (Digital):

```
GPIO.output(<Pin Number>, GPIO.HIGH) / GPIO.output(<Pin Number>, GPIO.LOW)
i = GPIO.input(<Pin Number>)
```

At end of Program:

```
GPIO.cleanup()
```

Img from: https://www.teachmemicro.com/

RPi.GPIO

PWM (Analog): only for GPIO18 (pin 12 on board)

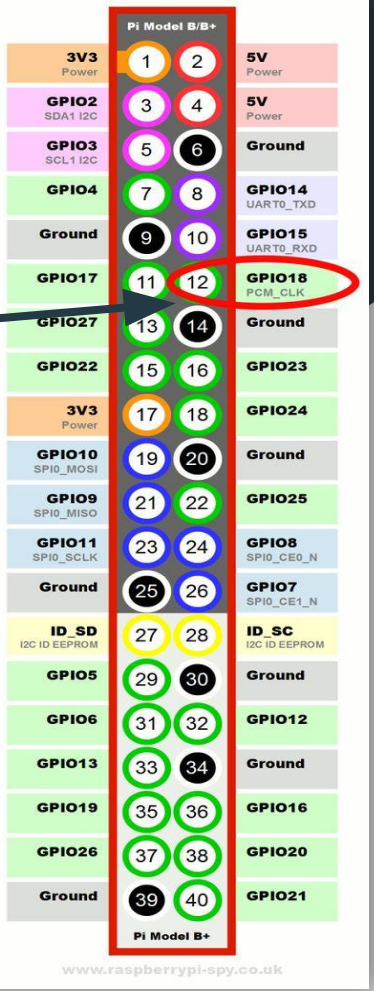
```
pwm = GPIO.PWM(<pin>, <frequency>)
```

```
pwm.start(<duty cycle>)
```

duty cycle can be anywhere from 0%/LOW - 100%/HIGH

Duty cycle is % of period signal is active

```
pwm.stop()
```



Sunfounder Kit

Package List

- Double Color LED x 1
- RGB LED x 1
- Auto-Flash LED x 1
- Relay module x 1
- Laser Emitter x 1
- Button x 1
- Tilt Switch x 1
- Vibration Switch x 1
- IR Receiver x 1
- Active Buzzer x 1
- Passive Buzzer x 1
- Reed switch x 1
- Photo-interrupt x 1
- AD/DAConvert-PCF8591 x 1
- RainDrop Sensor x 1
- Joystick PS2 x 1
- Potentiometer x 1
- Analog Hall Sensor x 1
- Hall Switch Sensor x 1
- Analog Temperature Sensor x 1
- Thermistor x 1
- Sound Sensor x 1
- Photoresistor x 1
- User Manual x 1
- Flame Sensor x 1
- Gas Sensor x 1
- Remote Control x 1
- Touch Switch x 1
- HC-SR04 Ultrasonic Sensor x 1
- Temperature Sensor-DS18B20 x 1
- Rotary Encode x 1
- Humiture Sensor x 1
- IR Obstacle x 1
- I2C LCD 1602 Module x 1
- Barometer-BMP280 x 1
- MPU6050 Module x 1
- RTC-DS1302 Module x 1
- Tracking Sensor x 1
- GPIO Extension Board x 1
- 40-pin Ribbon Cable for GPIO Board x 1
- Breadboard x 1
- 2-Pin Anti-Reverse Cable x 2
- 3-Pin Anti-Reverse Cable x 5
- 4-Pin Anti-Reverse Cable x 5
- 5-Pin Anti-Reverse Cable x 5
- Jumper wires (Male to Female) x 20
- Jumper wires (Male to Male) x 10

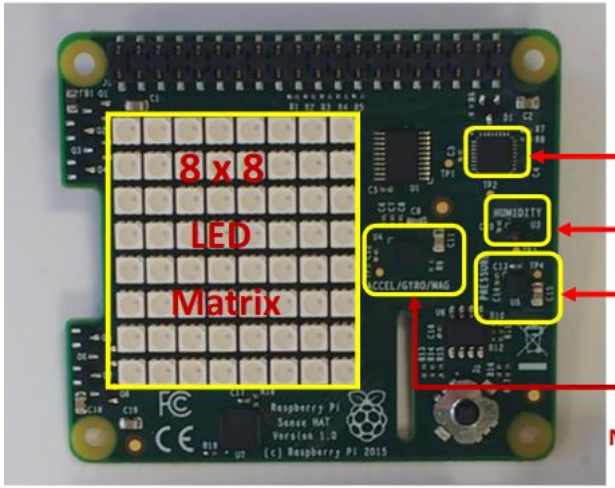
Kit documentation / example codes:

https://drive.google.com/file/d/1NFe2J9ZKHfuxOwmc8QsCO2cQ1PC0GDLS/view

Kit library:

https://github.com/sunfounder/SunFounder_SensorKit_for_RPi2

SenseHat



- The Sense HAT has a variety of sensors that can be read from:

"Temperature"	reads temperature in degrees Celsius
"Humidity"	reads humidity in % RH
"Pressure"	reads atmospheric pressure in millibars
"Rotation"	reads gyroscopic motion in revolutions per second
"Acceleration"	reads acceleration in terms of standard accelerations due to gravity on Earth's surface
"Orientation"	reads orientation relative to magnetic north in degrees
"Magnetic Field"	reads strength and direction of a magnetic field around the sensor in microteslas

“sudo apt-get install sense-hat”

Documentation: https://projects.raspberrypi.org/en/projects/getting-started-with-the-sense-hat/0