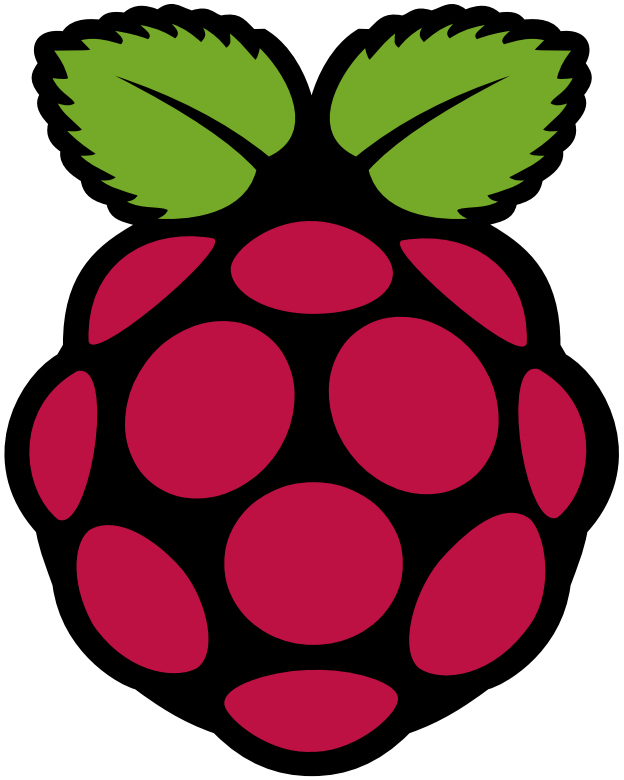
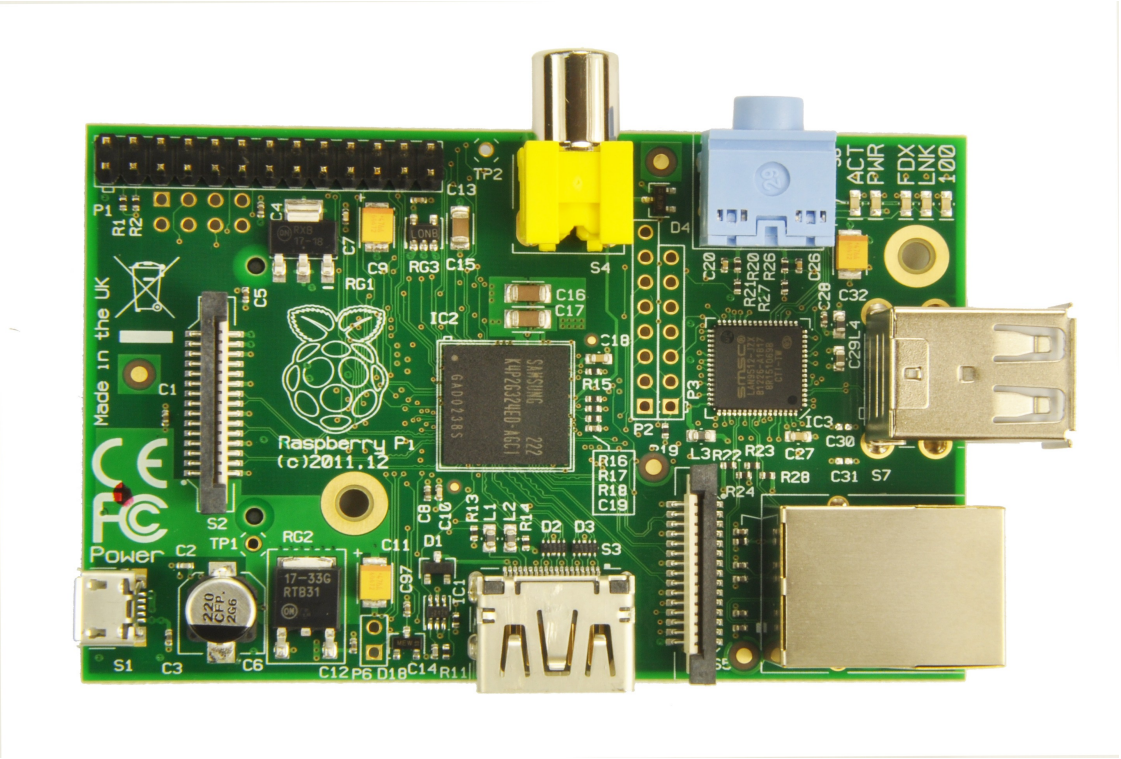
Exploring Raspberry Pi





http://elinux.org/images/f/f4/RaspiFront.JPG
http://upload.wikimedia.org/wikipedia/en/c/cb/Raspberry_Pi_Logo.svg

About Speakers

- Lentin Joseph, Achu Wilson and Aronin Chandu
- Experience in Robotics and Embedded systems for last 3 years
- http://www.lentinjoseph.com
- http://www.sastrarobotics.com

Questions ???

- Why did you choose this workshop ?
- What are you expecting from this workshop ?
- What do you want to make with RaspberryPi ?

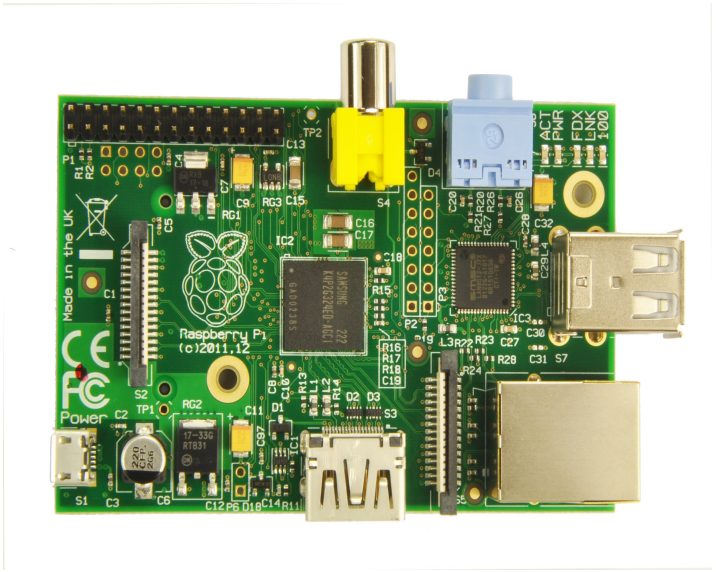
Agenda

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

Agenda

- Python & GCC
- Wiring Pi and Python GPIO
- Hello_World demo
- LED Blink, PWM etc
- Raspberry Pi and Arduino
- Raspberry Pi and Camera
- Hackathon

Raspberry Pi & PC



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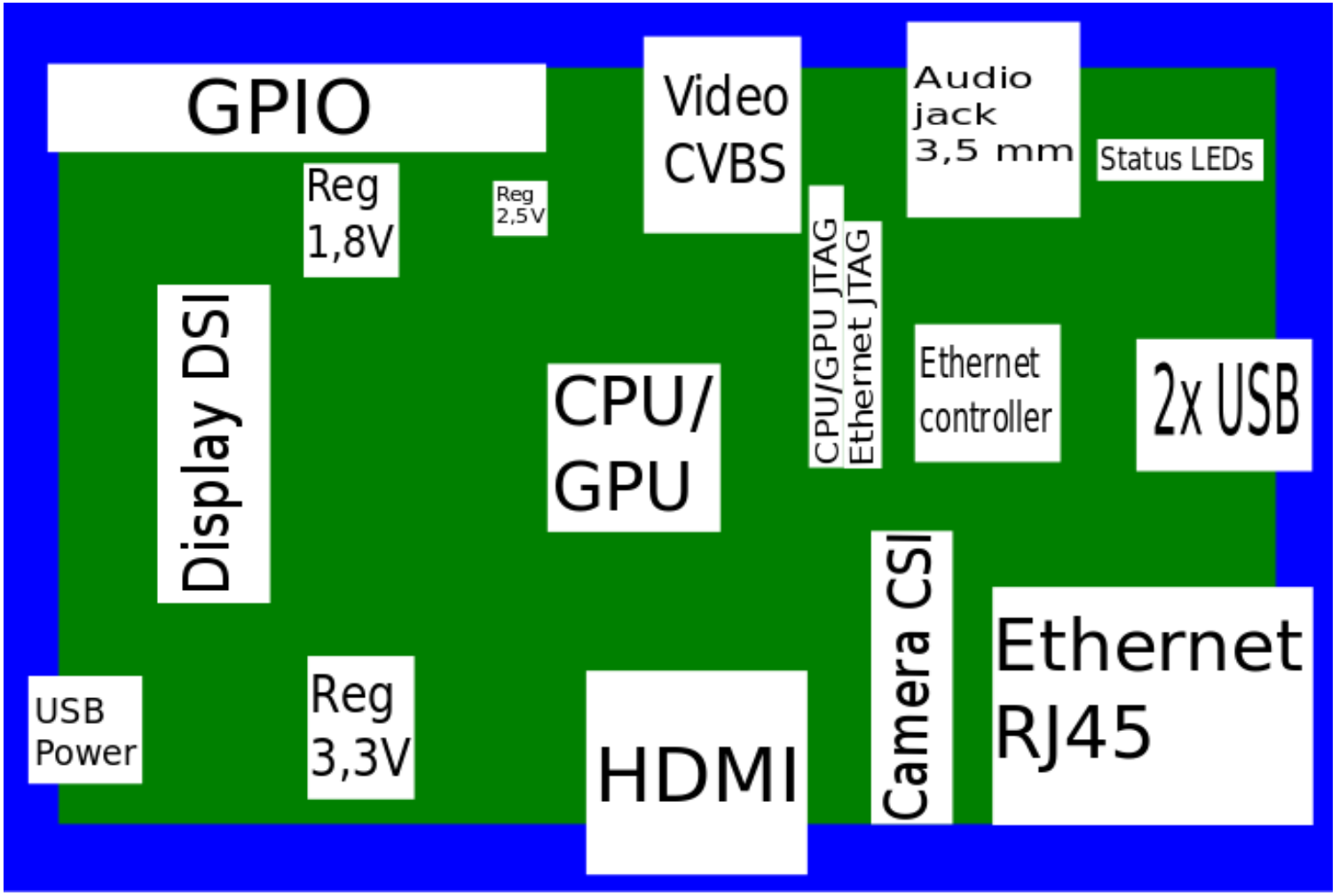
Compare Raspberry Pi and a PC

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

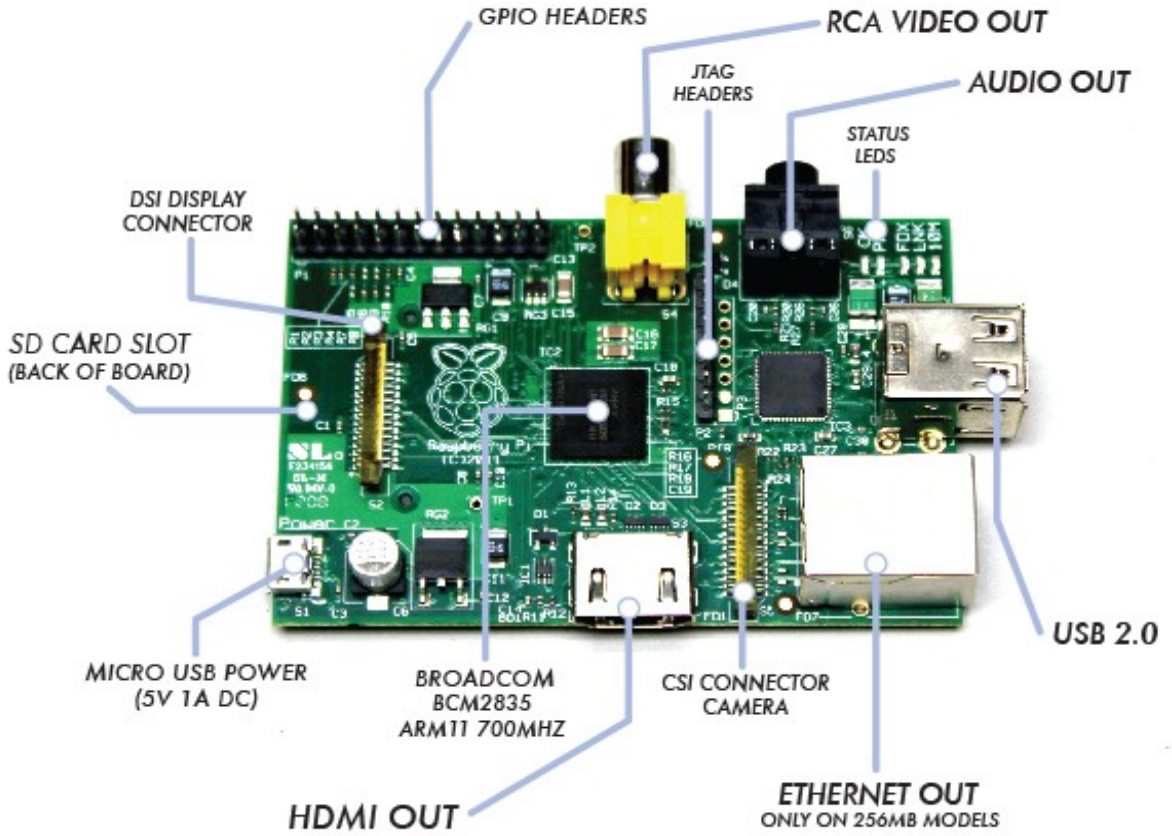
Raspberry Pi Model A&B

	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 15th 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 × GPIO, UART, I²C bus, SPI bus	
Power rating	300 mA (1.5 W)	700 mA (3.5 W)
Power source	5 volt via MicroUSB or GPIO header	

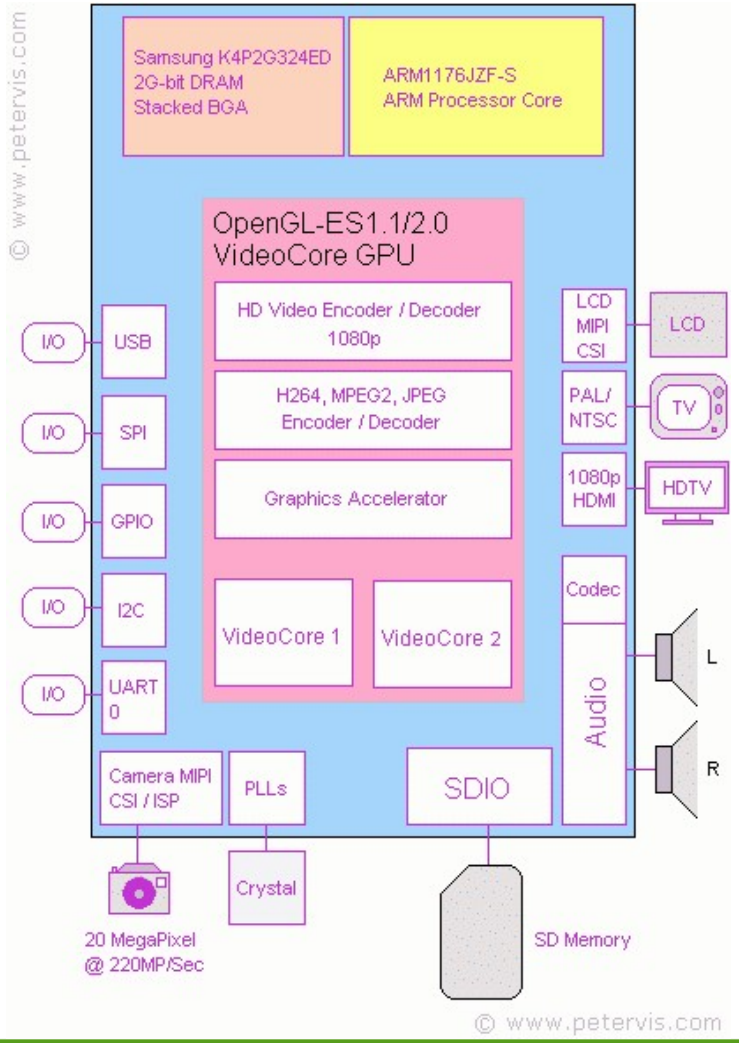
Raspberry Pi Components



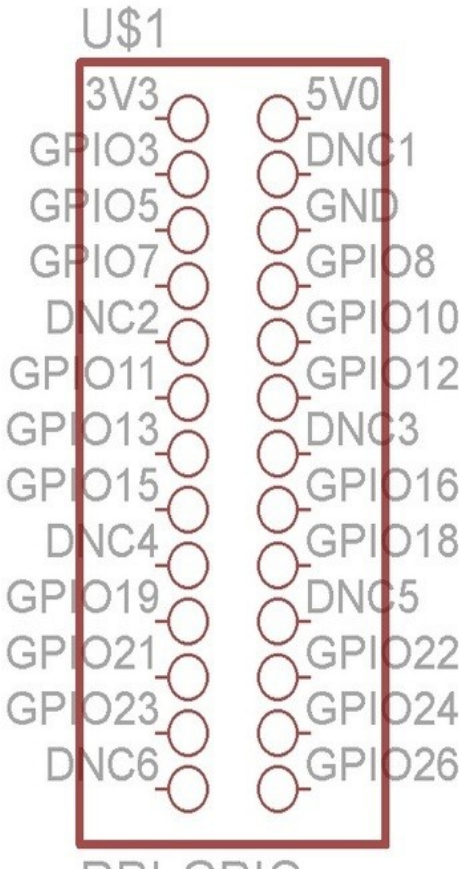
Raspberry Pi Components

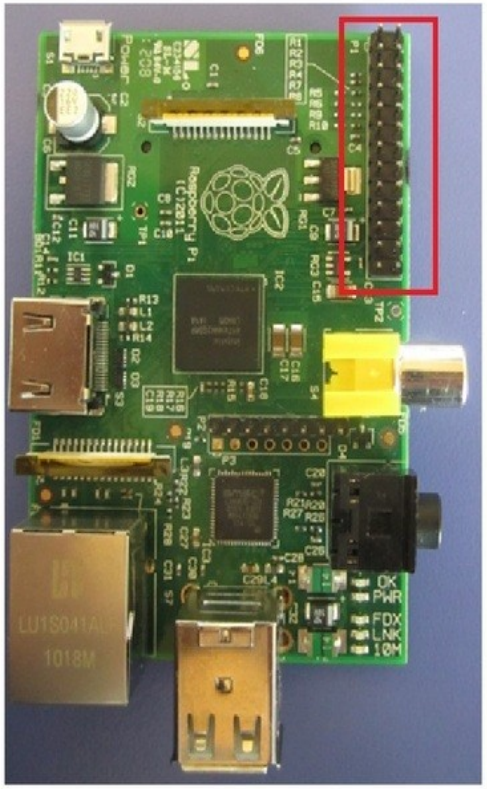


BCM 2835 SoC(System on Chip)



Raspberry Pi : GPIO



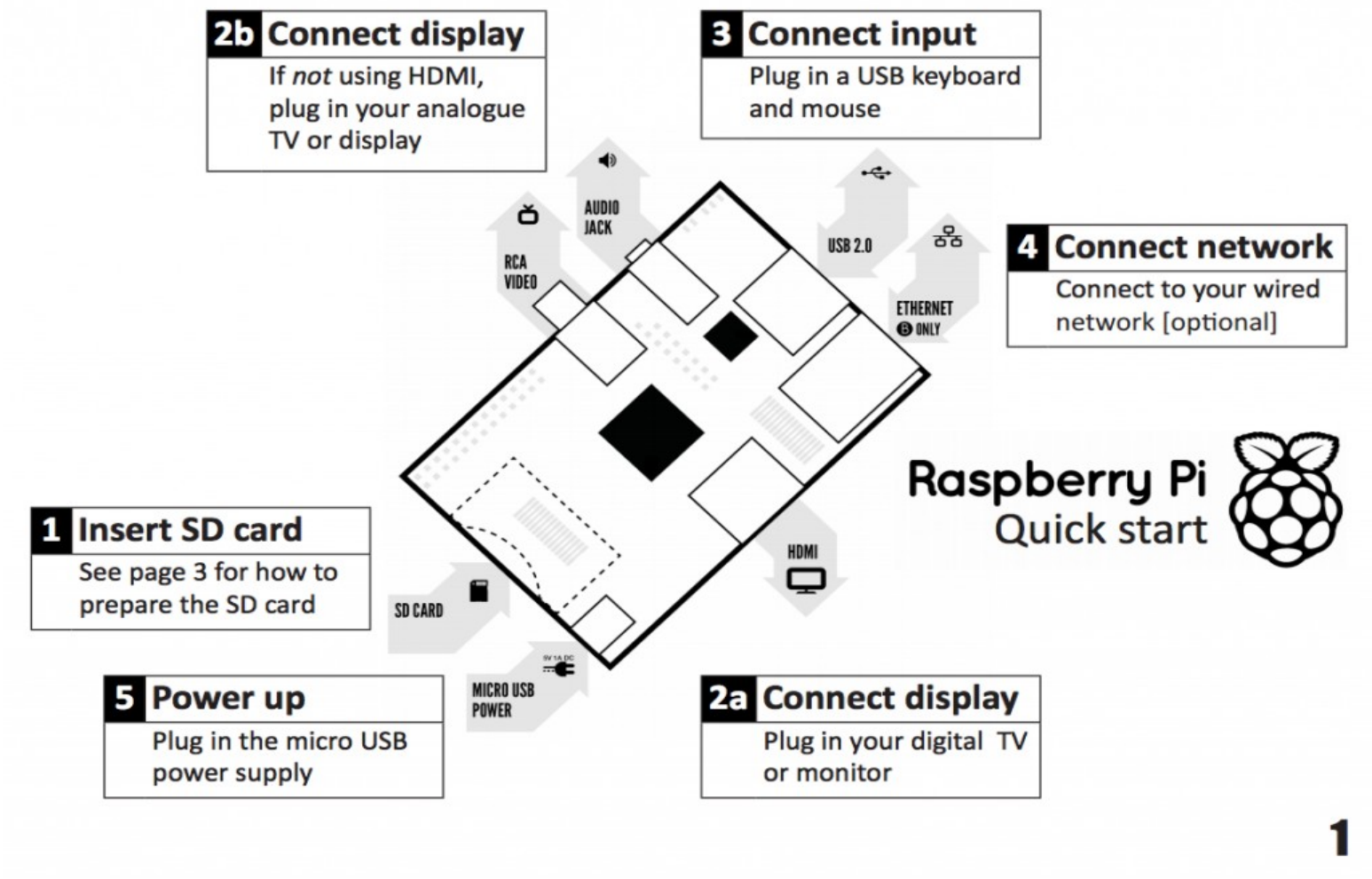


3.3V	1	2	5V
I2C1 SDA	3	4	5V
I2C1 SCL	5	6	GROUND
GPIO4	7	8	UART TXD
GROUND		10	UART RXD
GPIO 17	11	12	GPIO 18
GPIO 27	13	14	GROUND
GPIO 22	15	16	GPIO 23
3.3V	17	18	GPIO 24
SP10 MOSI	19	20	GROUND
SP10 MISO	21	22	GPIO 25
SP10 SCLK	23	24	SP10 CE0 N
GROUND	25	26	SP10 CE1 N

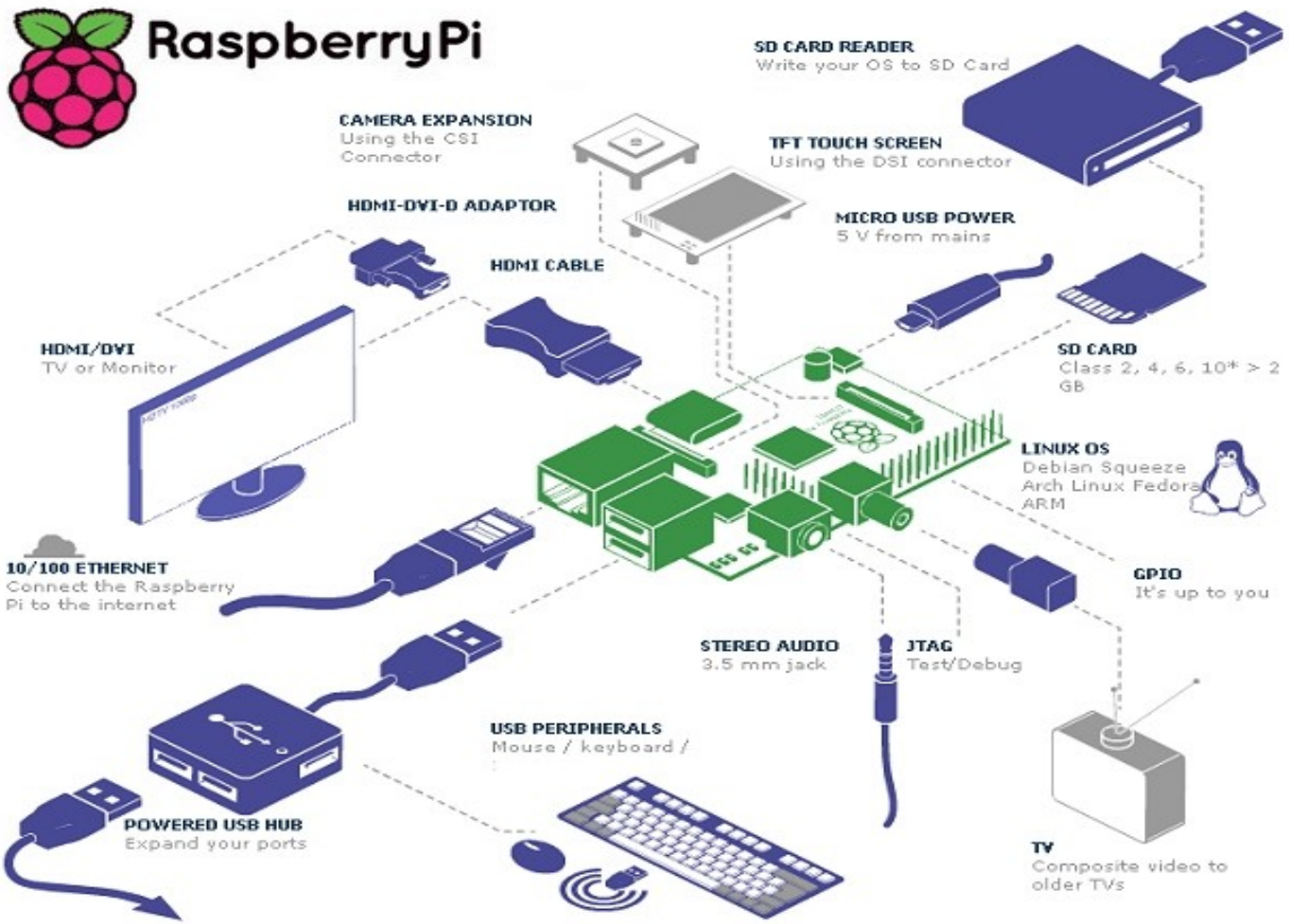
Raspberry Pi : GPIO

- 8x GPIO (General Purpose Input/Output)
- UART ,I2C ,SPI Bus
- 3.3 V and 5 V 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 Enviornment : LXDE
- Light weight OS

Installation of OS

- Installation tools
- For Windows
  - Win32DiskImager.exe
  - http://sourceforge.net/projects/win32diskimager/
- For Linux
  - $dd
  - http://sourceforge.net/projects/win32diskimager/

Installation of OS

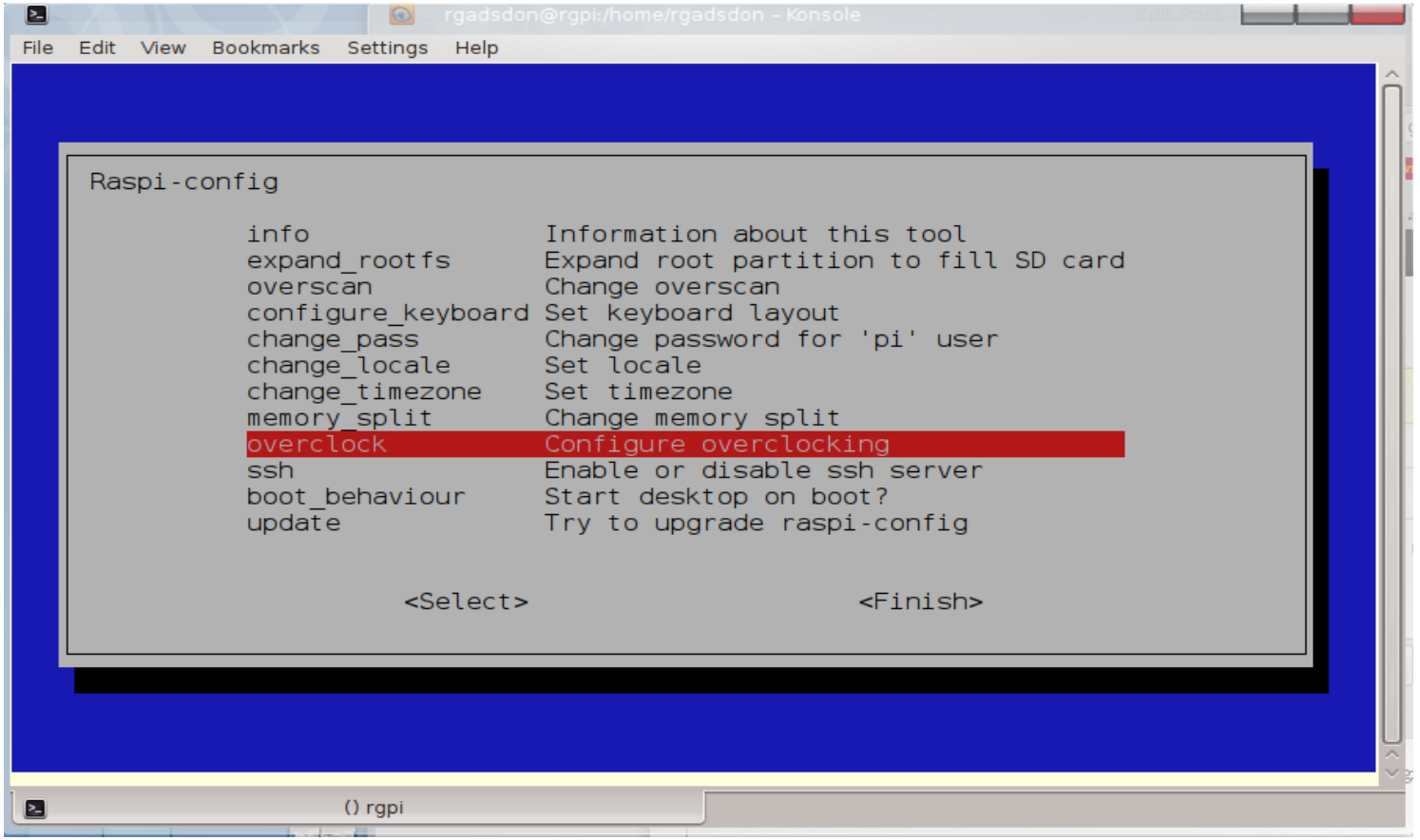
- Procedure in Linux
  - Format SD Card in FAT 32/ext2
  - sudo dd bs=4m if=<name_of_image>.img of=<device name>
  - Eg: sudo dd bs=4m if=2013-02-09-wheezy-raspbian.img of=/dev/sdb

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 Wifi Hotspot

Raspi-config

- What is raspi-config



Setting VNC Server

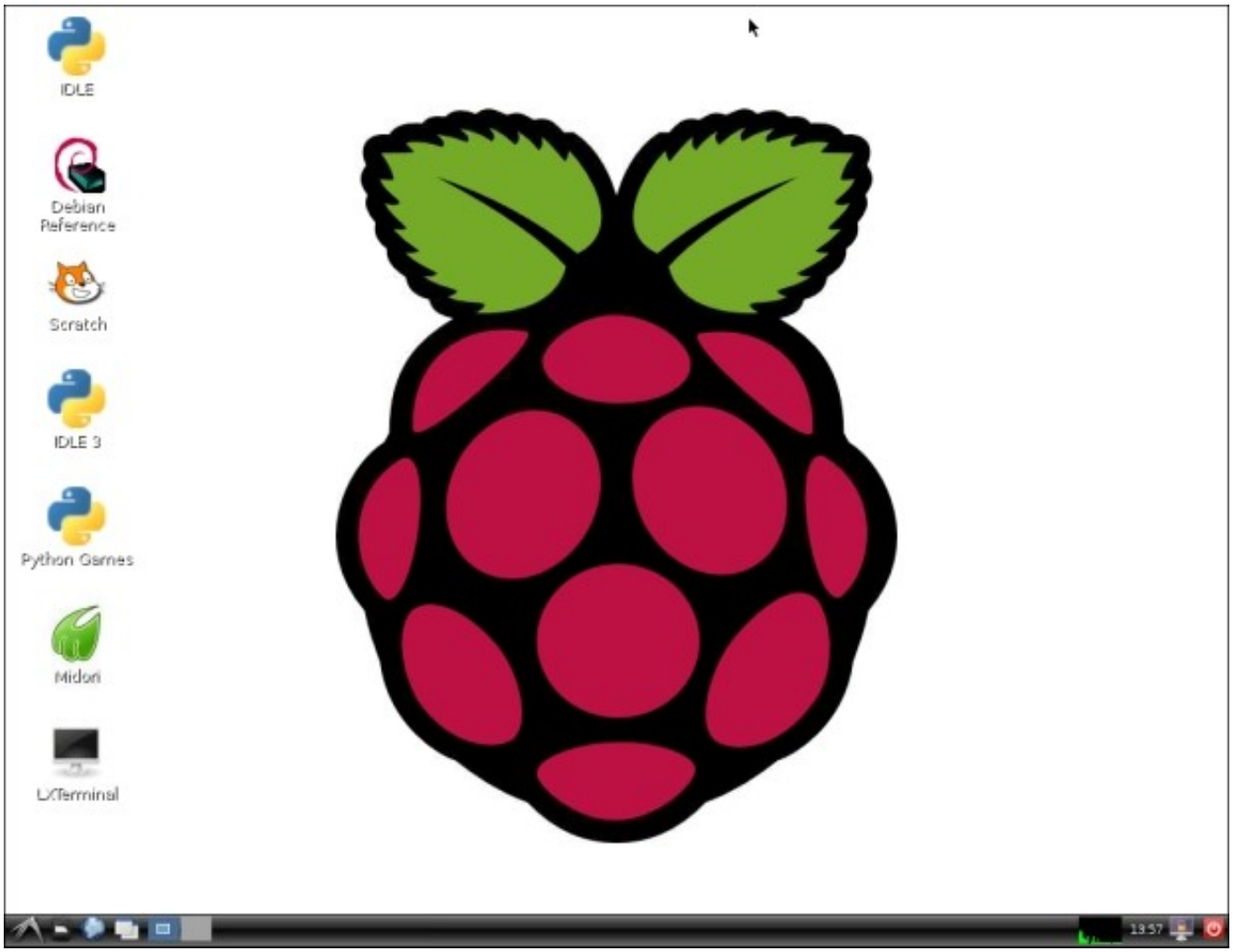
- VNC(Virtual Network Computing)
- http://en.wikipedia.org/wiki/VNC_server
- Graphical desktop sharing system
- Installation
    - $sudo apt-get install tightvncserver
- In Raspberry Pi
    - $ vncserver :1 -geometry 1366x600 -depth 16 -pixelformat rgb565

Setting VNC Server

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

Remote Desktop

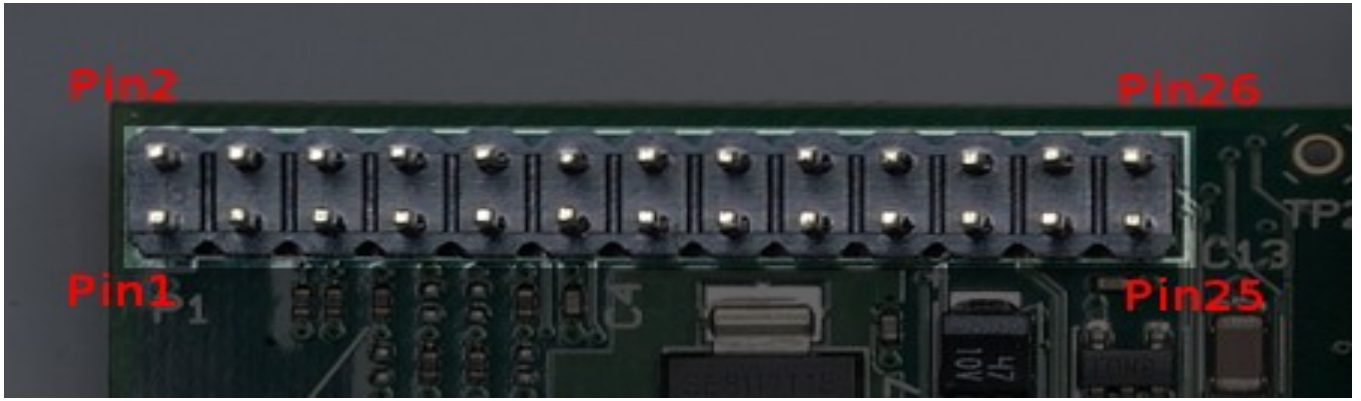
Introduction to Raspbian



Package Management

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

GPIO ,I2C,&SPI


Pin2
Pin26
Pin1
Pin25


R-Pi GPIO
left
bottom P1-01
top P1-02
P1
3V3 Power
5V Power
R1: GPIO 0 (SDA)
R2: GPIO 2 (SDA)
5V Power
R1: GPIO 1 (SCL)
R2: GPIO 3 (SCL)
Ground
GPIO 4 (GPCLK0)
GPIO 14 (TXD)
Ground
GPIO 15 (RXD)
GPIO 17
GPIO 18 (PCM_CLK)
R1: GPIO 21
R2: GPIO 27
Ground
GPIO 22
GPIO 23
3V3 Power
GPIO 24
GPIO 10 (MOSI)
Ground
GPIO 9 (MISO)
GPIO 25
GPIO 11 (SCLK)
GPIO 8 (CE0)
Ground
GPIO 7 (CE1)
P1-25 bottom
P1-26 top
right
R1: Revision 1
R2: Revision 2

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

WiringPi 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

Python & GCC

- Introduction to Python ?
- Sample codes
- Introduction to GCC(Gnu C compiler)
- Sample Codes

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
```

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

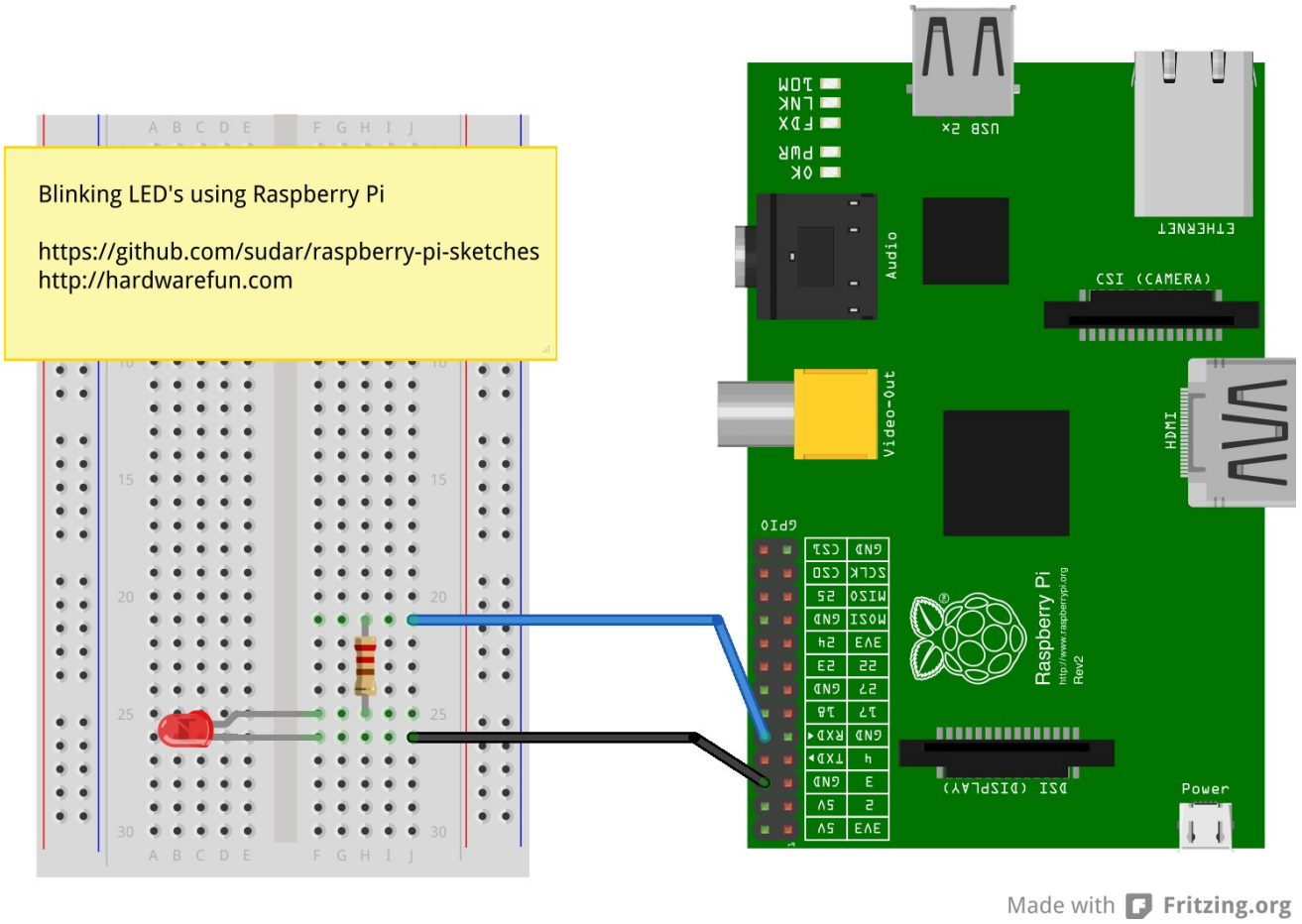
WiringPi Pinout

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

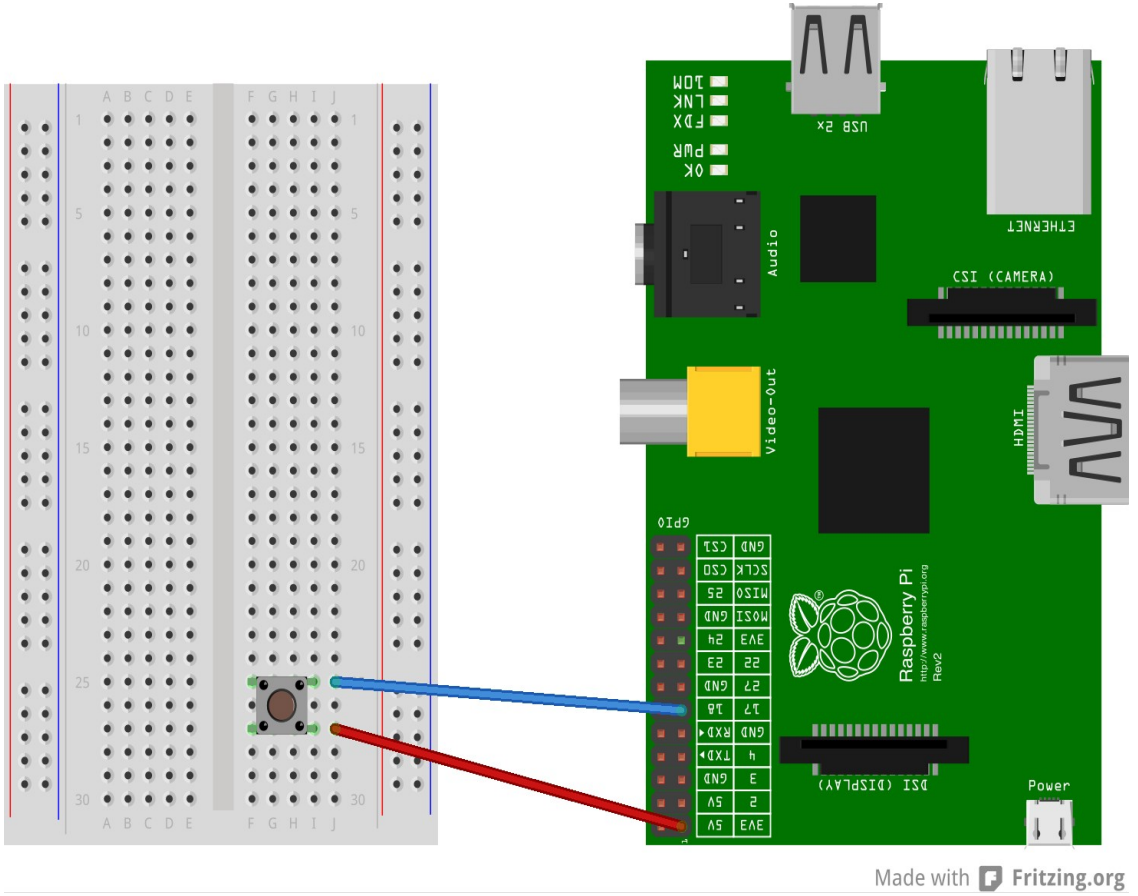
WiringPi Examples

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

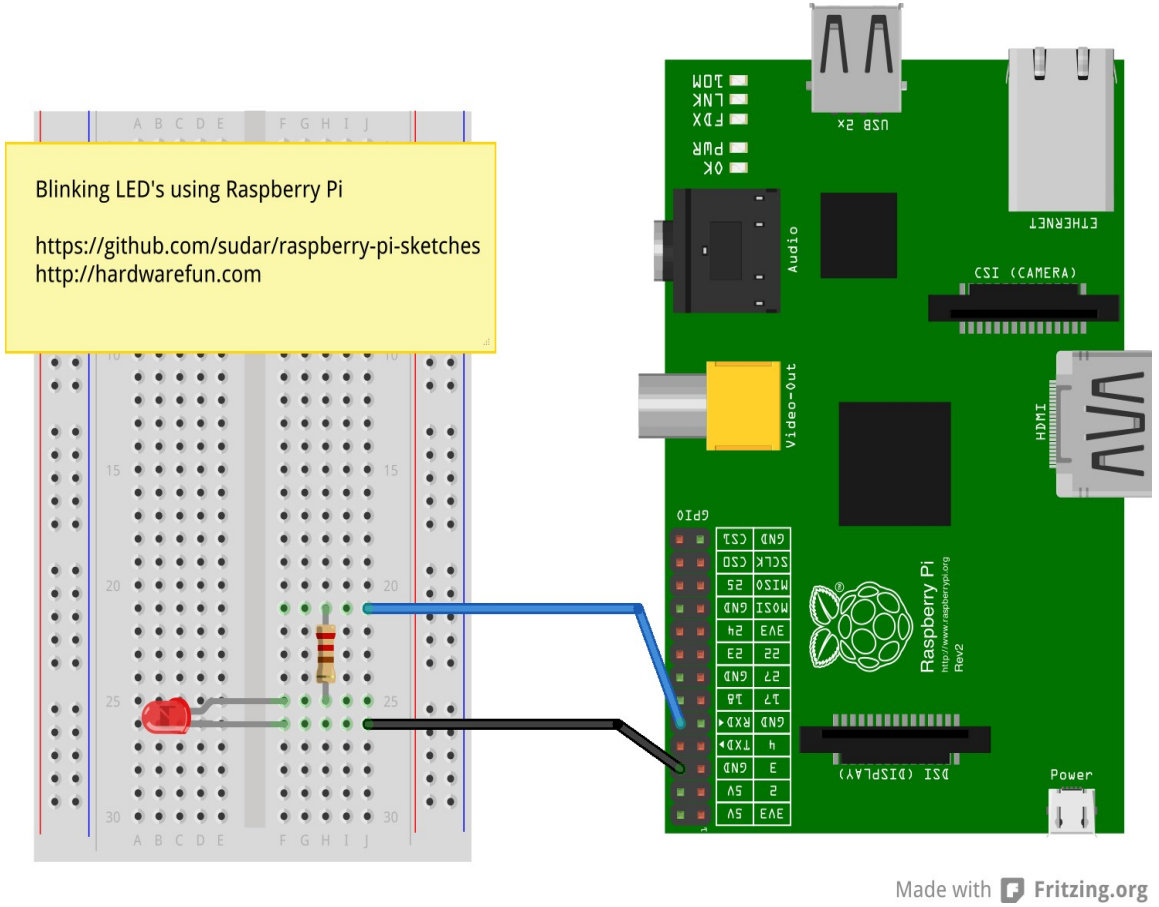
Demo_1:Blink Led



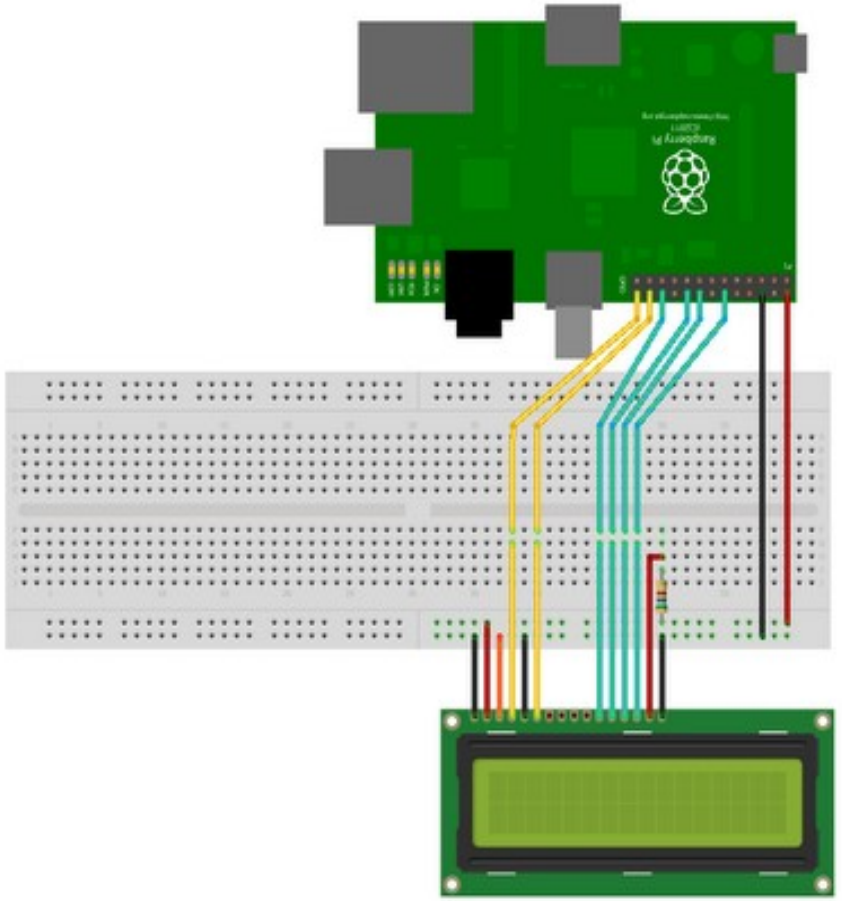
Demo_2:Button & Input



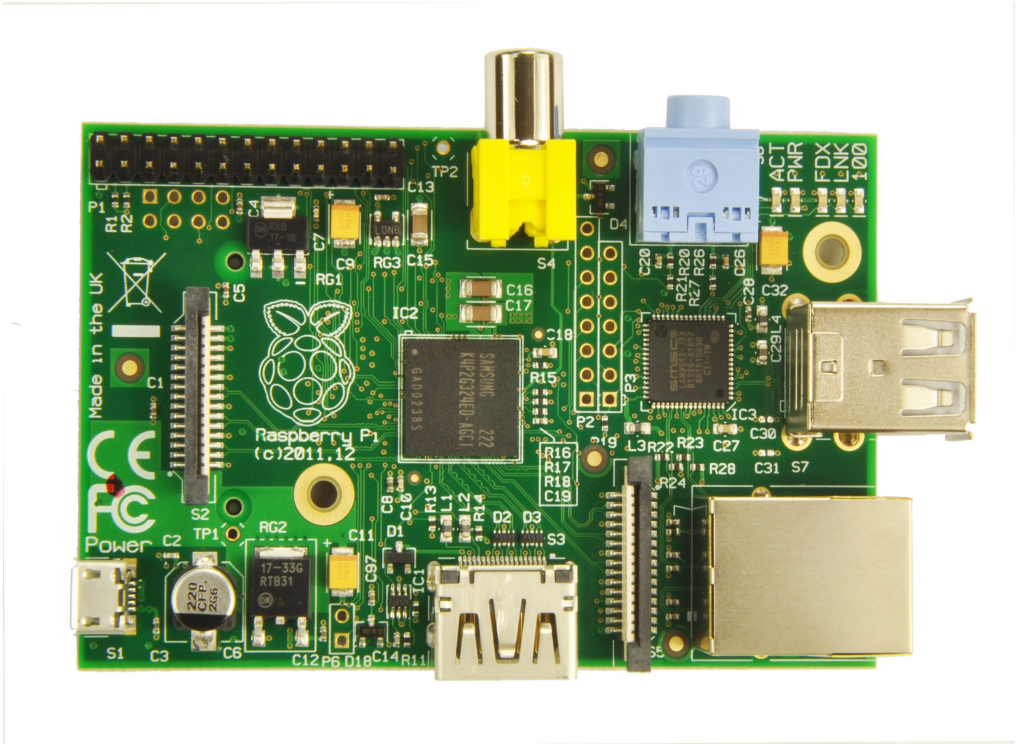
Demo_3:PWM

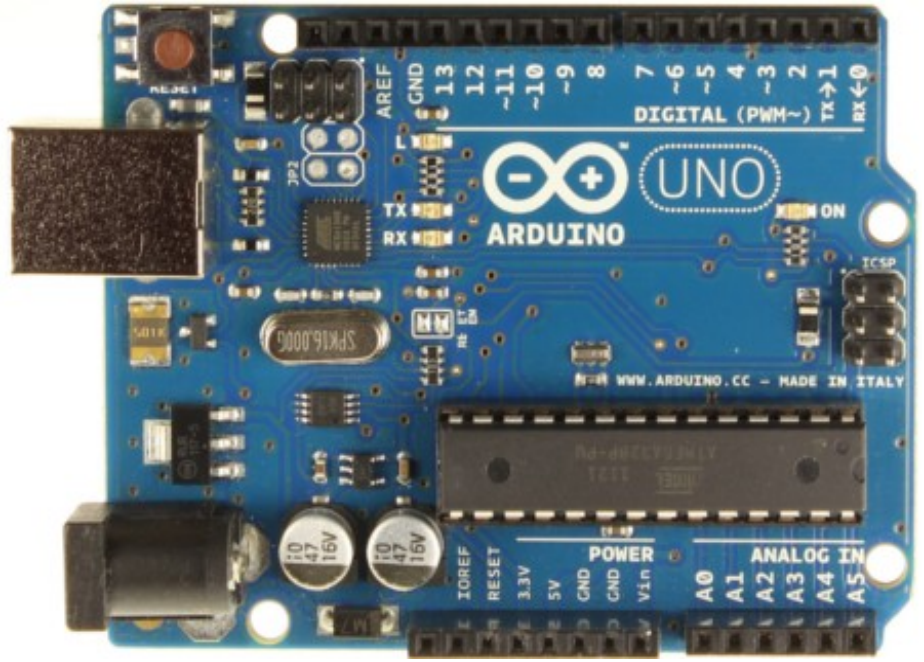

Blinking LED's using Raspberry Pi
https://github.com/sudar/raspberry-pi-sketches
http://hardwarefun.com
Audio
Video-Out
USB 2x
ETHERNET
CSI (CAMERA)
HDMI
DSI (DISPLAY)
Power
GPIO
Raspberry Pi
Rev2
Made with Fritzing.org

Demo_4:LCD Interfacing



Raspberry Pi & Arduino

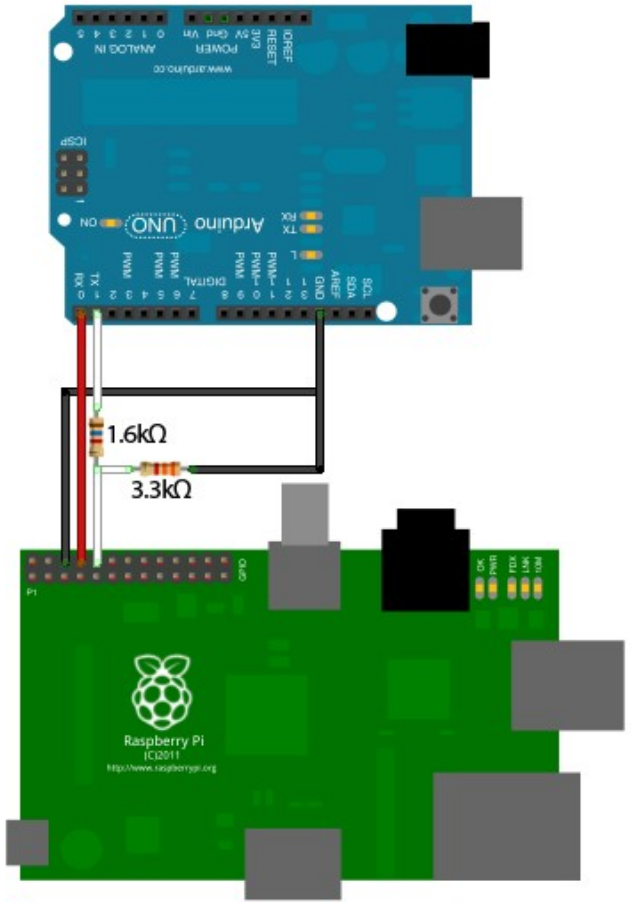




http://blog.oscarliang.net/raspberry-pi-and-arduino-connected-serial-gpio/

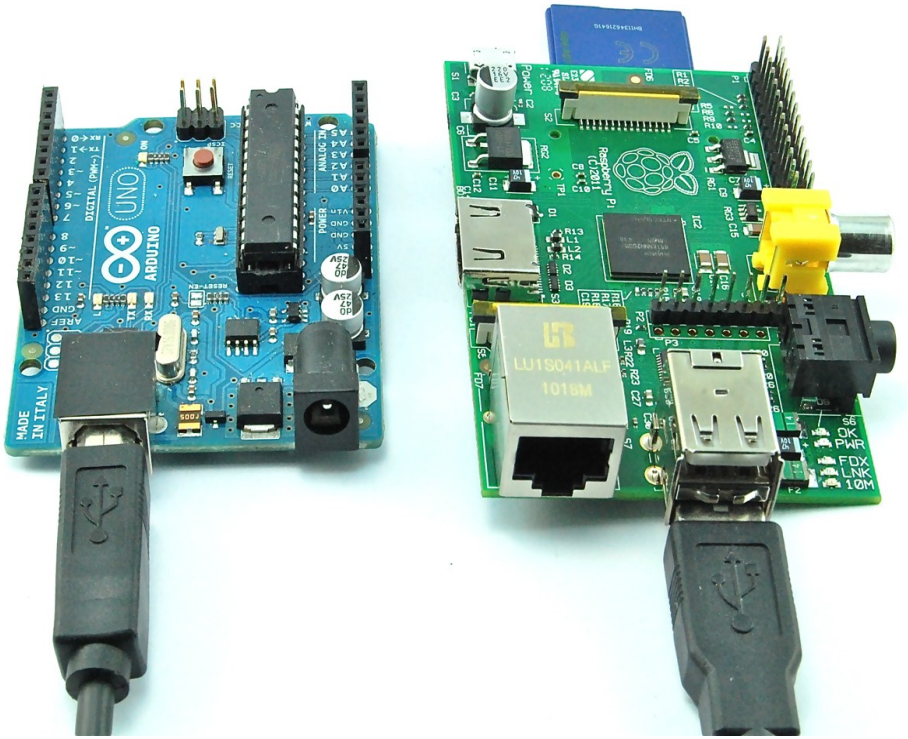
Raspberry Pi & Arduino

- Direct Serial Connection



Raspberry Pi & Arduino

- USB Connection



Raspberry Pi & Arduino

```
// Arduino Code
int serIn;
void setup() {
  Serial.begin(9600);
 }
void loop () {

  if(Serial.available()) {

     while (Serial.available()>0){
        serIn = Serial.read();
        Serial.print(serIn, BYTE);
     }
    Serial.println();
  }
  delay(1000);
}
```

```
// Python Code in Raspberry Pi

import serial
import time
ser=serial.Serial('/dev/ttyACM0
',9600)

while True:
    ser.write('A')
    Time.sleep(1)
```

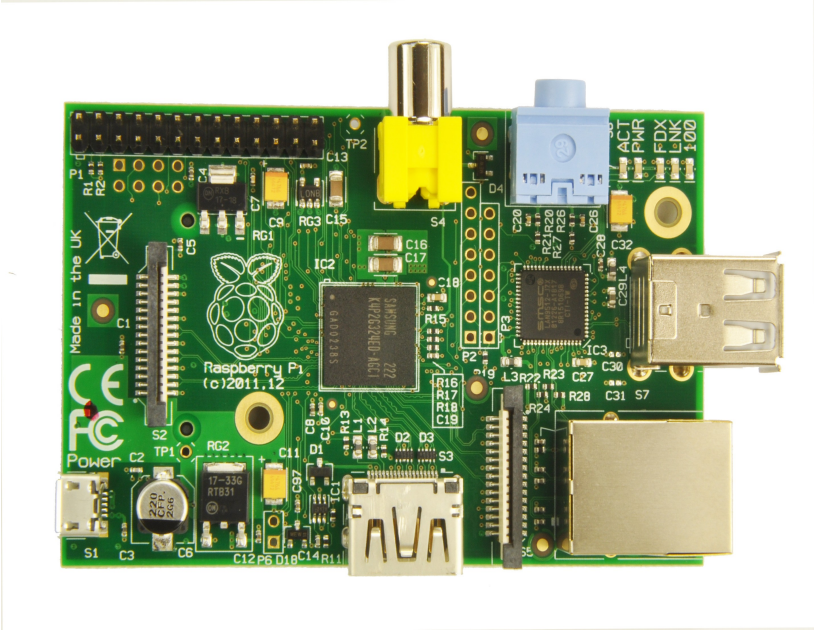
Raspberry Pi & Camera

Raspberry Pi & Camera

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

Raspberry Pi & Camera

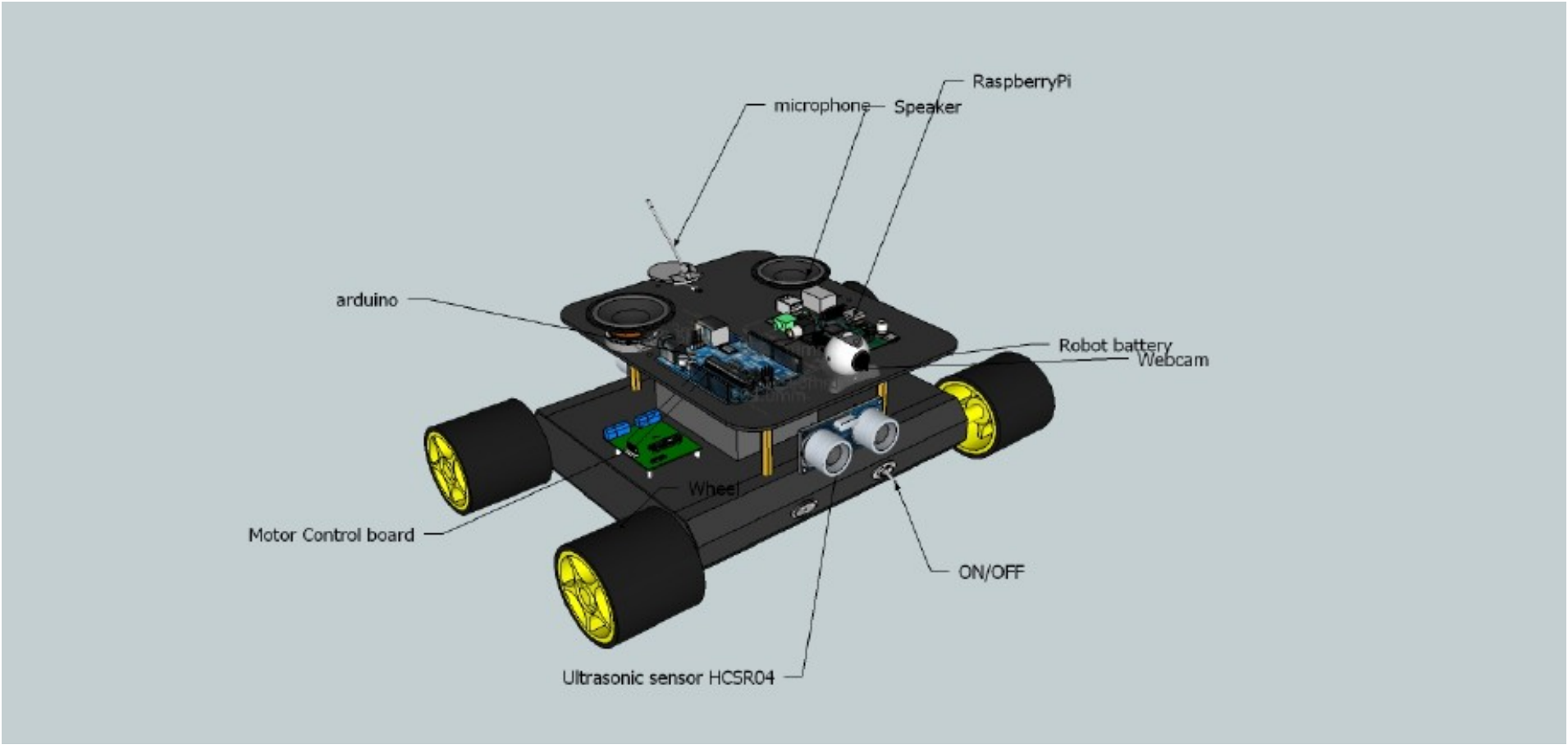
$ sudo apt-get install guvcview



Raspberry Pi & Sound

- $ sudo apt-get install mplayer

Raspberry Pi Robot demo



Questions ??

Hackathon

- Will select best 3 projects
- Duration : 2 hrs

Hackathon