Raspberry Pi build information
10/16/15

Adding gsl support to RaspBian
Requirements: gsl-1.15.tar.gz
/home/vidal/wkg/raspberrypi2_yocto/gsl
linalg.c poly.c sqmatrice.c testmatrices.c

```
cd wkg/
 tar xfz gsl-1.15.tar.gz
 cd gsl-1.15/
 ./configure
 make
 sudo make install
```

15:32 14:57 35 minutes to compile on target.

```
export CFLAGS="-I/usr/local/include -L/usr/local/lib -lgsl -lgslcblas -lm"
./compile_test_files
-rwxr-xr-x 1 vidal vidal 7530 Oct 16 15:37 linalg
-rwxr-xr-x 1 vidal vidal 6582 Oct 16 15:37 poly
-rwxr-xr-x 1 vidal vidal 8251 Oct 16 15:37 sqmatice
-rwxr-xr-x 1 vidal vidal 6669 Oct 16 15:37 testmatrices
vidal@raspberrypi ~/wkg/raspberrypi2_yocto/gsl $ ./linalg
x =
-4.05205
-12.6056
1.66091
8.69377
vidal@raspberrypi ~/wkg/raspberrypi2_yocto/gsl $ ./poly
z0 = -0.809016994374947673 +0.587785252292473359
z1 = -0.809016994374947673 -0.587785252292473359
z2 = +0.309016994374947507 +0.951056516295152976
z3 = +0.309016994374947507 -0.951056516295152976
z4 = +0.999999999999999889 +0.000000000000000000
vidal@raspberrypi ~/wkg/raspberrypi2_yocto/gsl $ ./sqmatice
The output file format ofmt %f
will be used in gsl_matrix_fprintf (opointer, m, ofmt)
Initial test matrice
m(0,0) = 2.58
m(0,1) = -3.1
m(0,2) = 4.25
m(1,0) = 3.821
m(1,1) = 4.44
m(1,2) = 5.656
m(2,0) = 1.82
m(2,1) = 7.41
m(2,2) = 3.33
transpose of initial matrice
the matrice needs to be square
3
```

```
sizeof of struct m 24
num of rows 3
num of cols 3
m(0,0) = 2.58
m(0,1) = 3.821
m(0,2) = 1.82
m(1,0) = -3.1
m(1,1) = 4.44
m(1,2) = 7.41
m(2,0) = 4.25
m(2,1) = 5.656
m(2,2) = 3.33
The identity matrice
m(0,0) = 1
m(0,1) = 0
m(0,2) = 0
m(1,0) = 0
m(1,1) = 1
m(1,2) = 0
m(2,0) = 0
m(2,1) = 0
m(2,2) = 1
vidal@raspberrypi ~/wkg/raspberrypi2_yocto/gsl $ ./testmatrices
m(0,0) = 0.23
m(0,1) = 1.23
m(0,2) = 2.23
m(1,0) = 100.23
m(1,1) = 101.23
m(1,2) = 102.23
m(2,0) = 200.23
m(2,1) = 201.23
m(2,2) = 202.23
m(3,0) = 300.23
m(3,1) = 301.23
m(3,2) = 302.23
m(4,0) = 400.23
m(4,1) = 401.23
m(4,2) = 402.23
m(5,0) = 500.23
m(5,1) = 501.23
m(5,2) = 502.23
m(6,0) = 600.23
m(6,1) = 601.23
m(6,2) = 602.23
m(7,0) = 700.23
m(7,1) = 701.23
m(7,2) = 702.23
m(8,0) = 800.23
m(8,1) = 801.23
m(8,2) = 802.23
m(9,0) = 900.23
m(9,1) = 901.23
```

m(9,2) = 902.23
gsl: ../gsl/gsl_matrix_double.h:275: ERROR: first index out of range
Default GSL error handler invoked.
Aborted

sudo apt-get install octave

GNU Octave

GNU Octave is a high-level interpreted language, primarily intended for numerical computations. It provides capabilities for the numerical solution of linear and nonlinear problems, and for performing other numerical experiments. It also provides extensive graphics capabilities for data visualization and manipulation. Octave is normally used through its interactive command line interface, but it can also be used to write non-interactive programs. The Octave language is quite similar to Matlab so that most programs are easily portable.

https://www.gnu.org/software/octave/

vidal@raspberrypi ~ $ octave

GNU Octave, version 3.8.2

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This is free software; see the source code for copying conditions.

There is ABSOLUTELY NO WARRANTY; not even for MERCHANTABILITY or

FITNESS FOR A PARTICULAR PURPOSE. For details, type 'warranty'.

Octave was configured for "arm-unknown-linux-gnueabihf".

Additional information about Octave is available at http://www.octave.org.

Please contribute if you find this software useful.

For more information, visit http://www.octave.org/get-involved.html

Read http://www.octave.org/bugs.html to learn how to submit bug reports.

For information about changes from previous versions, type 'news'.

```
octave:1> A = [ 0.18, 0.60, 0.57, 0.96;
>               0.41, 0.24, 0.99, 0.58;
>               0.14, 0.30, 0.97, 0.66;
>               0.51, 0.13, 0.19, 0.85 ];
octave:2> x = [ -4.05205; -12.6056; 1.66091; 8.69377];
octave:3> A * x
ans =


   1.0000
   2.0000
   3.0000
   4.0000
```

to exit Ctrl-D
Testing 5 in display from adafruit.
diff -u config.txt config.txt.disp

```
--- config.txt    2015-09-08 21:12:58.000000000 +0000
+++ config.txt.disp     2015-10-01 16:14:54.000000000 +0000
@@ -22,12 +22,15 @@
 #framebuffer_height=720


 # uncomment if hdmi display is not detected and composite is being output
-#hdmi_force_hotplug=1
+hdmi_force_hotplug=1
```

```
 # uncomment to force a specific HDMI mode (this will force VGA)
 #hdmi_group=1
-#hdmi_mode=1
-
+hdmi_group=2
+hdmi_mode=1
+hdmi_mode=87
+hdmi_cvt 800 480 60 6 0 0 0
+#max_usb_current=1
 # uncomment to force a HDMI mode rather than DVI. This can make audio work in
 # DMT (computer monitor) modes
 #hdmi_drive=2
```

Installing samba on RaspBian

```
sudo apt-get install samba


sudo apt-get update


sudo apt-get install samba


sudo mkdir /home/samba


sudo chown -R vidal:vidal /home/samba


sudo smbpasswd -a vidal
vidal@raspberrypi /etc/samba $ diff -u smb.conf.orig smb.conf
--- smb.conf.orig       2015-10-07 19:26:28.452158345 +0000
```

+++ smb.conf 2015-10-07 19:37:53.040567866 +0000

@@ -45,6 +45,7 @@

 # This can be either the interface name or an IP address/netmask;

 # interface names are normally preferred

 ;   interfaces = 127.0.0.0/8 eth0

+   interfaces = 192.168.1.0/24 127.0.0.0/8 eth0 wlan0

 # Only bind to the named interfaces and/or networks; you must use the

 # 'interfaces' option above to use this.

@@ -252,3 +253,9 @@

 # to the drivers directory for these users to have write rights in it

 ;   write list = root, @lpadmin

+[samba_extra]

+comment = Public Stuff

+path = /home/samba

+public = yes

+writable = yes

+printable = no

smbpasswd -a vidal

The repository https://github.com/fpga-logi/logi-tools.git
has a Raspberry Creates a Pi library.
Execute the command “cd logi-tools/c”.
Executing the command “sudo make install_logipi
”
provides the following output:
gcc -shared -o liblogipi.so logipilib.o

mv liblogipi.so /usr/lib/liblogi.so

cp logilib.h /usr/include

int logi_write(unsigned char * buffer, unsigned int length, unsigned int address);

int logi_write(unsigned char * buffer, unsigned int length, unsigned int address);

There is a 2nd repository https://github.com/fpga-logi/logi-hard.git
The tree of files in fpga-logi/logi-hard repository is found at Appendix F.
The raspberrypi2_gpio https://github.com/develone/raspberrypi2_gpio.git C code for
for GPIO signals. When running as a no root user "sudo ./gpio_ex" is used
Information on GPIO_Benchmarks is available raspberrypi2_yocto
https://github.com/develone/raspberrypi2_yocto.git in the file doc/GPIO_Benchmarks.pdf.
Also the README.MD in raspberrypi2_gpio provides information on connecting
resistors and leds to test GPIO.

XXXXXXXXXXyosys raspbianXXXXXXXXXXXXXXXXXX

RaspBian yosys 09/02/15

cd wkg/

Need to add adiitional packages to install yosys.

In addition installed squashfs-tools

****

sudo apt-get install python3

sudo apt-get install mercurial

sudo apt-get install gawk

sudo apt-get install libreadline-dev

sudo apt-get install libffi-dev

sudo apt-get install tcl-dev

sudo apt-get install tcl

sudo apt-get install squashfs-tools

****

git clone https://github.com/cliffordwolf/yosys.git

cd yosys/

make config-gcc

make

Note: this is the point that the yocto build crash since hg is having

[100%] Building abc/abc-c3698e053a7a

Pulling ABC from bitbucket.org:

+ test -d abc

+ hg clone https://bitbucket.org/alanmi/abc abc

requesting all changes

adding changesets

adding manifests

adding file changes

added 2948 changesets with 13693 changes to 2035 files (+5 heads)

updating to branch default

1533 files updated, 0 files merged, 0 files removed, 0 files unresolved

+ cd abc

[100%] Building share/ice40/brams_init3.vh

Build successful.

sudo make install

[Makefile.conf] CONFIG := gcc

mkdir -p /usr/local/bin

install yosys yosys-config yosys-abc yosys-filterlib /usr/local/bin/

mkdir -p /usr/local/share/yosys

cp -r share/. /usr/local/share/yosys/.

ls

abc frontends Makefile.conf README yosys

backends kernel manual share yosys-abc

CHANGELOG libs misc techlibs yosys-config

CodingReadme Makefile passes tests yosys-filterlib

created to tar files
yosys_bin.tgz & yosys_share.tgz

XXXXXXXXXXyosys raspbianXXXXXXXXXXXXXXXXXX

Installed OpenCV 7/01/15 details /home/vidal/wkg/pi/opencv_github.txt
Installed audio software details /home/vidal/wkg/pi/audio.txt
Installed GNURADIO 07/14/15 details /home/vidal//wkg/pi/gnuradio.txt
The following information was found at
https://www.raspberrypi.org/forums/viewtopic.php?f=91&t=46911
Backing up the RaspberyPi micro SD

```
sudo dd bs=4M if=/dev/sdb | gzip > /home/your_username/image`date
+%d%m%y`.gz
run as root gzip -dc /home/your_username/image.gz | dd bs=4M
of=/dev/sdb
The image was transferred to 500 GB hard drive

/
run/media/vidal/ef8bceae-4730-4810-b594-ce6aafd13919/vidal/fedora2
0_ws009

-rw-r--r-- 1 vidal users 25930659912 Jun 14 16:26
image-06-16-15.gz
```

This is the 2nd start of a build on 32GB card since 8GB does not provide enough space.
When you first boot a message will appear
Ensures that all SD card storage is availble to the OS Enter
You will get a messeage that the root will be resized on the next boot.

Filesystem	1K-blocks	Used	Available	Use%	Mounted on
rootfs	30139344	2512368	26352032	9%	/
/dev/root	30139344	2512368	26352032	9%	/
devtmpfs	470416	0	470416	0%	/dev
tmpfs	94944	296	94648	1%	/run
tmpfs	5120	0	5120	0%	/run/lock
tmpfs	189880	0	189880	0%	/run/shm

/dev/mmcblk0p1 57288 19400 37888 34% /boot

Locking down the system
Step 1
Change pi passwd to vidal's using sudo raspi-config

Step 2
Change default options for ssh

sudo su -
cd /etc/ssh
cp sshd_config sshd_config.factory-defaults
chmod a-w sshd_config.factory-defaults
cp ssh_config to ssh_config.lockdn
edit ssh_config.lockdn

```
#PasswordAuthentication yes PasswordAuthentication no
AllowUsers vidal, pi
Step 2a.
Need create ssh keys
ssh-keygen -t
This should prompt for a location where the key will be created.
Enter a phrase
ReEnter the phrase
This will generate 2 files  id_rsa & id_rsa.pub
in the .ssh folder of your home directory.
Step 2b.
cd /etc
sudo visudo -f sudoers
vidal ALL=(ALL) NOPASSWD: ALL

Need to create user vidal
useradd vidal
mkdir /home/vidal
add vidal:x:1001: to /etc/group
cp /home/pi/.profile /home/vidal
cp /home/pi/.bashrc /home/vidal
chown -R vidal:vidal /home/vidal
```
ls -la /home/vidal/

total 16

drwxr-xr-x 2 vidal vidal 4096 Jun 13 17:29 .

drwxr-xr-x 4 root root 4096 Jun 13 17:23 ..

-rw-r--r-- 1 vidal vidal 3243 Jun 13 17:29 .bashrc

-rw-r--r-- 1 vidal vidal 675 Jun 13 17:29 .profile
Raspberry Pi 2 Model B 1GB6X Faster
Step 3.
Change passwd for vidal

sudo passwd vidal
Editing the /etc/hosts.deny & /etc/hosts.allow files

```
20c20
< ALL: ALL
---
>
13c13
< ALL : 192.168.1.0/255.255.255.0
---
>
```

ALL: ALL in /etc/hosts.dney blocks hosts from connecting to the Raspberry Pi
ALL : 192.168.1.0/255.255.255.0 Allows hosts on local network to connect if a key is
.ssh/authorized.keys
ssh-rsa
AAAAB3NzaC1yc2EAAAADAQABAAACAQC70ZkXKGV/F100mldkWtTMeyaceJ8mhf33ft/7j
YZ8Ty7bP91DFXLqvZ0fJ2XaALGdfdkhdF8UshgGk8n0exBLAUkJMCLrpCyxeHl/HILEg9CaEl7
EQkRjlcAdwmtimf9ULy5HmDyNF4B/rB8X2tAfBh84yq11LtHsZAd2gsOPZS2vrEdqZQyj8rtz62d
fhDJNqPzuHep9xZMgWK8ndNdrE/NEnSz7jRdpXboTRIzd0wW+OC/SZubf3F/61kmCFmYR68p
kFsEcrK6EURBGwma6nqMYgKXlgtAHDmVQc03fs54s5Qei4fiDEHTVrAhNDGpIk/8Vh38H9fo
2s3T2s77uJOxMC7MGHGwDblJvtGv2+7A+e5uL3TQmsNZdn+FoC8ARxKKMriQgni86rsnxrzP1
/0gmvuJmv5jpMCv3ebQWtAblavH+ncVcrjPmpYlsjSTXSWLeh3MAPS2tLFth958y9knGzYKLM
BuBAnmnyHeRvppqr+Qe1JeCAL71VAxIxjern4DMqinKnWH8gj+Ttpl58QfkSJTI5Dd7iCYK6b/X
aJNmIPcPFfOCG8z+QSw/Qsaw18o9wrk08hGW9/23tKpiY/ebh7Q8FpTcAx802MAwvQFuakL1Y
00KbXelUEAzAtt8INMNjD5HTDrZKGnkGaHzQ7wdyvBGvB39EznGd362Nw==
vidal@vidal-MX6438
Python Rpi.GPIO
Downloaded Rpi.GPIO-0.5.11.tar.gz
tar xfz wkg/pi/RPi.GPIO-0.5.11.tar.gz
cd Rpi.GPIO-0.5.11/
sudo python setup.py install
sudo ls /usr/local/lib/python2.7/dist-packages/RPi*

/usr/local/lib/python2.7/dist-packages/RPi.GPIO-0.5.11.egg-info

/usr/local/lib/python2.7/dist-packages/RPi:

GPIO.so __init__.py __init__.pyc

- Broadcom BCM2836 ARMv7 Quad Core Processor powered Single Board Computer running at 900MHz
- 1GB RAM so you can now run bigger and more powerful applications
- Identical board layout and frint as the Model B+, so all cases and 3rd party add-on boards designed for the Model B+ will be fully compatible.
- Fully HAT compatible
- 40pin extended GPIO to enhance your "real world" projects
- 10/100 Ethernet Port to quickly connect the Raspberry Pi to the Internet
06/10/15

dpkg --get-selections > installed-software8.log creates a list of the packages that have been with apt-get which uses dkpg as the package management. A list of software installed found at

Appendix B. installed-software5.log . This file has 1509 packages
Appendix C Python packages installed most using pip
Appendix D GPIO information
Appendix E SCIPY FFT example

```
rootfs          7534284 3152188   4025780  44% /
/dev/root       7534284 3152188   4025780  44% /
devtmpfs         470416       0    470416   0% /dev
tmpfs             94944     264     94680   1% /run
tmpfs              5120       0      5120   0% /run/lock
tmpfs            189880     332    189548   1% /run/shm
/dev/mmcblk0p1    57288   19400     37888  34% /boot.
```

```
sudo apt-get install libreoffice
sudo apt-get install gedit geany
sudo apt-get install python-sphinx texlive biblatex texlive-fonts-recommended
sudo apt-get install diffuse
sudo apt-get install vlc
sudo apt-get install biblatex automake autotools-dev
sudo apt-get install fonts-liberation
sudo apt-get install libjpeg62:armhf
sudo easy_install -U distribute
```

git clone https://github.com/raspberrypi/hats.git

An Overview of MyHDL is found below. Further information can be found in the MyHDLpdf manual. The manual can be generated in the in doc folder.

The goal of the MyHDL project is to empower hardware designers with the elegance and simplicity of the Python language.

MyHDL is a free, open-source package for using Python as a hardware description and verification language. Python is a very high level language, and hardware designers can use its full power to model and simulate their designs. Moreover, MyHDL can convert a design to Verilog or VHDL. This provides a path into a traditional design flow.

Modeling

Python’s power and clarity make MyHDL an ideal solution for high level modeling. Python is famous for enabling elegant solutions to complex modeling problems. Moreover, Python is outstanding for rapid application development and experimentation.

The key idea behind MyHDL is the use of Python generators to model hardware concurrency. Generators are best described as resumable functions. MyHDL generators are similar to always blocks in Verilog and processes in VHDL.

A hardware module is modeled as a function that returns generators. This approach makes it straightforward to support features such as arbitrary hierarchy, named port association, arrays of instances, and conditional instantiation. Furthermore, MyHDL provides classes that implement traditional hardware description concepts. It provides a signal class to support communication between generators, a class to support bit oriented operations, and a class for enumeration types.

Simulation and Verification

The built-in simulator runs on top of the Python interpreter. It supports waveform viewing by tracing signal changes in a VCD file.

With MyHDL, the Python unit test framework can be used on hardware designs. Although unit testing is a popular modern software verification technique, it is still uncommon in the hardware design world.

MyHDL can also be used as hardware verification language for Verilog designs, by co-simulation with traditional HDL simulators.

Conversion to Verilog and VHDL

Subject to some limitations, MyHDL designs can be converted to Verilog or VHDL. This provides a path into a traditional design flow, including synthesis and implementation. The convertible subset is restricted, but much wider than the standard synthesis subset. It includes features that can be used for high level modeling and test benches.

The converter works on an instantiated design that has been fully elaborated. Consequently, the original design structure can be arbitrarily complex. Moreover, the conversion limitations apply only to code inside generators. Outside generators, Python’s full power can be used without compromising convertibility.

Finally, the converter automates a number of tasks that are hard in Verilog or VHDL directly.

A notable feature is the automated handling of signed arithmetic issues.

What Is Icarus Verilog?

Icarus Verilog is a Verilog simulation and synthesis tool. It operates as a compiler, compiling source code written in Verilog (IEEE-1364) into some target format. For batch simulation, the compiler can generate an intermediate form called *vvp assembly*. This intermediate form is executed by the ``vvp'' command. For synthesis, the compiler generates netlists in the desired format.

The compiler proper is intended to parse and elaborate design descriptions written to the IEEE standard *IEEE Std 1364-2005*. This is a fairly large and complex standard, so it will take some time to fill all the dark alleys of the standard, but that's the goal.

Icarus Verilog is a work in progress, and since the language standard is not standing still either, it probably always will be. That is as it should be. However, I will make stable releases from time to time, and will endeavor to not retract any features that appear in these stable releases. The quick links above will show the current stable release.

The main porting target is Linux, although it works well on many similar operating systems. Various people have contributed precompiled binaries of stable releases for a variety of targets. These releases are ported by volunteers, so what binaries are available depends on who takes the time to do the packaging. *Icarus Verilog* has been ported to That Other Operating System, as a command line tool, and there are installers for users without compilers. You can compile it entirely with free tools, too, although there are precompiled binaries of stable releases.

Welcome to GTKWave

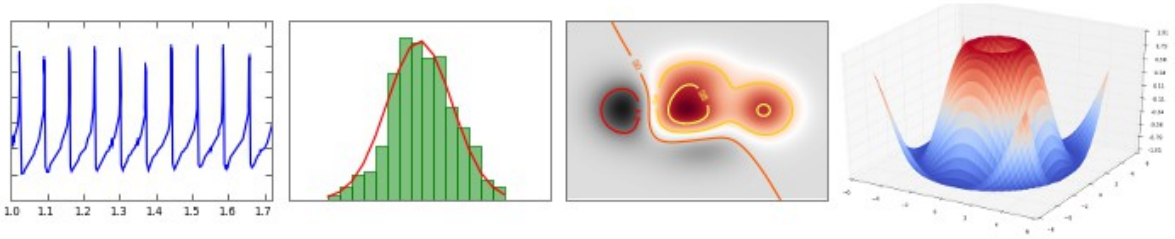
GTKWave is a fully featured GTK+ based wave viewer for Unix, Win32, and Mac OSX which reads LXT, LXT2, VZT, FST, and GHW files as well as standard Verilog VCD/EVCD files and allows their viewing. You can grab version 3.3.65 here. Documentation in pdf format can be found here.

For svn access to the experimental, pre-release sourcetree on Sourceforge:
svn checkout svn://svn.code.sf.net/p/gtkwave/code/ gtkwave-code

The Win32 version is available here, however if you are running Cygwin, running under that is recommended instead.
A Mac port can be found both here and here. A ready to use Quartz (not X11) App bundle for x86_64 can be found here.
Ports to other platforms which GTK supports should be trivial.

Introduction

matplotlib is a python 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms. matplotlib can be used in python scripts, the python and ipython shell (ala MATLAB®* or Mathematica®†), web application servers, and six graphical user interface toolkits.



matplotlib tries to make easy things easy and hard things possible. You can generate plots, histograms, power spectra, bar charts, errorcharts, scatterplots, etc, with just a few lines of code. For a sampling, see the screenshots, thumbnail gallery, and examples directory

For simple plotting the `pyplot` interface provides a MATLAB-like interface, particularly when combined with `IPython`. For the power user, you have full control of line styles, font properties, axes properties, etc, via an object oriented interface or via a set of functions familiar to MATLAB users.

mkdir myhdl
cd myhdl
git clone https://github.com/jandecaluwe/myhdl.git
cd myhdl

commit 254e458917b7a92502327ac5461c775e932e44a1
Merge: 47522fa 06f1e20
Author: jandecaluwe <jan@jandecaluwe.com>
Date: Sun May 31 14:52:58 2015 +0200

    Merge pull request #87 from josyb/std_logic_ports-ShadowSignals

    std_logic_ports and ShadowSignals (revisited)
sudo python setup.py install
cd ../
git clone https://github.com/steveicarus/iverilog.git
sudo apt-get install gimp
sudo apt-get install evince
gtkwave
sudo apt-get install python-pip
wi-fi wireless support
cd /etc/wpa_supplicant/
sudo cp wpa_supplicant.conf wpa_supplicant.conf.orig
edited /etc/wpa_supplicant/wpa_supplicant.conf
vi wpa_supplicant.conf
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
network={
ssid="wi-fi ssid"
proto=RSN
key_mgmt=WPA-PSK

pairwise=CCMP TKIP
group=CCMP TKIP
psk="wi-fi password"
}
sudo apt-get install iceweasel
sudo apt-get install chromium

sudo pip install numpy
Requirement already satisfied (use --upgrade to upgrade): numpy in /usr/lib/pymodules/python2.7
Cleaning up...

sudo apt-get install libjpeg62-dev
sudo apt-get install zlib1g-dev
sudo apt-get install libfreetype6-dev
sudo apt-get install liblcms1-dev

sudo pip install pillow

C920 camera
sudo apt-get install ffmpeg

wget https://www.libsdl.org/release/SDL2-2.0.3.tar.gz

tar xvfz SDL2-2.0.3.tar.gz

cd SDL2-2.0.3/

mkdir build

cd build

../configure --host=armv7l-raspberry-linux-gnueabihf --disable-pulseaudio --disable-esd
--disable-video-mir --disable-video-wayland --disable-video-x11 --disable-video-opengl

make -j 4

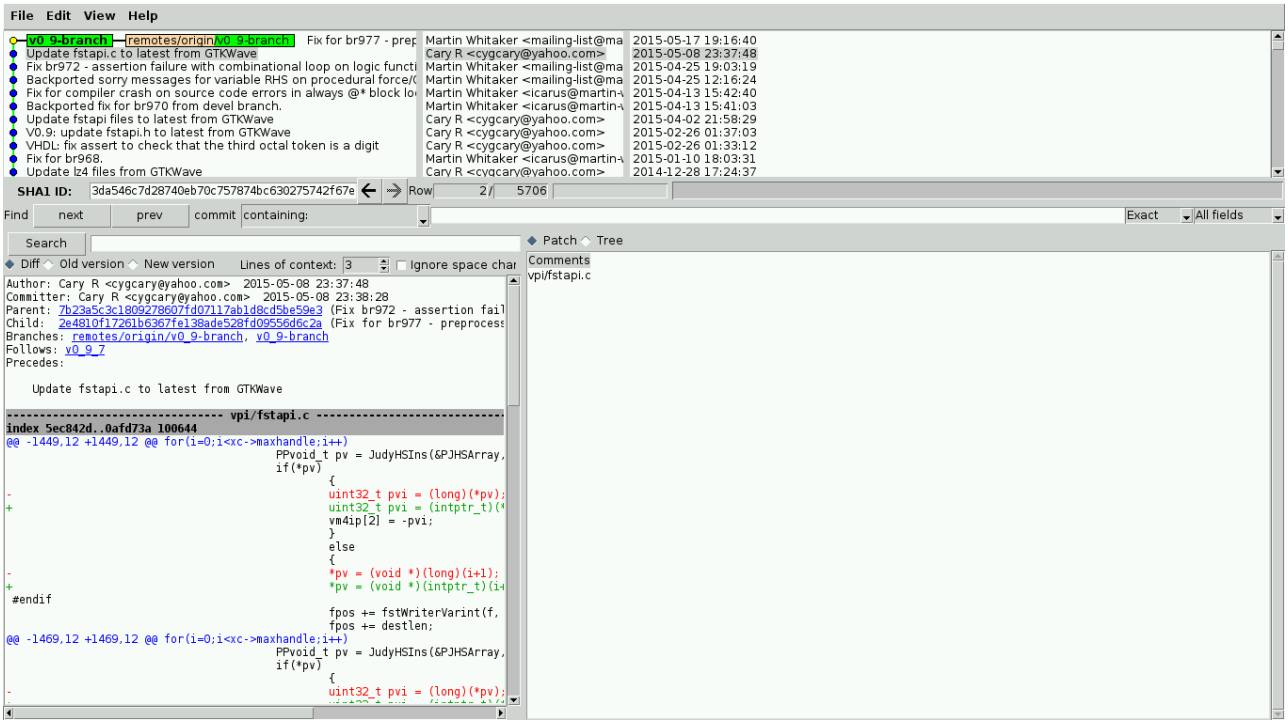
sudo make install

How To Take Screenshots On The Raspberry Pi

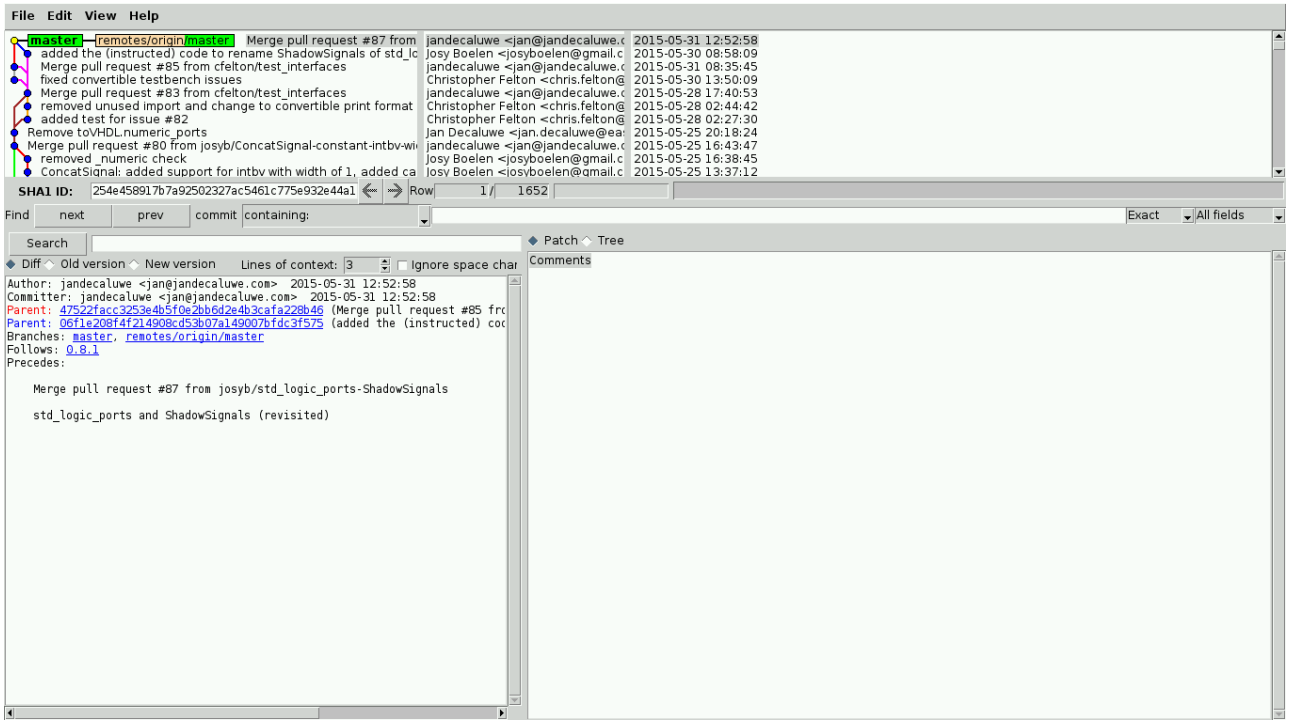
```
sudo apt-get install scrot
```

To take a screen shot after a delay use : scrot -d 10.
or scrot -s -d 1 for a single window.

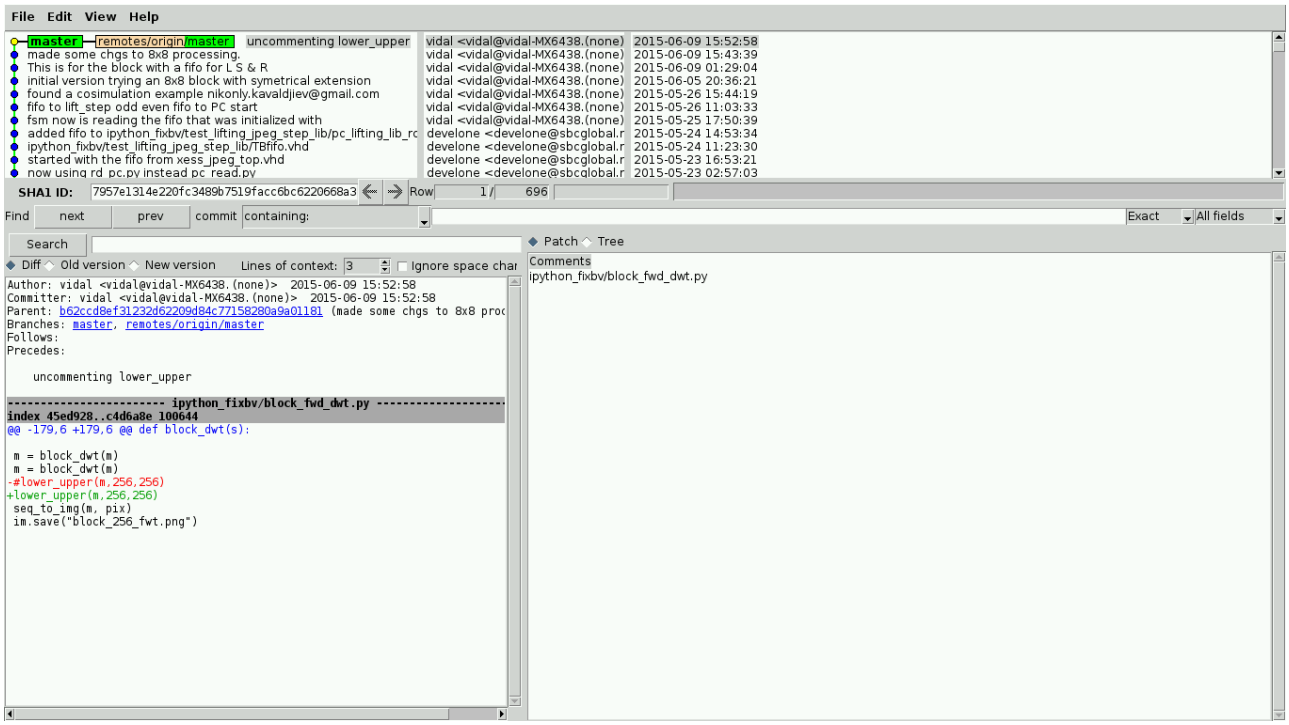
```
sudo apt-get install python-dev
pip install pillow

sudo pip install matplotlib

sudo apt-get install flex bison gperf
sudo apt-get install gitk
git checkout --track -b v0_9-branch origin/v0_9-branch
git pull
sudo apt-get install autoconf
./configure
make
 sudo make install
sudo ls /usr/local/bin/
easy_install       iverilog         nosetests-2.7  pilfile.py   vvp
easy_install-2.7  iverilog-vpi pilconvert.py  pilfont.py
indiecity          nosetests       pildriver.py   pilprint.py

cd ~/myhdl/myhdl/cosimulation/icarus/
make
cp myhdl.vpi ~/wkg/jpeg-2000-test/ipython_fixbv/test_verilog/
cd ~/wkg/jpeg-2000-test/ipython_fixbv/test_verilog/
vpp -m ./myhdl.vpi test_add_mul
pi test_add_mul
VCD info: dumpfile tb_add_mul.vcd opened for output.
At time                 0, d3  = xxxxxx (x) ,a2  = xxxxxx (x)
At time              8500, d3  = xxxxxx (x) ,a2  = dd3db8 (14499256)
At time             67500, d3  = 858bb0 (8752048) ,a2  = dd3db8 (14499256)
At time             77500, d3  = 7b1328 (8065832) ,a2  = dd3db8 (14499256)
At time             82500, d3  = ef7eb0 (15695536) ,a2  = dd3db8 (14499256)
** VVP Stop(0) **
** Flushing output streams.
** Current simulation time is 112200 ticks.
> finish
** Continue **
gitk views of git repositories.
```


File Edit View Help
v0_9-branch
remotes/origin/v0_9-branch
Fix for br977 - prep
Update fstapi.c to latest from GTKWave
Fix br972 - assertion failure with combinational loop on logic functi
Backported sorry messages for variable RHS on procedural force/(
Fix for compiler crash on source code errors in always @* block lo
Backported fix for br970 from devel branch.
Update fstapi files to latest from GTKWave
V0.9: update fstapi.h to latest from GTKWave
VHDL: fix assert to check that the third octal token is a digit
Fix for br968.
Update lz4 files from GTKWave
Martin Whitaker <mailing-list@ma 2015-05-17 19:16:40
Cary R <cygcary@yahoo.com> 2015-05-08 23:37:48
Martin Whitaker <mailing-list@ma 2015-04-25 19:03:19
Martin Whitaker <mailing-list@ma 2015-04-25 12:16:24
Martin Whitaker <icarus@martin- 2015-04-13 15:42:40
Martin Whitaker <icarus@martin- 2015-04-13 15:41:03
Cary R <cygcary@yahoo.com> 2015-04-02 21:58:29
Cary R <cygcary@yahoo.com> 2015-02-26 01:37:03
Cary R <cygcary@yahoo.com> 2015-02-26 01:33:12
Martin Whitaker <icarus@martin- 2015-01-10 18:03:31
Cary R <cygcary@yahoo.com> 2014-12-28 17:24:37
SHA1 ID: 3da546c7d28740eb70c757874bc630275742f67e
Row 2 / 5706
Find next prev commit containing:
Exact All fields
Search
Diff Old version New version Lines of context: 3 Ignore space char
Patch Tree
Comments
vpi/fstapi.c
Author: Cary R <cygcary@yahoo.com> 2015-05-08 23:37:48
Committer: Cary R <cygcary@yahoo.com> 2015-05-08 23:38:28
Parent: 7b23a5c3c1809278607fd07117ab1d8cd5be59e3 (Fix br972 - assertion fail
Child: 2e4810f17261b6367fe138ade528fd09556d6c2a (Fix for br977 - preprocess
Branches: remotes/origin/v0_9-branch, v0_9-branch
Follows: v0_9_7
Precedes:
Update fstapi.c to latest from GTKWave
vpi/fstapi.c
index 5ec842d..0afd73a 100644
@@ -1449,12 +1449,12 @@ for(i=0;i<xc->maxhandle;i++)
PPvoid_t pv = JudyHSIns(&PJHSArray,
if(*pv)
{
- uint32_t pvi = (long)(*pv);
+ uint32_t pvi = (intptr_t)(*
vm4ip[2] = -pvi;
}
else
{
- *pv = (void *)(long)(i+1);
+ *pv = (void *)(intptr_t)(i+
#endif
fpos += fstWriterVarint(f,
fpos += destlen;
@@ -1469,12 +1469,12 @@ for(i=0;i<xc->maxhandle;i++)
PPvoid_t pv = JudyHSIns(&PJHSArray,
if(*pv)
{
- uint32_t pvi = (long)(*pv);

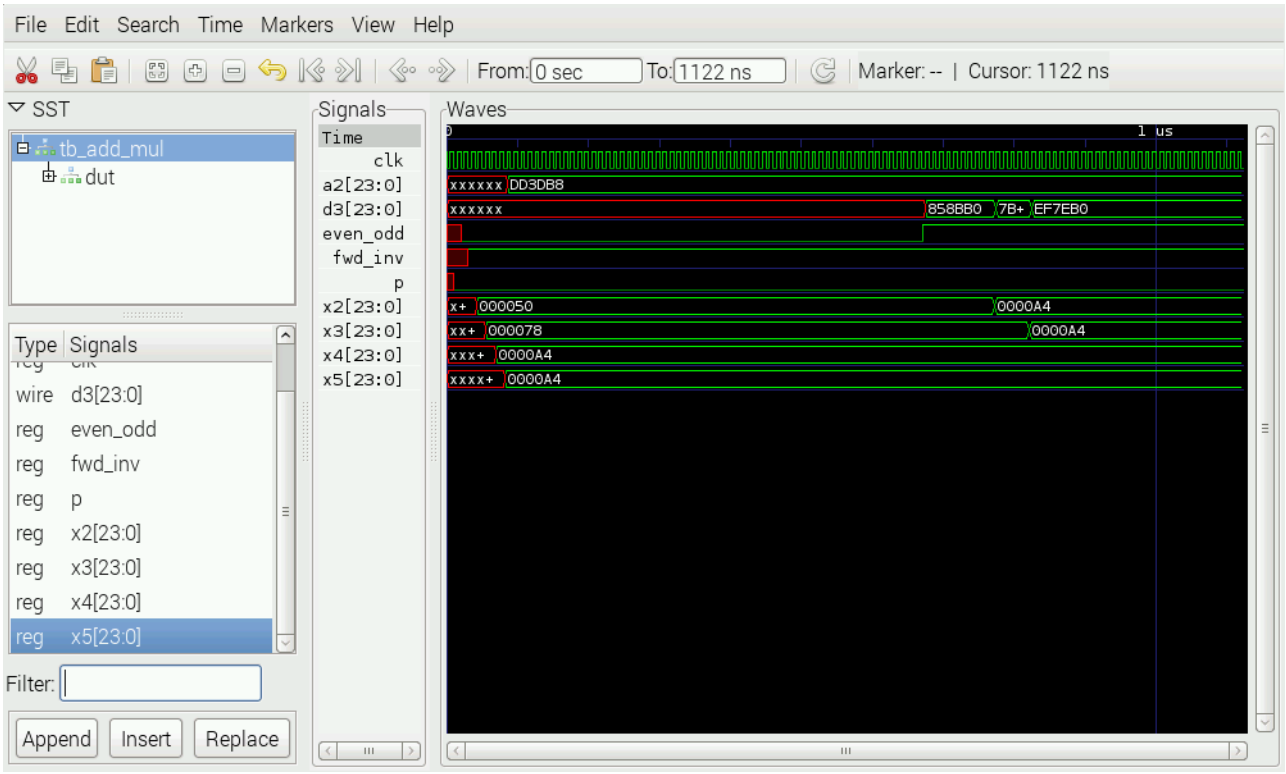
Myhdl repo



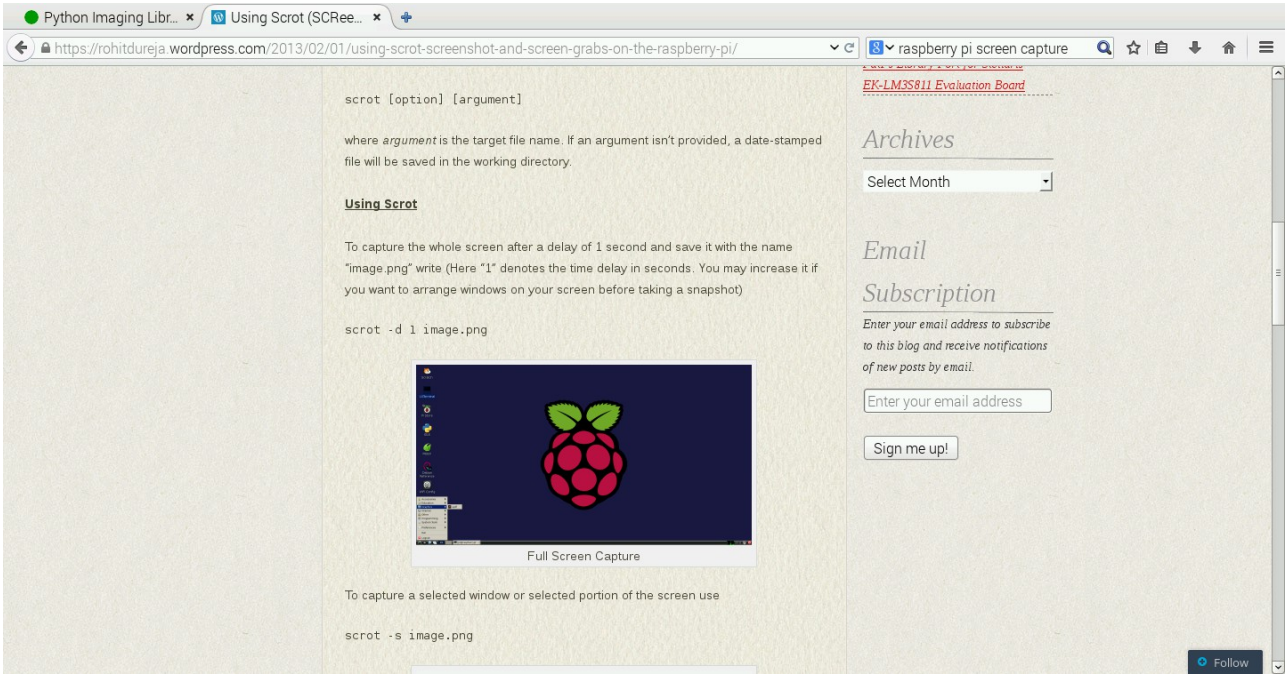
jpeg-2000-test repo



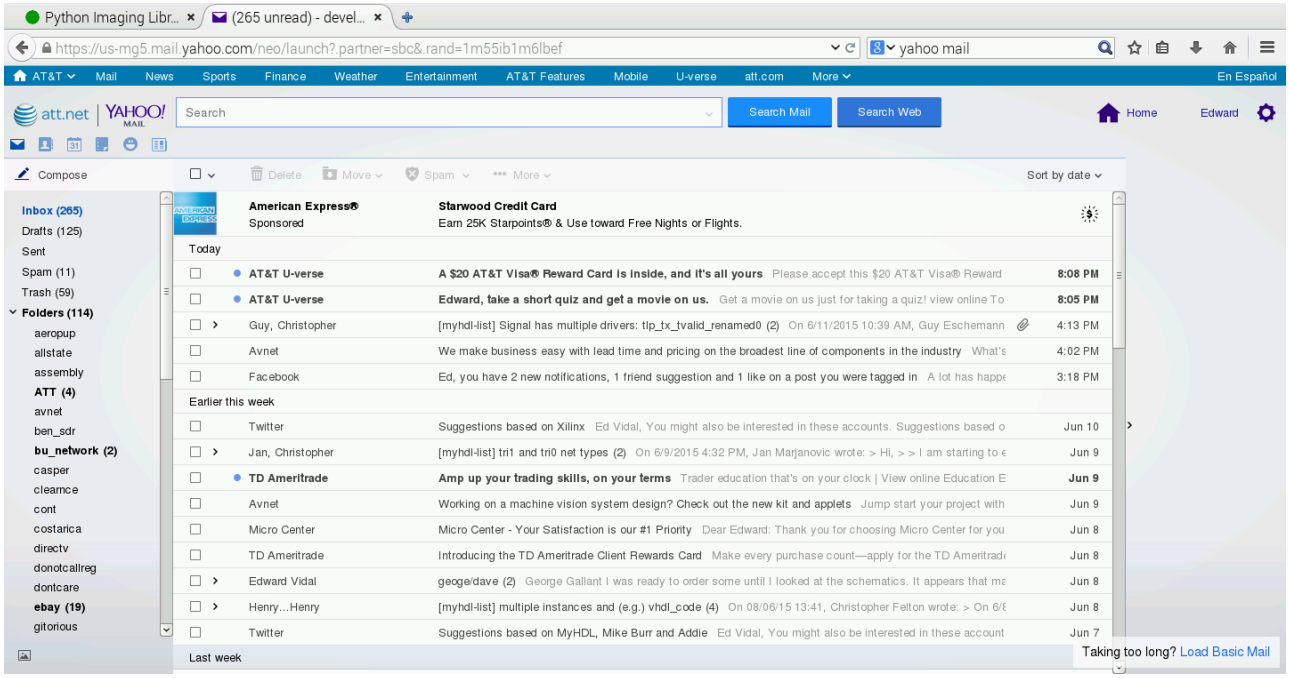
gtkwave of myhdl cosimulation generated with iverlog



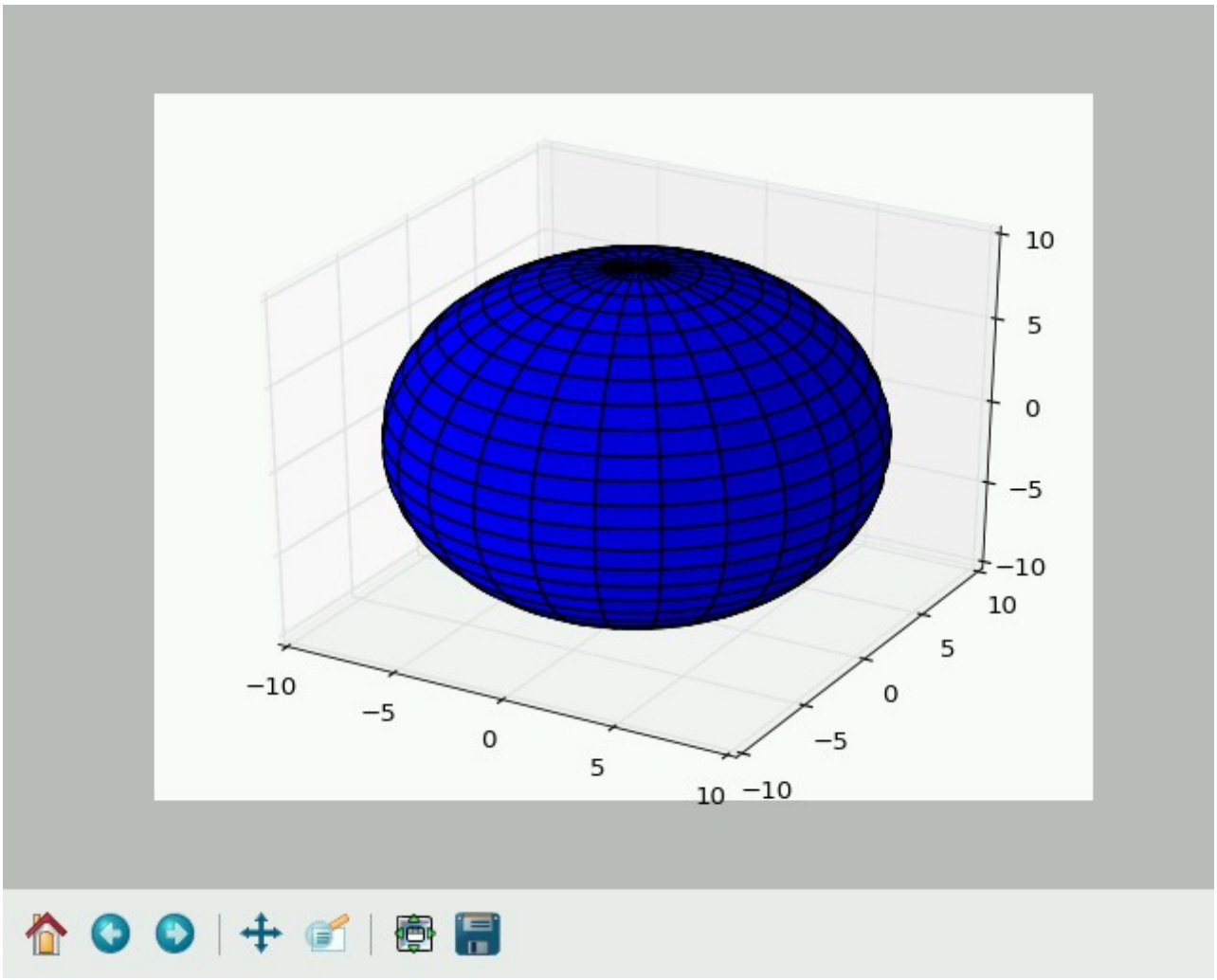
iceweasel firefox for Raspberry Pi



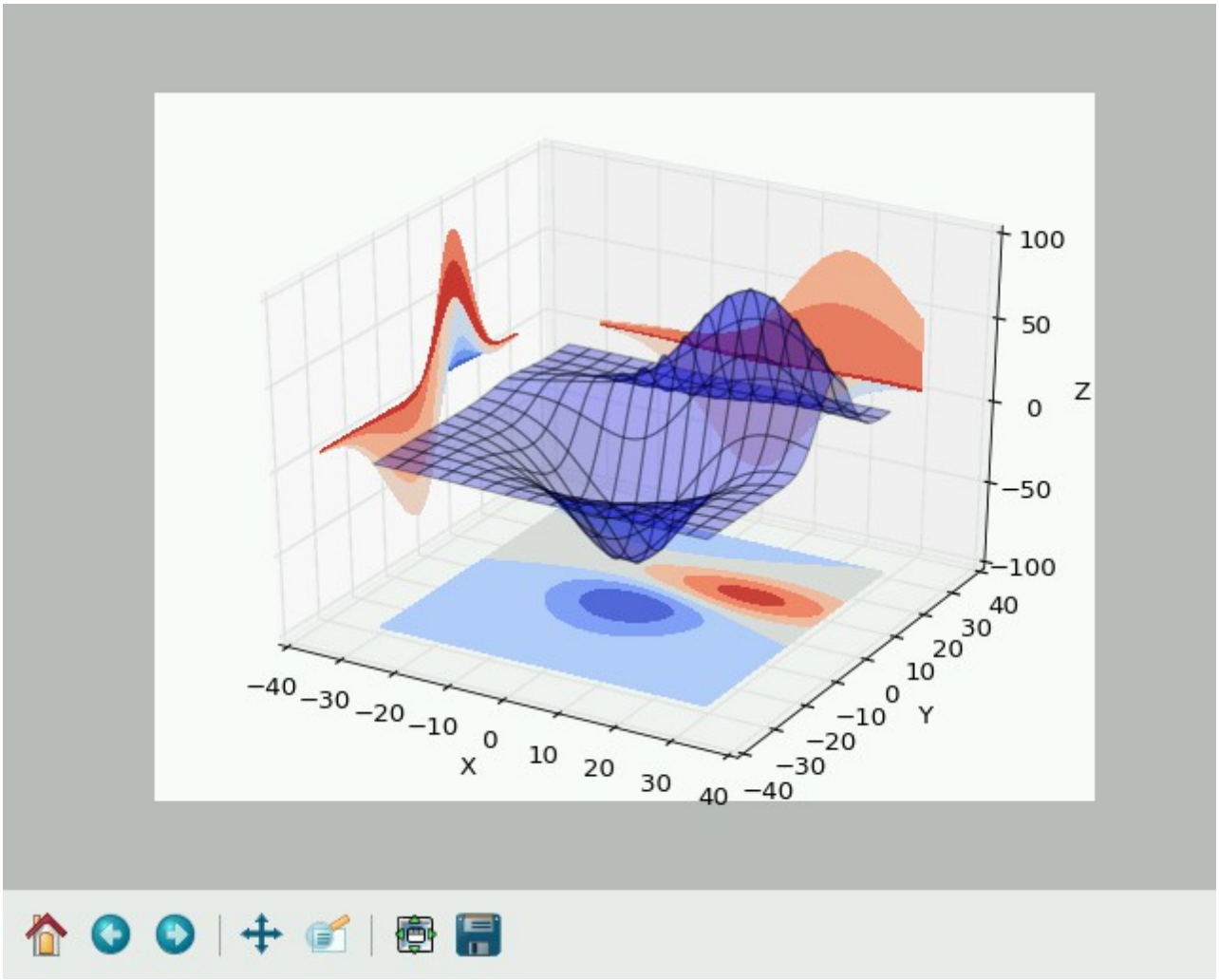
yahoo mail with iceweasel



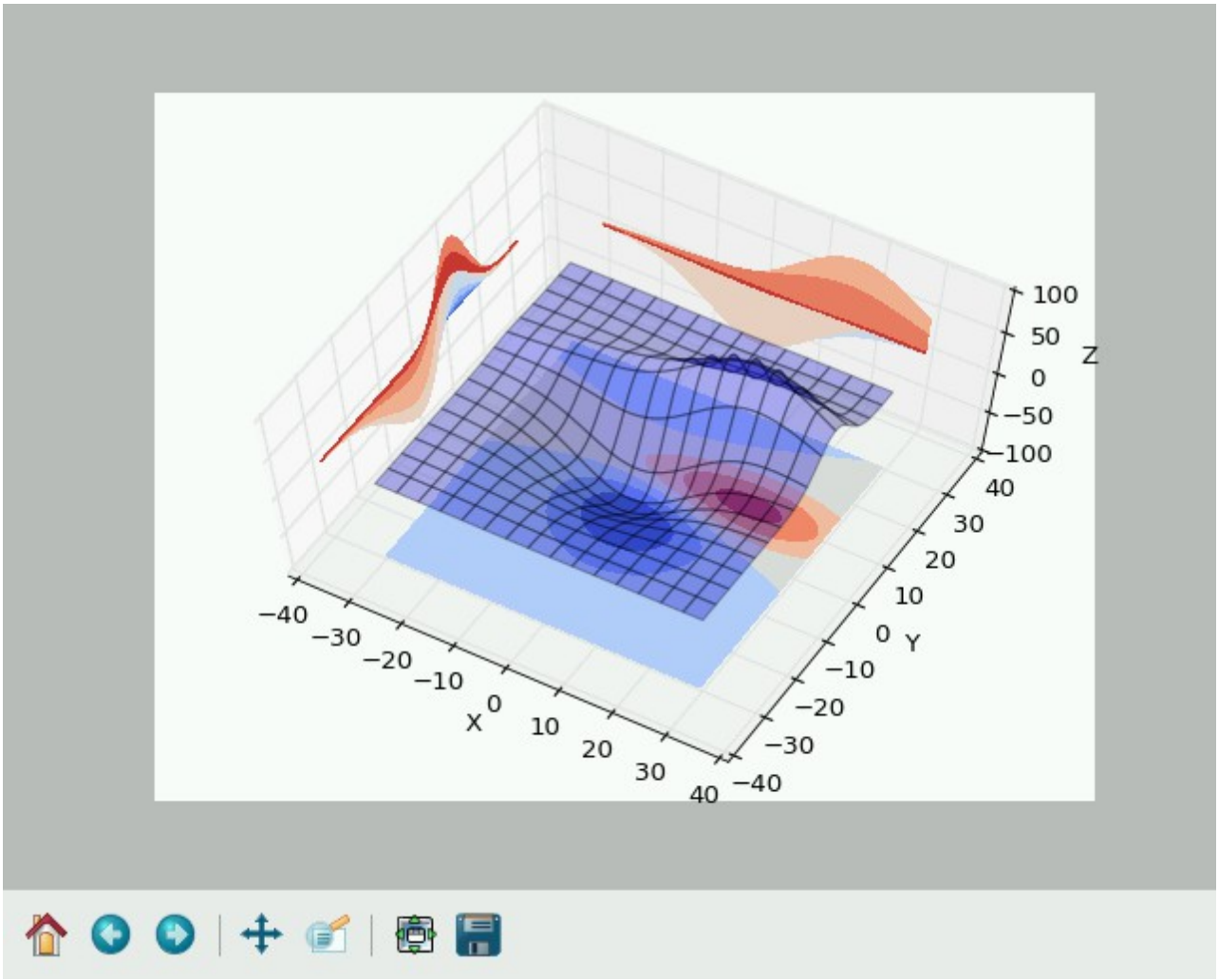
matplotlib



matplotlib



matplotlib image rotated.



OpenCV

Note: Lesson learned with all of the software installed an 8GB card does not have enough space to install openCV

Cleaning up space on RaspberryPi by rsync several directories on RaspberryPi to MX6438 wkg/RaspberryPi_clean_up

FpgasNowWhat hats jpeg-2000-test myhdl VHDL_Lib XSTOOLs

Filesystem 1K-blocks Used Available Use% Mounted on

rootfs 7534284 6907064 270904 97% /

/dev/root 7534284 6907064 270904 97% /

devtmpfs 470416 0 470416 0% /dev

tmpfs 94944 304 94640 1% /run

tmpfs 5120 0 5120 0% /run/lock

tmpfs 189880 0 189880 0% /run/shm

/dev/mmcblk0p1 57288 19400 37888 34% /boot

After freeing up space

cd opencv-2.4.10/build

make quickly ran to 77% which is where the previous build ran out of space.

The build of matplotbuild took place in wkg/jpeg-2000-test/ipython_fixbv
http://www.pyimagesearch.com/2015/02/23/install-opencv-and-python-on-your-raspberry-pi-2-and-b/

Hello! I'm Adrian Rosebrock.

I'm an entrepreneur and Ph.D who has launched two successful image search engines, ID My Pill and Chic Engine. I'm here to share my tips, tricks, and hacks I've learned along the way.
Step 1 Install the required developer tools and packages:
sudo apt-get install build-essential cmake pkg-config
Step 2 Install the necessary image I/O packages. These packages allow you to load various image file formats such as JPEG, PNG, TIFF, etc.
sudo apt-get install libjpeg8-dev libtiff4-dev libjasper-dev libpng12-dev

Step 3 Install the GTK development library. This library is used to build Graphical User Interfaces (GUIs) and is required for the highgui library of OpenCV which allows you to view images on your screen:
sudo apt-get install libgtk2.0-dev
Step 4 Install the necessary video I/O packages. These packages are used to load video files using OpenCV:
sudo apt-get install libavcodec-dev libavformat-dev libswscale-dev libv4l-dev
Step 5 Install libraries that are used to optimize various operations within OpenCV:
sudo apt-get install libatlas-base-dev gfortran
Step 6 Install pip :

wget https://bootstrap.pypa.io/get-pip.py

sudo python get-pip.py
Step 7 Install virtualenv and virtualenvwrapper :

sudo pip install virtualenv virtualenvwrapper
~~add to .profile~~

```
# virtualenv and virtualenvwrapper
export
WORKON_HOME=$HOME/.virtu
alenvs
source
/usr/local/bin/virtualenvwrapper.sh
```

~~source ~/.profile~~
~~mkvirtualenv cv~~
~~New python executable in cv/bin/python~~

Installing setuptools, pip, wheel...done.
sudo apt-get install python2.7-dev

Reading package lists... Done

Building dependency tree

Reading state information... Done

python2.7-dev is already the newest version.

python2.7-dev set to manually installed.

0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.

Note: *Yes, we are going to use Python 2.7. OpenCV 2.4.X does not yet support Python 3 and OpenCV 3.0 is still in beta. It's also unclear when the Python bindings for OpenCV 3.0 will be complete so I advise to stick with OpenCV 2.4.X for the time being.*

We also need to install NumPy since the OpenCV Python bindings represent images as multi-dimensional NumPy arrays:

Using opencv from github and not virtual details /home/vidal/wkg/pi/opencv_github.txt

~~wget -O opencv-2.4.10.zip http://sourceforge.net/projects/opencvlibrary/files/opencv-unix/2.4.10/opencv-2.4.10.zip/download~~

~~unzip opencv-2.4.10.zip~~
~~cd opencv-2.4.10~~
~~mkdir build~~
~~cd build~~
~~cmake -D CMAKE_BUILD_TYPE=RELEASE -D CMAKE_INSTALL_PREFIX=/usr/local -D BUILD_NEW_PYTHON_SUPPORT=ON -D INSTALL_C_EXAMPLES=ON -D INSTALL_PYTHON_EXAMPLES=ON -D BUILD_EXAMPLES=ON ..~~
~~make~~
Raspberry Pi B+: < 9.5 hours

Raspberry Pi 2: < 2.8 hours

Finally, we can install OpenCV:

sudo make install
sudo ldconfig
Step 10
If you've gotten this far in the guide, OpenCV should now be installed in
/usr/local/lib/python2.7/site-packages

But in order to utilize OpenCV within our cv virtual environment, we first need to sym-link OpenCV into our site-packages directory:

cd ~/.virtualenvs/cv/lib/python2.7/site-packages/
ln -s /usr/local/lib/python2.7/site-packages/cv2.so cv2.so
ln -s /usr/local/lib/python2.7/site-packages/cv.py cv.py
$ workon cv
$ python
>>> import cv2
>>> cv2.__version__
'2.4.10'

pwd

/home/vidal/.virtualenvs/cv/lib/python2.7/site-packages
ls -la

total 48

drwxr-xr-x 10 vidal vidal 4096 Jun 13 13:01 .

drwxr-xr-x 4 vidal vidal 4096 Jun 13 00:33 ..

lrwxrwxrwx 1 vidal vidal   45 Jun 13 13:00 cv2.so -> /usr/local/lib/python2.7/site-packages/cv2.so

lrwxrwxrwx 1 vidal vidal   44 Jun 13 13:01 cv.py -> /usr/local/lib/python2.7/site-packages/cv.py

-rw-r--r-- 1 vidal vidal 126 Jun 13 00:34 easy_install.py

-rw-r--r-- 1 vidal vidal 315 Jun 13 00:34 easy_install.pyc

drwxr-xr-x 2 vidal vidal 4096 Jun 13 00:34 _markerlib

drwxr-xr-x 10 vidal vidal 4096 Jun 13 00:34 pip

drwxr-xr-x 2 vidal vidal 4096 Jun 13 00:34 pip-7.0.3.dist-info

drwxr-xr-x 3 vidal vidal 4096 Jun 13 00:34 pkg_resources

drwxr-xr-x 3 vidal vidal 4096 Jun 13 00:34 setuptools

drwxr-xr-x 2 vidal vidal 4096 Jun 13 00:34 setuptools-17.0.dist-info

drwxr-xr-x 5 vidal vidal 4096 Jun 13 00:34 wheel

drwxr-xr-x 2 vidal vidal 4096 Jun 13 00:34 wheel-0.24.0.dist-info

A list of opencv_binaries installed found at Appendix C.

Step 11
Finally, we can give our OpenCV and Python installation a test drive:

To enable the camera.

sudo raspi-config

raspistill -o output.jpg
source ~/.profile
workon cv
pip install "picamera[array]"

In a file test_image.py

```
# import the necessary packages
from picamera.array import PiRGBArray
from picamera import PiCamera
import time
import cv2

# initialize the camera and grab a reference to the raw camera capture
camera = PiCamera()
rawCapture = PiRGBArray(camera)

# allow the camera to warmup
time.sleep(0.1)

# grab an image from the camera
camera.capture(rawCapture, format="bgr")
image = rawCapture.array

# display the image on screen and wait for a keypress
cv2.imshow("Image", image)
cv2.waitKey(0)
```

XESS Products

git clone https://github.com/develone/FpgasNowWhat.git
git clone https://github.com/develone/VHDL_Lib.git
git clone https://github.com/xesscorp/XSTOOLs.git
sudo pip install wheel in the requirements.txt wheel==0.23.0
sudo apt-get install libusb-dev python-usb
cd XSTOOLs/
sudo python setup.py install

Now works see Xula2_flash.doc for details.

With no XulA2-LX9 connect the lsusb has the following entries.

Bus 001 Device 002: ID 0424:9514 Standard Microsystems Corp.

Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub

Bus 001 Device 003: ID 0424:ec00 Standard Microsystems Corp.

Bus 001 Device 004: ID 0409:0059 NEC Corp. HighSpeed Hub

Bus 001 Device 005: ID 148f:5370 Ralink Technology, Corp. RT5370 Wireless Adapter

Bus 001 Device 006: ID 046d:c001 Logitech, Inc. N48/M-BB48 [FirstMouse Plus]

Bus 001 Device 007: ID 413c:2005 Dell Computer Corp. RT7D50 Keyboard

Bus 001 Device 008: ID 062a:3286 Creative Labs Nano Receiver [Sandstrom Laser Mouse SMWLL11]

With the XulA2-LX9 connect the lsusb command has the following entries.

Bus 001 Device 002: ID 0424:9514 Standard Microsystems Corp.

Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub

Bus 001 Device 003: ID 0424:ec00 Standard Microsystems Corp.

Bus 001 Device 011: ID 04d8:ff8c Microchip Technology, Inc.

Bus 001 Device 004: ID 0409:0059 NEC Corp. HighSpeed Hub

Bus 001 Device 005: ID 148f:5370 Ralink Technology, Corp. RT5370 Wireless Adapter

Bus 001 Device 006: ID 046d:c001 Logitech, Inc. N48/M-BB48 [FirstMouse Plus]

Bus 001 Device 007: ID 413c:2005 Dell Computer Corp. RT7D50 Keyboard

Bus 001 Device 008: ID 062a:3286 Creative Labs Nano Receiver [Sandstrom Laser Mouse SMWLL11]

This indicates the XulA2-LX9 is seen by the Raspberry Pi.

Bus 001 Device 011: ID 04d8:ff8c Microchip Technology, Inc.

pwd

/usr/local/bin

As root or sudo xstest -v

xstest 0.1.30
As root or sudo xstest -h

usage: xstest [-h] [-u {0}] [-b {xula-50,xula-200,xula2-lx9,xula2-lx25}] [-m]

[-v]

Run self-test on an XESS board.

optional arguments:

-h, --help show this help message and exit

-u {0}, --usb {0} The USB port number for the XESS board. If you only have one board, then use 0.

-b {xula-50,xula-200,xula2-lx9,xula2-lx25}, --board {xula-50,xula-200,xula2-lx9,xula2-lx25}

-m, --multiple Run the self-test each time a board is detected on the USB port.

-v, --version Print the version number of this program and exit.

As root or sudo xsload -h

usage: xsload [-h] [--fpga FILE.BIT] [--flash FILE.HEX] [--ram FILE.HEX] [-u LOWER UPPER] [--usb {0}] [-b {xula-50,xula-200,xula2-lx9,xula2-lx25}] [-v]

Program a bitstream file into the FPGA on an XESS board.

optional arguments:

-h, --help show this help message and exit

--fpga FILE.BIT The name of the bitstream file to load into the FPGA.

--flash FILE.HEX The name of the file to down/upload to/from the serial configuration flash.

--ram FILE.HEX The name of the file to down/upload to/from the RAM.

-u LOWER UPPER, --upload LOWER UPPER Upload from RAM or flash the data between the lower and upper addresses.

--usb {0} The USB port number for the XESS board. If you only

have one board, then use 0.

-b {xula-50,xula-200,xula2-lx9,xula2-lx25}, --board {xula-50,xula-200,xula2-lx9,xula2-lx25}

-v, --version Print the version number of this program and exit.

As root or sudo xstest -u 0 -b xula2-lx9

Success: XuLA2-LX9 passed diagnostic test!

The files needed for the following test are
raspberrypi2_yocto/xstools-test-files.

As root or sudo xsload --usb 0 --fpga pc_fast_blinker_sub_h1.bit

Success: Bitstream in pc_fast_blinker_sub_h1.bit downloaded to FPGA on XuLA2-LX9!

As root or sudo python pc_subtractor_test.py

```
##########################################################################
# This program tests the interface between the host PC and the FPGA
# on the XuLA board that has been programmed to act as a subtractor.
##########################################################################

 37 -  60 =  -23 ==> CORRECT!
 34 -  57 =  -23 ==> CORRECT!
 12 -  69 =  -57 ==> CORRECT!
 12 - 109 =  -97 ==> CORRECT!
 62 -  57 =    5 ==> CORRECT!
 64 - 125 =  -61 ==> CORRECT!
 23 - 107 =  -84 ==> CORRECT!
109 -  70 =   39 ==> CORRECT!
126 -  16 =  110 ==> CORRECT!
  6 -  30 =  -24 ==> CORRECT!
 95 - 126 =  -31 ==> CORRECT!
```

54 - 123 = -69 ==> CORRECT!

116 - 56 =   60 ==> CORRECT!

124 - 114 =   10 ==> CORRECT!

49 - 67 = -18 ==> CORRECT!

37 - 117 = -80 ==> CORRECT!

125 - 122 =   3 ==> CORRECT!

37 - 13 =   24 ==> CORRECT!

0 - 58 = -58 ==> CORRECT!

94 - 55 =   39 ==> CORRECT!

8 - 24 = -16 ==> CORRECT!

91 - 57 =   34 ==> CORRECT!

113 - 24 =   89 ==> CORRECT!

73 - 102 = -29 ==> CORRECT!

13 - 24 = -11 ==> CORRECT!

22 -   7 =   15 ==> CORRECT!

71 - 98 = -27 ==> CORRECT!

101 - 80 =   21 ==> CORRECT!

106 - 113 =   -7 ==> CORRECT!

122 - 22 = 100 ==> CORRECT!

106 - 70 =   36 ==> CORRECT!

9 - 27 = -18 ==> CORRECT!

21 - 43 = -22 ==> CORRECT!

46 - 63 = -17 ==> CORRECT!

24 -   6 =   18 ==> CORRECT!

57 - 89 = -32 ==> CORRECT!

18 -   5 =   13 ==> CORRECT!

53 - 9 = 44 ==> CORRECT!

82 - 102 = -20 ==> CORRECT!

25 - 2 = 23 ==> CORRECT!

67 - 66 = 1 ==> CORRECT!

118 - 114 = 4 ==> CORRECT!

84 - 10 = 74 ==> CORRECT!

119 - 50 = 69 ==> CORRECT!

71 - 3 = 68 ==> CORRECT!

102 - 92 = 10 ==> CORRECT!

70 - 7 = 63 ==> CORRECT!

83 - 114 = -31 ==> CORRECT!

41 - 38 = 3 ==> CORRECT!

89 - 88 = 1 ==> CORRECT!

14 - 61 = -47 ==> CORRECT!

10 - 75 = -65 ==> CORRECT!

51 - 84 = -33 ==> CORRECT!

95 - 65 = 30 ==> CORRECT!

3 - 80 = -77 ==> CORRECT!

32 - 116 = -84 ==> CORRECT!

110 - 29 = 81 ==> CORRECT!

15 - 116 = -101 ==> CORRECT!

33 - 16 = 17 ==> CORRECT!

45 - 105 = -60 ==> CORRECT!

80 - 46 = 34 ==> CORRECT!

54 - 90 = -36 ==> CORRECT!

73 - 37 = 36 ==> CORRECT!

86 - 66 = 20 ==> CORRECT!

20 - 26 = -6 ==> CORRECT!

121 - 52 = 69 ==> CORRECT!

1 - 55 = -54 ==> CORRECT!

38 - 75 = -37 ==> CORRECT!

32 - 40 = -8 ==> CORRECT!

95 - 69 = 26 ==> CORRECT!

21 - 83 = -62 ==> CORRECT!

85 - 82 = 3 ==> CORRECT!

56 - 24 = 32 ==> CORRECT!

18 - 116 = -98 ==> CORRECT!

28 - 46 = -18 ==> CORRECT!

78 - 109 = -31 ==> CORRECT!

117 - 27 = 90 ==> CORRECT!

55 - 20 = 35 ==> CORRECT!

102 - 118 = -16 ==> CORRECT!

51 - 99 = -48 ==> CORRECT!

21 - 91 = -70 ==> CORRECT!

81 - 118 = -37 ==> CORRECT!

17 - 71 = -54 ==> CORRECT!

117 - 74 = 43 ==> CORRECT!

91 - 90 = 1 ==> CORRECT!

62 - 109 = -47 ==> CORRECT!

87 - 83 = 4 ==> CORRECT!

123 - 112 = 11 ==> CORRECT!

34 - 10 = 24 ==> CORRECT!

113 - 50 = 63 ==> CORRECT!

55 - 120 = -65 ==> CORRECT!

75 - 64 = 11 ==> CORRECT!

26 - 101 = -75 ==> CORRECT!

85 - 3 = 82 ==> CORRECT!

52 - 37 = 15 ==> CORRECT!

43 - 105 = -62 ==> CORRECT!

117 - 126 = -9 ==> CORRECT!

91 - 73 = 18 ==> CORRECT!

52 - 81 = -29 ==> CORRECT!

56 - 52 = 4 ==> CORRECT!

The above test send 2 random to FPGA over the USB
and receives the diffence displaying if correct or not correct.
Code to generate the bit file is found
https://github.com/develone/jpeg-2000-test/tree/master/windows8_XulA2-LX9/pc_fast_blinker_sub
A describtion of the program in found at
https://github.com/develone/raspberrypi2_yocto/blob/master/doc/FpgasNowWhatBook.pdf

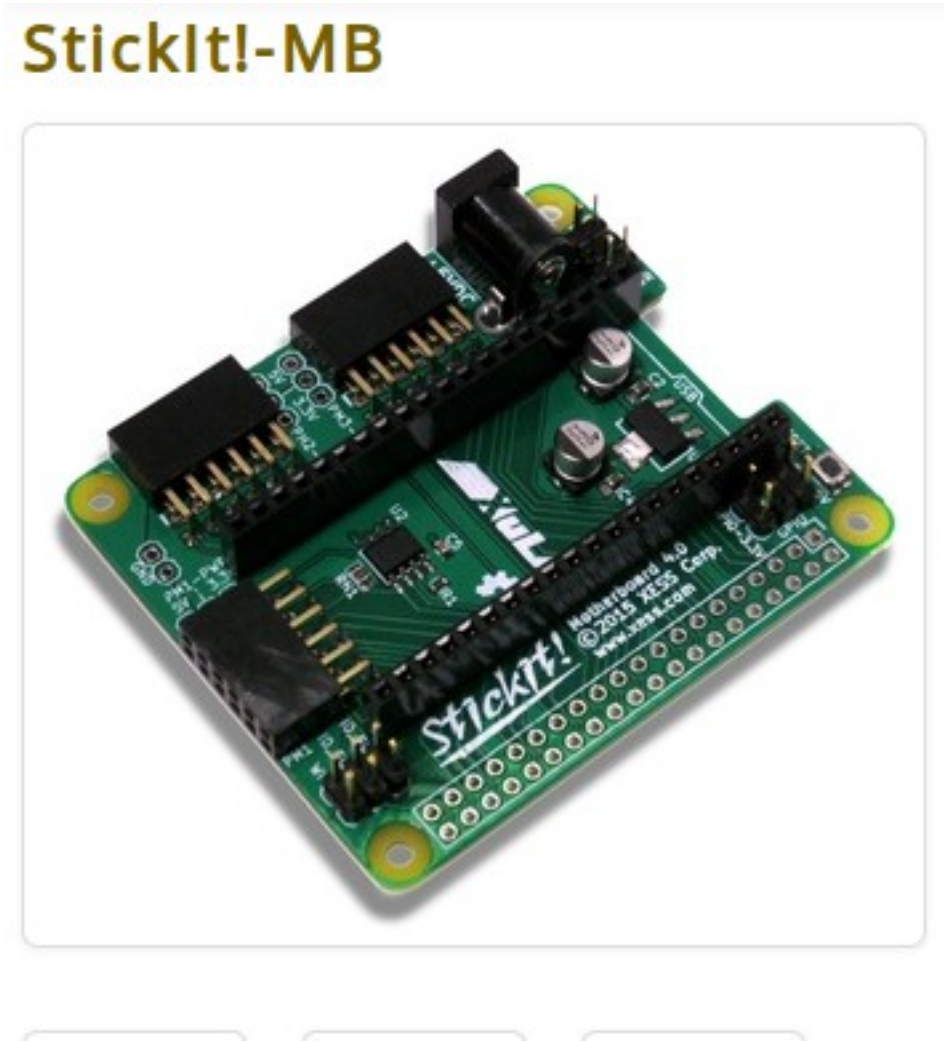
This is the site for XESS products http://www.xess.com/
XESS has two models of Xilinx Spartan 6 which are the XulA2-LX9 & XulA2-LX25.
The form factor is the same for both. The LX25 model has more logic cells

- Open-source design
- XC6SLX9 FPGA
- 32 MByte SDRAM
- 8 Mbit Flash
- microSD card socket
- 3.3 & 1.2V regulators
- 40-pin interface
- 12 MHz oscillator
- PIC 18F14K50 micro
- USB 2.0 port
- Auxiliary JTAG port
- Works with the XSTOOLs software
- Works with XILINX ISE and WebPACK
- Works with XILINX iMPACT and ChipScope (requires Xilinx JTAG cable)

- XC6SLX25 FPGA
- 32 MByte SDRAM

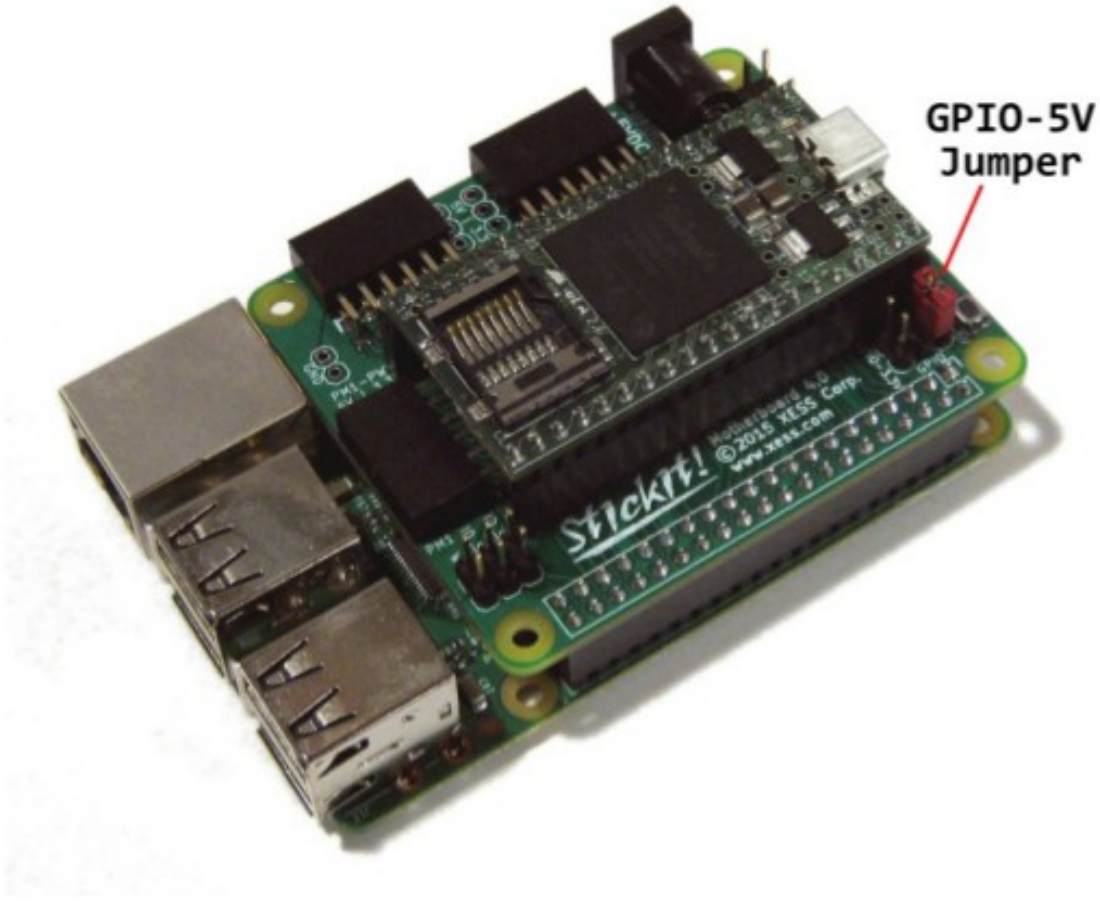
- 8 Mbit Flash
- microSD card socket
- 3.3 & 1.2V regulators
- 40-pin interface
- 12 MHz oscillator
- PIC 18F14K50 micro
- USB 2.0 port
- Auxiliary JTAG port
- Works with the XSTOOLs software
- Works with XILINX ISE and WebPACK
- Works with XILINX iMPACT and ChipScope (requires Xilinx JTAG cable)

The newest product is the Stickit!-MB which connects the XulA2-LX9 or XulA2-LX25 to the Raspberry Pi 2 B.



- 40-pin XuLA socket
- Raspberry Pi B+/2 connector
- 3 PMOD connectors
- Serial EEPROM
- 3.3V regulator
- XuLA reset button
- Raspberry Pi HAT compliant
- Open-source design

This new combo provides many additional features to both the Raspberry Pi and



TBD: Use the blinker.vhd to blink and led on a PMOD.

TBD: Use the pc_fast_blinker_sub.vhd to blink and led on a PMOD. This demonstrates the use of DCM Digital Clock Module to increase the speed of 12 MHz clock to 100 MHz.

TBD: Use the a bit on the GPIO of Raspberry to blink and led on a PMOD.

sudo apt-get install python-wxgtk2.8 Note: Did not fix XSTOOLs
sudo apt-get install tree

sudo apt-get install gstreamer1.0

Appendix A first boot dmesg

[0.000000] Booting Linux on physical CPU 0xf00
[0.000000] Initializing cgroup subsys cpu
[0.000000] Initializing cgroup subsys cpuacct
[0.000000] Linux version 3.18.11-v7+ (dc4@dc4-XPS13-9333) (gcc version 4.8.3 20140303 (prerelease) (crosstool-NG linaro-1.13.1+bzr2650 - Linaro GCC 2014.03)) #781 SMP PREEMPT Tue Apr 21 18:07:59 BST 2015
[0.000000] CPU: ARMv7 Processor [410fc075] revision 5 (ARMv7), cr=10c5387d
[0.000000] CPU: PIPT / VIPT nonaliasing data cache, VIPT aliasing instruction cache
[0.000000] Machine model: Raspberry Pi 2 Model B
[0.000000] cma: Reserved 8 MiB at 0x3a800000
[0.000000] Memory policy: Data cache writealloc
[0.000000] On node 0 totalpages: 241664
[0.000000] free_area_init_node: node 0, pgdat 8080f480, node_mem_map ba093000
[0.000000] Normal zone: 1888 pages used for memmap
[0.000000] Normal zone: 0 pages reserved
[0.000000] Normal zone: 241664 pages, LIFO batch:31
[0.000000] [bcm2709_smp_init_cpus] enter (8620->f3003010)
[0.000000] [bcm2709_smp_init_cpus] ncores=4
[0.000000] PERCPU: Embedded 10 pages/cpu @ba061000 s11456 r8192 d21312 u40960
[0.000000] pcpu-alloc: s11456 r8192 d21312 u40960 alloc=10*4096
[0.000000] pcpu-alloc: [0] 0 [0] 1 [0] 2 [0] 3
[0.000000] Built 1 zonelists in Zone order, mobility grouping on. Total pages: 239776
[0.000000] Kernel command line: dma.dmachans=0x7f35 bcm2708_fb.fbwidth=1440 bcm2708_fb.fbheight=900 bcm2709.boardrev=0xa21041 bcm2709.serial=0xb11b068 smsc95xx.macaddr=B8:27:EB:11:B0:68 bcm2708_fb.fbswap=1 bcm2709.disk_led_gpio=47 bcm2709.disk_led_active_low=0 sdhci-bcm2708.emmc_clock_freq=250000000 vc_mem.mem_base=0x3dc00000 vc_mem.mem_size=0x3f000000 dwc_otg.lpm_enable=0 console=ttyAMA0,115200 console=tty1 root=/dev/mmcblk0p2 rootfstype=ext4 elevator=deadline rootwait
[0.000000] PID hash table entries: 4096 (order: 2, 16384 bytes)
[0.000000] Dentry cache hash table entries: 131072 (order: 7, 524288 bytes)
[0.000000] Inode-cache hash table entries: 65536 (order: 6, 262144 bytes)
[0.000000] Memory: 940832K/966656K available (5722K kernel code, 397K rwdata, 1748K rodata, 384K init, 763K bss, 25824K reserved)
[0.000000] Virtual kernel memory layout:
[0.000000] vector : 0xffff0000 - 0xffff1000 (4 kB)
[0.000000] fixmap : 0xffc00000 - 0xffe00000 (2048 kB)
[0.000000] vmalloc : 0xbb800000 - 0xff000000 (1080 MB)
[0.000000] lowmem : 0x80000000 - 0xbb000000 (944 MB)
[0.000000] modules : 0x7f000000 - 0x80000000 (16 MB)
[0.000000] .text : 0x80008000 - 0x80753a48 (7471 kB)
[0.000000] .init : 0x80754000 - 0x807b4000 (384 kB)
[0.000000] .data : 0x807b4000 - 0x808174bc (398 kB)
[0.000000] .bss : 0x808174bc - 0x808d6254 (764 kB)
[0.000000] SLUB: HWalign=64, Order=0-3, MinObjects=0, CPUs=4, Nodes=1
[0.000000] Preemptible hierarchical RCU implementation.
[0.000000] NR_IRQS:608
[0.000000] Architected cp15 timer(s) running at 19.20MHz (virt).
[0.000015] sched_clock: 56 bits at 19MHz, resolution 52ns, wraps every 3579139424256ns
[0.000038] Switching to timer-based delay loop, resolution 52ns

[0.000332] Console: colour dummy device 80x30
[0.001759] console [tty1] enabled
[0.001808] Calibrating delay loop (skipped), value calculated using timer frequency.. 38.40 BogoMIPS (lpj=192000)
[0.001889] pid_max: default: 32768 minimum: 301
[0.002291] Mount-cache hash table entries: 2048 (order: 1, 8192 bytes)
[0.002353] Mountpoint-cache hash table entries: 2048 (order: 1, 8192 bytes)
[0.003618] Initializing cgroup subsys memory
[0.003710] Initializing cgroup subsys devices
[0.003769] Initializing cgroup subsys freezer
[0.003818] Initializing cgroup subsys net_cls
[0.003882] Initializing cgroup subsys blkio
[0.003986] CPU: Testing write buffer coherency: ok
[0.004098] ftrace: allocating 19614 entries in 58 pages
[0.052585] CPU0: update cpu_capacity 1024
[0.052663] CPU0: thread -1, cpu 0, socket 15, mpidr 80000f00
[0.052705] [bcm2709_smp_prepare_cpus] enter
[0.052858] Setting up static identity map for 0x528478 - 0x5284ac
[0.112484] [bcm2709_boot_secondary] cpu:1 started (0) 17
[0.112797] CPU1: Booted secondary processor
[0.112806] [bcm2709_secondary_init] enter cpu:1
[0.112858] CPU1: update cpu_capacity 1024
[0.112867] CPU1: thread -1, cpu 1, socket 15, mpidr 80000f01
[0.132467] [bcm2709_boot_secondary] cpu:2 started (0) 18
[0.132721] CPU2: Booted secondary processor
[0.132729] [bcm2709_secondary_init] enter cpu:2
[0.132760] CPU2: update cpu_capacity 1024
[0.132768] CPU2: thread -1, cpu 2, socket 15, mpidr 80000f02
[0.152544] [bcm2709_boot_secondary] cpu:3 started (0) 16
[0.152784] CPU3: Booted secondary processor
[0.152791] [bcm2709_secondary_init] enter cpu:3
[0.152820] CPU3: update cpu_capacity 1024
[0.152828] CPU3: thread -1, cpu 3, socket 15, mpidr 80000f03
[0.152921] Brought up 4 CPUs
[0.153042] SMP: Total of 4 processors activated (153.60 BogoMIPS).
[0.153075] CPU: All CPU(s) started in SVC mode.
[0.154086] devtmpfs: initialized
[0.178872] VFP support v0.3: implementor 41 architecture 2 part 30 variant 7 rev 5
[0.180848] pinctrl core: initialized pinctrl subsystem
[0.183958] NET: Registered protocol family 16
[0.189598] DMA: preallocated 4096 KiB pool for atomic coherent allocations
[0.190778] bcm2709.uart_clock = 3000000
[0.193540] hw-breakpoint: found 5 (+1 reserved) breakpoint and 4 watchpoint registers.
[0.193594] hw-breakpoint: maximum watchpoint size is 8 bytes.
[0.193649] mailbox: Broadcom VideoCore Mailbox driver
[0.193779] bcm2708_vcio: mailbox at f300b880
[0.194133] bcm_power: Broadcom power driver
[0.194169] bcm_power_open() -> 0
[0.194195] bcm_power_request(0, 8)
[0.694883] bcm_mailbox_read -> 00000080, 0
[0.694915] bcm_power_request -> 0
[0.695057] Serial: AMBA PL011 UART driver

[0.695204] dev:f1: ttyAMA0 at MMIO 0x3f201000 (irq = 83, base_baud = 0) is a PL011 rev3
[1.203395] console [ttyAMA0] enabled
[1.275714] SCSI subsystem initialized
[1.279732] usbcore: registered new interface driver usbfs
[1.285405] usbcore: registered new interface driver hub
[1.290875] usbcore: registered new device driver usb
[1.297790] Switched to clocksource arch_sys_counter
[1.333434] FS-Cache: Loaded
[1.336670] CacheFiles: Loaded
[1.351219] NET: Registered protocol family 2
[1.356865] TCP established hash table entries: 8192 (order: 3, 32768 bytes)
[1.364121] TCP bind hash table entries: 8192 (order: 4, 65536 bytes)
[1.370822] TCP: Hash tables configured (established 8192 bind 8192)
[1.377292] TCP: reno registered
[1.380569] UDP hash table entries: 512 (order: 2, 16384 bytes)
[1.386554] UDP-Lite hash table entries: 512 (order: 2, 16384 bytes)
[1.393284] NET: Registered protocol family 1
[1.398334] RPC: Registered named UNIX socket transport module.
[1.404278] RPC: Registered udp transport module.
[1.409047] RPC: Registered tcp transport module.
[1.413765] RPC: Registered tcp NFSv4.1 backchannel transport module.
[1.421184] hw perfevents: enabled with armv7_cortex_a7 PMU driver, 5 counters available
[1.429600] bcm2708_dma: DMA manager at f3007000
[1.434392] vc-mem: phys_addr:0x00000000 mem_base=0x3dc00000
mem_size:0x3f000000(1008 MiB)
[1.444218] futex hash table entries: 1024 (order: 4, 65536 bytes)
[1.450743] audit: initializing netlink subsys (disabled)
[1.456215] audit: type=2000 audit(1.239:1): initialized
[1.477755] VFS: Disk quotas dquot_6.5.2
[1.482115] Dquot-cache hash table entries: 1024 (order 0, 4096 bytes)
[1.491649] FS-Cache: Netfs 'nfs' registered for caching
[1.498092] NFS: Registering the id_resolver key type
[1.503232] Key type id_resolver registered
[1.507428] Key type id_legacy registered
[1.512700] msgmni has been set to 1853
[1.518443] Block layer SCSI generic (bsg) driver version 0.4 loaded (major 252)
[1.526063] io scheduler noop registered
[1.530041] io scheduler deadline registered (default)
[1.535523] io scheduler cfq registered
[1.542014] BCM2708FB: allocated DMA memory fac00000
[1.547047] BCM2708FB: allocated DMA channel 0 @ f3007000
[1.574134] Console: switching to colour frame buffer device 180x56
[1.594382] bcm2708-dmaengine bcm2708-dmaengine: Load BCM2835 DMA engine driver
[1.602172] uart-pl011 dev:f1: no DMA platform data
[1.607660] vc-cma: Videocore CMA driver
[1.611696] vc-cma: vc_cma_base   = 0x00000000
[1.616490] vc-cma: vc_cma_size   = 0x00000000 (0 MiB)
[1.622007] vc-cma: vc_cma_initial   = 0x00000000 (0 MiB)
[1.639609] brd: module loaded
[1.648700] loop: module loaded
[1.652278] vchiq: vchiq_init_state: slot_zero = 0xba800000, is_master = 0
[1.660164] Loading iSCSI transport class v2.0-870.

[1.666136] usbcore: registered new interface driver smsc95xx
[1.672133] dwc_otg: version 3.00a 10-AUG-2012 (platform bus)
[1.878349] Core Release: 2.80a
[1.881567] Setting default values for core params
[1.886487] Finished setting default values for core params
[2.092586] Using Buffer DMA mode
[2.095975] Periodic Transfer Interrupt Enhancement - disabled
[2.101936] Multiprocessor Interrupt Enhancement - disabled
[2.107611] OTG VER PARAM: 0, OTG VER FLAG: 0
[2.112076] Dedicated Tx FIFOs mode
[2.116002] WARN::dwc_otg_hcd_init:1047: FIQ DMA bounce buffers: virt = 0xbac14000 dma = 0xfac14000 len=9024
[2.130168] FIQ FSM acceleration enabled for :
[2.130168] Non-periodic Split Transactions
[2.130168] Periodic Split Transactions
[2.130168] High-Speed Isochronous Endpoints
[2.163553] dwc_otg: Microframe scheduler enabled
[2.163669] WARN::hcd_init_fiq:412: FIQ on core 1 at 0x803d98b4
[2.173833] WARN::hcd_init_fiq:413: FIQ ASM at 0x803d9c10 length 36
[2.184326] WARN::hcd_init_fiq:438: MPHI regs_base at 0xbb80a000
[2.194540] dwc_otg bcm2708_usb: DWC OTG Controller
[2.203626] dwc_otg bcm2708_usb: new USB bus registered, assigned bus number 1
[2.215090] dwc_otg bcm2708_usb: irq 32, io mem 0x00000000
[2.224770] Init: Port Power? op_state=1
[2.232778] Init: Power Port (0)
[2.240357] usb usb1: New USB device found, idVendor=1d6b, idProduct=0002
[2.251246] usb usb1: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[2.262566] usb usb1: Product: DWC OTG Controller
[2.271345] usb usb1: Manufacturer: Linux 3.18.11-v7+ dwc_otg_hcd
[2.281514] usb usb1: SerialNumber: bcm2708_usb
[2.290995] hub 1-0:1.0: USB hub found
[2.298877] hub 1-0:1.0: 1 port detected
[2.307215] dwc_otg: FIQ enabled
[2.307229] dwc_otg: NAK holdoff enabled
[2.307241] dwc_otg: FIQ split-transaction FSM enabled
[2.307281] Module dwc_common_port init
[2.307683] usbcore: registered new interface driver usb-storage
[2.318134] mousedev: PS/2 mouse device common for all mice
[2.328439] bcm2835-cpufreq: min=600000 max=900000
[2.337600] sdhci: Secure Digital Host Controller Interface driver
[2.347867] sdhci: Copyright(c) Pierre Ossman
[2.356409] DMA channels allocated for the MMC driver
[2.397829] Load BCM2835 MMC driver
[2.410677] sdhci-pltfm: SDHCI platform and OF driver helper
[2.421119] ledtrig-cpu: registered to indicate activity on CPUs
[2.431509] hidraw: raw HID events driver (C) Jiri Kosina
[2.441343] usbcore: registered new interface driver usbhid
[2.452062] usbhid: USB HID core driver
[2.460276] TCP: cubic registered
[2.468679] Initializing XFRM netlink socket
[2.477007] NET: Registered protocol family 17
[2.485729] Key type dns_resolver registered

[2.494554] Registering SWP/SWPB emulation handler
[2.504469] registered taskstats version 1
[2.512839] Indeed it is in host mode hprt0 = 00021501
[2.522380] vc-sm: Videocore shared memory driver
[2.537851] [vc_sm_connected_init]: start
[2.545929] mmc0: host does not support reading read-only switch, assuming write-enable
[2.558743] [vc_sm_connected_init]: end - returning 0
[2.568333] mmc0: new high speed SDHC card at address 1234
[2.578343] Waiting for root device /dev/mmcblk0p2...
[2.578626] mmcblk0: mmc0:1234 SA08G 7.42 GiB
[2.587683] mmcblk0: p1 p2
[2.618887] EXT4-fs (mmcblk0p2): mounted filesystem with ordered data mode. Opts: (null)
[2.631294] VFS: Mounted root (ext4 filesystem) readonly on device 179:2.
[2.643732] devtmpfs: mounted
[2.651603] Freeing unused kernel memory: 384K (80754000 - 807b4000)
[2.717943] usb 1-1: new high-speed USB device number 2 using dwc_otg
[2.728984] Indeed it is in host mode hprt0 = 00001101
[2.938321] usb 1-1: New USB device found, idVendor=0424, idProduct=9514
[2.949413] usb 1-1: New USB device strings: Mfr=0, Product=0, SerialNumber=0
[2.961710] hub 1-1:1.0: USB hub found
[2.969881] hub 1-1:1.0: 5 ports detected
[3.258127] usb 1-1.1: new high-speed USB device number 3 using dwc_otg
[3.368364] usb 1-1.1: New USB device found, idVendor=0424, idProduct=ec00
[3.380045] usb 1-1.1: New USB device strings: Mfr=0, Product=0, SerialNumber=0
[3.394822] smsc95xx v1.0.4
[3.462313] smsc95xx 1-1.1:1.0 eth0: register 'smsc95xx' at usb-bcm2708_usb-1.1, smsc95xx USB 2.0 Ethernet, b8:27:eb:11:b0:68
[3.558110] usb 1-1.3: new high-speed USB device number 4 using dwc_otg
[3.668365] usb 1-1.3: New USB device found, idVendor=0409, idProduct=0059
[3.680304] usb 1-1.3: New USB device strings: Mfr=0, Product=0, SerialNumber=0
[3.693413] hub 1-1.3:1.0: USB hub found
[3.702211] hub 1-1.3:1.0: 4 ports detected
[3.861083] udevd[175]: starting version 175
[3.988113] usb 1-1.3.3: new low-speed USB device number 5 using dwc_otg
[4.127767] usb 1-1.3.3: New USB device found, idVendor=413c, idProduct=2005
[4.142929] usb 1-1.3.3: New USB device strings: Mfr=1, Product=2, SerialNumber=0
[4.156669] usb 1-1.3.3: Product: DELL USB Keyboard
[4.177929] usb 1-1.3.3: Manufacturer: DELL
[4.194375] input: DELL DELL USB Keyboard as /devices/platform/bcm2708_usb/usb1/1-1/1-1.3/1-1.3.3/1-1.3.3:1.0/0003:413C:2005.0001/input/input0
[4.212883] hid-generic 0003:413C:2005.0001: input,hidraw0: USB HID v1.10 Keyboard [DELL DELL USB Keyboard] on usb-bcm2708_usb-1.3.3/input0
[4.328224] usb 1-1.3.4: new low-speed USB device number 6 using dwc_otg
[4.485314] usb 1-1.3.4: New USB device found, idVendor=046d, idProduct=c001
[4.499285] usb 1-1.3.4: New USB device strings: Mfr=1, Product=2, SerialNumber=0
[4.515516] usb 1-1.3.4: Product: USB Mouse
[4.526284] usb 1-1.3.4: Manufacturer: Logitech
[4.558518] input: Logitech USB Mouse as /devices/platform/bcm2708_usb/usb1/1-1/1-1.3/1-1.3.4/1-1.3.4:1.0/0003:046D:C001.0002/input/input1
[4.579762] hid-generic 0003:046D:C001.0002: input,hidraw1: USB HID v1.10 Mouse [Logitech

USB Mouse] on usb-bcm2708_usb-1.3.4/input0
[6.361622] EXT4-fs (mmcblk0p2): re-mounted. Opts: (null)
[6.613617] EXT4-fs (mmcblk0p2): re-mounted. Opts: (null)
[7.166801] random: nonblocking pool is initialized
[10.937983] EXT4-fs (mmcblk0p2): resizing filesystem from 784640 to 1930240 blocks
[12.497395] EXT4-fs (mmcblk0p2): resized filesystem to 1930240
[20.900697] smsc95xx 1-1.1:1.0 eth0: hardware isn't capable of remote wakeup
[23.586354] cfg80211: Calling CRDA to update world regulatory domain
[24.909989] Adding 102396k swap on /var/swap. Priority:-1 extents:2 across:2134012k SSFS
[132.406987] smsc95xx 1-1.1:1.0 eth0: link up, 100Mbps, full-duplex, lpa 0xCDE1

Appendix B. A list of software installed-software4.log

adduser	install
alsa-base	install
alsa-utils	install
apt	install
apt-utils	install
aptitude	install
aptitude-common	install
aspell	install
aspell-en	install
at-spi2-core	install
autoconf	install
automake	install
autopoint	install
autotools-dev	install
avahi-daemon	install
base-files	install
base-passwd	install
bash	install
bash-completion	install
biblatex	install
bind9-host	install
binutils	install
bison	install
blt	install
bsdmainutils	install
bsdutils	install
build-essential	install
bzip2	install
ca-certificates	install
ca-certificates-java	install
cgroup-bin	install
chromium	install
chromium-inspector	install
cifs-utils	install
cmake	install
cmake-data	install
console-setup	install
console-setup-linux	install
consolekit	install

coreutils	install
cpio	install
cpp	install
cpp-4.6	install
cron	install
cups-bsd	install
cups-client	install
cups-common	install
curl	install
dash	install
dbus	install
dbus-x11	install
dconf-gsettings-backend:armhf	install
dconf-service	install
debconf	install
debconf-i18n	install
debconf-utils	install
debhelper	install
debian-reference-common	install
debian-reference-en	install
debianutils	install
default-jre	install
default-jre-headless	install
desktop-base	install
desktop-file-utils	install
dhcpcd5	install
dictionaries-common	install
diffuse	install
diffutils	install
dillo	install
dmsetup	install
docutils-common	install
docutils-doc	install
dosfstools	install
dphys-swapfile	install
dpkg	install
dpkg-dev	install
e2fslibs:armhf	install
e2fsprogs	install
ed	install
emacsen-common	install
epiphany-browser	install
epiphany-browser-data	install
esound-common	install
etoolbox	install
evince	install
evince-common	install
fake-hwclock	install
fakeroot	install
fbset	install
ffmpeg	install
file	install

findutils	install
firmware-atheros	install
firmware-brcm80211	install
firmware-libertas	install
firmware-ralink	install
firmware-realtek	install
flex	install
fontconfig	install
fontconfig-config	install
fonts-droid	install
fonts-freefont-ttf	install
fonts-liberation	install
fonts-lyx	install
fonts-opensymbol	install
fonts-roboto	install
fonts-sil-gentium	install
fonts-sil-gentium-basic	install
fonts-stix	install
freeglut3:armhf	install
freepats	install
fuse	install
g++	install
g++-4.6	install
galculator	install
gcc	install
gcc-4.5-base:armhf	install
gcc-4.6	install
gcc-4.6-base:armhf	install
gcc-4.7-base:armhf	install
gcc-4.8-base:armhf	install
gcc-4.9-base:armhf	install
gccxml	install
gconf-service	install
gconf2	install
gconf2-common	install
gdb	install
gdbserver	install
geany	install
geany-common	install
gedit	install
gedit-common	install
geoip-database	install
gettext	install
gettext-base	install
gfortran	install
gfortran-4.6	install
ghostscript	install
giblib1:armhf	install
gimp	install
gimp-data	install
gir1.2-atk-1.0	install
gir1.2-clutter-1.0	install

gir1.2-cogl-1.0 install
gir1.2-coglpango-1.0 install
gir1.2-freedesktop install
gir1.2-gdkpixbuf-2.0 install
gir1.2-glib-2.0 install
gir1.2-gstreamer-0.10 install
gir1.2-gstreamer-1.0 install
gir1.2-gtk-3.0 install
gir1.2-gtksource-3.0 install
gir1.2-json-1.0 install
gir1.2-pango-1.0 install
gir1.2-peas-1.0 install
git install
git-core install
git-man install
gitk install
gksu install
glib-networking:armhf install
glib-networking-common install
glib-networking-services install
gnome-desktop3-data install
gnome-icon-theme install
gnome-icon-theme-symbolic install
gnome-js-common install
gnome-themes-standard:armhf install
gnome-themes-standard-data install
gnome-user-guide install
gnupg install
gnuradio install
gnuradio-dev install
gperf install
gpgv install
gpicview install
gr-fcdproplus install
gr-iqbal install
gr-osmosdr install
graphviz install
grep install
groff-base install
gsettings-desktop-schemas install
gsfonts install
gsfonts-x11 install
gstreamer0.10-alsa:armhf install
gstreamer0.10-ffmpeg:armhf install
gstreamer0.10-gconf:armhf install
gstreamer0.10-plugins-bad:armhf install
gstreamer0.10-plugins-base:armhf install
gstreamer0.10-plugins-good:armhf install
gstreamer0.10-x:armhf install
gstreamer1.0-alsa:armhf install
gstreamer1.0-doc install
gstreamer1.0-libav:armhf install

gstreamer1.0-libav-dbg:armhf		install
gstreamer1.0-omx	install	
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gstreamer1.0-plugins-bad:armhf		install
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gstreamer1.0-plugins-good:armhf		install
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gstreamer1.0-pulseaudio:armhf		install
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gstreamer1.0-x:armhf	install	
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iceweasel	install	
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idle-python3.2	install	
idle3	install	
ifplugd	install	
ifupdown	install	
info	install	
init-system-helpers	install	
initramfs-tools	install	
initscripts	install	
insserv	install	
install-info	install	
intltool-debian	install	
iproute	install	

iptables	install	
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isc-dhcp-common		install
iso-codes	install	
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jackd2	install	
java-common	install	
javascript-common	install	
kbd	install	
keyboard-configuration		install
klibc-utils	install	
kmod	install	
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libavahi-common3:armhf install
libavahi-core7:armhf install
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libavc1394-0:armhf install
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liblog-message-perl install
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libopencv-stitching2.4 install
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libqwt6 install
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libraspberrypi-doc install
libraspberrypi0 install
librasqal3 install
libraw1394-11:armhf install
librdf0 install
libreadline5:armhf install
libreadline6:armhf install
libregexp-common-perl install
libreoffice install
libreoffice-base install
libreoffice-base-core install
libreoffice-calc install
libreoffice-common install
libreoffice-core install
libreoffice-draw install
libreoffice-emailmerge install
libreoffice-filter-mobiledev install
libreoffice-impress install
libreoffice-java-common install
libreoffice-math install
libreoffice-report-builder-bin install
libreoffice-style-galaxy install
libreoffice-writer install
libresid-builder0c2a install
librsvg2-2:armhf install
librsvg2-common:armhf install
librtlsdr0:armhf install
librtmp0:armhf install
libruby1.9.1 install
libsamplerate0:armhf install
libsasl2-2:armhf install
libsasl2-modules:armhf install
libsbc1:armhf install
libschroedinger-1.0-0:armhf install
libsclang1 install

libscsynth1 install
libsctp1:armhf install
libsdl-image1.2:armhf install
libsdl-mixer1.2:armhf install
libsdl-ttf2.0-0:armhf install
libsdl1.2debian:armhf install
libsecret-1-0:armhf install
libsecret-common install
libseed-gtk3-0 install
libselinux1:armhf install
libsemanage-common install
libsemanage1:armhf install
libsepol1:armhf install
libservlet2.5-java install
libsgutils2-2 install
libshout3:armhf install
libsidplay2 install
libsigc++-1.2-5c2 install
libsigc++-2.0-0c2a:armhf install
libslang2:armhf install
libslv2-9 install
libsm-dev:armhf install
libsm6:armhf install
libsmbclient:armhf install
libsmpeg0:armhf install
libsndfile1:armhf install
libsodium13:armhf install
libsoftware-license-perl install
libsoundtouch0:armhf install
libsoup-gnome2.4-1:armhf install
libsoup2.4-1:armhf install
libspandsp2 install
libspectre1:armhf install
libspeex1:armhf install
libspeexdsp1:armhf install
libsqlite3-0:armhf install
libsrtp0 install
libss2:armhf install
libssh-4:armhf install
libssh2-1:armhf install
libssl-dev install
libssl-doc install
libssl1.0.0:armhf install
libstartup-notification0 install
libstdc++6:armhf install
libstdc++6-4.6-dev install
libsub-exporter-perl install
libsub-install-perl install
libswitch-perl install
libswscale-dev install
libswscale2:armhf install
libsys-hostname-long-perl install

libsysfs2:armhf install
libsystemd-login0:armhf install
libt1-5 install
libtag1-vanilla:armhf install
libtag1c2a:armhf install
libtagcoll2-dev install
libtalloc2:armhf install
libtar0 install
libtasn1-3:armhf install
libtcl8.6:armhf install
libtdb1:armhf install
libterm-ui-perl install
libtext-charwidth-perl install
libtext-iconv-perl install
libtext-soundex-perl install
libtext-template-perl install
libtext-wrapi18n-perl install
libthai-data install
libthai0:armhf install
libtheora0:armhf install
libtiff4:armhf install
libtiff4-dev install
libtiff5:armhf install
libtiffxx0c2:armhf install
libtimedate-perl install
libtinfo5:armhf install
libtirpc1:armhf install
libtk8.6:armhf install
libtool install
libts-0.0-0:armhf install
libtwolame0 install
libudev0:armhf install
libudev1:armhf install
libuhd003:armhf install
libumfpack5.4.0 install
libunistring0:armhf install
libupnp6 install
liburi-perl install
libusb-0.1-4:armhf install
libusb-1.0-0:armhf install
libusb-dev install
libusbmuxd1 install
libustr-1.0-1:armhf install
libuuid1:armhf install
libv4l-0:armhf install
libv4l-dev:armhf install
libv4l2rds0:armhf install
libv4lconvert0:armhf install
libva-x11-1:armhf install
libva1:armhf install
libvcdinfo0 install
libvisio-0.0-0 install

libvisual-0.4-0:armhf install
libvisual-0.4-plugins:armhf install
libvlc5 install
libvlccore5 install
libvo-aacenc0:armhf install
libvo-amrwbenc0:armhf install
libvolk-bin install
libvolk-dev install
libvolk0.0.0:armhf install
libvorbis0a:armhf install
libvorbisenc2:armhf install
libvorbisfile3:armhf install
libvpx1:armhf install
libvte-common install
libvte9 install
libwavpack1:armhf install
libwayland0:armhf install
libwbclient0:armhf install
libwebkitgtk-1.0-0 install
libwebkitgtk-1.0-common install
libwebkitgtk-3.0-0:armhf install
libwebkitgtk-3.0-common install
libwebp2:armhf install
libwibble-dev install
libwildmidi-config install
libwildmidi1:armhf install
libwmf0.2-7:armhf install
libwnck-3-0 install
libwnck-3-common install
libwnck-common install
libwnck22 install
libwpd-0.9-9 install
libwpg-0.2-2 install
libwps-0.2-2 install
libwrap0:armhf install
libwww-perl install
libwww-robotrules-perl install
libwxbase2.8-0:armhf install
libwxgtk2.8-0:armhf install
libx11-6:armhf install
libx11-data install
libx11-dev:armhf install
libx11-doc install
libx11-xcb-dev:armhf install
libx11-xcb1:armhf install
libx264-123:armhf install
libx264-130:armhf install
libxalan2-java install
libxapian-dev install
libxapian22 install
libxau-dev:armhf install
libxau6:armhf install

libxaw7:armhf install
libxcb-composite0:armhf install
libxcb-dri2-0:armhf install
libxcb-dri2-0-dev:armhf install
libxcb-dri3-0:armhf install
libxcb-dri3-dev:armhf install
libxcb-glx0:armhf install
libxcb-glx0-dev:armhf install
libxcb-keysyms1:armhf install
libxcb-present-dev:armhf install
libxcb-present0:armhf install
libxcb-randr0:armhf install
libxcb-randr0-dev:armhf install
libxcb-render0:armhf install
libxcb-render0-dev:armhf install
libxcb-shape0:armhf install
libxcb-shape0-dev:armhf install
libxcb-shm0:armhf install
libxcb-shm0-dev:armhf install
libxcb-sync-dev:armhf install
libxcb-sync1:armhf install
libxcb-util0:armhf install
libxcb-xfixes0:armhf install
libxcb-xfixes0-dev:armhf install
libxcb-xv0:armhf install
libxcb1:armhf install
libxcb1-dev:armhf install
libxcomposite-dev install
libxcomposite1:armhf install
libxcursor-dev:armhf install
libxcursor1:armhf install
libxdamage-dev install
libxdamage1:armhf install
libxdmcp-dev:armhf install
libxdmcp6:armhf install
libxdot4 install
libxerces2-java install
libxext-dev:armhf install
libxext6:armhf install
libxfce4ui-1-0 install
libxfce4util-bin install
libxfce4util-common install
libxfce4util4 install
libxfconf-0-2 install
libxfixes-dev install
libxfixes3:armhf install
libxfont1 install
libxft-dev install
libxft2:armhf install
libxi-dev install
libxi6:armhf install
libxinerama-dev:armhf install

libxinerama1:armhf install
libxkbcommon0:armhf install
libxkbfile1:armhf install
libxklavier16 install
libxm4:armhf install
libxml-commons-external-java install
libxml-commons-resolver1.1-java install
libxml2:armhf install
libxml2-utils install
libxmlrpc-core-c3 install
libxmu6:armhf install
libxmuu1:armhf install
libxp6:armhf install
libxpm4:armhf install
libxrandr-dev install
libxrandr2:armhf install
libxrender-dev:armhf install
libxrender1:armhf install
libxres1:armhf install
libxshmfence-dev:armhf install
libxshmfence1:armhf install
libxslt1.1:armhf install
libxss1:armhf install
libxt6:armhf install
libxtst6:armhf install
libxv1:armhf install
libxvidcore4:armhf install
libxxf86dga1:armhf install
libxxf86vm-dev:armhf install
libxxf86vm1:armhf install
libyajl2 install
libyaml-0-2:armhf install
libyelp0 install
libzbar0 install
libzmq3:armhf install
libzvbi-common install
libzvbi0:armhf install
lightdm install
lightdm-gtk-greeter install
linux-libc-dev:armhf install
lksctp-tools install
lmodern install
locales install
login install
logreq install
logrotate install
lp-solve install
lsb-base install
lua5.1 install
luajit install
luatex install
lxappearance install

lxde	install	
lxde-common	install	
lxde-core	install	
lxde-icon-theme		install
lxinput	install	
lxmenu-data	install	
lxpanel	install	
lxpanel-data	install	
lxpolkit	install	
lxrandr	install	
lxsession	install	
lxsession-edit	install	
lxshortcut	install	
lxtask	install	
lxterminal	install	
m4	install	
make	install	
makedev		install
man-db		install
manpages	install	
manpages-dev	install	
mawk	install	
menu	install	
menu-xdg	install	
mesa-common-dev:armhf		install
mime-support	install	
minecraft-pi	install	
module-init-tools	install	
mount	install	
mountall	install	
mpg321		install
mpi-default-dev		install
multiarch-support	install	
mysql-common		install
nano	install	
ncdu	install	
ncurses-base	install	
ncurses-bin	install	
ncurses-term	install	
net-tools	install	
netbase		install
netcat-openbsd		install
netcat-traditional	install	
netsurf-common		install
netsurf-gtk	install	
nfs-common	install	
ntp	install	
nuscratch	install	
obconf	install	
ocl-icd-libopencl1:armhf	install	
omxplayer	install	
openbox		install

openjdk-6-jre:armhf	install	
openjdk-6-jre-headless:armhf		install
openjdk-6-jre-lib	install	
openmpi-common		install
openresolv	install	
openssh-blacklist	install	
openssh-blacklist-extra		install
openssh-client	install	
openssh-server		install
openssl		install
oracle-java8-jdk	install	
parted	install	
passwd	install	
patch	install	
pciutils	install	
pcmanfm		install
penguinspuzzle		install
perl	install	
perl-base	install	
perl-modules	install	
pgf	install	
pipanel	install	
pistore	install	
pkg-config	install	
plymouth	install	
po-debconf	install	
policykit-1	install	
poppler-data	install	
poppler-utils	install	
preview-latex-style	install	
procps	install	
prosper		install
ps2eps	install	
psmisc	install	
pypy-setuptools		install
pypy-upstream		install
pypy-upstream-dev	install	
pypy-upstream-doc	install	
python	install	
python-cairo	install	
python-chardet		install
python-cheetah		install
python-dateutil		install
python-dbus	install	
python-dbus-dev		install
python-decorator	install	
python-dev	install	
python-docutils		install
python-gi	install	
python-gi-cairo		install
python-glade2	install	
python-gobject-2	install	

python-gtk2	install
python-imaging	install
python-jinja2	install
python-lxml	install
python-markupsafe	install
python-matplotlib	install
python-matplotlib-data	install
python-minecraftpi	install
python-minimal	install
python-mock	install
python-networkx	install
python-nose	install
python-numpy	install
python-opengl	install
python-picamera	install
python-pifacecommon	install
python-pifacedigitalio	install
python-pip	install
python-pkg-resources	install
python-pygame	install
python-pygments	install
python-pygraphviz	install
python-pyparsing	install
python-qt4	install
python-qwt5-qt4	install
python-roman	install
python-rpi.gpio	install
python-scipy	install
python-serial	install
python-setuptools	install
python-sip	install
python-six	install
python-sphinx	install
python-support	install
python-tk	install
python-tz	install
python-uno	install
python-usb	install
python-wxgtk2.8	install
python-wxversion	install
python-yaml	install
python-zmq	install
python2.6	install
python2.6-minimal	install
python2.7	install
python2.7-dev	install
python2.7-minimal	install
python3	install
python3-minecraftpi	install
python3-minimal	install
python3-numpy	install
python3-picamera	install

python3-pifacecommon		install
python3-pifacedigital-scratch-handler		install
python3-pifacedigitalio		install
python3-pygame		install
python3-rpi.gpio	install	
python3-serial	install	
python3-tk	install	
python3.2	install	
python3.2-minimal	install	
qdbus	install	
qjackctl	install	
qt4-linguist-tools	install	
qt4-qmake	install	
qtchooser	install	
qtcore4-l10n	install	
qthid-fcd-controller	install	
raspberrypi-artwork	install	
raspberrypi-bootloader		install
raspberrypi-net-mods	install	
raspberrypi-ui-mods	install	
raspbian-archive-keyring	install	
raspi-config	install	
raspi-copies-and-fills	install	
readline-common		install
rename	install	
rpcbind		install
rpi-update	install	
rsync	install	
rsyslog	install	
rtl-sdr	install	
ruby	install	
ruby1.9.1	install	
samba-common		install
scratch	install	
scrot	install	
sed	install	
sensible-utils	install	
sgml-base	install	
shared-mime-info	install	
smartsim	install	
smbclient	install	
sonic-pi	install	
sphinx-common		install
squeak-plugins-scratch		install
squeak-vm	install	
ssh	install	
strace	install	
sudo	install	
supercollider	install	
supercollider-common		install
supercollider-server	install	
sysv-rc	install	

sysvinit	install
sysvinit-utils	install
tar	install
tasksel	install
tasksel-data	install
tcl	install
tcl8.5	install
tcpd	install
tex-common	install
texlive	install
texlive-base	install
texlive-binaries	install
texlive-common	install
texlive-doc-base	install
texlive-extra-utils	install
texlive-font-utils	install
texlive-fonts-recommended	install
texlive-generic-recommended	install
texlive-latex-base	install
texlive-latex-base-doc	install
texlive-latex-extra	install
texlive-latex-extra-doc	install
texlive-latex-recommended	install
texlive-latex-recommended-doc	install
texlive-luatex	install
texlive-pictures	install
texlive-pictures-doc	install
texlive-pstricks	install
texlive-pstricks-doc	install
timidity	install
tk	install
tk8.5	install
traceroute	install
tree	install
triggerhappy	install
tsconf	install
ttf-dejavu	install
ttf-dejavu-core	install
ttf-dejavu-extra	install
ttf-marvosym	install
ttf-sil-gentium-basic	install
tzdata	install
tzdata-java	install
ucf	install
udev	install
udisks	install
uhd-host	install
uno-libs3	install
unzip	install
update-inetd	install
ure	install
usbmuxd	install

usbutils	install
util-linux	install
v4l-utils	install
vim-common	install
vim-tiny	install
vlc	install
vlc-data	install
vlc-nox	install
vlc-plugin-notify	install
vlc-plugin-pulse	install
weston	install
wget	install
whiptail	install
wireless-tools	install
wolfram-engine	install
wpagui	install
wpasupplicant	install
wwwconfig-common	install
x11-common	install
x11-utils	install
x11-xkb-utils	install
x11-xserver-utils	install
x11proto-composite-dev	install
x11proto-core-dev	install
x11proto-damage-dev	install
x11proto-dri2-dev	install
x11proto-fixes-dev	install
x11proto-gl-dev	install
x11proto-input-dev	install
x11proto-kb-dev	install
x11proto-randr-dev	install
x11proto-render-dev	install
x11proto-xext-dev	install
x11proto-xf86vidmode-dev	install
x11proto-xinerama-dev	install
x2x	install
xarchiver	install
xauth	install
xdg-utils	install
xfce-keyboard-shortcuts	install
xfce4-mixer	install
xfconf	install
xfonts-encodings	install
xfonts-mathml	install
xfonts-utils	install
xinit	install
xkb-data	install
xml-core	install
xorg-sgml-doctools	install
xpdf	install
xserver-common	install
xserver-xorg	install

xserver-xorg-core	install
xserver-xorg-input-all	install
xserver-xorg-input-evdev	install
xserver-xorg-input-synaptics	install
xserver-xorg-video-fbdev	install
xserver-xorg-video-fbturbo	install
xtrans-dev	install
xz-utils	install
yelp	install
yelp-xsl	install
zenity	install
zenity-common	install
zlib1g:armhf	install
zlib1g-dev:armhf	install

Appendix C Python packages installed most using pip

backports
backports.ssl_match_hostname-3.4.0.2.egg-info
bitstring-3.1.3-py2.7.egg
certifi
certifi-2015.04.28.egg-info
clonevirtualenv.py
clonevirtualenv.pyc
dateutil
distribute-0.7.3-py2.7.egg
easy-install.pth
intelhex-2.0-py2.7.egg
matplotlib
matplotlib-1.4.3-py2.7.egg-info
matplotlib-1.4.3-py2.7-nspkg.pth
mock-1.0.1-py2.7.egg-info
mock.py
mock.pyc
mpl_toolkits
myhdl-0.9.dev0-py2.7.egg
nose
nose-1.3.7.egg-info
pbr
pbr-1.1.1-py2.7.egg-info
PIL
Pillow-2.8.2-py2.7.egg-info
pylab.py
pylab.pyc
pyparsing-2.0.3-py2.7.egg-info
pyparsing.py
pyparsing.pyc
PyPubSub-3.3.0-py2.7.egg
python_dateutil-2.4.2-py2.7.egg-info
pytz
pytz-2015.4-py2.7.egg-info
pyusb-1.0.0a3-py2.7.egg

RPi
RPi.GPIO-0.5.11.egg-info
scipy
scipy-0.15.1-py2.7.egg-info
setuptools-17.1.1-py2.7.egg
setuptools.pth
six-1.9.0-py2.7.egg-info
six.py
six.pyc
stevedore
stevedore-1.5.0-py2.7.egg-info
tornado
tornado-4.2.egg-info
virtualenv-13.0.3-py2.7.egg-info
virtualenv_clone-0.2.5-py2.7.egg-info
virtualenv.py
virtualenv.pyc
virtualenv_support
virtualenvwrapper
virtualenvwrapper-4.6.0-py2.7.egg-info
virtualenvwrapper-4.6.0-py2.7-nspkg.pth
wheel
wheel-0.24.0-py2.7.egg-info
wx.pth
wxPython_common-3.0.2.0.egg-info
wxversion.py
wxversion.pyc
XsTools-0.1.26-py2.7.egg

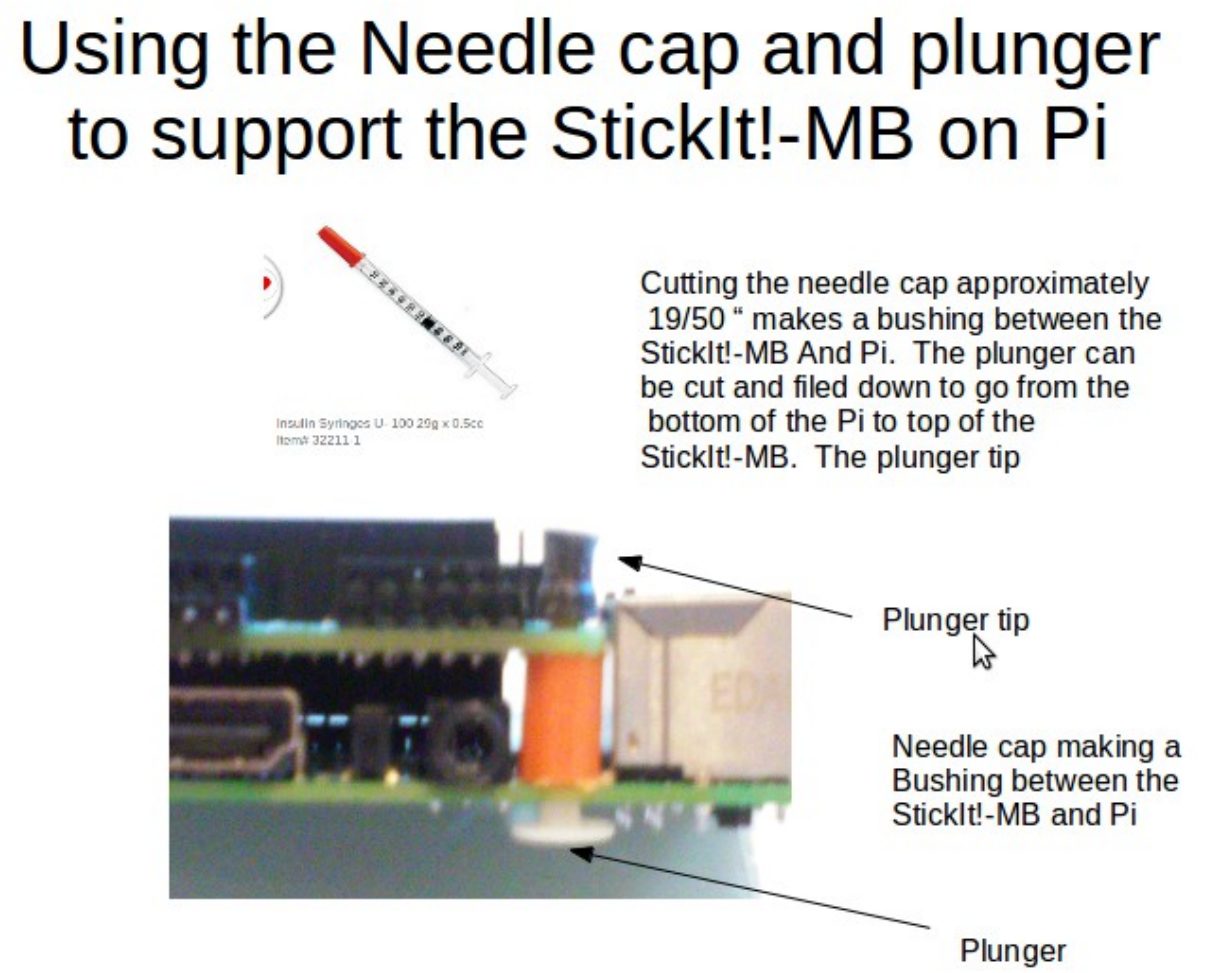
Appendix D GPIO information

GPIO

```
sudo python
    >>> import RPi.GPIO as GPIO
    >>> GPIO.setup(18, GPIO.OUT)
    >>> GPIO.output(18, False)
```

If you look at the LED's I'm using the 3.3v rail to power the led and have the cathode going to the GPIO's this mean that to turn the LED on we set the output to LOW or False (in python's case) but to turn the off we set the output to HIGH or True.
This means we a sinking the current through the Raspberry Pi rather that trying to source it from the pin's. For the push button we are using a 10K pull-down resistor, this makes sure the button read a solid LOW or False when not pressed, when pressed the 3.3v is connected and we get a solid HIGH or True reading.

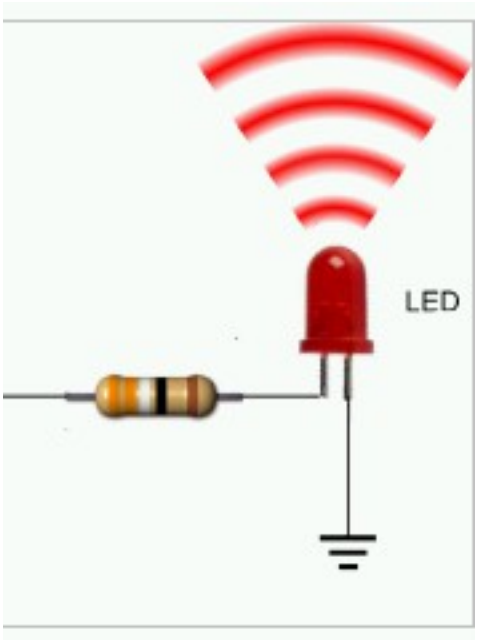
In the image below the Raspberry Pi and StickIt!-MB are connected.



Default Shunts for ID_SC, ID_SD, and WP. In the image below the shunts are open towards the bottom.

When the EEPROM needs to be programmed by the Raspberry Pi the shunt on left WP needs to be on to disable the write protection, during the programming and placed back to normal mode for the Pi to read the EEPROM.

A red led was connected in series with a 470 ohm resistor. The resistor was connected on PMOD 2 using CHAN22 which is BCM 5 pin on the Raspberr Pi..



The command to execute the program is ***"sudo python /home/vidal/test_gpio.py" to turn on and off the led.***

The python code which controls the gpio BCM 5 connected to Led on PMOD3 grd and 470 ohm

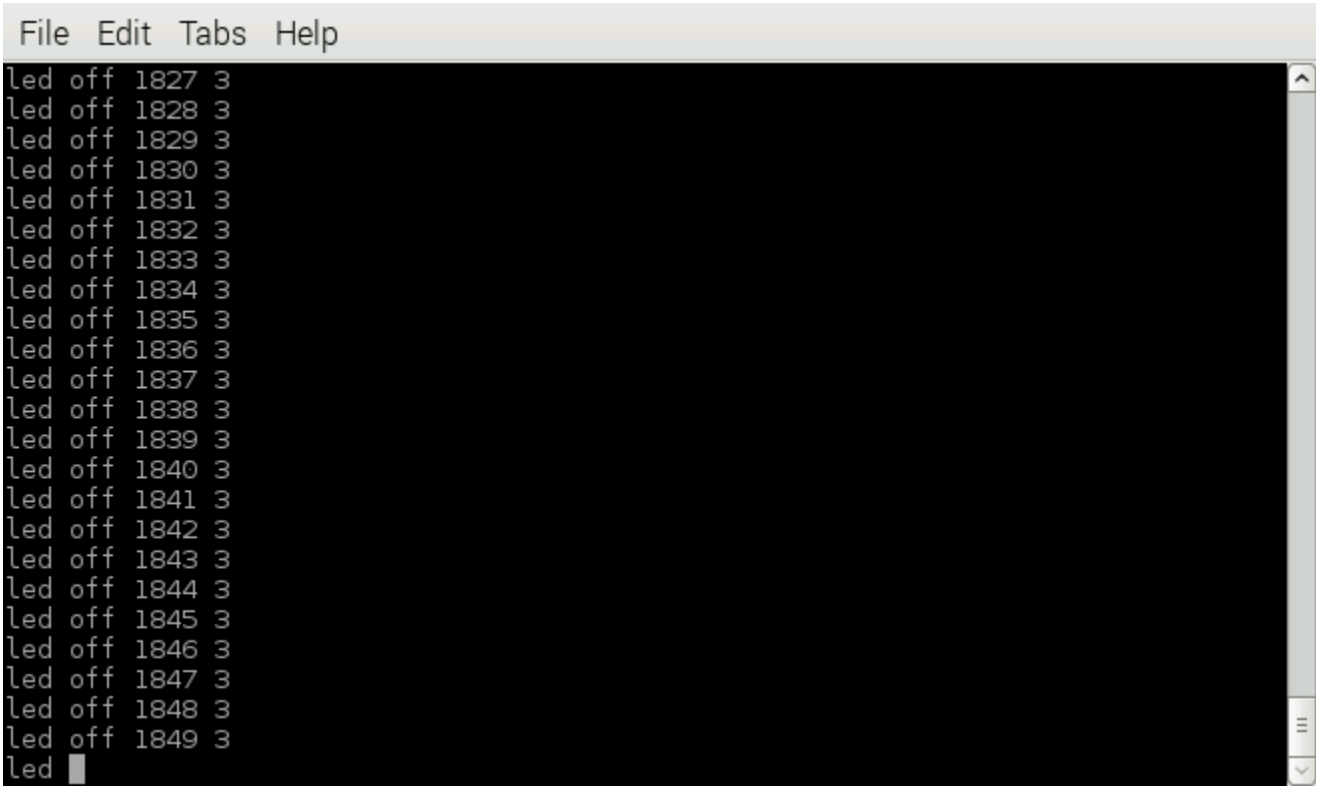
resitor on PMOD 2 CHAN22.

**********test_gpio.py**********

```
import RPi.GPIO as GPIO

#help(GPIO)

#GPIO.setmode(GPIO.BOARD)

GPIO.setmode(GPIO.BCM)

GPIO.setup(5, GPIO.OUT)

for j in range(100000):
    for i in range(100000):
        GPIO.output(5, True)
        print 'led on', i, j
    for i in range(100000):
        GPIO.output(5, False)
        print 'led off', i, j
```

**********test_gpio.py**********

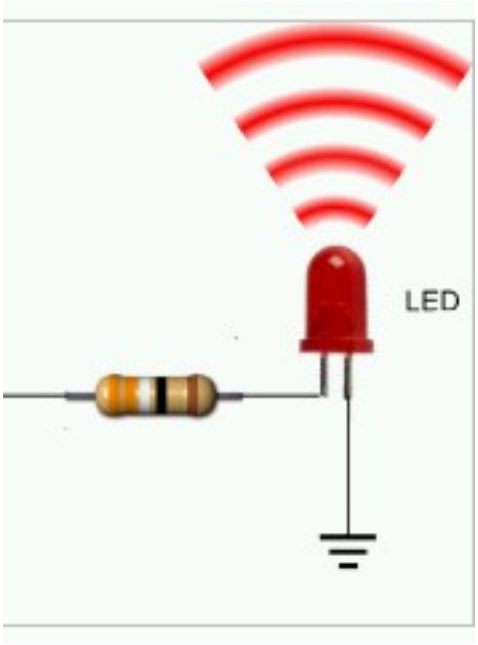
This is the output of the python program when the led is off



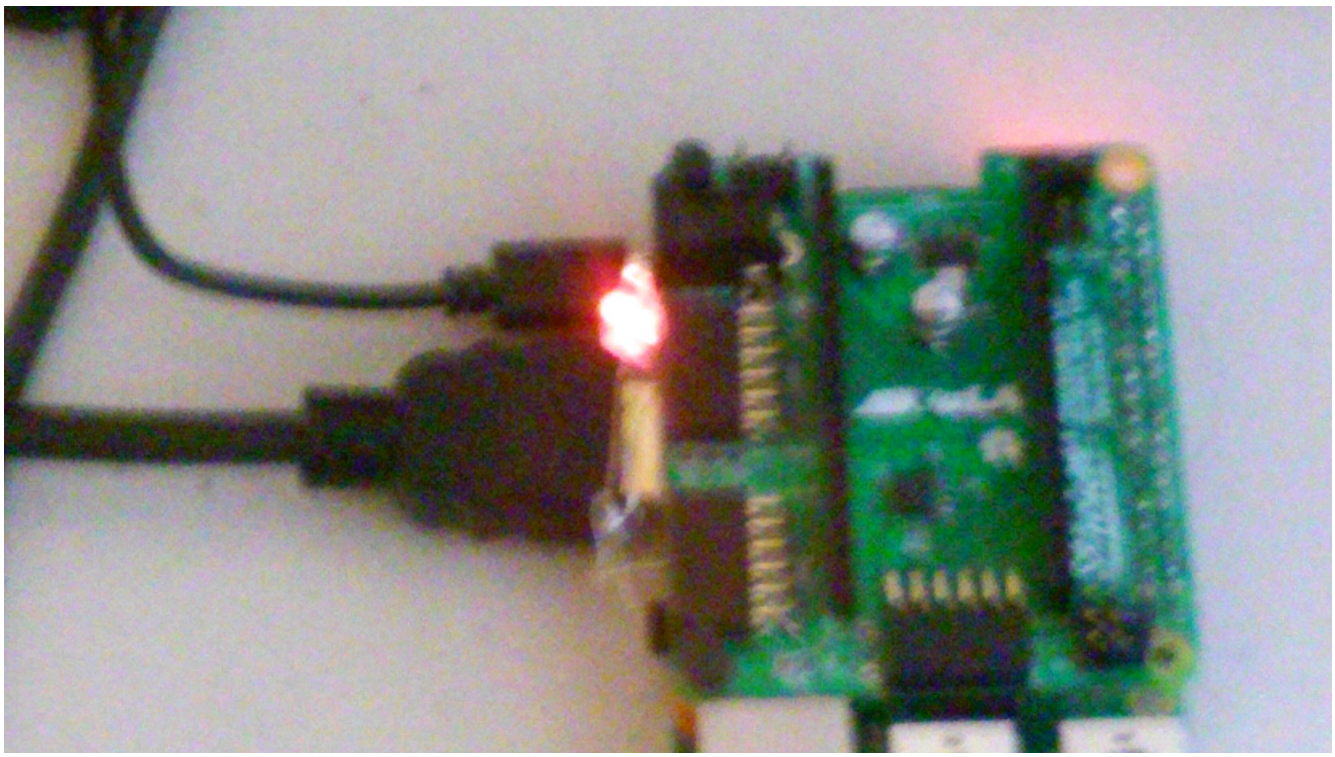
This is the output of python program when the led is on.

```
File  Edit  Tabs  Help
led on 38831 6
led on 38832 6
led on 38833 6
led on 38834 6
led on 38835 6
led on 38836 6
led on 38837 6
led on 38838 6
led on 38839 6
led on 38840 6
led on 38841 6
led on 38842 6
led on 38843 6
led on 38844 6
led on 38845 6
led on 38846 6
led on 38847 6
led on 38848 6
led on 38849 6
led on 38850 6
led on 38851 6
led on 38852 6
led on 38853 6
l
```

The image below is from the FpgasNowBook. The Raspberry Pi is connected to the resistor which is used to drive the LED.



This is picture of the led and resistor connected to StickIt!-MB.



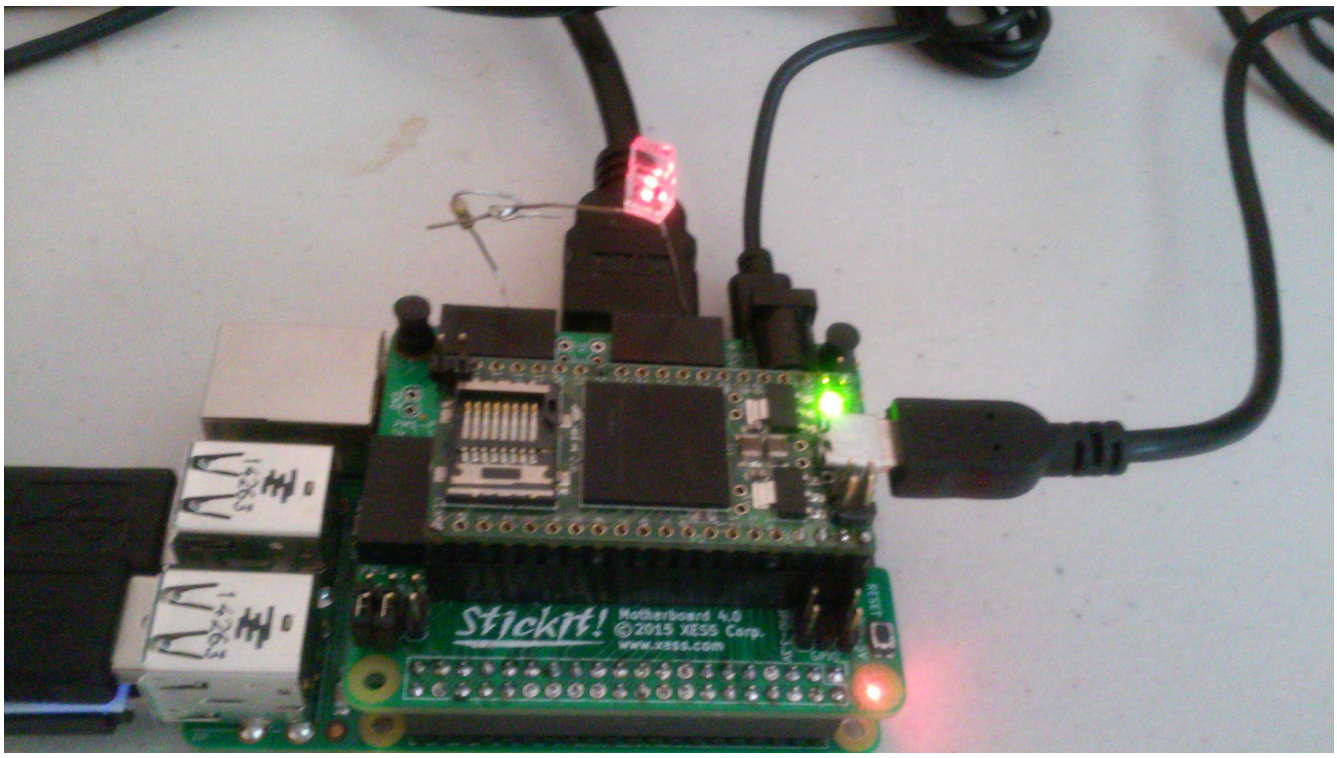
PMOD 3 is where the led is connect to Grd. The signal which toggles between True and False is on BCM 5 which corresponds to CHAN 22.

Now instead of the Raspberry Pi turning on the led the XulA2-LX9 is connected to c1 instead of t7 in the blinler program. This is done by changing the ucf file.

net clk_i loc=a9; # 12MHz input clock

net blinker_o loc=t7 | IOSTANDARD=LVTTL | DRIVE=24 | SLEW=SLOW ; # Blinker output to LED.

Note: In this mode the USB is powering the XulA2-LX9 the shunt was removed from the GPIO +5V

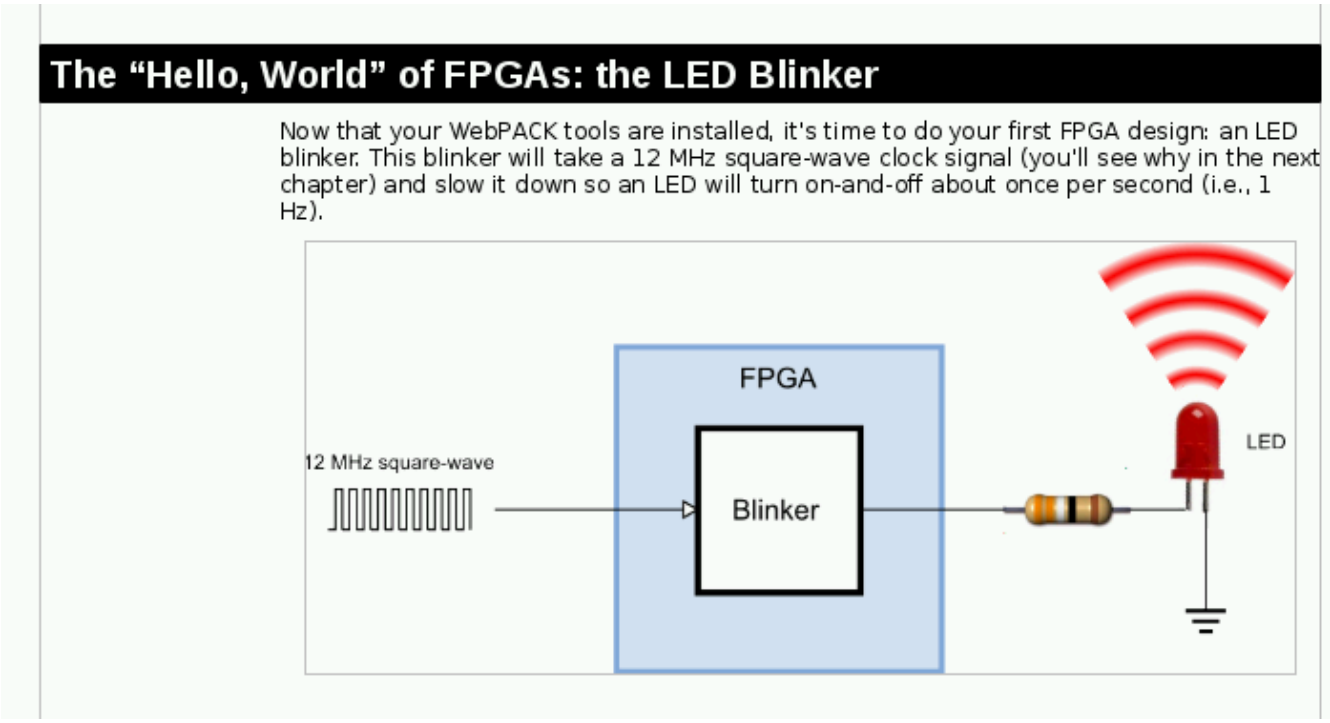


This is the test_in_gpio.py

This is the output of the test_in_gpio.py for several runs.

```
File  Edit  Tabs  Help
off
off
off
off
off
vidal@raspberrypi ~ $ sudo python test_in_gpio.py
off
off
off
off
off
vidal@raspberrypi ~ $ sudo python test_in_gpio.py
on
on
on
on
on
vidal@raspberrypi ~ $ sudo python test_in_gpio.py
off
off
off
off
off
vidal@raspberrypi ~ $
```

Using the XulA2 to drive a LED on the StickIt!-MB and an input bit to Raspberry Pi.



Prior to running the python program below ***“test_in_gpio.py “*** the FPGA needs to be programmed with the command ***“sudo python /usr/local/bin/xsload.py --usb 0 --fpga blinker_c1.bit” or . sudo python /usr/local/bin/xsload.py --usb 0 --fpga blinker_h1.bit”***

Success: Bitstream blinker.bit downloaded into XuLA2-LX9 !

Exception AttributeError: "'NoneType' object has no attribute 'copy'" in <bound method Device.__del__ of <usb.core.Device object at 0x7656ce50>> ignored

Exception AttributeError: "'NoneType' object has no attribute 'libusb_unref_device'" in <bound method _Device.__del__ of <usb.backend.libusb1._Device object at 0x7656ce30>> ignored

Note :The “test_in_gpio.py” only reads the input bit when the FPGA is programmed with ***“blinler_c1.bit”***

During this time the FPGA is being programmed. The green led on XulA2 will flash indicating the that the communications between the Raspberry Pi and the XulA2. This takes a very short time approximatlely 30 sec.

Details for generating the ***“blinker.bit”*** file using the Xilinx ISE WebPack from are found in the FpgasNowWhatBook section C.3 The “Hello World” of FPGAs: the LED Blinker

**********test_in_gpio.py**********

```
import RPi.GPIO as GPIO

import datetime

#help(GPIO)
```

```
#GPIO.setmode(GPIO.BOARD)

GPIO.setmode(GPIO.BCM)

GPIO.setup(17, GPIO.IN)

ctn_on = 0

ctn_off = 0

x = GPIO.input(17)

while(x != GPIO.input(17) ):


    ctn_off = 0


now0 = datetime.datetime.now()

print now0.microsecond

for i in range(100000):

    if(GPIO.input(17) ==1):

        ctn_on =  ctn_on + 1

    else:

        ctn_off = ctn_off + 1

now1 = datetime.datetime.now()

print now1.microsecond

print now1 - now0

print 'on ctn', ctn_on,'off ctn', ctn_off
```

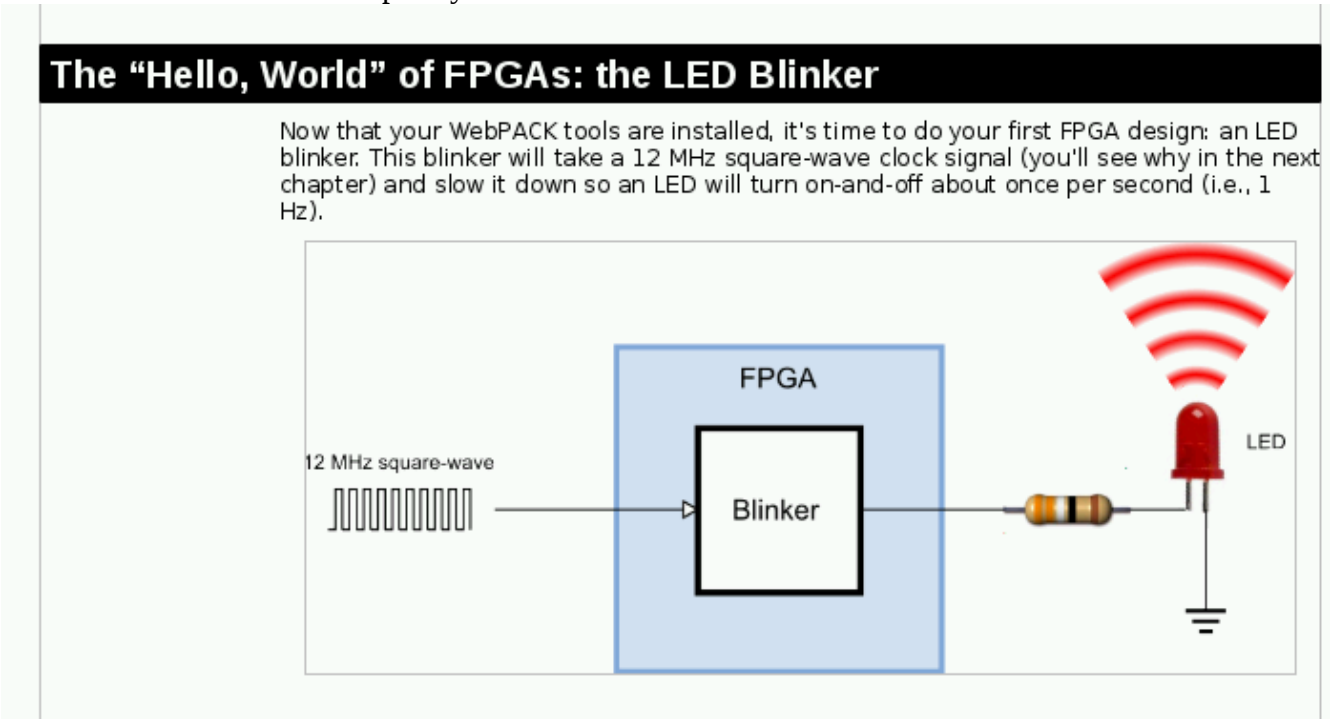
**********test_in_gpio.py**********

In the python code above BCM 17 is used as the input which is driven by CHAN 28 on PMOD 3 Now instead of the Raspberry Pi turning on the led the XulA2-LX9 is connected to c1 instead of t7 in the blinler program. This is done by changing the ucf file.

```
net clk_i       loc=a9; # 12MHz input clock

net blinker_o loc=t7 | IOSTANDARD=LVTTL | DRIVE=24 | SLEW=SLOW ;  # Blinker output to
```

LED.

Making modification to blinker program adds the a couple of new features.
Changing the speed of LED blink rate by increasing the clk from 12 Mhz to 100 Mhz.
Adding a method that accepts data in from USB and provides data to Raspberry Pi on the USB between the XulA2 and Raspberry Pi.



The red LED flashes at the faster rate ***"sudo python /usr/local/bin/xsload.py --usb 0 --fpga pc_fast_blinker_sub_h1.bit".***

The yellow LED flashes at the faster rate ***"sudo python /usr/local/bin/xsload.py --usb 0 --fpga pc_fast_blinker_sub_c1.bit".***

The command to send 2 values to the FPGA and get the result is ***"sudo python wkg/jpeg-2000-test/windows8_XulA2-LX9/pc_fast_blinker_sub/pc_subtractor_test.py"***

Random values are sent and the difference is returned to the Raspberr Pi over the USB.

```
#######################################################################

# This program tests the interface between the host PC and the FPGA

# on the XuLA board that has been programmed to act as a subtractor.

#######################################################################


104 -   8 =   96 ==> CORRECT!

 85 - 105 =  -20 ==> CORRECT!
```

53 - 76 = -23 ==> CORRECT!

92 - 71 = 21 ==> CORRECT!

37 - 118 = -81 ==> CORRECT!

77 - 125 = -48 ==> CORRECT!

49 - 77 = -28 ==> CORRECT!

100 - 22 = 78 ==> CORRECT!

59 - 83 = -24 ==> CORRECT!

126 - 89 = 37 ==> CORRECT!

115 - 20 = 95 ==> CORRECT!

11 - 17 = -6 ==> CORRECT!

41 - 65 = -24 ==> CORRECT!

98 - 109 = -11 ==> CORRECT!

126 - 96 = 30 ==> CORRECT!

28 - 59 = -31 ==> CORRECT!

7 - 63 = -56 ==> CORRECT!

120 - 101 = 19 ==> CORRECT!

54 - 12 = 42 ==> CORRECT!

104 - 105 = -1 ==> CORRECT!

104 - 9 = 95 ==> CORRECT!

125 - 104 = 21 ==> CORRECT!

112 - 60 = 52 ==> CORRECT!

62 - 34 = 28 ==> CORRECT!

62 - 90 = -28 ==> CORRECT!

116 - 121 = -5 ==> CORRECT!

87 - 89 = -2 ==> CORRECT!

77 - 113 = -36 ==> CORRECT!

22 - 111 = -89 ==> CORRECT!

53 - 61 =   -8 ==> CORRECT!

87 - 83 =   4 ==> CORRECT!

13 - 42 = -29 ==> CORRECT!

12 - 122 = -110 ==> CORRECT!

92 - 119 = -27 ==> CORRECT!

71 - 53 =   18 ==> CORRECT!

110 - 32 =   78 ==> CORRECT!

110 - 28 =   82 ==> CORRECT!

1 - 105 = -104 ==> CORRECT!

4 - 5 =   -1 ==> CORRECT!

123 - 45 =   78 ==> CORRECT!

110 - 64 =   46 ==> CORRECT!

49 - 127 = -78 ==> CORRECT!

23 - 0 =   23 ==> CORRECT!

40 - 60 = -20 ==> CORRECT!

6 - 2 =   4 ==> CORRECT!

70 - 84 = -14 ==> CORRECT!

110 - 75 =   35 ==> CORRECT!

41 - 77 = -36 ==> CORRECT!

5 - 57 = -52 ==> CORRECT!

103 - 56 =   47 ==> CORRECT!

22 - 92 = -70 ==> CORRECT!

44 - 66 = -22 ==> CORRECT!

21 - 21 =   0 ==> CORRECT!

89 - 41 =   48 ==> CORRECT!

122 - 46 = 76 ==> CORRECT!

62 - 99 = -37 ==> CORRECT!

104 - 114 = -10 ==> CORRECT!

122 - 127 = -5 ==> CORRECT!

11 - 46 = -35 ==> CORRECT!

41 - 93 = -52 ==> CORRECT!

72 - 103 = -31 ==> CORRECT!

103 - 6 = 97 ==> CORRECT!

111 - 122 = -11 ==> CORRECT!

16 - 41 = -25 ==> CORRECT!

86 - 116 = -30 ==> CORRECT!

112 - 5 = 107 ==> CORRECT!

33 - 41 = -8 ==> CORRECT!

116 - 43 = 73 ==> CORRECT!

95 - 119 = -24 ==> CORRECT!

101 - 124 = -23 ==> CORRECT!

118 - 4 = 114 ==> CORRECT!

20 - 7 = 13 ==> CORRECT!

99 - 14 = 85 ==> CORRECT!

3 - 6 = -3 ==> CORRECT!

101 - 10 = 91 ==> CORRECT!

35 - 74 = -39 ==> CORRECT!

79 - 3 = 76 ==> CORRECT!

88 - 78 = 10 ==> CORRECT!

8 - 45 = -37 ==> CORRECT!

3 - 96 = -93 ==> CORRECT!

43 - 50 = -7 ==> CORRECT!

22 - 27 = -5 ==> CORRECT!

65 - 88 = -23 ==> CORRECT!

40 - 67 = -27 ==> CORRECT!

38 - 25 = 13 ==> CORRECT!

121 - 101 = 20 ==> CORRECT!

112 - 107 = 5 ==> CORRECT!

80 - 70 = 10 ==> CORRECT!

106 - 49 = 57 ==> CORRECT!

22 - 0 = 22 ==> CORRECT!

111 - 126 = -15 ==> CORRECT!

22 - 90 = -68 ==> CORRECT!

26 - 55 = -29 ==> CORRECT!

117 - 104 = 13 ==> CORRECT!

126 - 58 = 68 ==> CORRECT!

55 - 118 = -63 ==> CORRECT!

14 - 114 = -100 ==> CORRECT!

121 - 53 = 68 ==> CORRECT!

59 - 8 = 51 ==> CORRECT!

29 - 26 = 3 ==> CORRECT!

Help on module RPi.GPIO in RPi:

NAME
RPi.GPIO - GPIO functionality of a Raspberry Pi using Python

FILE
/usr/local/lib/python2.7/dist-packages/RPi/GPIO.so

CLASSES
__builtin__.object
PWM

```
   class PWM(__builtin__.object)
    |  Pulse Width Modulation class
    |
    |  Methods defined here:
    |
    |  ChangeDutyCycle(...)
    |      Change the duty cycle
    |      dutycycle - between 0.0 and 100.0
    |
    |  ChangeFrequency(...)
    |      Change the frequency
    |      frequency - frequency in Hz (freq > 1.0)
    |
    |  __init__(...)
    |      x.__init__(...) initializes x; see help(type(x)) for signature
    |
    |  start(...)
    |      Start software PWM
    |      dutycycle - the duty cycle (0.0 to 100.0)
    |
    |  stop(...)
    |      Stop software PWM
    |
    |  ----------------------------------------------------------------------
    |  Data and other attributes defined here:
    |
    |  __new__ = <built-in method __new__ of type object>
    |      T.__new__(S, ...) -> a new object with type S, a subtype of T

FUNCTIONS
   add_event_callback(...)
      Add a callback for an event already defined using add_event_detect()
      channel      - either board pin number or BCM number depending on which mode is set.
      callback     - a callback function

   add_event_detect(...)
      Enable edge detection events for a particular GPIO channel.
      channel      - either board pin number or BCM number depending on which mode is set.
      edge         - RISING, FALLING or BOTH
      [callback]   - A callback function for the event (optional)
      [bouncetime] - Switch bounce timeout in ms for callback

   cleanup(...)
      Clean up by resetting all GPIO channels that have been used by this program to INPUT with
no pullup/pulldown and no event detection
      [channel] - individual channel or list/tuple of channels to clean up.  Default - clean every
channel that has been used.

   event_detected(...)
      Returns True if an edge has occured on a given GPIO.  You need to enable edge detection
using add_event_detect() first.
```

channel - either board pin number or BCM number depending on which mode is set.

getmode(...)
Get numbering mode used for channel numbers.
Returns BOARD, BCM or UNKNOWN

gpio_function(...)
Return the current GPIO function (IN, OUT, PWM, SERIAL, I2C, SPI)
channel - either board pin number or BCM number depending on which mode is set.

input(...)
Input from a GPIO channel. Returns HIGH=1=True or LOW=0=False
channel - either board pin number or BCM number depending on which mode is set.

output(...)
Output to a GPIO channel or list of channels
channel - either board pin number or BCM number depending on which mode is set.
value - 0/1 or False/True or LOW/HIGH

remove_event_detect(...)
Remove edge detection for a particular GPIO channel
channel - either board pin number or BCM number depending on which mode is set.

setmode(...)
Set up numbering mode to use for channels.
BOARD - Use Raspberry Pi board numbers
BCM - Use Broadcom GPIO 00..nn numbers

setup(...)
Set up a GPIO channel or list of channels with a direction and (optional) pull/up down control
channel - either board pin number or BCM number depending on which mode is set.
direction - IN or OUT
[pull_up_down] - PUD_OFF (default), PUD_UP or PUD_DOWN
[initial] - Initial value for an output channel

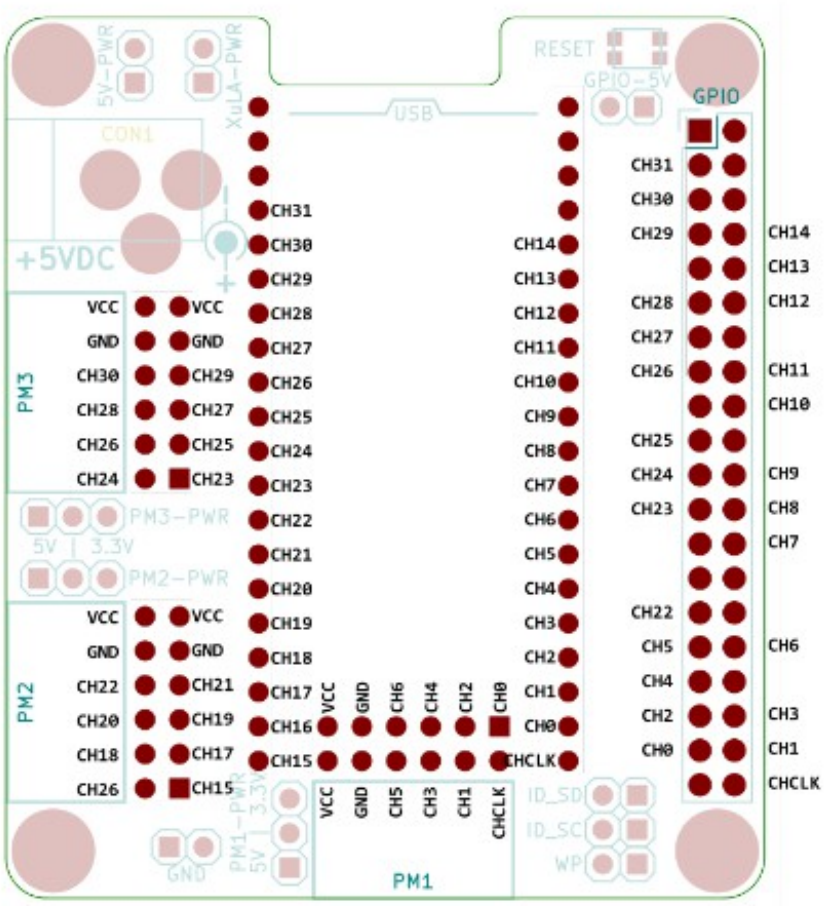
setwarnings(...)
Enable or disable warning messages

wait_for_edge(...)
Wait for an edge.
channel - either board pin number or BCM number depending on which mode is set.
edge - RISING, FALLING or BOTH
[bouncetime] - time allowed between calls to allow for switchbounce

DATA
BCM = 11
BOARD = 10
BOTH = 33
FALLING = 32
HARD_PWM = 43
HIGH = 1
I2C = 42

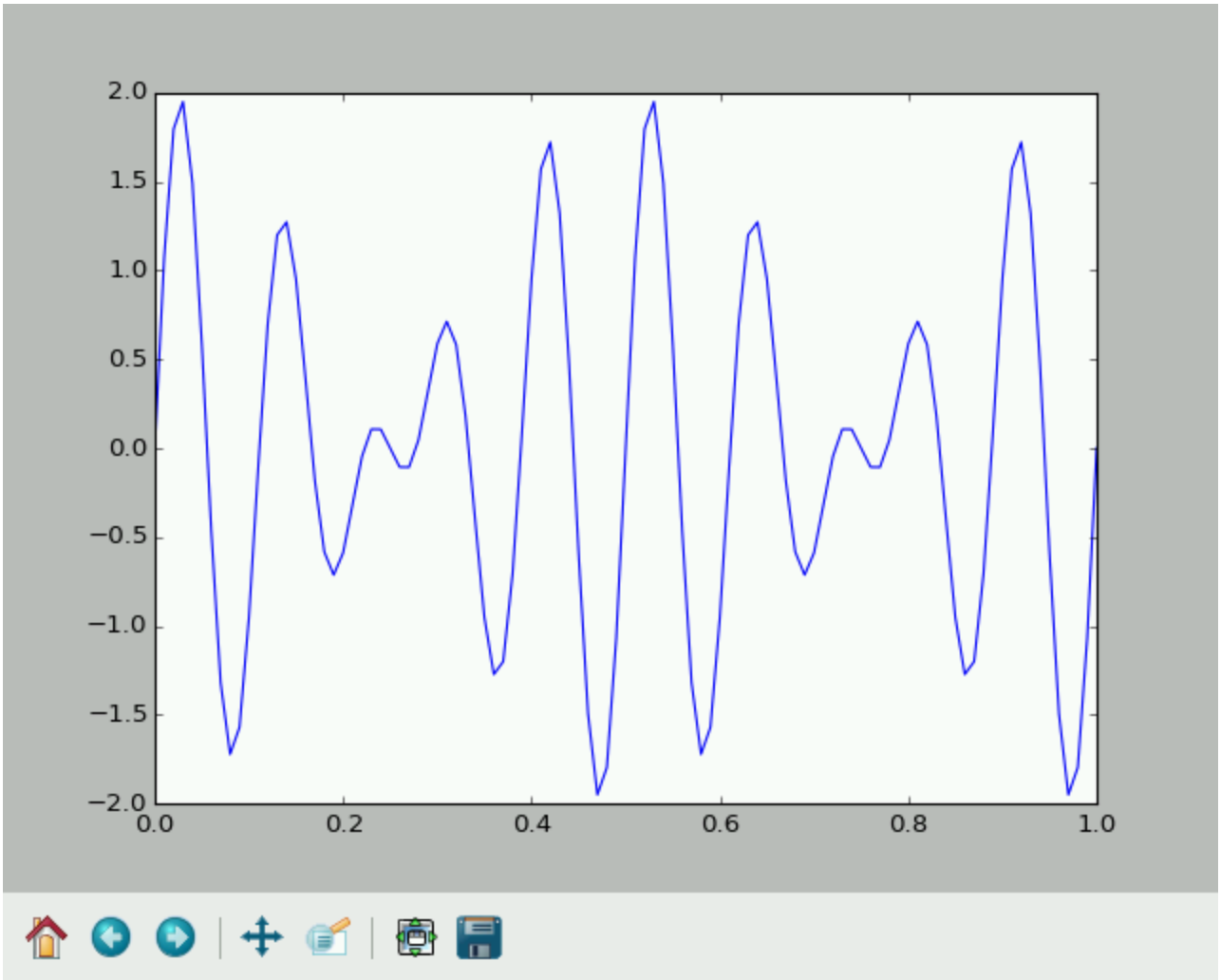
IN = 1
LOW = 0
OUT = 0
PUD_DOWN = 21
PUD_OFF = 20
PUD_UP = 22
RISING = 31
RPI_INFO = {'MANUFACTURER': 'Embest', 'P1_REVISION': 3, 'PROCESSOR': '...
RPI_REVISION = 3
SERIAL = 40
SPI = 41
UNKNOWN = -1
VERSION = '0.5.11'

The connections of the XuLA Board I/O channels to the PMOD and Raspberry Pi sockets of the StickIt! Board are shown below.

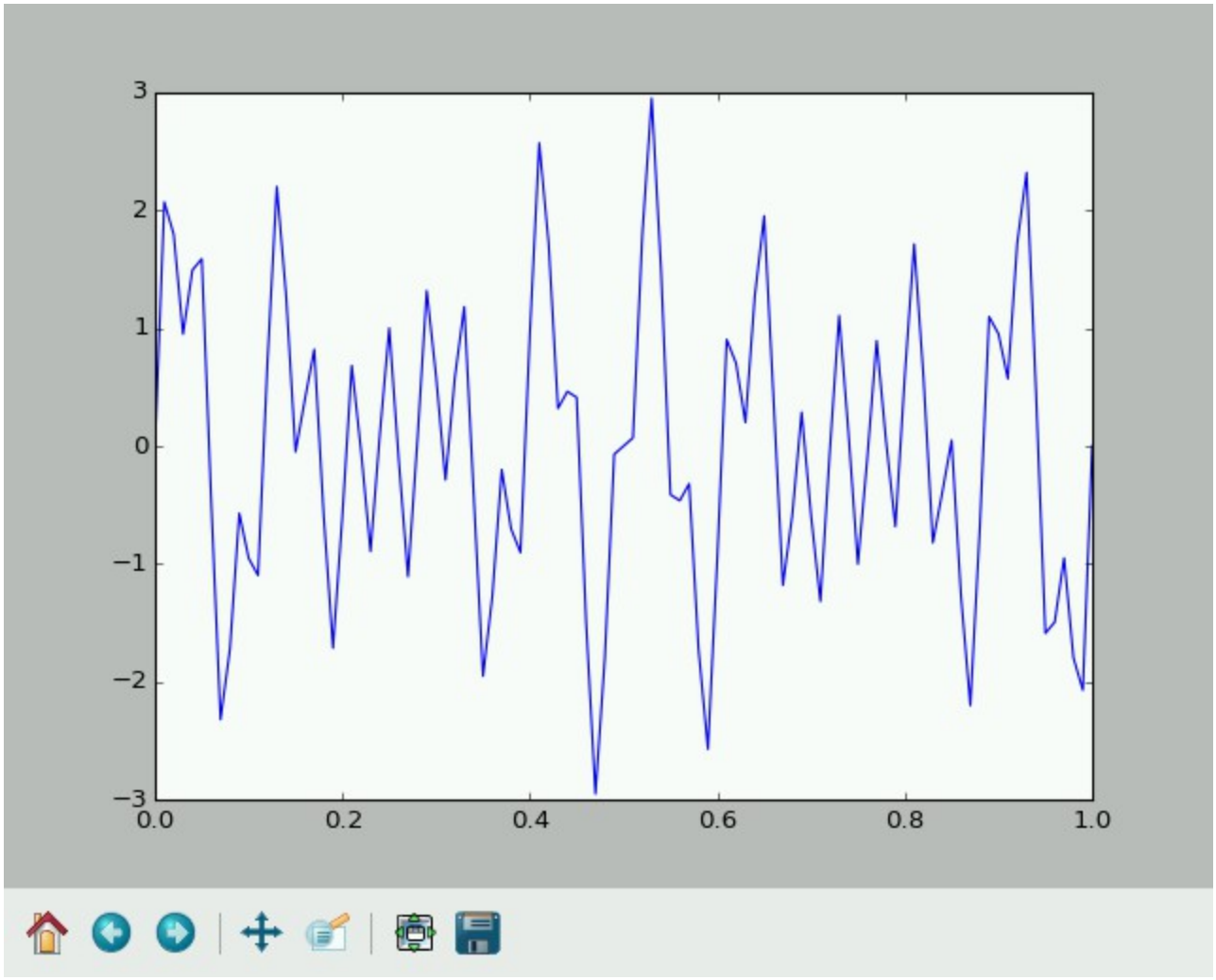


Appendix E SCIPY FFT example

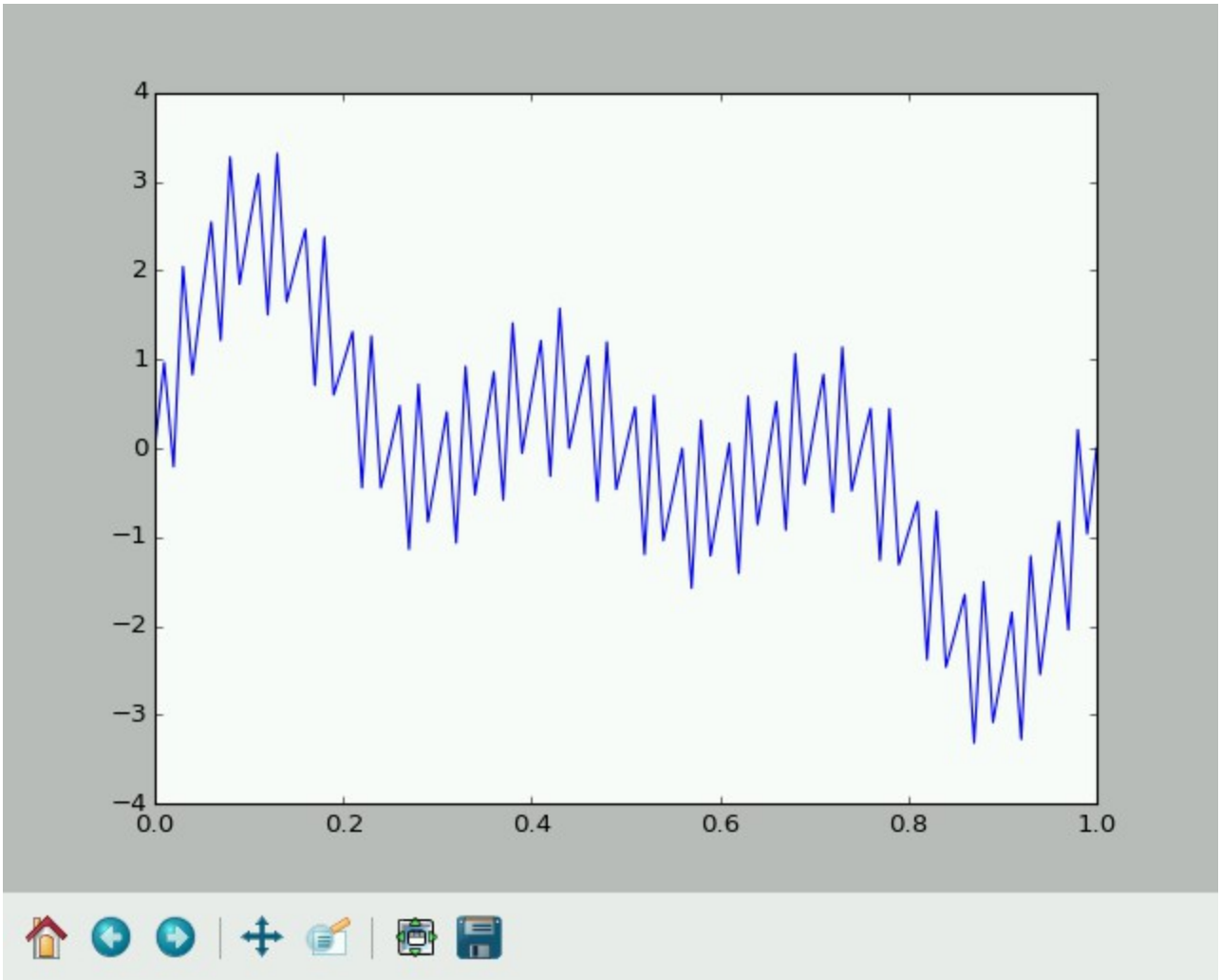
Generated a composite signal.



Gernerating nosie to add to the composite signal



Adding noise



[4.16665332e+01 +0.00000000e+00j 4.78746256e+01 +1.58838526e+00j

9.69714404e+01 +7.28295056e+00j -6.71824050e+01 -1.09342808e+01j

-7.56013069e+00 -6.54810284e+00j 3.26694709e+01 -1.22553568e+02j

1.64127120e+01 +1.20954638e+01j 5.88297915e+01 +2.26362616e+01j

-8.71149314e+01 -2.79856756e+01j -2.72397083e+01 -8.03800813e+00j

-1.90177218e+01 +7.42630071e-01j -1.14936935e+01 -4.74608560e+00j

-1.00957730e+01 -4.25302670e+00j -4.20388738e+00 -1.01579190e+00j

-5.19078437e+00 -1.72168814e+00j -6.25108707e+00 +2.87859871e-01j

-3.83820895e+00 -2.34416930e+00j -4.02098546e+00 -2.39625467e+00j

-1.67955719e+00 -2.11120462e-01j -2.60109865e+00 -1.03920595e+00j

-3.70451687e+00 -1.52032702e-01j -1.91360751e+00 -1.64632984e+00j

-2.16731155e+00 -1.71123105e+00j -1.04711440e+00 +1.17386984e-02j

-1.68696865e+00 -8.16014203e-01j -2.57480886e+00 -4.43906852e-01j

-1.09457693e+00 -1.26019685e+00j -1.32902571e+00 -1.30872798e+00j

-8.55316232e-01 +4.10344934e-02j -1.23778923e+00 -7.33889425e-01j

-1.89151967e+00 -6.32503070e-01j -6.86750762e-01 -9.96383788e-01j

-8.96255377e-01 -1.03648881e+00j -7.93750838e-01 -3.29293380e-02j

-9.64505583e-01 -7.07405531e-01j -1.40468923e+00 -7.39028454e-01j

-4.85079483e-01 -8.07686427e-01j -6.65747692e-01 -8.49511130e-01j

-7.55478856e-01 -1.69524873e-01j -7.70595288e-01 -6.99975455e-01j

-1.03048973e+00 -7.76699347e-01j -4.05591987e-01 -6.83821196e-01j

-5.46232197e-01 -7.30409365e-01j -6.93153175e-01 -3.41204605e-01j

-6.21004834e-01 -6.92603367e-01j -7.38855254e-01 -7.57292251e-01j

-4.03039651e-01 -6.27776653e-01j -4.86959743e-01 -6.70031917e-01j

-5.82960642e-01 -5.24290436e-01j -5.05883485e-01 -6.75884770e-01j

-5.20165168e-01 -6.93690493e-01j -4.45173120e-01 -6.48028069e-01j

-4.54902612e-01 -6.61009036e-01j -4.12941558e-01 -6.96047295e-01j

-4.27683457e-01 -6.47850047e-01j -3.72809249e-01 -6.00878907e-01j

-5.02649691e-01 -7.55377273e-01j -4.26330388e-01 -6.95254207e-01j

-1.78388654e-01 -8.33580501e-01j -3.95693036e-01 -6.13913425e-01j

-2.97784094e-01 -4.96342329e-01j -5.43899864e-01 -9.61744029e-01j

-3.83496269e-01 -7.63023780e-01j   1.20481822e-01 -9.13094624e-01j

-4.23515235e-01 -5.88122656e-01j -2.96196123e-01 -4.00394615e-01j

-5.31039390e-01 -1.28034731e+00j -3.13352799e-01 -8.52730851e-01j

 4.80285725e-01 -9.08618158e-01j -5.28202069e-01 -5.96096473e-01j

-3.68317253e-01 -3.36987129e-01j -4.14169612e-01 -1.72767623e+00j

-2.07102320e-01 -9.51183865e-01j   8.96555626e-01 -7.88969775e-01j

-7.31109721e-01 -6.81444064e-01j -5.13901634e-01 -3.36017352e-01j

-1.19917478e-01 -2.32892047e+00j -6.00593913e-02 -1.04408193e+00j

 1.36724603e+00 -5.10164360e-01j -1.06200556e+00 -9.20972698e-01j

-7.34330648e-01 -4.39775706e-01j   4.76547275e-01 -3.13199353e+00j

 1.28424978e-01 -1.11665785e+00j   1.90043922e+00 +5.14004036e-03j

-1.57197712e+00 -1.46596600e+00j -1.03923038e+00 -7.22159216e-01j

 1.63289472e+00 -4.24825011e+00j   3.55101700e-01 -1.15438146e+00j

 2.53669276e+00 +9.33306963e-01j -2.37804230e+00 -2.68004639e+00j

-1.46952255e+00 -1.35779485e+00j   4.04475204e+00 -6.00389933e+00j

 6.13082294e-01 -1.14364247e+00j   3.44279848e+00 +2.83531509e+00j

-3.87690990e+00 -5.79660345e+00j -2.21773280e+00 -2.99009466e+00j

 1.06796849e+01 -9.84619084e+00j   8.92233866e-01 -1.07233027e+00j

 5.70162913e+00 +9.08496497e+00j -9.09762580e+00 -2.01579064e+01j

-5.54425889e+00 -1.26265690e+01j   8.36468398e+01 -4.64115371e+01j

-4.54541172e+00 -1.85502848e+01j -1.15658239e+01 -4.45445313e+01j

 9.23069242e+00 +3.81429067e+01j   1.46195276e+00 +9.42057295e+00j

-2.54581635e+01 +6.90867691e+00j   1.46046750e+00 -7.09033838e-01j

 3.15562743e-01 -8.22497657e+00j   4.68916560e-01 +1.32305461e+01j

-5.27522248e-01 +3.62034592e+00j -1.30246553e+01 +2.82938145e-01j

 1.71800285e+00 -4.02036534e-01j   1.50380748e+00 -4.56756262e+00j

-1.62175935e+00 +8.99471785e+00j -1.08320937e+00 +2.03214829e+00j

-9.17285152e+00 -2.06818610e+00j   1.93463956e+00 -2.77097838e-03j

 1.95308250e+00 -2.93887810e+00j -3.00565376e+00 +7.08210766e+00j

-1.35001525e+00 +1.09727431e+00j -7.05687400e+00 -3.53172987e+00j

 2.09161510e+00 +4.97713883e-01j   2.13697942e+00 -1.89567807e+00j

-4.24563645e+00 +5.80472219e+00j -1.46766137e+00 +3.50758519e-01j

-5.53551246e+00 -4.69731871e+00j 2.16802230e+00 +1.11696107e+00j

2.16802230e+00 -1.11696107e+00j -5.53551246e+00 +4.69731871e+00j

-1.46766137e+00 -3.50758519e-01j -4.24563645e+00 -5.80472219e+00j

2.13697942e+00 +1.89567807e+00j 2.09161510e+00 -4.97713883e-01j

-7.05687400e+00 +3.53172987e+00j -1.35001525e+00 -1.09727431e+00j

-3.00565376e+00 -7.08210766e+00j 1.95308250e+00 +2.93887810e+00j

1.93463956e+00 +2.77097838e-03j -9.17285152e+00 +2.06818610e+00j

-1.08320937e+00 -2.03214829e+00j -1.62175935e+00 -8.99471785e+00j

1.50380748e+00 +4.56756262e+00j 1.71800285e+00 +4.02036534e-01j

-1.30246553e+01 -2.82938145e-01j -5.27522248e-01 -3.62034592e+00j

4.68916560e-01 -1.32305461e+01j 3.15562743e-01 +8.22497657e+00j

1.46046750e+00 +7.09033838e-01j -2.54581635e+01 -6.90867691e+00j

1.46195276e+00 -9.42057295e+00j 9.23069242e+00 -3.81429067e+01j

-1.15658239e+01 +4.45445313e+01j -4.54541172e+00 +1.85502848e+01j

8.36468398e+01 +4.64115371e+01j -5.54425889e+00 +1.26265690e+01j

-9.09762580e+00 +2.01579064e+01j 5.70162913e+00 -9.08496497e+00j

8.92233866e-01 +1.07233027e+00j 1.06796849e+01 +9.84619084e+00j

-2.21773280e+00 +2.99009466e+00j -3.87690990e+00 +5.79660345e+00j

3.44279848e+00 -2.83531509e+00j 6.13082294e-01 +1.14364247e+00j

4.04475204e+00 +6.00389933e+00j -1.46952255e+00 +1.35779485e+00j

-2.37804230e+00 +2.68004639e+00j 2.53669276e+00 -9.33306963e-01j

3.55101700e-01 +1.15438146e+00j 1.63289472e+00 +4.24825011e+00j

-1.03923038e+00 +7.22159216e-01j -1.57197712e+00 +1.46596600e+00j

1.90043922e+00 -5.14004036e-03j 1.28424978e-01 +1.11665785e+00j

4.76547275e-01 +3.13199353e+00j -7.34330648e-01 +4.39775706e-01j

-1.06200556e+00 +9.20972698e-01j 1.36724603e+00 +5.10164360e-01j

-6.00593913e-02 +1.04408193e+00j -1.19917478e-01 +2.32892047e+00j

-5.13901634e-01 +3.36017352e-01j -7.31109721e-01 +6.81444064e-01j

 8.96555626e-01 +7.88969775e-01j -2.07102320e-01 +9.51183865e-01j

-4.14169612e-01 +1.72767623e+00j -3.68317253e-01 +3.36987129e-01j

-5.28202069e-01 +5.96096473e-01j   4.80285725e-01 +9.08618158e-01j

-3.13352799e-01 +8.52730851e-01j -5.31039390e-01 +1.28034731e+00j

-2.96196123e-01 +4.00394615e-01j -4.23515235e-01 +5.88122656e-01j

 1.20481822e-01 +9.13094624e-01j -3.83496269e-01 +7.63023780e-01j

-5.43899864e-01 +9.61744029e-01j -2.97784094e-01 +4.96342329e-01j

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-3.72809249e-01 +6.00878907e-01j -4.27683457e-01 +6.47850047e-01j

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-4.45173120e-01 +6.48028069e-01j -5.20165168e-01 +6.93690493e-01j

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-4.86959743e-01 +6.70031917e-01j -4.03039651e-01 +6.27776653e-01j

-7.38855254e-01 +7.57292251e-01j -6.21004834e-01 +6.92603367e-01j

-6.93153175e-01 +3.41204605e-01j -5.46232197e-01 +7.30409365e-01j

-4.05591987e-01 +6.83821196e-01j -1.03048973e+00 +7.76699347e-01j

-7.70595288e-01 +6.99975455e-01j -7.55478856e-01 +1.69524873e-01j

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-1.23778923e+00 +7.33889425e-01j -8.55316232e-01 -4.10344934e-02j

-1.32902571e+00 +1.30872798e+00j -1.09457693e+00 +1.26019685e+00j

-2.57480886e+00 +4.43906852e-01j -1.68696865e+00 +8.16014203e-01j

-1.04711440e+00 -1.17386984e-02j -2.16731155e+00 +1.71123105e+00j

-1.91360751e+00 +1.64632984e+00j -3.70451687e+00 +1.52032702e-01j

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-4.02098546e+00 +2.39625467e+00j -3.83820895e+00 +2.34416930e+00j

-6.25108707e+00 -2.87859871e-01j -5.19078437e+00 +1.72168814e+00j

-4.20388738e+00 +1.01579190e+00j -1.00957730e+01 +4.25302670e+00j

-1.14936935e+01 +4.74608560e+00j -1.90177218e+01 -7.42630071e-01j

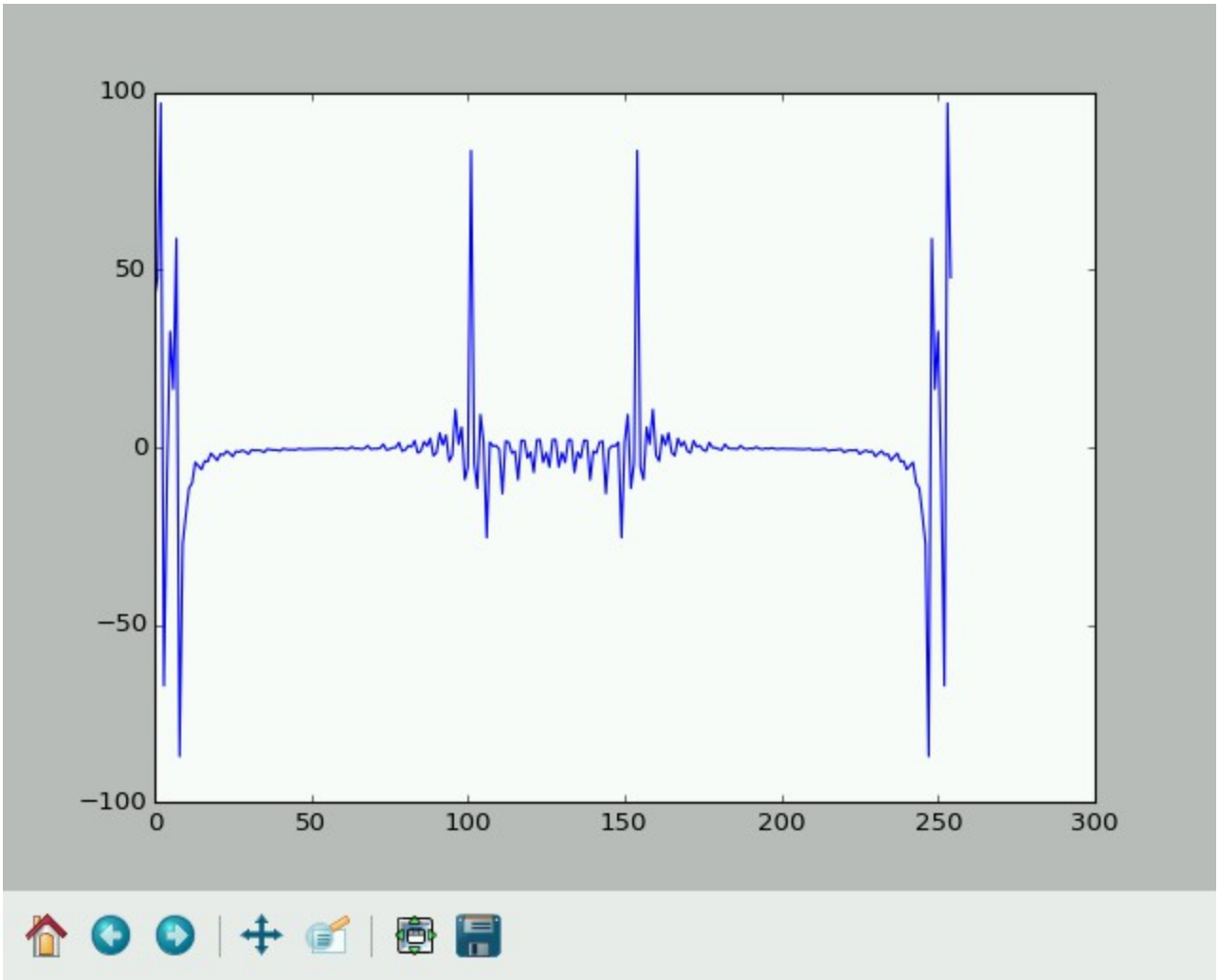
-2.72397083e+01 +8.03800813e+00j -8.71149314e+01 +2.79856756e+01j

 5.88297915e+01 -2.26362616e+01j   1.64127120e+01 -1.20954638e+01j

 3.26694709e+01 +1.22553568e+02j -7.56013069e+00 +6.54810284e+00j

-6.71824050e+01 +1.09342808e+01j   9.69714404e+01 -7.28295056e+00j

 4.78746256e+01 -1.58838526e+00j]



Appendix A code that produce the above plots

```
import sys, os
import pylab as plt
import math
import sin_f
t = [];
y = [];

y_sum = [];
y1 = sin_f.sin_f(1)
y2 = sin_f.sin_f(2)
y3 = sin_f.sin_f(3)
y4 = sin_f.sin_f(40)
y5 = sin_f.sin_f(5)

t = y4[0]
y1 = y1[1]
y2 = y2[1]
y3 = y3[1]
y4 = y4[1]
y5 = y5[1]
```

```
#adds the freq 1hz, 2hz, 3hz, and 4hz to create a composite signal
for i in range(len(t)):
  yy = (y1[i] + y2[i] + y3[i] + y4[i])
  y_sum.append(yy)
y = y_sum
plt.plot(t,y)
plt.show()
y = y + y + y
y = y[0:255]
print len(y)
#print y
import numpy as np
from scipy.fftpack import fft
#N = 600
#T = 1.0 / 800.0
#x = np.linspace(0.0, N*T, N)
#y = np.sin(50.0 * 2.0*np.pi*x) + 0.5*np.sin(80.0 * 2.0*np.pi*x)
yf = fft(y)
print yf
plt.plot(yf)
plt.show()
#xf = np.linspace(0.0, 1.0/(2.0*T), N/2)
import matplotlib.pyplot as plt
#plt.plot(xf, 2.0/N * np.abs(yf[0:N/2]))
#plt.grid()
#plt.show()
```

Appendix B

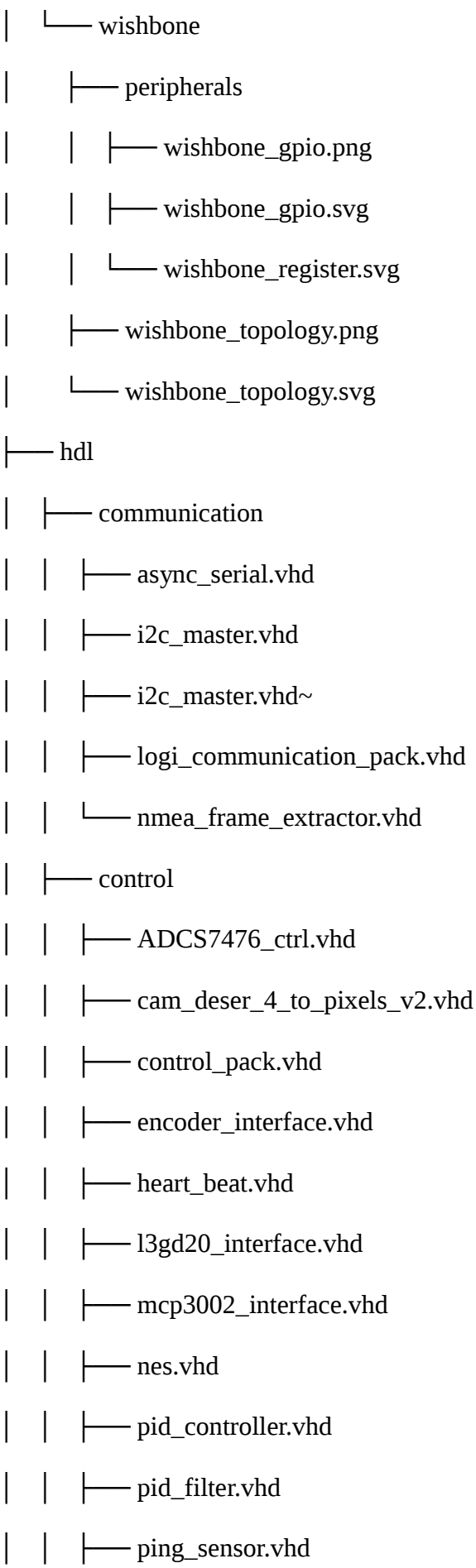
```
import sys, os
import pylab as plt
import math

t = [];
y = [];

freq = [4]
def list_adder(a1, a2):
        a = [];
        #Complete the listAdder function here.
        if len(a1) != len(a2):
          print ("Those lists cannot be added")
        elif len(a1) == len(a2):
                #print [i+j for i,j in zip(a1, a2)]
           a = [i+j for i,j in zip(a1, a2)]
           return a


def sin_f(f):
        t = [];
        y = [];
        for i in range(101):
```

```
            r1 = i/100.0
            t.append(r1)

            y1 = math.sin((f*2)*math.pi*t[i])

            y.append(y1)
          return t,y

def sin_sum(freq):
          y_sum = [];
       y = [];
       yy = [];
          t = [];
          f = freq[0]
       t, y = sin_f(f)
       #print t
       #print y
       if len(freq) == 1 :
             print 'freq = 1'
          elif  len(freq) == 2:
             f = freq[1]
             t,yy = sin_f(f)
             y = list_adder(y,yy)
       else :
             f = freq[1]
             t,yy = sin_f(f)
             y = list_adder(y,yy)
             yy = [];
             y_sum = y
             f = freq[2]
             t,yy = sin_f(f)
             y = list_adder(y,yy)
                print 'freq > 2 '
       return t, y

def test_sinf():
          f = 1
          t,y = sin_f(f)
          plt.plot(t,y)
          plt.show()
#test_sinf()
#freq = [8]
#t, y = sin_sum(freq)
#plt.plot(t,y)
#plt.show()
#freq = [10]
#t, y = sin_sum(freq)
#plt.plot(t,y)
#plt.show()
#freq = [25]
#t, y = sin_sum(freq)
#plt.plot(t,y)
```

```
#plt.show()

freq = [8,10];
t, y = sin_sum(freq);
plt.plot(t,y)
plt.show()
freq = [8,10,25]
t, y = sin_sum(freq)
plt.plot(t,y)
plt.show()
```

Appendix F. tree of files in fpga-logi/logi-hard repository

```
logi-hard/
├── build_lib
│   └── synth
│       ├── xilinx.mk
│       └── xilinx.opt
├── COPYING.LESSER
├── doc
│   ├── control
│   │   ├── encoder.png
│   │   ├── encoder.svg
│   │   ├── pwm_ctrl.svg
│   │   ├── quadrature_disk.png
│   │   ├── quadrature_disk.svg
│   │   ├── quadrature_signal_backward.png
│   │   ├── quadrature_signal_backward.svg
│   │   ├── quadrature_signal_forward.png
│   │   ├── quadrature_signal_forward.svg
│   │   ├── quadrature_signal_stalled.png
│   │   ├── quadrature_signal_stalled.svg
│   │   └── quadrature_signal.svg
```


└── wishbone
├── peripherals
│ ├── wishbone_gpio.png
│ ├── wishbone_gpio.svg
│ └── wishbone_register.svg
├── wishbone_topology.png
└── wishbone_topology.svg
├── hdl
├── communication
│ ├── async_serial.vhd
│ ├── i2c_master.vhd
│ ├── i2c_master.vhd~
│ ├── logi_communication_pack.vhd
│ └── nmea_frame_extractor.vhd
├── control
│ ├── ADCS7476_ctrl.vhd
│ ├── cam_deser_4_to_pixels_v2.vhd
│ ├── control_pack.vhd
│ ├── encoder_interface.vhd
│ ├── heart_beat.vhd
│ ├── l3gd20_interface.vhd
│ ├── mcp3002_interface.vhd
│ ├── nes.vhd
│ ├── pid_controller.vhd
│ ├── pid_filter.vhd
│ ├── ping_sensor.vhd

```
│   │   ├── pwm.vhd
│   │   ├── rgb_32_32_matrix_ctrl.vhd
│   │   ├── servo_controller.vhd
│   │   └── sseg_4x.vhd
│   ├── interface
│   │   └── SDRAM_Controller.vhd
│   ├── primitive
│   │   ├── dpram_NxN.vhd
│   │   ├── logi_primitive_pack.vhd
│   │   ├── MAC16.vhd
│   │   └── tdp_bram.vhd
│   ├── utils
│   │   ├── dp_fifo.vhd
│   │   ├── dram_fifo.vhd
│   │   ├── edge_triggered_latch.vhd
│   │   ├── generic_delay.vhd
│   │   ├── generic_latch.vhd
│   │   ├── generic_rs_latch.vhd
│   │   ├── hold.vhd
│   │   ├── led8_sseg.vhd
│   │   ├── logi_utils_pack.vhd
│   │   ├── simple_counter.vhd
│   │   ├── small_fifo.vhd
│   │   ├── small_stack.vhd
│   │   └── up_down_counter.vhd
│   ├── virtual_instrument
```

```
│   │   ├── logi_virtual_7seg.vhd
│   │   ├── logi_virtual_components_pack.vhd
│   │   ├── logi_virtual_led.vhd
│   │   ├── logi_virtual_pb.vhd
│   │   ├── logi_virtual_sw.vhd
│   │   └── virtual_top_level.vhd
│   └── wishbone
│       ├── gpmc_wishbone_wrapper.vhd
│       ├── logi_wishbone_pack.vhd
│       ├── peripherals
│       │   ├── logi_wishbone_peripherals_pack.vhd
│       │   ├── peripheral_template.vhd
│       │   ├── wishbone_7seg4x.vhd
│       │   ├── wishbone_double_buffer.vhd
│       │   ├── wishbone_dram_fifo.vhd
│       │   ├── wishbone_fifo_dev.vhd
│       │   ├── wishbone_fifo.vhd
│       │   ├── wishbone_gpio.vhd
│       │   ├── wishbone_gps.vhd
│       │   ├── wishbone_i2c_master.vhd
│       │   ├── wishbone_interrupt_manager.vhd
│       │   ├── wishbone_led_matrix_ctrl.vhd
│       │   ├── wishbone_max7219.vhd
│       │   ├── wishbone_mem.vhd
│       │   ├── wishbone_mp_sdram_controller.vhd
│       │   ├── wishbone_nes.vhd
```

```
│   │   ├── wishbone_ping.vhd
│   │   ├── wishbone_pmic.vhd
│   │   ├── wishbone_pwm.vhd
│   │   ├── wishbone_register.vhd
│   │   ├── wishbone_servo.vhd
│   │   ├── wishbone_shared_mem.vhd
│   │   ├── wishbone_to_xil_fifo.vhd
│   │   ├── wishbone_uart.vhd
│   │   └── wishbone_watchdog.vhd
│   ├── spi_wishbone_wrapper.vhd
│   └── wishbone_intercon.vhd
├── master_ucf
│   ├── logi-bone
│   │   ├── beta
│   │   │   ├── logibone_ra2_0.ucf
│   │   │   ├── logibone_ra2_1.ucf
│   │   │   ├── logibone_ra2_2.ucf
│   │   │   └── logibone_ra3.ucf
│   │   ├── logibone_r1_0.ucf
│   │   └── logibone_r1_5.ucf
│   └── logi_pi
│       ├── beta
│       │   ├── logipi_ra1.ucf
│       │   ├── logipi_ra2_edu.ucf
│       │   ├── logipi_ra2.ucf
│       │   ├── logipi_ra3_edu.ucf
```

```
│       │   └── logipi_ra3.ucf
│       ├── logipi_r1_0_edu.ucf
│       ├── logipi_r1_0.ucf
│       ├── logipi_r1_1_edu.ucf
│       └── logipi_r1_5.ucf
├── README.md
└── test_bench
    ├── ADCS7446_ctrl_tb.vhd
    ├── async_serial_tb.vhd
    ├── cam_deser_4_to_pixels_tb.vhd
    ├── coregen.log
    ├── dram_fifo_tb.vhd
    ├── encoder_interface_tb.vhd
    ├── heart_beat_tb.vhd
    ├── logibone_wishbone_tb.vhd
    ├── max7219_tb.vhd
    ├── mcp_3002_tb.vhd
    ├── mcp3002_tb.vhd
    ├── pid_controller_tb.vhd
    ├── servo_controller_tb.vhd
    ├── spi2ad_testbench.vhd
    ├── spi_wishbone_wrapper_tb.vhd
    ├── sseg_tb.vhd
    ├── tmp
    │   └── _cg
    │       └── _dbg
```

24 directories, 129 files