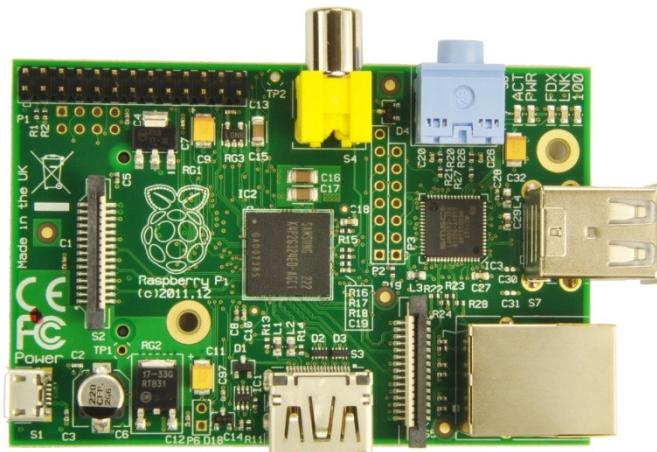
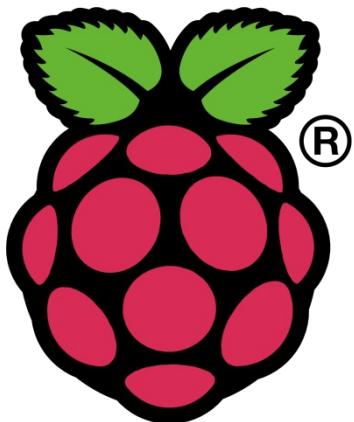


How to become a maker using Raspberry Pi and Python



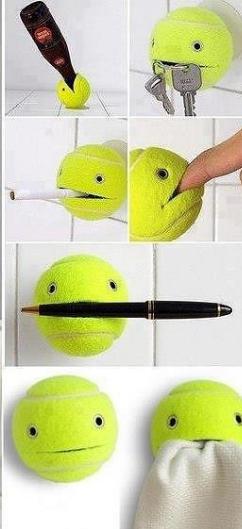
Lentin Joseph
Founder of **Qbotics Labs**
<http://www.qboticslabs.com>

<http://www.lentinjoseph.com>

<http://www.technolabsz.com>

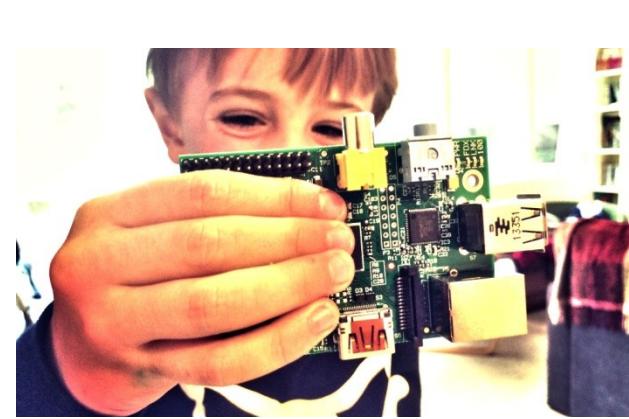
DIY Culture ??

- “Do It Yourself”
- Build things without the help of a paid expert
- Building things by re-using and recycling old products



Maker Culture

- Focusing mainly on engineering oriented subjects like electronics, robotics, 3D printing etc.
- <http://makerfaire.com/>
- <http://makezine.com/>

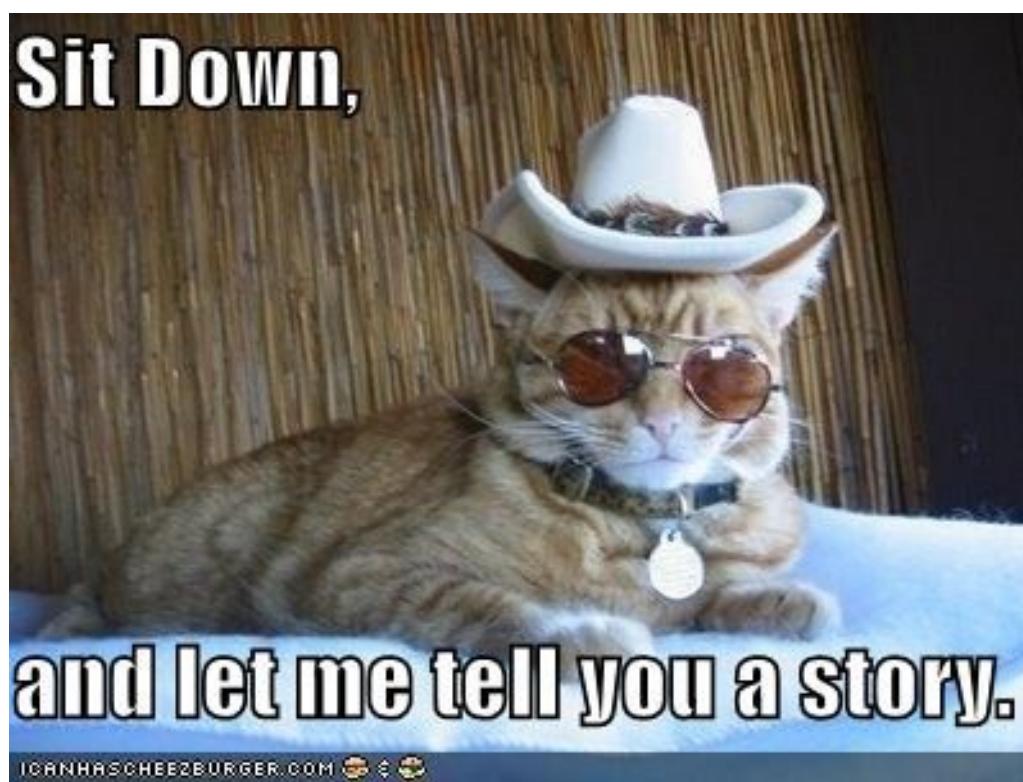


How to become a maker

- Achieve Self-Sufficiency(Google, YouTube)
- Build a workbench
- Start hacking



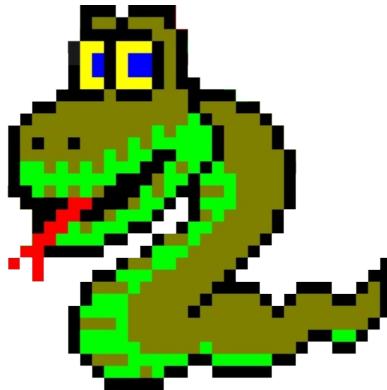
Let me tell you my story of learning python..



**Joined Btech & bought a
computer : 2007**



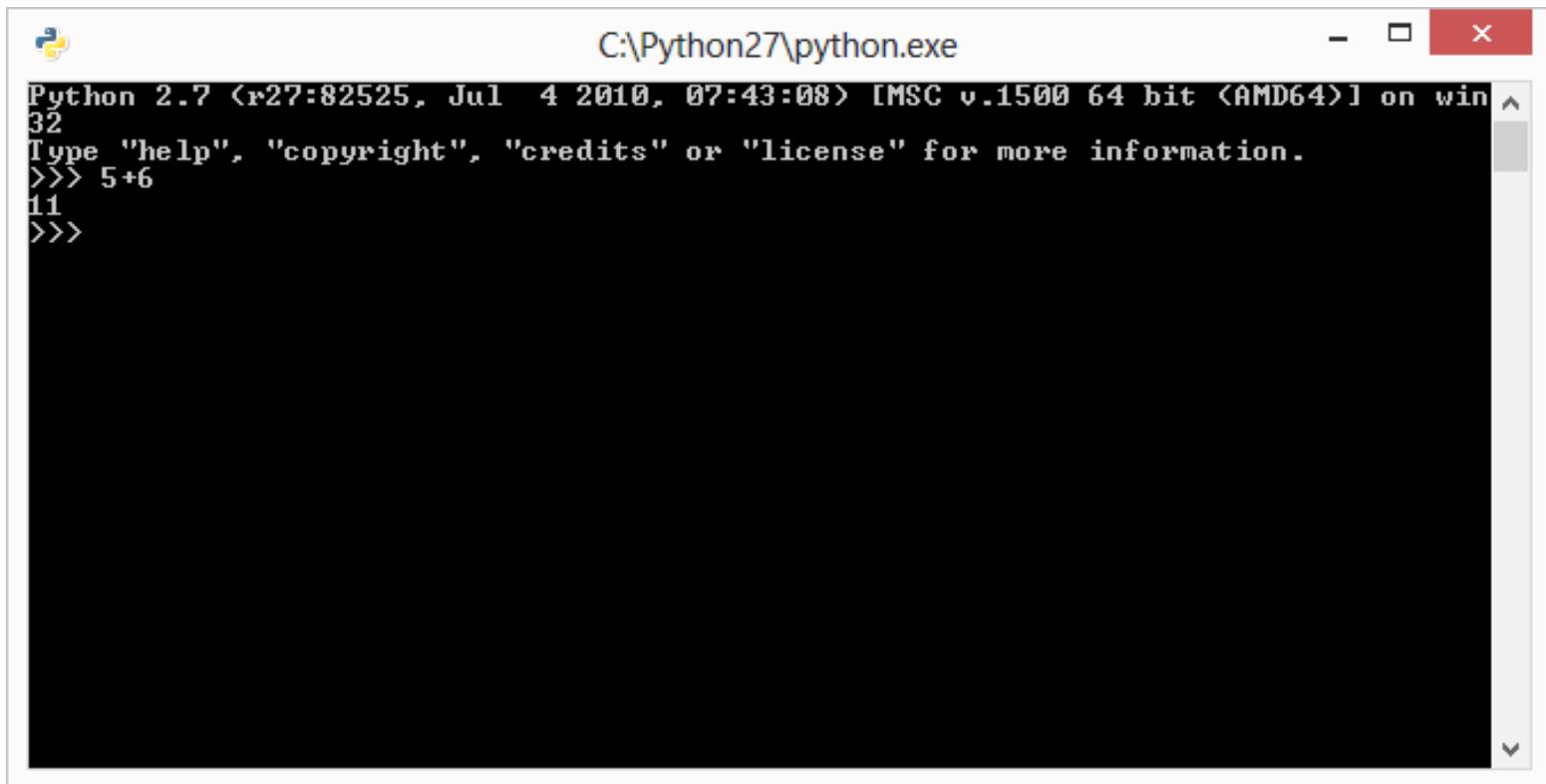
What is Python ? Is it a game like snake ???? : 2007



Python
 [Download](#)



My first Python code :2007



A screenshot of a Windows command prompt window titled "C:\Python27\python.exe". The window contains the following text:

```
Python 2.7 (r27:82525, Jul  4 2010, 07:43:08) [MSC v.1500 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> 5+6
11
>>>
```

Joined FISAT Research Team : 2008

- Python helped me to get in this group
- Learned more about Python from this Group too.



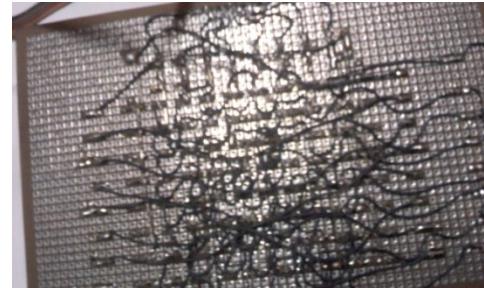
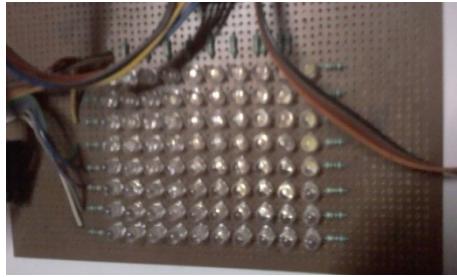
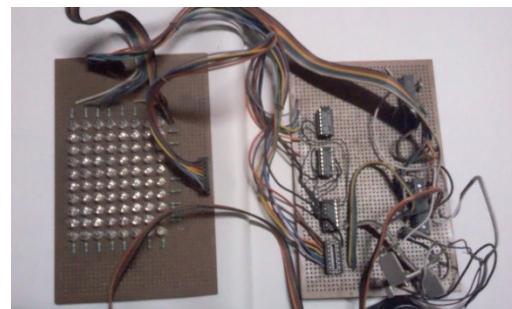
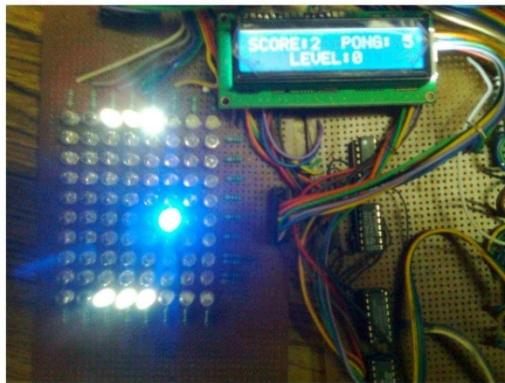
DIY Walker Robot : 2008



Implemented DIY Ping-Pong game : 2009

- Mini Project

MINI PROJECT: PONG GAMING CONSOLE

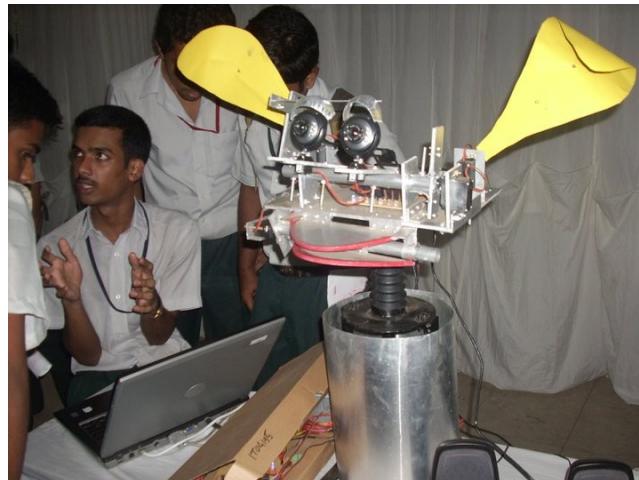


DIY Scoreboard for FISAT - 2010



DIY Social Robot : 2010

- Final Year Project
- Running in Linux and Python



<https://github.com/lentinjoseph/Social-Robot>

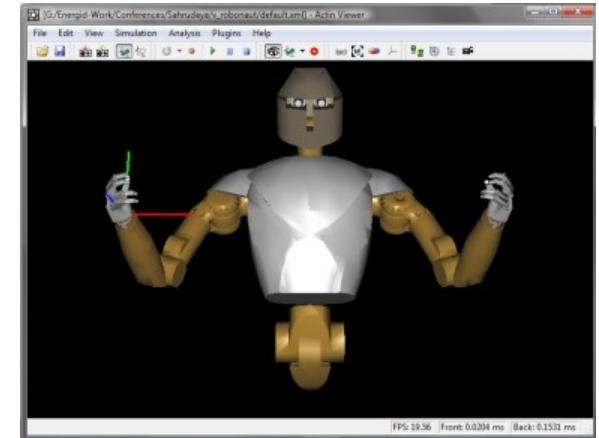


Media Clips. 2011



Started Working @Energid-2011

- <http://www.energid.com/>
- Build Python wrapper for the simulation tool and arm interface to ROS using Python



Started blogging about Python and Robotics.. 2011

- <http://www.technolabsz.com>



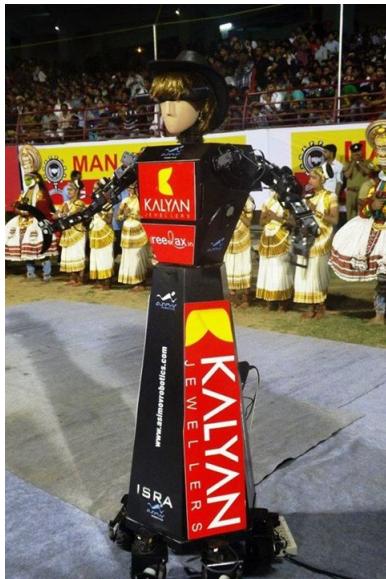
Energid team forms ASIMVO Robotics..2012

- <http://www.asimovrobotics.com>



ISRA(Intelligent Service Robot Assistant) . 2012

- Running in Linux, Python and ROS



ISRA Robot on Media .2012



The prototype of the social robot extending a warm welcome to Chief Minister Oommen Chandy before the inauguration of the Startup Village at Kinfrapark in Kalamassery on Friday. K Rajesh Kumar

A collage of images from Startup Village. It includes a man in a white shirt and tie standing in front of a blue wall; a group of people gathered around a table with a laptop; a man in a striped shirt standing next to a woman; a man in a white shirt working at a desk; and a man in a white shirt standing next to a large industrial machine.



(From top to bottom) 1) England fans at the stadium. 2) A humanoid robot built by Asimov Robotics waves the Indian flag. It also mimicked the decisions taken by the umpire on the ground. The company says it is a step towards robot-enabled umpiring. 3) Kerala Chief Minister Oommen Chandy congratulates Ravindra Jadeja for his man-of-the-match performance.

Speaker @PyCon13

- Application of Python in Robotics
- <https://www.slideshare.net/lentinjoseph/py-con2013-application-of-python-in-robotics-2580517>
- Showcased a Raspberry Pi Robot Demo having image processing



Workshops in Raspberry Pi and Python . 2013



Started Qbotics Labs. 2014

- Mainly into Robotics, Image Processing, Embedded System



<http://www.qboticslabs.com>

Developed an autonomous mobile robot for serving and cleaning. 2014

Running in Linux, ROS and Python

THE NEW INDIAN EXPRESS MONDAY 17 NOVEMBER 2014

BUSINESS KERALA

Thanks to Chefbot, Robots to Wait Tables at Food Joints Soon

by Alex Mathew

Kochi: Ever fancied a robot serving food on your table at restaurants? The sci-fi dream is finally coming true with 'Chefbot'. If things go as planned, you will soon see robots populating restaurants near you. Designed and developed by Lentin Joseph, founder and CEO of Qbotics Labs, a startup virtually incubated at Startup Village, Kochi, it is currently operating from Kumbamassery near Aluva. Chefbot, is an intelligent robot that functions on autonomous mobile navigation concept. Once the table number is fed, the said robot can serve food to customers on its own. How does it work? Customers place orders through the digital menu and the Chefbot will deliver the order to the table. The

ground work for the project has begun a few years ago and it is poised to be implemented in a few years time.

Lentin made his baby steps towards Chefbot about three years ago and the prototype is ready. At the recently concluded YES summit 2014 held at Angamaly, he got critical appreciation and even the Chief Minister himself took a look at the functioning of the robot.

"During my studies at Federal Institute of Science and Technology (FISAT), I had built a social robot which can communicate with human beings. After my BTech graduation in Electronics and Communication Engineering from a robotics-based company, Energid Technology later known as ASIMOV Robotics. After three years there,

START-UPS

"I started my own company in January 2014," Lentin says.

Lentin, who has had a passion for serving food, cleaning robots, and cars, can be used as research platform for students and engineers at ITIs.

"We are mainly focusing on developing service robots and we named it as Chefbot. Low cost hardware is used now and the manufacturing cost comes



Lentin Joseph and his team members Jeron K Joy and Socray Krishnan with the prototype of (right) autonomous mobile robot - Chefbot

AUTONOMOUS MOBILE NAVIGATION
Mobile robots are complex systems that can move in real world environments and can take decisions based on uncertain or on partially available information. The Indian School of Business has a program that involves developing technology for autonomous cars works on Autonomous Mobile Navigation concept.

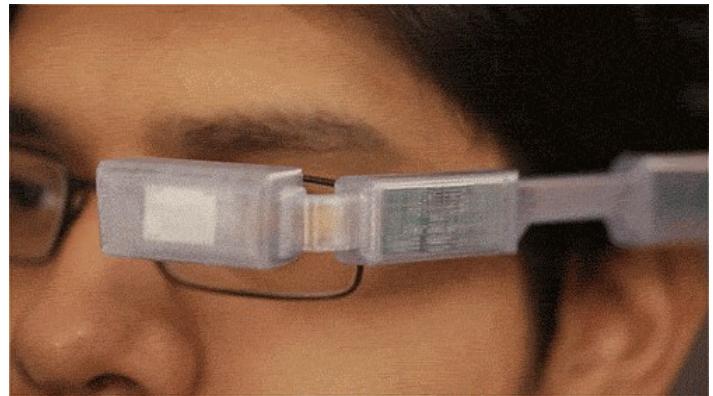
technology includes green inventions that are environmentally friendly and involve energy efficiency, recycling, reusing, and health conscious, renewable resources etc. Apart from Lentin, two other interns - Socray Krishnan and Jeron K Joy, are working on midnight oil to develop robotic applications at Qbotics Labs. www.qboticslabs.com 8907590702.



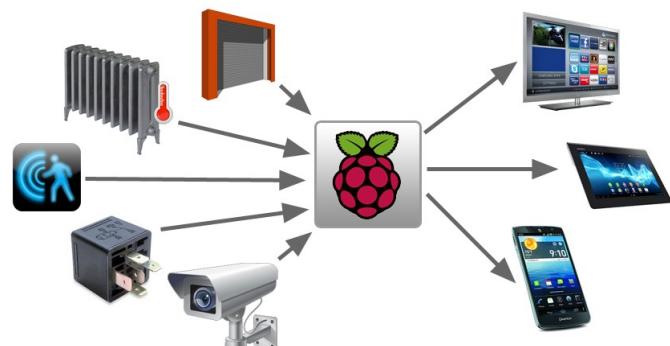
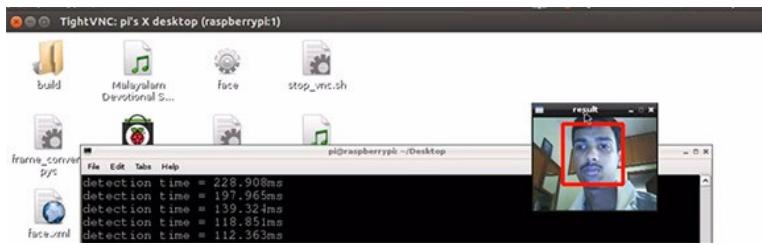
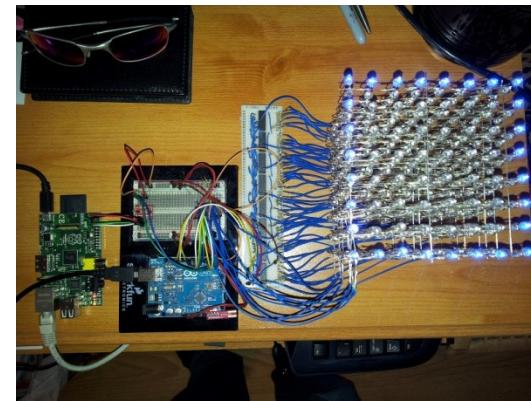
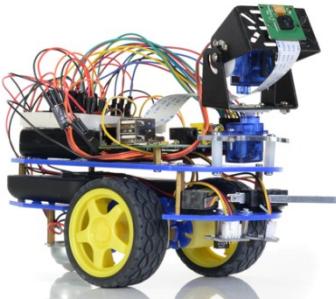
**Journey continues ..
Still studying Python like a Kid....20xx**



Let's see, things built using Rpi.



Let's see, things built using Rpi.



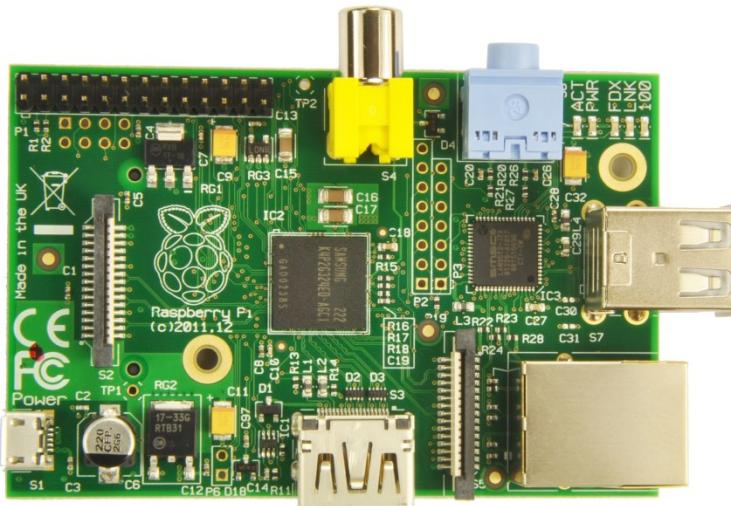
Agenda

- Introduction to Raspberry
- Hardware description
- Installation of OS
- OS Introduction
- Remote Access using SSH, VNC
- Package Management
- GPIO, I2C, SPI

Agenda

- Wiring Pi and Python GPIO
- Hello World demo
- LED Blink, PWM etc
- Raspberry Pi and Arduino
- Raspberry Pi and Camera

Raspberry Pi & PC



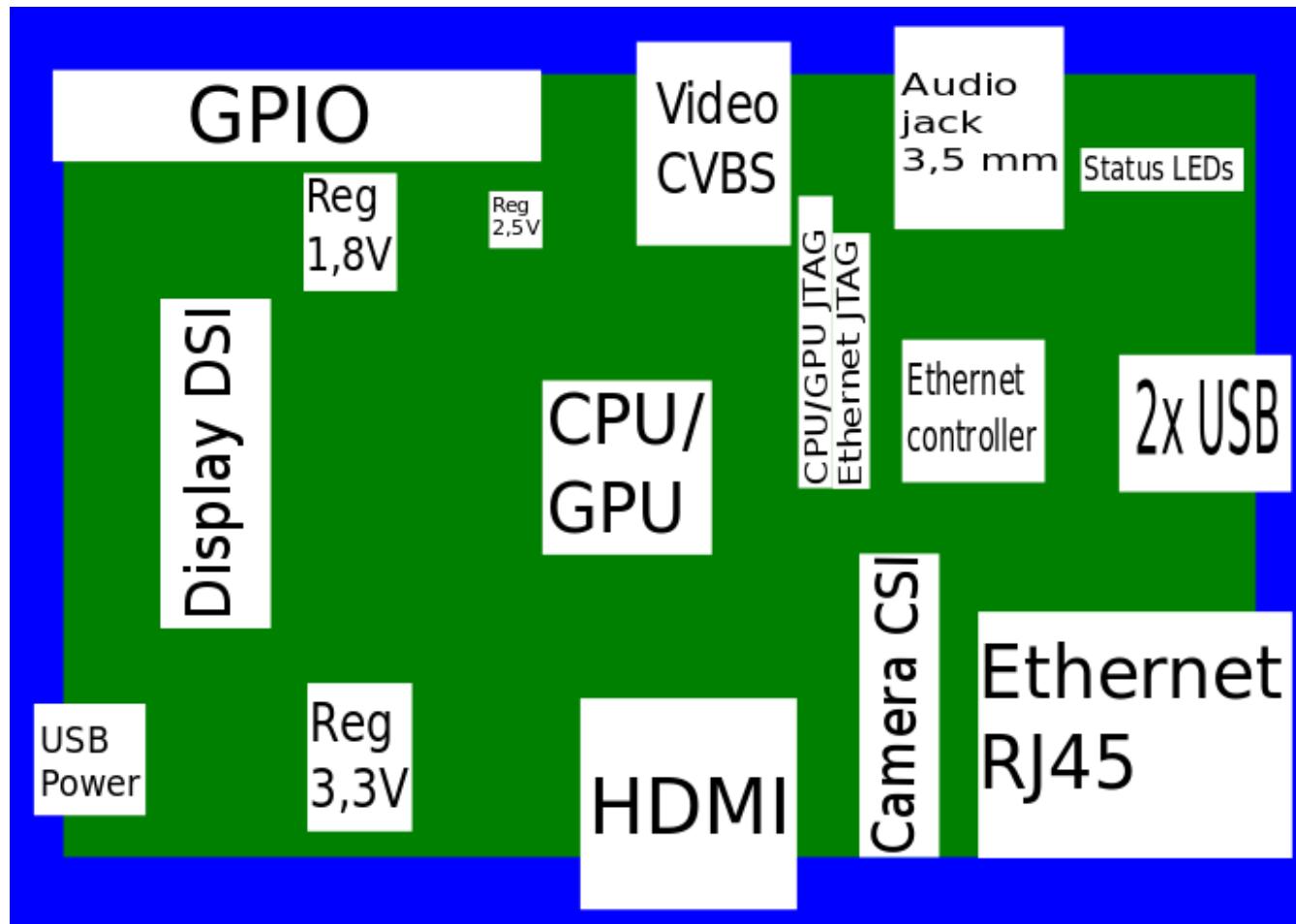
Compare Raspberry Pi and a PC

Components	Laptop or PC	Raspberry Pi Ver B
Processor	Intel 2.2 Ghz,Dual Core	700 Mhz,Single Core Arm 11
RAM	6GB	512 MB
Graphics	Intel HD 3000	Dual core video core IV
Ethernet	Yes	Yes
USB 2.0	Yes	Yes
Video O/P	VGA ,HDMI	Composite RCA HDMI
Audio O/P	Yes	Yes
Storage	500 GB Harddisk	32 GB SD Card
Operating System	Linux/Windows	Only Linux
Dimensions	14 inch laptop	8.6x5.4x1.7 cm

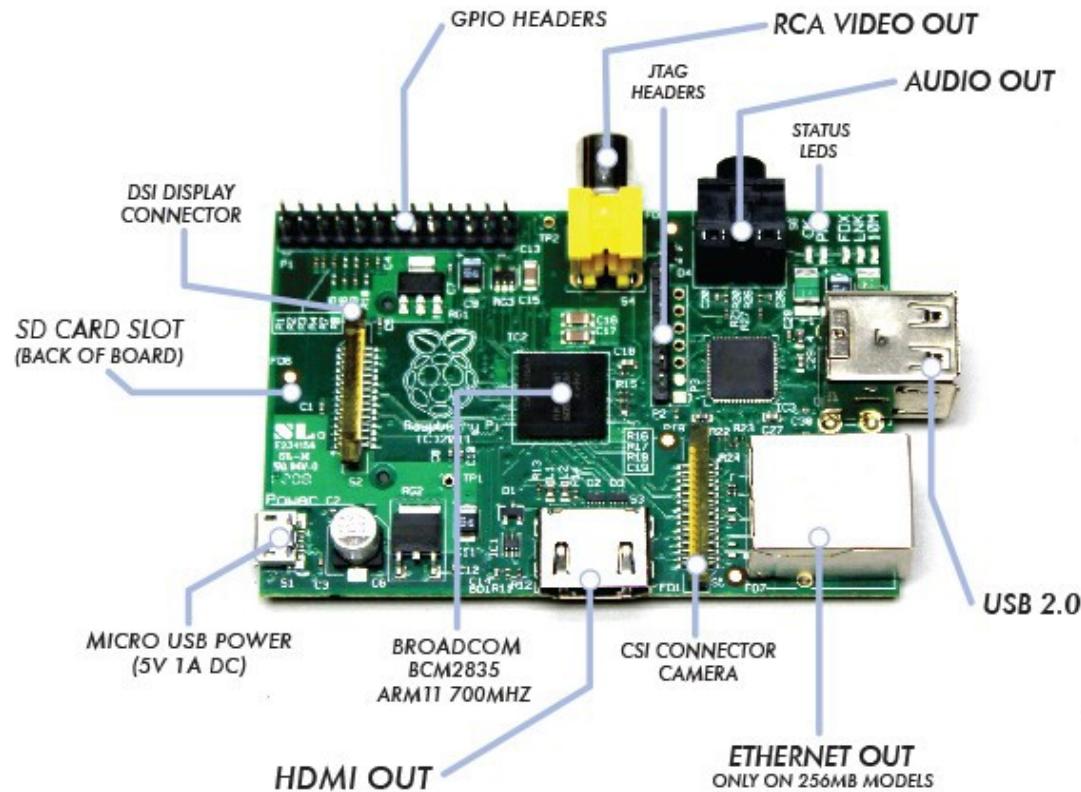
Raspberry Pi Model A&B

	Model A	Model B
RRP	\$25	\$35
System on a Chip		Broadcom BCM2835
CPU		700 MHz ARM1176JZF-S core
GPU		Broadcom VideoCore IV, OpenGL ES 2.0. Device capable of MPEG-2 and VC-1, 1080p30 h.264/MPEG-4 AVC decoding and encoding.
Memory (SDRAM)	256 MB, shared with GPU	512 MB (models build since October 15 th 2012), shared with GPU
USB 2.0	1	2 (integrated USB hub)
Video Out		Composite RCA (PAL and NTSC), HDMI (also Display Serial Interface for LCD panels)
Audio Out		3.5 mm jack, HDMI
Storage		SD/MMC/SDIO card slot
Network	No connector	RJ45 Ethernet through integrated USB hub
Peripheral connectors		8 x GPIO, UART, I ² C bus, SPI bus
Power rating	300 mA (1.5 W)	700 mA (3.5 W)
Power source		5 volt via MicroUSB or GPIO header

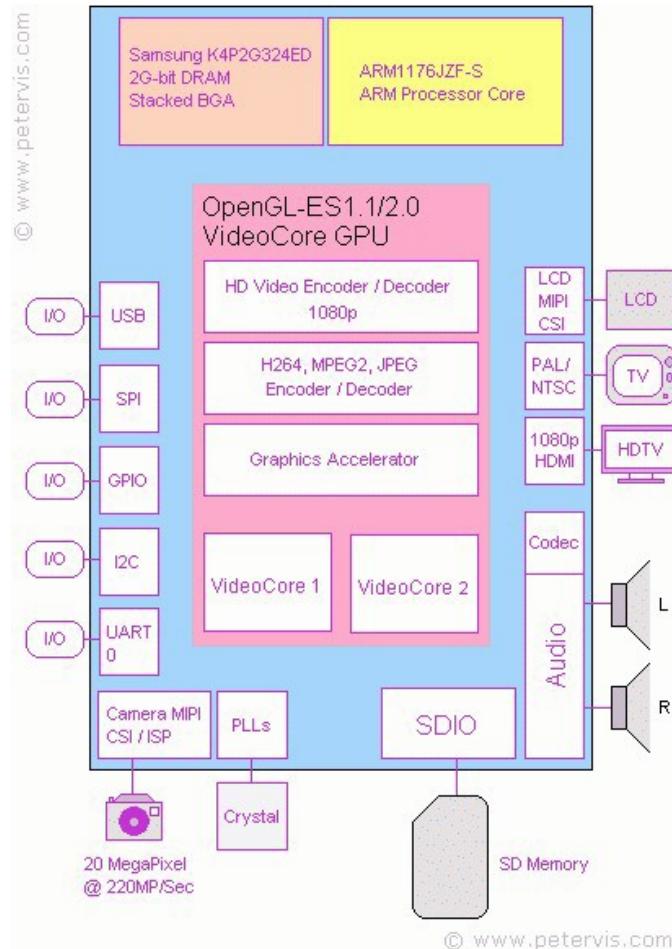
Raspberry Pi Components



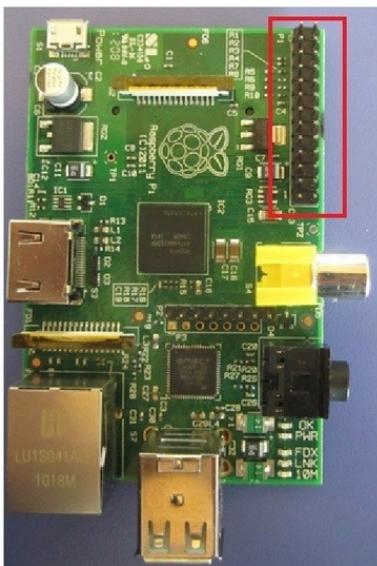
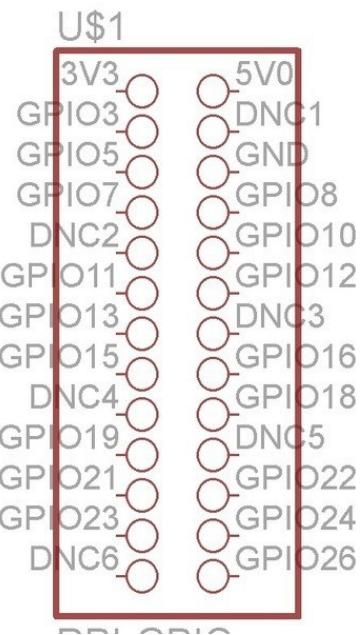
Raspberry Pi Components



BCM 2835 SoC(System on Chip)



Raspberry Pi : GPIO

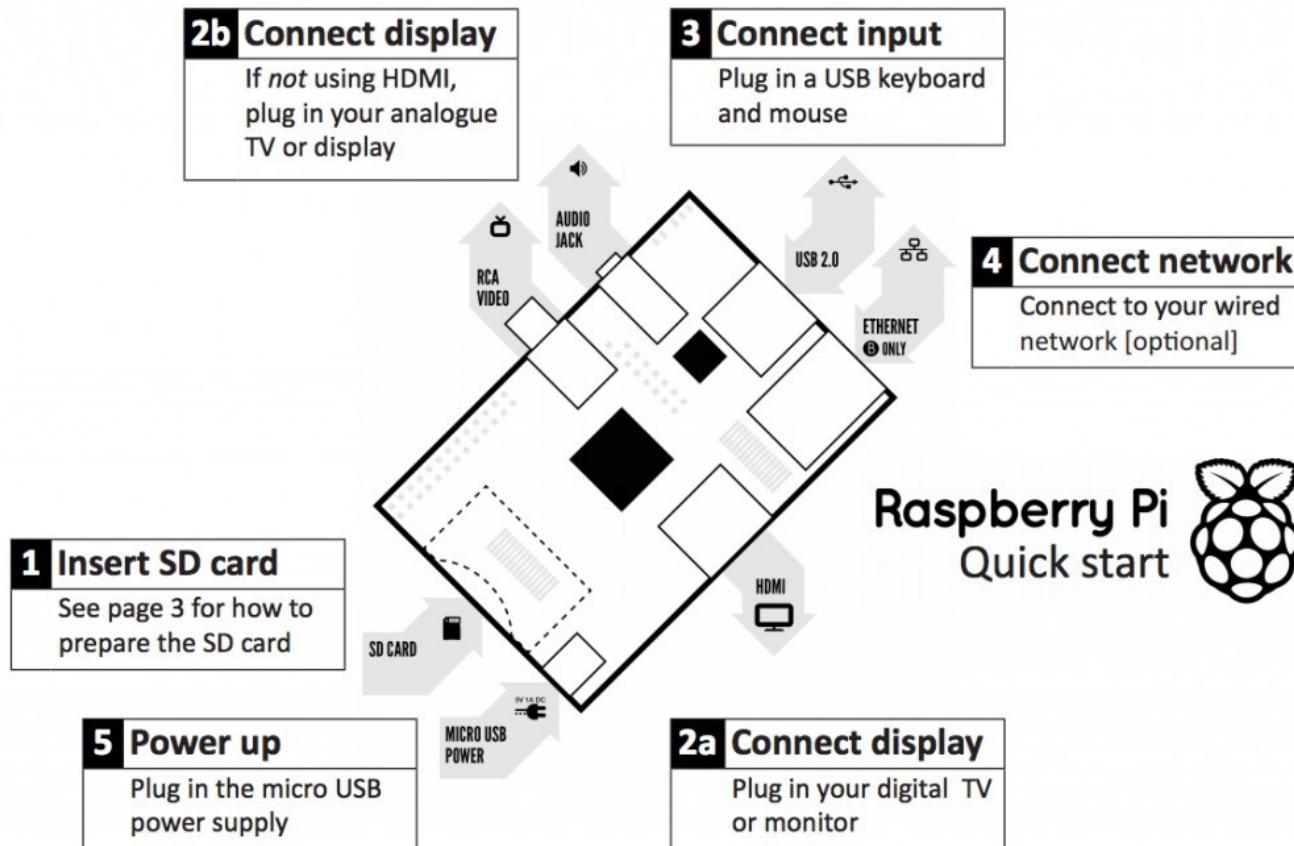


3.3V	1	2	5V
I2C1 SDA	3	4	5V
I2C1 SCL	5	6	GROUND
GPIO4	7	8	UART TXD
GROUND		10	UART RXD
GPIO 17	11	12	GPIO 18
GPIO 27	13	14	GROUND
GPIO 22	15	16	GPIO 23
3.3V	17	18	GPIO 24
SP10 MOSI	19	20	GROUND
SP10 MISO	21	22	GPIO 25
SP10 SCLK	23	24	SP10 CEO N
GROUND	25	26	SP10 CE1 N

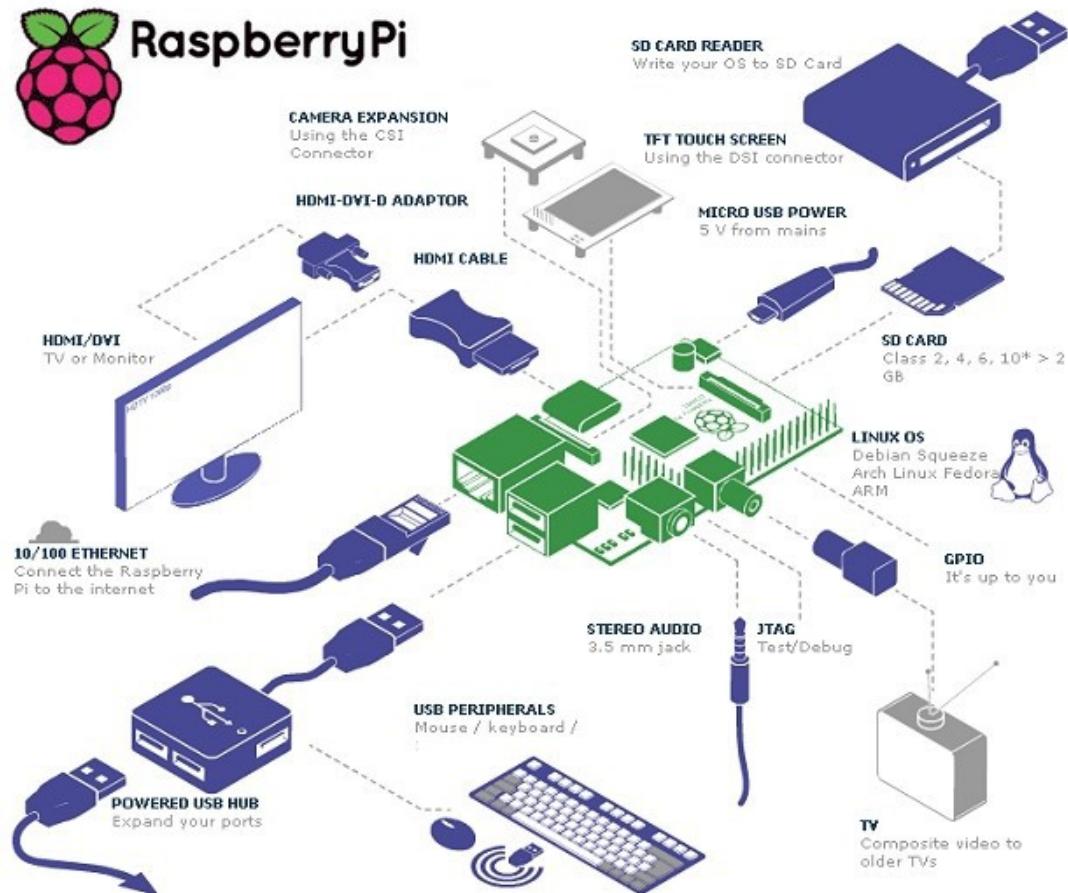
Raspberry Pi : GPIO

- 8x GPIO(General Purpose Input/Output)
- UART, I2C, SPI Bus
- 3.3V and 5V pins

RPi Connection Diagram



Rpi Connection Diagram



Basic GNU/Linux commands

- \$ls – List Files
- \$cd – Change Directory
- \$mkdir – Create folder
- \$rmdir – Delete folder
- \$clear – Clear terminal
- \$nano – Text editor

Basic GNU/Linux commands

- \$dmesg – Show kernel messages
- \$lsusb – List connected usb devices
- \$cp – Copy Files
- \$ssh – Secure shell
- \$scp – Copy files from one pc to other using ssh
- \$vncviewer – Connect to vnc server

Basic GNU/Linux commands

- \$sudo – Run in root privilage
- \$ping – Pinging to ip address
- \$nmap – Searching tool of IP and Ports

Installation of OS

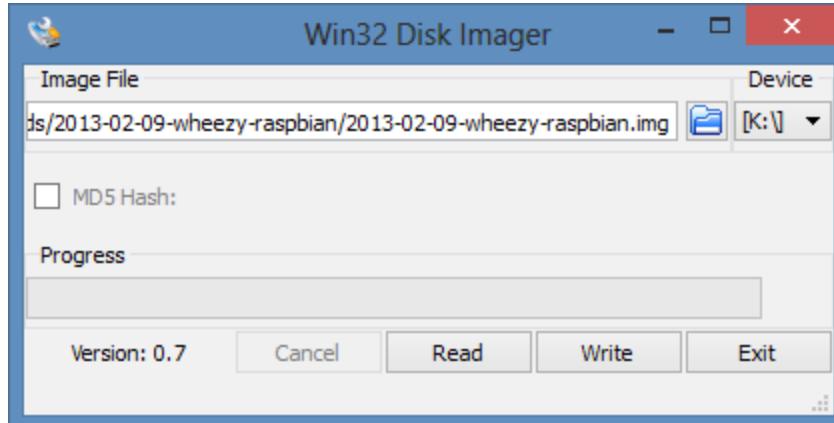
- OS Name : Raspbian/Linux
- Download link:
- <http://www.raspberrypi.org/downloads>
- Based on Debian operating system
- Desktop Environment : LXDE
- Light weight OS

Installation of OS

- Installation tools
- For Windows
 - Win32DiskImager.exe
 - <http://sourceforge.net/projects/win32diskimager/>
- For Linux
 - \$dd(Disk Dump)

Installation of OS

- Procedure in Windows
 - Format SD Card in FAT 32/ext2
 - Use Win32DiskImager.exe



Installation of OS

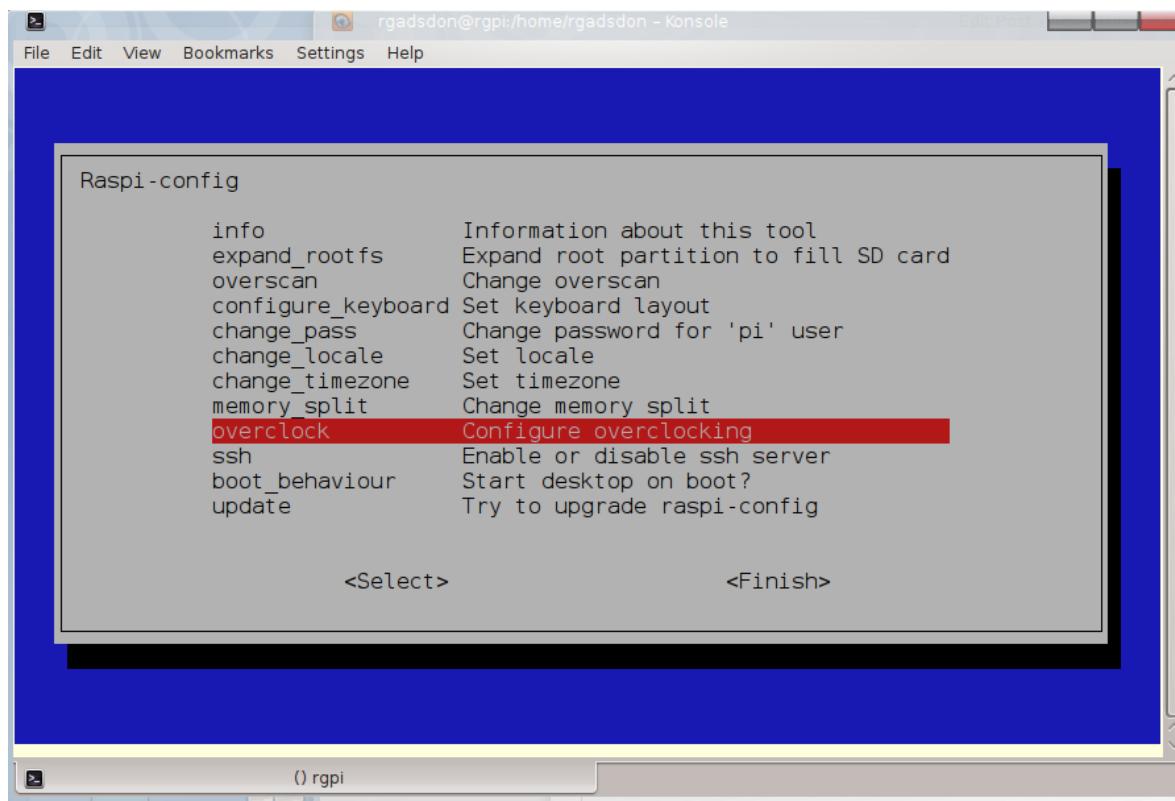
- Procedure in Linux
 - Format SD Card in FAT 32/ext2
 - \$ sudo apt-get install pv(pipe viewer)
 - \$ dd bs=1M if=<img_name>.img | pv | sudo dd of=<dev_name>
 - Eg: \$ dd bs=4M if=2013-02-09-wheezy-raspbian.img | pv | sudo dd of=/dev/mmcblk0

Setting SSH

- SSH - Secure Shell
- http://en.wikipedia.org/wiki/Secure_Shell
- Direct and Remote Login methods in Rpi
- Types of remote connections
 - Rpi and PC connected through router
 - Rpi and PC connected through direct connection
 - Rpi Wi-Fi Hotspot

Raspi-config

- What is raspi-config



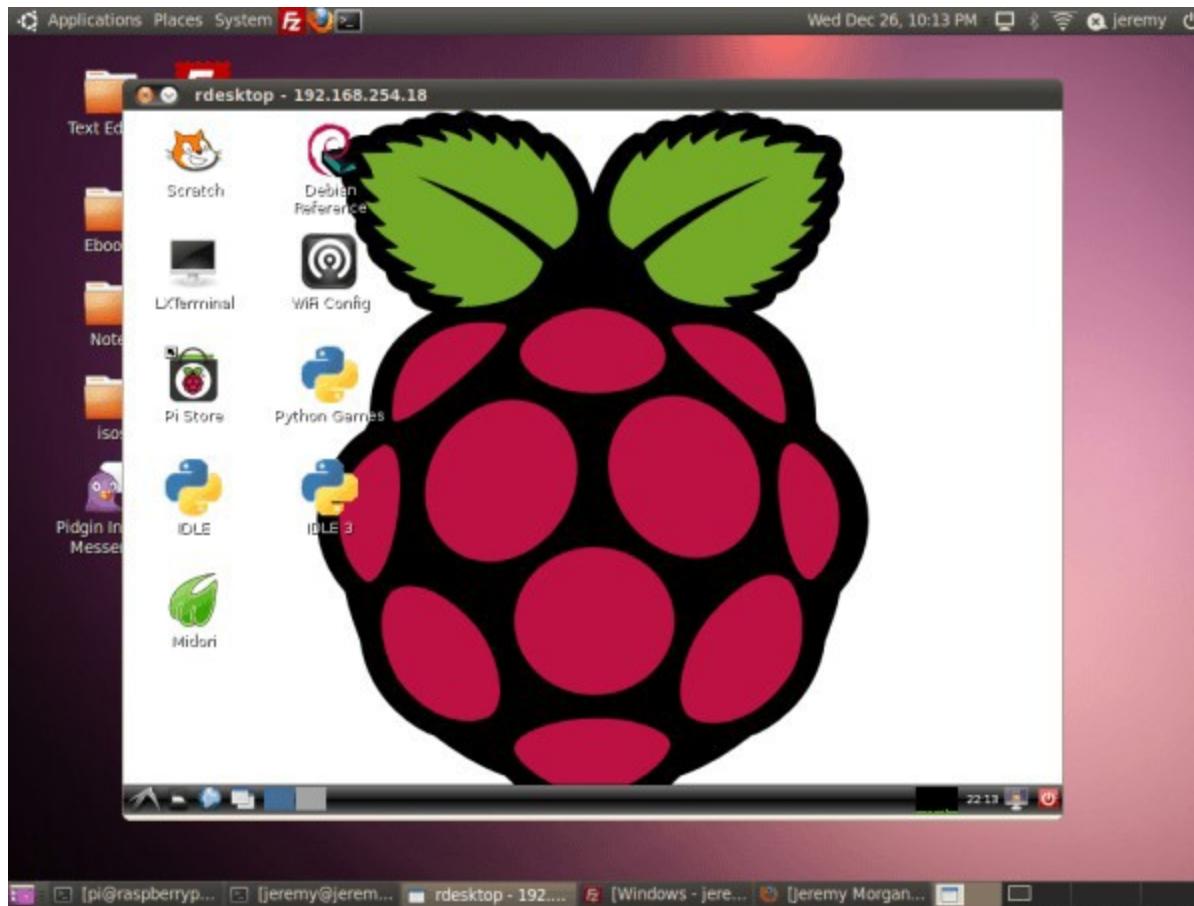
Setting VNC Server

- VNC(Virtual Network Computing)
- http://en.wikipedia.org/wiki/VNC_server
- Graphical desktop sharing system
- Installation
 - \$sudo apt-get install tightvncserver
- In Raspberry Pi
 - \$ vncserver :1 -geometry 1366x600 -depth 16 -pixelformat rgb565

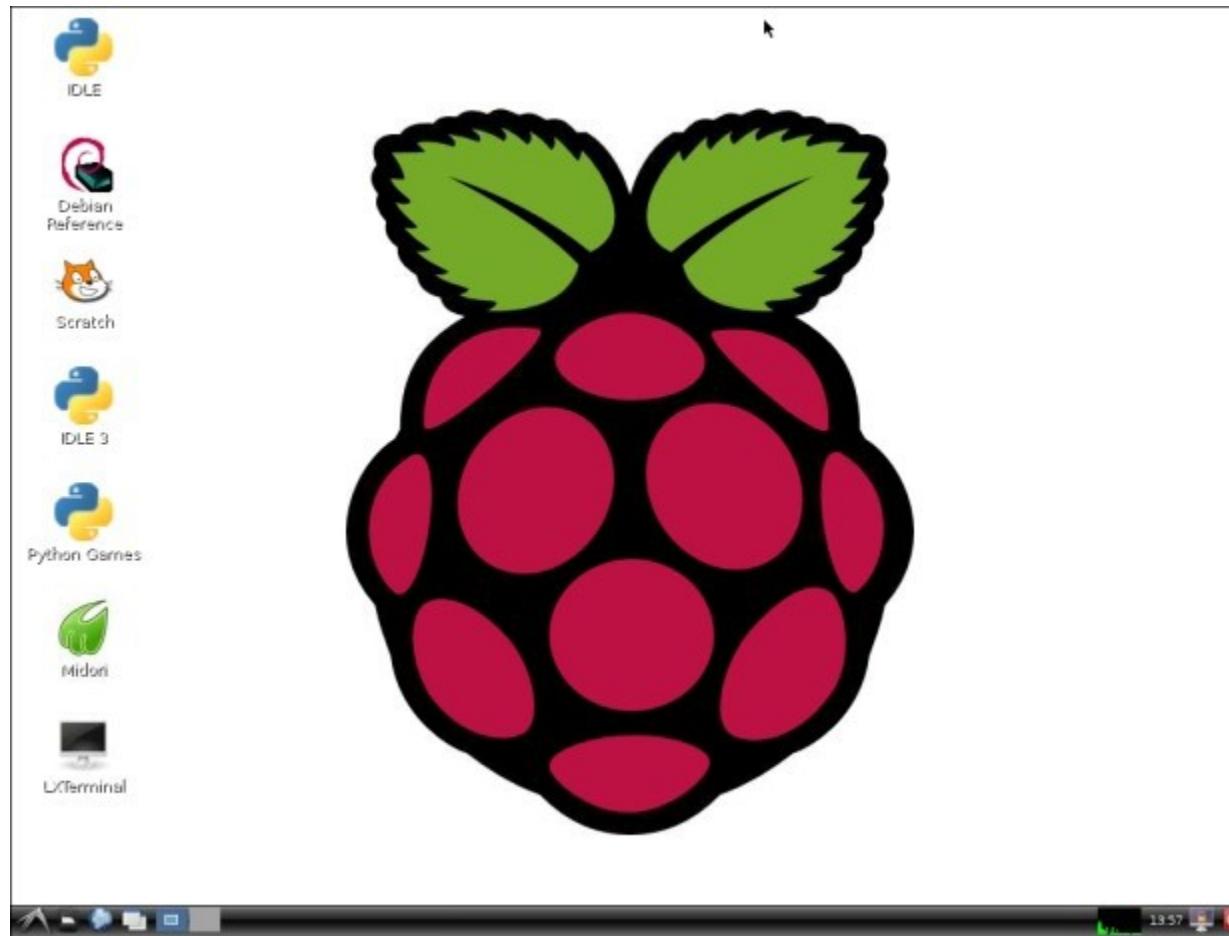
Setting VNC Server

- In PC
- Install tightvncviewer
 - \$ vncviewer ip:5901
 - \$ vncviewer 192.168.1.3:5901

Remote Desktop



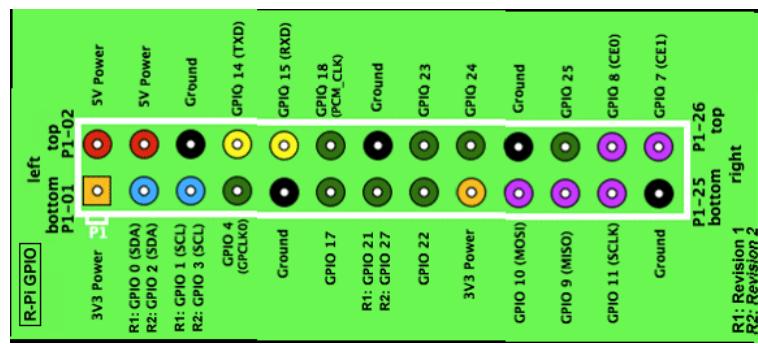
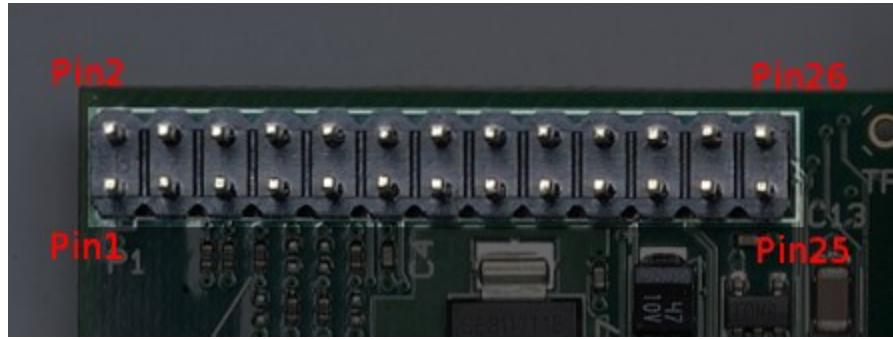
Introduction to Raspbian



Package Management

- \$apt-get install
- Synaptic Package Manager : GUI of apt-get
- \$dpkg

GPIO ,I2C,&SPI



GPIO ,I2C,&SPI

3.3V	1	2	5V
I2CO SDA	3	4	DNC
I2CO SCL	5	6	GROUND
GPIO4	7	8	UART TXD
DNC	9	10	UART RXD
GPIO 17	11	12	GPIO 18
GPIO 21	13	14	DNC
GPIO 22	15	16	GPIO 23
DNC	17	18	GPIO 24
SP10 MOSI	19	20	DNC
SP10 MISO	21	22	GPIO 25
SP10 SCLK	23	24	SP10 CEO N
DNC	25	26	SP10 CE1 N

GPIO ,I2C,&SPI

- GPIO Libraries
 - Rpi.GPIO
 - Wiring Pi

Rpi.GPIO Installation

- GPIO Library Installation
 - \$ sudo apt-get update
 - \$ sudo apt-get install python-dev
 - \$ sudo apt-get install python-rpi.gpio

Wiring Pi Installation

- Wiring Pi Library Installation
 - \$ sudo apt-get install git-core
 - \$ sudo apt-get update
 - \$ sudo apt-get upgrade
 - \$ git clone git://git.drogon.net/wiringPi
 - \$ cd wiringPi
 - \$ git pull origin
 - \$ cd wiringPi
 - \$./build

WiringPi Basics

- \$ man gpio
- \$ gpio -g # Taking BCM GPIO Number
- \$gpio [-g] mode <pin> in/out/pwm/up/down/tri
- \$ gpio [-g] write <pin> <value>
- \$gpio [-g] pwm <pin> <value>(0-1023)
- \$ gpio [-g] read < pin>
- \$ gpio readall

WiringPi Pinout

P1: The Main GPIO connector							
WiringPi Pin	BCM GPIO	Name	Header		Name	BCM GPIO	WiringPi Pin
		3.3v	1	2	5v		
8	Rv1:0 - Rv2:2	SDA	3	4	5v		
9	Rv1:1 - Rv2:3	SCL	5	6	0v		
7	4	GPIO7	7	8	TxD	14	15
		0v	9	10	RxD	15	16
0	17	GPIO0	11	12	GPIO1	18	1
2	Rv1:21 - Rv2:27	GPIO2	13	14	0v		
3	22	GPIO3	15	16	GPIO4	23	4
		3.3v	17	18	GPIO5	24	5
12	10	MOSI	19	20	0v		
13	9	MISO	21	22	GPIO6	25	6
14	11	SCLK	23	24	CE0	8	10
		0v	25	26	CE1	7	11

WiringPi Pin	BCM GPIO	Name	Header		Name	BCM GPIO	WiringPi Pin

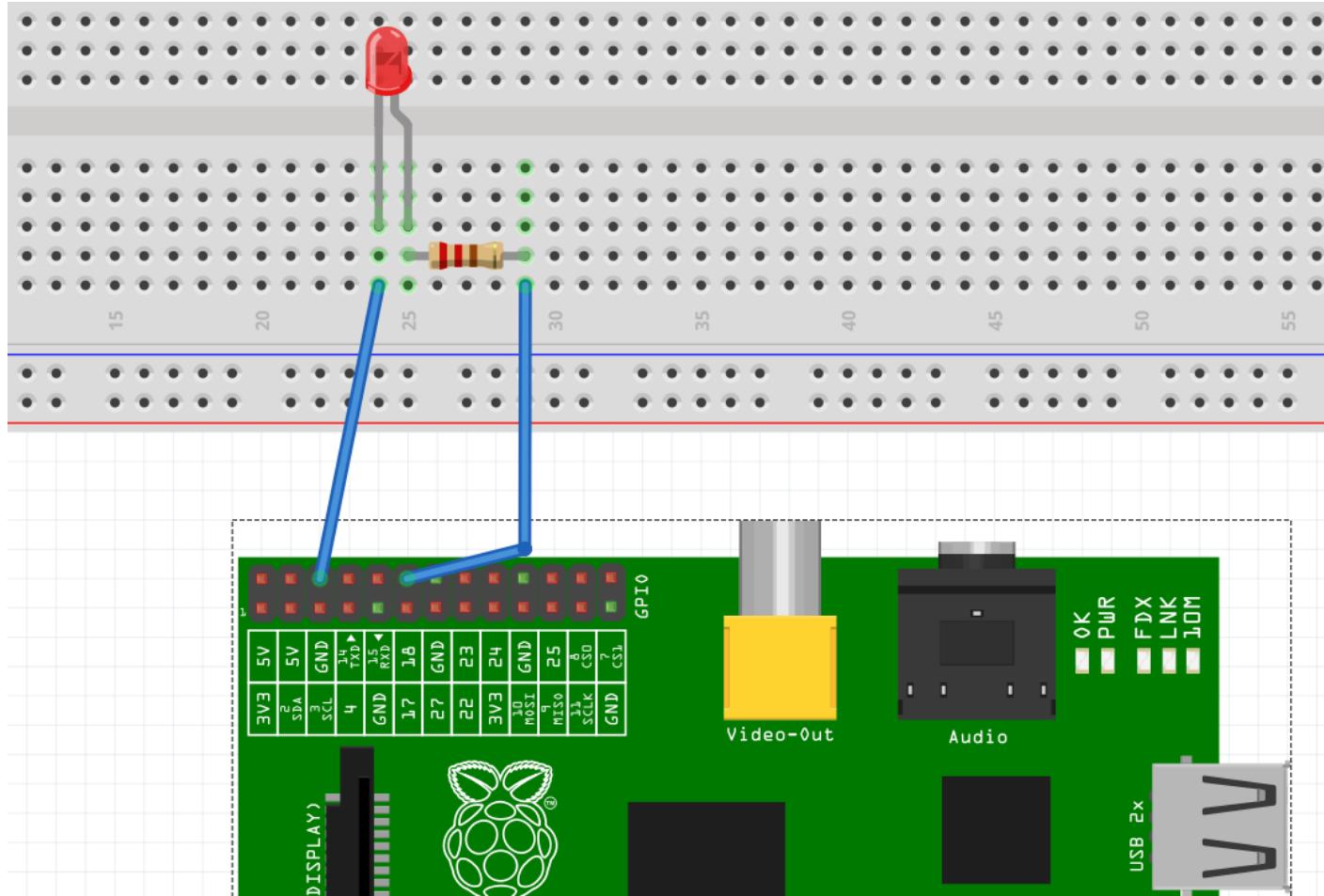
WiringPi Examples

- Setting wiring pin to HIGH
 - \$gpio mode 1 out
 - \$gpio write 1 1
- Setting PWM
 - \$gpio mode 1 pwm
 - \$gpio pwm 1 200

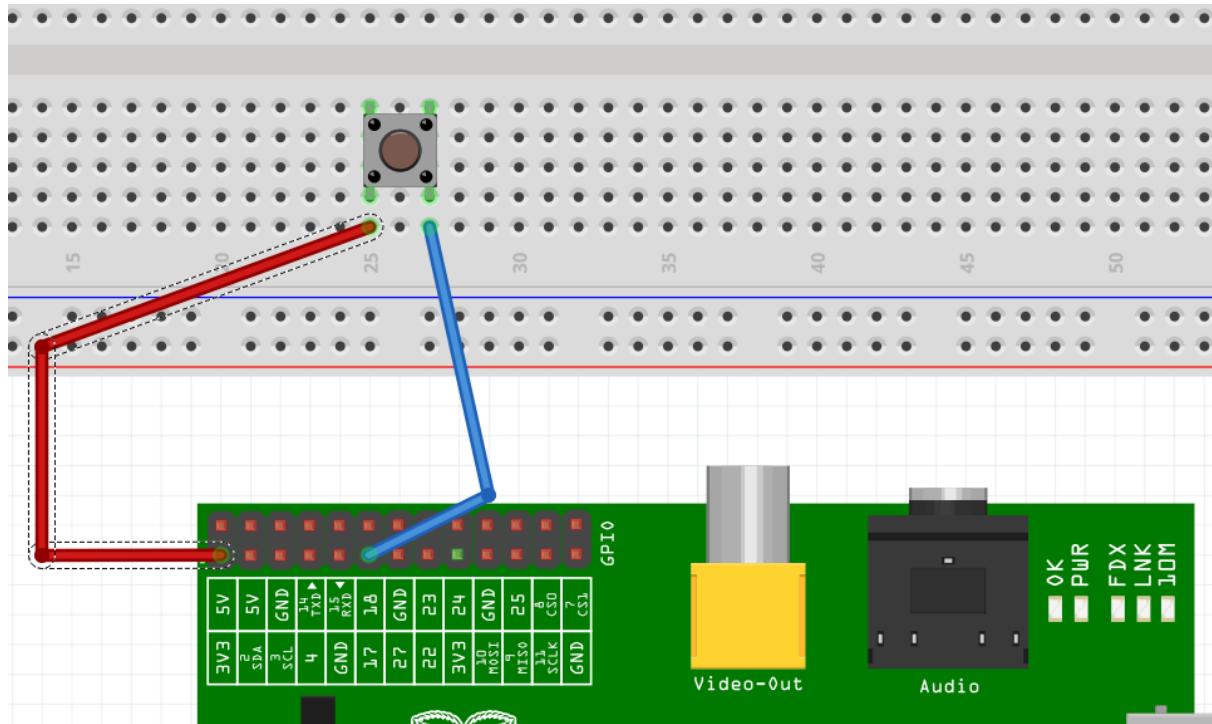
Rpi.GPIO Basics

```
> import RPi.GPIO as GPIO #Importing GPIO Module
> import time # Importing Time module
>
> GPIO.setmode(GPIO.BOARD) # Taking Pin number from the board
> GPIO.setup(12, GPIO.OUT) # Setting 12th pin as OUTPUT
>
> try:
>     while True:
>         GPIO.output(12, GPIO.HIGH) #Setting 12th pin high
>         time.sleep(1)           # 1 sec delay
>         GPIO.output(12, GPIO.LOW) #Setting 12th pin low
>         time.sleep(1)
>     finally:
>         GPIO.cleanup()          #Cleaning the configurations
```

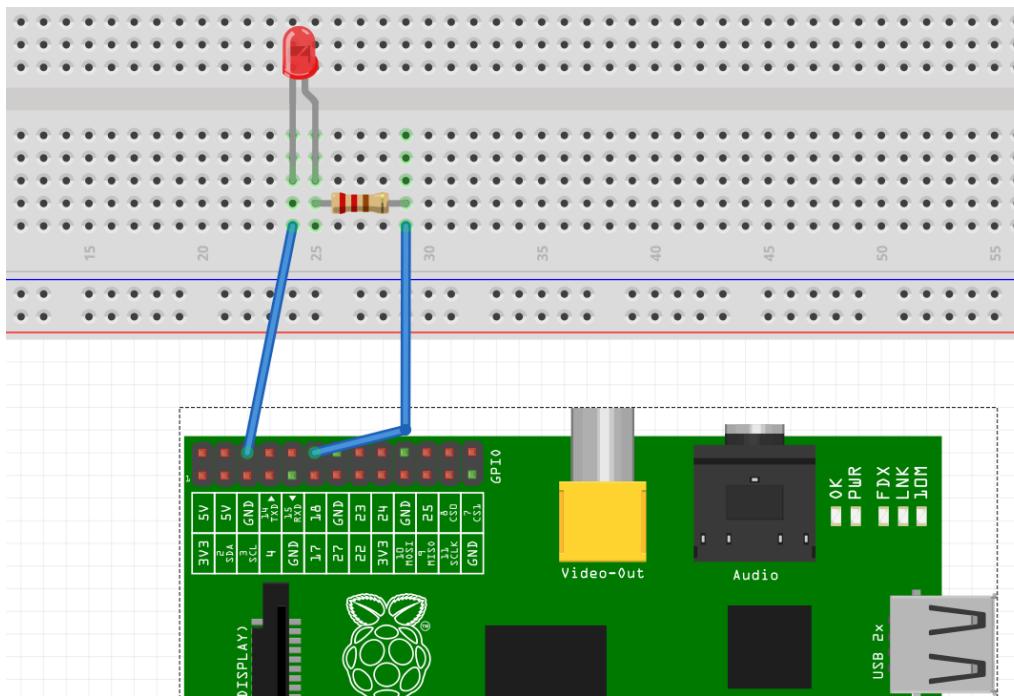
Demo Blink LED



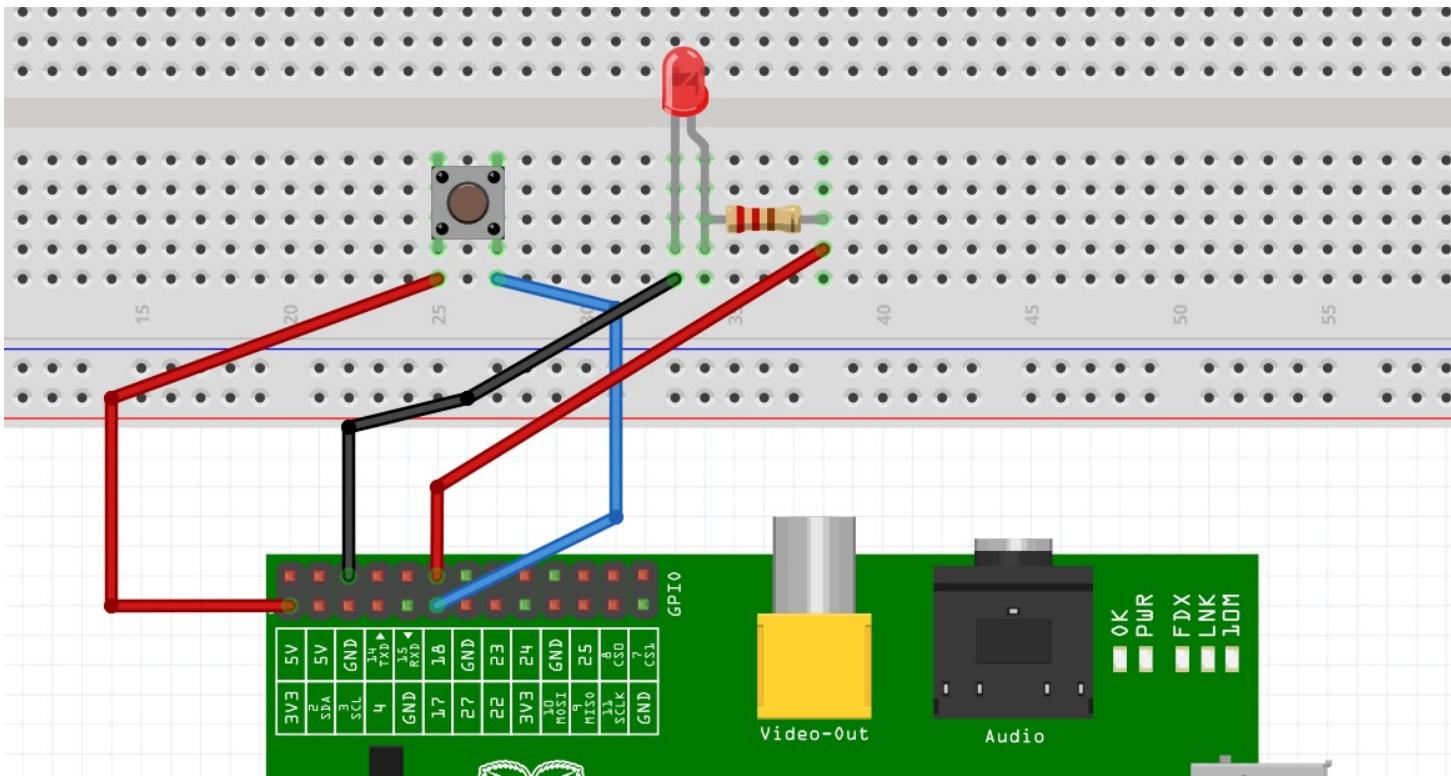
Demo_2: Button & Input



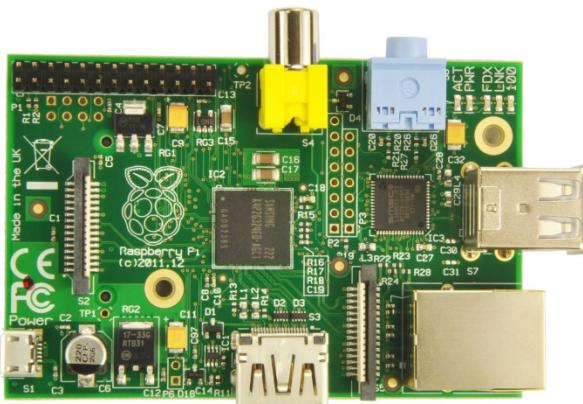
Demo_3:PWM



Demo_4: LED+ Button

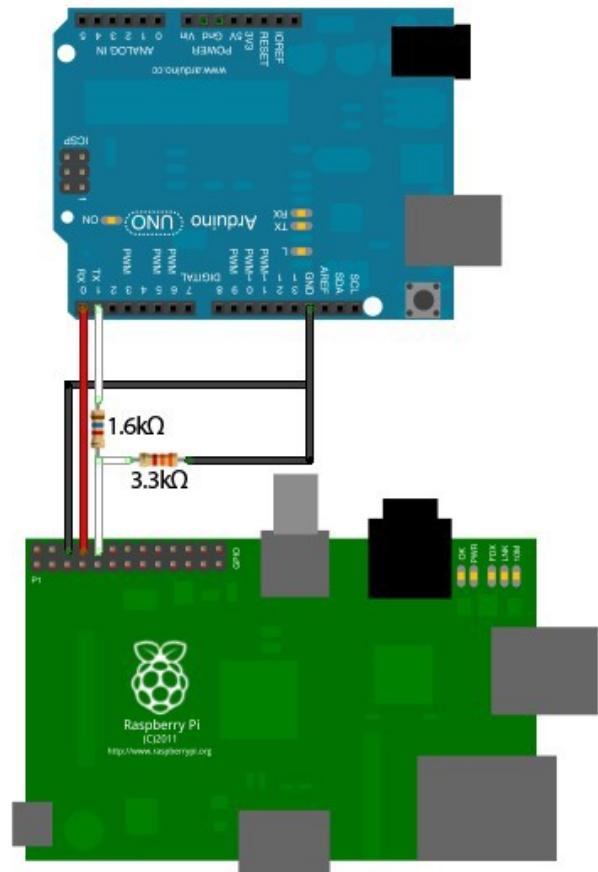


Raspberry Pi & Arduino



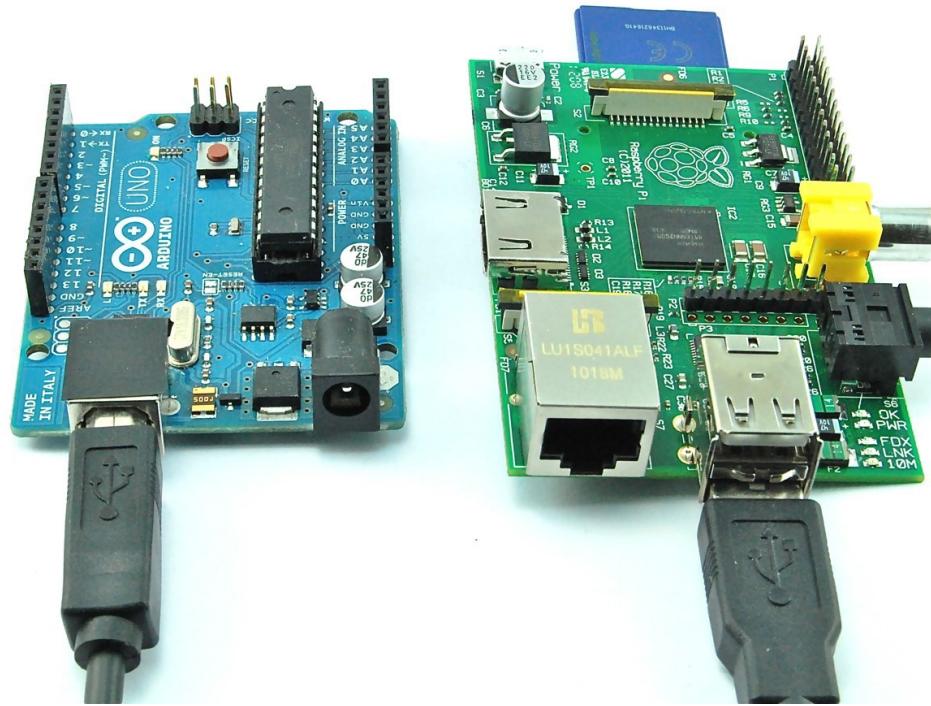
Raspberry Pi & Arduino

Direct Serial Connection



Raspberry Pi & Arduino

USB Connection



Raspberry Pi & Arduino

Arduino Code

```
// Arduino Code
char serIn;
void setup()
{
Serial.begin(9600);
}
void loop ()
{
    if(Serial.available())
    {
        while (Serial.available()>0){
            serIn = Serial.read();
            Serial.print(serIn);
        }
    }
}
```

Raspberry Pi & Arduino

Python Code

```
#!/usr/bin/env python
import serial
import time
ser = serial.Serial('/dev/ttyACM0', 9600)

while True:
    print "Writing letter 'A' to arduino"
    ser.write('A')
    print "Reading from arduino"
    print ser.read(1)
    time.sleep(1)
```

Raspberry Pi & Pi Camera



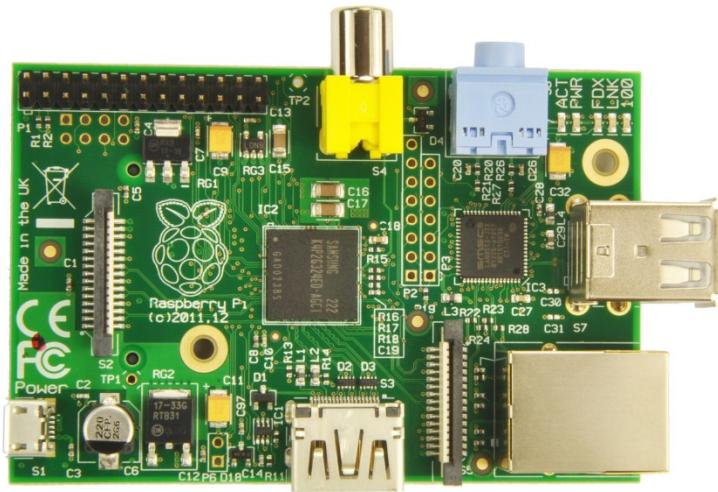
Raspberry Pi & Pi Camera Demo

- Connection: Camera Serial Interconnect (CSI)
- Maximum Still Resolution: $2,592 \times 1,944$
(currently limited to $1,920 \times 1,080$)
- Maximum Video Resolution:
 $1,920 \times 1,080$ (1080p) 30fps

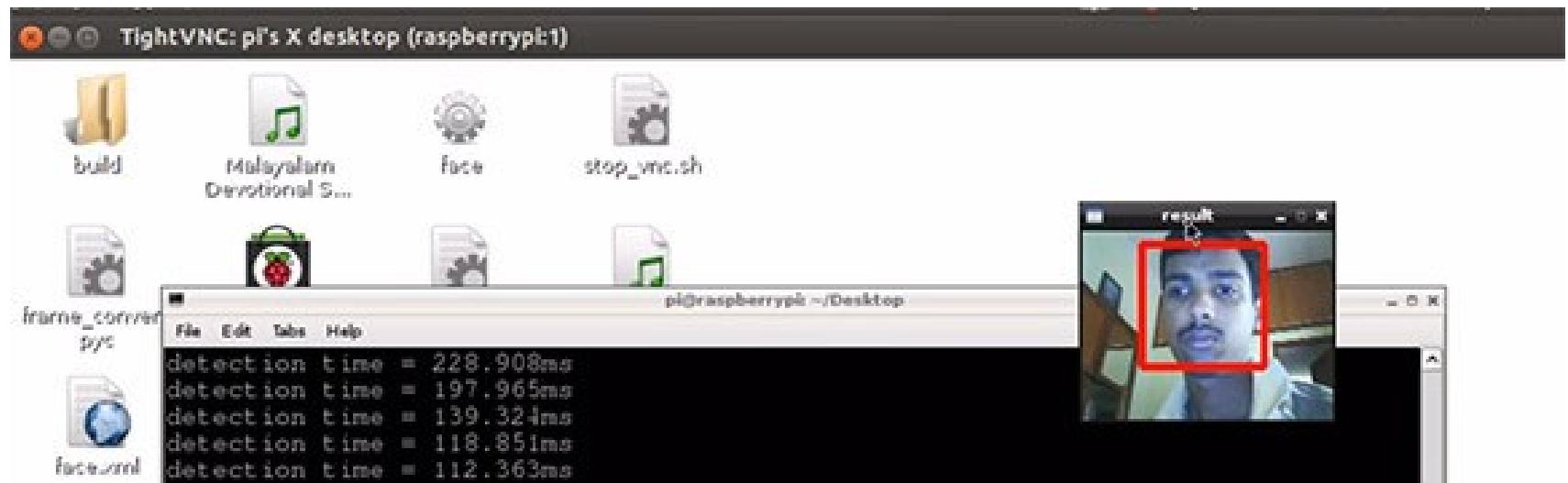


Raspberry Pi & Camera

```
$ sudo apt-get install guvcview
```



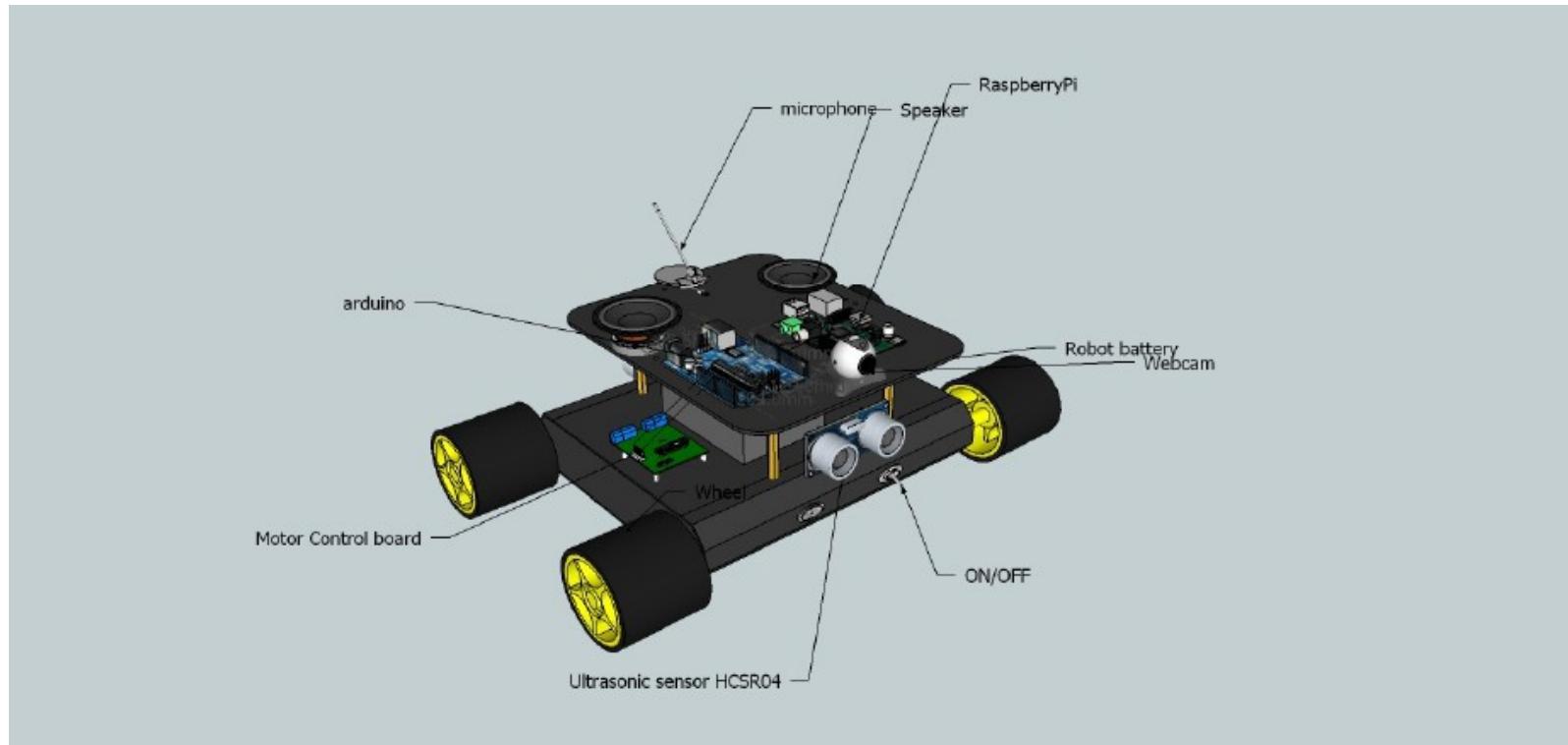
Face Detection Demo



Raspberry Pi & Sound

- \$ sudo apt-get install mplayer

Raspberry Pi Robot



Questions ??



THANK YOU!

