

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

```
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
```

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:/bin:/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
```

```
[=====] 950/950
100%
```

```
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     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/.pyenv/plugins/pyenv-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 pyenv-virtualenv 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 environment
```

```
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, 0x00, 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/magic_wand_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 are 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
```

```
./klt-dwt-ultibo/klt-dwt-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 redpgm.png
```

```
scrot -d 3 -s rcblu.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.

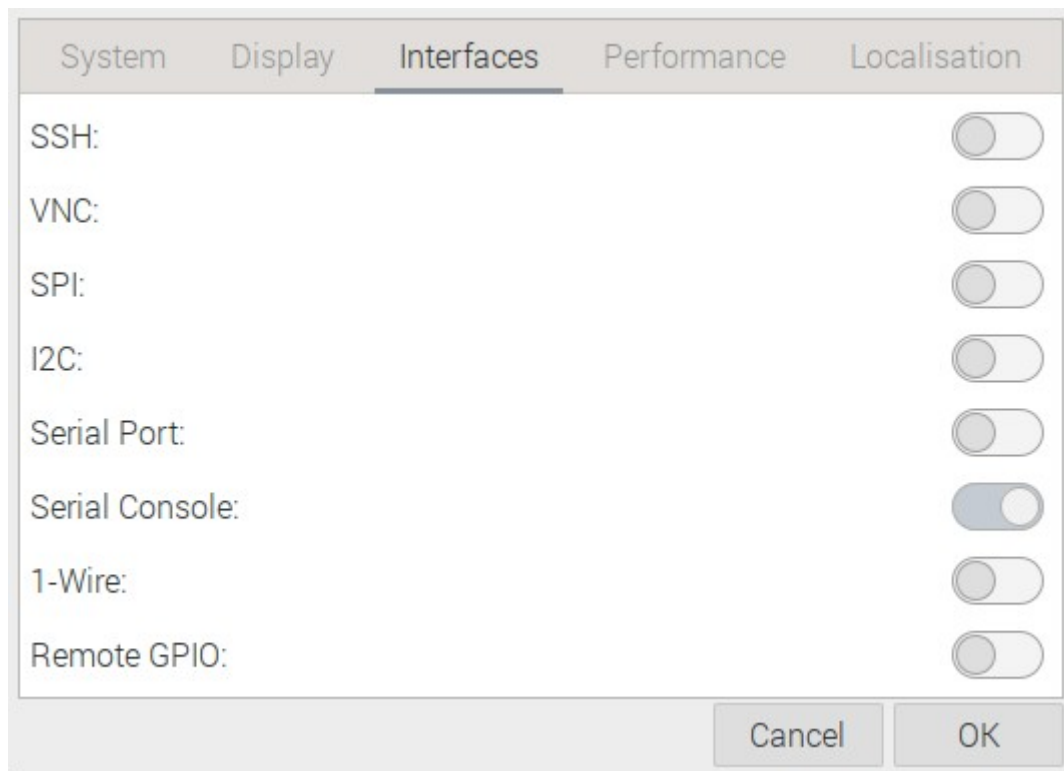
\$30.00 at Amazon

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

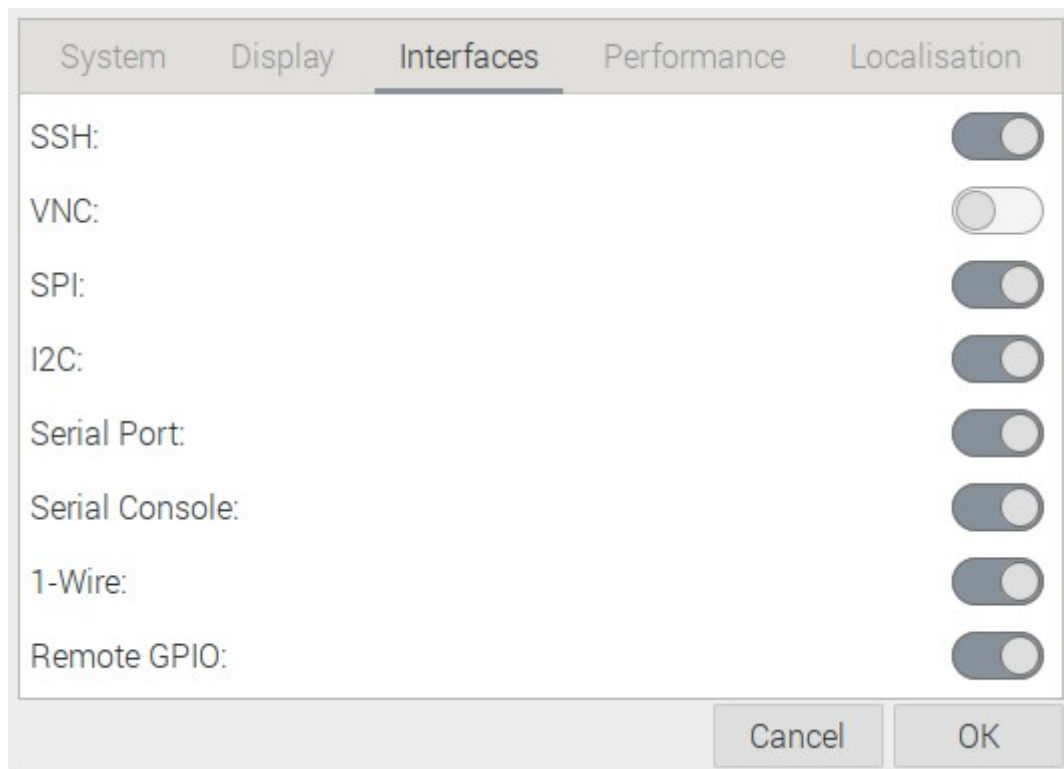
```
magic_wand_ble.uf2 person_detection_benchmark.uf2 pico4ml_ble_magic_wand.uf2
```

```
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>

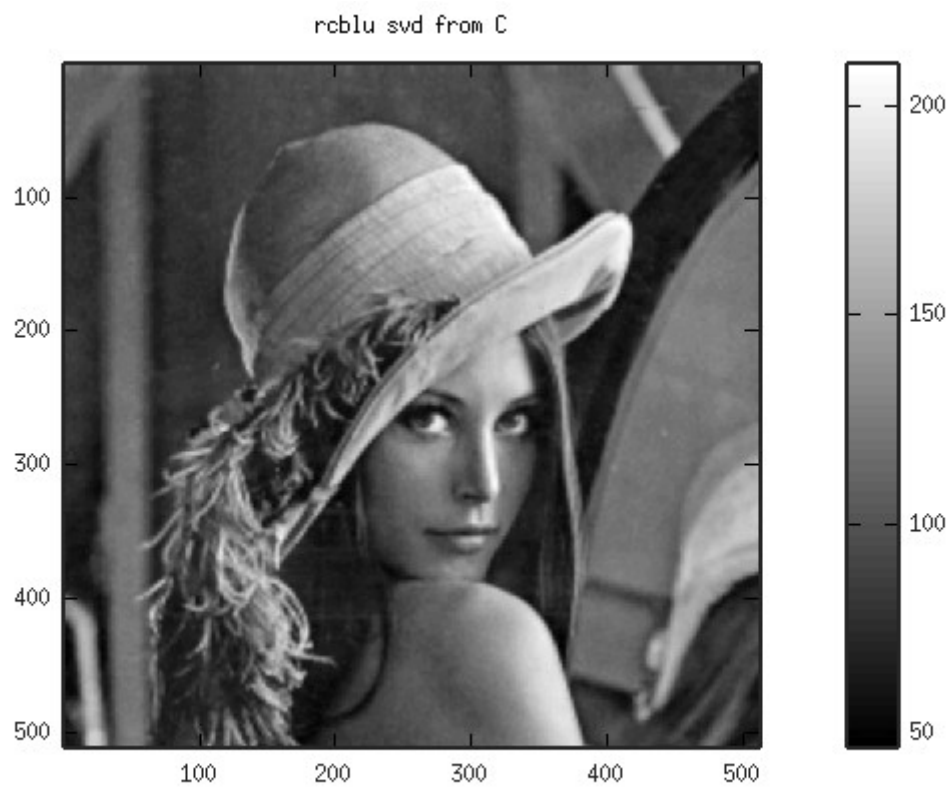
svd_rgb

red.pgm



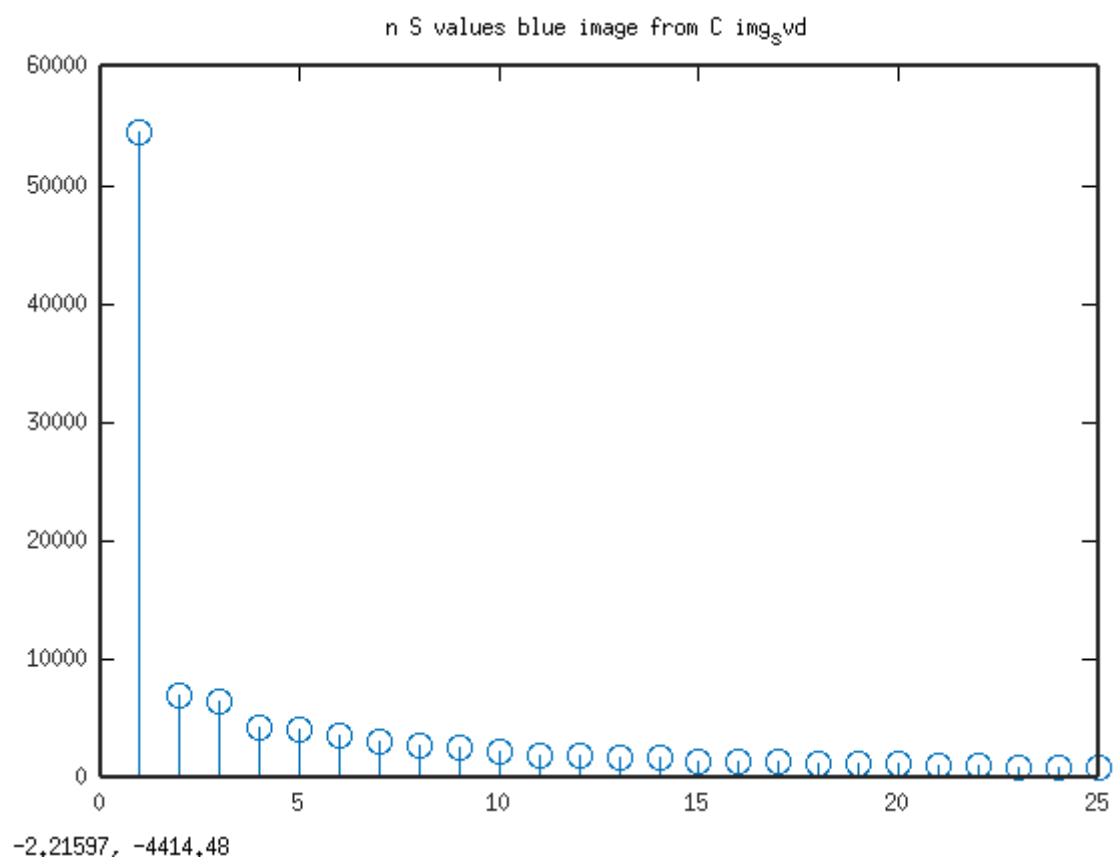
$y_2 = 230.686$

reconstructed



$\mu_2 = 23.8538$

svd



Arducam PicoML

GitHub - ArduCAM/pico × Firefox Privacy Notice × arducam pico4ml - Google ×

← → ↻

https://www.google.com/search?client=firefox-b-1-e&q=arducam+pico4ml

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arducam pico4ml

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📺 Videos

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Tools

About 10,100 results (0.43 seconds)

https://www.arducam.com › Raspberry Pi Pico

Arducam Pico4ML TinyML Dev Kit: RP2040 Board w

Arducam Pico4ML Specifications · Microcontroller: Raspberry Pi RP2040 · IMU: ICM-20948 (low power) · Mono channel microphone w/ direct PCM output · Camera Module: ...




https://www.arducam.com › pico4ml-an-rp2040-based-...

Pico4ML: Raspberry Pi RP2040 Based Board for Machine

...

Mar 5, 2021 — The single-board microcontroller – powered by Raspberry Pi's RP2040 chip – to support all Tensorflow Lite Micro tiny machine learning examples ...




https://www.amazon.com › Arducam-Pico4ML-TinyM...

Arducam Pico4ML TinyML Dev Kit, RP2040 Board w ...

Arducam Pico4ML is a microcontroller dev board based on the Raspberry Silicon (RP2040 chip), exclusively for running and training machine learning examples. Camera Module: HiMax HM01B0, Up to ... Board Size: 2" x 0.83" (51mm x 21m...

★★★★★ Rating: 4.5 · 13 reviews · \$29.99



Popular products



Arducam Mini



ArduCam

SALE



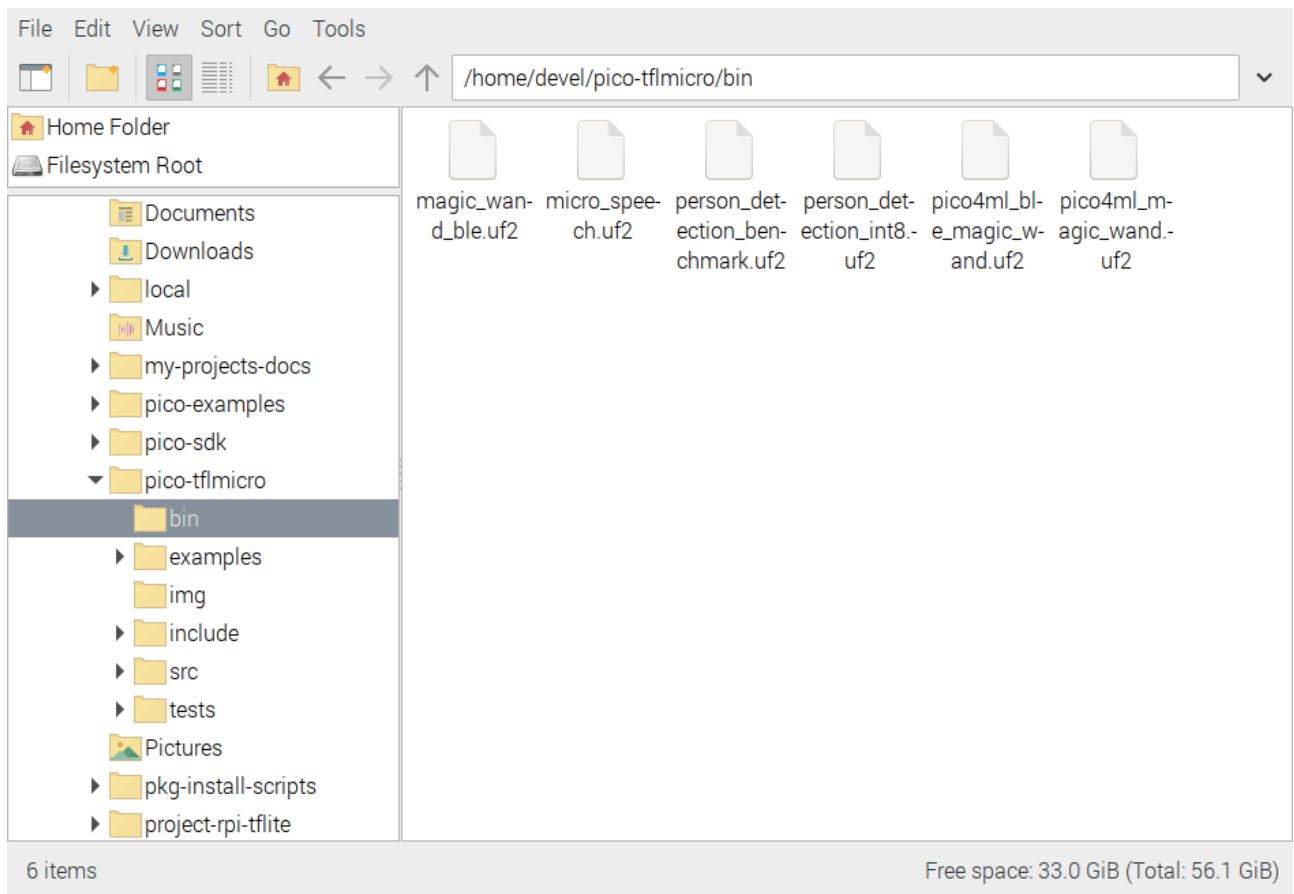
Arducam



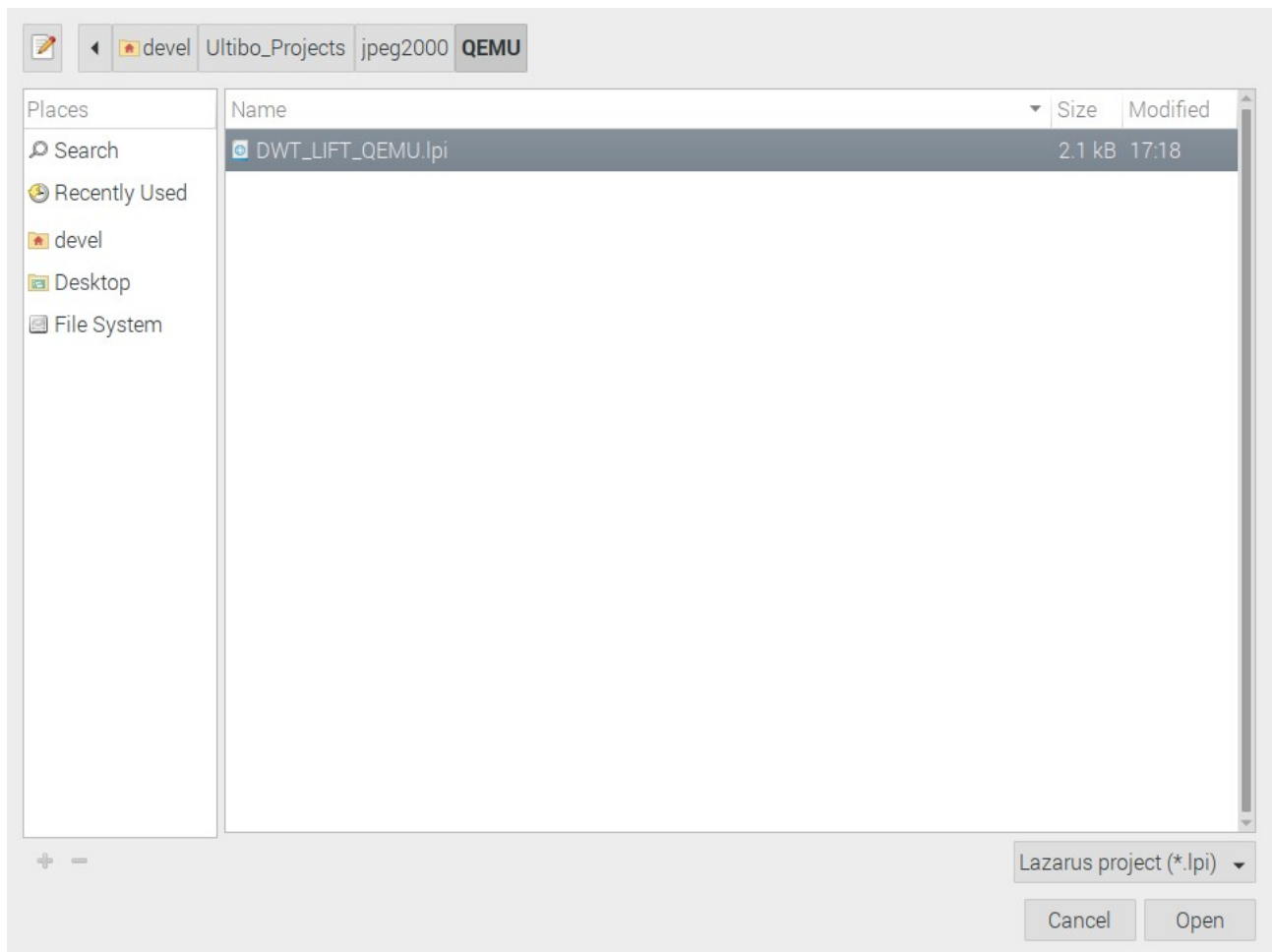
Arducam

➤

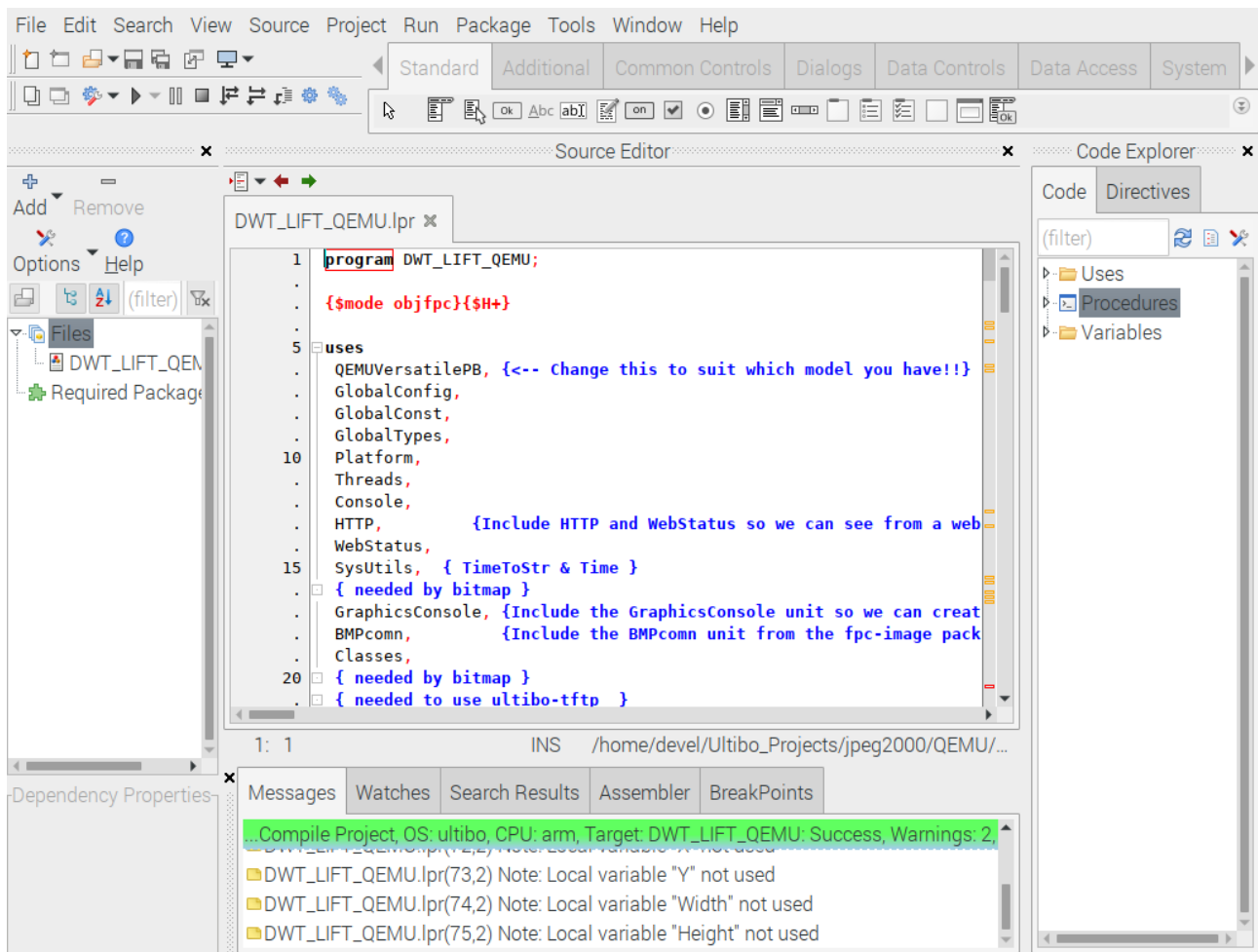
UF2



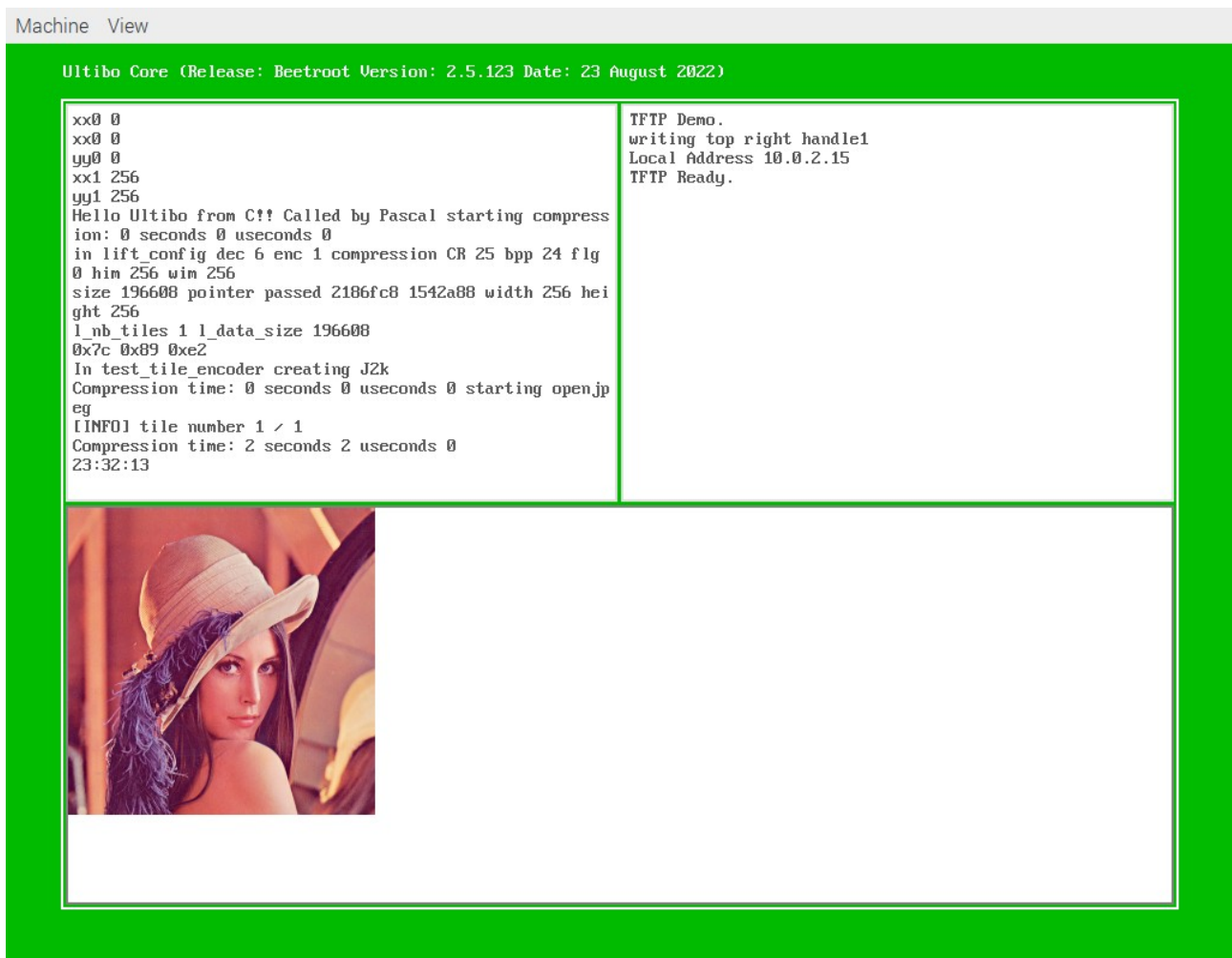
QEMU



QEMU



QEMU



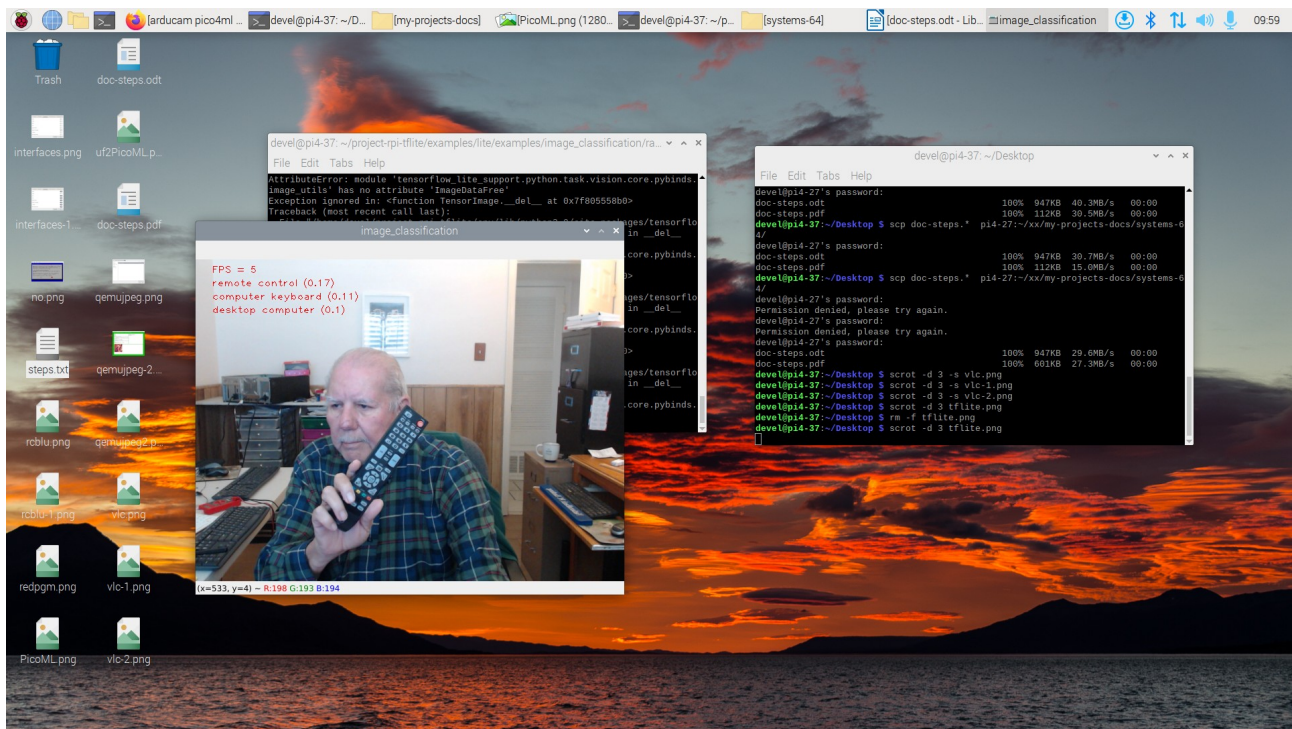
Starting here will be in an update.

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

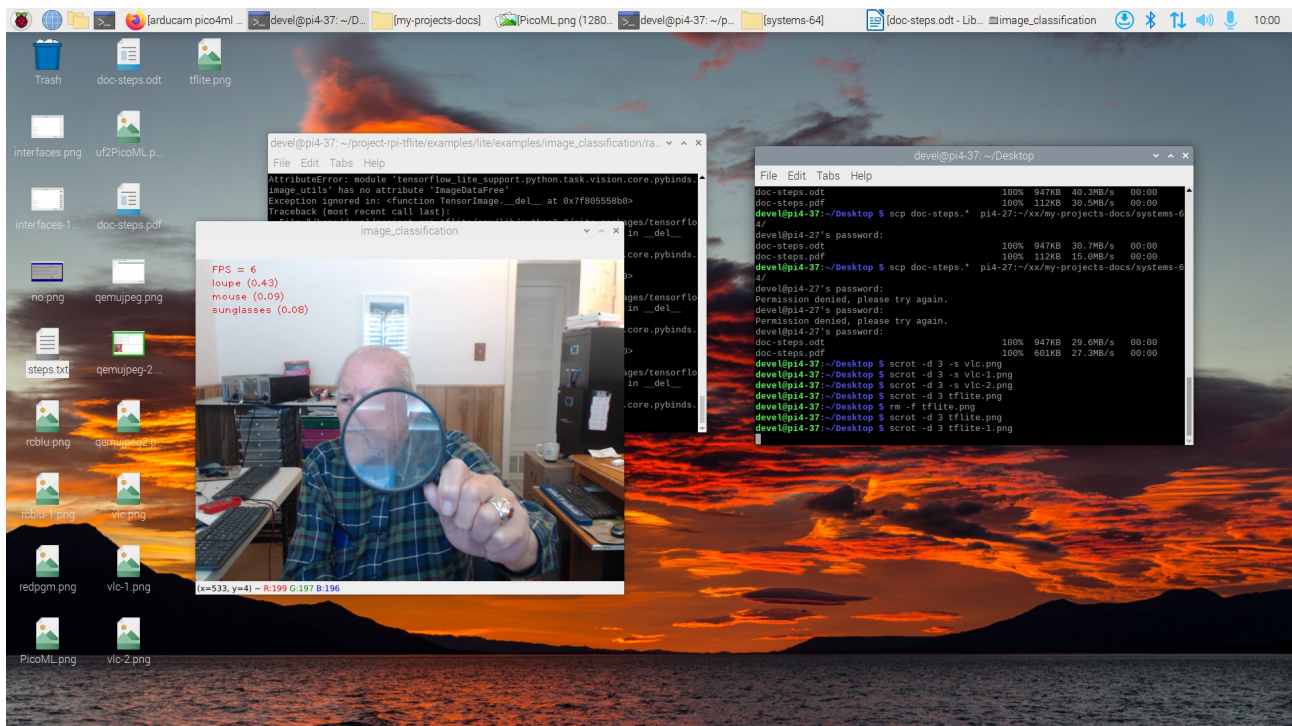
```
cd examples/lite/examples/image_classification/raspberry_pi/
```

```
python3 classify.py
```

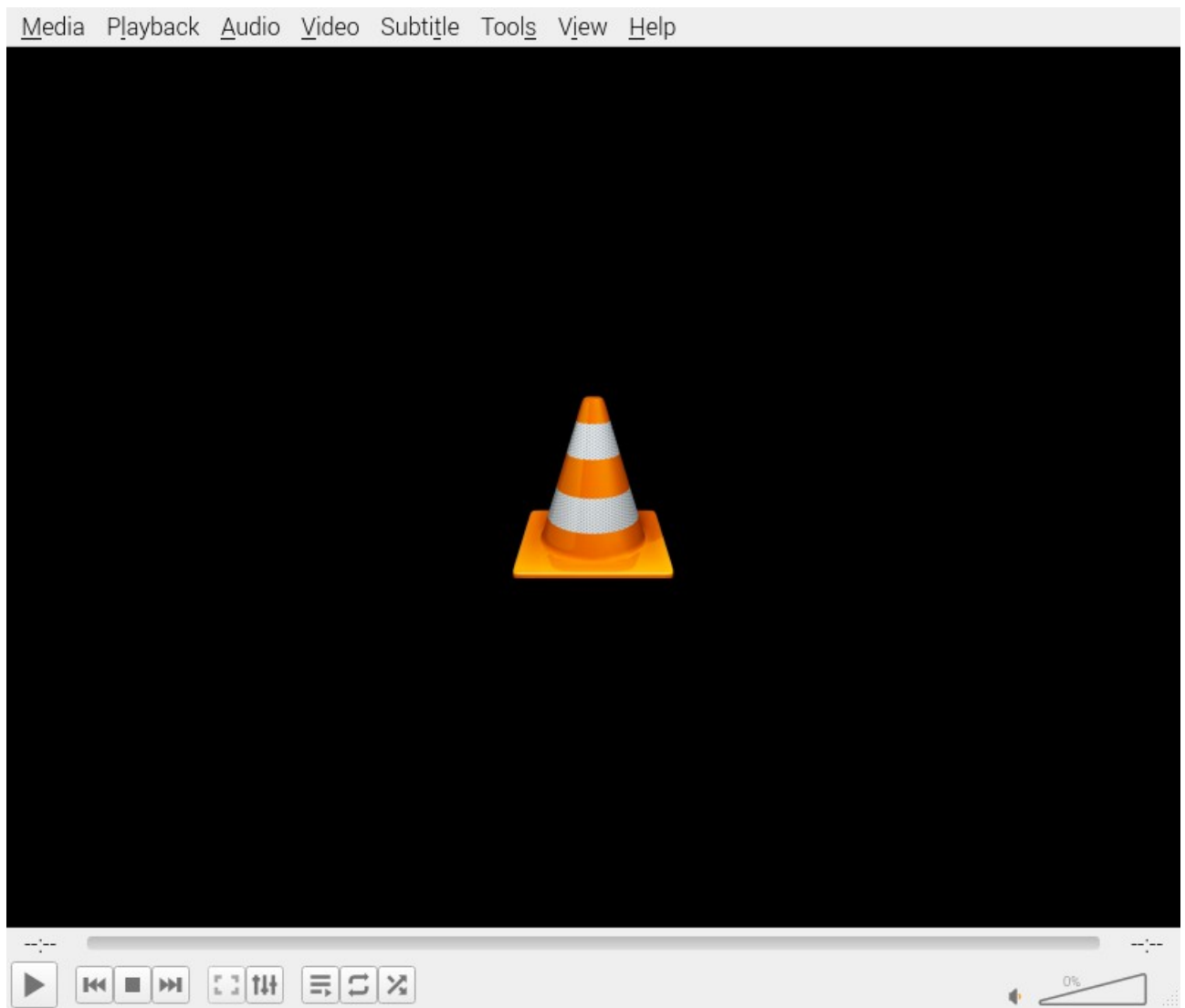
TensorFlow Lite detects remote control



TensorFlow Lite detects loupe



vlc & camera



selecting the video device

File

Disc

Network

Capture Device

Capture mode

Video camera

Device Selection

Video device name

/dev/video0

Audio device name

Options

Video standard

Undefined

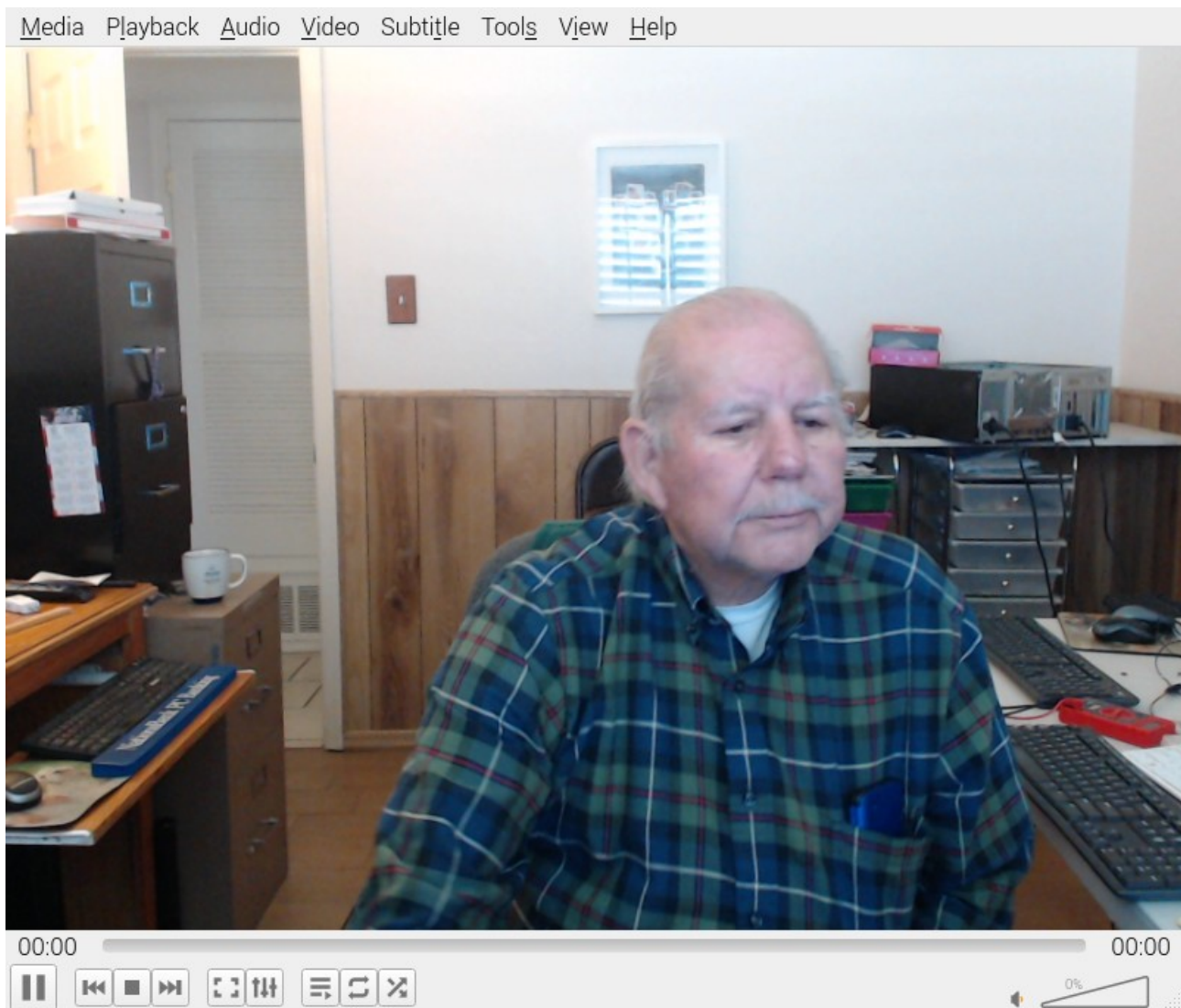
advanced options.

☐ Show more options

Play

Cancel

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(-)

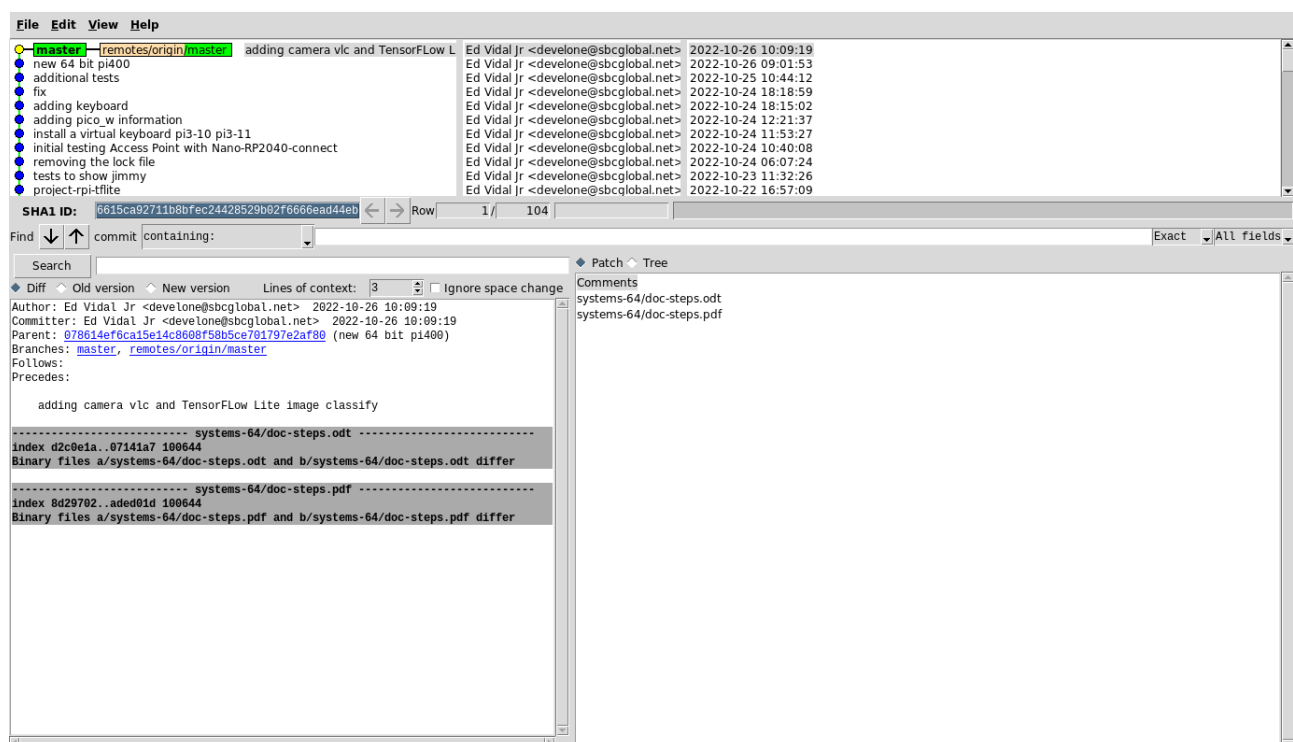
devel@pi4-37:~/my-projects-docs \$ diff systems-64/doc-steps.odt ~/Desktop/doc-steps.odt

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

xx