ROBOTICS / PYTHON MEETUP 6/21/17

RASPBERRY PI

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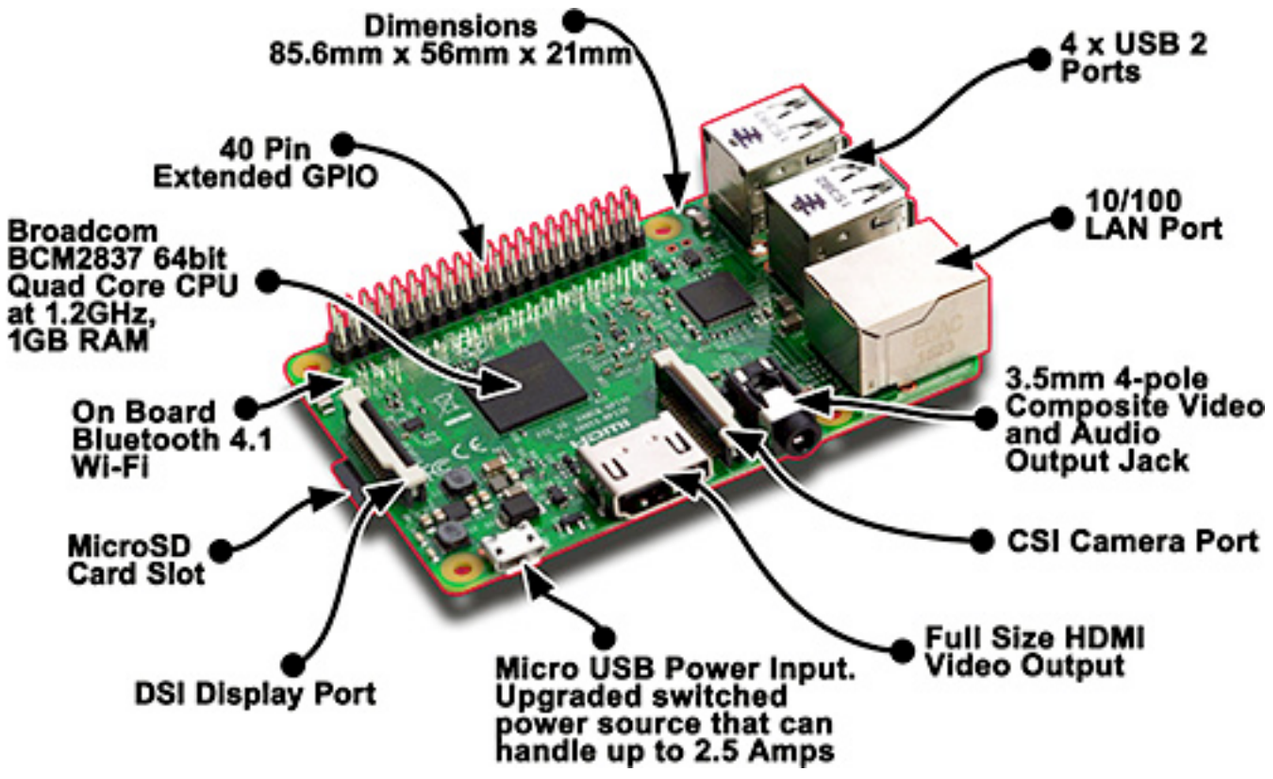
PART 1 – 1.5 HOURS

- PI Board / Linux
- Connecting to Pi
- GPIO
- Code (GitHub)
- Output (LED)
- Input (Switch)
- PWM (pulse-width modulation)
- Output (Motor Control)

PI3 HARDWARE

- ARM processor (1.2 GHz)
- Memory (2 GB)
- Wifi
- Ethernet
- SD Card (OS)
- USB 2 (4 ports)
- HDMI
- Audio/Video Jack
- MicroUSB Power



CONNECTING TO PI – ETHERNET

- 1. Find pi's IP address.
- 2. ssh to your pi using Terminal (Mac) or Putty (PC)

```
% ifconfig | grep net
% sudo nmap -sP 169.254.213.0/24
% ssh pi@169.254.213.64
```

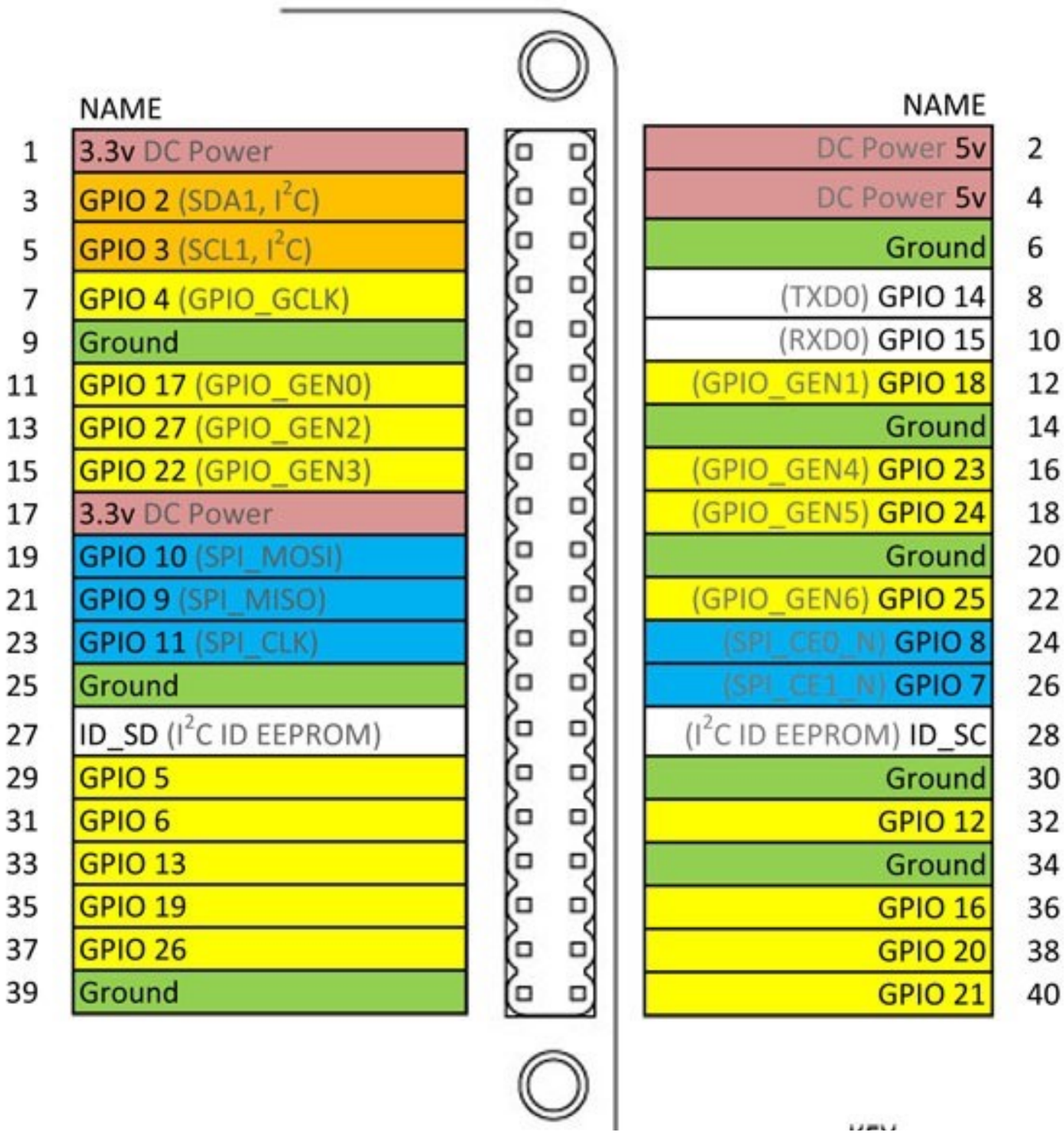
```
pi@raspberrypi:~ $ ifconfig | grep inet
          inet addr:169.254.213.64  Bcast:169.254.255.255  Mask:255.255.0.0
          inet6 addr: fe80::deeb:f40d:d2ec:9b98/64 Scope:Link
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          inet addr:192.168.1.87  Bcast:192.168.1.255  Mask:255.255.255.0
          inet6 addr: fe80::f0aa:dfdc:35b1:9a7f/64 Scope:Link
pi@raspberrypi:~ $ sudo nmap -sP 169.254.213.0/24

Starting Nmap 6.47 ( http://nmap.org ) at 2017-03-27 18:34 EDT
Nmap scan report for 169.254.213.64
Host is up.
Nmap done: 256 IP addresses (1 host up) scanned in 10.63 seconds
pi@raspberrypi:~ $ ssh pi@169.254.213.64
The authenticity of host '169.254.213.64 (169.254.213.64)' can't be established.
ECDSA key fingerprint is fa:0a:1a:31:83:49:21:68:f1:7d:08:da:d2:a2:2c:19.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '169.254.213.64' (ECDSA) to the list of known hosts.
pi@169.254.213.64's password:
```

CONNECTING TO PI – WIFI

- 1. Use keyboard, mouse, display to login to pi
- 2. Add wifi network (upper right)
- 3. Run nmap on wifi segment
- 4. ssh to the pi (same as ethernet)

GPIO




```
pi@raspberrypi:~ $ gpio readall
 +-----+-----+---------+------+---+---Pi 3---+---+------+---------+-----+-----+
 | BCM | wPi |   Name  | Mode | V | Physical | V | Mode | Name    | wPi | BCM |
 +-----+-----+---------+------+---+----++----+---+------+---------+-----+-----+
 |     |     |    3.3v |      |   |  1 || 2  |   |      | 5v      |     |     |
 |   2 |   8 |   SDA.1 | ALT0 | 1 |  3 || 4  |   |      | 5v      |     |     |
 |   3 |   9 |   SCL.1 | ALT0 | 1 |  5 || 6  |   |      | 0v      |     |     |
 |   4 |   7 | GPIO. 7 |   IN | 1 |  7 || 8  | 1 | ALT5 | TxD     | 15  | 14  |
 |     |     |      0v |      |   |  9 || 10 | 1 | ALT5 | RxD     | 16  | 15  |
 |  17 |   0 | GPIO. 0 |   IN | 0 | 11 || 12 | 0 | IN   | GPIO. 1 | 1   | 18  |
 |  27 |   2 | GPIO. 2 |   IN | 0 | 13 || 14 |   |      | 0v      |     |     |
 |  22 |   3 | GPIO. 3 |   IN | 0 | 15 || 16 | 0 | IN   | GPIO. 4 | 4   | 23  |
 |     |     |    3.3v |      |   | 17 || 18 | 0 | IN   | GPIO. 5 | 5   | 24  |
 |  10 |  12 |    MOSI | ALT0 | 0 | 19 || 20 |   |      | 0v      |     |     |
 |   9 |  13 |    MISO | ALT0 | 0 | 21 || 22 | 0 | IN   | GPIO. 6 | 6   | 25  |
 |  11 |  14 |    SCLK | ALT0 | 0 | 23 || 24 | 1 | OUT  | CE0     | 10  | 8   |
 |     |     |      0v |      |   | 25 || 26 | 1 | OUT  | CE1     | 11  | 7   |
 |   0 |  30 |   SDA.0 |   IN | 1 | 27 || 28 | 1 | IN   | SCL.0   | 31  | 1   |
 |   5 |  21 | GPIO.21 |   IN | 1 | 29 || 30 |   |      | 0v      |     |     |
 |   6 |  22 | GPIO.22 |   IN | 1 | 31 || 32 | 0 | IN   | GPIO.26 | 26  | 12  |
 |  13 |  23 | GPIO.23 |   IN | 0 | 33 || 34 |   |      | 0v      |     |     |
 |  19 |  24 | GPIO.24 |   IN | 0 | 35 || 36 | 0 | IN   | GPIO.27 | 27  | 16  |
 |  26 |  25 | GPIO.25 |   IN | 0 | 37 || 38 | 0 | IN   | GPIO.28 | 28  | 20  |
 |     |     |      0v |      |   | 39 || 40 | 0 | IN   | GPIO.29 | 29  | 21  |
 +-----+-----+---------+------+---+----++----+---+------+---------+-----+-----+
 | BCM | wPi |   Name  | Mode | V | Physical | V | Mode | Name    | wPi | BCM |
 +-----+-----+---------+------+---+---Pi 3---+---+------+---------+-----+-----+
```

KEY

- Power
- Ground
- UART
- I²C
- SPI
- GPIO

CODE – GITHUB

- Slides and code are all included here:

```
% md code

% cd code

% git pull https://github.com/xemjeff/Pi-Code.git
```

OUTPUT : LED

Pi	Controller	Color	GPIO-Channel
2	VCC	Orange	2
8	Switch In	Yellow	15
6	GND	Black	6

```
% gpio mode 15 out
% gpio write 15 1
% gpis write 15 0
```

INPUT : SWITCH

Pi	Controller	Color	GPIO-Channel
2	VCC	Orange	
7	Switch In	Yellow	7
6	GND	Black	

```
% gpio mode 7 up

% gpio read
```

Requires that you have WiringPi already installed.

OUTPUT-PWM / MOTOR

Pi	Controller	Color	GPIO-Channel
10	Dir	White	15
12	PWM	Yellow	18
6	GND	Gray	--

```
% cd code

% sudo ./motorDrive
```

OTHER TOPICS

- 1. Orientation: Gyro, Accelerometer Sensors (IMU)
- 2. Sonar Sensor
- 3. IR Sensors / PIR Sensors
- GPS integration
- 4. Capacitive Touch sensors
- 5. Motor Encoder Sensor