RaspberryPi + IoT

How to build your own Pet Machine

What is IoT and RaspberryPi
and Lab about how to build your own IoT RC Car

About me…

Developer Advocate

Java, PHP, JavaScript,
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Braintree_Dev.
A PayPal Company

Do you want one for you?

Demo

Let’s drive it

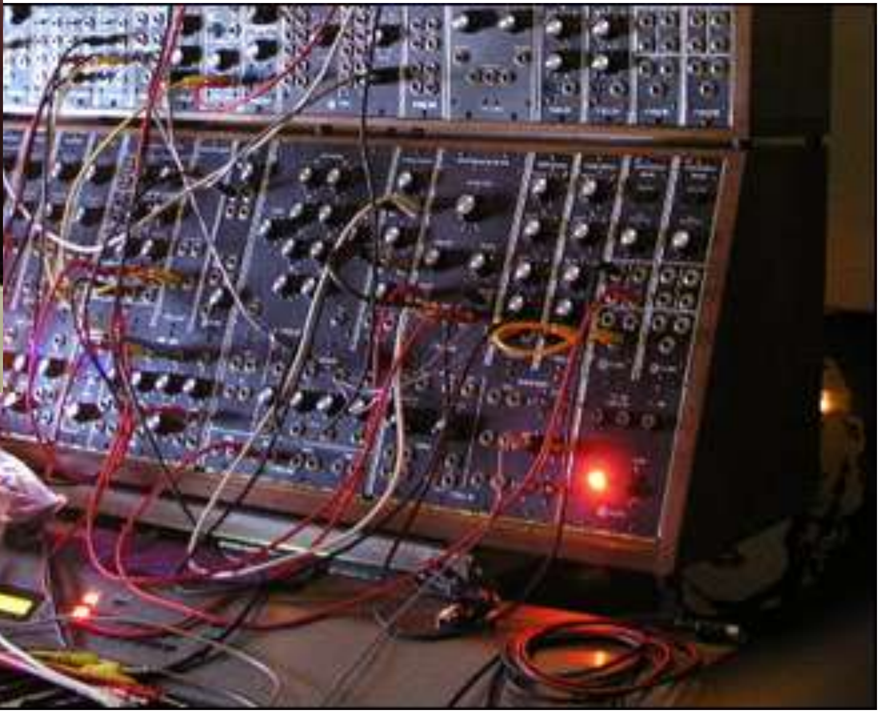
Now, let's build it!!

This is not IoT… (IMHO)

This is so cool but this is Eletronic!!

And this is not new…

(who has gray hair can say… P)



What is IoT?

Internet

Million of Web Services

(PayPal, Twitter, Google, Netflix, Facebook)

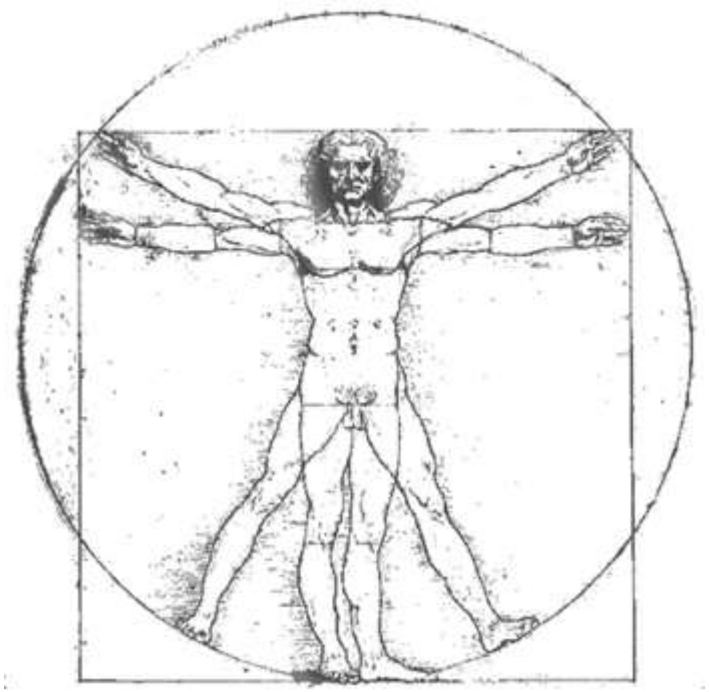
+

Things

Billions of sensors, motors, displays, appliances, toys, cars, stores, robots

And to work with IoT you’re going to need more skills

You’re going to need to a Polimath



A polymath (Greek: πολυμαθής, polymathēs, "having learned much")[1] is a person whose expertise spans a significant number of different subject areas; such a person is known to draw on complex bodies of knowledge to solve specific problems. The term was first used in the seventeenth century; the related term, polyhistor, is an ancient term with similar meaning.

(Source: Wikipedia - http://en.wikipedia.org/wiki/Polymath)

#polimathdevs

L da Vinci

Italian Polymath. What was da Vinci? Scientist? Engineer? Mathematic? Painter? Sculptor? Musician? Botanic? Anatomist?

Source: Wikipedia - http://en.wikipedia.org/wiki/Leonardo_da_Vinci

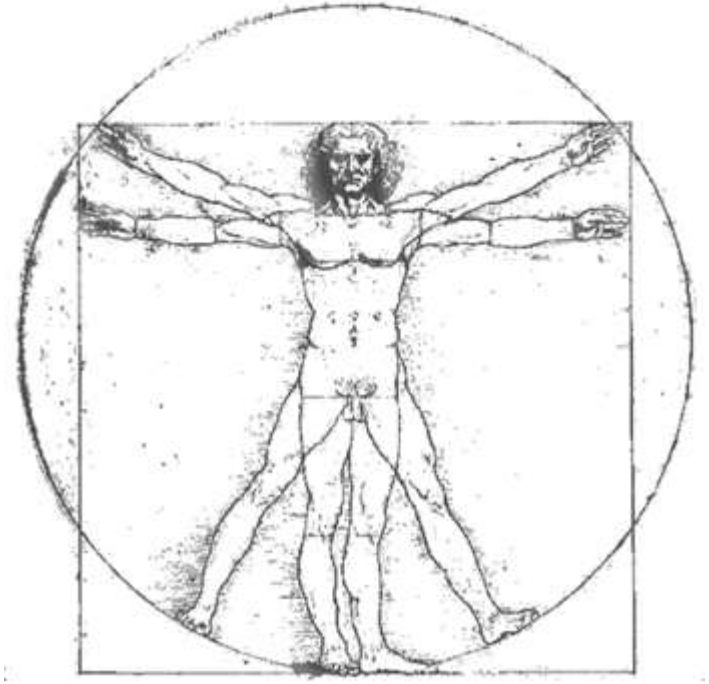
Could **IoT** bring us a broad vision of Technology?

No more specialists…

But new **Polymath Developers**

Server Side

Client/Desktop



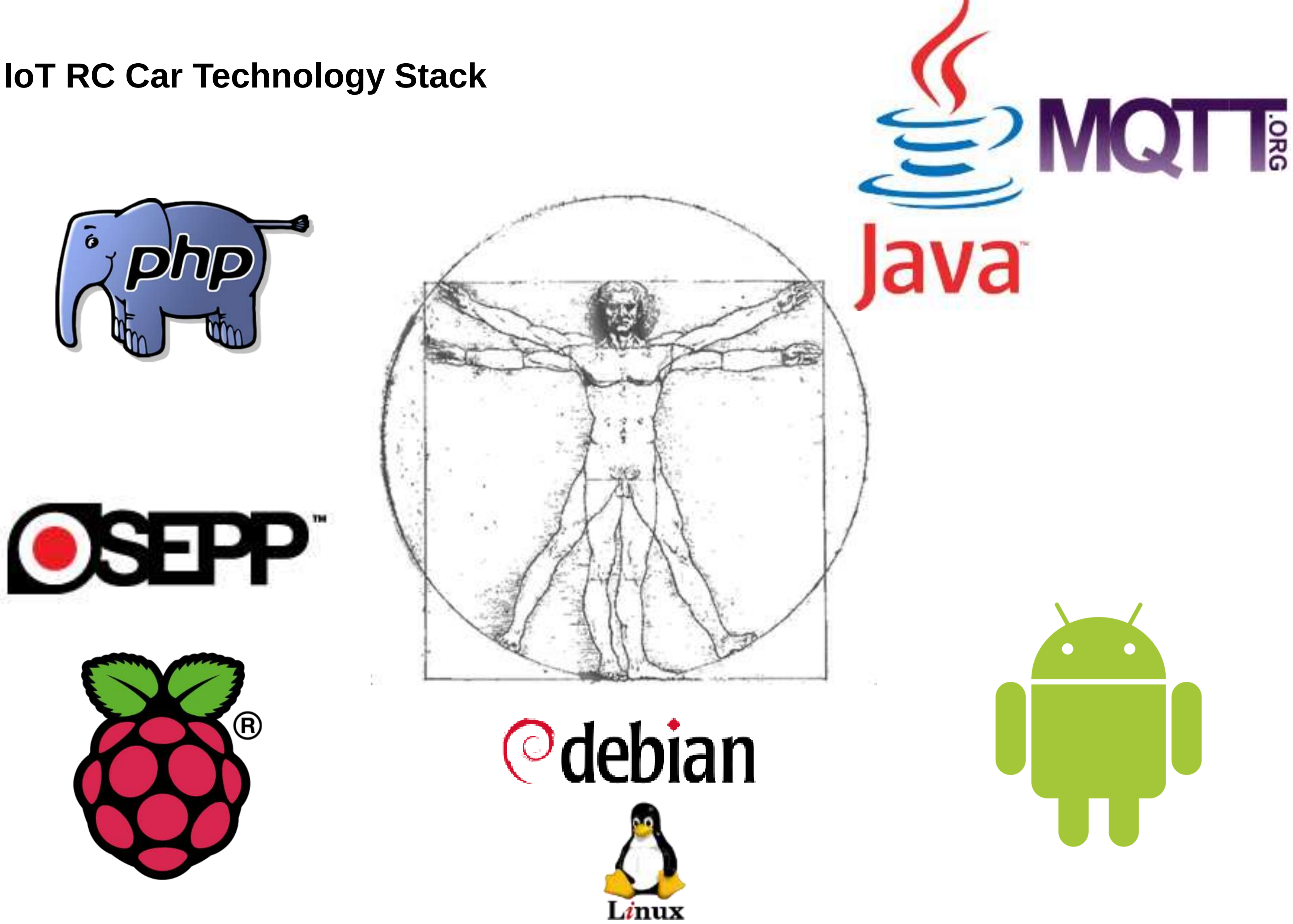
Eletronic
(sometimes mechanic
and sculptor on wood or iron)

Mobile
(Beacons e Weareables)

Operational Systems

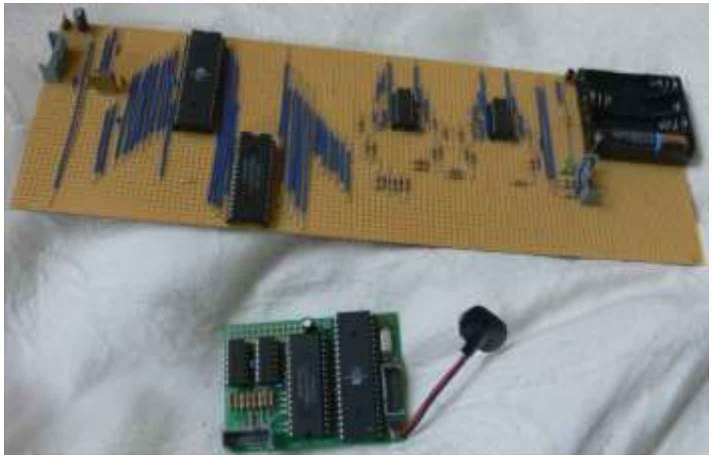
OMG
AM I PREPARED?
memegenerator.net

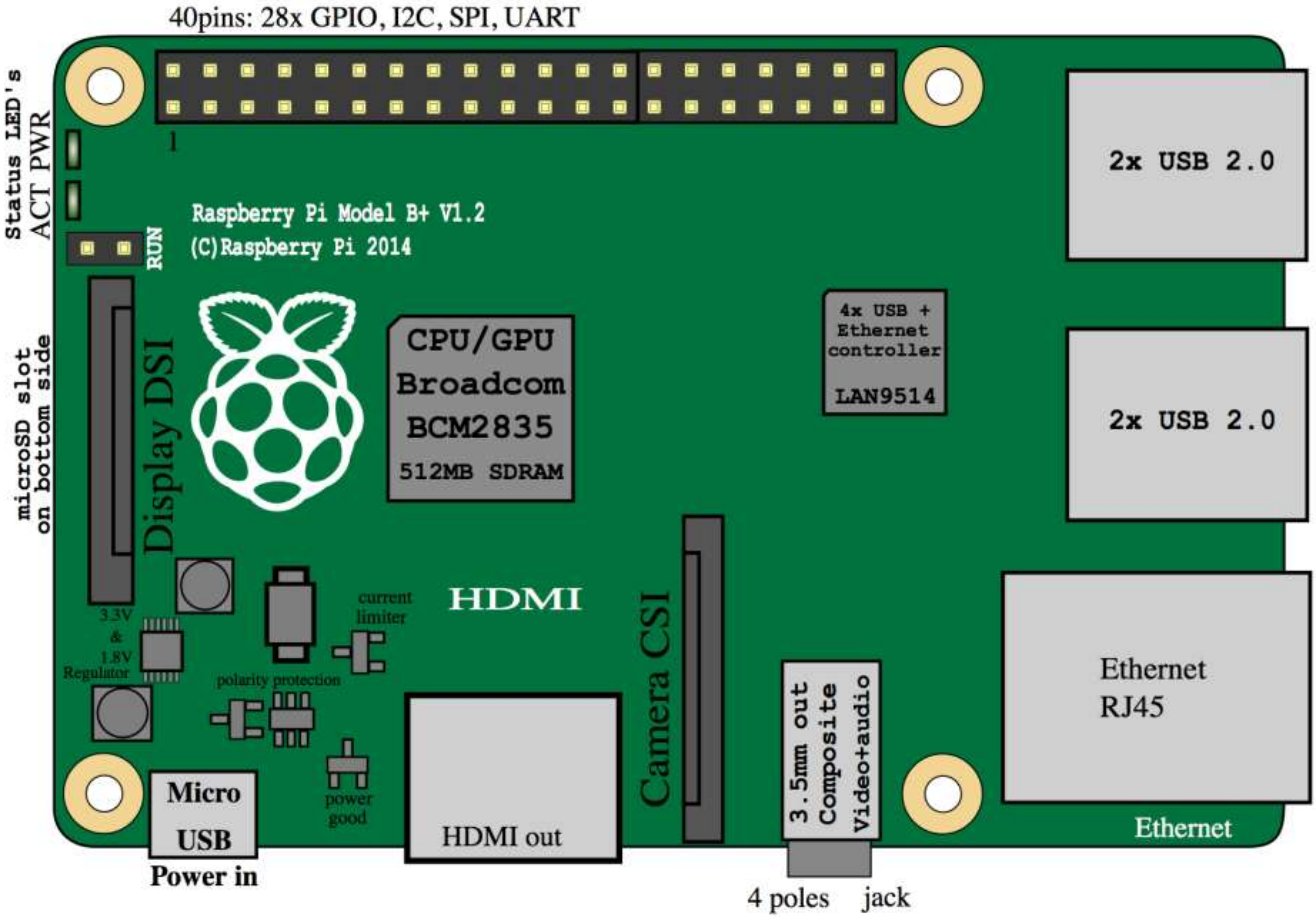
IoT RC Car Technology Stack



History

- Designed in UK, **University of Cambridge, 2006**, to be a chip alternative to computers to students. Also a way to students rediscover how cool is to work with Robotic.
  It has been projected to educational purposes but can used in Commercial ones too.




40pins: 28x GPIO, I2C, SPI, UART
1
Status LED's
ACT PWR
RUN
Raspberry Pi Model B+ V1.2
(C)Raspberry Pi 2014
2x USB 2.0
2x USB 2.0
4x USB + Ethernet controller
LAN9514
CPU/GPU
Broadcom
BCM2835
512MB SDRAM
microSD slot on bottom side
Display DSI
3.3V & 1.8V Regulator
current limiter
HDMI
polarity protection
power good
Camera CSI
3.5mm out Composite Video+audio
Ethernet RJ45
Ethernet
Micro USB
Power in
HDMI out
4 poles jack

Arduino is a microcontroller board

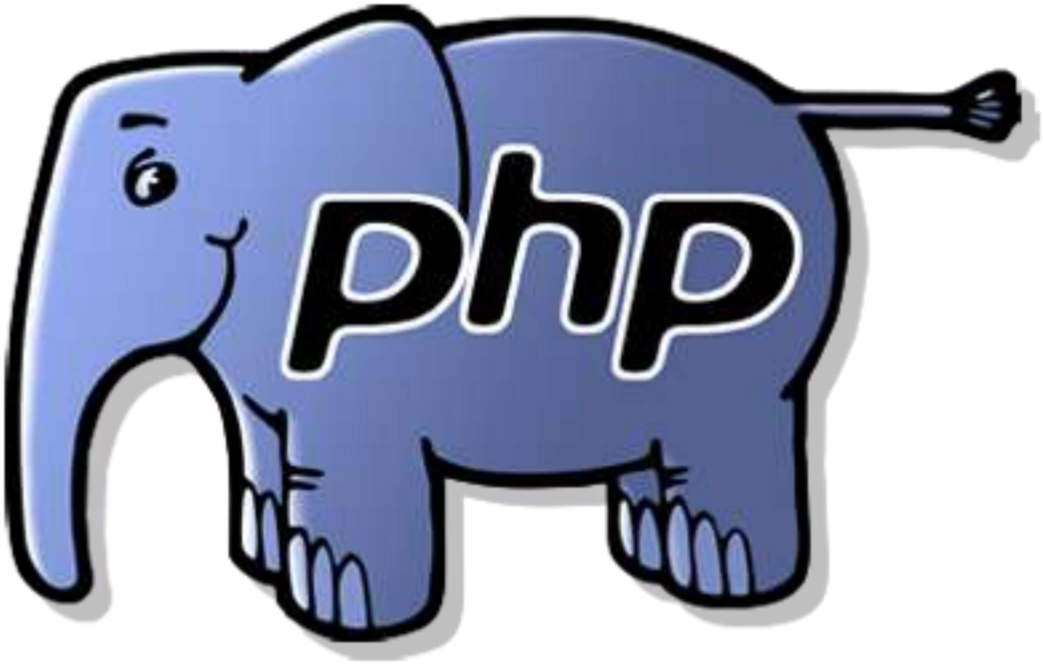
Single Board Computer, SBC, as **Raspberry Pi**, is a complete computer built on single circuit board with microprocessor, memory, input/output (I/O) and other features required of a funcional computer

Raspbian is an unofficial port of Debian Wheezy armhf with compilation settings adjusted to produce optimized "hard float" code that will run on the Raspberry Pi.

Best OS to Raspberry Pi nowadays. If you use Ubuntu, you're going to feeling in home. All basic Unix commands works on it and almost all basic server-side too: **Apache, Nginx, PHP, Java, Python, MySQL**

Note: Raspbian is not affiliated with the Raspberry Pi Foundation. Raspbian was created by a small, dedicated team of developers that are fans of the Raspberry Pi hardware, the educational goals of the Raspberry Pi Foundation and, of course, the Debian Project.

Game controller and car’s image viewer



Capture image & control streaming data

Client. Commands motor & sends car’s moviment data
We’re going to use the JVM and PI4J Library

Have you had noticed?

LAB TIME

To install it in your MicroSD card (Recommend 8Gb or more)

http://www.raspberrypi.org/documentation/installation/installing-images

Turn it on connecting a 1amp 5v power supply.
It’s recommended at first time you connect it to a HDMI Display and to a keyboard.

Default user: pi / Default password: raspberry
And never forget: **sudo apt-get install** and be happy :D

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+ = Raspbian

Configure your wifi credentials:

```
sudo nano /etc/wpa_supplicant/wpa_supplicant.conf
```

(file content below)

```
network={
        ssid="iPhone"
        psk="43070720"
}

network={
        ssid=”<<your-wifi-name-here>>"
        psk=”<<your-wifi-password>>"
}

network={
        ssid="BoxNet"
        psk="hackkitty"
}
```

Configure your wifi network using **static IP**:

sudo nano /etc/network/interfaces

(file content below)

```
auto lo

iface lo inet loopback
iface eth0 inet dhcp

auto wlan0
allow-hotplug wlan0
iface wlan0 inet static
address 192.168.0.218
netmask 255.255.255.0
gateway 192.168.0.1
wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf

iface default inet static
```

Configure your wifi network using **DHCP** (most used):

```
sudo nano /etc/network/interfaces
```

(file content below)

```
auto lo

iface lo inet loopback
iface eth0 inet dhcp

auto wlan0
allow-hotplug wlan0
iface wlan0 inet dhcp
wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf

iface default inet dhcp
```

```
sudo apt-get update
sudo apt-get dist-upgrade
//Upgrades Raspbian

sudo reboot
//Use Reboot to restart Raspbian safetly

sudo halt
//Use halt to turn off Raspbian safetly
```

Configure the DNS Servers

```
sudo nano /etc/resolv.conf
```

(file content below)

```
nameserver 8.8.8.8
nameserver 8.8.4.4

//Google DNS servers
```

Wiring Pi

It is GPIO Interface library for the Raspberry Pi. It’s written in C for the BCM2835 used in the Raspberry Pi.

WiringPi includes a command-line utility **gpio** which can be used to program and setup the GPIO pins.

Wiring Pi

Installation

```
sudo apt-get install git-core
git clone git://git.drogon.net/wiringPi
cd wiringPi
git pull origin
./build
```

Test

```
gpio -v
gpio readall
```

Wiring Pi

Installation

```
sudo apt-get install git-core
git clone git://git.drogon.net/wiringPi
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git pull origin
./build
```

Test

```
gpio -v
gpio readall
```

Accessing your Raspberry Pi Remotely via SSH

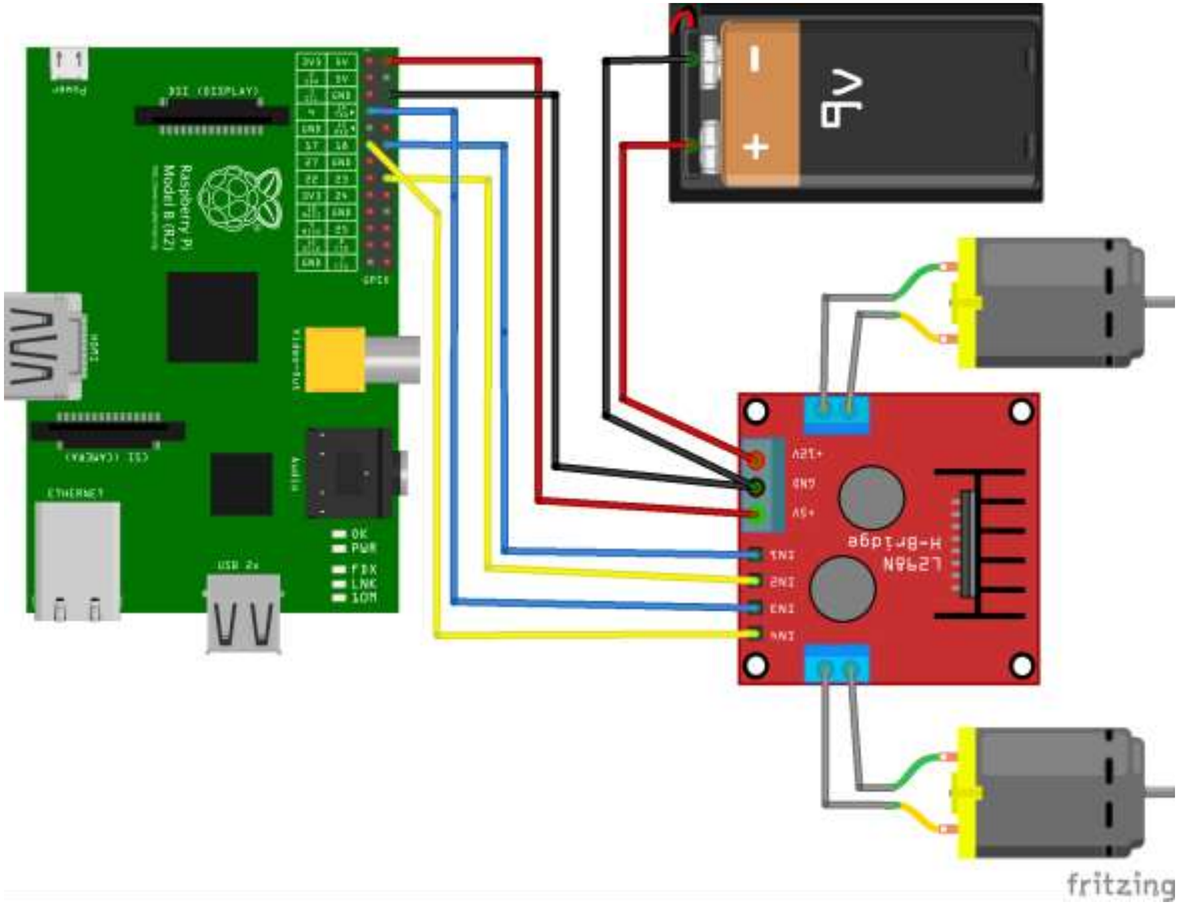
It’s recommended you connect the wires and access your Raspberry Pi via SSH from now on.

From your computer (that must be on the same network):

```
$ ssh pi@<<your-raspberrypi-ip>>
```

IoT RC Car
Electronic Schema

Turn your Raspberry Pi off and connect the jump wires following this schema:



PI4J Installation

It depends on Wiring Pi library so don’t jump Wiring Pi installation steps

```
$ cd ~/

$ curl -s get.pi4j.com | sudo bash
```

Brasilino’s Client compilation & installation

This project uses Maven and Git

In your computer create a folder and execute:

```
$ git clone https://github.com/jeffprestes/brasilino.git
$ cd brasilino-java-client-raspberry
$ mvn install
$ cd target
```

```
$ scp brasilino-java-client-raspberry-0.1-jar-with-dependencies.jar
<your-user>@<yourmachineip>:~/brasilino.jar
```

Or use your WinSCP

Brasilino’s Client execution

Access via SSH the RaspberryPi of your Car again.
And execute:

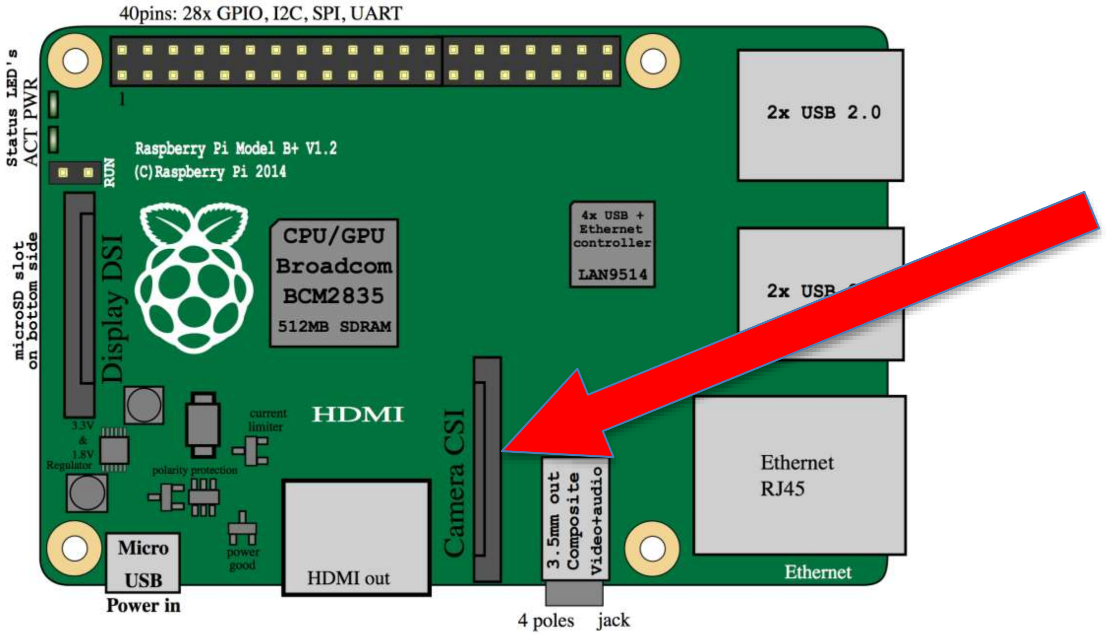
```
$ sudo java –jar brasilino.jar
```

You must start to see the logs (the Controller test the motor access)

Media streaming installation

If you want to see real time image from your Car you will need to use Raspberry Pi camera module.

If you have it, turn the Raspberry Pi off and connect it physically to the correct slot



Media streaming installation

Turn it on again, connect via SSH and go back to pi root folder:

```
$ cd ˜/
```

And get the installer script, give the appropriate permissions and execute it:

```
$ git clone https://github.com/silvanmelchior/RPi_Cam_Web_Interface.git
$ cd RPi_Cam_Web_Interface
$ chmod u+x RPi_Cam_Web_Interface_Installer.sh
$ ./RPi_Cam_Web_Interface_Installer.sh install
```

You’ll see that Apache, PHP and raspimjpeg will be installed.

Media streaming configuration

To have access to IoT RC Car images just access the root page of the Apache Web Server we have installed.

From your computer:

http://<<your-raspberrypi-ip>>/

More details you can find at:
https://github.com/silvanmelchior/RPi_Cam_Web_Interface/blob/master/RPiCam.pdf

Thanks Sylvan Melchior & Robert Tidey

Mobile controller

This project uses **Android Studio**.

In your Android Studio, import the Brasilino’s project that is located inside the Android’s folder at Brasilino main project folder.

If everything is correct, just run it on your device or emulator (yes, you’ll be able to run it from your computer too!)

Mobile controller

Important: the idea of the project is give an idea to make money renting your IoT RC car, like Car2Go services :D

So, at First time it will connects you to a PayPal Checkout running in PayPal Test Environment called Sandbox.

To use it, just go to developers.paypal.com, login with your PayPal account, go to Dashboard. In new screen click on Accounts under Sandbox menu and create a fake Personal account and use it when Mobile Controller redirects you to PayPal Sandbox checkout

Mobile controller

After that, click on Toolbox icon and defines the IP of your IoT RC Car.

The Mobile controller uses Sockets to connect and send the commands to the Raspberry Pi on IoT RC Car.

Also, it uses WebViewer to show Raspberry Pi’s camera image.

Mobile controller

But, wait! You aren’t viewing the image.

You must copy the camera.php script that is at camera folder under Brasilino’s project folder to /var/www/camera.php on the IoT RC’s Car Raspberry Pi.

```
$ scp camera.php pi@<<your-pi-ip>:/home/pi/camera.php
```

Access your IoT RC’s Car Raspberry Pi via SSH. And on it:

```
$ cp camera.php /var/www/camera.php
$ chown /var/www/camera.php www-data
```

Try it again!

YES!!
IT WORKS!
memegenerator.net

QUESTIONS?
memegenerator.net

Thanks.

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