Raspberry Pi Hacks

Presented by
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@suehle

Tom Callaway
@spotrh
The history of the RasPi

- Early 2006 concept based on Atmel ATmega644
- Designed for educational use
- Intended for Python (but of course is friendly to all)
26 WAY GPIO

40 WAY GPIO
# Model comparison

<table>
<thead>
<tr>
<th></th>
<th>Model A+</th>
<th>Model B</th>
<th>Model B+</th>
<th>Pi 2 (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Broadcom BCM2835/ARMv6 single core</td>
<td>Broadcom BCM2835/ARMv6 single core</td>
<td>Broadcom BCM2835/ARMv6 single core</td>
<td>Broadcom BCM2836/ARMv7 quad core</td>
</tr>
<tr>
<td>Clock Speed</td>
<td>700 MHz processor</td>
<td>700 MHz processor</td>
<td>700 MHz processor</td>
<td>900 MHz processor</td>
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<tr>
<td>SDRAM</td>
<td>256 MB SDRAM</td>
<td>512 MB SDRAM</td>
<td>512 MB SDRAM</td>
<td>1 GB SDRAM</td>
</tr>
<tr>
<td>USB</td>
<td>1 USB</td>
<td>2 USB</td>
<td>2 USB</td>
<td>4 USB</td>
</tr>
</tbody>
</table>
# Raspberry Pi2 GPIO Header

<table>
<thead>
<tr>
<th>Pin#</th>
<th>NAME</th>
<th>NAME</th>
<th>Pin#</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>3.3v DC Power</td>
<td>DC Power 5v</td>
<td>02</td>
</tr>
<tr>
<td>03</td>
<td>GPIO02 (SDA1, PCl)</td>
<td>DC Power 5v</td>
<td>04</td>
</tr>
<tr>
<td>05</td>
<td>GPIO03 (SCL1, PCl)</td>
<td>Ground</td>
<td>06</td>
</tr>
<tr>
<td>07</td>
<td>GPIO04 (GPIO_GCLK)</td>
<td>(TXD0) GPIO14</td>
<td>08</td>
</tr>
<tr>
<td>09</td>
<td>Ground</td>
<td>(RXD0) GPIO15</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>GPIO17 (GPIO_GEN0)</td>
<td>(GPIO_GEN1) GPIO18</td>
<td>12</td>
</tr>
<tr>
<td>13</td>
<td>GPIO27 (GPIO_GEN2)</td>
<td>Ground</td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>GPIO22 (GPIO_GEN3)</td>
<td>(GPIO_GEN4) GPIO23</td>
<td>16</td>
</tr>
<tr>
<td>17</td>
<td>3.3v DC Power</td>
<td>(GPIO_GEN5) GPIO24</td>
<td>18</td>
</tr>
<tr>
<td>19</td>
<td>GPIO10 (SPI_MOSI)</td>
<td>Ground</td>
<td>20</td>
</tr>
<tr>
<td>21</td>
<td>GPIO09 (SPI_MISO)</td>
<td>(GPIO_GEN6) GPIO25</td>
<td>22</td>
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<td>23</td>
<td>GPIO11 (SPI_CLK)</td>
<td>(SPI_CE0_N) GPIO08</td>
<td>24</td>
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<tr>
<td>25</td>
<td>Ground</td>
<td>(SPI_CE1_N) GPIO07</td>
<td>26</td>
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<tr>
<td>27</td>
<td>ID_SD (I^2C ID EEPROM)</td>
<td>(I^2C ID EEPROM) ID_SC</td>
<td>28</td>
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<tr>
<td>29</td>
<td>GPIO05</td>
<td>Ground</td>
<td>30</td>
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<tr>
<td>31</td>
<td>GPIO06</td>
<td>GPIO12</td>
<td>32</td>
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<td>33</td>
<td>GPIO13</td>
<td>Ground</td>
<td>34</td>
</tr>
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<td>35</td>
<td>GPIO19</td>
<td>GPIO16</td>
<td>36</td>
</tr>
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<td>37</td>
<td>GPIO26</td>
<td>GPIO20</td>
<td>38</td>
</tr>
<tr>
<td>39</td>
<td>Ground</td>
<td>GPIO21</td>
<td>40</td>
</tr>
</tbody>
</table>

http://www.element14.com
Raspberry Leaf

http://www.doctormonk.com/2013/02/raspberry-pi-and-breadboard-raspberry.html
GPIO reference board

http://www.adafruit.com/products/2196

http://www.adafruit.com/products/2263
Find your Pi

- `cat /proc/cpuinfo`

  Processor: ARMv6-compatible processor rev 7 (v6l)
  CPU architecture: 7

  Hardware: BCM2708
  Revision: 000e
  Serial: 0000000011185abc
Get the right SD card

- Most quality cards are OK
- Micro (with adapter)
- elinux.org/RPi_SD_cards
Pick the right distro

- Pidora
- Raspbian
- RaspBMC
- Occidentalis
There's one for you!

<table>
<thead>
<tr>
<th>DietPi</th>
<th>Moebius</th>
<th>Osmc</th>
<th>Raspberry Digital Signage</th>
<th>Occidentalis</th>
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<tr>
<td>Arch (ARM)</td>
<td>MINIBIAN</td>
<td>RISC OS</td>
<td>Volumio</td>
<td>Tiny Core</td>
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<tr>
<td>BerryTerminal</td>
<td>NOS</td>
<td>SliTaz</td>
<td>Volumio</td>
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<td>Bodhi</td>
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<td>Debian ARM</td>
<td>OpenWRT</td>
<td>Plan9</td>
<td>ThinkBox</td>
<td>MotionPie</td>
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<td>DRUMS</td>
<td>PiBang</td>
<td>9front</td>
<td>Slrpi</td>
<td>Puppi</td>
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<td>Pidora</td>
<td>PwnPi</td>
<td>SlaXBMCRPI</td>
<td>Slackware ARM</td>
<td>Angstrom</td>
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<tr>
<td>Gentoo</td>
<td>QtonPi</td>
<td>PiMAME</td>
<td>ARM</td>
<td>Void Linux</td>
</tr>
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<td>IPFire</td>
<td>VPNbian</td>
<td>PiBox</td>
<td>Windows 10 IOT</td>
<td>OSMC</td>
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<td>I2berry</td>
<td>Raspbian</td>
<td>PipaOS</td>
<td>Raspberry-ua-netinst</td>
<td>Inferno</td>
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<tr>
<td>Kali</td>
<td>OpenELEC</td>
<td>Raspberry WebKiosk</td>
<td>Raspbian-ua-netinst</td>
<td>Ark OS</td>
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<tr>
<td>Meego MER</td>
<td>Xbian (Kodi)</td>
<td>FreeBSD</td>
<td>NetBSD</td>
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NOOBS

New Out Of Box Software
Installing it

- Fedora ARM installer
  - fedoraproject.org/wiki/Fedora_ARM_Installer
  - yum install fedora-arm-installer
- On a Mac, Rpi-sd card builder or RasPiWrite
  - Google “Rpi-sd builder”
  - github.com/exaviorn/RasPiWrite
1 + 2 – worrying = Buy pre-loaded
Power

- 5V. 5V. 5V.
- Why you shouldn't use iPhones
- Your laptop's USB port is not the droid you're looking for
- Put a power brick on your shopping list
- Did I mention C6?
Android on your Pi

http://androidpi.wikia.com
Display options

- HDMI rev 1.3 & 1.4, 14 HDMI resolutions from 640×350 to 1920×1200 plus various PAL and NTSC standards, composite video (PAL and NTSC) via 3.5 mm TRRS jack shared with audio out (replaces dedicated composite video out from Pi 1)
- No VGA
- DSI
Fun display alternatives

- Kindleberry Pi
  www.ponuki.net
  2012/09/
  kindleberry-pi/
Fun display alternatives
Touchscreens

- Ooh, look! DSI connector!
- Mimo 720
  - USB DisplayLink Framebuffer Driver CONFIG_FB_UDL/udlfb.ko
  - USB DisplayLink Kernel Mode Setting (KMS) driver CONFIG_DRM_UDL/udl.ko
Couture kernel

- 3.18.y with testing code for 4.*

$ git clone
git://github.com/raspberrypi/linux.git

$ tar xvfz rpi-3.18.y.tar.gz

$ make mrproper
Write down these words

220 uF 16v electrolytic capacitor
Add an off switch
Johnny Five alive!
Test your might! (In volts)
Test your might! (In volts)
Decode the LEDs

- D5 OK (Rev 1.0) ACT (Rev 2.0) Green SD card access, connected to GPIO 16
- D6 PWR Red 3.3 V Power, connected to 3V3
- D7 FDX Green Full Duplex LAN
- D8 LNK Green Link/Activity LAN
- D9 10M (Rev 1.0) 100 (Rev 2.0) Yellow 10/100Mbit LAN
Why didn't it start?

- 1 blink: Pi from Micron. Update software, use 4 GB SD card
- 2 blinks: SD card can't be read
- 3-7 flashes: Problems with loader.bin, start.elf, or kernel.img
- 8 blinks: SDRAM not recognized. Update bootcode.bin and start.elf.
Blah blah blah. Stop saying words and show us pretty pictures of cool things people made.
Case closed.

- Make one
- 3D print one
- Buy one
- (or use the one it comes in)
Cyntech case

http://www.modmypi.com
Not bigger on the inside.

©Miriam E Lewis  www.miriamelewis.co.uk
Temple of Pi

©Miriam E Lewis  www.miriamelewis.co.uk
Or just buy it.

http://www.thedailybrick.co.uk/lego-sets/custom/lego-custom-raspberry-pi-case.html
NinTastic

http://www.thingiverse.com/thing:307832
Apple II case

http://www.thingiverse.com/thing:340677
Experimenting Board

http://www.thingiverse.com/thing:53688
Pi Ball

Broadcom WiFi/Hub
 Aren't you a little small for an HTPC?

- RaspBMC/XBMC
  - 1080p
  - Share over NFS, SMB, FTP, HTTP, USB, XYZ, and other acronyms
  - Install to SD, USB, or run off NFS Embedded Samba TVHeadend FTP SSH
Can you do it?

Anton Hvornum - 5 months ago

Within 3 minutes, i’ve:

* Opened a package containing a Raspberry Pi
* Found a SD card in a drawer
* Googled "Raspberry pi xbmc"
* Installed Raspbmc onto the SD card
* Booted it and it works...

I havn’t even figured out who’s behind raspbmc or anything, but whoever you are... i love you!

72  •   •   Reply   •   Share  •
Geiger Counter - Radiation Sensor Board for Raspberry Pi tutorial
www.cooking-hacks.com//geiger-counter-raspberry-pi-radiation-sensor... ▼
Manifesto • The main finality of the Radiation Sensor Board for Raspberry Pi is to help people in Japan to measure the levels of radiation in their everyday life ...
Manifesto • The Board • The Geiger Tube • Types of radiation

RPI Geiger Counter | MAKE
makezine.com/2013/06/12/pi-geiger-counter/ ▼
by John Baichtal • in 725 Google+ circles
Jun 12, 2013 • The Raspberry Pi is a perfect platform to be a cheap but very versatile geiger counter. It can be connected to a TV/Monitor to display a nice ...

Raspberry Pi • View topic - My Raspberry Pi Geiger Counter
Dec 28, 2012 • 1 post • 1 author
I got a Mighty Ohm Geiger counter for Christmas and made it into a Random Number Generator. Luckily you can mute the counter so I won't be ...

Geiger Counter Kit - Radiation Sensor ID: 483 - $99.95 : Adafruit ...
www.adafruit.com/products/483 ▼
Adafruit Industries, Unique & fun DIY electronics and kits Geiger Counter Kit - Radiation Sensor ID: 483 • Detect particles and/or make a cool ... Raspberry Pi [96].

Nuclear Emergency Tracking Center
www.netc.com/Radiation%20Equipment%20Compatible.html ▼
Special Deal • Complete Radiation Monitoring Site • for $199.00 • Sold Out 1. Raspberry Pi Model B, case and power supply 2. GMC-200 Geiger counter 3.

Apollo-NG - PiPi - Raspberry Pi Geiger-Müller Interface
Pop quiz!
The BBC Microcomputer Is Here!

A WONDER FOR THE MONEY. Even before its introduction in the U.S., the BBC microcomputer was acclaimed as a "no-nonsense computer" (BYTE magazine); "a remarkably friendly machine" the "will set the standard for home computers for quite some time" (POPULAR COMPUTING); and "the most versatile, small general-purpose computer I've seen... a wonder for the money" (COMPUTERS & ELECTRONICS).

EDUCATIONAL USES. The BBC micro was designed as part of a national computer literacy project, one portion of which is "The Computer Programme" TV series being shown in the U.S. on more than 220 PBS stations. BBC micros now account for more than 75% of the computers being ordered by British schools under a government plan to put a computer into every primary and secondary school.

THE SYSTEM. The BBC micro is based on a 2MHz 6502 main microprocessor with a combined RAM/ROM address capability of 64K.

HIGH RESOLUTION GRAPHICS. The system features very high resolution color graphics in modes up to 640 x 256 (163,840 pixels). Text display can be 80, 40 or 20 characters by 32 or 25 lines.

EXPANDABILITY. The computer includes built-in serial and parallel interfaces, a floppy disc interface, a 1MHz expansion bus, analog-digital interfaces, eiconet interface which allows schools and businesses to link economically up to 254 computers in a low cost local area network, and a unique high-speed data channel called the Tube® for adding a second processor.

SECOND PROCESSORS. An additional 6502 microprocessor provides increased processing speed and an extra 64K of RAM. Alternatively, a Z-80B Second Processor can be joined to add 64K of RAM and allow running of CP/M programs*, which are extensively used for business applications. A third choice is a UNIX based 16032 16-bit processor with 32-bit architecture that provides 256K RAM.

CONTACT
FOURTH DIMENSION SYSTEMS
for details and name of your local dealer.
Dealer inquiries invited.

FOURTH DIMENSION SYSTEMS
1101 South Grand Ave., Suite A
Santa Ana, California 92705
(714) 835-8202

*Registered trademark of Digital Research, Inc.
Pis in education

- Raspberry Pi Education Fund
- 15,000 Pis in UK schools
- Madanyu
- Local clubs and classes
Powering Potential

Students Qualifying for the Next Level of Education after Phase 1 implementation in 2012

- 2012
- 2013

<table>
<thead>
<tr>
<th>Location</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slahamo</td>
<td>0%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Endallah</td>
<td>22.5%</td>
<td>30%</td>
</tr>
<tr>
<td>Baray</td>
<td>7.5%</td>
<td>22.5%</td>
</tr>
</tbody>
</table>
RaspberryPi Hacking Course!?!?

http://advfoss-ritigm.rhcloud.com

- Advanced seminar course at RIT IGM department
- Each student gets a Raspberry Pi for semester
- 5-week release cycles
  - Focuses on shipping code, releasing early/often
- Over 20 projects developed in one semester
- http://github.com/FOSSRIT
In-Glass: Real-time Temperature Sensors

https://github.com/chrisknepper/in-glass
NeuroPi: Brain Interface a la Raspberry Pi

https://github.com/ArcticSphinx/NeuroPi
BarkTracker: Sound Tracking Notifications

https://github.com/lle6138/BarkTracker
Scratch an itch

HACK ATTACK

Chapter Focus

Learn to control sprites with the mouse, program objects to bounce back, and start a game by pressing the spacebar.

The Game

Heb Scratchy attack flying viruses and stop them from touching the server at the bottom of the screen. If you successfully block 30 viruses, you win the game!

First, go to the Stage and import a sparkly nighttime picture of Hong Kong!

Did you know you can add programs to the Stage, too? We can add this program to make our city glow!

---

STAGE 4

MISAOH COMPLETED!

FABU'S FREE AGAIN!

*SNIFF* FOILED AGAIN...

AWW...DON'T BE UPSET! I JUST THINK THAT ART'S MEANT TO BE SHARED!

DO YOU THINK THE COSMIC DEFENDERS WOULD TAKE ME BACK IF I APOLOIZED?

PROBABLY BUT BE CAREFUL NOW! WIZARD HAS IT THAT THE DARK WORLD IS PLANNING TO LAUNCH A VIRUS ATTACK ON HONG KONG!

OH NO! BUT IF THAT HAPPENS, THE WHOLE DIGITAL WORLD COULD BE DESTROYED!

FABU'S RIGHT! WE HAVE TO DESTROY THE VIRUS RIGHT AWAY!

HONG KONG

STAND BACK. I KNOW KUNG FU!

HERE IT COMES!
**Developer's Description**

This is a Port of Chocolate Doom v1.7 that supports Dispmanx

---

**Requirements**

The binary requires a couple of libraries that need to be installed following these instructions:

```
sudo apt-get update
sudo apt-get install libbsd1.2debian libbsd-image1.2 libbsd-mixer1.2 libbsd-net1.2
```

The binary requires also a data file from Doom (1, 2 or Ultimate) called a WAD file.

**User Guide for Chocolate Doom**


**Using WAD file**

Here is an example of executing chocolate doom with a WAD file.

```
pi@raspberrypi ~ $ chocolate-doom -iwad where_is_my_wad\Doom1.wad
```

**If you want (free) X11 support:**


Source can be downloaded here: [http://www.norisc-motan.co.uk/downloads/Chocolate_doom-1.7.0.tar.gz](http://www.norisc-motan.co.uk/downloads/Chocolate_doom-1.7.0.tar.gz)

**Content Rating**

The developer has provided the following content rating for this item:

- [T] Teen

**Licence**

Custom Agreement

The developer is using a Custom End User Licence Agreement. Click the link below for details:

[Licence info](#)
Googler Coder

CODER

+  Gadgetoid!

Eyeball  Hello Coder
Googler Coder

```javascript
// Try changing the variables below to change the game.
SpaceRocks.projectileColor = "#00cdac"
SpaceRocks.projectileSpeed = 40;
SpaceRocks.enemyColors = ["#ff4d4d",
                        "#00cdac",
                        "#ff9933",
                        "#ff9933",
                        "#ff9933",];
SpaceRocks.shipColor = "#00cdac"
SpaceRocks.lineThickness = 2;
SpaceRocks.outlineShapes = true;
SpaceRocks.fillShapes = true;

// The 3 letter name for your ship.
SpaceRocks.ship.name = "You";

// Ship properties
SpaceRocks.ship.speed = 3;
SpaceRocks.ship.size = 1;
SpaceRocks.ship.drag = 0;
```
Raspberry Pi Hacks

Coder helps you learn how to make web pages.
Coder Projects

Life in the Public Domain

Words by John Q. Public. Pictures from the Smithsonian Institution Archives.

http://googlecreativelab.github.io/coder-projects/
Education resources

- elinux.org/Rpi_Education
- github.com/gskielian/Raspberry-Pi-Curriculum
PiBoy
Success!

http://imgur.com/a/ksgBg#0
PIP-Boy 3000
RIP Pi-PIP-Boy

http://blog.ryangrieve.com/the-raspberry-pipboy/
Emulating your childhood
Teeny arcade!
www.instructables.com/id/Coffee-Table-Pi
NaCade

Cupcade
Steam stream

http://possiblyunsafe.com/2015/03/17/diy-raspberry-pi-2-steam-machine/#more-122
Fisher Price Chatter
Fisher Price Chatter

http://www.grantgibson.co.uk/2014/08/fisher-price-talking-chatter-smartphone/
PiLorean

fortoffee.org.uk/raspberry-pi-delorean/
PiLorean

http://www.youtube.com/watch?v=ncXxBmbuFII
Home automation

Home automation

Laundry Room

Laundry Room Status

<table>
<thead>
<tr>
<th>Device</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dryer</td>
<td>Off</td>
</tr>
<tr>
<td>Washer</td>
<td>Off</td>
</tr>
<tr>
<td>Laundry Room Temp</td>
<td>74.0 °F</td>
</tr>
<tr>
<td>Laundry Room Humidity</td>
<td>45.0 %</td>
</tr>
<tr>
<td>Laundry Room Light</td>
<td></td>
</tr>
<tr>
<td>Laundry Water Leak Status</td>
<td></td>
</tr>
<tr>
<td>Laundry Water Leak Notifier</td>
<td></td>
</tr>
</tbody>
</table>
LCARS Home Automation

http://www.youtube.com/watch?v=176YaM5jta4
Coffee ordering

http://www.youtube.com/watch?v=BQBOPGSfFwY
BrewPi.com

### Maintenance Panel

**PID algorithm for fridge setting**

- Beer temp. error: 0.006
- Beer temp. error integral: -9.49
- Beer temp. derivative: -0.006

\[ \text{Beer Setting} = 19, \quad \text{Fridge Setting} = 17.02 \]

**Predictive ON/OFF and peak detection**

- Estimated peak: 16.3
- Last detected negative peak: 16.3
- Last target for negative peak: 16.3
- Last detected positive peak: 22.1
- Last target for positive peak: 22.1

**Cooling overshoot estimator:** 13.619
**Heating overshoot estimator:** 0.199

The red values are control settings. The beer setting is set by the profile or constant. The fridge setting is set by PID or constant.
The orange values are control variables. These are intermediate results of the fridge setting calculation.
The blue values are constants, they never change automatically.

The heater and cooler are controlled by a predictive on-off algorithm. BrewPi estimates the overshoot that would happen when it would go to IDLE. When that lands on the target temperature, it goes to IDLE. The overshoot is estimated as time active in hours * estimator. BrewPi detects the actual peaks and compares them to the prediction to automatically adjust the estimators. You can change them manually in 'advanced settings' when they are far off.
Ice cream with your Pi
Ice cream with your Pi
Control Christmas lights
Control Christmas lights

http://chivalrytimberz.wordpress.com/2012/12/03/pi-lights/
PiFM

- Go to bit.ly/TMgytl from the Pi (and download to home folder)

```python
sudo python
    >> import PiFM
    >> PiFm.play_sound("sound.wav")
```

- Tune a nearby radio to 103.3
PiFM

- System Clock = 500Mhz
- Divider Register = 5.000
- FM radio clock frequency = 500/5 = 100Mhz
Best Valentine EVER
Photography and Pi
Tux Photobooth
Tux Photobooth
Soundwave
3D Scanner

http://www.pi3dscan.com/
Pi Microwave

http://madebynathan.com/2013/07/10/raspberry-pi-powered-microwave/
Raspberry Microwave @rbmicrowave · 12 Jul 2013
Finished cooking 2 Minute Noodles - Chicken! I'm pretty sure it tastes like chicken. Or maybe tasty wheat.

Raspberry Microwave @rbmicrowave · 9 Jul 2013
Just heated up some Raspberry Pie Filling!

Raspberry Microwave @rbmicrowave · 9 Jul 2013
Just finished cooking up some Beef, Bacon & Cheese Pie! I hope they like it!

Raspberry Microwave @rbmicrowave · 9 Jul 2013
Just finished cooking some Hearty Roast Chicken & Vegetable Soup!

Raspberry Microwave @rbmicrowave · 9 Jul 2013
Just heated up some Hot chocolate! I hope they like it!
Magic Mirror

http://michaelteeuw.nl/post/84026273526/and-there-it-is-the-end-result-of-the-magic
Resources

- learn.adafruit.com
- elinux.org
- instructables.com
- rsuehle.fedorapeople.org/raspi/

*Raspberry Pi Hacks*

Contact:
- @suehle  |  ruth@redhat.com
- @spotrh  |  spot@fedoraproject.org