Università degli studi di Roma Tor Vergata

Facoltà di Ingegneria

Roma2LUG
Linux User Group

Roma2LUG Incontra

Music On Linux
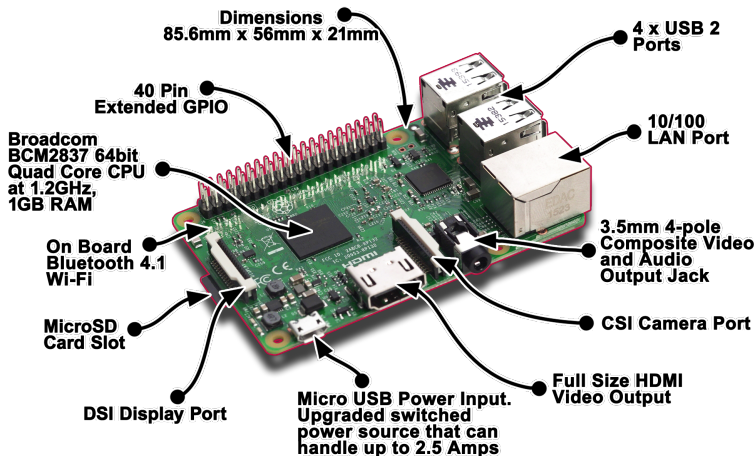
Speaker
Giulia Cassarà

Speaker
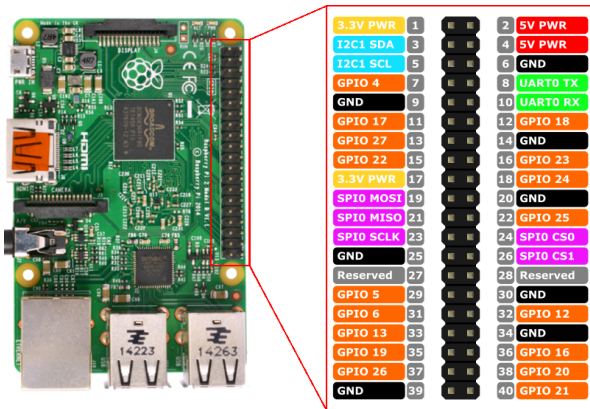*Emanuele Savo*

Studio Piattaforma IaaS

- Born as a MiniPC
- Can reproduce HD movies
- The main difference with a PC are the GPIO ports

Dimensions
85.6mm x 56mm x 21mm

4 x USB 2 Ports

40 Pin Extended GPIO

10/100 LAN Port

Broadcom BCM2837 64bit Quad Core CPU at 1.2GHz, 1GB RAM

On Board Bluetooth 4.1 Wi-Fi

3.5mm 4-pole Composite Video and Audio Output Jack

MicroSD Card Slot

CSI Camera Port

DSI Display Port

Micro USB Power Input. Upgraded switched power source that can handle up to 2.5 Amps

Full Size HDMI Video Output

OpenStack

Esempio di topologia virtuale realizzabile sulla piattaforma IaaS

Roma2LUG

AAAAAAAAAAAAAAAAAAAAAAAAAA

- Download Raspbian OS for the Raspberry Pi

  ```
  $ wget https://downloads.raspberrypi.org/
     raspbian_lite_latest
  ```

- Unzip Raspbian OS for the Raspberry Pi

  ```
  $ unzip xxxx-xx-xx-raspbian-jessie-lite.zip
  ```

Studio Piattaforma IaaS

- Insert SD card

- Search for device name of the SD card with this command:

  ```
  $ sudo fdisk -l
  ```

- Search for info about your SD card. *Warning, be careful!*

  ```
  Disk /dev/mmcblk0: 14,5 GiB, 15523119104 bytes, 30318592 sectors
  Units: sectors of 1 * 512 = 512 bytes
  Sector size (logical/physical): 512 bytes / 512 bytes
  I/O size (minimum/optimal): 512 bytes / 512 bytesa
  Disklabel type: dos
  Disk identifier: 0x6f92008e
  ```

- Replace mmcblk0 with device name of your SD

  ```
  $ sudo dd \
    if=/xxxx-xx-xx-raspbian-jessie-lite.img \
    of=/dev/mmcblk0
  ```

Studio Piattaforma IaaS

- Connect ethernet cable to the Raspberry Pi
- Connect HDMI cable to the Raspberry Pi
- Connect micro USB power cable to the Raspberry Pi
- Waiting for coplete boot...
- Login
  - user: pi
  - password: raspberry
- Execute these commands:

```
$ sudo apt-get update
$ sudo apt-get dist-upgrade -y
$ sudo apt-get install rpi-upate -y
```

Studio Piattaforma IaaS

- Config Raspbian OS with this tool

  ```
  $ sudo raspi-config
  ```

  - Expand Filesystem
  - Internationalisation Options
    - Change Locale
    - Change Timezone
    - Change Keyboard Layout
    - Change wifi Country

  ```
  $ sudo reboot
  ```

- Update Raspberry Pi firmware

  ```
  $ sudo rpi-update
  $ sudo reboot
  ```

Studio Piattaforma IaaS

- Install library for gpio and other tools

  ```
  $ sudo apt-get install -y wiringpi git vim
  ```

- Download the scripts

  ```
  $ git clone https://github.com/Roma2Lug-
    Projects/MusicOnLinux.git
  ```

- Open the script

  ```
  $ cd MusicOnLinux
  $ vim keyboard.sh
  $ vim smario.sh
  ```

Studio Piattaforma IaaS

- Give execute permission

```
$ chmod +x keyboard.sh
$ chmod +x smario.sh
```

- Execute the scripts!

```
$ ./keyboard.sh
$ ./smario.sh
```

Keyboard.sh

```bash
#! /bin/bash
tone () {
  local note="$1"
  local duration="$2"
  if test "$note" -eq 0; then
    gpio -g mode 18 in
  else
    local period="$(perl -e"printf '%.0f
      ',600000/440/2**(( $note-69)/12 )")"
    gpio -g mode 18 pwm
    gpio pwmr "$(( period ))"
    gpio -g pwm 18 "$(( period/2 ))"
    gpio pwm-ms
    sleep $duration
    tone 0
  fi
}
```

Keyboard.sh nel dettaglio

```
tone () {
  local note="$1"
  local duration="$2"
  if test "$note" -eq 0; then
    gpio -g mode 18 in
  ...
```

- first parameter: note
- second parameter: duration of the note
- If the note is 0 I put the GPIO in input mode, so the speaker doesn't make any sound.

Keyboard.sh nel dettaglio(1)

```
...
else
  local period="$(perl -e"printf '%.0f
    ',600000/440/2**(( $note-69)/12 )")"
...
```

- We use the formula below to obtain the frequency of the note.

$$K \cdot \frac{440}{2^{\frac{X-69}{12}}}$$

- K=600.000 is a hardware constant.
- The twelfth root of two or $\sqrt[12]{2}$ is an algebraic irrational number. It is most important in music theory, where it represents the frequency ratio of a semitone in twelve-tone equal temperament.
- X is our note, encoded in ASCII. note 'A' = 69 and has a frequency of 440 Hz.

Keyboard.sh nel dettaglio(2)

```
    ...
        gpio -g mode 18 pwm
    gpio pwmr "$(( period ))"
    gpio -g pwm 18 "$(( period/2 ))"
    gpio pwm-ms
    sleep $duration
    tone 0
  fi
}
```

- This is the core function. I give power to the speaker with a modulation technique called Pulse Width Modulation.

- The speaker beeps for a time "duration".

- I mute the sound passing 0 to the function tone. Without tone 0 the speaker will sound indefinitily.

Grazie per l'attenzione