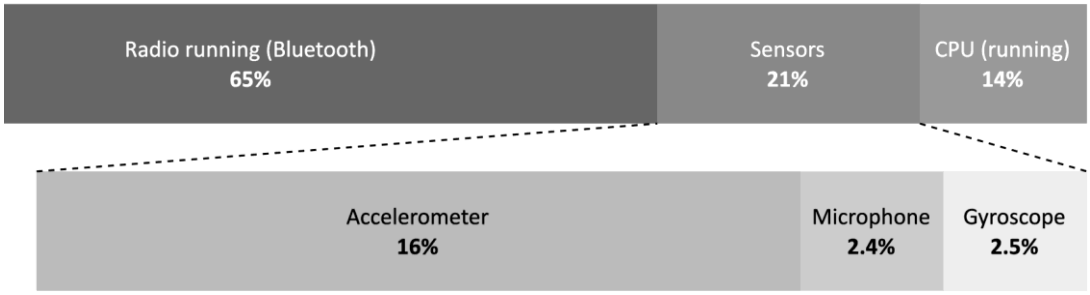
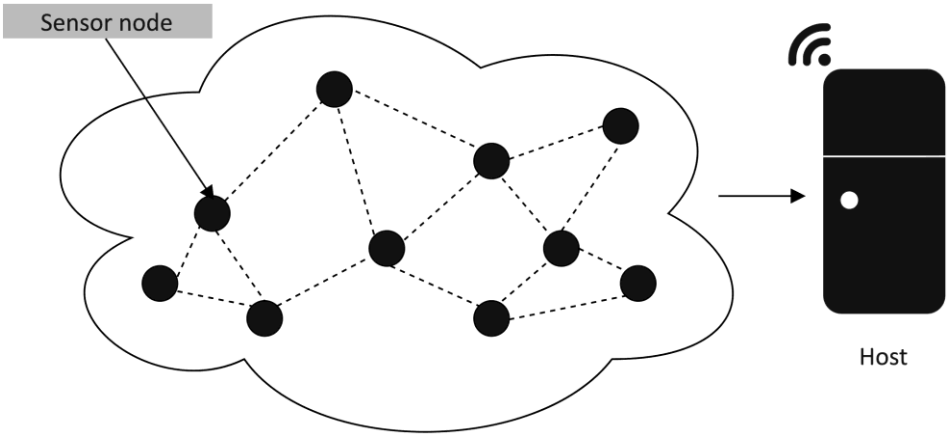
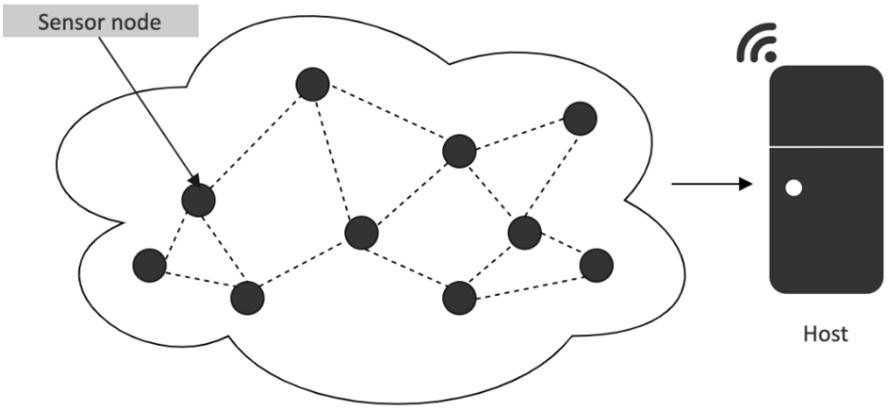
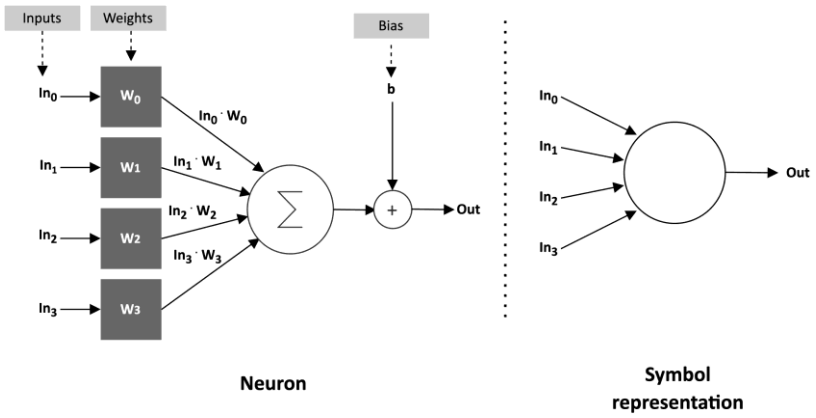
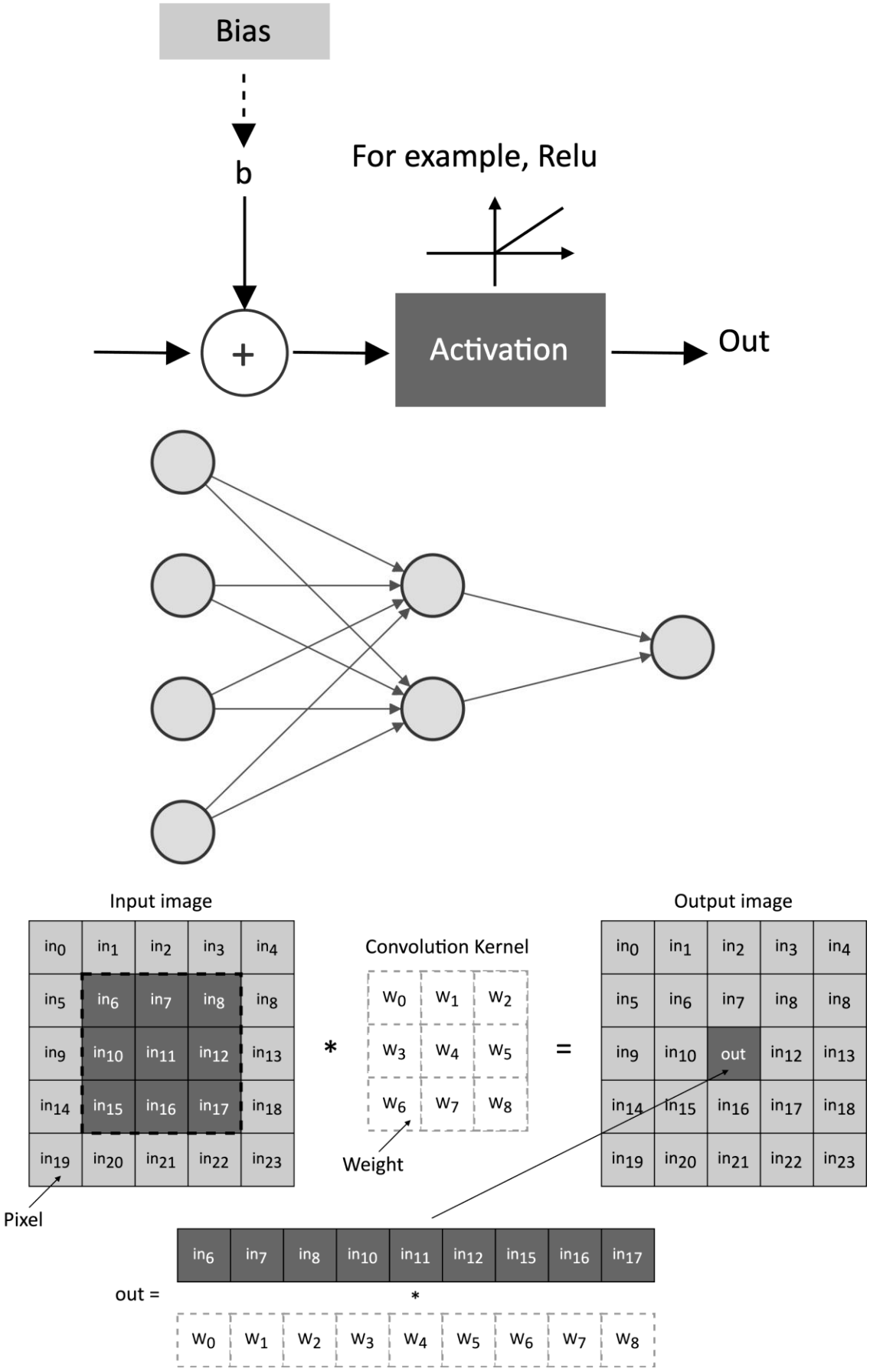
Chapter 1: Getting Started with TinyML

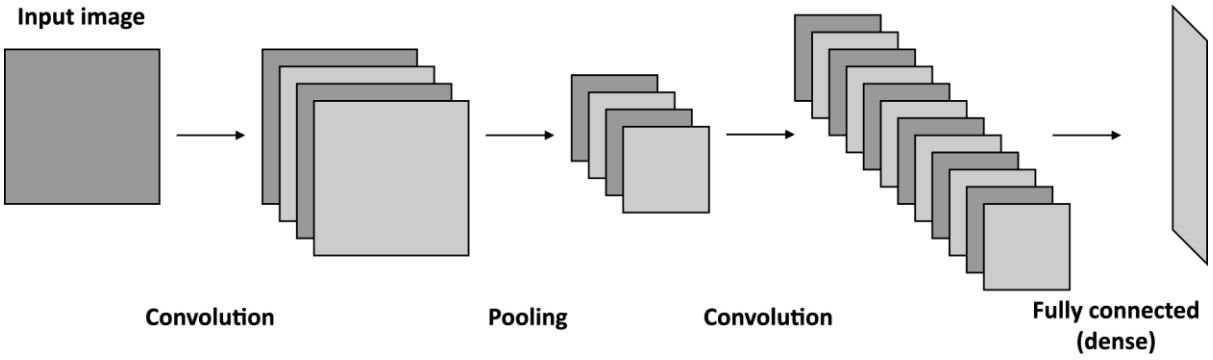


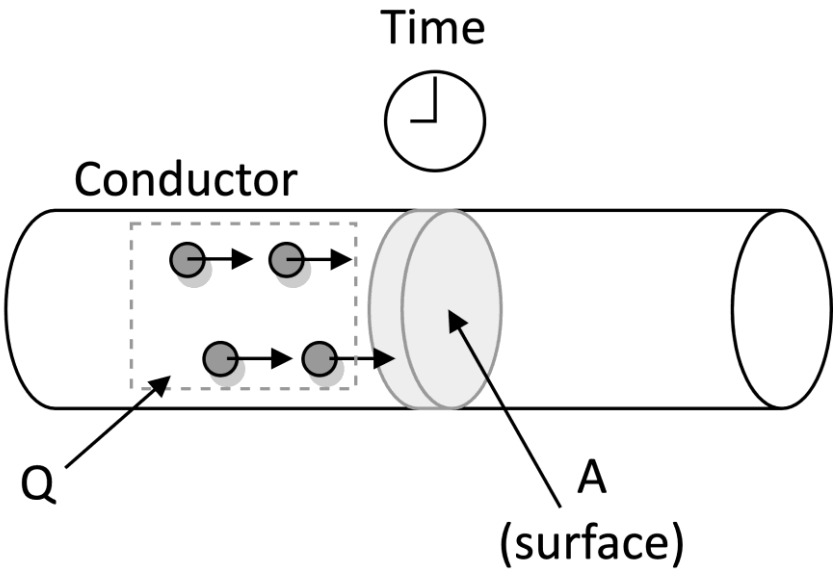




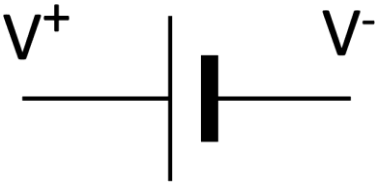



Bias
b
For example, Relu
+
Activation
Out
Input image
Convolution Kernel
Output image
Weight
Pixel
out =
*
=





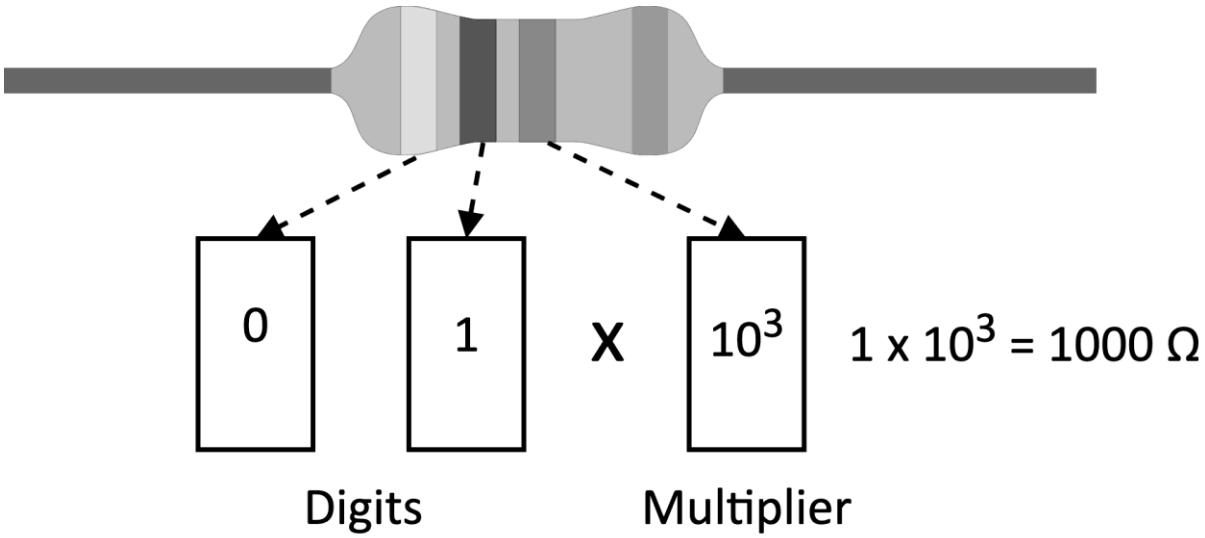
Battery



Symbol representation

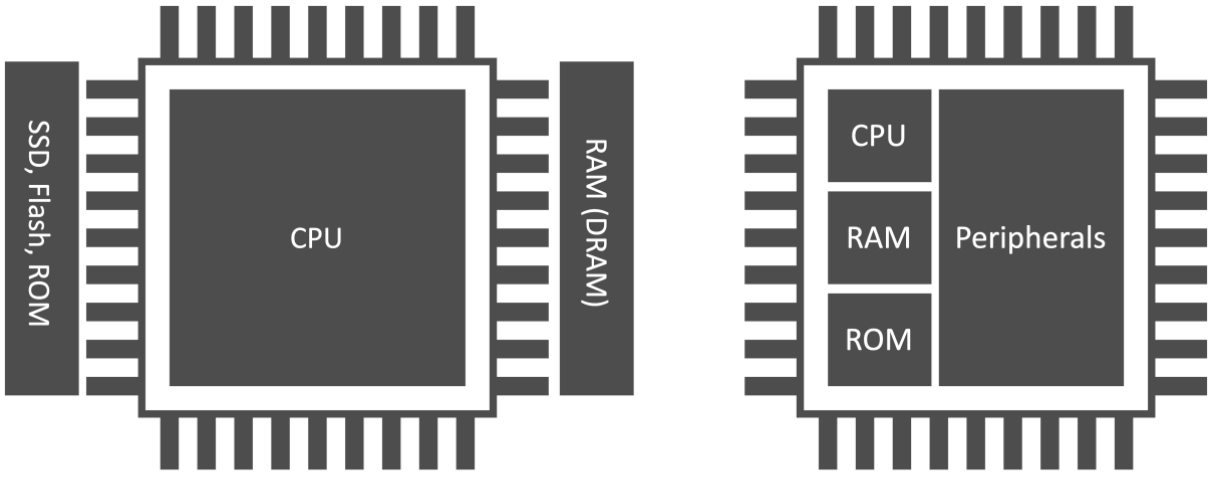
Resistor

Symbol representation



Physical quantity	Unit	Meaning
P	Watt (W)	Power
E	Joule (J)	Energy
V	Volts (V)	Voltage supply
I	Ampere (A)	Current consumption
T	Seconds (s)	Operating time

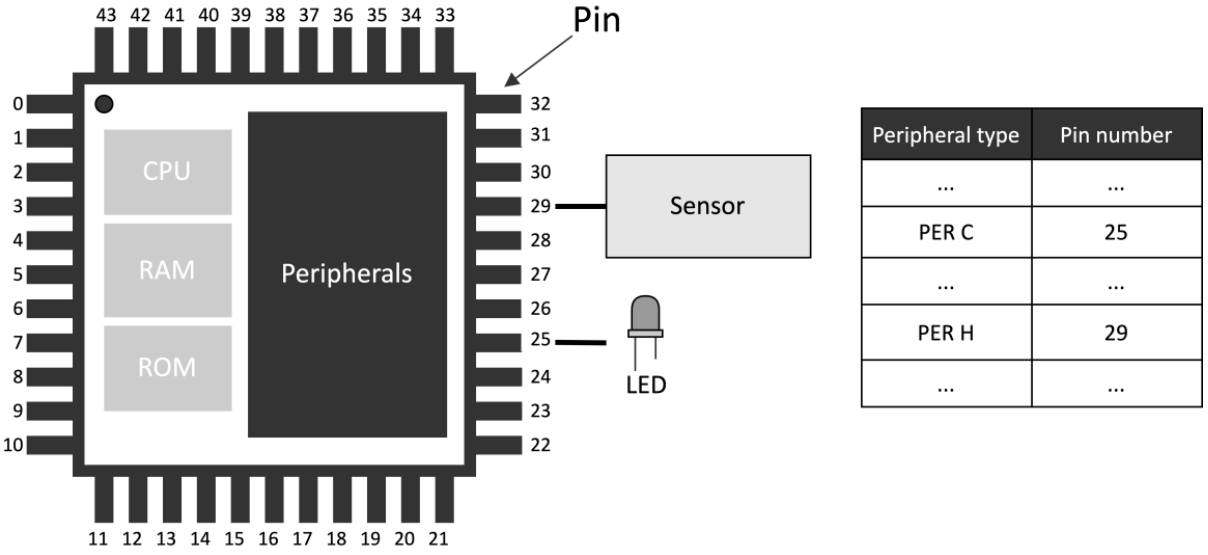
Processing unit	Power consumption
PU1	12
PU2	3



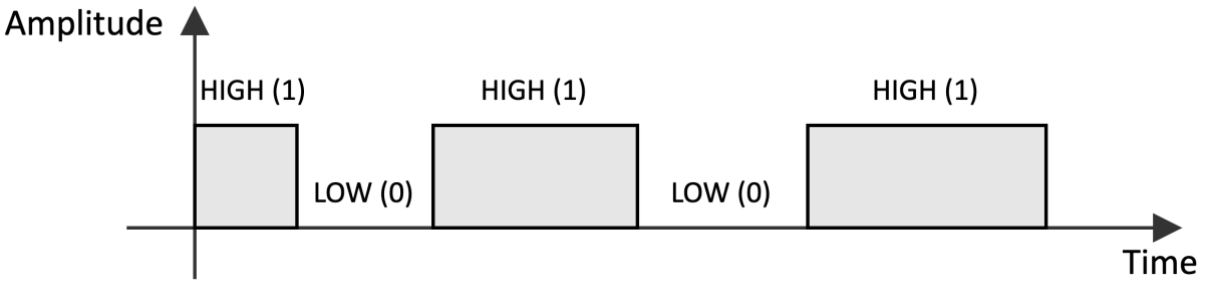
Microprocessor

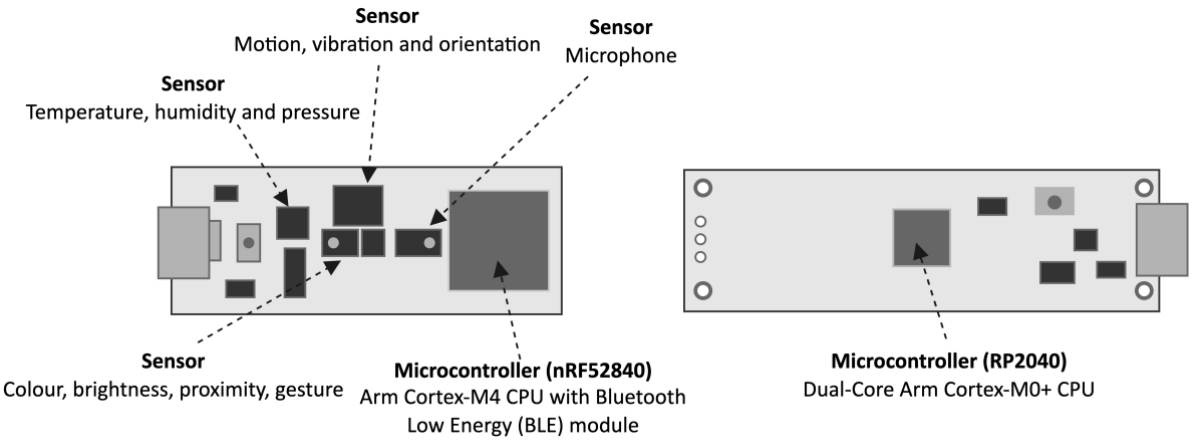
Microcontroller

Feature	Microprocessor	Microcontroller
Application	General-purpose	Single-purpose
CPU arithmetic	It can perform heavy mathematical calculations in floating-point or double precision	Mainly integer arithmetic
RAM	A few GB	A few hundred KB
ROM (or hard-drive)	GB or TB	KB or MB
Clock frequency	GHz	MHz
Power consumption	W	mW or below
Operating System (OS)	Required	Not strictly required
Cost	From ten to hundreds of dollars	From a few cents (low-end) to a few dollars (high-end)



Peripheral type	Pin number
...	...
PER C	25
...	...
PER H	29
...	...





Arduino Nano 33 BLE sense board

CPU: Arm Cortex-M4 64MHz
Program memory: 1MB
Data memory: 256KB
Board size: 45x18mm
Cost: $31.10

Raspberry Pi Pico

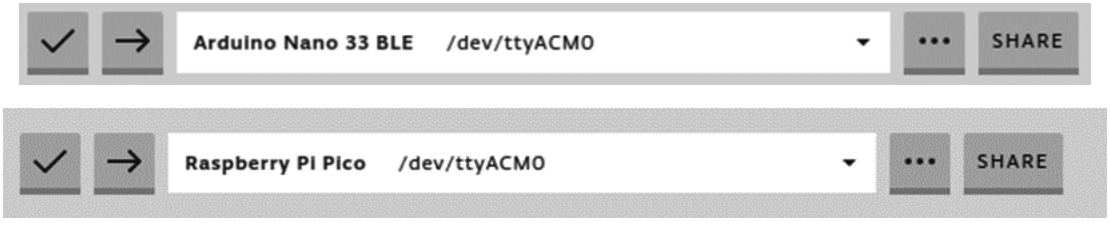
CPU: Dual core Arm Cortex-M0+ 133MHz
Program memory: 2MB
Data memory: 264KB
Board size: 51.3x21mm
Cost: $4

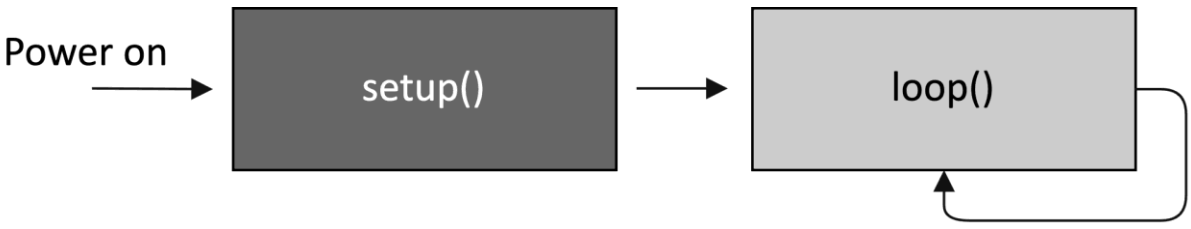
Notebook settings

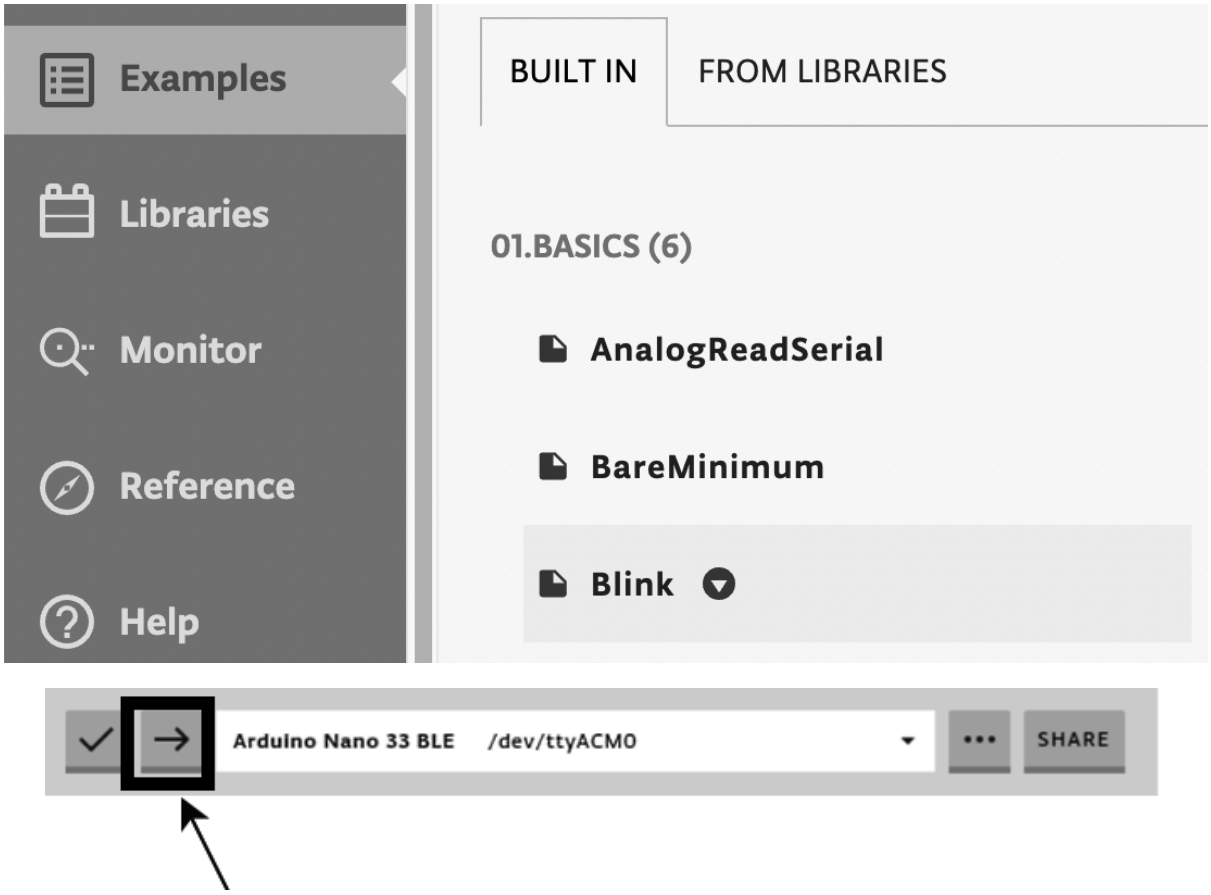
Hardware accelerator

GPU

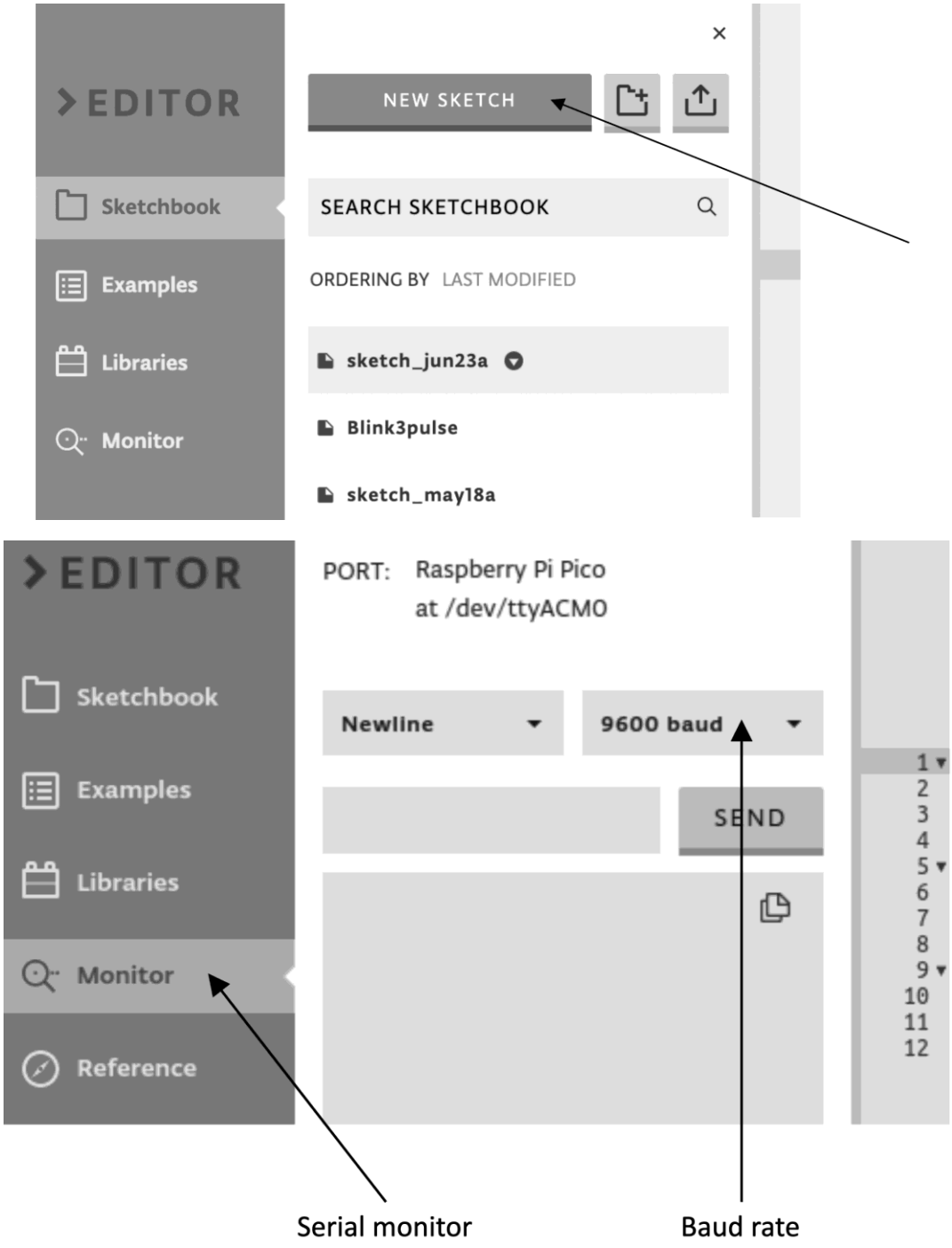
To get the most out of Colab Pro, avoid using a GPU unless you need one. Learn more

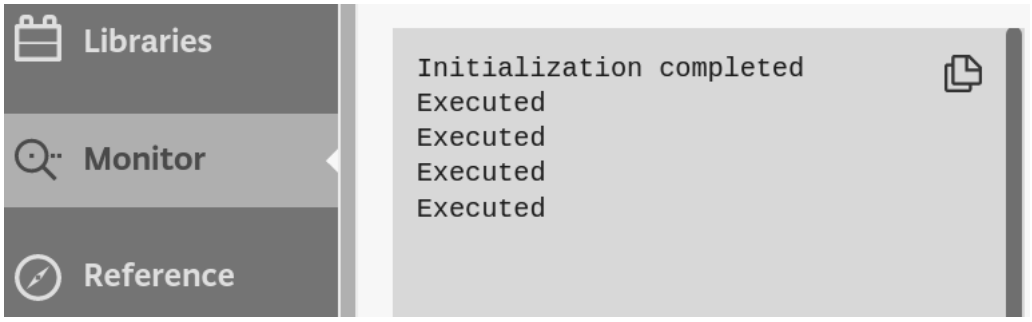


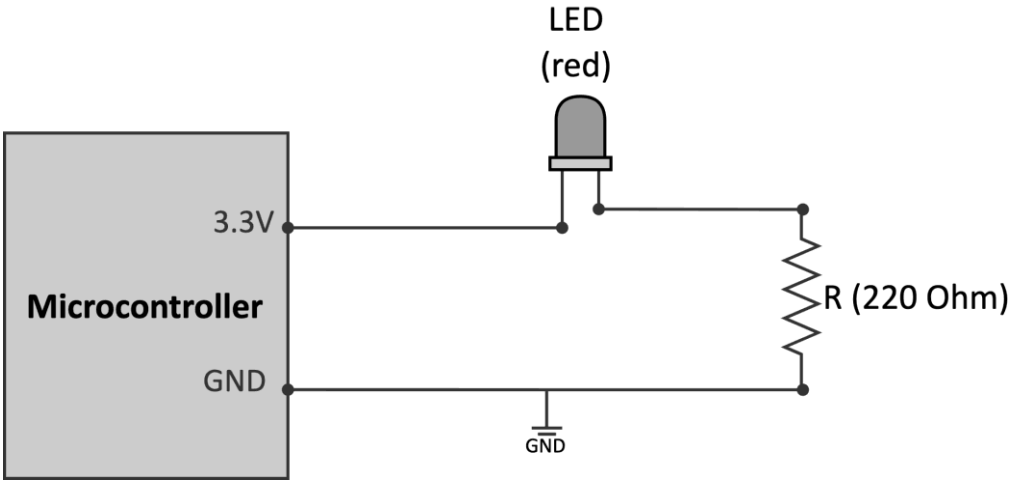


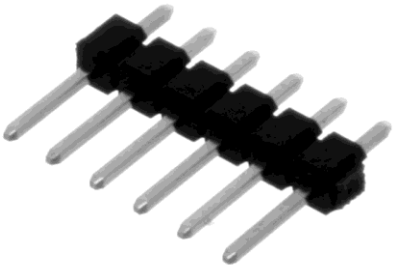

Examples
Libraries
Monitor
Reference
Help
BUILT IN
FROM LIBRARIES
01.BASICS (6)
AnalogReadSerial
BareMinimum
Blink
Arduino Nano 33 BLE
/dev/ttyACM0
SHARE

Chapter 2: Prototyping with Microcontrollers

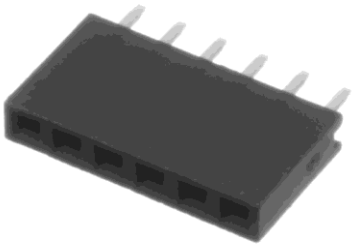




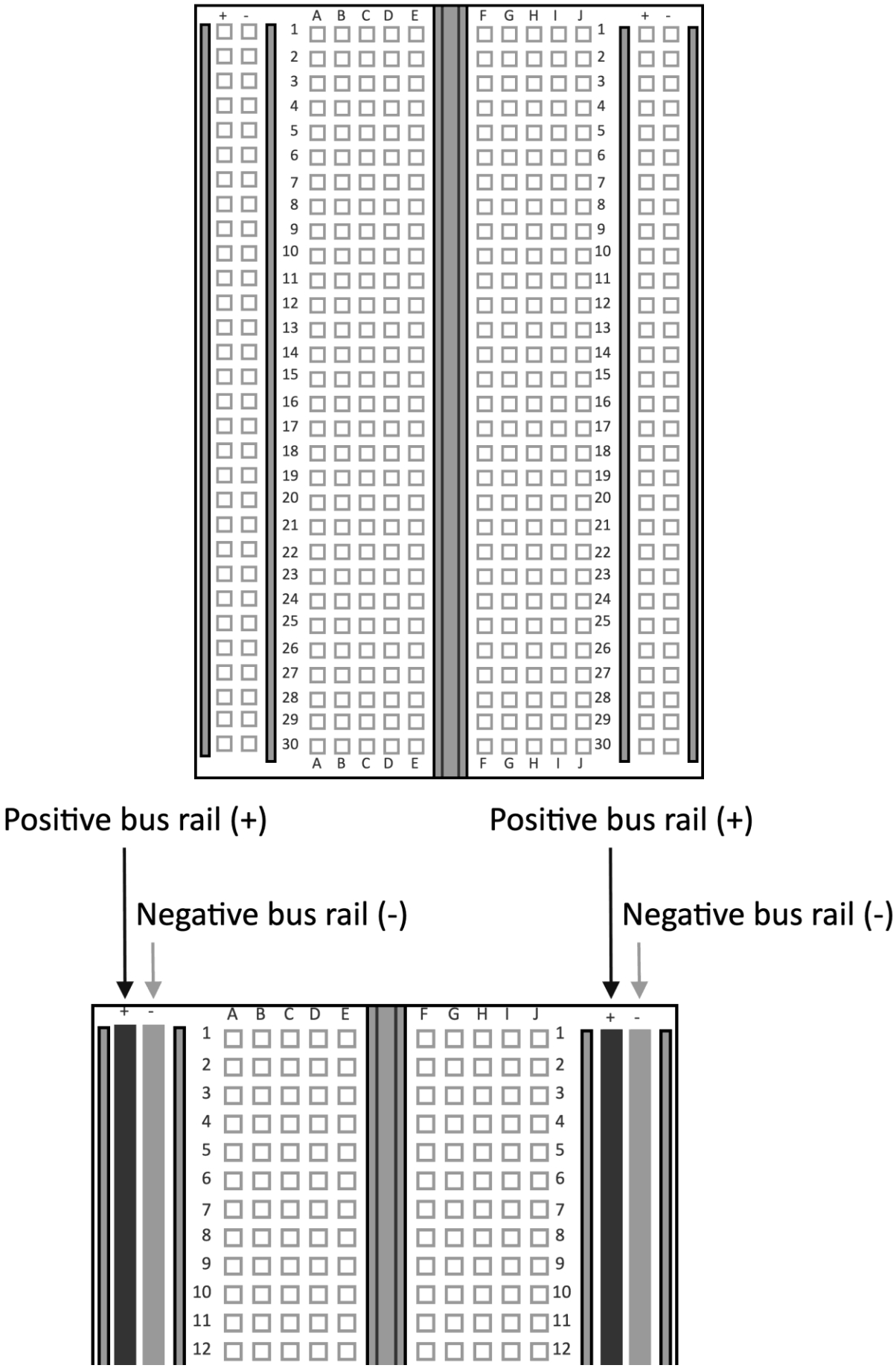


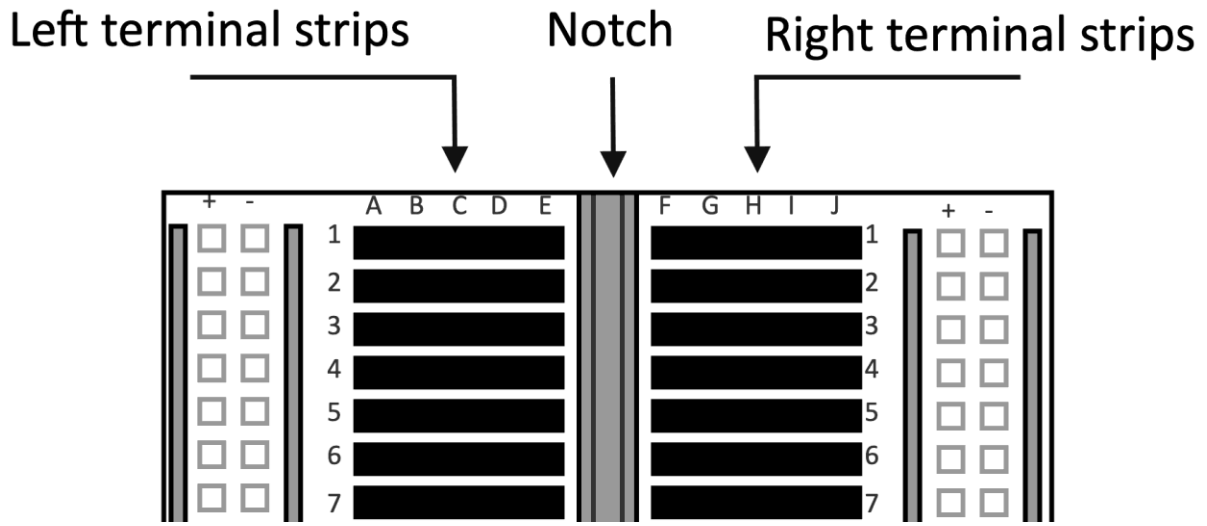


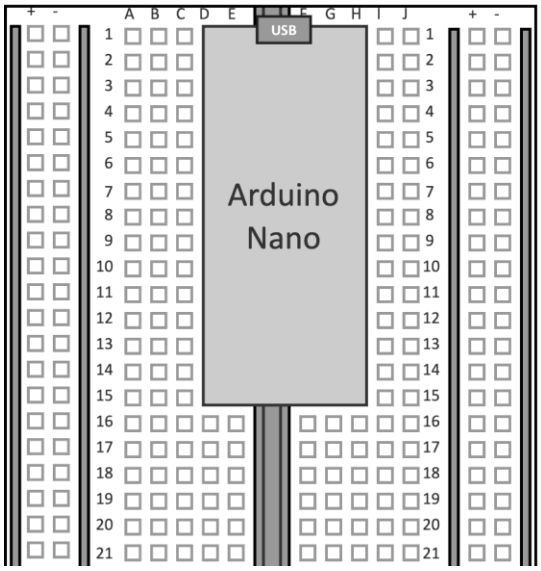
Male header (pin header)

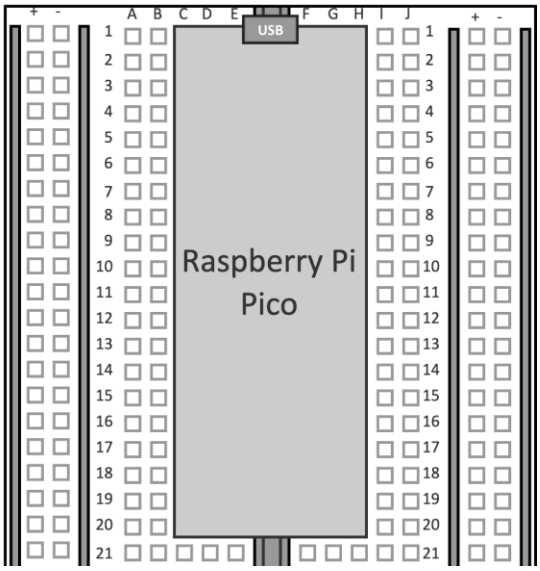


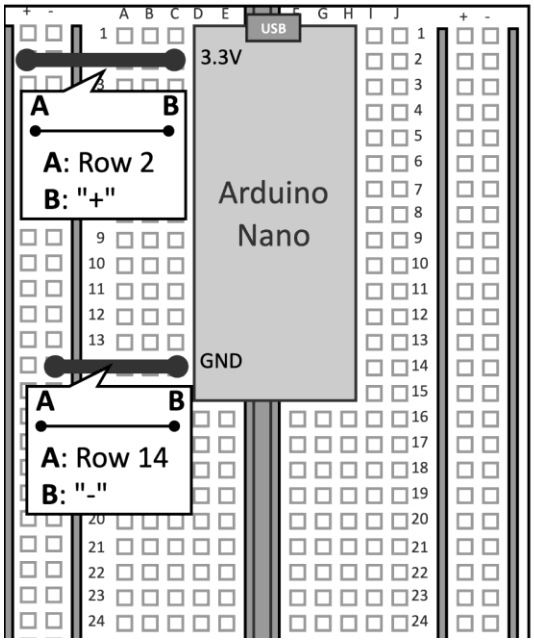
Female header (socket header)

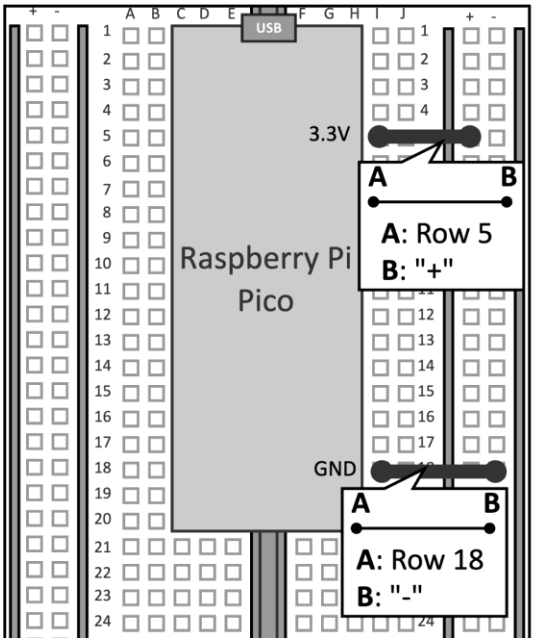

Positive bus rail (+)
Negative bus rail (-)
Positive bus rail (+)
Negative bus rail (-)

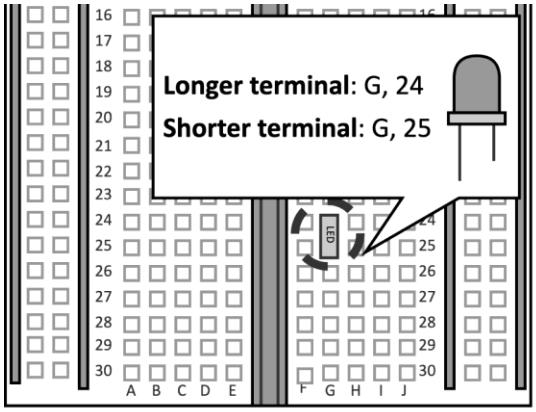

Left terminal strips
Notch
Right terminal strips
+ -
A B C D E
F G H I J
1
2
3
4
5
6
7


USB
Arduino
Nano

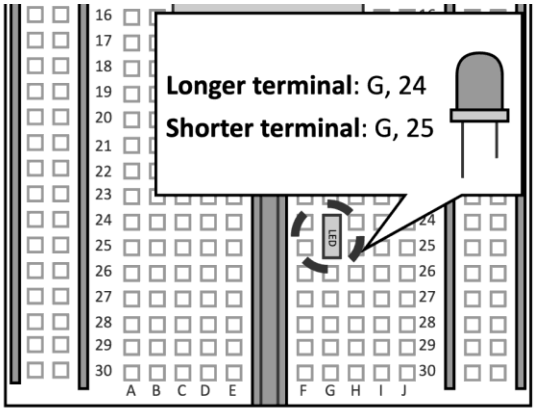

USB
Raspberry Pi
Pico


USB
3.3V
A
B
A: Row 2
B: "+"
Arduino
Nano
GND
A: Row 14
B: "-"

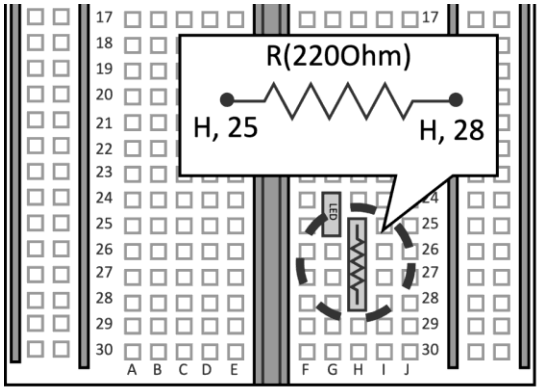

USB
3.3V
A: Row 5
B: "+"
Raspberry Pi
Pico
GND
A: Row 18
B: "-"



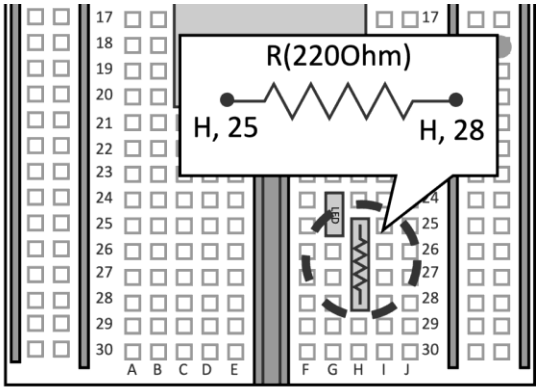
Arduino Nano



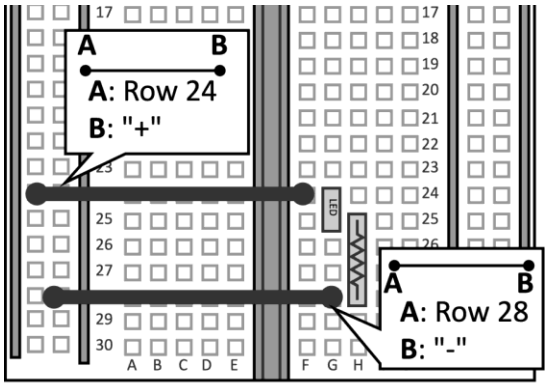
Raspberry Pi Pico



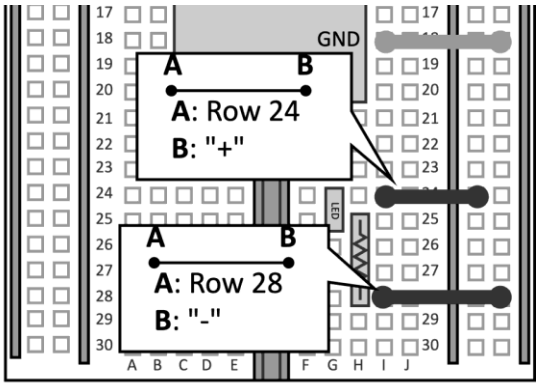
Arduino Nano



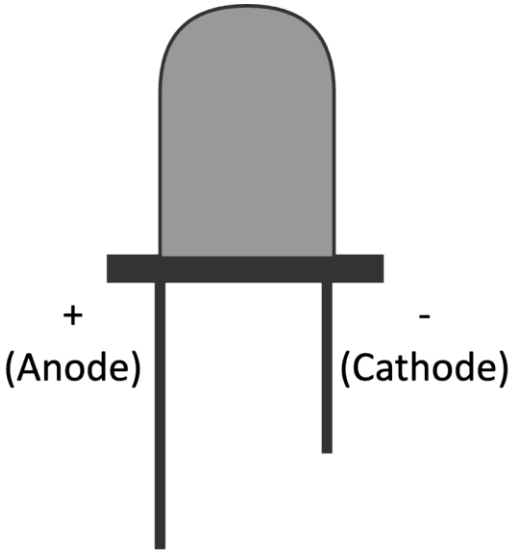
Raspberry Pi Pico



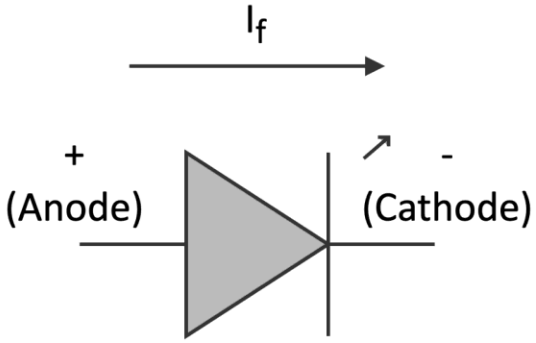
Arduino Nano



Raspberry Pi Pico

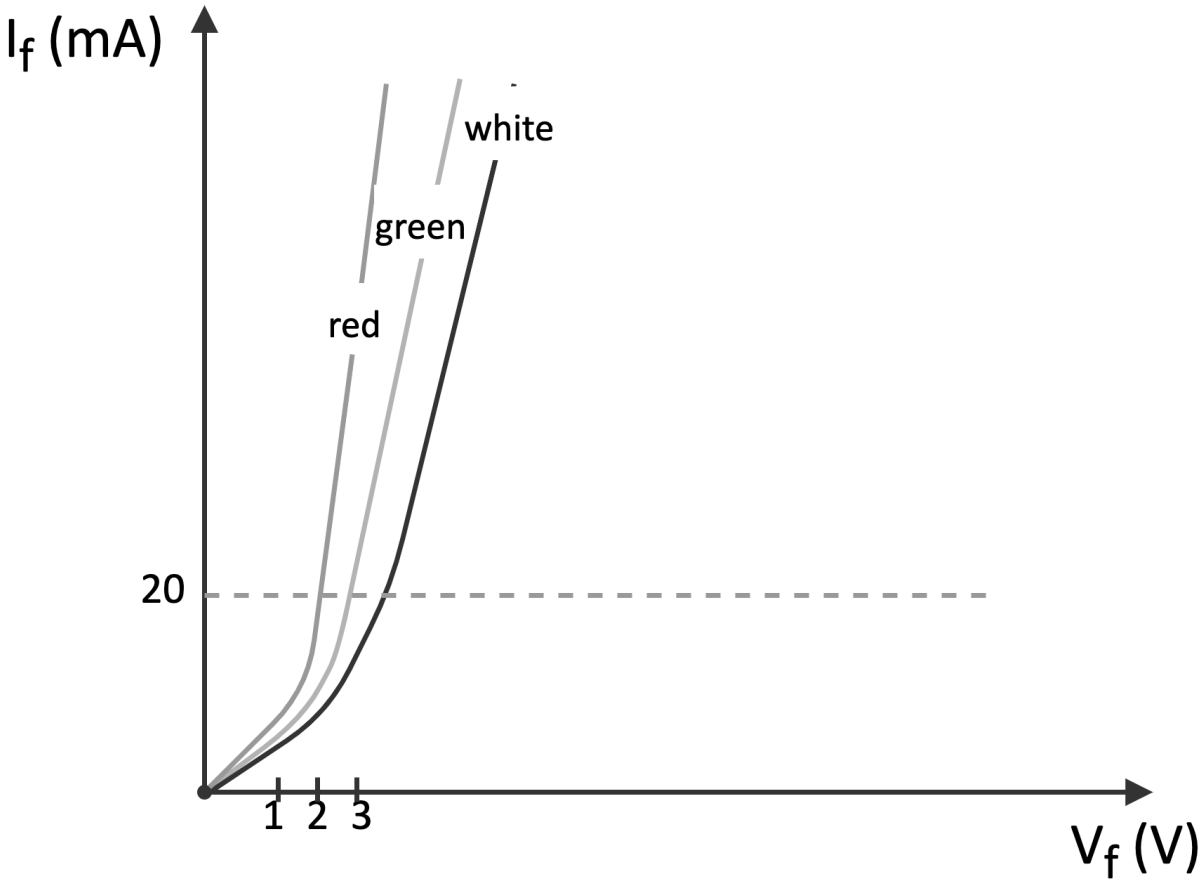


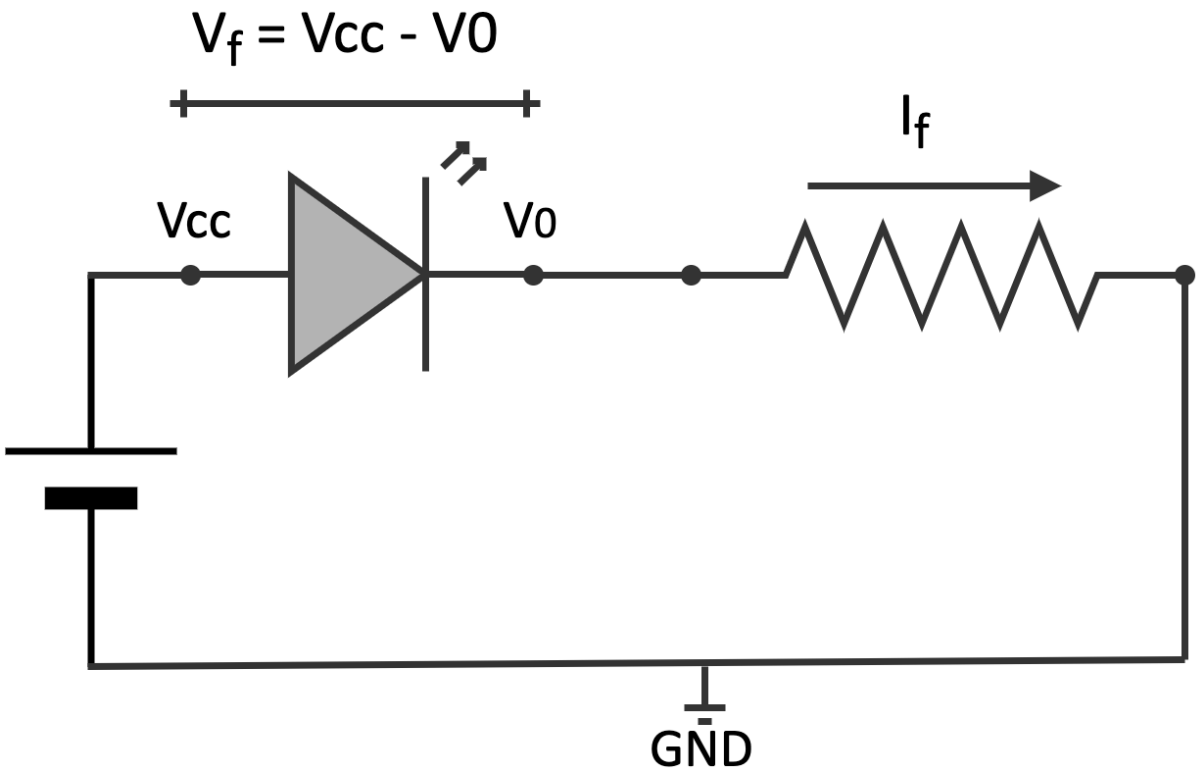
LED



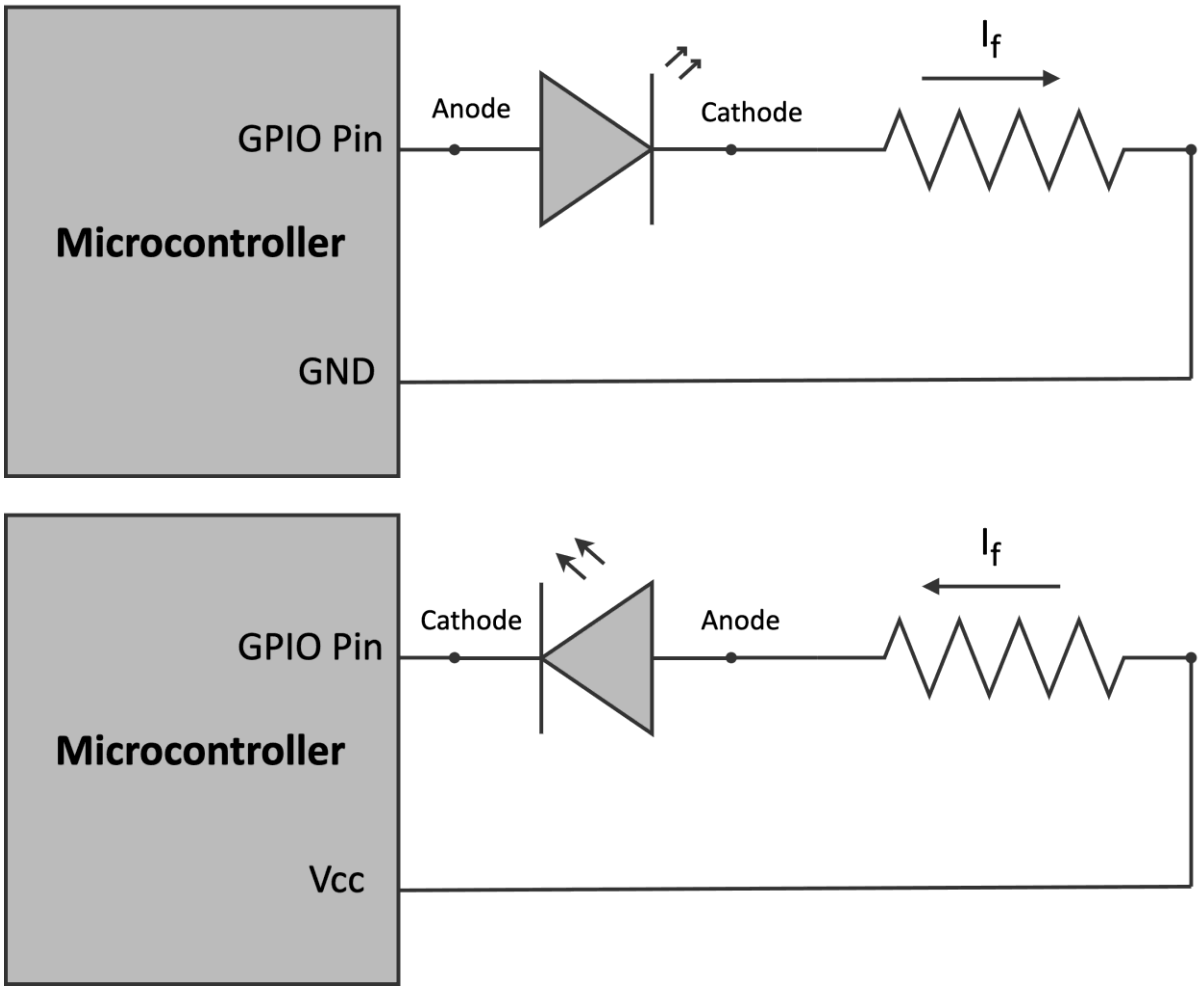
Symbol representation

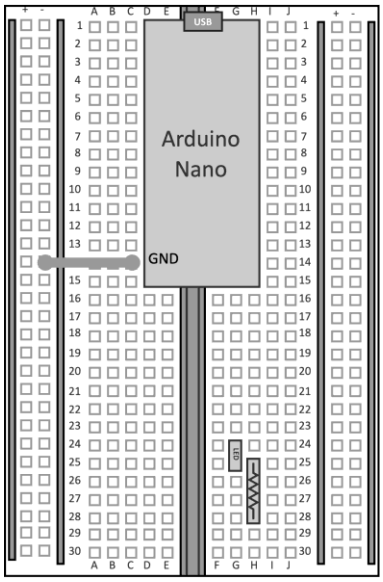
LED color	Forward voltage (V)
Red	1.8 – 2.1
Orange	1.9 - 2.2
Yellow	1.9 – 2.2
Green	2 – 3.1
Blue	3 – 3.7
White	3 – 3.4

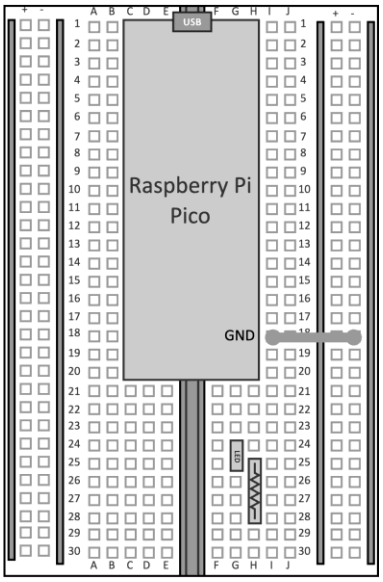

If (mA)
white
green
red
20
1 2 3
Vf (V)


Vf = Vcc - V0
If
Vcc
V0
GND

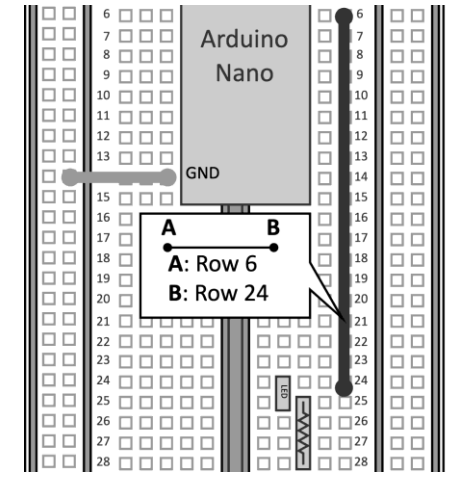
Logical level	Voltage (V)
1 or HIGH	Vcc, microcontroller supply voltage (e.g., 3.3 V, 5V)
0 or LOW	GND

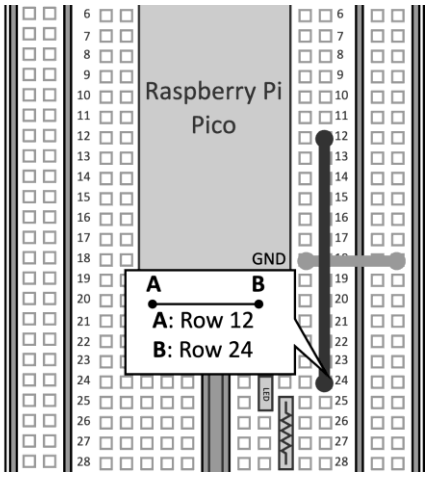


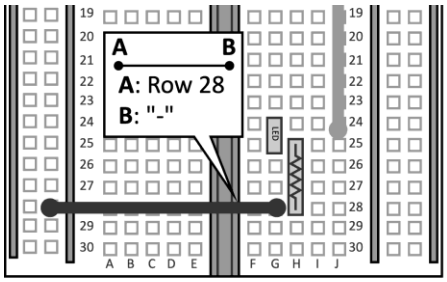




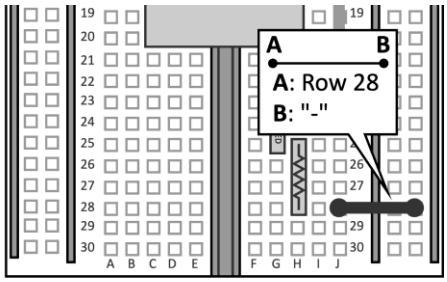
Platform	GPIO Pin
Arduino Nano	P0.23
Raspberry Pi Pico	GP22





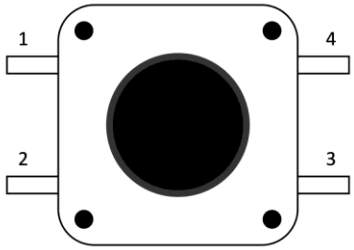


Arduino Nano

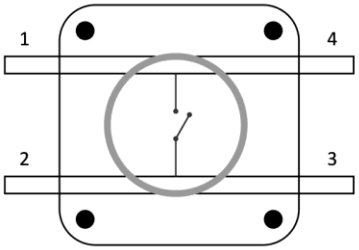


Raspberry Pi Pico

Platform	Max GPIO current (sourcing) – mA
Arduino Nano	12
Raspberry Pi Pico	10

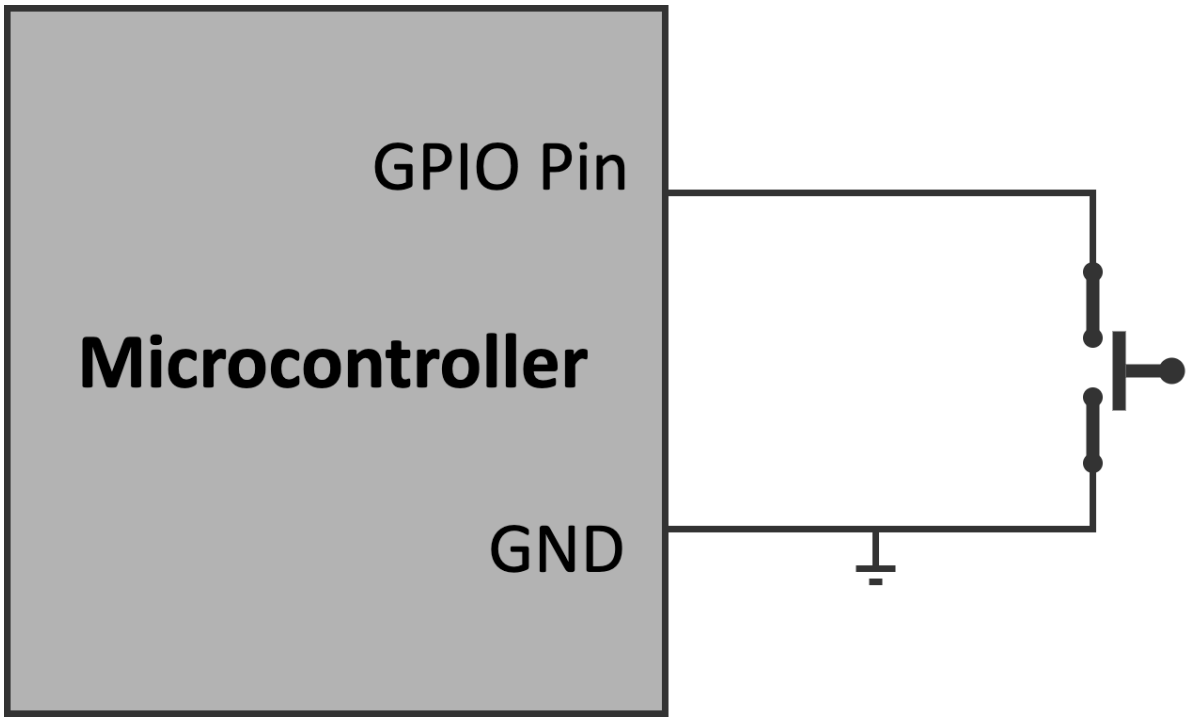


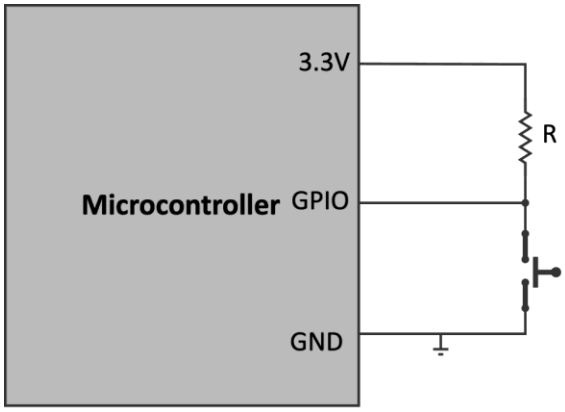
Push-button



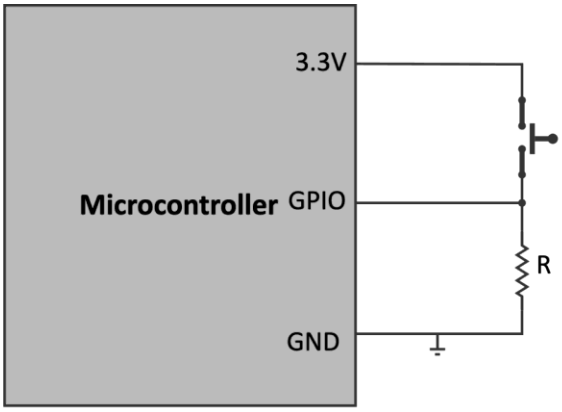
Push-button (internal)

Symbolic representation



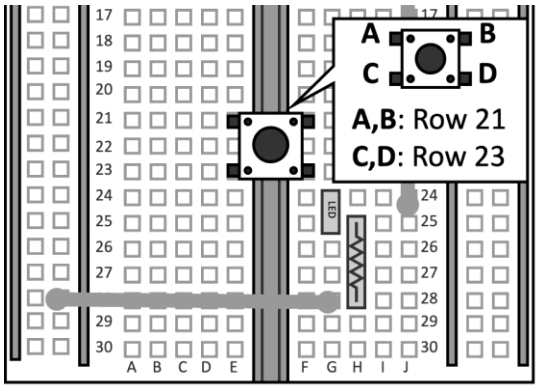


Pull-up

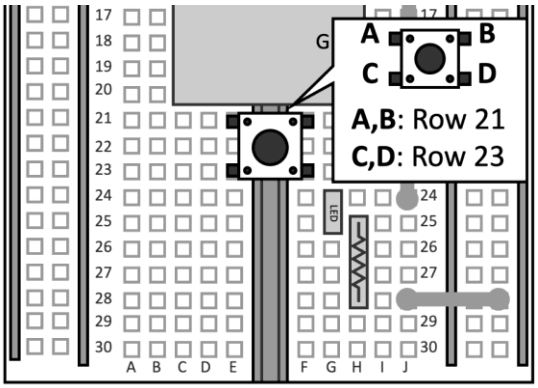


Pull-down

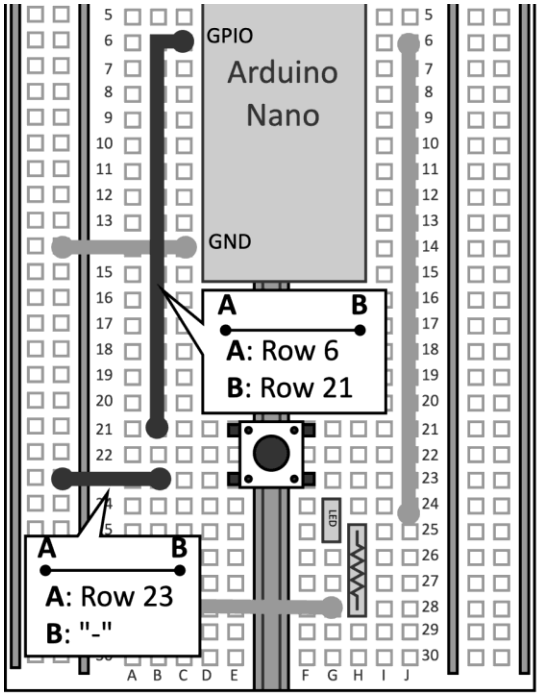
Platform	GPIO Pin INPUT
Arduino Nano	P0.30
Raspberry Pi Pico	GP10

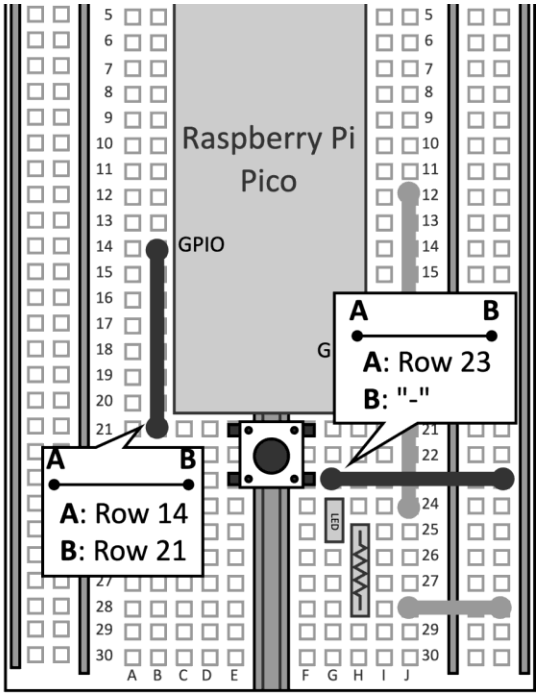


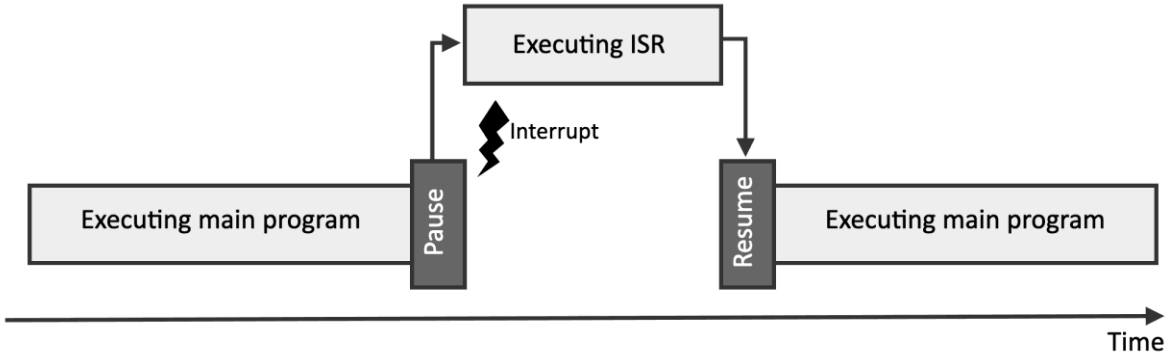
Arduino Nano

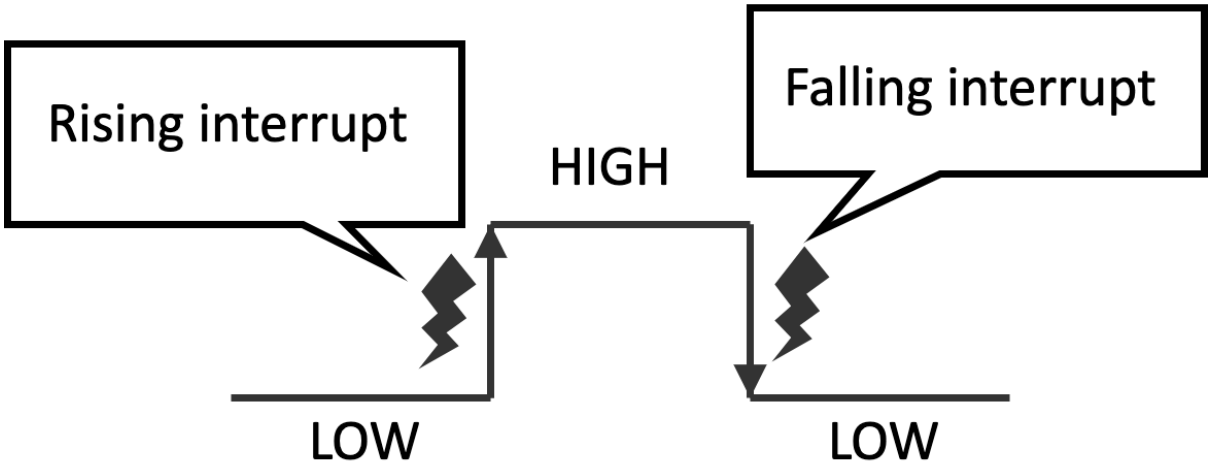


Raspberry Pi Pico

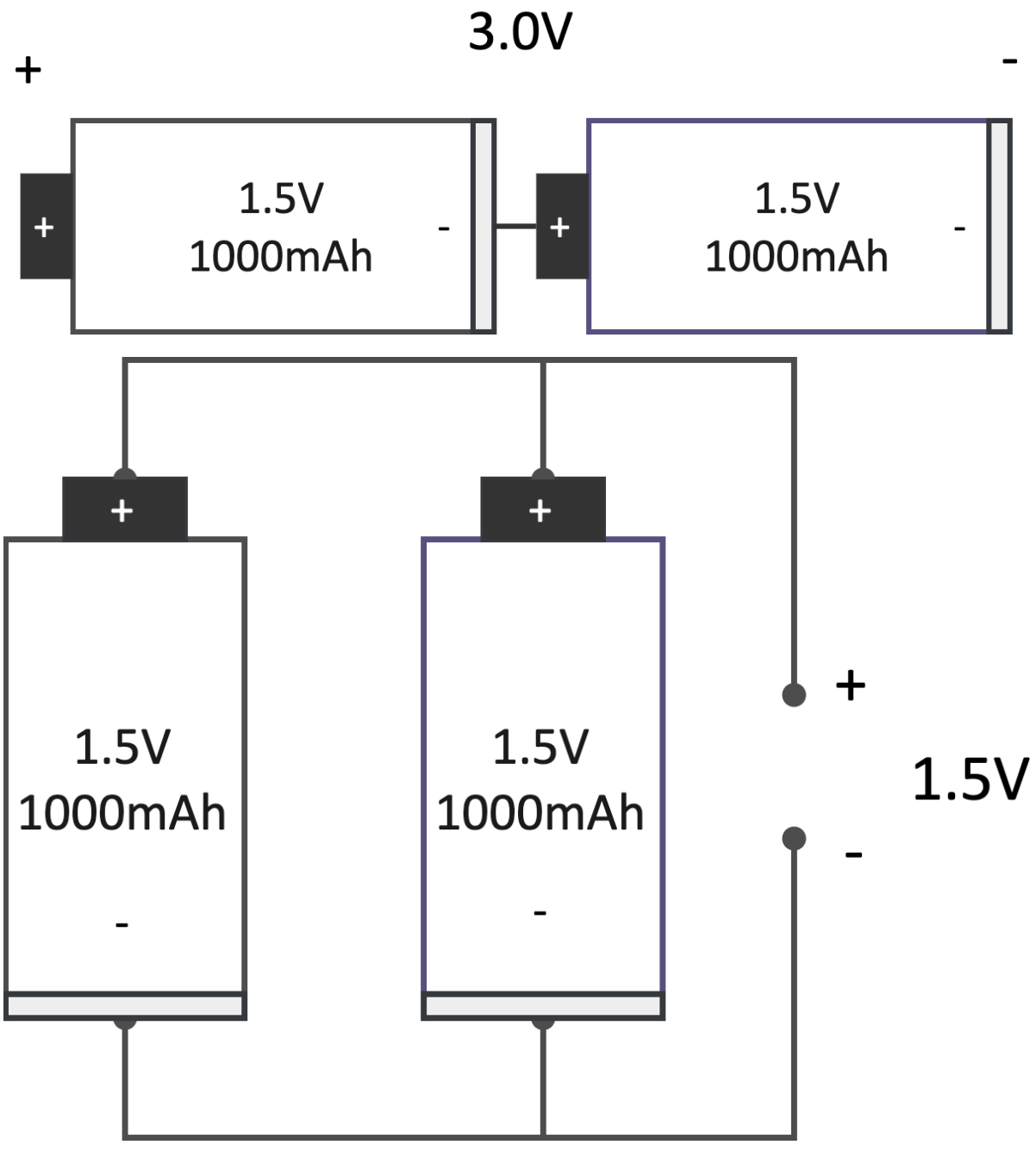

GPIO
Arduino
Nano
GND
A
B
A: Row 6
B: Row 21
A
B
A: Row 23
B: "-"

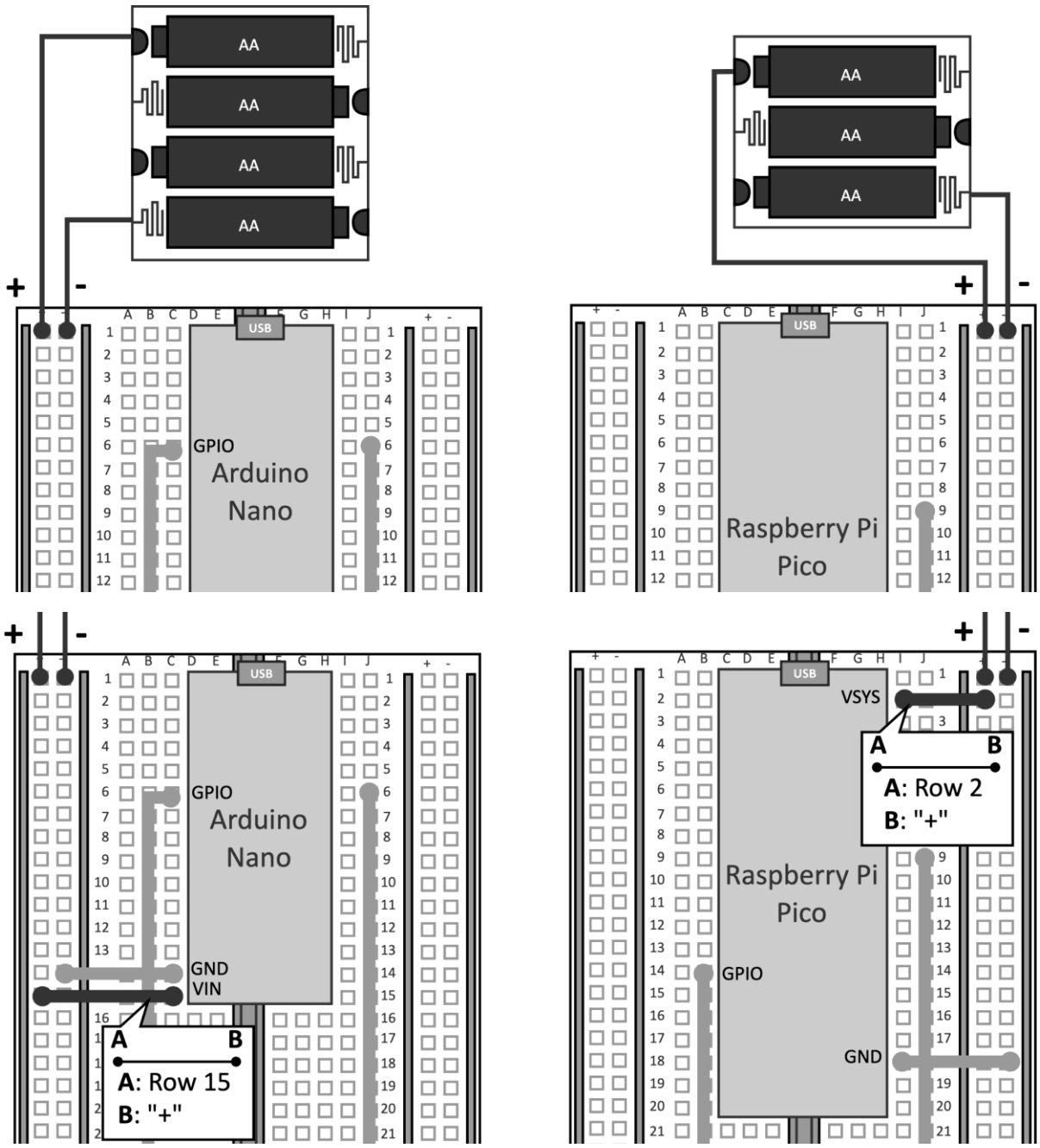

Raspberry Pi
Pico
GPIO
A
B
A: Row 23
B: "-"
A
B
A: Row 14
B: Row 21


Executing ISR
Interrupt
Executing main program
Pause
Resume
Executing main program
Time


Rising interrupt
Falling interrupt
HIGH
LOW
LOW

Battery type	Voltage (V)	Energy capacity (mAh)
AAA	1.5	~1000
AA	1.5	~2400 (Alkaline)
CR2032	3.6	~240
CR2016	3.6	~90

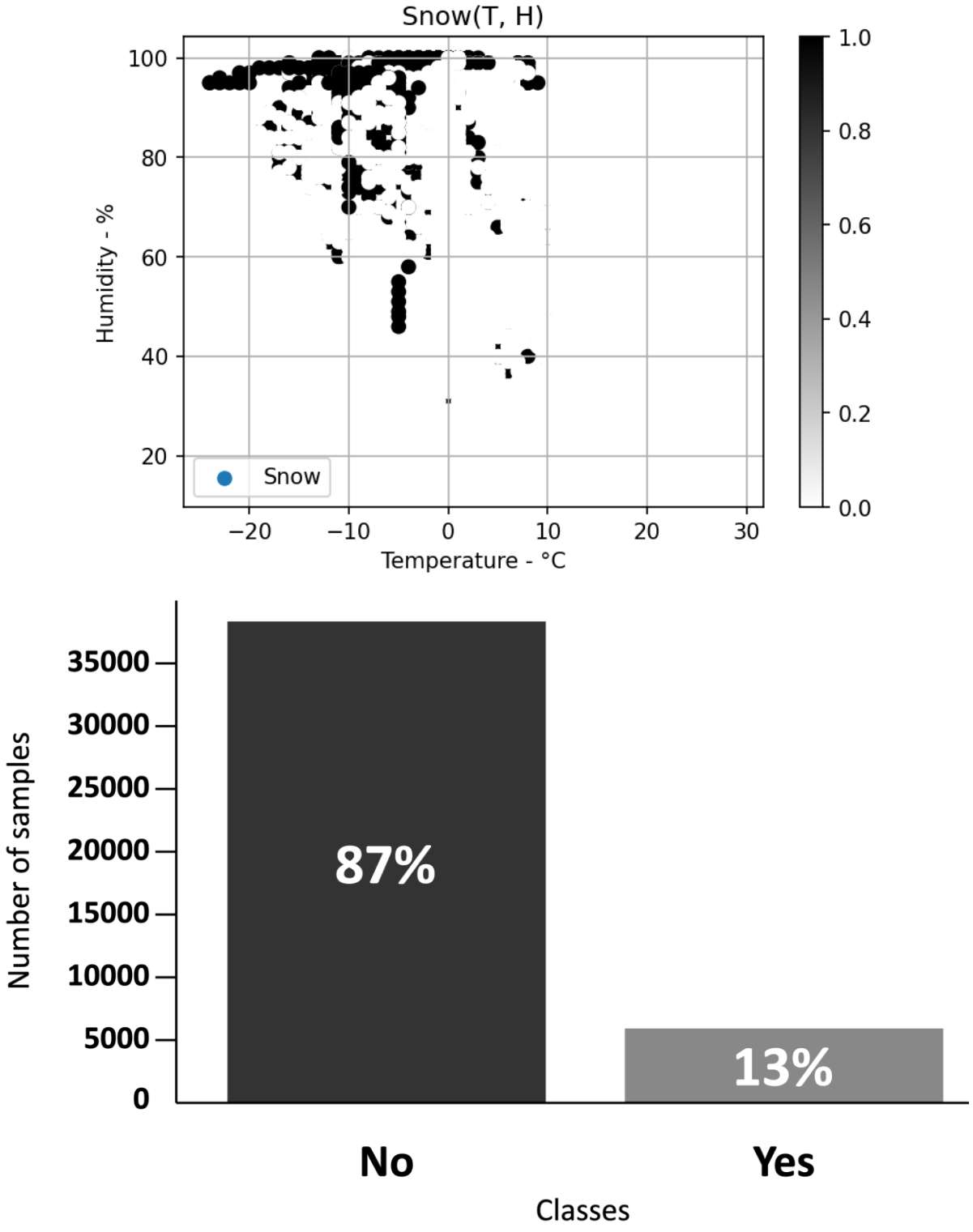




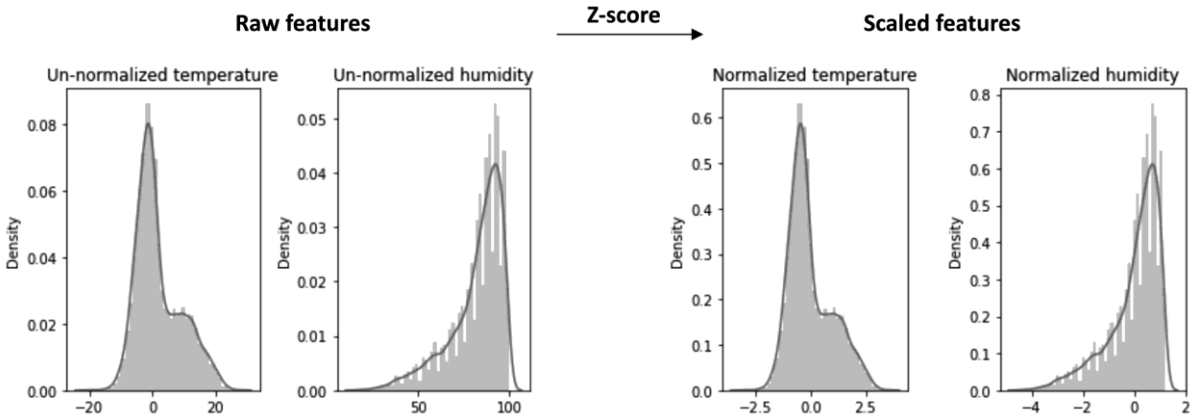
Quantity	Unit	Meaning
BL	Hours (h)	Battery life
BC	mAh	Battery capacity
IL	mA	Load current consumption required by the microcontroller

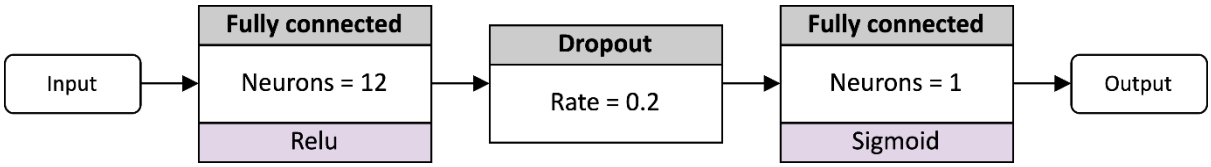
```
Battery life: 1600.0 hours, 66.66666666666667 days
```

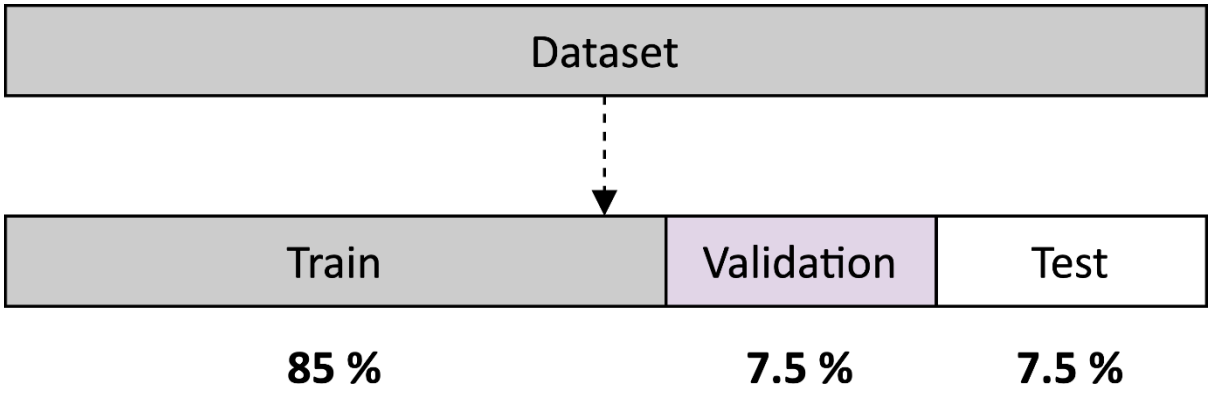
Chapter 3: Building a Weather Station with TensorFlow Lite for Microcontrollers



COPY ME!
Temperature - [MEAN, STD] 2.05179 7.33084
Humidity - [MEAN, STD] 82.30551 14.55707





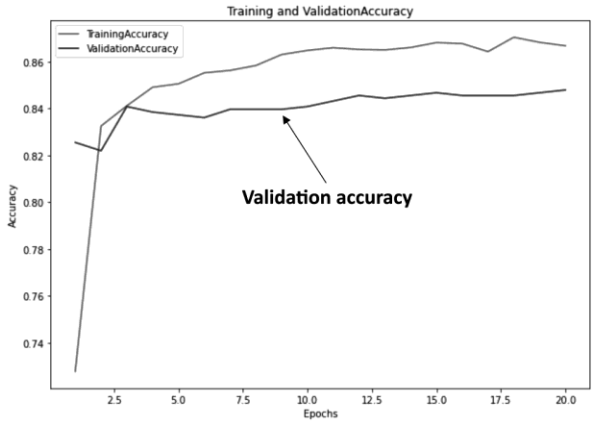


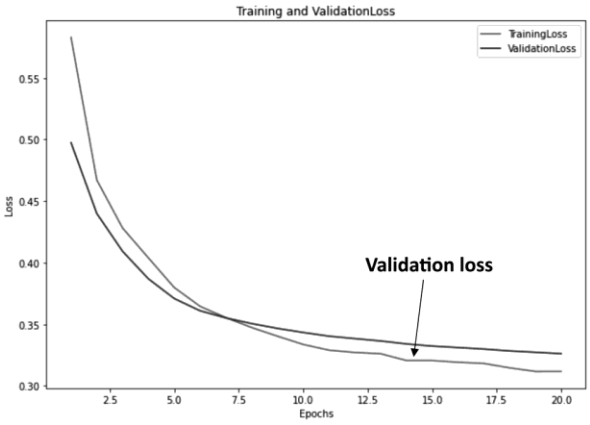
Model: "sequential"

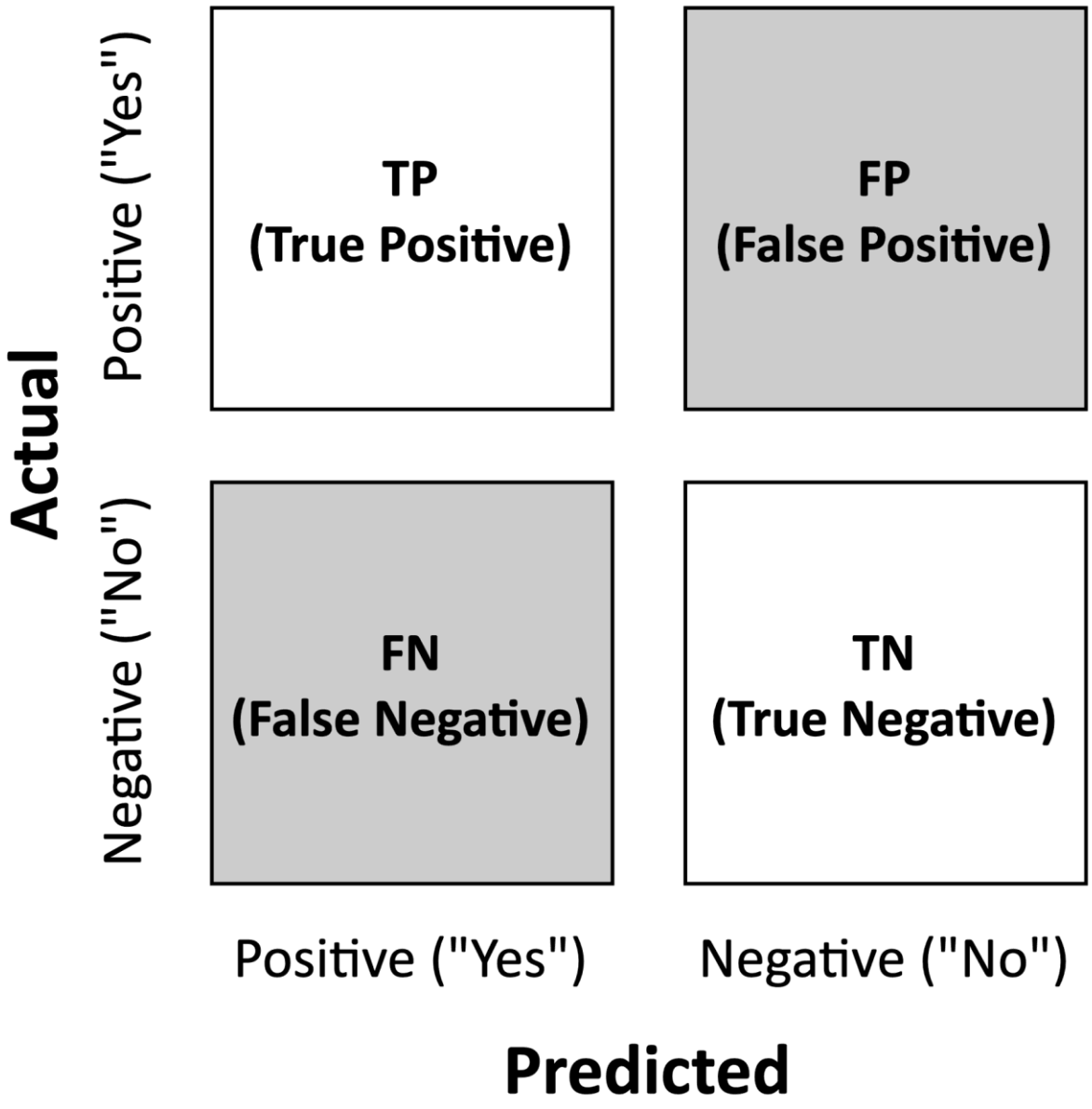
Layer (type)	Output Shape	Param #
dense (Dense)	(None, 12)	84
dropout (Dropout)	(None, 12)	0
dense_1 (Dense)	(None, 1)	13

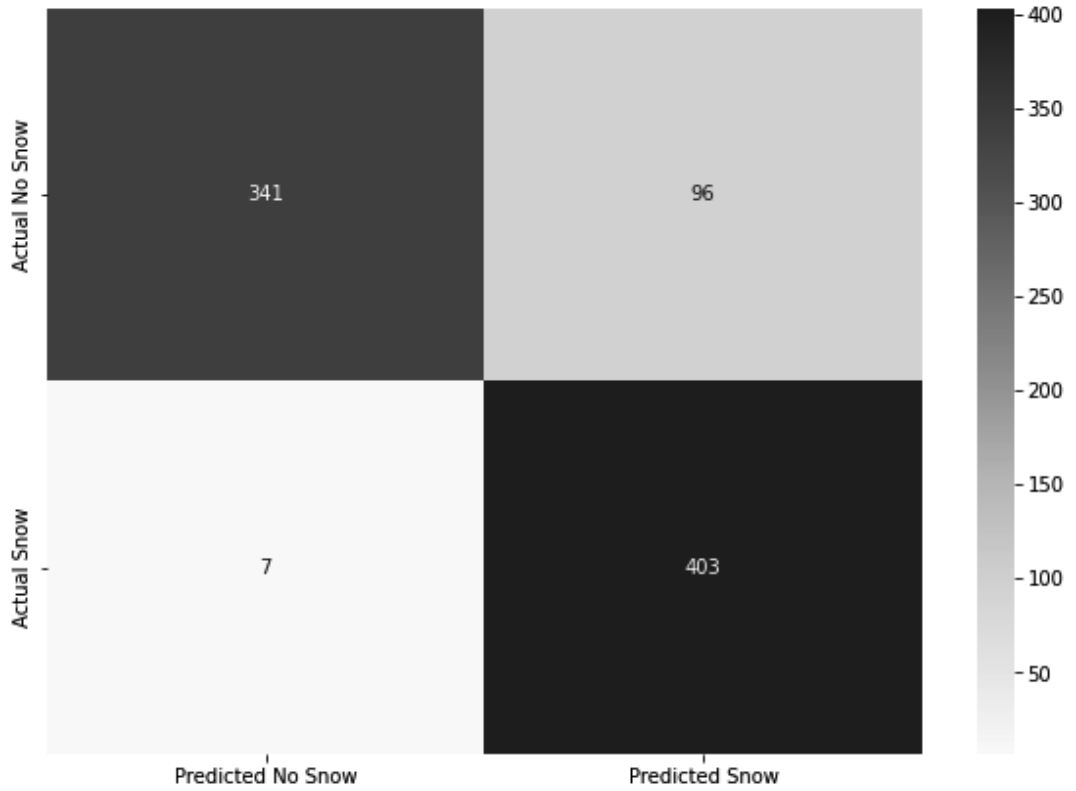
Total params: 97
Trainable params: 97
Non-trainable params: 0

loss: 0.3118 - accuracy: 0.8668 - val_loss: 0.3261 - val_accuracy: 0.8479

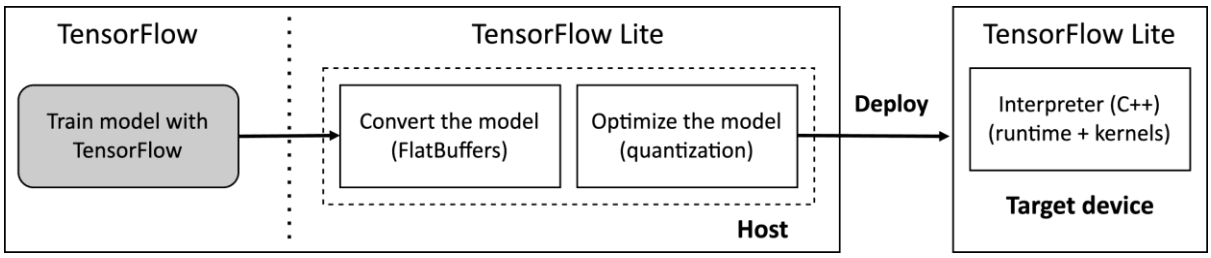

Training and ValidationAccuracy
TrainingAccuracy
ValidationAccuracy
Validation accuracy
Accuracy
Epochs

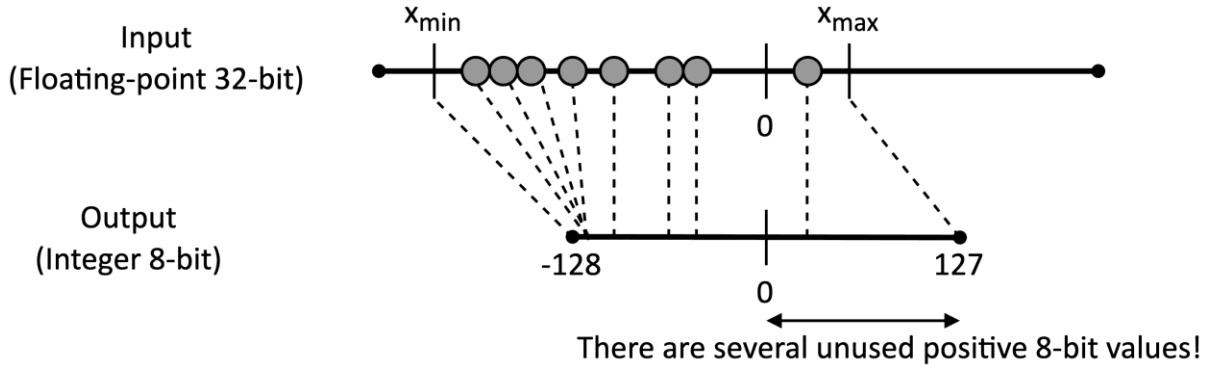

Training and ValidationLoss
TrainingLoss
ValidationLoss
Validation loss
Loss
Epochs

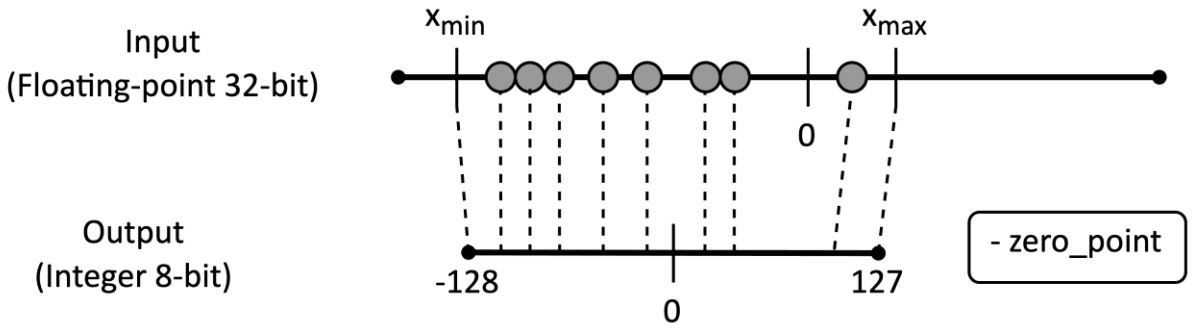

Actual
Positive ("Yes")
Negative ("No")
TP
(True Positive)
FP
(False Positive)
FN
(False Negative)
TN
(True Negative)
Positive ("Yes")
Negative ("No")
Predicted

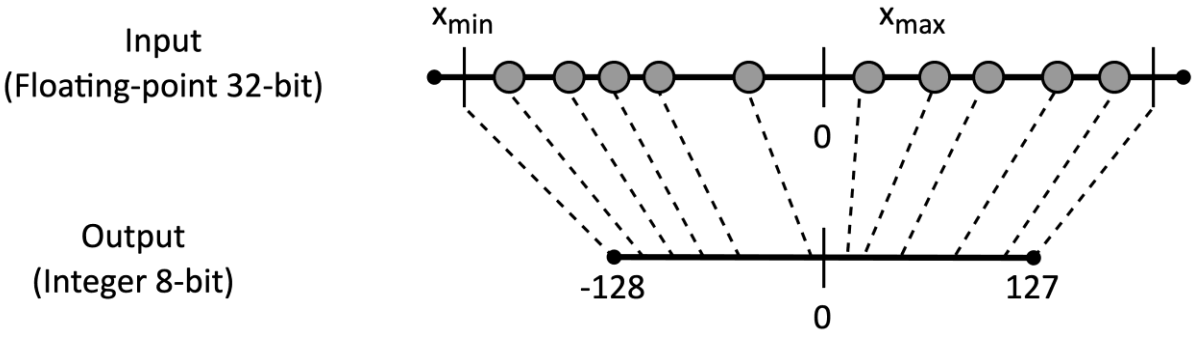


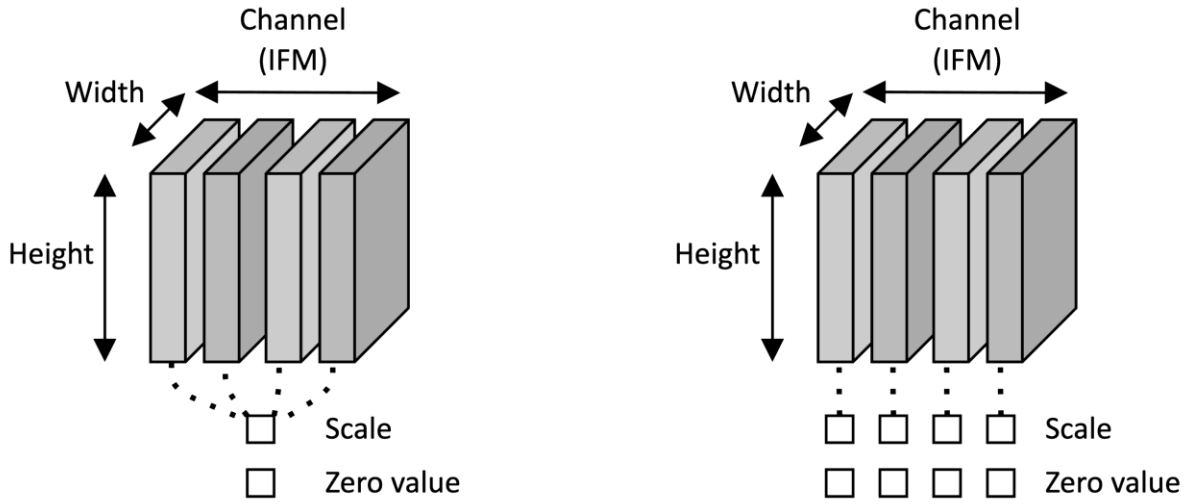
Recall: 0.983
Precision: 0.808
F-score: 0.887





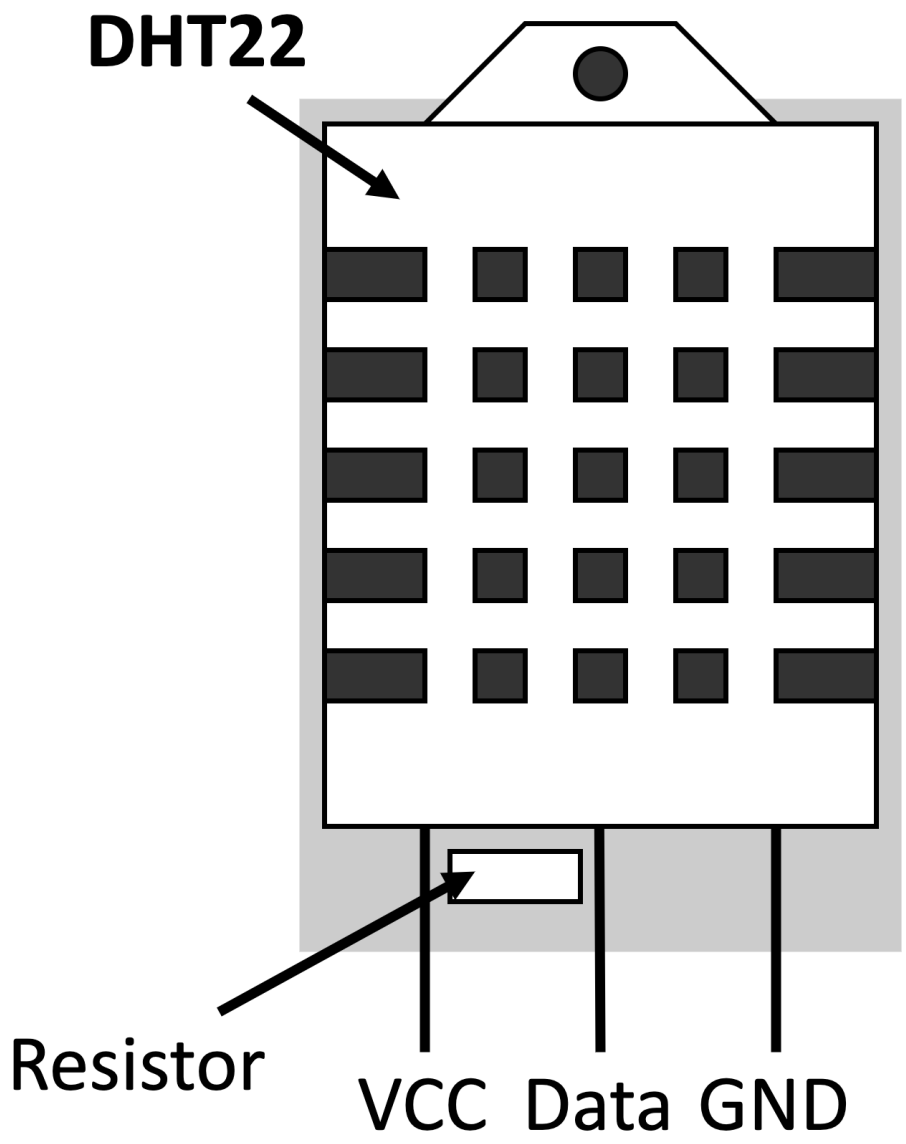




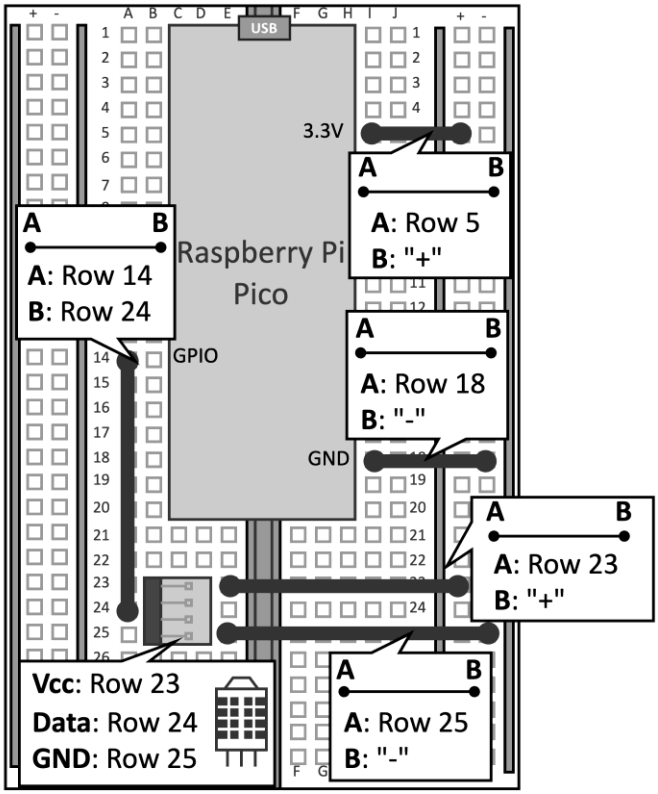


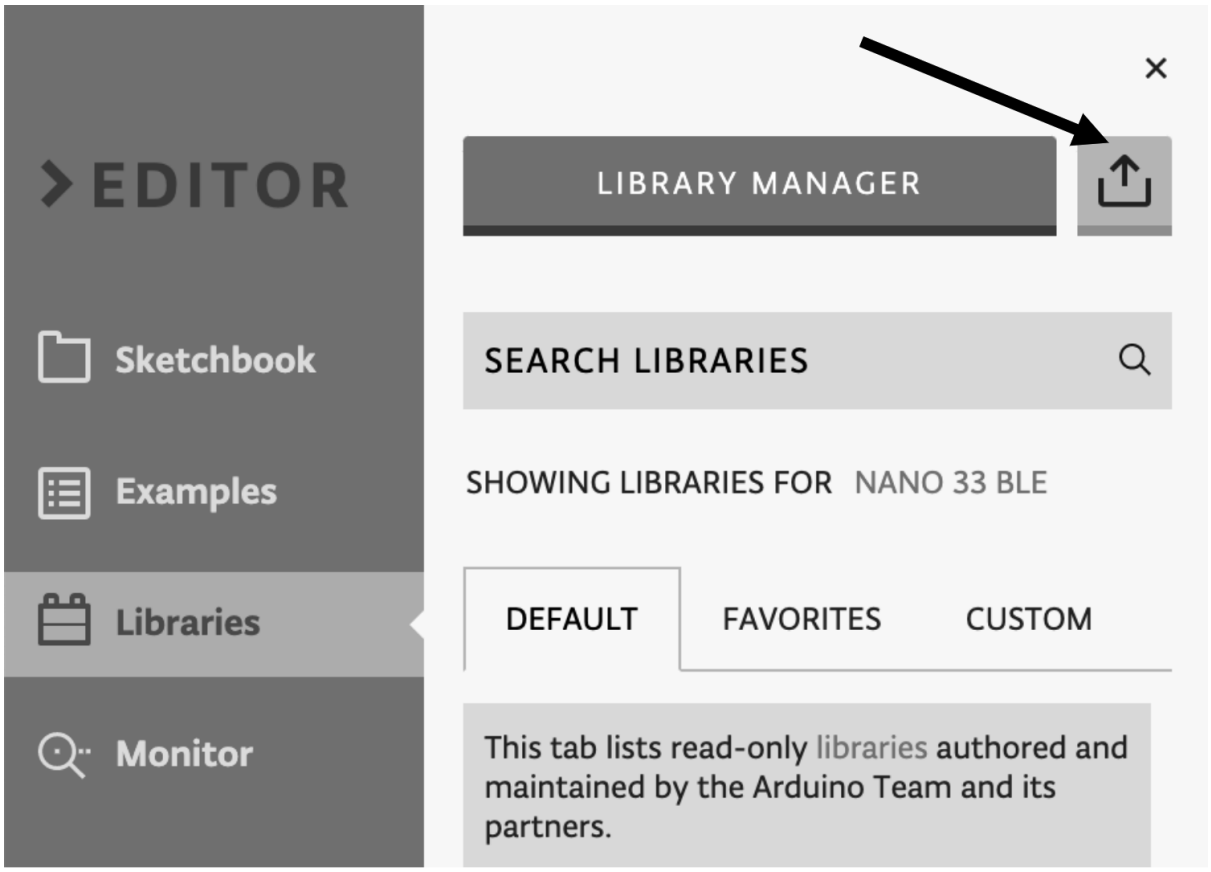
Per-tensor quantization Per-channel quantization

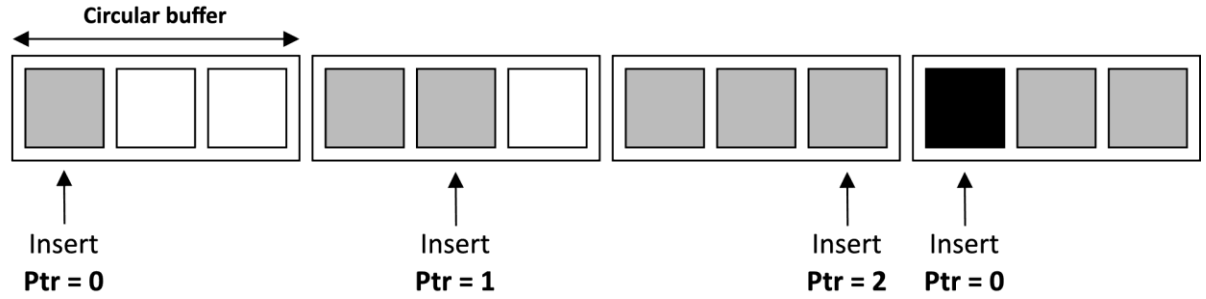
Relative humidity range	0 – 100 %
Temperature range	-40°C - 120°C
Humidity accuracy	± 3.5 %
Temperature accuracy	± 0.5°C
Current consumption	2uA at 1Hz Output Data Rate (ODR)

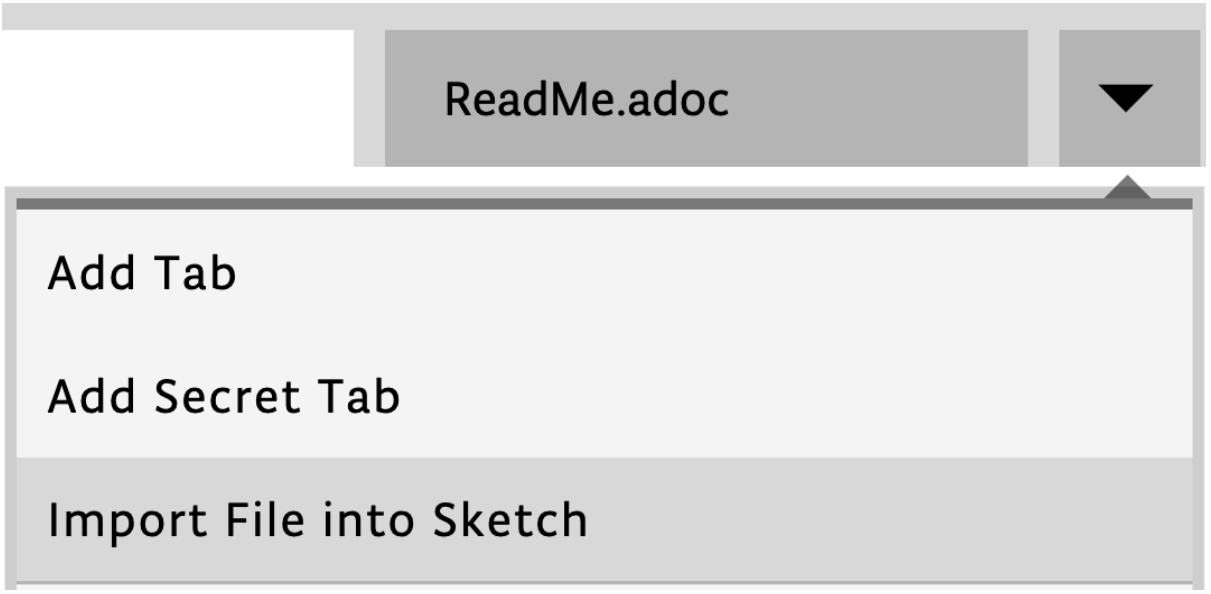


Relative humidity range	0 – 100 %
Temperature range	-40°C - 80°C
Humidity accuracy	2-5%
Temperature accuracy	± 0.5°C
Current consumption	2.5mA max when requesting data

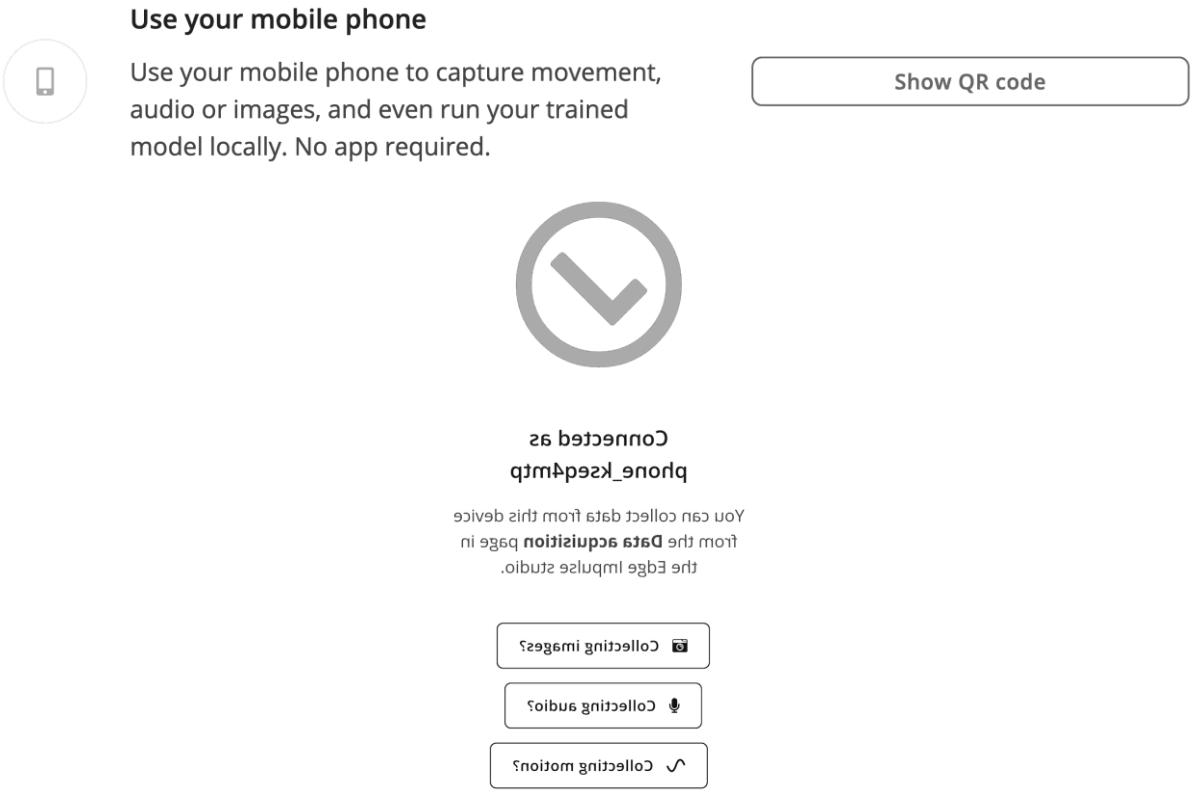

USB
3.3V
A: Row 5
B: "+"
A: Row 14
B: Row 24
Raspberry Pi
Pico
GPIO
A: Row 18
B: "-"
GND
A: Row 23
B: "+"
Vcc: Row 23
Data: Row 24
GND: Row 25
A: Row 25
B: "-"


EDITOR
Sketchbook
Examples
Libraries
Monitor
LIBRARY MANAGER
SEARCH LIBRARIES
SHOWING LIBRARIES FOR NANO 33 BLE
DEFAULT
FAVORITES
CUSTOM
This tab lists read-only libraries authored and maintained by the Arduino Team and its partners.

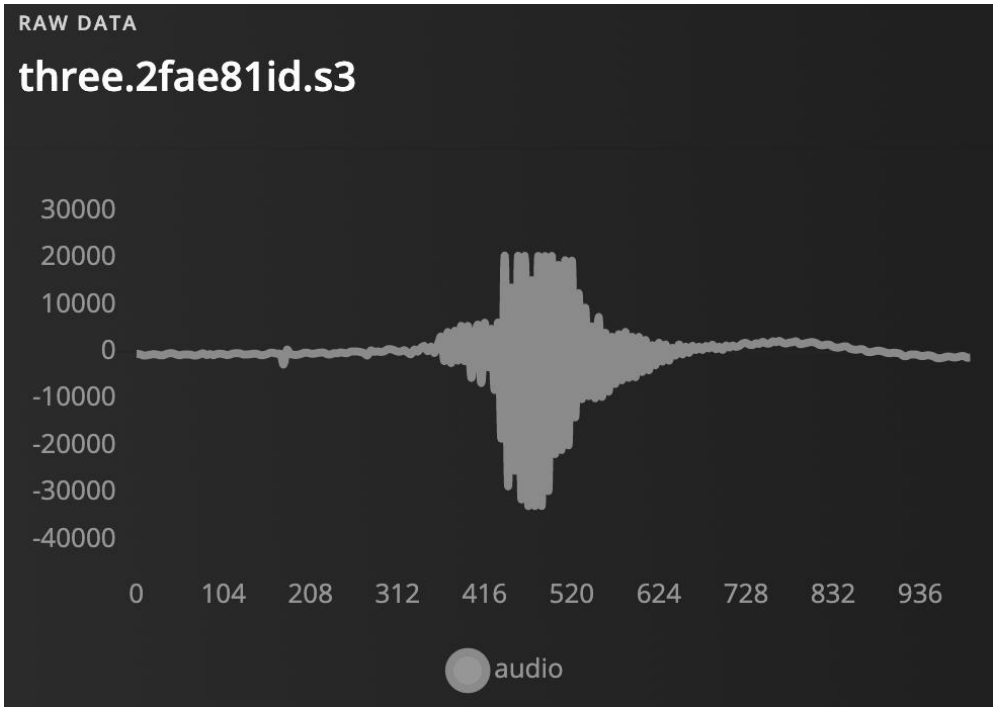

Circular buffer
Insert
Ptr = 0
Insert
Ptr = 1
Insert
Ptr = 2
Insert
Ptr = 0

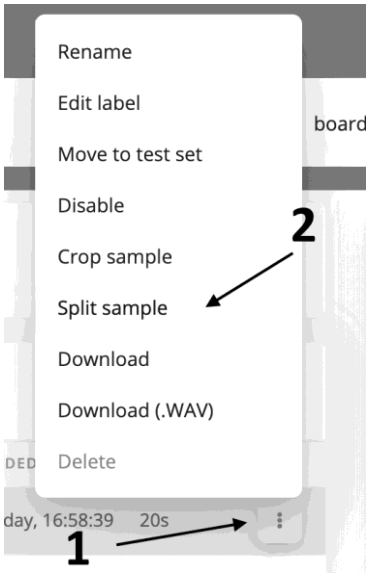

ReadMe.adoc
Add Tab
Add Secret Tab
Import File into Sketch

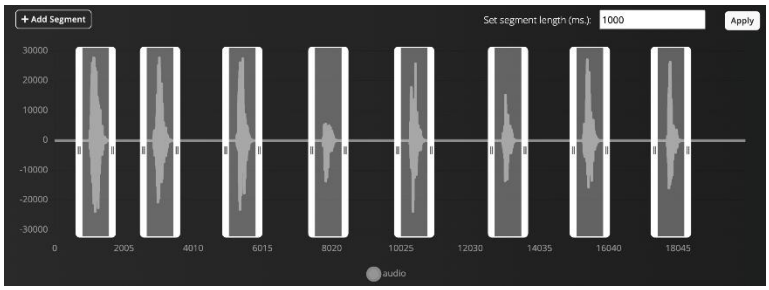
Chapter 4: Voice Controlling LEDs with Edge Impulse

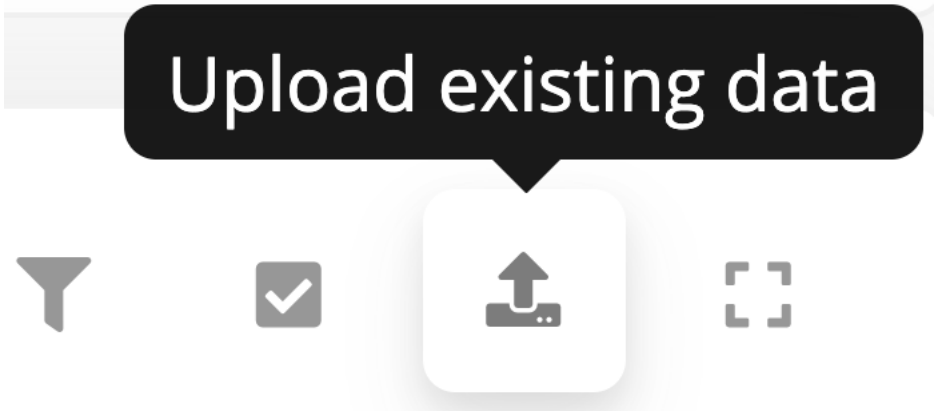


Class	Red	Green	Blue	One	Two	Three
Label	00_red	01_green	02_blue	03_one	04_two	05_three



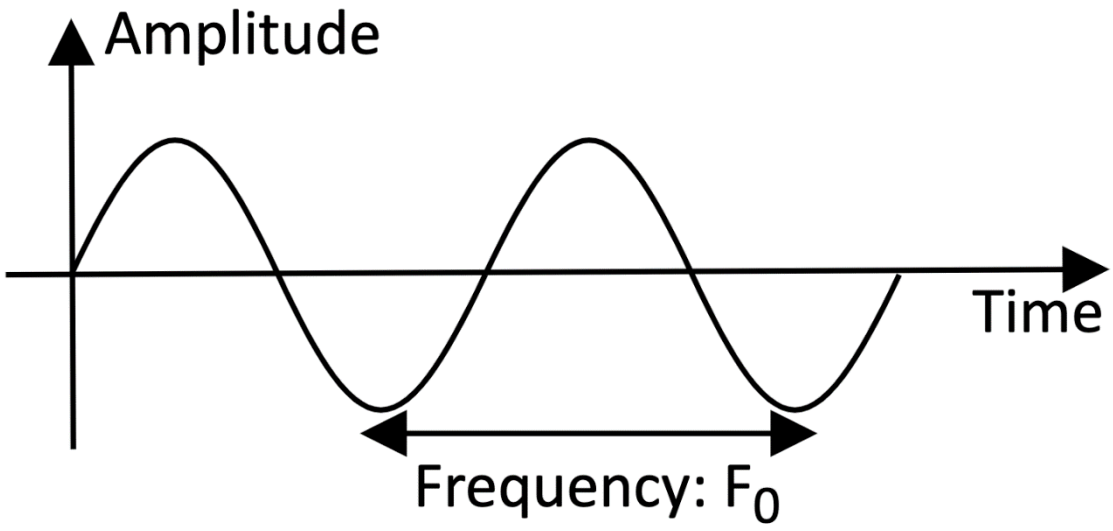


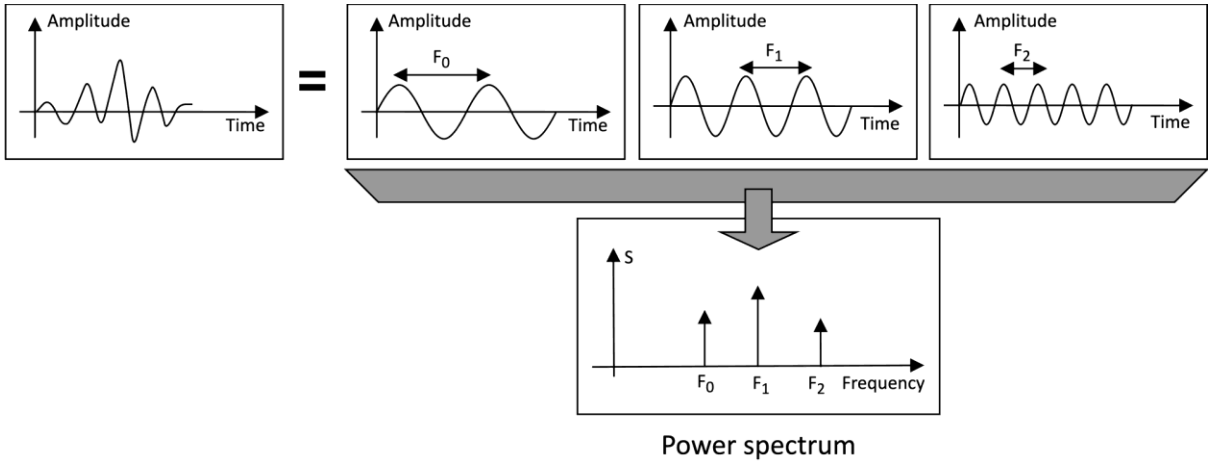


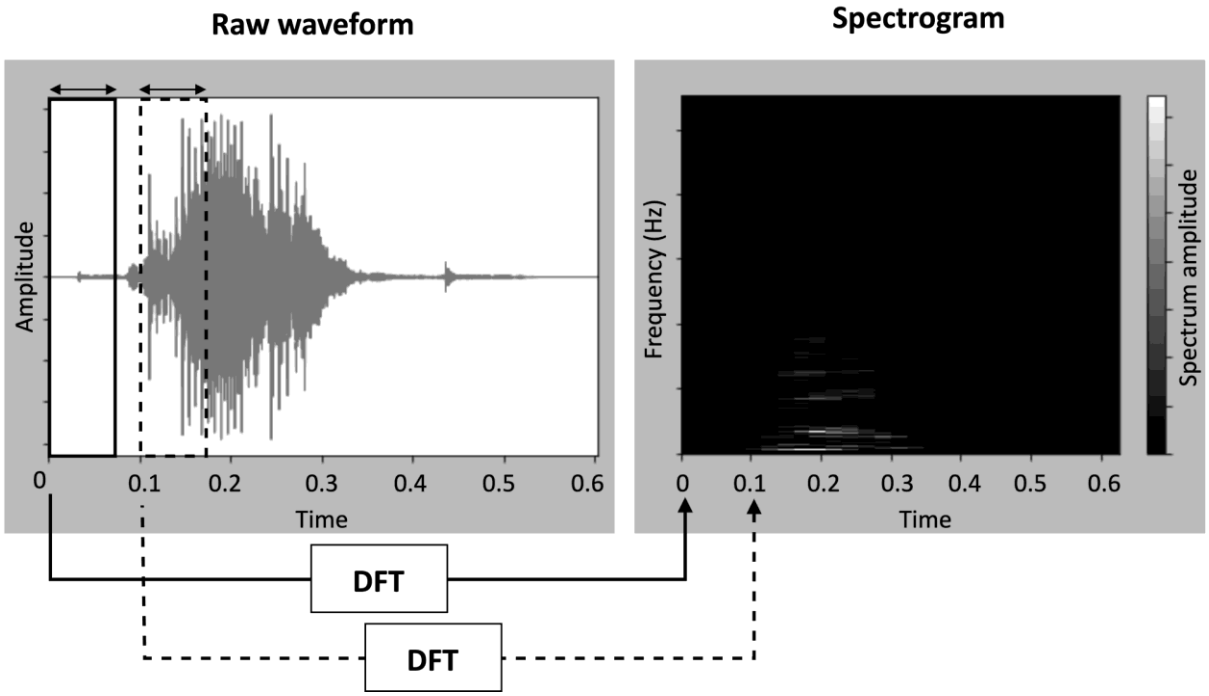


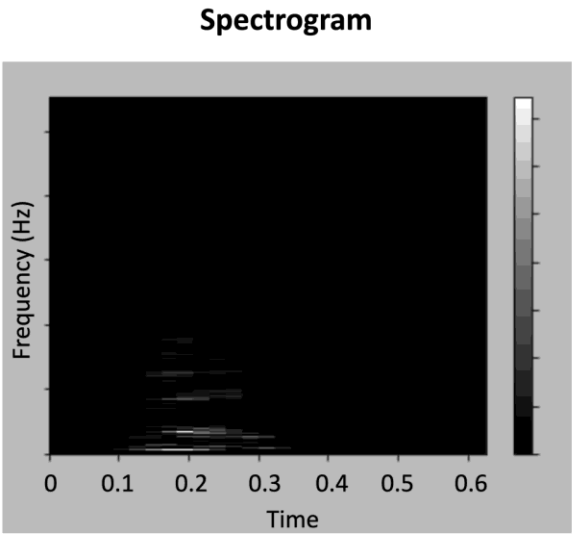
Danger zone

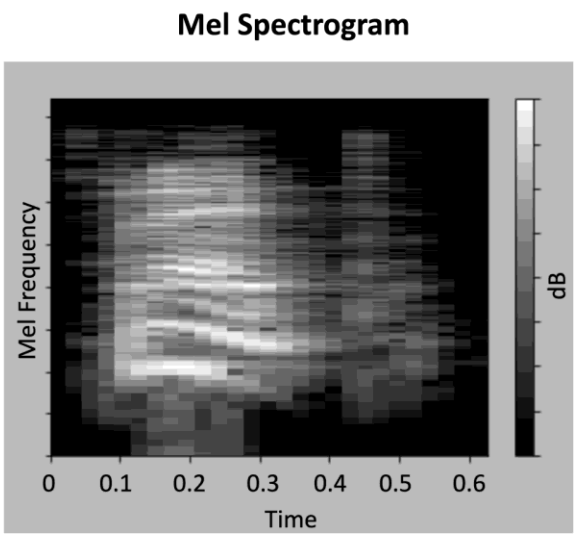
Perform train / test split


Amplitude
Time
Frequency: F_0


Amplitude
Time
=
Amplitude
F_0
Time
Amplitude
F_1
Time
Amplitude
F_2
Time
S
F_0
F_1
F_2
Frequency
Power spectrum


Raw waveform
Spectrogram
Amplitude
0
0.1
0.2
0.3
0.4
0.5
0.6
Time
Frequency (Hz)
Spectrum amplitude
DFT
DFT

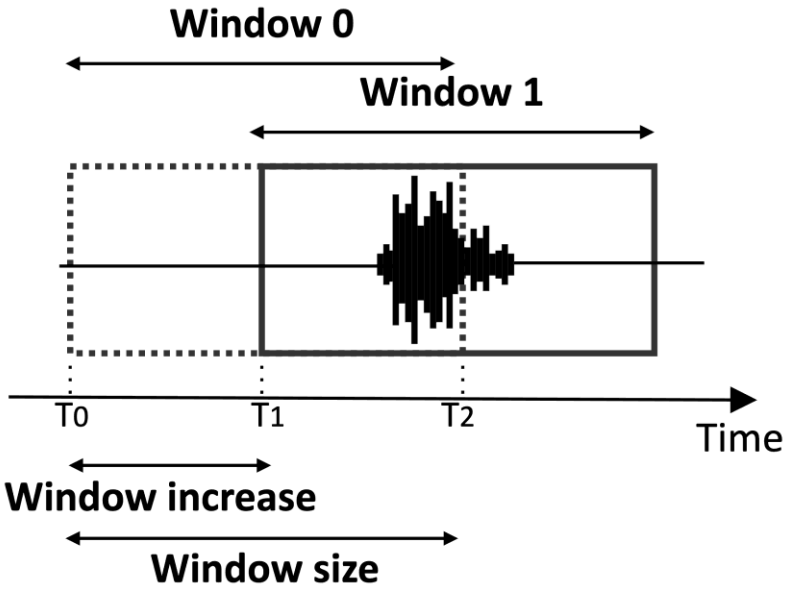




Data acquisition

Impulse design

Create impulse

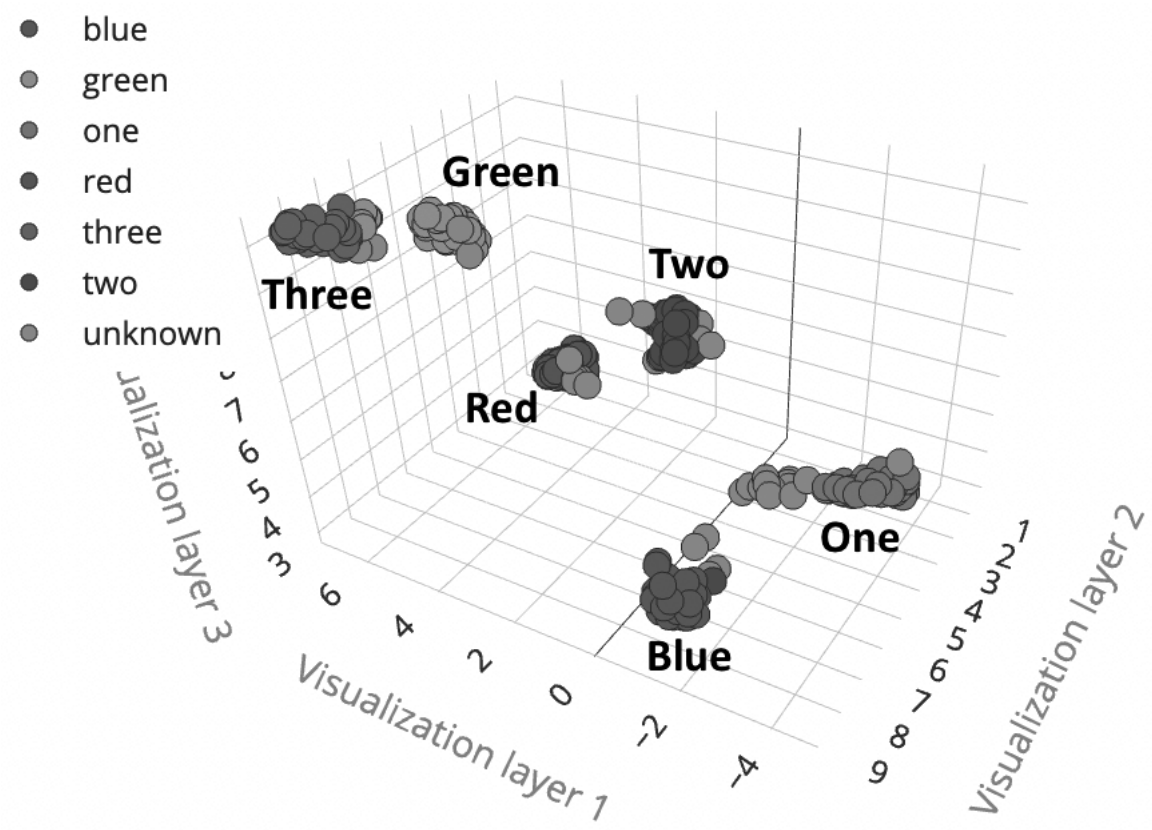


Output features

7 (00_red, 01_green, 02_blue, 03_one, 04_two, 05_three, unknown)

Save Impulse

Parameters **Generate features**



On-device performance

PROCESSING TIME
292 ms.

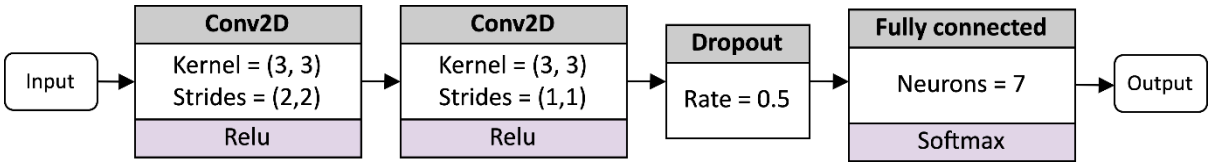
PEAK RAM USAGE
17 KB

Project info

Project ID

Labeling method — One label per d

Latency calculations — Arduino Nano 3



2D conv / pool layer (8 filters, 3 kernel size, 1 layer)

Dropout (rate 0.5)

Delete layer

2D conv / pool layer (16 filters, 3 kernel size, 1 layer)

```
    =(input_length, )))
14  model.add(Conv2D(8, kernel_size=3, activation='relu',
        kernel_constraint=tf.keras.constraints.MaxNorm(1),
        padding='same'))
15  model.add(MaxPooling2D(pool_size=2, strides=2, padding
        ='same'))
16  model.add(Dropout(0.5))
17  model.add(Conv2D(16, kernel_size=3, activation='relu',
        kernel_constraint=tf.keras.constraints.MaxNorm(1),
        padding='same'))
18  model.add(MaxPooling2D(pool_size=2, strides=2, padding
        ='same'))
19  model.add(Dropout(0.5))
20  model.add(Flatten())
```

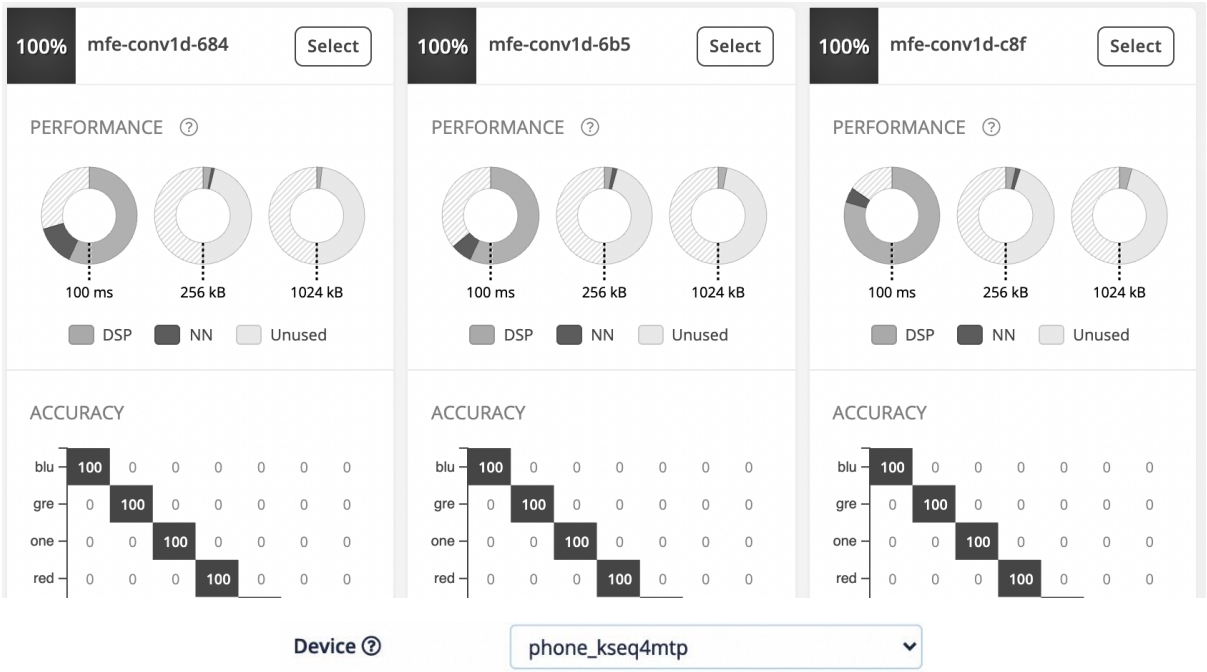
Delete

Delete

Output layer (7 classes)

Start training

Target

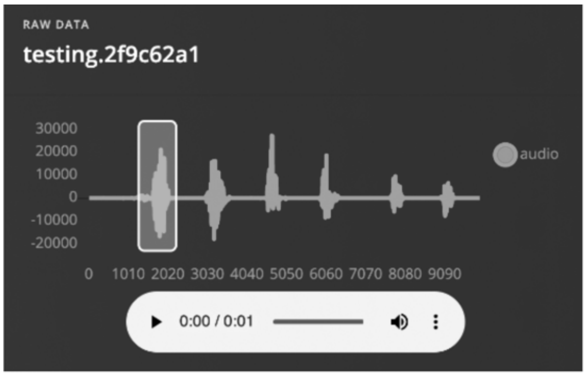


Device

phone_kseq4mtp

CATEGORY	COUNT
blue	1
green	1
one	1
red	2
three	1
two	1
unknown	29
uncertain	1

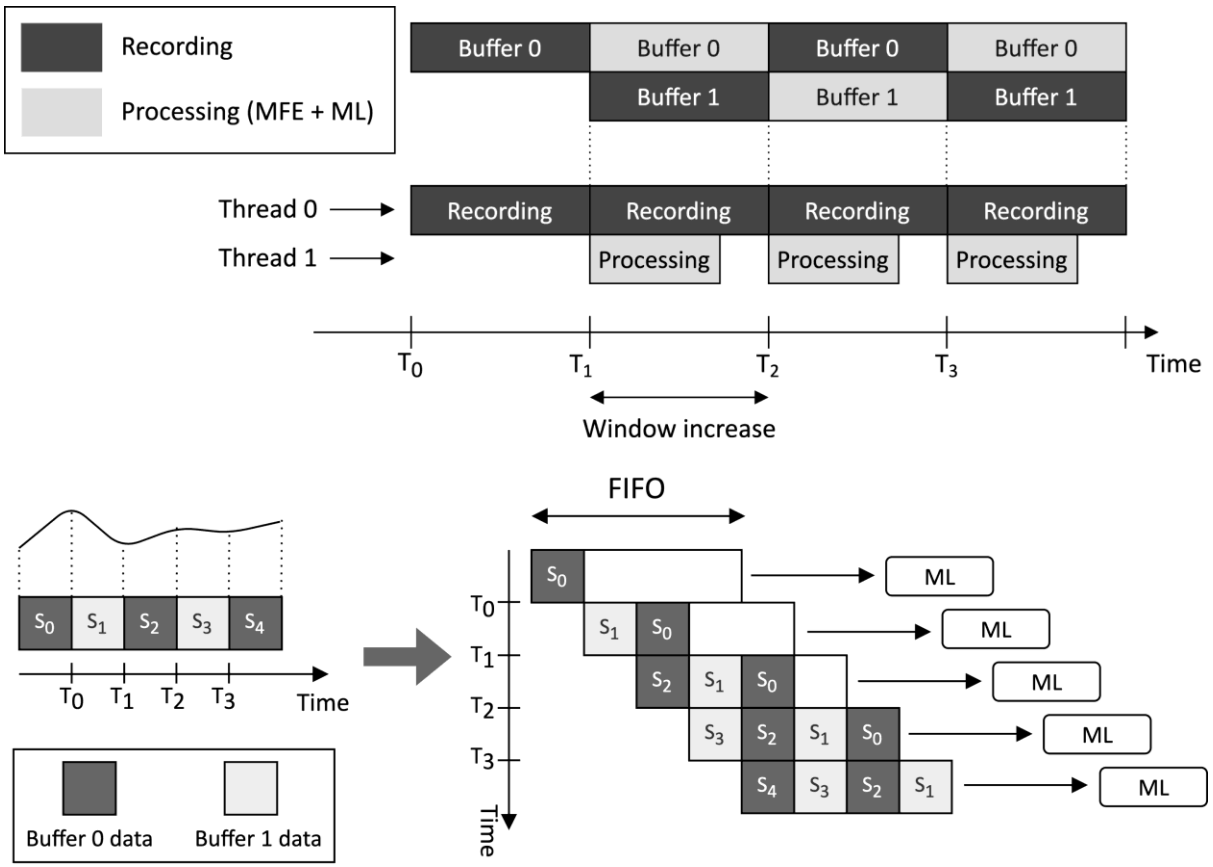
TIMESTAMP	BLUE	GREEN	ONE	RED	THREE	TWO	UNKNOWN
1000	0	0	0	0	0	0	1.00
1250	0.94	0	0.05	0	0	0	0
1500	0.02	0	0	0	0	0	0.98
1750	0	0	0	0	0	0	1.00
2000	0	0	0	0	0	0	1.00



Your devices

These are devices that are connected to the Edge Impulse remote management API, or have posted data to the inge

NAME	ID	TYPE	SENSORS
phone_kseq4mtp		MOBILE_CLIENT	Accelerometer, Microp...
personal		ARDUINO_NANO33...	Built-in accelerometer, ...



Deploy your impulse

You can deploy your impulse to any device. This makes the model run without an internet connection, minimizes latency, and runs with minimal power consumption. Read more.

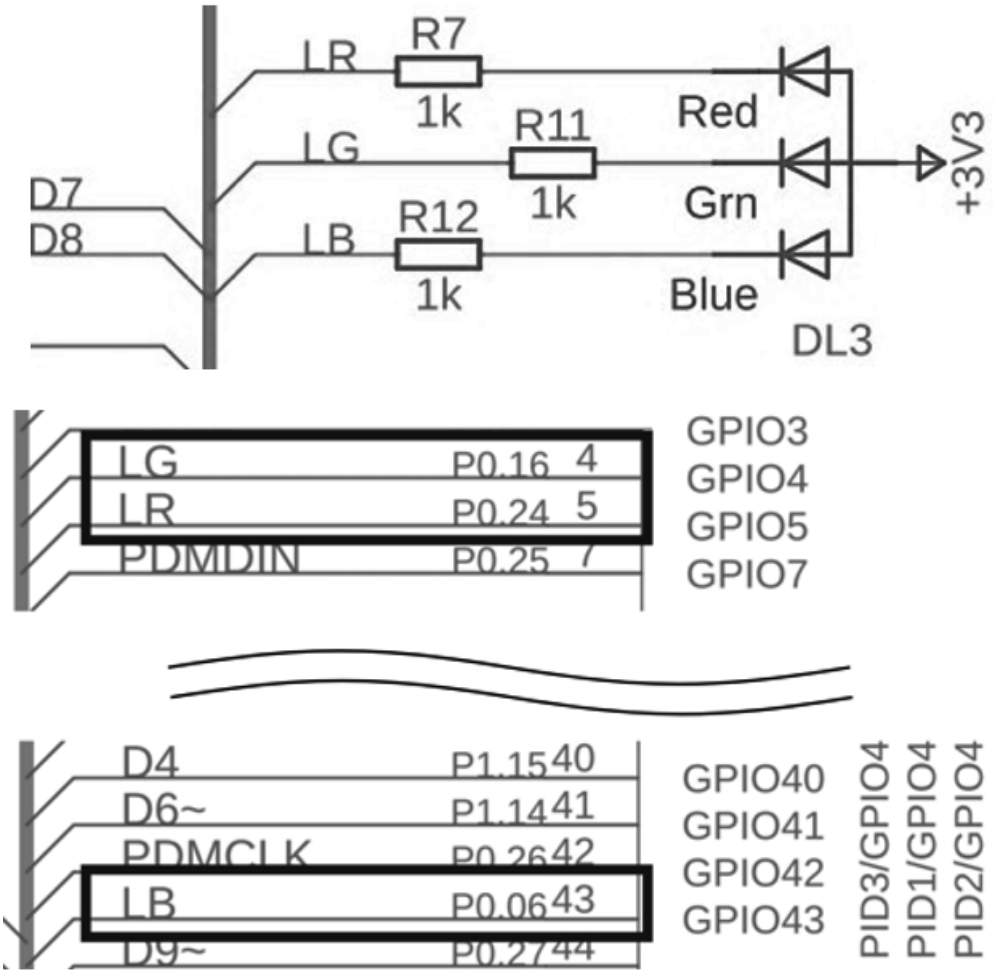
Create library

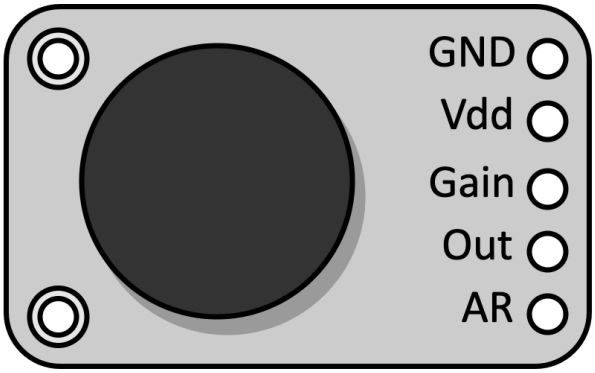
Turn your impulse into optimized source code that you can run on any device.

C++ library

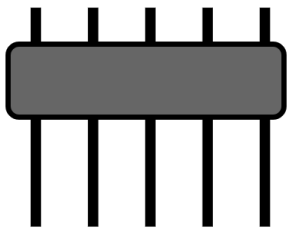
Arduino library

Cube.MX CMSIS-PACK



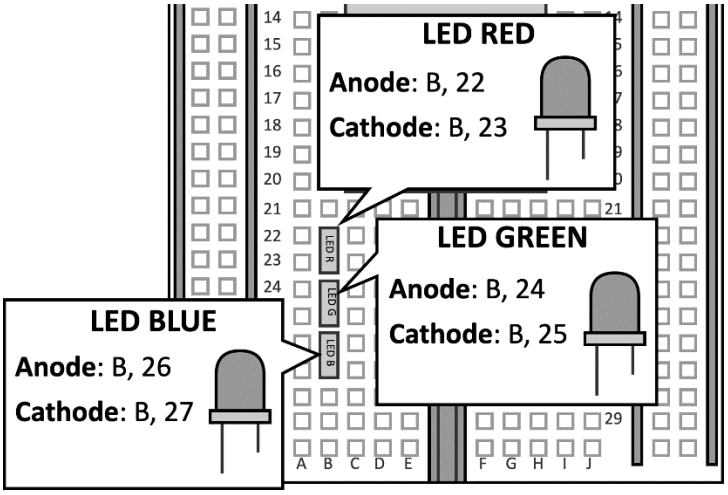


Electret microphone with MAX9814

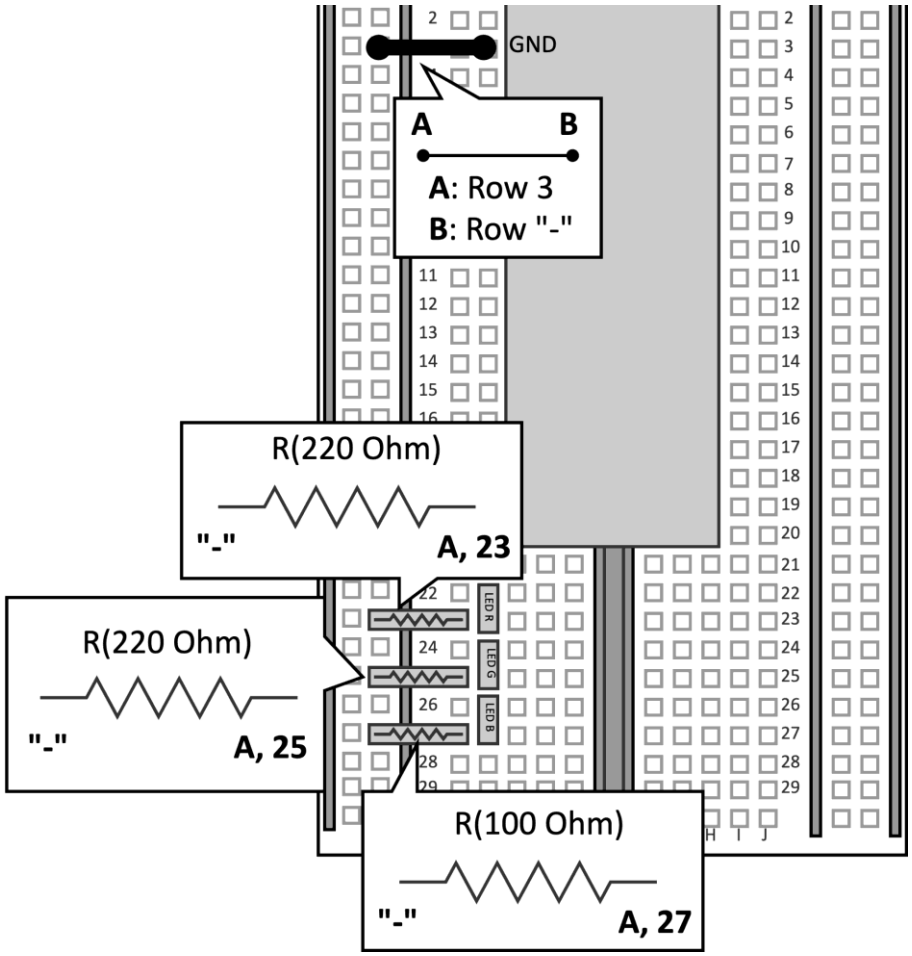


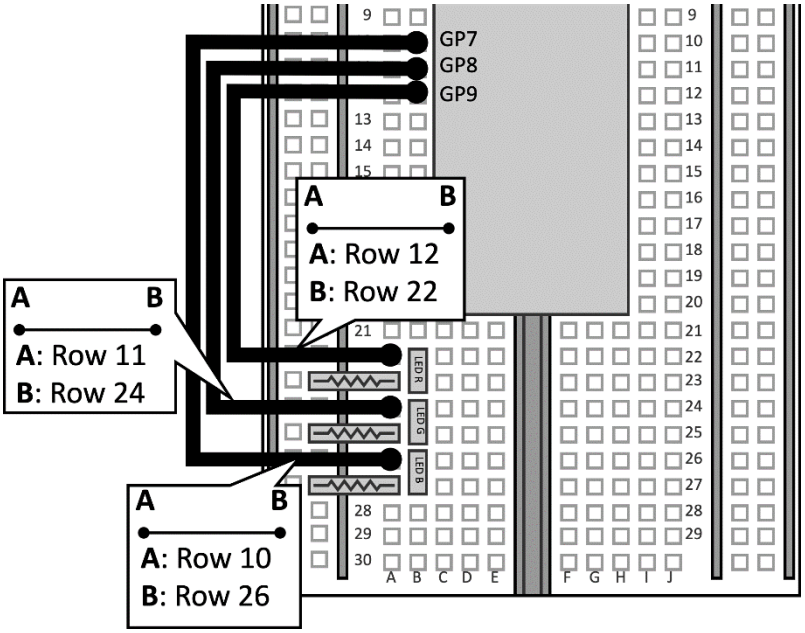
Five pins header strip

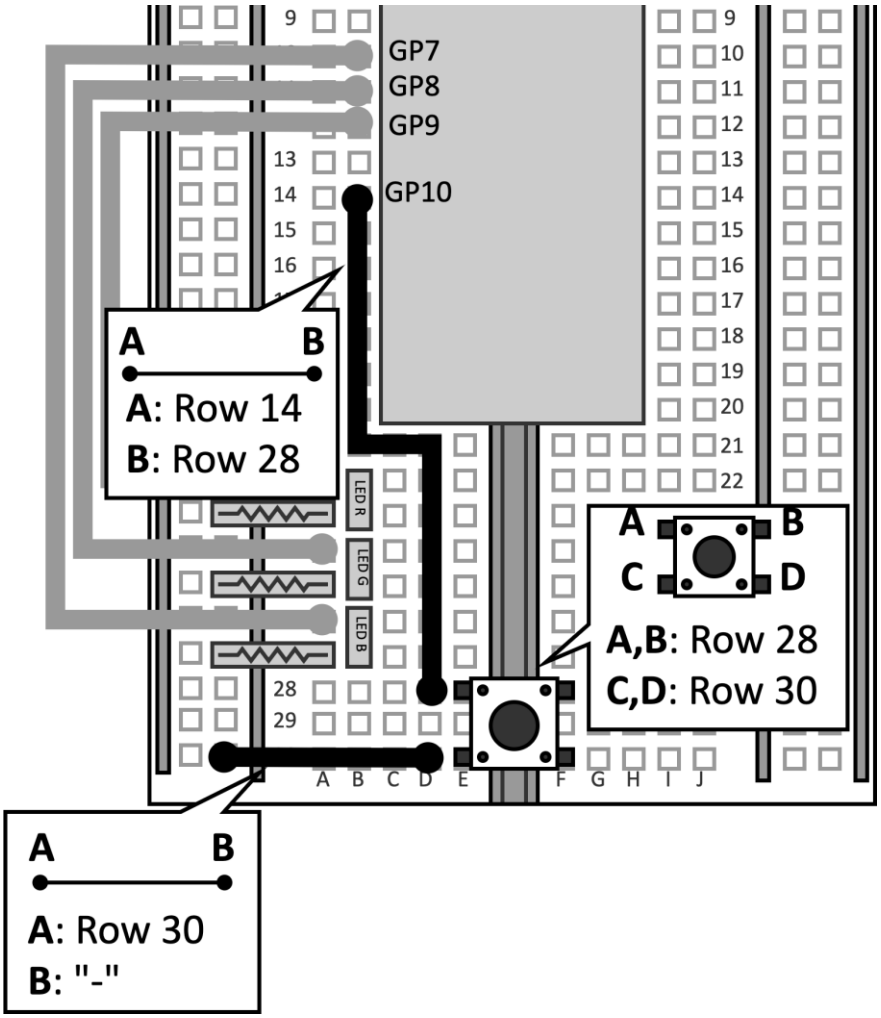
ADC name	ADC0	ADC1	ADC2
Pin	GP26	GP27	GP28

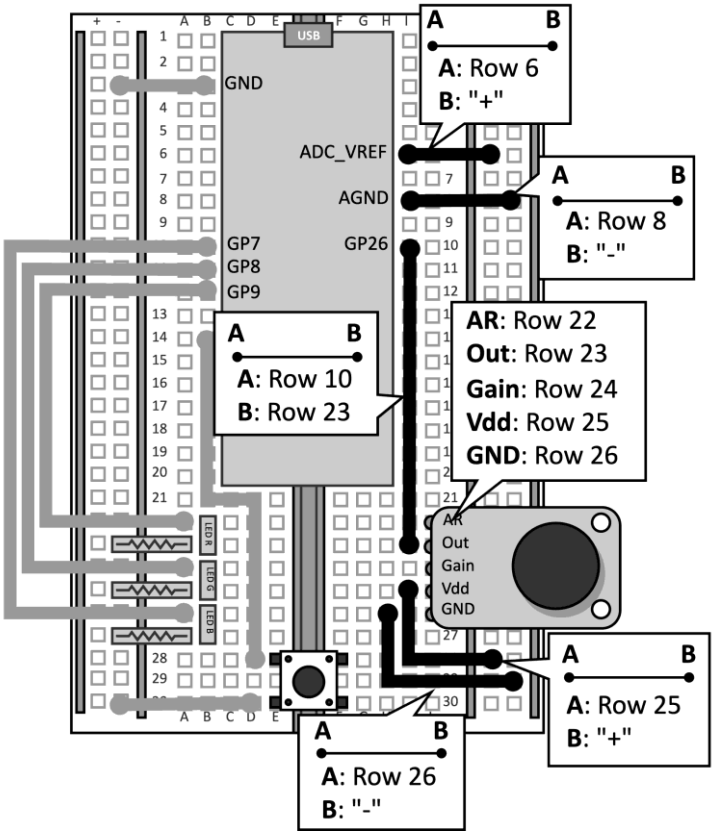


LED	Red	Green	Blue
Resistance (Ohm)	220	220	100



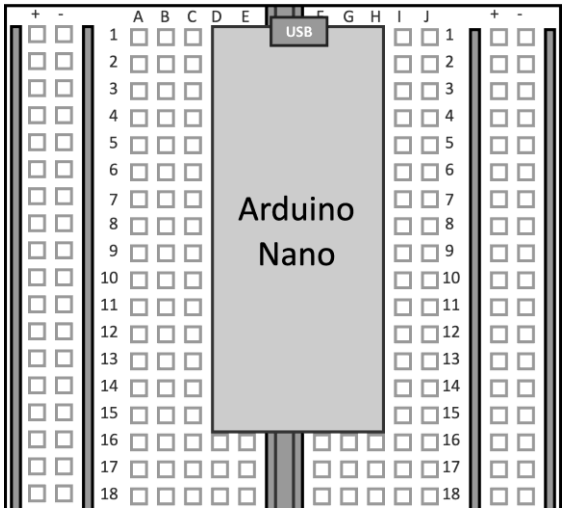

GP7
GP8
GP9
A
B
A: Row 12
B: Row 22
A: Row 11
B: Row 24
A: Row 10
B: Row 26
LED R
LED G
LED B


GP7
GP8
GP9
GP10
A
B
A: Row 14
B: Row 28
LED R
LED G
LED B
C
D
A,B: Row 28
C,D: Row 30
A: Row 30
B: "-"

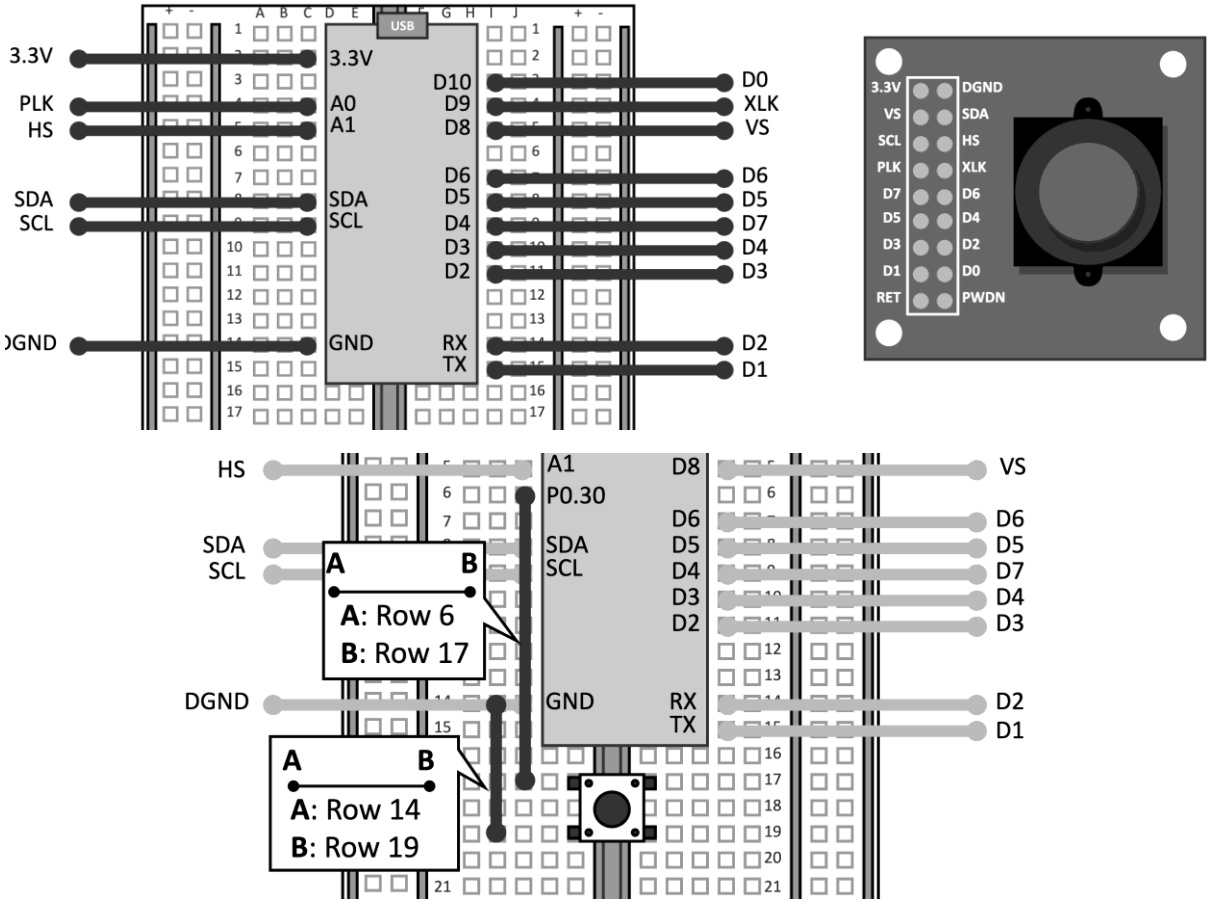


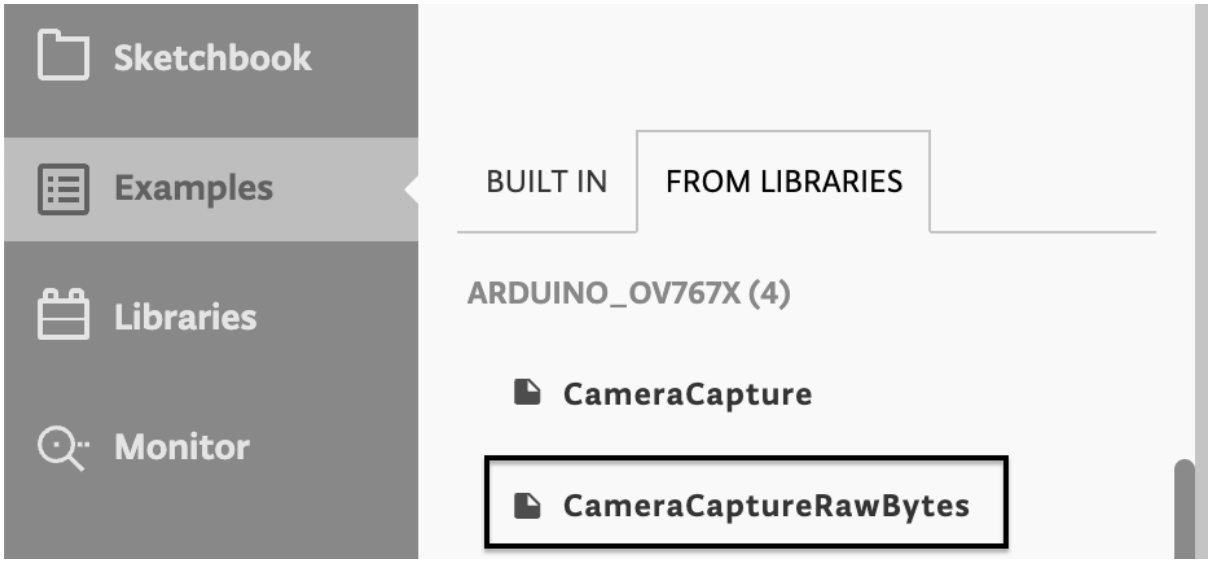
Mic with MAX9814 - Pin	Vdd	GND	Out
Raspberry Pi Pico - Pin	ADC_VREF	AGND	GP26

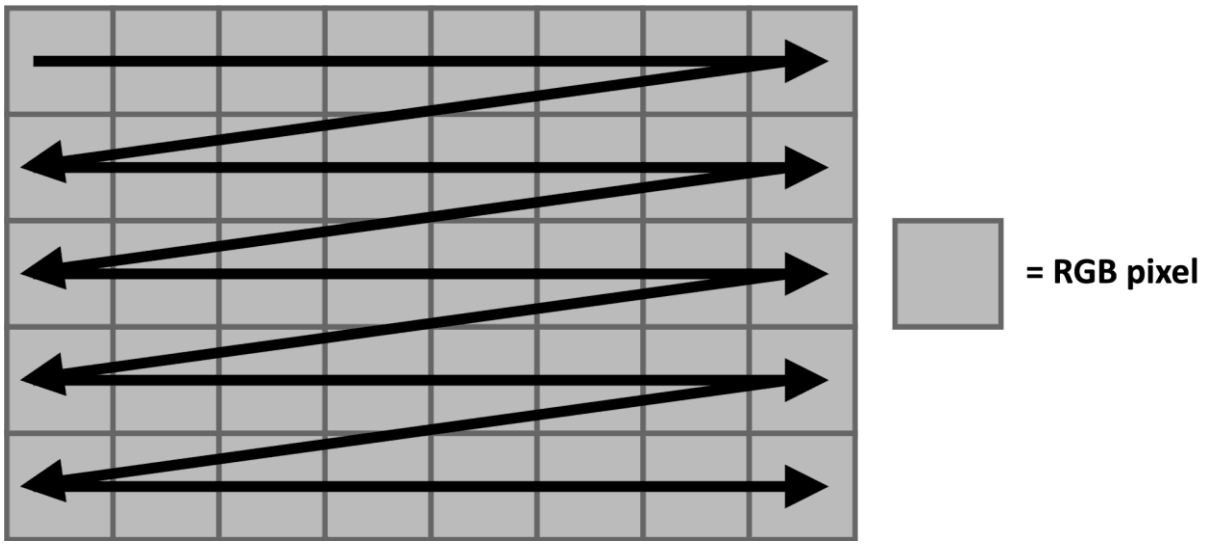
Chapter 5: Indoor Scene Classification with TFLu and the Arduino Nano



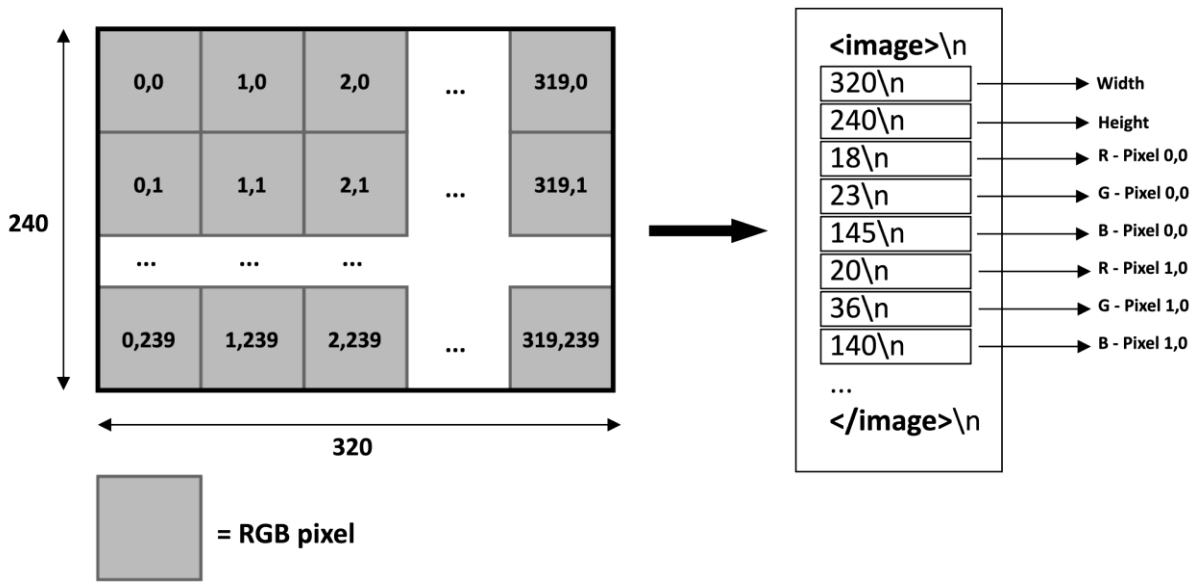
Arduino Nano **OV7670**

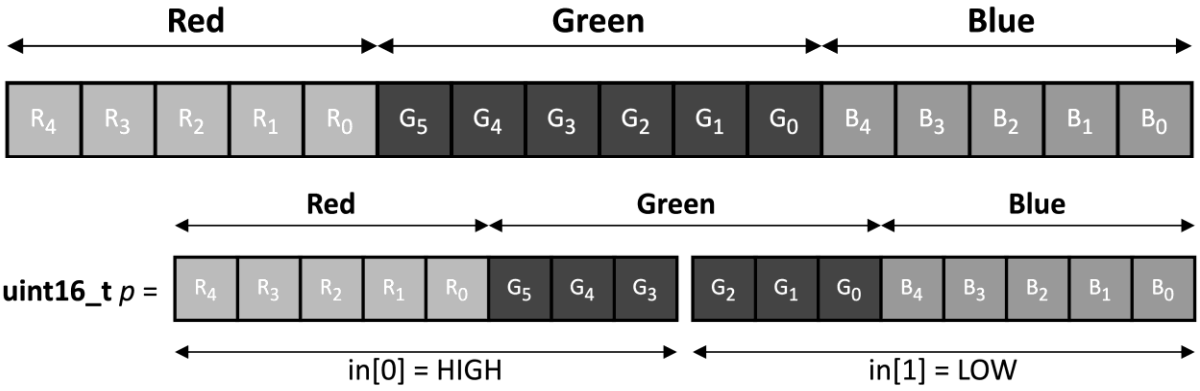


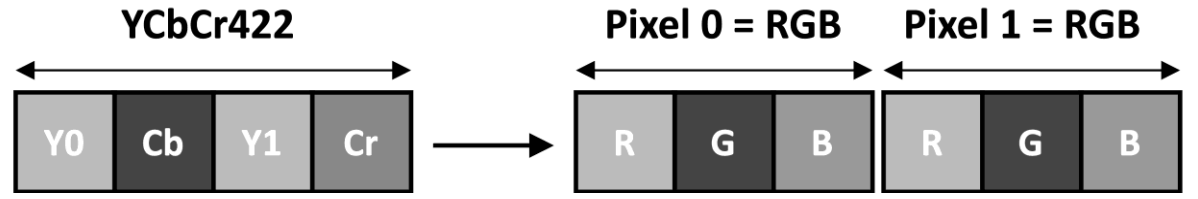




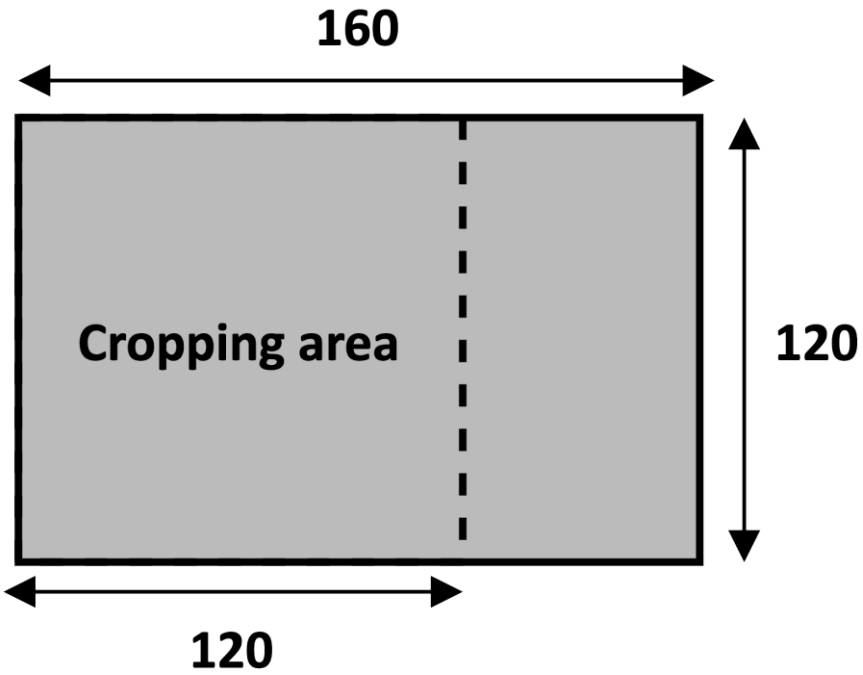
RGB Image **RGB image transmitted over serial**







Color	Formula
Red	$R_i = Y_i + Cr + (Cr \gg 2) + (Cr \gg 3) + (cr \gg 5) \in [0, 255]$
Green	$G_i = Y_i - (Cb \gg 2) - (Cb \gg 4) - (Cb \gg 5) - (Cr \gg 1) - (Cr \gg 3) - (Cr \gg 5) \in [0, 255]$
Blue	$B_i = Y_i + Cb + (Cb \gg 1) + (Cb \gg 2) + (Cb \gg 6) \in [0, 255]$



kitchen/

kitchen_1278sda.png

kitchen_323uasd.png

....

bathroom/

bathroom_aasud18a.png

bathroom_bghyu1sd.png

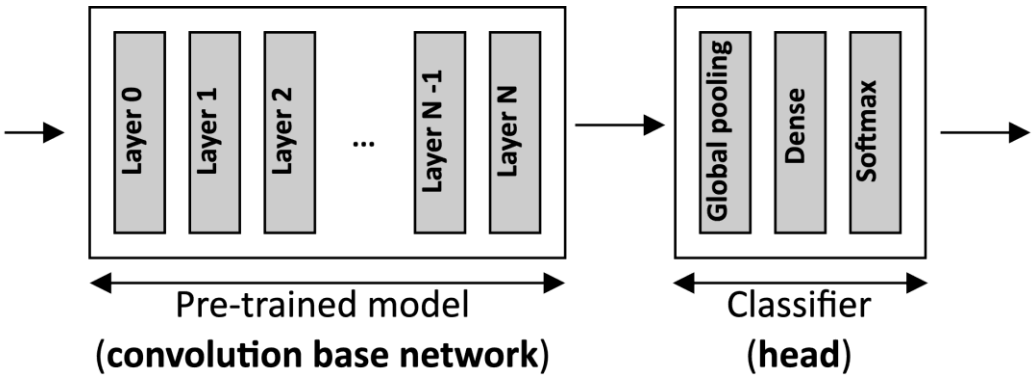
....

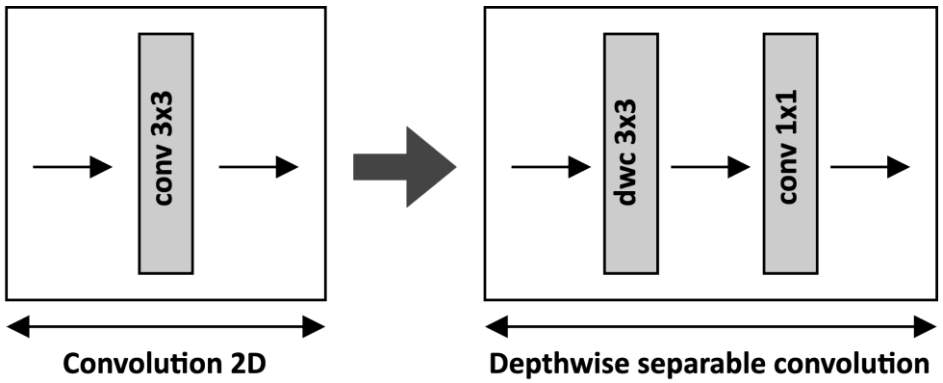
unknown/

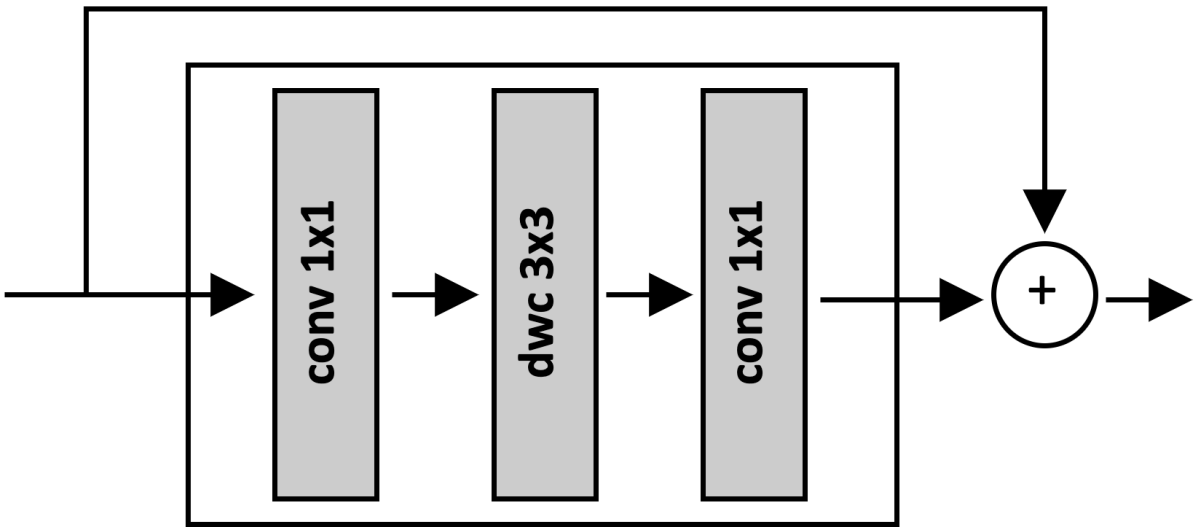
unknown_kkad1f9o.png

unknown_iub651sxj.png

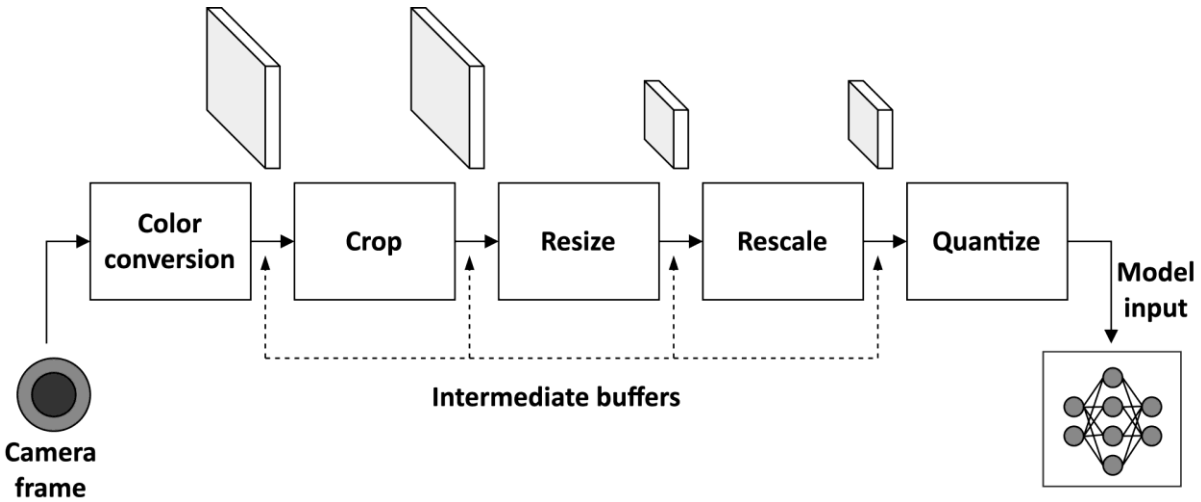
....

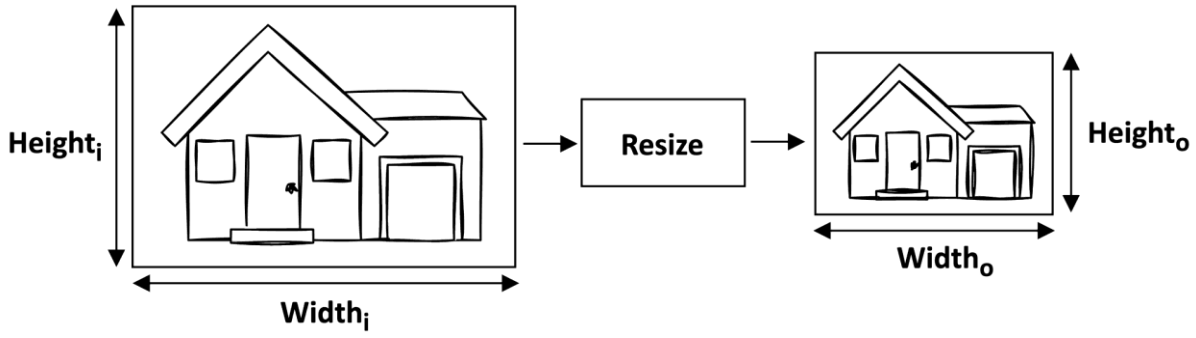


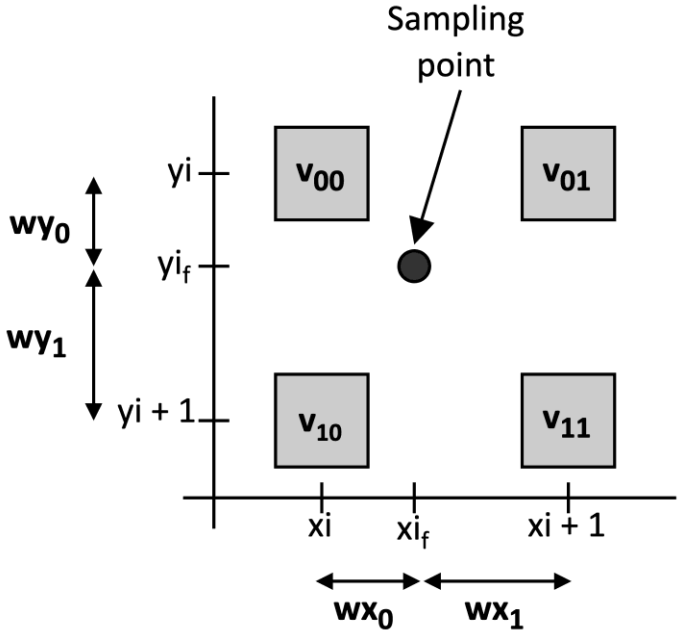



conv 1x1
dwc 3x3
conv 1x1
+


Files
..
sample_data
{x}


Color conversion
Crop
Resize
Rescale
Quantize
Model input
Intermediate buffers
Camera frame

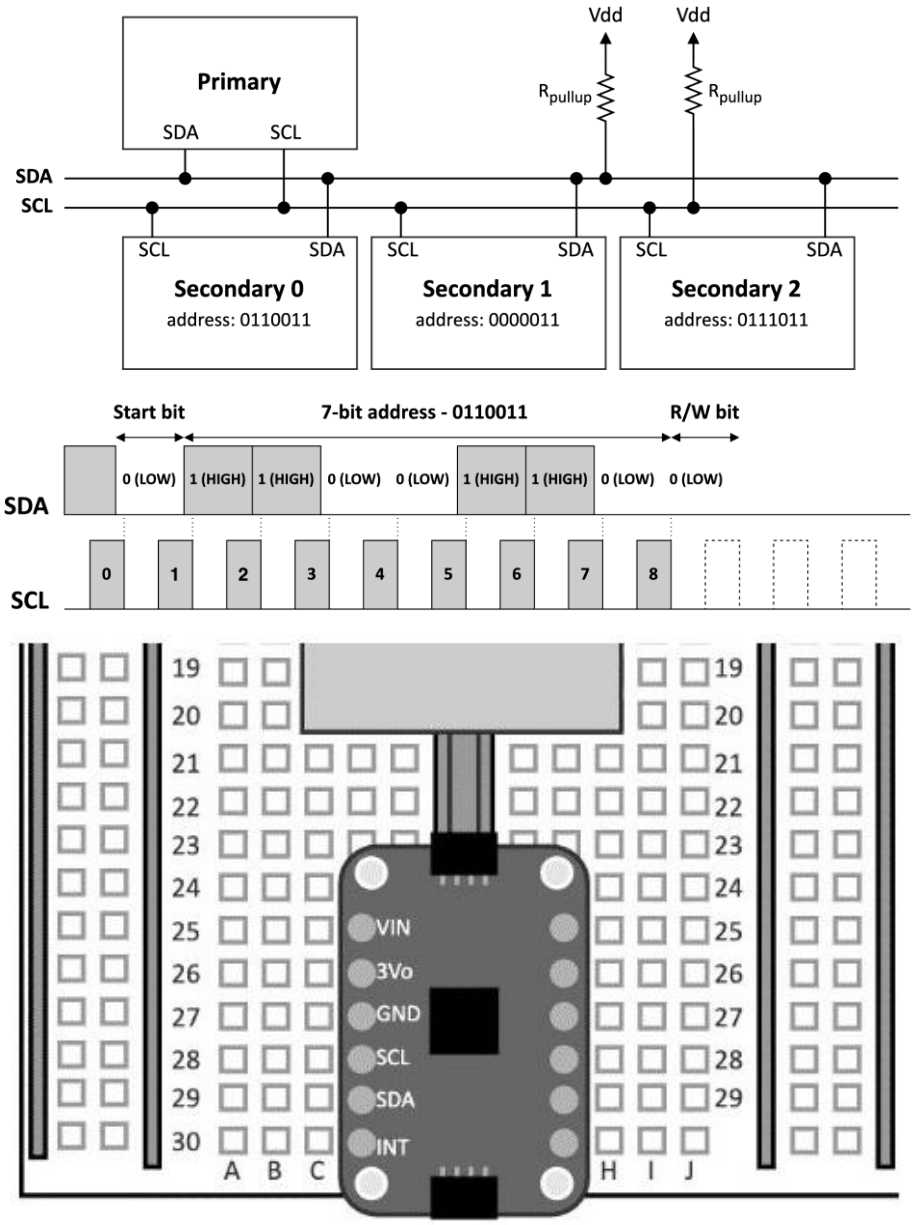


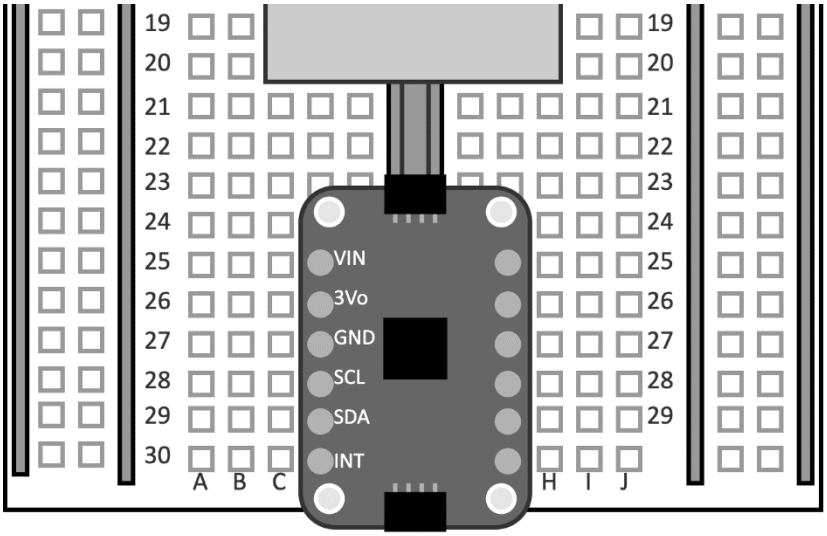


Bilinear interpolation

$$\text{out} = v_{00} \times wx_0 \times wy_0 + v_{01} \times wx_1 \times wy_0 + v_{10} \times wx_0 \times wy_1 + v_{11} \times wx_1 \times wy_1$$

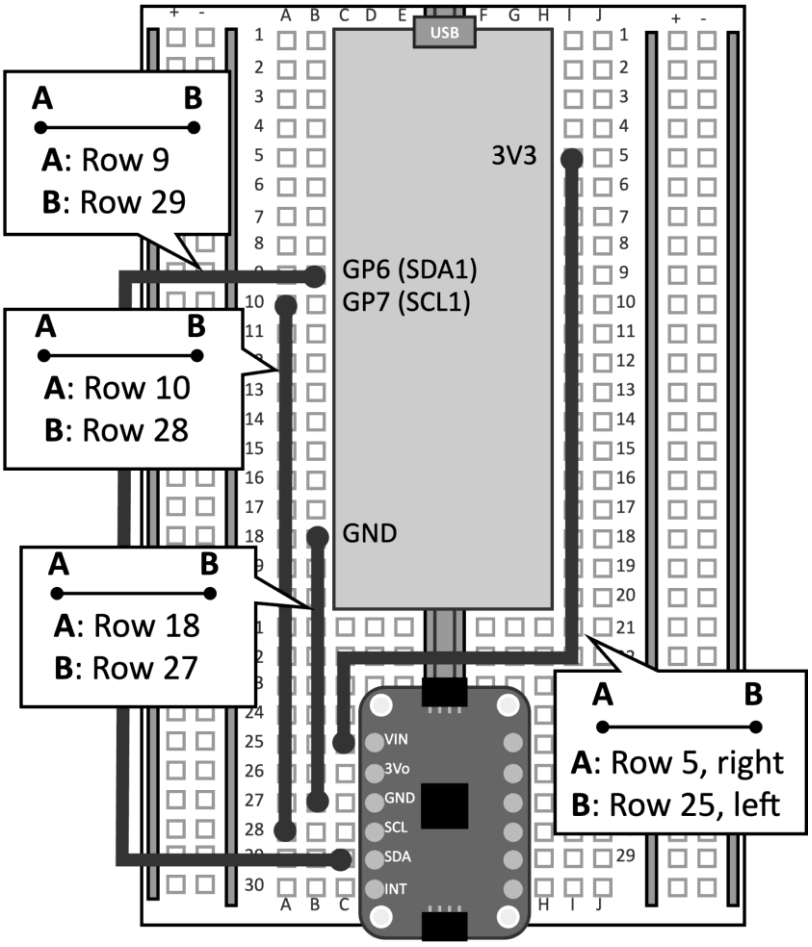
Chapter 6: Building a Gesture-Based Interface for YouTube Playback

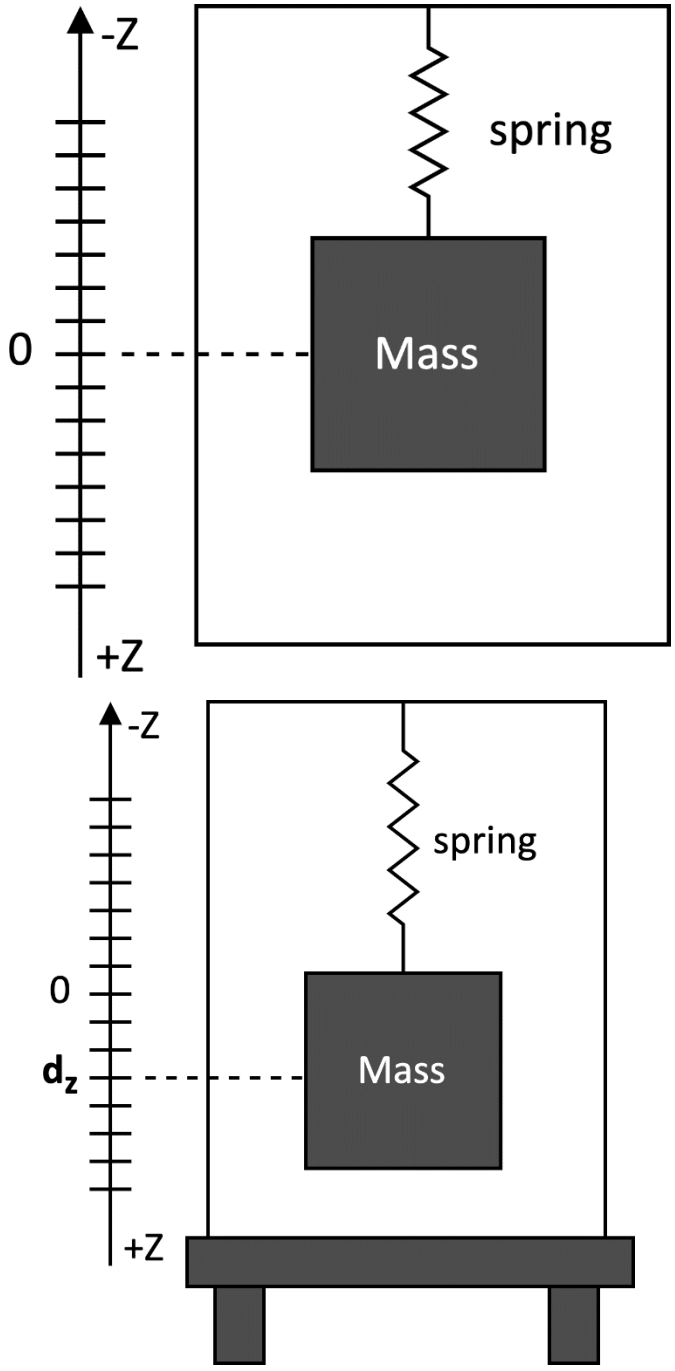




MPU-6050	VIN	GND	SCL	SDA
Raspberry Pi Pico	3V3	GND	GP7 (SCL1)	GP6 (SDA1)

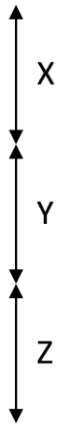
Raspberry Pi Pico

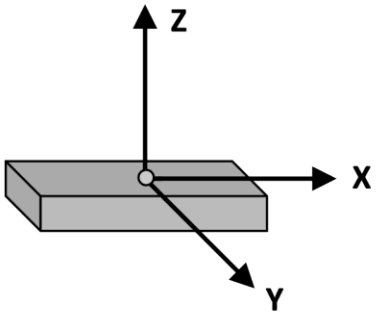


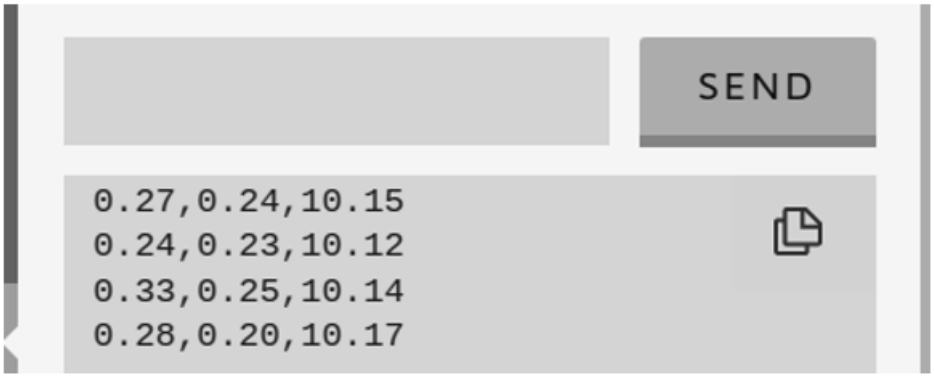


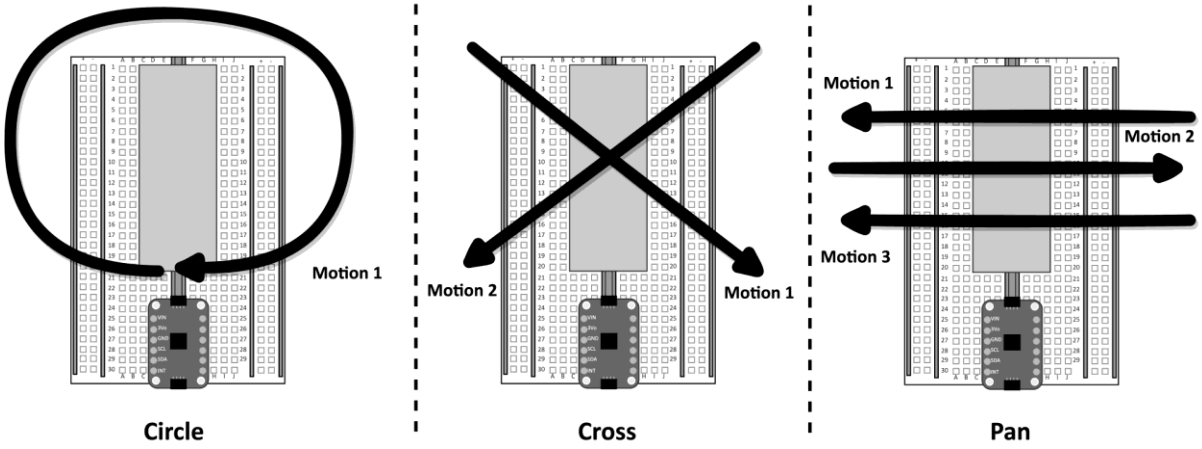
Measurement range (g)	±2g	±4g	±8g	±16g
Sensitivity (LSB/g)	16384	8192	4096	2048
ACCEL_CONFIG register value	0x00	0x01	0x02	0x03

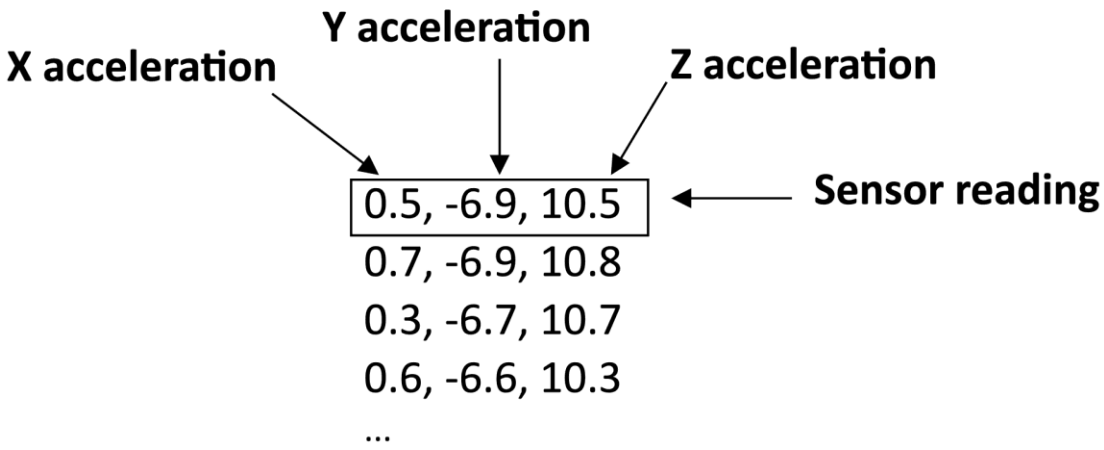
Address	Register
3B	ACCEL_XOUT_H
3C	ACCEL_XOUT_L
3D	ACCEL_YOUT_H
3E	ACCEL_YOUT_L
3F	ACCEL_ZOUT_H
40	ACCEL_ZOUT_L











Record new data

Device

pico

Label

circle

Sample length (ms.)

20000

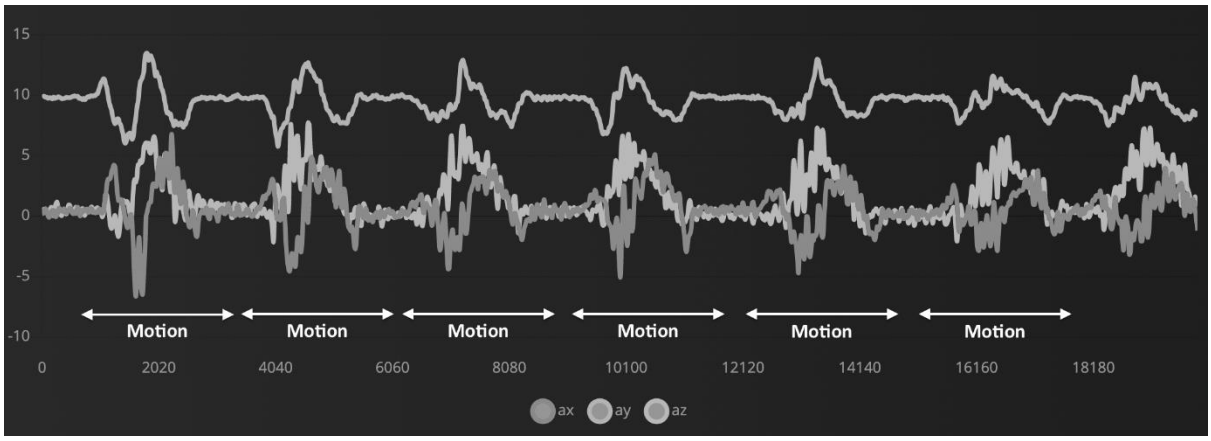
Sensor

Sensor with 3 axes (ax, ay, az)

Frequency

50Hz

Start sampling



SAMPLE NAME	LABEL	ADDED	LENGTH
circle.json.2jam5jrk	circle	Today, 15:2...	20s
circle.json.2j930h3c	circle	To	
circle.json.2j910pi...	circle	Ye	
circle.json.2j910pi...	circle	Ye	
circle.json.2j910pi...	circle	Ye	
circle.json.2j910pi...	circle	Ye	

Rename

Edit label

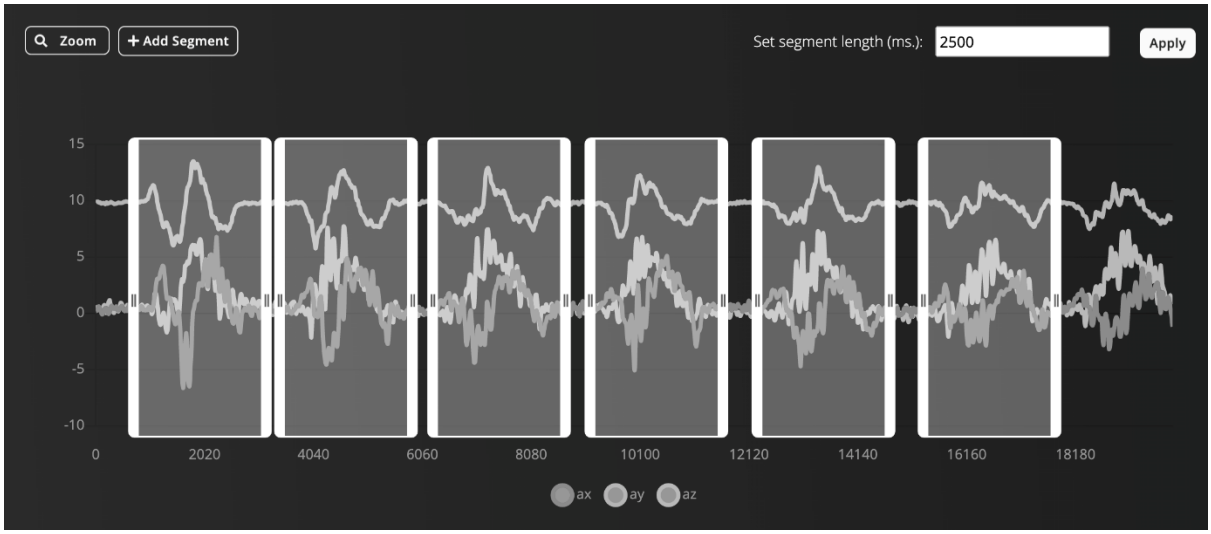
Move to test set

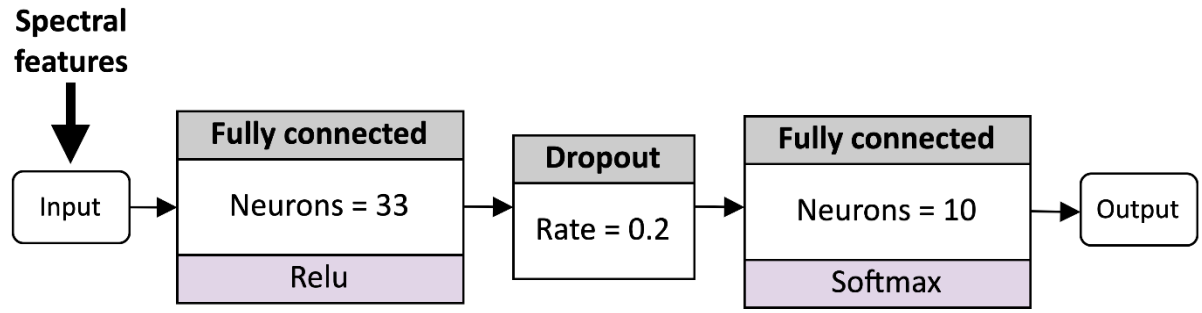
Disable

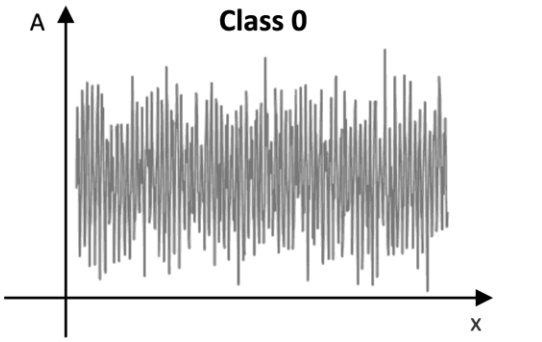
Crop sample

Split sample

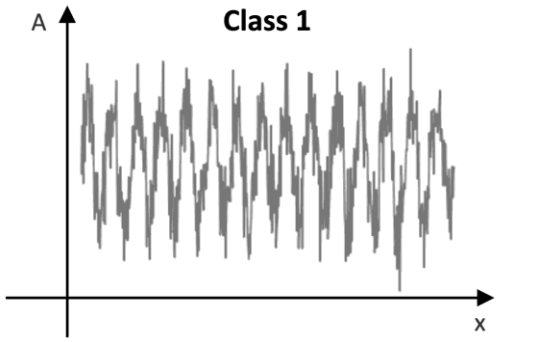
Download



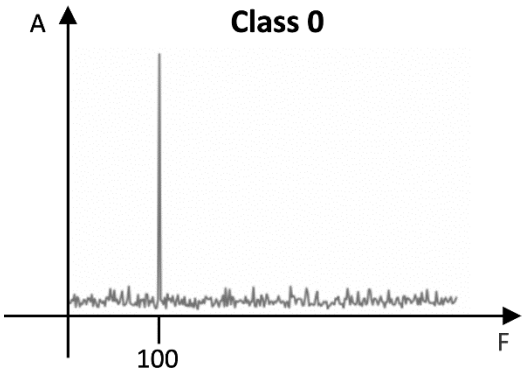


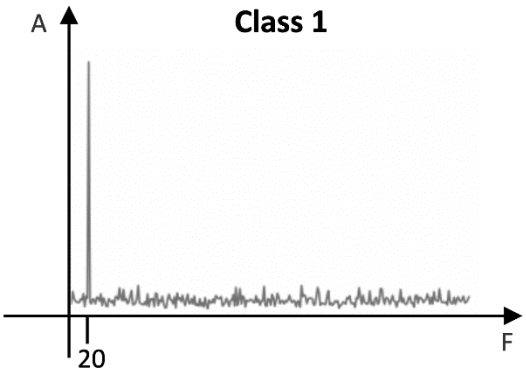


y = sine(100 * 2 * π * x) + random.normal(-0.5,0.5)



y = sine(20 * 2 * π * x) + random.normal(-0.5,0.5)



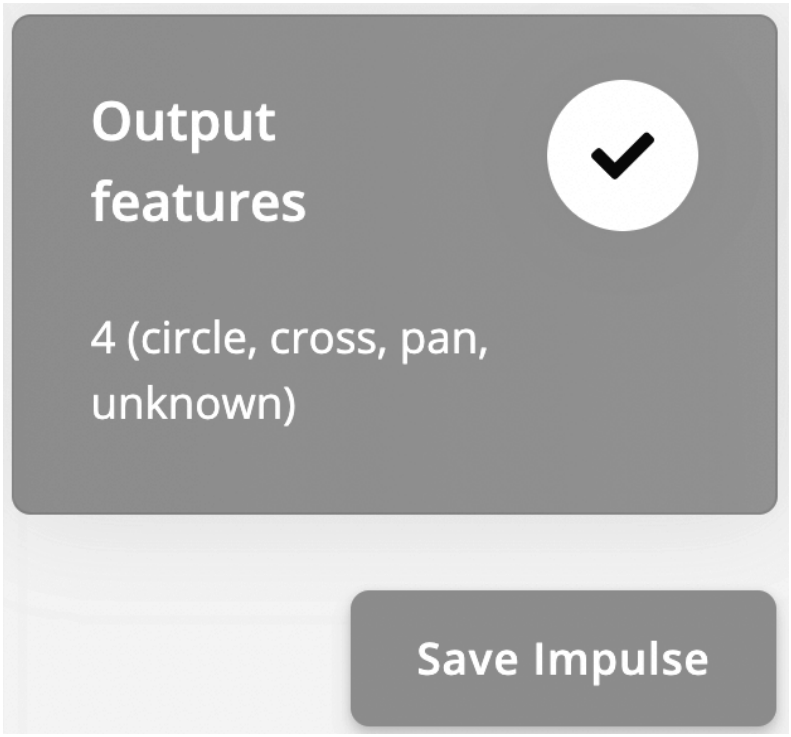


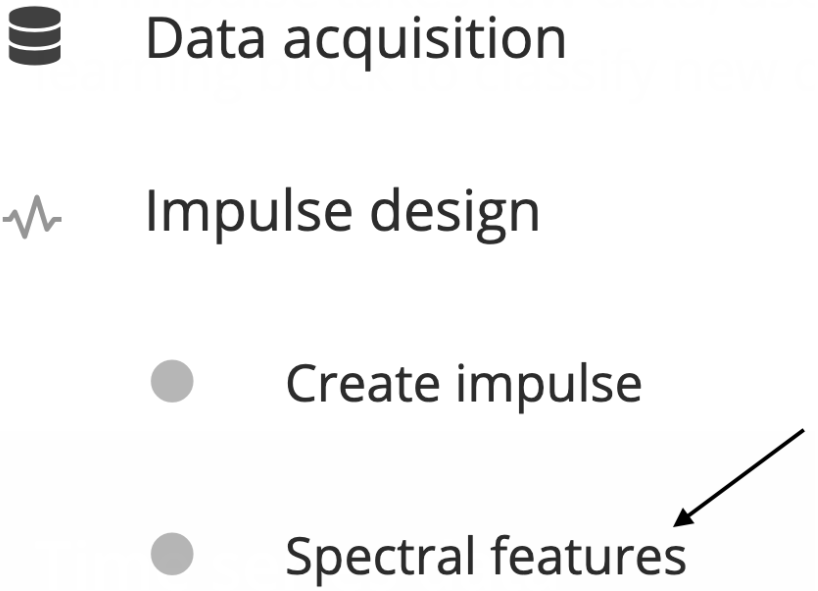
Spectral Analysis

Great for analyzing repetitive motion, such as data from accelerometers. Extracts the frequency and power characteristics of a signal over time.

EdgeImpulse Inc.

Add





Neural network architecture

Input layer (33 features)

Dense layer (33 neurons)

Dropout (rate 0.2)

Dense layer (10 neurons)

Add an extra layer

Output layer (4 classes)

Start training

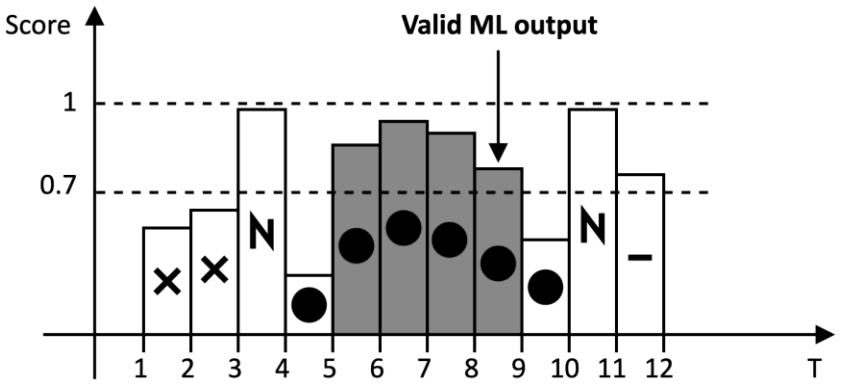
ACCURACY

88.46%

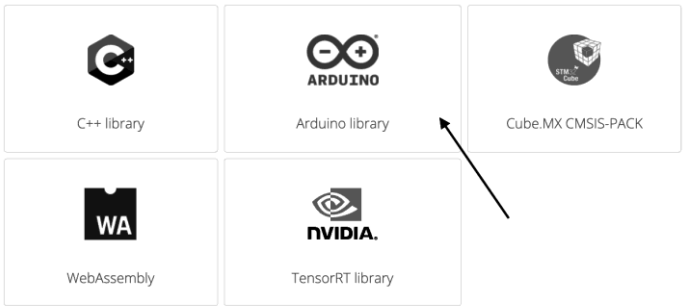
	CIRCLE	CROSS	PAN	UNKNOWN	UNCERTAIN
CIRCLE	81.8%	0%	0%	0%	18.2%
CROSS	0%	100%	0%	0%	0%
PAN	0%	0%	100%	0%	0%
UNKNOWN	0%	0%	0%	73.3%	26.7%
F1 SCORE	0.90	1.00	1.00	0.85	

Classify new data

Device ⓘ pico

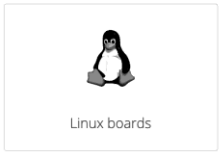


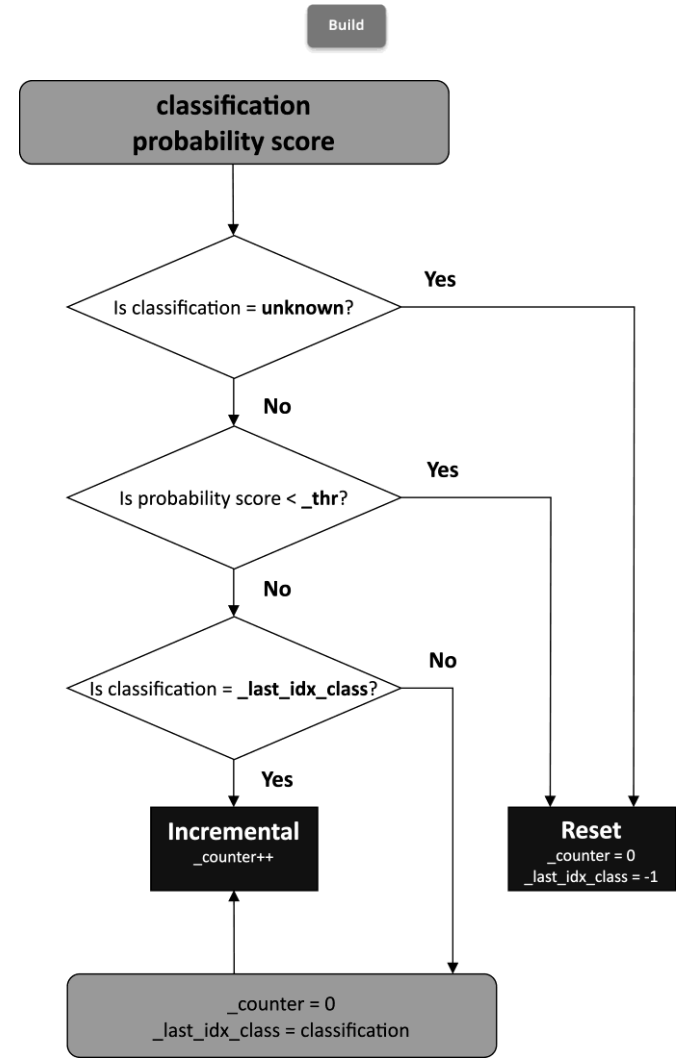
Symbol	Gesture
●	Circle
×	Cross
–	Pan
N	Unknown



Build firmware

Or get a ready-to-go binary for your development board that includes your impulse.

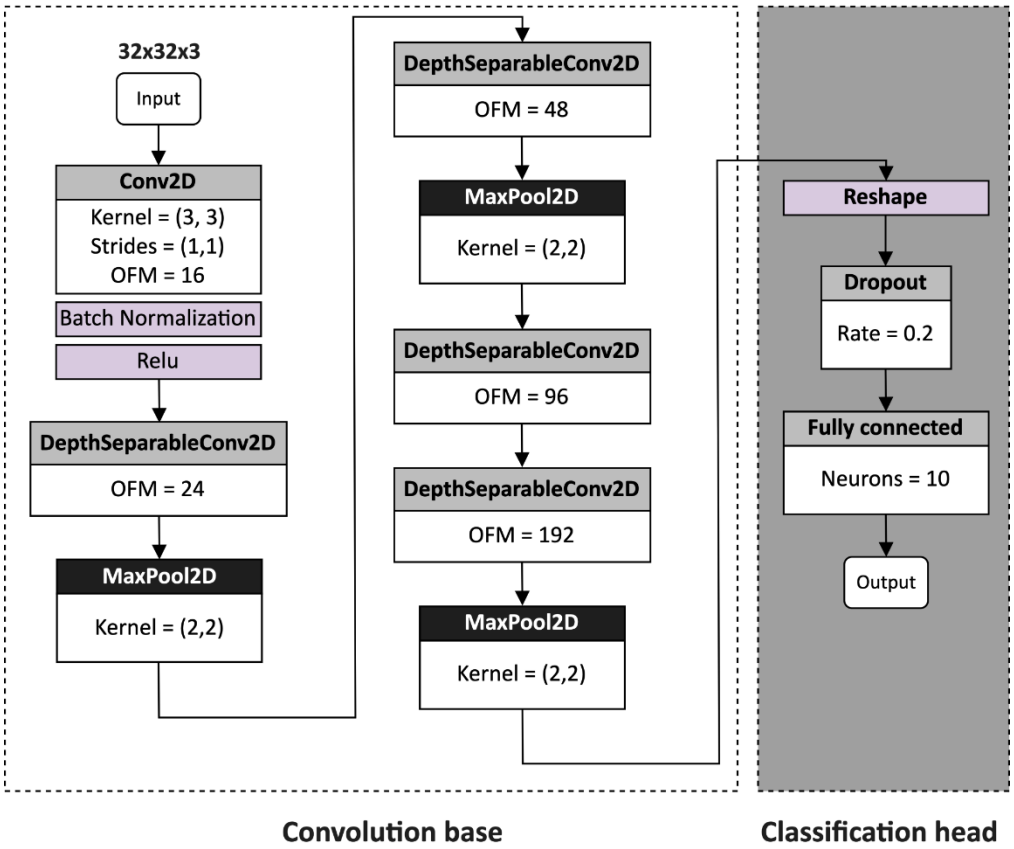


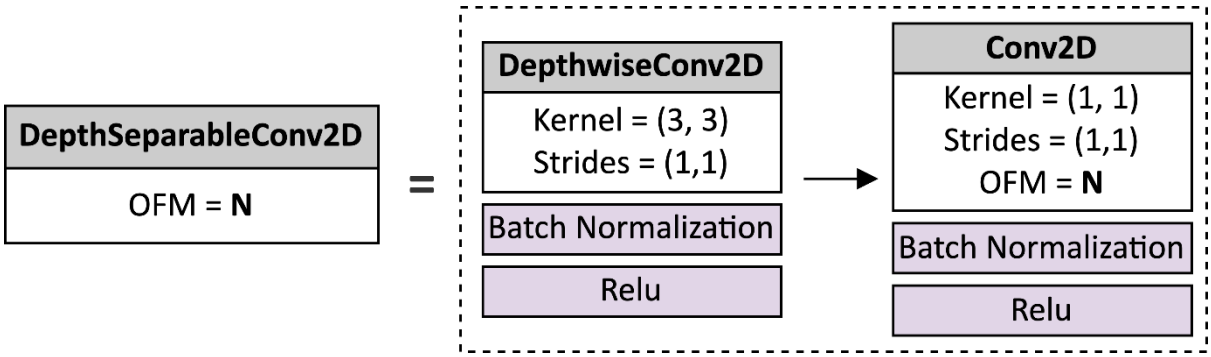


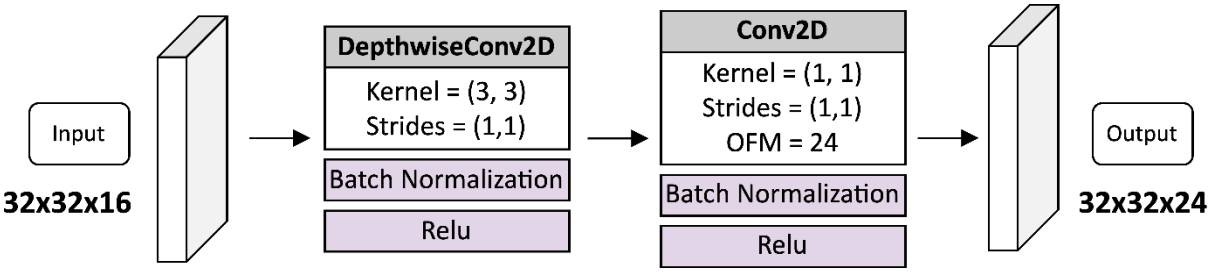
Gesture	Circle	Cross	Pan
Function	Mute/Unmute	Play/Pause	Move to the next video

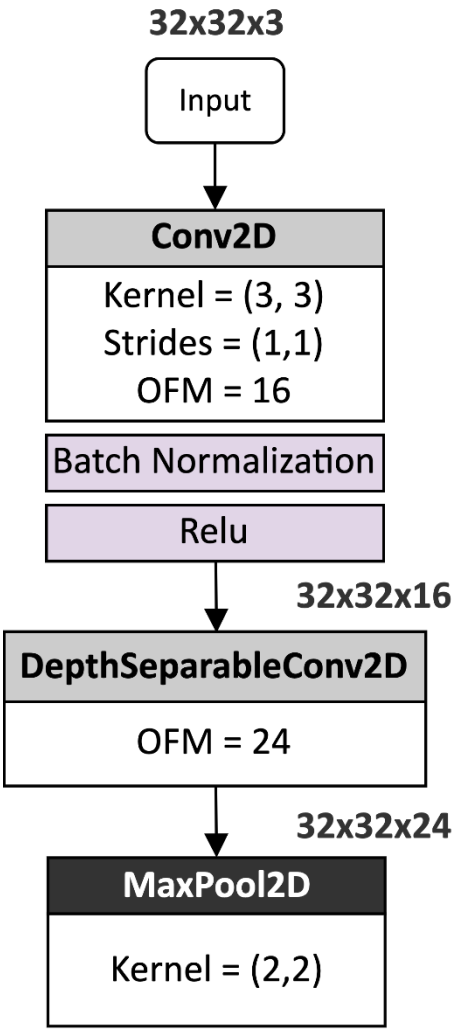
Gesture	Playback action	Keyboard shortcut
Circle	Mute/Unmute	m
Cross	Play/Pause	k
Pan	Move to the next video	Shift + N

Chapter 7: Running a Tiny CIFAR-10 Model on a Virtual Platform with the Zephyr OS





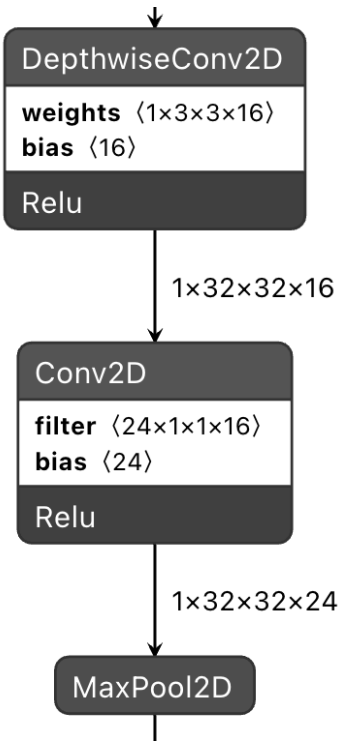





```
==================================
Total params: 60,194
Trainable params: 59,074
Non-trainable params: 1,120
_________________________________________________________________
act1 (Activation)               (None, 32, 32, 16)        0
dwc0_dwsc2 (DepthwiseConv2D)    (None, 32, 32, 16)        160
bn0_dwsc2 (BatchNormalization)  (None, 32, 32, 16)        64
act0_dwsc2 (Activation)         (None, 32, 32, 16)        0
conv0_dwsc2 (Conv2D)            (None, 32, 32, 24)        408
bn1_dwsc2 (BatchNormalization)  (None, 32, 32, 24)        96
act1_dwsc2 (Activation)         (None, 32, 32, 24)        0
pool1 (MaxPooling2D)            (None, 16, 16, 24)        0
```

DWSC

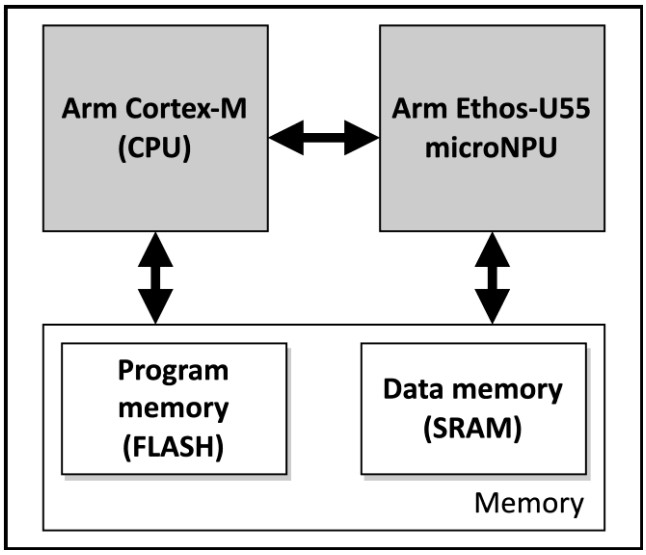
```
// Input image
int8_t g_test[] = {
// data
}

// Array size
const int g_test_len = 3072;

// Index label
const int g_test_ilabel = 8;
```



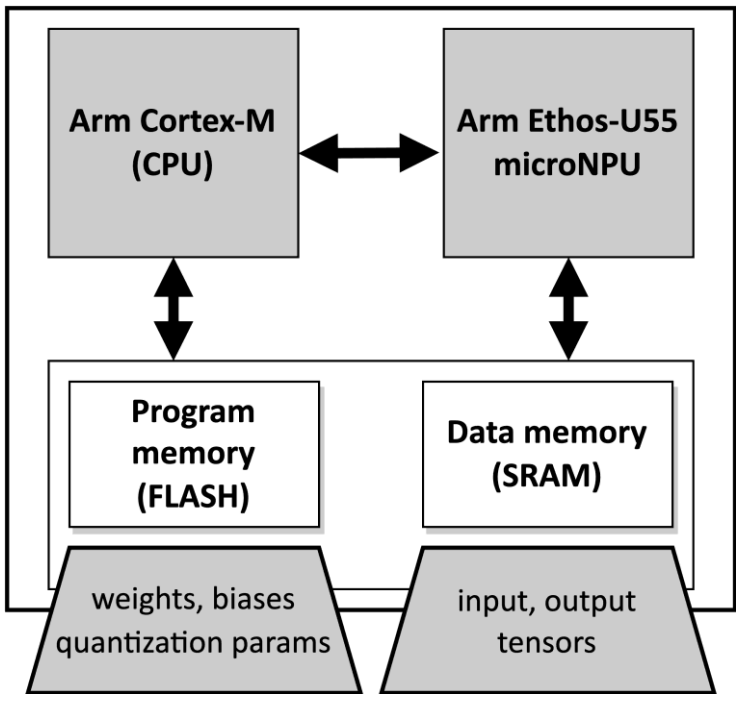
```
Memory region         Used Size  Region Size  %age Used
           FLASH:      137668 B       256 KB     52.52%
            SRAM:        4536 B        64 KB      6.92%
        IDT_LIST:           0 GB         2 KB      0.00%
```

```
-- west build: running target run
[1/1] To exit from QEMU enter: 'CTRL+a, x'[QEMU] CPU: cortex-m3
qemu-system-arm: warning: nic stellaris_enet.0 has no peer
Timer with period zero, disabling
*** Booting Zephyr OS build v2.7.99-1639-g73a957e4b316  ***
CORRECT classification!: ship
```

Chapter 8: Toward the Next TinyML Generation with microNPU



Convolution 2D	Depthwise convolution 2D	De-convolution	Max pooling
Average pooling	Fully connected	LSTM/GRU	Add/Sub/Mul
Softmax	Relu/Relu6/Tanh/Sigmoid	Reshape	**many more…**



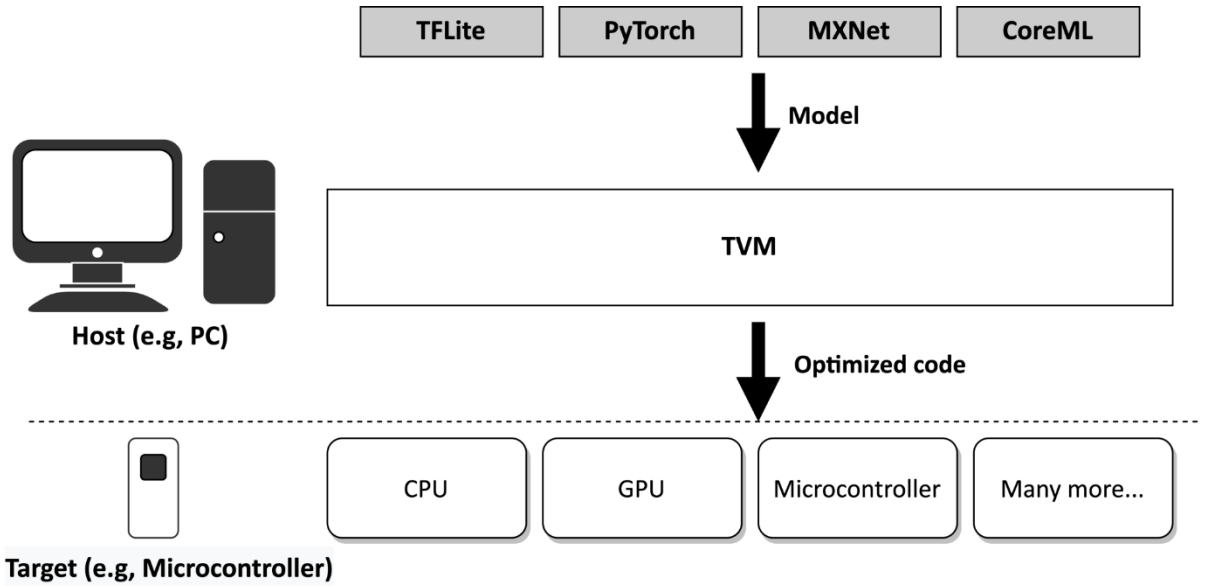
Corstone-300 Ecosystem FVPs

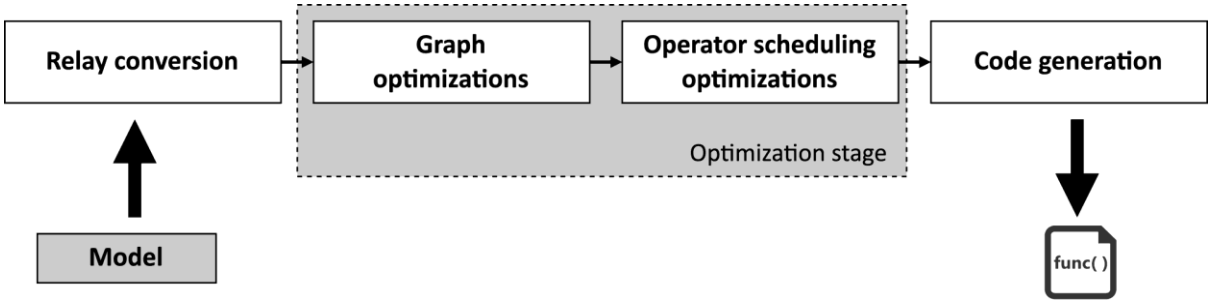
Download the FVP model for the Corstone-300 MPS3 based platform

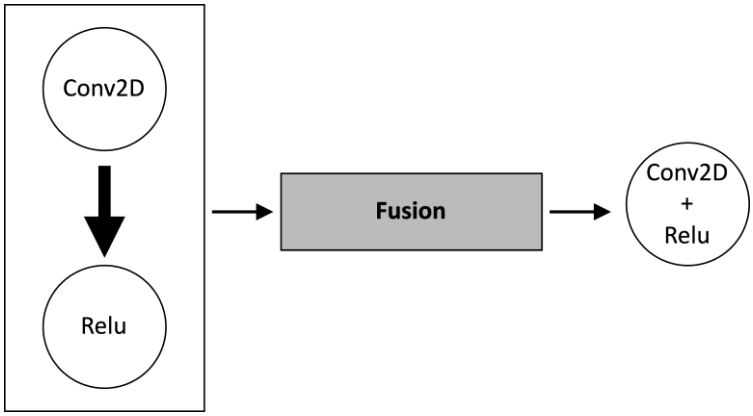
The Corstone-300 model is aligned with the Arm MPS3 development platform. It is based on the Cortex the Ethos-U55 and Ethos-U65 processors. This FVP is provided free of charge for the limited developme software on the Corstone-300 platform while Arm Virtual Hardware is recommended for commercial so

Download Windows | Download Linux

```
~ $FVP_Corstone_SSE-300_Ethos-U55 --version

Fast Models [11.15.24 (Aug 17 2021)]
Copyright 2000-2021 ARM Limited.
All Rights Reserved.
```







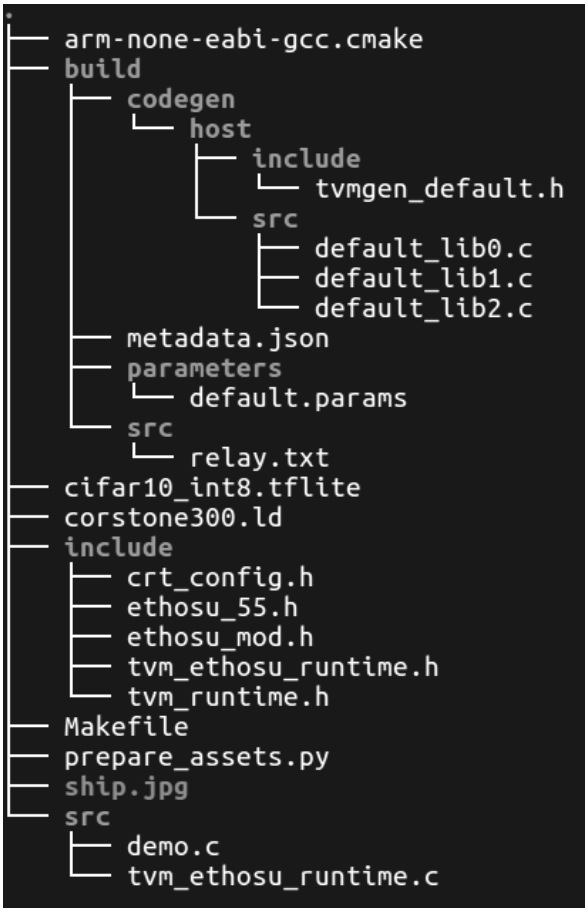

```
arm-none-eabi-gcc: note: valid arguments are: arm8 arm810 strongarm strongarm110 fa526
fa626 arm7tdmi arm7tdmi-s arm710t arm720t arm740t arm9 arm9tdmi arm920t arm920 arm922t
arm940t ep9312 arm10tdmi arm1020t arm9e arm946e-s arm966e-s arm968e-s arm10e arm1020e a
rm1022e xscale iwmmxt iwmmxt2 fa606te fa626te fmp626 fa726te arm926ej-s arm1026ej-s arm
1136j-s arm1136jf-s arm1176jz-s arm1176jzf-s mpcorenovfp mpcore arm1156t2-s arm1156t2f-
s cortex-m1 cortex-m0 cortex-m0plus cortex-m1.small-multiply cortex-m0.small-multiply c
ortex-m0plus.small-multiply generic-armv7-a cortex-a5 cortex-a7 cortex-a8 cortex-a9 cor
tex-a12 cortex-a15 cortex-a17 cortex-r4 cortex-r4f cortex-r5 cortex-r7 cortex-r8 cortex
-m7 cortex-m4 cortex-m3 marvell-pj4 cortex-a15.cortex-a7 cortex-a17.cortex-a7 cortex-a3
2 cortex-a35 cortex-a53 cortex-a57 cortex-a72 cortex-a73 exynos-m1 xgene1 cortex-a57.co
rtex-a53 cortex-a72.cortex-a53 cortex-a73.cortex-a35 cortex-a73.cortex-a53 cortex-a55 c
ortex-a75 cortex-a76 cortex-a76ae cortex-a77 neoverse-n1 cortex-a75.cortex-a55 cortex-a
76.cortex-a55 neoverse-v1 neoverse-n2 cortex-m23 cortex-m33 cortex-m35p cortex-m55 cort
ex-r52
```

```
./
./codegen/
./codegen/host/
./codegen/host/include/
./codegen/host/include/tvmgen_default.h
./codegen/host/src/
./codegen/host/src/default_lib2.c
./codegen/host/src/default_lib0.c
./codegen/host/src/default_lib1.c
./metadata.json
./parameters/
./parameters/default.params
./src/
./src/relay.txt
```

Memory	Size	microNPU access
ITCM	512KB	No
DTCM	512KB	No
SSE-300 SRAM	2MB	Yes
Data SRAM	2MB	Yes
DDR	32MB	Yes

INPUTS

serving_default...	name: **serving_default_input_2:0**
	type: **int8[1,32,32,3]**
	quantization: **0.003921568859368563 * (q + 128)**
	location: **0**




```
ethosu_invoke COMMAND_STREAM
handle_command_stream: cmd_stream=0x6100fc60, cms_length 534
QBASE=0x000000006100fc60, QSIZE=2136, base_pointer_offset=0x00000000
BASEP0=0x00000000610104c0
BASEP1=0x0000000060003010
BASEP2=0x0000000060003010
BASEP3=0x0000000060000010
BASEP4=0x0000000060000c10
CMD=0x00000005Interrupt. status=0xffff0022, qread=2136
CMD=0x00000006

CMD=0x0000000c
ethosu_release_driver - Driver 0x20000a18 released
10
The image has been classified as 'ship'
```