```
sudo su
cd /etc
cp hostname hostname.orig
diff hostname hostname.orig
1c1
< pi4-37
> raspberrypi
cp dphys-swapfile dphys-swapfile.orig
diff dphys-swapfile dphys-swapfile.orig
16c16
< CONF_SWAPSIZE=1000
> CONF_SWAPSIZE=100
fetch pkg installers
scp -r pi4-27:~/xx/my-projects-docs/pkg*.
dpkg -l | sort > pkgs.txt
cp pkg-install-scripts/ex*.
adds first set of packages
./extra_pkgs_64bit.sh
dpkg -l | sort > pkgs-a.txt
cp pkg-install-scripts/tensorflow/ex*.
adds 2nd set of packages
./extra-1.sh
dpkg -l | sort > pkgs-b.txt
./extra-2.sh
dpkg -l | sort > pkgs-c.txt
./extra-3.sh
dpkg -l | sort > pkgs-d.txt
./extra-4.sh
dpkg -l | sort > pkgs-e.txt
```

All the documents and images used to document were done with the software on the Rpi

This is the software to program the picos with SWD

installed-openocd082722-228ede-64bit.img openocd082722-228ede-64bit.img

Bare Metal for Raspbery Pi

ultibo2.5.123-082722-64bit.img sudo unsquashfs -d ultibo ultibo2.5.123-082722-64bit.img

qemu-6.2.0-rpios-64bit.img sudo unsquashfs -d qemu-6.2.0-rpios qemu-6.2.0-rpios-64bit.img git clone https://github.com/develone/Ultibo\_Projects.git cd Ultibo\_Projects/jpeg2000/src/ ./compile\_ultibo.sh cd ../QEMU/ ./libbuild.sh

vi ~/.local/share/applications/ultibo.desktop

[Desktop Entry]

Name=Lazarus IDE (Ultibo Edition)

Comment=A free pascal platform for bare metal development

Exec=/home/devel/ultibo/core/lazarus.sh

Icon=/home/devel/ultibo/core/images/icons/lazarus.ico

Terminal=false

Type=Application

Categories=Development;IDE;

X-Desktop-File-Install-Version=0.26

scrot -d 3 -s qemujpeg.png

scrot -d 3 -s qemujpeg-1.png

. ~/Ultibo\_Projects/picoultibo.sh

/home/devel/ultibo/core:/home/devel/qemu-6.2.0-rpios/bin:/home/devel/local/openocd/bin:/home/devel/picotool/build/:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/usr/local/games:/usr/games

./startqemu.sh

This is what is used to program pico's with SWD.

cd ~/

mkdir local

sudo unsquashfs -d local/openocd/ installed-openocd082722-228ede-64bit.img

Parallel unsquashfs: Using 4 processors

800 inodes (950 blocks) to write

created 800 files created 33 directories created 0 symlinks created 0 devices created 0 fifos

which openocd

/home/devel/local/openocd/bin/openocd

openocd -V

Open On-Chip Debugger 0.11.0-g228ede4-dirty (2022-08-27-19:45)

Licensed under GNU GPL v2

For bug reports, read

http://openocd.org/doc/doxygen/bugs.html

openocd: invalid option -- 'V'

curl https://pyenv.run | bash

% Total % Received % Xferd Average Speed Time Time Current

Dload Upload Total Spent Left Speed

100 270 100 270 0 0 704 0 --:--:- 703

Cloning into '/home/devel/.pyenv'...

remote: Enumerating objects: 1007, done.

remote: Counting objects: 100% (1007/1007), done. remote: Compressing objects: 100% (436/436), done.

remote: Total 1007 (delta 581), reused 707 (delta 442), pack-reused 0 Receiving objects: 100% (1007/1007), 495.52 KiB | 3.02 MiB/s, done.

Resolving deltas: 100% (581/581), done.

Cloning into '/home/devel/.pyenv/plugins/pyenv-doctor'...

remote: Enumerating objects: 11, done.

remote: Counting objects: 100% (11/11), done. remote: Compressing objects: 100% (9/9), done.

remote: Total 11 (delta 1), reused 5 (delta 0), pack-reused 0

Receiving objects: 100% (11/11), 38.72 KiB | 777.00 KiB/s, done.

Resolving deltas: 100% (1/1), done.

Cloning into '/home/devel/.pyenv/plugins/pyenv-installer'...

remote: Enumerating objects: 16, done.

remote: Counting objects: 100% (16/16), done.

remote: Compressing objects: 100% (13/13), done.

remote: Total 16 (delta 1), reused 7 (delta 0), pack-reused 0 Receiving objects: 100% (16/16), 5.88 KiB | 2.94 MiB/s, done.

Resolving deltas: 100% (1/1), done.

Cloning into '/home/devel/.pyenv/plugins/pyenv-update'...

remote: Enumerating objects: 10, done.

remote: Counting objects: 100% (10/10), done. remote: Compressing objects: 100% (6/6), done.

remote: Total 10 (delta 1), reused 6 (delta 0), pack-reused 0

Receiving objects: 100% (10/10), done. Resolving deltas: 100% (1/1), done.

Cloning into '/home/devel/.pyenv/plugins/pyenv-virtualenv'...

remote: Enumerating objects: 63, done.

remote: Counting objects: 100% (63/63), done. remote: Compressing objects: 100% (55/55), done.

remote: Total 63 (delta 11), reused 28 (delta 1), pack-reused 0 Receiving objects: 100% (63/63), 38.44 KiB | 2.75 MiB/s, done.

Resolving deltas: 100% (11/11), done.

Cloning into '/home/devel/.pvenv/plugins/pvenv-which-ext'...

remote: Enumerating objects: 10, done.

remote: Counting objects: 100% (10/10), done.

```
remote: Compressing objects: 100% (6/6), done.
remote: Total 10 (delta 1), reused 6 (delta 0), pack-reused 0
Receiving objects: 100% (10/10), done.
Resolving deltas: 100% (1/1), done.
WARNING: seems you still have not added 'pyenv' to the load path.
# Load pyenv automatically by appending
# the following to
~/.bash_profile if it exists, otherwise ~/.profile (for login shells)
and ~/.bashrc (for interactive shells):
export PYENV_ROOT="$HOME/.pyenv"
command -v pyenv >/dev/null || export PATH="$PYENV ROOT/bin:$PATH"
eval "$(pyenv init -)"
# Restart your shell for the changes to take effect.
# Load pyeny-virtualeny automatically by adding
# the following to ~/.bashrc:
eval "$(pyenv virtualenv-init -)"
These steps save a lot of time installing a lot of python code.
tensorflow
test-1-2.8.img
sudo unsquashfs -d test-1-2.8 test-1-2.8.img
This setup virtual enviornment
cd test-1-28
devel@pi4-37:~/test-1-2.8 $ python3 -m venv env
devel@pi4-37:~/test-1-2.8 $ source env/bin/activate
(env) devel@pi4-37:~/test-1-2.8 $
devel@pi4-37:~/test-1-2.8 $ ipython3 Copy_of_train_hello_world_model.ipynb
 0x01, 0x00, 0x00, 0x00, 0x1f, 0x00, 0x00, 0x00, 0x73, 0x65, 0x72, 0x76.
 0x69, 0x6e, 0x67, 0x5f, 0x64, 0x65, 0x66, 0x61, 0x75, 0x6c, 0x74, 0x5f,
 0x64, 0x65, 0x6e, 0x73, 0x65, 0x5f, 0x32, 0x5f, 0x69, 0x6e, 0x70, 0x75,
 0x74, 0x3a, 0x30, 0x00, 0x02, 0x00, 0x00, 0x00, 0x01, 0x00, 0x00, 0x00,
 0x01, 0x00, 0x00, 0x00, 0x0c, 0x0c, 0x0c, 0x0c, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x04, 0x00, 0x08, 0x00, 0x0c, 0x00, 0x00, 0x00, 0x14, 0x00, 0x00, 0x00,
 0x04, 0x00, 0x00, 0x00, 0x01, 0x00, 0x00, 0x00, 0x80, 0xff, 0xff, 0xff,
 0xff, 0xff, 0xff, 0xff, 0x01, 0x00, 0x00, 0x00, 0x5d, 0x4f, 0xc9, 0x3c,
 0x04, 0x00, 0x04, 0x00, 0x04, 0x00, 0x00, 0x00
};
unsigned int g_model_len = 2408;
(env) devel@pi4-37:~/test-1-2.8 $ exec $SHELL
tensorflow lite
sudo unsquashfs -d project-rpi-tflite project-rpi-tflite102222.img
```

add to the end of ~/.bashrc

export PICO\_SDK\_PATH=/home/devel/sdk/pico-sdk export PATH="\$HOME/.pyenv/bin:\$PATH" eval "\$(pyenv init --path)" eval "\$(pyenv virtualenv-init -)"

mkdir sdk

cd sdk

This is when the repo is yours. git clone git@github.com:develone/pico-sdk.git With this you can not push changes. git clone https://github.com/develone/pico-sdk.git

cd pico-sdk/

git submodule update --init

Submodule 'lib/cyw43-driver' (https://github.com/georgerobotics/cyw43-driver.git) registered for path 'lib/cyw43-driver'

Submodule 'lib/lwip' (https://github.com/lwip-tcpip/lwip.git) registered for path 'lib/lwip' Submodule 'tinyusb' (https://github.com/hathach/tinyusb.git) registered for path 'lib/tinyusb' Cloning into '/home/devel/sdk/pico-sdk/lib/cyw43-driver'...

Cloning into '/home/devel/sdk/pico-sdk/lib/lwip'...

Cloning into '/home/devel/sdk/pico-sdk/lib/tinyusb'...

Submodule path 'lib/cyw43-driver': checked out '195dfcc10bb6f379e3dea45147590db2203d3c7b' Submodule path 'lib/lwip': checked out '239918ccc173cb2c2a62f41a40fd893f57faf1d6' Submodule path 'lib/tinyusb': checked out '4bfab30c02279a0530e1a56f4a7c539f2d35a293'

cd ../../

This is when the repo is yours.

git clone git@github.com:develone/devel-pico-tflmicro.git

git clone https://github.com/develone/devel-pico-tflmicro.git

cd devel-pico-tflmicro

mkdir build

cd build

cmake -DPICO BOARD=pico .. about 4 hours

Using PICO\_SDK\_PATH from environment ('/home/devel/sdk/pico-sdk')

PICO\_SDK\_PATH is /home/devel/sdk/pico-sdk

Defaulting PICO\_PLATFORM to rp2040 since not specified.

Defaulting PICO platform compiler to pico\_arm\_gcc since not specified.

-- Defaulting build type to 'Release' since not specified.

PICO compiler is pico\_arm\_gcc

- -- The C compiler identification is GNU 8.3.1
- -- The CXX compiler identification is GNU 8.3.1
- -- The ASM compiler identification is GNU
- -- Found assembler: /usr/bin/arm-none-eabi-gcc

Build type is Release

PICO target board is pico.

Using board configuration from /home/devel/sdk/pico-sdk/src/boards/include/boards/pico.h

-- Found Python3: /usr/bin/python3.9 (found version "3.9.2") found components: Interpreter TinyUSB available at /home/devel/sdk/pico-sdk/lib/tinyusb/src/portable/raspberrypi/rp2040; enabling build support for USB.

cyw43-driver available at /home/devel/sdk/pico-sdk/lib/cyw43-driver lwIP available at /home/devel/sdk/pico-sdk/lib/lwip

- -- Configuring done
- -- Generating done
- -- Build files have been written to: /home/devel/devel-pico-tflmicro/build make this will take about 4 hours

```
-rw-r--r-- 1 devel devel 1788264 Oct 25 22:10 libpico-tflmicro.a
-rw-r--r-- 1 devel devel 234456 Oct 25 21:46 libpico-tflmicro_test.a
```

```
./pico-sdk/src/rp2_common/boot_stage2/bs2_default.elf
./examples/micro_speech/command_responder_test.elf
./examples/micro_speech/audio_provider_mock_test.elf
./examples/micro_speech/audio_provider_test.elf
./examples/micro_speech/recognize_commands_test.elf
./examples/magic_wand/magic_wand.elf
./examples/magic_wand/gesture_output_handler_test.elf
./examples/magic_wand/gesture_predictor_test.elf
./examples/magic_wand/gesture_predictor_test.elf
./examples/hello_world/hello_world.elf
```

This is when the repo is yours. git clone git@github.com:develone/my-projects-docs.git git clone https://github.com/develone/my-projects-docs.git

This project uses cmake Important to understand cmake the source code is 1 level above build.

This is when the repo is yours. git clone https://github.com/develone/pico-examples -b dev cd pico-examples mkdir build

This is when the repo is yours. -b dev is branch dev git clone --recursive git@github.com:develone/rp2040-freertos-project.git -b dev git clone --recursive https://github.com/develone/rp2040-freertos-project.git -b dev cd rp2040-freertos-project/ mkdir build cd build

cmake -DPICO\_BOARD=pico ..
Using PICO\_SDK\_PATH from environment ('/home/devel/sdk/pico-sdk')
PICO\_SDK\_PATH is /home/devel/sdk/pico-sdk
Defaulting PICO\_PLATFORM to rp2040 since not specified.
Defaulting PICO platform compiler to pico\_arm\_gcc since not specified.
-- Defaulting build type to 'Release' since not specified.
PICO compiler is pico\_arm\_gcc

- -- The C compiler identification is GNU 8.3.1
- -- The CXX compiler identification is GNU 8.3.1

- -- The ASM compiler identification is GNU
- -- Found assembler: /usr/bin/arm-none-eabi-gcc

Build type is Release

PICO target board is pico.

Using board configuration from /home/devel/sdk/pico-sdk/src/boards/include/boards/pico.h

-- Found Python3: /home/devel/test-1-2.8/env/bin/python3.9 (found version "3.9.2") found components: Interpreter

TinyUSB available at /home/devel/sdk/pico-sdk/lib/tinyusb/src/portable/raspberrypi/rp2040; enabling build support for USB.

cyw43-driver available at /home/devel/sdk/pico-sdk/lib/cyw43-driver

lwIP available at /home/devel/sdk/pico-sdk/lib/lwip

- -- Configuring done
- -- Generating done
- -- Build files have been written to: /home/devel/rp2040-freertos-project/build make

The elf files a loaded with openocd

. ~/Ultibo/picoultibo.sh

this program a file system performs either klt or dwt lifting step,

openocd -f interface/raspberrypi-swd.cfg -f target/rp2040.cfg -c "program test-read-crc16/test-read-crc16.elf verify reset exit"

ls ../doc lots of documentation

ls ../doc/rp2040-logic-analyzer/rp2040-logic-analyzer.pdf

qpdfview ../doc/rp2040-logic-analyzer/rp2040-logic-analyzer.pdf

./first\_pwm/50\_pwm.elf

./pico-lifting/pico-lifting.elf

./ultibo\_blink/ultibo\_blink.elf

./rp2040-logic-analyzer/rp2040-logic-analyzer.elf

./Scheduling/Scheduling.elf

./pico-sdk/src/rp2 common/boot stage2/bs2 default.elf

./pico-littlefs/e-rw-r--r-- 1 devel devel 1788264 Oct 25 22:10 libpico-tflmicro.a

-rw-r--r-- 1 devel devel 234456 Oct 25 21:46 libpico-tflmicro\_test.axample0.elf

./pico-littlefs/example2.elf

./pico-littlefs/example1.elf

./pico-ultibo/pico-ultibo.elf

./test-read/test-read.elf

./ProjectFiles/blink.elf

./kltdwt-ultibo/kltdwt-ultibo.elf

./2tasks/2tasks.elf

./2cores/multicore.elf

./pico-lifting-sf/hello\_usb.elf

./test-read-crc16/test-read-crc16.elf

./Mutex/Mutex.elf

./HCSR04/HCSR04.elf

./Semaphore/Semaphore.elf

./klt-test/klt-test.elf

This needed for octave

.octaverc

graphics\_toolkit("gnuplot");

```
https://github.com/develone/svd_rgb.git
cd svd rgb/src/
devel@pi4-37:~/svd_rgb/src $ make
gcc -c -o obj/svd.o svd.c -I../include
gcc -c -o obj/disp_mat.o disp_mat.c -I../include
gcc -c -o obj/mul_mat.o mul_mat.c -I../include
gcc -c -o obj/pnmio.o pnmio.c -I../include
gcc -c -o obj/error.o error.c -I../include
gcc -c -o obj/mythread.o mythread.c -I../include
gcc -c -o obj/trans mat.o trans mat.c -I../include
gcc -c -o obj/master.o master.c -I../include
gcc -o master obj/svd.o obj/disp_mat.o obj/mul_mat.o obj/pnmio.o obj/error.o obj/mythread.o
obj/trans_mat.o obj/master.o -I../include -lm -lpthread
./master
octave
In a 2nd shell
```

scrot -d 3 -s rcblu.png

scrot -d 3 -s redpgm.png

scrot -d 3 -s rcblu-1.png

quit

git clone https://github.com/ArduCAM/pico-tflmicro.git

Cloning into 'pico-tflmicro'...

remote: Enumerating objects: 1812, done.

remote: Counting objects: 100% (106/106), done. remote: Compressing objects: 100% (47/47), done.

remote: Total 1812 (delta 73), reused 59 (delta 59), pack-reused 1706 Receiving objects: 100% (1812/1812), 13.92 MiB | 14.64 MiB/s, done.

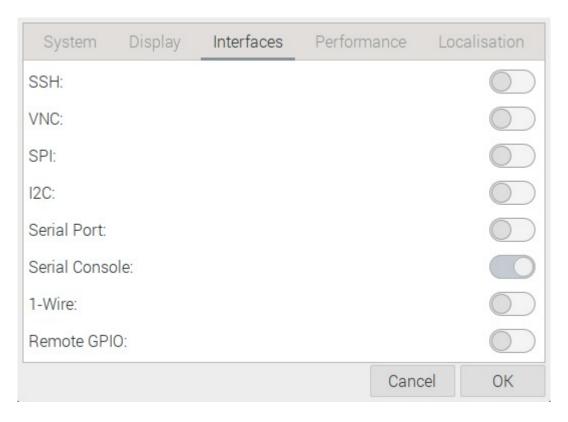
Resolving deltas: 100% (950/950), done.

\$30.00 at Amazon

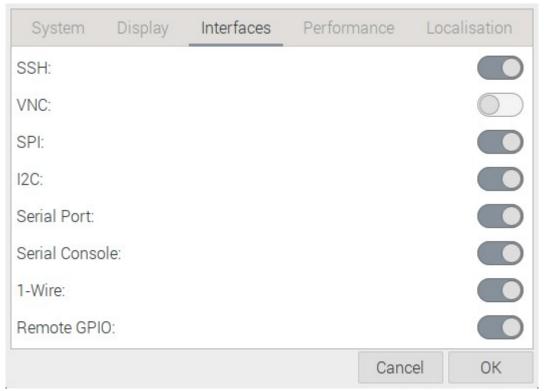
devel@pi4-37:~/pico-tflmicro/bin

magic\_wand\_ble.uf2 person\_detection\_benchmark.uf2 pico4ml\_ble\_magic\_wand.uf2 micro\_speech.uf2 person\_detection\_int8.uf2 pico4ml\_magic\_wand.uf2

Setting up the interfaces



# Setting up the interfaces



When installing

## File Edit Tabs Help

#### Package configuration

#### Configuring wireshark-common

Dumpcap can be installed in a way that allows members of the "wireshark" system group to capture packets. This is recommended over the alternative of running Wireshark/Tshark directly as root, because less of the code will run with elevated privileges.

For more detailed information please see /usr/share/doc/wireshark-common/README.Debian.gz once the package is installed.

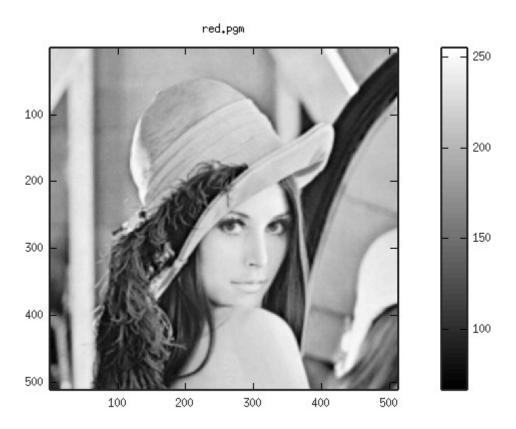
Enabling this feature may be a security risk, so it is disabled by default. If in doubt, it is suggested to leave it disabled.

Should non-superusers be able to capture packets?

<Yes>

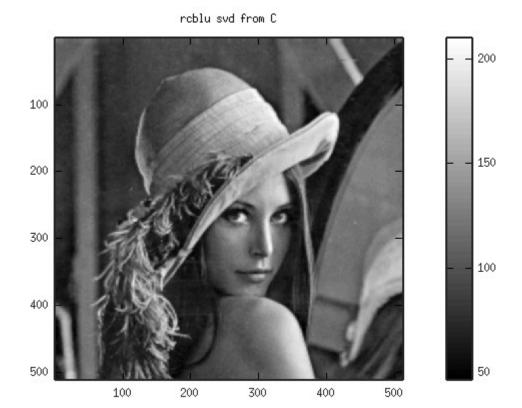
<No>

### svd\_rgb



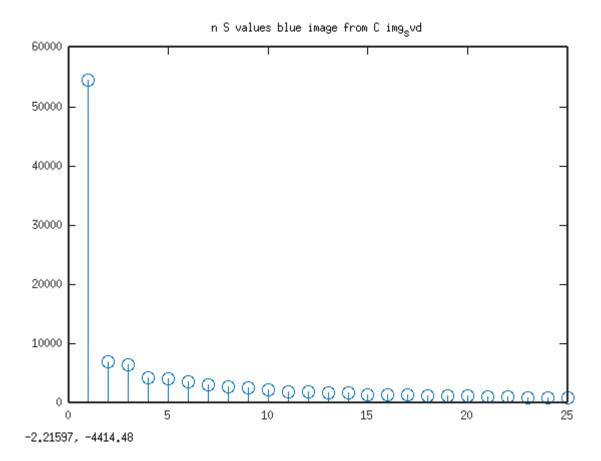
y2= 230,686

reconstruted

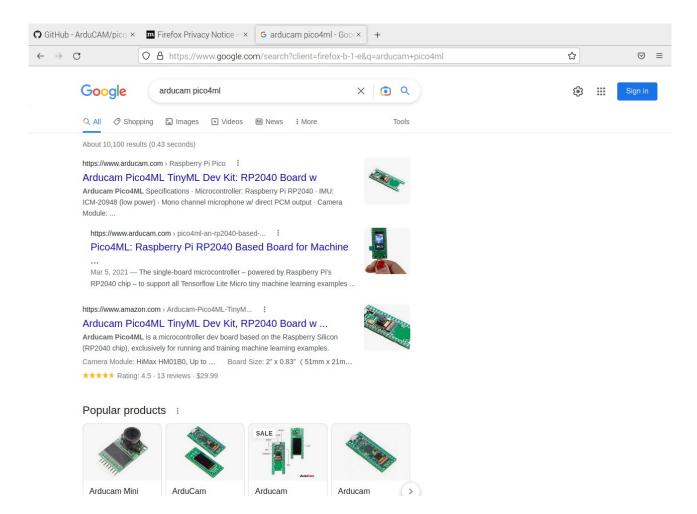


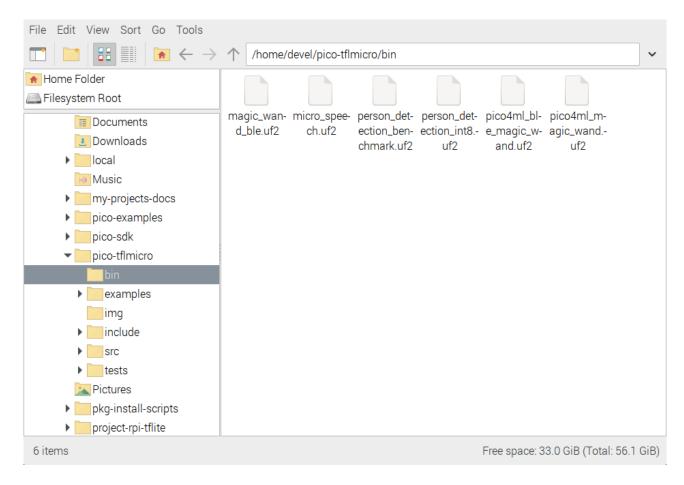
y2= 23,8538

svd

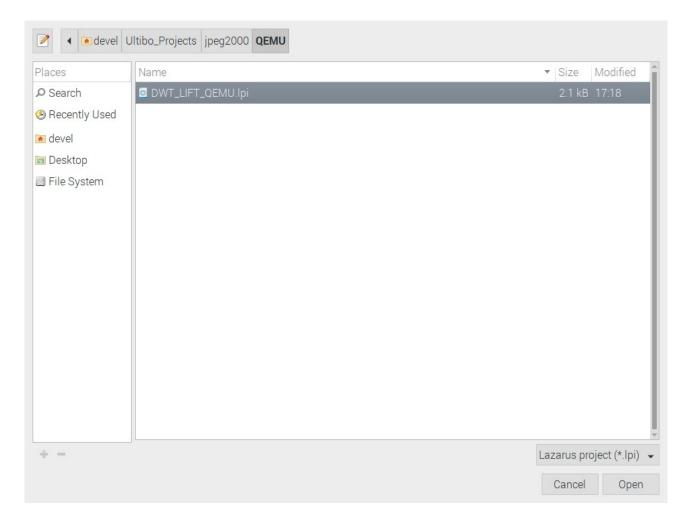


Arducam PicoML

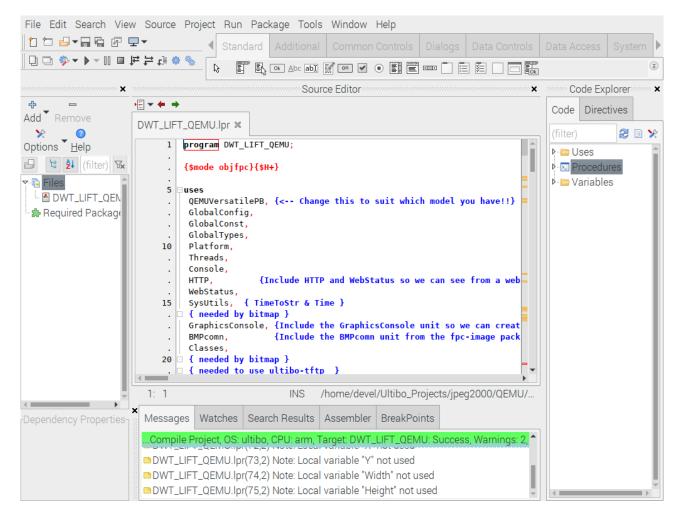




### **QEMU**



QEMU



**QEMU** 

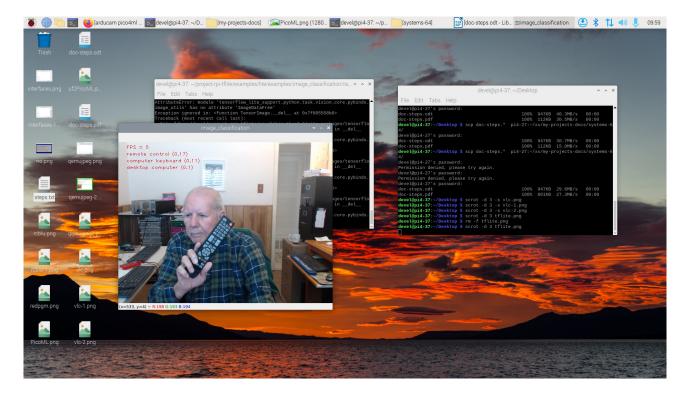
Starting here will be in an update.

cd ~/project-rpi-tflite/ python3 -m venv env source env/bin/activate (env) devel@pi4-37:~/project-rpi-tflite \$

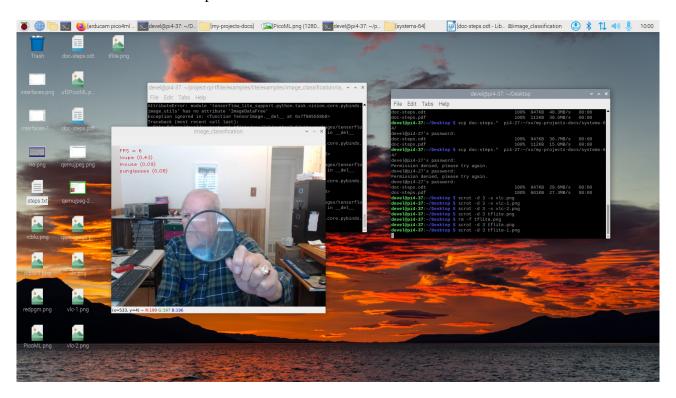
cd examples/lite/examples/image\_classification/raspberry\_pi/

python3 classify.py

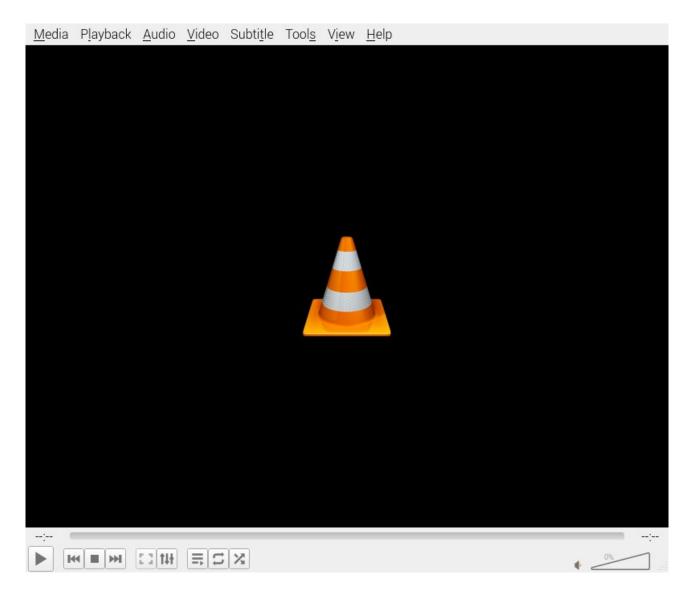
TensorFlow Lite detects remote control



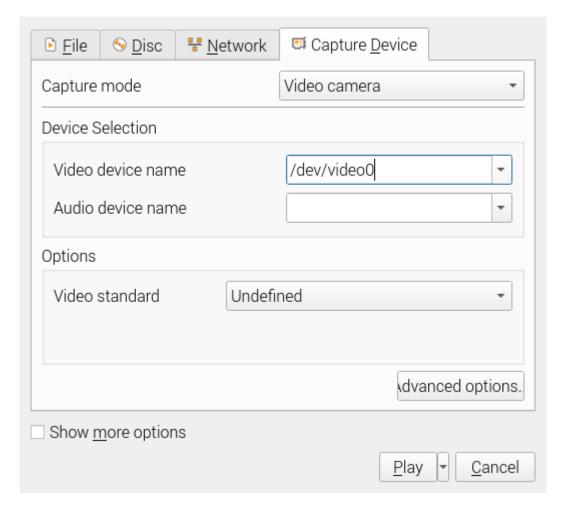
## TensorfFlow Lite detects loupe



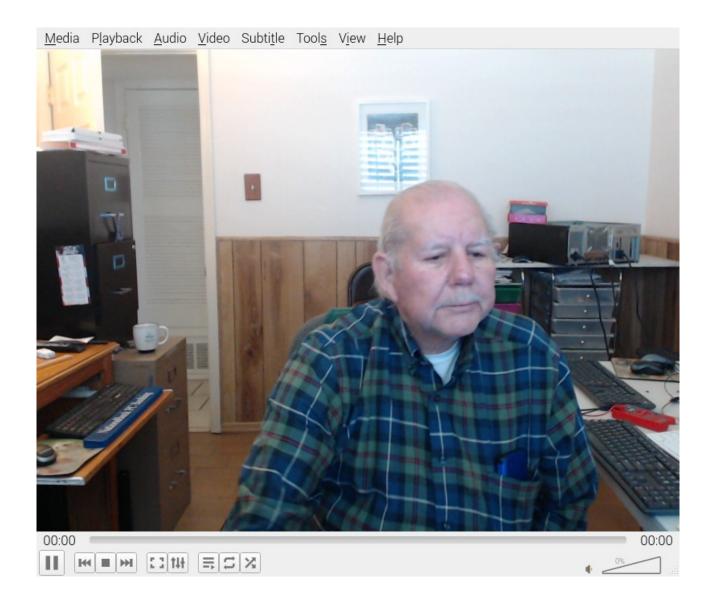
vlc & camera



selecting the video device



me in my lab



ps -ax | grep python3 xxxx pts/3 Sl+ 39:15 python3 classify.py kill -9 xxxx

### version control

cd my-projects-docs/

devel@pi4-37:~/my-projects-docs \$ git pull

hint: Pulling without specifying how to reconcile divergent branches is

hint: discouraged. You can squelch this message by running one of the following

hint: commands sometime before your next pull:

hint:

hint: git config pull.rebase false # merge (the default strategy)

hint: git config pull.rebase true # rebase

hint: git config pull.ff only # fast-forward only

hint:

hint: You can replace "git config" with "git config --global" to set a default hint: preference for all repositories. You can also pass --rebase, --no-rebase,

hint: or --ff-only on the command line to override the configured default per

hint: invocation.

remote: Enumerating objects: 9, done. remote: Counting objects: 100% (9/9), done. remote: Compressing objects: 100% (3/3), done.

remote: Total 5 (delta 2), reused 5 (delta 2), pack-reused 0 Unpacking objects: 100% (5/5), 7.61 MiB | 4.31 MiB/s, done.

From https://github.com/develone/my-projects-docs 078614e..6615ca9 master -> origin/master

Updating 078614e..6615ca9

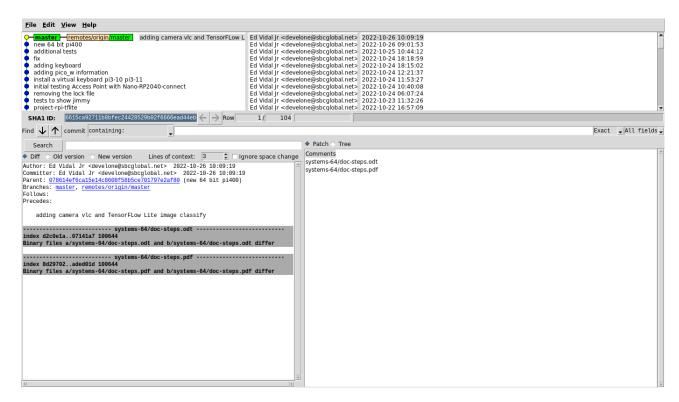
Fast-forward

systems-64/doc-steps.odt | Bin 969808 -> 6580211 bytes systems-64/doc-steps.pdf | Bin 615076 -> 1634728 bytes

2 files changed, 0 insertions(+), 0 deletions(-)

devel@pi4-37:~/my-projects-docs \$ diff systems-64/doc-steps.odt ~/Desktop/doc-steps.odt devel@pi4-37:~/my-projects-docs \$ diff systems-64/doc-steps.pdf ~/Desktop/doc-steps.pdf devel@pi4-37:~/my-projects-docs \$ gitk & [1] 8231

#### gitk &



git log

commit 6615ca92711b8bfec24428529b02f6666ead44eb (HEAD -> master, origin/master, origin/HEAD)

Author: Ed Vidal Jr <develone@sbcglobal.net>

Date: Wed Oct 26 10:09:19 2022 -0600

adding camera vlc and TensorFLow Lite image classify

commit 078614ef6ca15e14c8608f58b5ce701797e2af80

Author: Ed Vidal Jr <develone@sbcglobal.net>

Date: Wed Oct 26 09:01:53 2022 -0600

new 64 bit pi400

commit 35f6add124a7fe0aac9fb65c697459f3b0dce72c

Author: Ed Vidal Jr <develone@sbcglobal.net>

Date: Tue Oct 25 10:44:12 2022 -0600

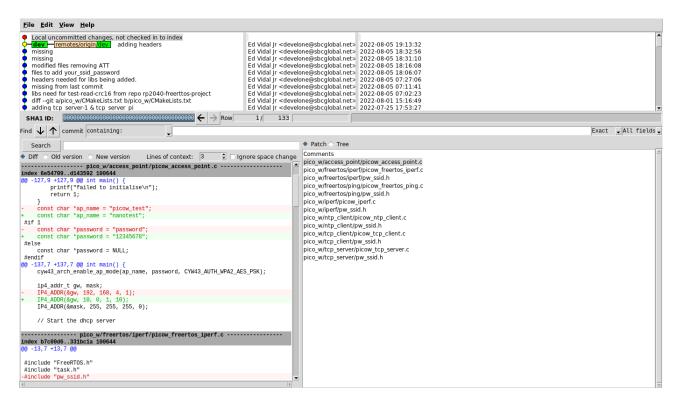
additional tests

commit f4b4834fb04e78d8cdda68075eb286c9d854c9e4

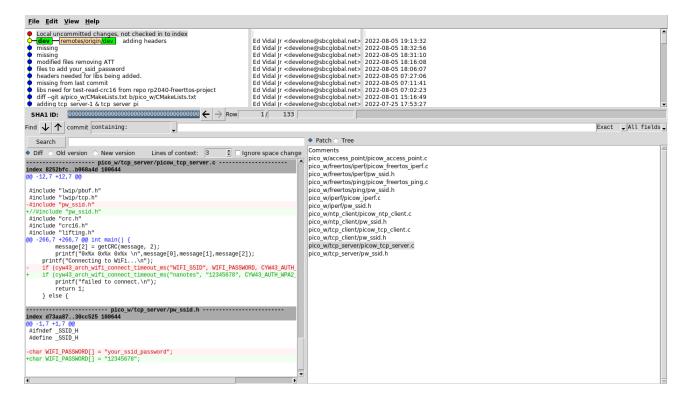
Author: Ed Vidal Jr <develone@sbcglobal.net>

Date: Mon Oct 24 18:18:59 2022 -0600

mkdir pi4-28
mkdir pi4-35
cd pi4-28
git clone <a href="https://github.com/develone/pico-examples.git">https://github.com/develone/pico-examples.git</a> -b dev cd pico-examples/
mkdir build
cd build
gitk &



tcp-server



cmake -DPICO\_BOARD=pico\_w -DTEST\_TCP\_SERVER\_IP="10.0.1.13" -

DWIFI\_SSID="nanotest" -DWIFI\_PASSWORD="12345678" ...

Using PICO\_SDK\_PATH from environment ('/home/devel/sdk/pico-sdk')

PICO\_SDK\_PATH is /home/devel/sdk/pico-sdk

Defaulting PICO\_PLATFORM to rp2040 since not specified.

Defaulting PICO platform compiler to pico\_arm\_gcc since not specified.

-- Defaulting build type to 'Release' since not specified.

PICO compiler is pico\_arm\_gcc

- -- The C compiler identification is GNU 8.3.1
- -- The CXX compiler identification is GNU 8.3.1
- -- The ASM compiler identification is GNU
- -- Found assembler: /usr/bin/arm-none-eabi-gcc

Build type is Release

PICO target board is pico\_w.

Using CMake board configuration from /home/devel/sdk/pico-sdk/src/boards/pico\_w.cmake Using board configuration from /home/devel/sdk/pico-sdk/src/boards/include/boards/pico\_w.h

-- Found Python3: /usr/bin/python3.9 (found version "3.9.2") found components: Interpreter TinyUSB available at /home/devel/sdk/pico-sdk/lib/tinyusb/src/portable/raspberrypi/rp2040; enabling build support for USB.

cyw43-driver available at /home/devel/sdk/pico-sdk/lib/cyw43-driver

lwIP available at /home/devel/sdk/pico-sdk/lib/lwip

Enabling build support for Pico W wireless.

Skipping Pico W FreeRTOS examples as FREERTOS\_KERNEL\_PATH not defined

- -- Configuring done
- -- Generating done
- -- Build files have been written to: /home/devel/pi4-28/pico-examples/build

make