



# Build a Machine Learning IoT device running Python

PyDay Barcelona - 27th of November 2021





# Marc Pous

[balena.io](#) Developer Advocate

Co-Founder at thethings.iO & 1m1Labs

IoT Barcelona & IoT Stars & IoT Coffee Talk

...



A screenshot of a YouTube video player window. The video is titled "PyDayBCN 2020 Track 2 - Building My First Python IoT Device with Containers in 20 minutes by M. Pous". The video has 78 views and was posted on Dec 15, 2020. The video duration is 25:00, and it is currently at 0:37. The video content shows an aerial view of a port with many shipping containers stacked in rows. A white overlay text box contains the text "Containers love IoT" and a small 3D cube icon. In the top right corner of the video frame, there is a circular profile picture of a man wearing a t-shirt with the text "balena Enter". The YouTube interface includes a search bar, a magnifying glass icon, a microphone icon, and a user profile icon. The video player has a dark theme with yellow dots scattered across the background. The bottom right corner of the video frame features the "python barcelona" logo.

PyDayBCN 2020 Track 2 - Building My First Python IoT Device with Containers in 20 minutes by M. Pous

78 views · Dec 15, 2020

0:37 / 25:00

Containers love IoT

Containers love IoT

Containers love IoT

All Watched

How to Connect Github with PyCharm | #Hindi |

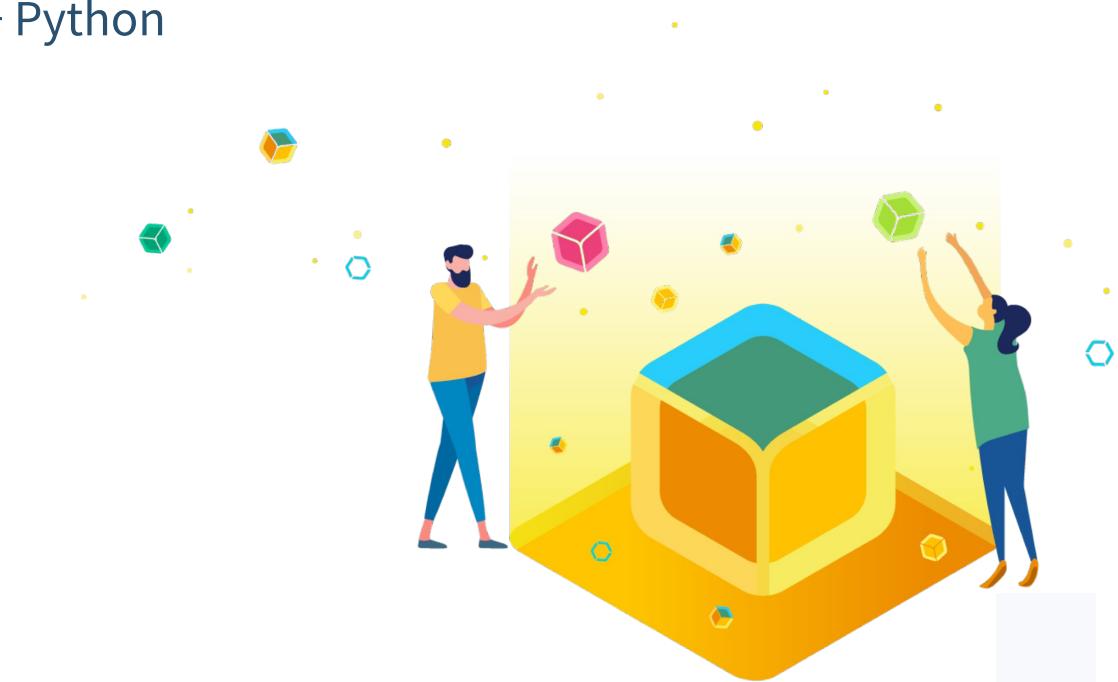
<https://www.youtube.com/watch?v=nWVJ7HfFC5E>



# Today

$\frac{1}{3}$  Stories about birds + AI + IoT + Python

$\frac{2}{3}$  Let's build it together



# Prerequisites

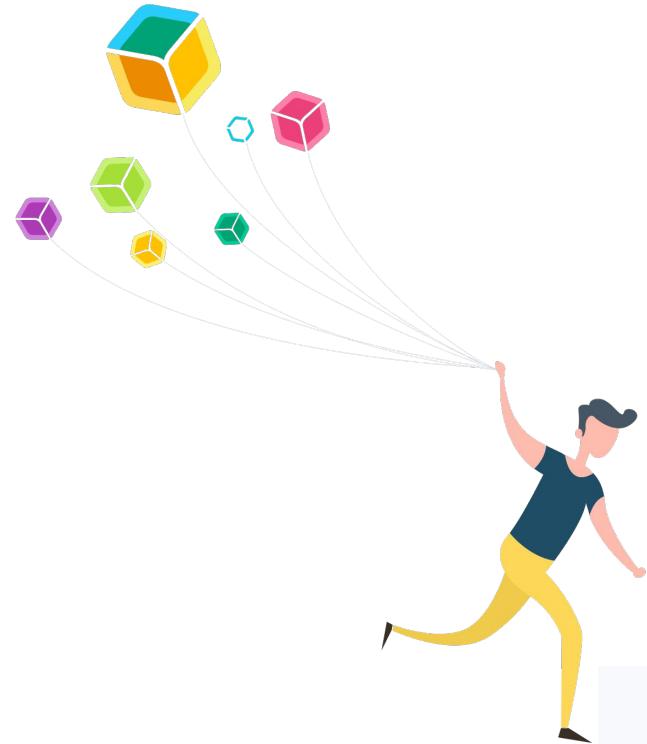
Raspberry Pi 3 / 4

USB Camera or Pi Camera

Telegram app

[balenaCloud](#) account

[Edge Impulse](#) account

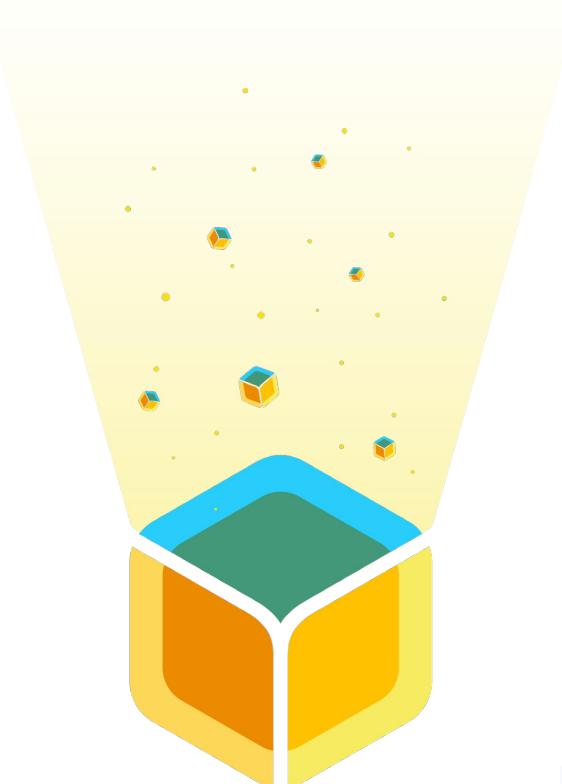


# Goals

Learn about birds and others around us.

Introduce on IoT and AI using Python SDK.

Involve the community into the project.



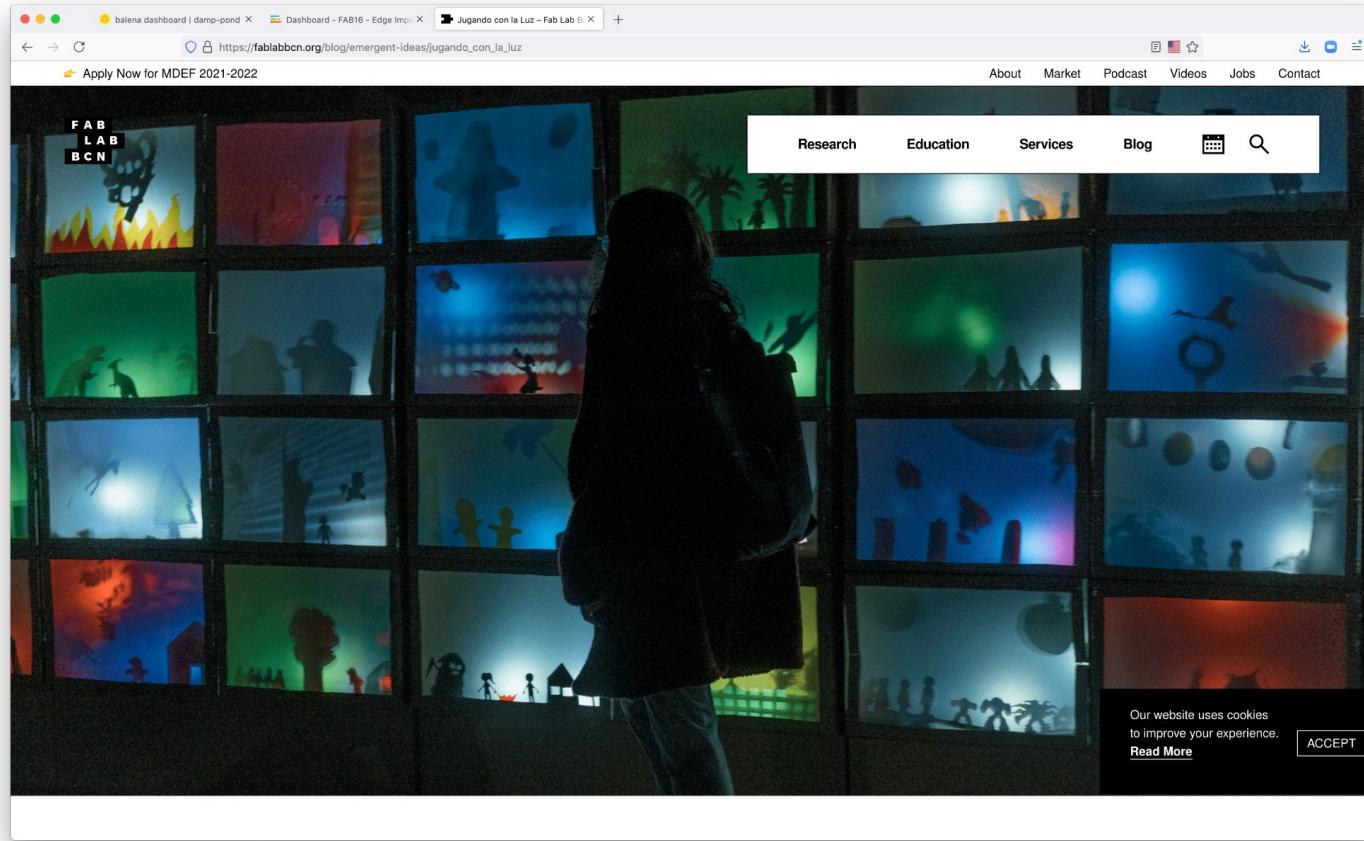
First, let me tell you a  
story...



Vilallonga de Ter



Escola Sant Martí Barcelona



[https://fablabbcn.org/blog/emergent-ideas/jugando\\_con\\_la\\_luz](https://fablabbcn.org/blog/emergent-ideas/jugando_con_la_luz)



balena dashboard | damp-pond X Dashboard - FAB16 - Edge Imp. X Pájaros en la Nube: qué es el pro X +

https://pajarosenlanube.ibercivis.es/2020/11/09/pajaros-en-la-nube-proyecto/

Inicio Profesores Proyecto Blog de Actualidad Recursos del proyecto

Pájaros en la Nube: qué es el proyecto

por aembid | Nov 9, 2020 | blog | 0 Comentarios



Programa en tu casa una caseta sensorizada conectada a internet de las cosas y descubre los pájaros de tu entorno.

Pájaros en la nube

ibercivis

FECYT

Bienvenidos al proyecto Pájaros en la Nube que tiene como objetivo la monitorización de la fauna insectívora del entorno. Se trata de un proyecto inclusivo y dirigido a todas las edades en el ámbito de la educación tanto a nivel científico como tecnológico.

**Metodología del proyecto Pájaros en la Nube:**

Con Pájaros en la Nube, en el aula se aprenderá a crear una caseta y programarla mediante una placa de Arduino, para que, mediante el internet de las cosas y la computación en la nube, se podrá colocar dicha caseta en el exterior y recibir en el aula los datos científicos que se buscan obtener.

Los datos científicos adquiridos muestran la diversidad de la fauna de la zona de los animales, sobre todo pájaros, que

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Cookie Settings Accept All

Buscar

Entradas recientes

Actividades realizadas en los centros participantes

Pájaros en la Nube: FAQS

Ya está lista la caja de Pájaros en La Nube

85 centros escolares participarán en Pájaros en la Nube 2020/21

Plazo de inscripción hasta el 20/01/2021

Comentarios recientes

Nuria Aliana Colomer en Pájaros en la Nube: FAQS

Belén Barbero en 85 centros escolares participarán en Pájaros en la Nube 2020/21

Miquel en 85 centros escolares participarán en Pájaros en la Nube 2020/21

<https://pajarosenlanube.ibercivis.es/2020/11/09/pajaros-en-la-nube-proyecto/>





Pájaros en la nube @ Escola Sant Martí Barcelona





balena

Bird Buddy: A Smart Bird Feeder

<https://www.kickstarter.com/projects/mybirdbuddy/bird-buddy-a-smart-bird-feeder>

**KICKSTARTER**

Descubrir Empieza un proyecto Búsqueda Iniciar sesión

## Bird Buddy: A Smart Bird Feeder



Bird Buddy notifies you of feathered visitors, captures their photos and organizes them in a beautiful collection!

Pre-order now!

Creado por  
Bird Buddy

22.925 patrocinadores contribuyeron 4.190.158 € para que este proyecto se pudiera realizar.

Última actualización 4 de agosto de 2021

Campaña Preguntas frecuentes 6 Actualizaciones 16 Comentarios 1,631 Comunidad



Apoyar

Contribuir 1 € o más





Project made by Mithun Das

balena dashboard | damp-pond X Dashboard - FAB10 - Edge Imp... X balenaHub: an easier way to fin... X +

https://hub.balena.io

What is balenaHub? Contribute Community

Fleets Projects Blocks

Submit a fleet Add filter

Search entries.

Views

balenaSound by balenalabs

Build a single or multi-room streamer for an existing audio device using a Raspberry Pi! Supports Bluetooth, Airplay and Spotify Connect.

WORKS WITH Fin Nano

rosetta-at-home-arm by balenalabs

Help fight the COVID-19 pandemic with your old laptop, Raspberry Pi, or other spare computer

WORKS WITH Nano

pihole by gh\_klutchell's Organization

Pi-hole is a Linux network-level advertisement and Internet tracker blocking application!

WORKS WITH Fin Nano

Home\_Assistant-AdGu... by github.com/abulaisik

A project to deploy Home Assistant and AdGuard Home on a single device

WORKS WITH Fin

balena-minecraft-server by AlexProgrammerDE

Build a Minecraft Server using a Raspberry Pi 4! Supports common Servers, SCP, RCON and Wifi Connect.

WORKS WITH Nano

rosetta-at-home-amd64 by balenalabs

Help fight the COVID-19 pandemic with your old laptop, Raspberry Pi, or other spare computer

WORKS WITH Intel\_NUC

balenaSense by balenalabs

Take readings from a BME680 or similar sensors on a Raspberry Pi, store with InfluxDB and view with Grafana.

WORKS WITH Fin Nano

internetspeedtest by Will\_Phillips

Periodically tests your internet speed, stores the result in InfluxDB and charts it in grafana.

WORKS WITH Fin

adguard by gh\_klutchell's Organization

AdGuard Home is a network-wide software for blocking ads & tracking

WORKS WITH

led-pixel-controller by chrisys.world

Remotely control and program configurable RGB LED pixel matrices, strings, trees, and more with this handy all-in-one setup.

WORKS WITH

bookstack by gh\_klutchell's Organization

BookStack is a simple and free, self-hosted, easy-to-use wiki platform for organising and storing information.

WORKS WITH

octoprint by balenalabs

Remotely control your 3D-printer with Octoprint and balena!

WORKS WITH



<https://hub.balena.io>

balenaHub: an easier way to fin X +

https://hub.balena.io/?0[0][n]=any&0[0][o]=full\_text\_search&0[0][v]=bird

Add your Project or Fleet before November 30th 2021 to enter the balenaHub Challenge for the chance of getting your project featured on Etcher and winning £2.5k in cash! Click to find out more

What is balenaHub? Contribute Community CHALLENGE

Fleets Projects Blocks

[Publish a fleet](#) [Add filter](#)

bird

Views ▾ [Save as view](#)

Filters (1) Clear all

Any field contains bird

**birdwatcher**  
by g\_mithun\_das's Organization

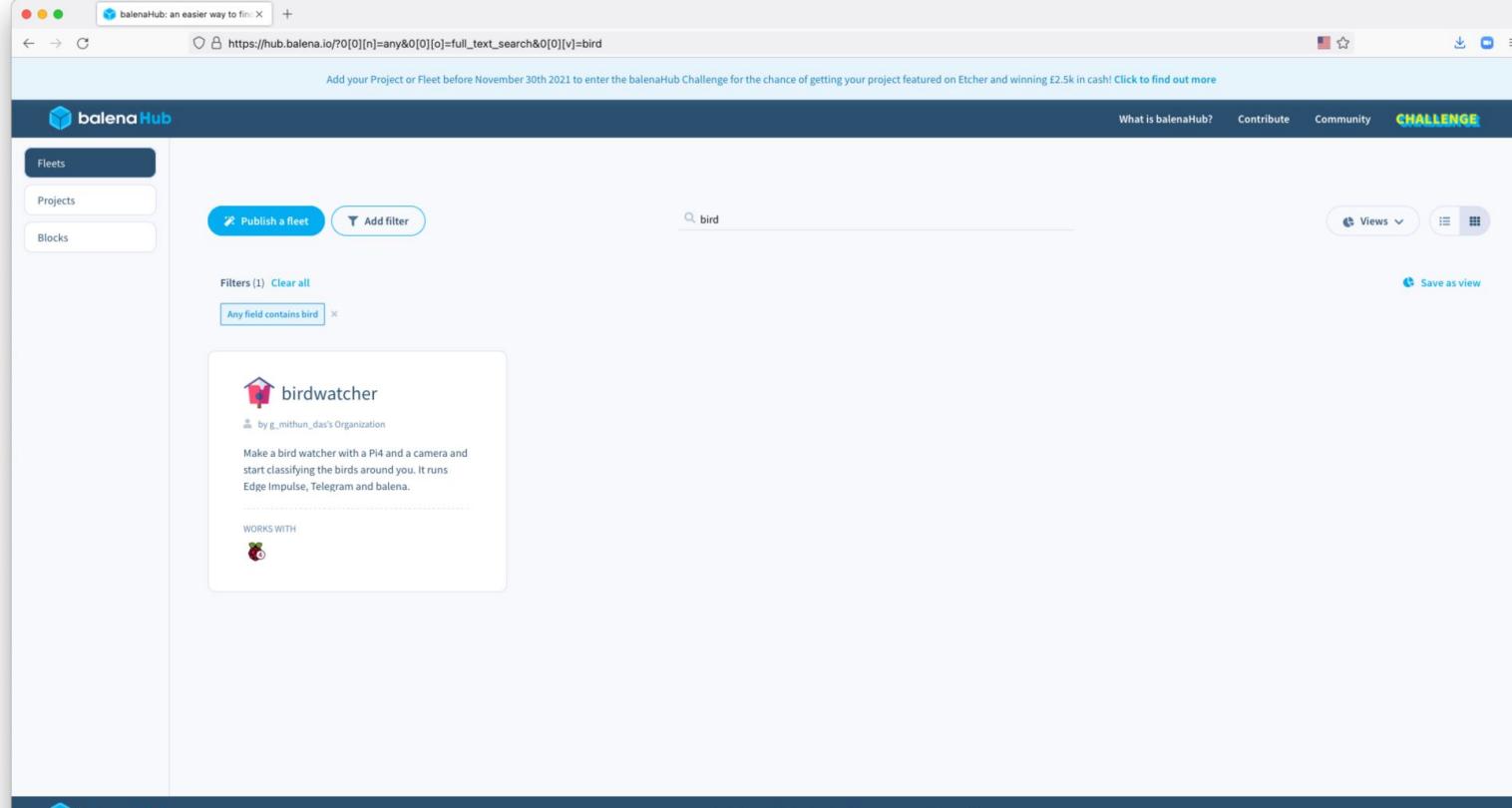
Make a bird watcher with a Pi4 and a camera and start classifying the birds around you. It runs Edge Impulse, Telegram and balena.

WORKS WITH

balena Hub A project by balena.io

Twitter Facebook Instagram Youtube

Terms of use



<https://hub.balena.io>



balenaHub: an easier way to find X +

https://hub.balena.io/g\_mithun\_das/birdwatcher

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What is balenaHub? Contribute Community CHALLENGE

Fleets Projects Blocks ← Back to Fleets

**birdwatcher** by g\_mithun\_das's Organization

Map Hybrid

Get birdwatcher It's free and open source 8 Active devices, last 28 days Get started

Google

Keyboard shortcuts Map data ©2021 Google, INEGI Terms of Use

Description Make a bird watcher with a Pi4 and a camera and start classifying the birds around you. It runs Edge Impulse, Telegram and balena.

Works With Raspberry Pi 4

Version - View code | last updated at: 11 Oct 2021 Fork this fleet Report issue

**What is Bird Watcher?**  
Bird Watcher is a Bird Feeder with a Raspberry Pi 4 with a camera running balena and Edge Impulse Machine Learning service. This project run Edge Impulse Linux SDK on balenaOS allowing you to manage a fleet of devices.

**Installation Instructions**

[https://hub.balena.io/g\\_mithun\\_das/birdwatcher](https://hub.balena.io/g_mithun_das/birdwatcher)





Project made by Mithun



Project made by Mithun



Sparrow 93%



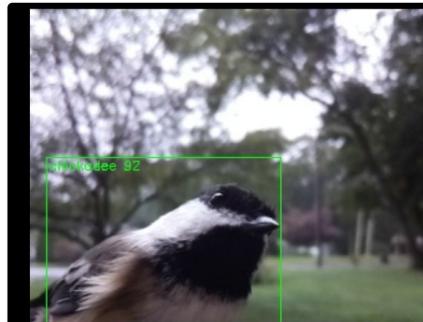
chickadee 94

chickadee

9/24/2021, 7:26:55 AM

Train Edge Impulse

Delete



<http://birdwatcher.local>



V 2.0.0



# How to build it?





The DIE HARD method

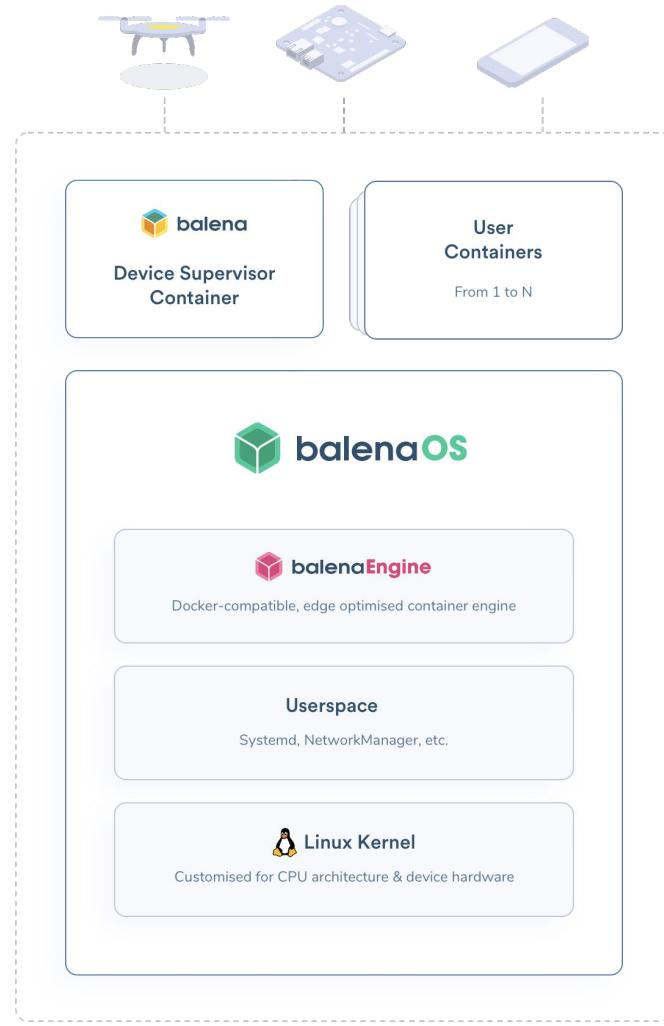


Deploy with balena

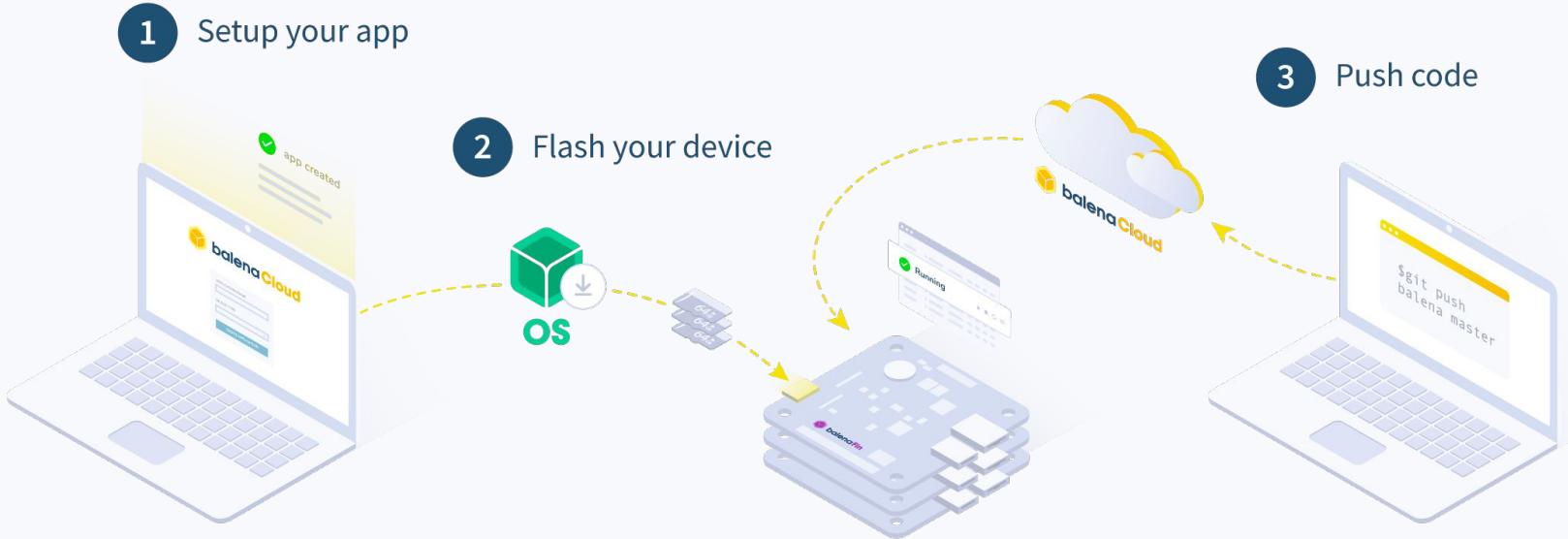
or KEEP CALM AND US USE balena methods

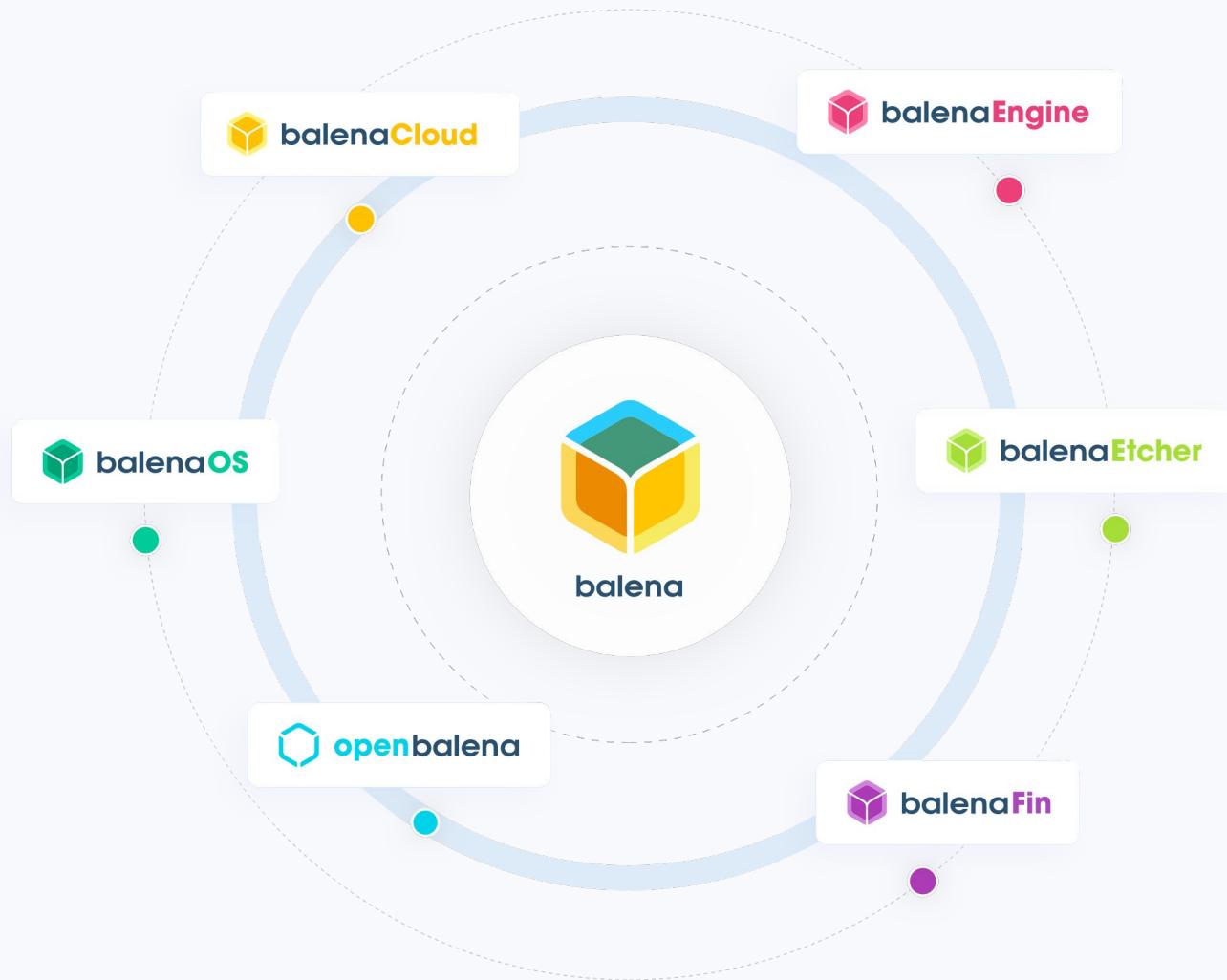


Why [balena.io](https://balena.io)?



# How it works





Build it with me :-)



balenaCam

Today we are  
going to train  
and deploy a  
Santa Claus  
detector.



- 1 Prepare the camera + Raspberry Pi (or similar)
- 2 Deploy the balena Fleet on the Pi
- 3 Train a ML model with Edge Impulse
- 4 Share it, contribute and inspire



1

# Prepare the camera

Raspberry Pi



# Hardware

Raspberry Pi 3 / 4 or balenaFin

USB Camera or Pi Camera

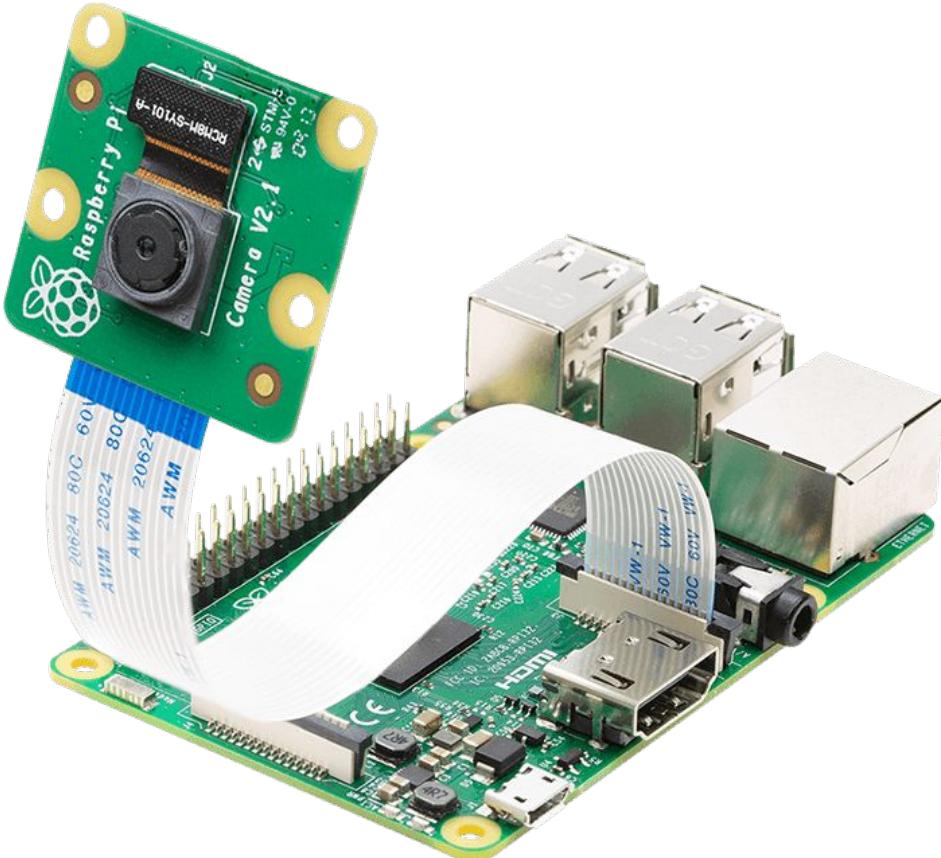
SD Card

Power Adapter

[balenaCloud](#)

[Edge Impulse](#)

[balenaEtcher](#)



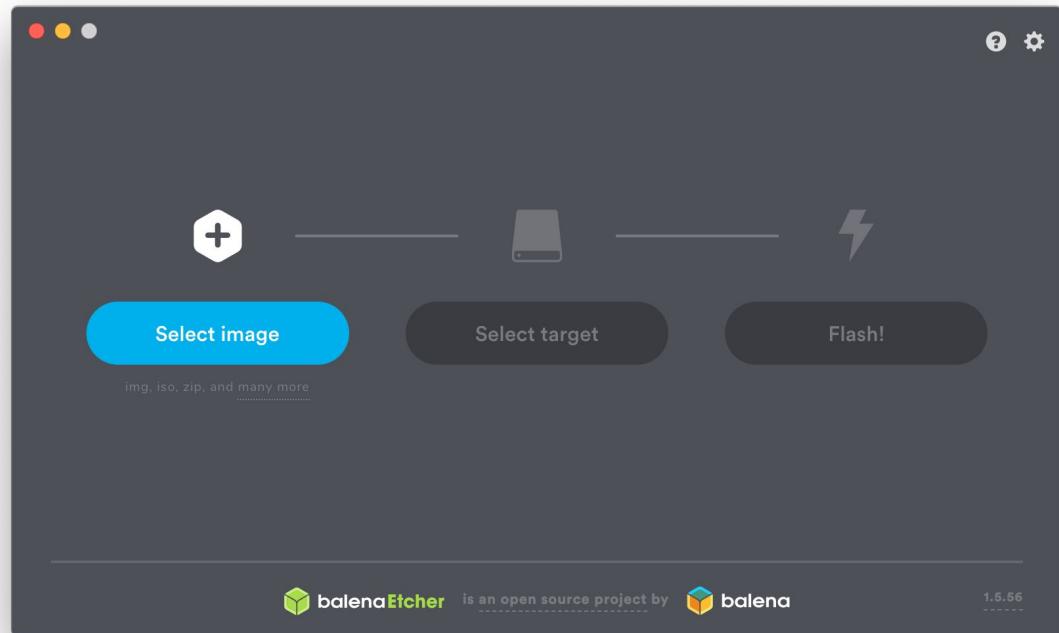
# Software

[balenaCloud](#)

[Edge Impulse](#)

[balenaEtcher](#)

Telegram app



2

# Deploy the balena fleet in just one click



balena dashboard | damp-pond X Dashboard - FAB16 - Edge Impulse X balenaHub: an easier way to find... +

https://hub.balena.io/projects

What is balenaHub? Contribute Community

Fleets Projects Blocks

Submit a project Add filter

Search entries...

Views

uk-train-departure-dis...

by chrisj's world

A balenaCloud Raspberry Pi app to display replica near real-time UK railway station departure data on SSD1322 screens.

WORKS WITH

gpsTime

by mall1's Organization

Uses attached GPS UART with PPS to provide accurate time via chrony ntp server

WORKS WITH

bird-watcher-balena-fin

by g\_mithun\_das's Organization

Build a Smart Bird Feeder powered by Edge Impulse and Balena

WORKS WITH

agriaiv-v2

by Arjit Das

Pest detection and classification made using Edge Impulse and balena.

WORKS WITH

basicstation-gateway-...

by Marc Pouss

Deploys the Things Stack LoRaWAN gateway with Basics Station Packet Forward protocol on SX1301 or SX1302 LoRa concentrators.

WORKS WITH

balena-ads-b

by Ketil

Track the flight traffic over your head with a Raspberry Pi running balena and a cheap RTL-SDR USB dongle.

WORKS WITH

kerberos

by Kerberos.io

Video surveillance and video analytics for people and enterprises making this world a safer and smarter place.

WORKS WITH

home-urbit

by gh\_0dyslam's Organization

Urbit is a new OS and peer-to-peer network that's simple by design, built to last forever, and 100% owned by its users. Urbit is your last computer.

WORKS WITH

TTS-network-server

by Xose Pérez

Deploys the Things Stack LoRaWAN Network Server Open Source Edition.

WORKS WITH

wifi-repeater

by balenalabs

Easily create a WiFi Access Point or WiFi repeater with balenaOS.

WORKS WITH

balenaLocating

by Will Phillion

Use Raspberry Pi's and Bluetooth BLE beacons to ensure you never lose your important stuff again.

WORKS WITH

TTS-network-server-ba...

by Xose Pérez

Deploys the Things Stack LoRaWAN Network Server alongside BasicStation Gateway Protocol.

WORKS WITH

<https://hub.balena.io>



just4give/birdwatcher

https://github.com/just4give/birdwatcher

Search or jump to... Pull requests Issues Marketplace Explore

Watch 1 Unstar 5 Fork 2

Code Issues Pull requests Actions Projects Wiki Security Insights

master 8 branches 0 tags Go to file Add file Code

mpous Update ei\_run.sh f83a448 on 16 Oct 107 commits

data Update birds.json 3 months ago

docs site update last month

ei-processing Update ei\_run.sh last month

supervisor supervisor block 2 months ago

tools rename block name 2 months ago

web code fix 2 months ago

wifi-connect website update and wifi-connect block 2 months ago

.gitignore docs 2 months ago

README.md Update README.md 2 months ago

balena.yml Update balena.yml 2 months ago

docker-compose.yml rename block name 2 months ago

logo.png changed app name 4 months ago

README.md

Bird Watcher using Edge Impulse Linux SDK and

About

No description, website, or topics provided.

Readme

Releases

No releases published Create a new release

Packages

No packages published Publish your first package

Contributors 2

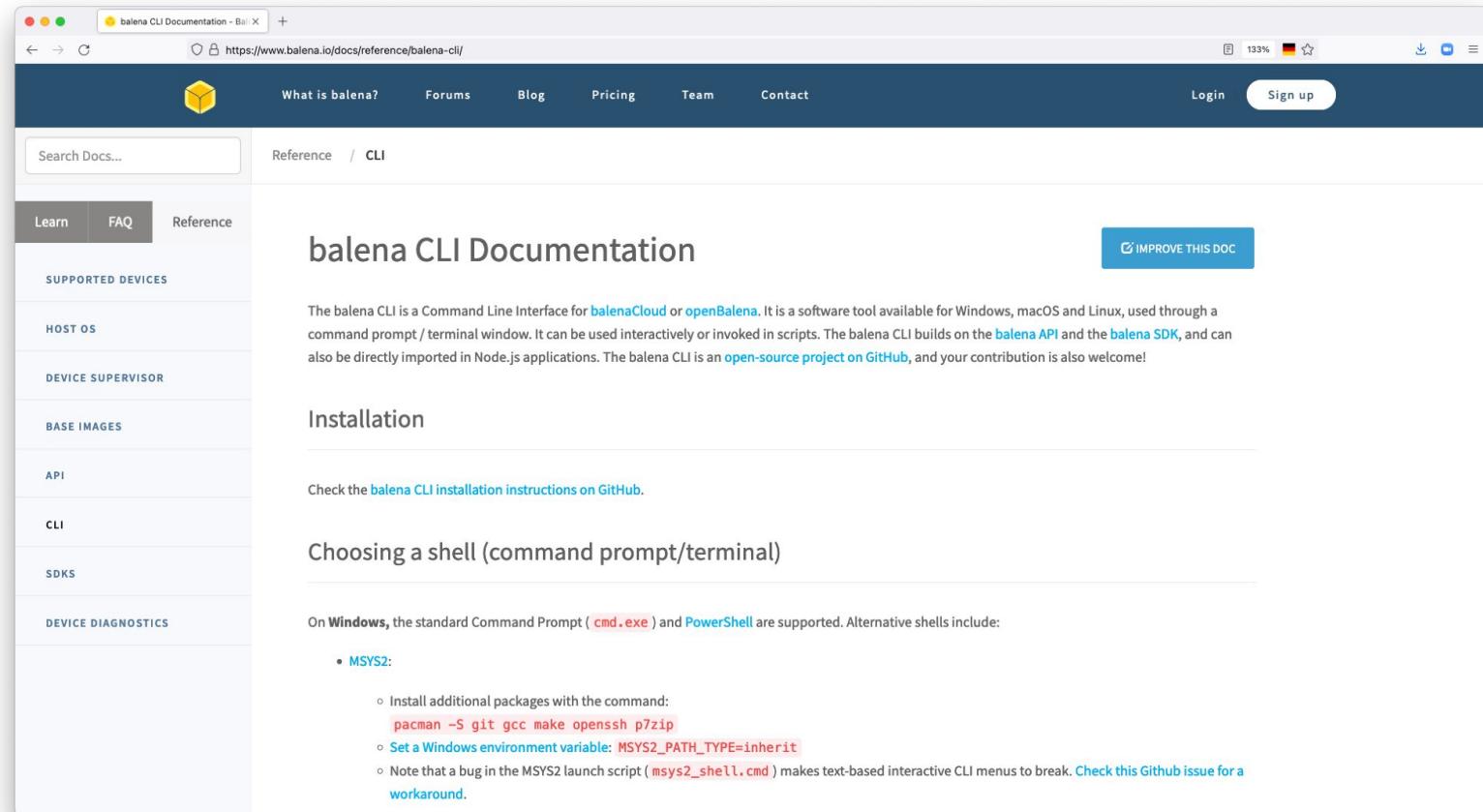
mpous Marc Pous  
just4give Mithun Das

Environments 1

github-pages Active

<https://github.com/just4give/birdwatcher>





The screenshot shows a web browser window displaying the [balena CLI Documentation](https://www.balena.io/docs/reference/balena-cli/). The page has a dark blue header with the balena logo, navigation links for 'What is balena?', 'Forums', 'Blog', 'Pricing', 'Team', 'Contact', and user options 'Login' and 'Sign up'. A search bar is at the top left. The main content area has a light gray background. On the left is a sidebar with a vertical list of categories: 'Learn' (selected), 'FAQ', 'Reference', 'SUPPORTED DEVICES', 'HOST OS', 'DEVICE SUPERVISOR', 'BASE IMAGES', 'API', 'CLI' (selected), 'SDKS', and 'DEVICE DIAGNOSTICS'. The 'CLI' category is highlighted with a dark gray background. The main content title is 'balena CLI Documentation' with a 'IMPROVE THIS DOC' button. Below the title, a paragraph explains what the balena CLI is: 'The balena CLI is a Command Line Interface for [balenaCloud](#) or [openBalena](#). It is a software tool available for Windows, macOS and Linux, used through a command prompt / terminal window. It can be used interactively or invoked in scripts. The balena CLI builds on the [balena API](#) and the [balena SDK](#), and can also be directly imported in Node.js applications. The balena CLI is an [open-source project on GitHub](#), and your contribution is also welcome!' Below this is a section titled 'Installation' with a sub-section 'Choosing a shell (command prompt/terminal)'. A note says 'On Windows, the standard Command Prompt ([cmd.exe](#)) and [PowerShell](#) are supported. Alternative shells include:' followed by a list for MSYS2.

What is balena? Forums Blog Pricing Team Contact Login Sign up

Search Docs... Reference / CLI

Learn FAQ Reference

SUPPORTED DEVICES

HOST OS

DEVICE SUPERVISOR

BASE IMAGES

API

CLI

SDKS

DEVICE DIAGNOSTICS

# balena CLI Documentation

IMPROVE THIS DOC

The balena CLI is a Command Line Interface for [balenaCloud](#) or [openBalena](#). It is a software tool available for Windows, macOS and Linux, used through a command prompt / terminal window. It can be used interactively or invoked in scripts. The balena CLI builds on the [balena API](#) and the [balena SDK](#), and can also be directly imported in Node.js applications. The balena CLI is an [open-source project on GitHub](#), and your contribution is also welcome!

## Installation

Check the [balena CLI installation instructions on GitHub](#).

### Choosing a shell (command prompt/terminal)

On **Windows**, the standard Command Prompt ([cmd.exe](#)) and [PowerShell](#) are supported. Alternative shells include:

- **MSYS2:**
  - Install additional packages with the command:  
`pacman -S git gcc make openssh p7zip`
  - Set a Windows environment variable: `MSYS2_PATH_TYPE=inherit`
  - Note that a bug in the MSYS2 launch script ([msys2\\_shell.cmd](#)) makes text-based interactive CLI menus to break. [Check this Github issue for a workaround](#).

<https://github.com/balena-io/balena-cli/blob/master/INSTALL.md>



```
$ git clone https://github.com/just4give/birdwatcher.git  
$ cd birdwatcher  
$ balena login  
$ balena push birdwatcher
```



balena dashboard | bird-watcher X + https://dashboard.balena-cloud.com/fleets/1850718/summary

Marc Pous MP

Getting Started Docs Forums Status

bird-watcher-El-linux

Devices 2

Releases 2

Summary

Devices

Releases

Variables

Configuration

Actions

Settings

Members

Location

Add device

Name	Status	Device type	Last seen	UUID	OS version	OS variant	Supervisor version	IP address	Actions
damp-pond	✓ Online	Raspberry Pi 4 (using 64bit OS)	Online (for 11 days)	7b7fa16	balenaOS 2.80.5+rev1	Production	12.8.7	192.168.1.44	2.
FAB16	✗ Offline	Raspberry Pi 4 (using 64bit OS)	3 days ago	a605363	balenaOS 2.82.10+rev1	Production	12.9.3	192.168.100.57	18

Tags Actions

Add device

Need help



balena dashboard | Fleets

https://dashboard.balena-cloud.com/fleets/1847723/summary

Getting Started Docs Forums Status Marc Pous MP

birdwatcher

Devices

Releases

303

Add new device

Select device type: Raspberry Pi

Select OS type: balenaOS

Select version: v2.85.2+rev3 (recommended)

Show outdated versions

Select edition:

- Development (Recommended for first time users): Development images should be used when you are developing an application and want to use the fast local mode workflow. This variant should never be used in production.
- Production: Production images are ready for production deployments, but don't offer easy access for local development.

Network Connection:

- Ethernet only (selected)
- Wifi + Ethernet

+ Advanced

Download balenaOS (~167 MB)

Instructions

- Use the form on the left to configure and download balenaOS for your new device.
- Write the OS file you downloaded to your SD card. We recommend using Etcher.
- Insert the freshly burnt SD card into the Raspberry Pi 4.
- Connect your Raspberry Pi 4 to the internet, then power it up.
- Your device should appear in your fleet in the dashboard within a few minutes. Have fun!

For more details please refer to our [Getting Started Guide](#).

Tags Actions

address Current

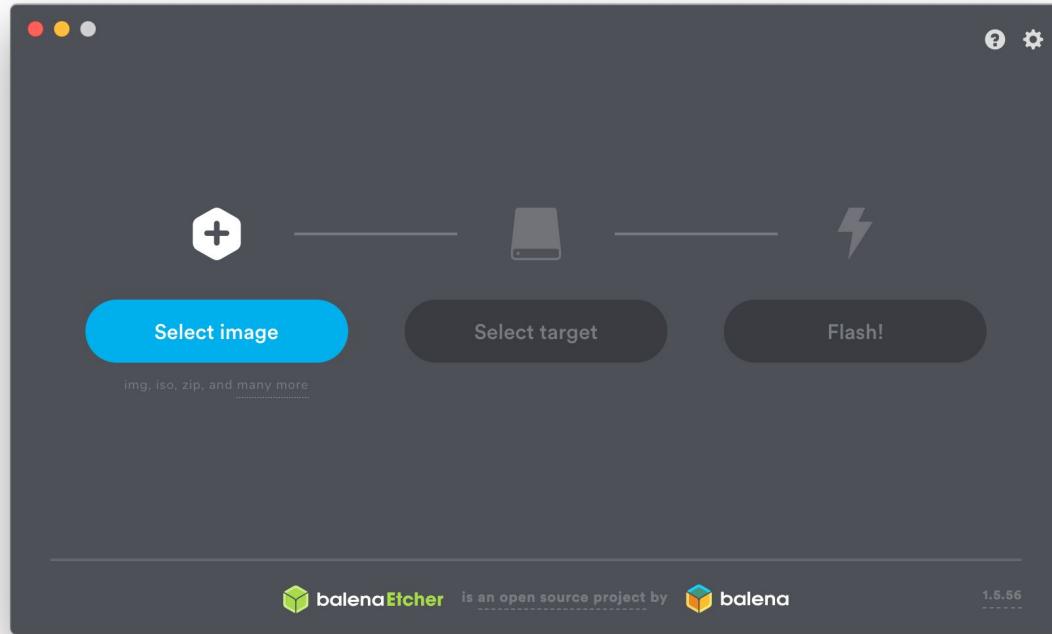
59.195.42 9f0e622

215.109 9f0e622

Need help

The screenshot shows the balenaCloud dashboard interface. On the left, a sidebar navigation includes 'Organizations', 'Fleets' (selected), 'Devices', 'Releases', 'Variables', 'Configuration', 'Actions', 'Settings', 'Members', 'Teams', and 'Location'. The main content area displays a 'birdwatcher' fleet summary with 303 devices. A central modal window titled 'Add new device' is open, prompting the user to select a device type (Raspberry Pi), OS type (balenaOS), and version (v2.85.2+rev3). It also allows selecting between 'Development' and 'Production' editions, with 'Production' being selected. Under 'Network Connection', 'Ethernet only' is chosen. At the bottom of the modal is a blue 'Download balenaOS (~167 MB)' button. To the right of the modal, a sidebar provides fleet statistics (59.195.42, 215.109) and a list of devices (9f0e622, 9f0e622).





balena dashboard | mean-stream

https://dashboard.balena-cloud.com/devices/21b2603d367ea6af227356d1c82cd23b/summary

Getting Started Docs Forums Status Marc Pous MP

### mean-stream

**STATUS** Online **UUID** 21b2603d367ea6af227356d1c82cd23b **TYPE** Raspberry Pi 3 (using 64bit OS)

**ONLINE FOR** a minute **HOST OS VERSION** balenaOS 2.80.3+rev1 **SUPERVISOR VERSION** 12.7.0

**CURRENT RELEASE** 4585238 **TARGET RELEASE** 4585238

**LOCAL IP ADDRESS** 192.168.1.43 **PUBLIC IP ADDRESS** 81.34.94.229 **MAC ADDRESS** B8:27:EB:F8:7C:38  
B8:27:EB:AD:29:6D

**TAGS (0)** No tags configured yet **PUBLIC DEVICE URL** [Toggle](#)

**NOTES** Add device notes...

**SERVICES**

Service	Status	Release	Actions
ei-processing	Running	4585238	<a href="#">Start</a> <a href="#">Stop</a> <a href="#">Restart</a> <a href="#">Logs</a>
hostname	Starting	4585238	<a href="#">Start</a> <a href="#">Stop</a> <a href="#">Restart</a> <a href="#">Logs</a>
telegram	Running	4585238	<a href="#">Start</a> <a href="#">Stop</a> <a href="#">Restart</a> <a href="#">Logs</a>
web	Running	4585238	<a href="#">Start</a> <a href="#">Stop</a> <a href="#">Restart</a> <a href="#">Logs</a>

**CPU** ~91% **Temperature** ~54C **Memory** 178 MB/540 MB **Storage** /dev/mmcblk0p6 3.1 GB/13.8 GB

**Logs** UTC Timestamps

Add filter Search entries... Views

```
24.11.21 12:14:23 (+0100) ei-processing Edge Impulse Linux runner v1.2.9
24.11.21 12:14:27 (+0100) ei-processing
24.11.21 12:14:29 (+0100) ei-processing [RUN] Downloading model...
24.11.21 12:14:55 (+0100) ei-processing [RUN] Stored model in /usr/src/app/modelfile.eml
24.11.21 12:15:03 (+0100) Starting service 'hostname sha256:158a5a8894f493ef7e1a414e2be0256ce50586
66e96f1dc9599427ae8bc5e23e'
24.11.21 12:15:03 (+0100) telegram
24.11.21 12:15:03 (+0100) telegram > app@1.0.0 start /usr/src/app
24.11.21 12:15:03 (+0100) telegram > node app.js
24.11.21 12:15:03 (+0100) telegram
```

**Terminal**

Select a target Start terminal session

Need help



3

# Train the ML model using Edge Impulse



Dashboard - bird-watcher-ei - +

https://studio.edgeimpulse.com/public/40986/latest

You are viewing a public Edge Impulse project. Clone this project to add data or make changes.

Clone this project

EDGE IMPULSE

Project info Keys Export

Mithun / bird-watcher-ei

This is your Edge Impulse project. From here you acquire new training data, design impulses and train models.

Creating your first impulse (100% complete)

Acquire data

Every Machine Learning project starts with data. You can capture data from a development board or your phone, or import data you already collected.

LET'S COLLECT SOME DATA

Design an impulse

Teach the model to interpret previously unseen data, based on historical data. Use this to categorize new data, or to find anomalies in sensor readings.

GETTING STARTED: CONTINUOUS MOTION RECOGNITION

GETTING STARTED: RESPONDING TO YOUR VOICE

GETTING STARTED: ADDING SIGHT TO YOUR SENSORS

Deploy

Package the complete impulse up, from signal processing code to trained model, and deploy it on your device. This ensures that the impulse runs with low latency and without requiring a network connection.

DEPLOY YOUR MODEL

Summary

DATA COLLECTED  
102 items

Project info

Project ID	40986
Project version	1

<https://studio.edgeimpulse.com/public/40986/latest>



Dashboard - FAB16-demo - Edge Impulse

https://studio.edgeimpulse.com/studio/44781

Project info Keys Export gy4nt

EDGE IMPULSE

Dashboard Devices Data acquisition Impulse design Create impulse Retrain model Live classification Model testing Versioning Deployment

gy4nt / FAB16-demo

This is your Edge Impulse project!

Welcome to your new Edge Impulse project!

You're ready to add real intelligence to your edge devices. Let's set up your project. What type of data are you dealing with?

Creating your first project

Acquire data

Every Mac or PC can be a developer

LET'S GET STARTED

Design a machine learning model

Teach the model to recognize data. Use sensor readings.

GETTING STARTED

Documentation

Forums

Deploy

Package the complete impulse up, from signal processing code to trained model, and deploy it on your device. This ensures that the impulse runs with low latency and without requiring a network connection.

DEPLOY YOUR MODEL

Accelerometer data

Analyze movement of your device in real-time to predict machine failure, detect human gestures, or monitor rotating machines.

Audio

Listen to what's happening around you to create voice interfaces, listen to keywords, detect audible events, or to hear what's happening around your device.

Images

Add sight to your sensors with image classification or object detection - to detect humans and animals, monitor production lines or track objects.

Something else

Different sensor? No problem! You can collect and import data from any sensor, from environmental sensors to radars - and deploy your trained model back to virtually any device.

I know what I'm doing. Hide this wizard!

Sharing

Your project is private.

Make this project public

Summary

DEVICES CONNECTED 0

DATA COLLECTED -

Collaborators

gy4nt OWNER

Project info

The screenshot shows the Edge Impulse Studio interface. A central modal window titled 'Welcome to your new Edge Impulse project!' is displayed, prompting the user to choose the type of data they are dealing with. The options include 'Accelerometer data', 'Audio', 'Images', and 'Something else'. Below the modal, there is a 'Deploy' section with a 'DEPLOY YOUR MODEL' button. To the right of the modal, a 'Sharing' section indicates the project is private, with a button to make it public. Further down, a 'Summary' section shows 'DEVICES CONNECTED 0' and 'DATA COLLECTED -'. On the left, a sidebar lists various project management and development tools like Dashboard, Devices, and Data acquisition. The top navigation bar includes links for Project info, Keys, Export, and a user profile for 'gy4nt'. The overall theme is purple and blue.



Dashboard - FAB16-demo Edge X

https://studio.edgeimpulse.com/studio/44781

Project info Keys Export gy4nt

EDGE IMPULSE

Dashboard Devices Data acquisition Impulse design Create impulse Retrain model Live classification Model testing Versioning Deployment

gy4nt / FAB16-demo

This is your Edge Impulse project!

Welcome to your new Edge Impulse project!

Great! What do you want to detect?

**Creating your first project**

Acquire data

Every Microcontroller can be used to collect data from a developer's environment or a physical world.

Let's get started

**Classify a single object (image classification)**

Detect one object in an image, for example whether you see a lamp or a plant. Image classification is efficient and can be ran on microcontrollers, including development boards from OpenMV, Arduino, Himax and Eta Compute.

**Classify multiple objects (object detection)**

Detect the location of multiple objects in an image, for example to detect how many apples you see. Object detection is a lot more compute intensive than image classification and currently only works on Linux-based devices like the Raspberry Pi 4 or Jetson Nano.

I know what I'm doing, hide this wizard!

Deploy

Package the complete impulse up, from signal processing code to trained model, and deploy it on your device. This ensures that the impulse runs with low latency and without requiring a network connection.

DEPLOY YOUR MODEL

Sharing

Your project is private.

Make this project public

Summary

DEVICES CONNECTED 0

DATA COLLECTED -

Collaborators

gy4nt OWNER

Project info

The screenshot shows the Edge Impulse Studio interface. A central modal window titled 'Welcome to your new Edge Impulse project!' is displayed, asking 'Great! What do you want to detect?' It offers two options: 'Classify a single object (image classification)' and 'Classify multiple objects (object detection)'. Below the modal, there's a 'Creating your first project' section with a 'Let's get started' button. To the right, a 'Sharing' sidebar indicates the project is private and has a 'Make this project public' button. On the left, a sidebar lists various project management and documentation links. At the bottom, a 'Collaborators' section shows 'gy4nt OWNER'. The overall theme is purple and blue.



Dashboard - FAB16 - Edge Impulse

https://studio.edgeimpulse.com/studio/44463

Project info Keys Export gy4nt

EDGE IMPULSE

Dashboard Devices Data acquisition Impulse design Create impulse Image Object detection Retrain model Live classification Model testing Versioning Deployment

gy4nt / FAB16

This is your Edge Impulse project. From here you acquire new training data, design impulses and train models.

Creating your first impulse (100% complete)

Acquire data

Every Machine Learning project starts with data. You can capture data from a development board or your phone, or import data you already collected.

LET'S COLLECT SOME DATA

Design an impulse

Teach the model to interpret previously unseen data, based on historical data. Use this to categorize new data, or to find anomalies in sensor readings.

GETTING STARTED: CONTINUOUS MOTION RECOGNITION  
GETTING STARTED: RESPONDING TO YOUR VOICE  
GETTING STARTED: ADDING SIGHT TO YOUR SENSORS

Deploy

Package the complete impulse up, from signal processing code to trained model, and deploy it on your device. This ensures that the impulse runs with low latency and without requiring a network connection.

DEPLOY YOUR MODEL

Sharing

Your project is private.

Make this project public

Summary

DEVICES CONNECTED 1

DATA COLLECTED 15 items

Collaborators

gy4nt OWNER

Project info



Workshop FAB16 - Introducing just4give/balena-ei-linux-bird → Data acquisition - FAB16 - Edge Impulse

https://studio.edgeimpulse.com/studio/44463/acquisition/training?page=1

gy4nt

EDGE IMPULSE

DATA ACQUISITION (FAB16)

Training data Test data Labeling queue (4)

Did you know? You can capture data from any device or development board, or upload your existing datasets - Show options

DATA COLLECTED  
6 items

LABELS  
2

Collected data

SAMPLE NAME	LABELS	ADDED	LENGTH
canary-1.jpg.2cfs4ju2	canary	Today, 17:53:26	-
robin-4.jpg.2cfs4j8l	robin	Today, 17:53:26	-
canary-5.jpg.2cfs4j2k	canary	Today, 17:53:25	-
canary-4.jpg.2cfs4ito	canary	Today, 17:53:25	-
robin-5.jpg.2cfs4isl	robin	Today, 17:53:25	-
canary-3.jpg.2cfs4idv	canary	Today, 17:53:25	-

Record new data

No devices connected to the remote management API.

RAW DATA  
Click on a sample to load...

< 1 >

The screenshot shows the Edge Impulse Data Acquisition interface for a project titled "FAB16". The left sidebar contains navigation links for Dashboard, Devices, Data acquisition (selected), Impulse design, Create impulse, Retrain model, Live classification, Model testing, Versioning, Deployment, Getting Started, Documentation, and Forums. The main content area has a purple header "DATA ACQUISITION (FAB16)" with tabs for "Training data" (selected), "Test data", and "Labeling queue (4)". A modal message says "Did you know? You can capture data from any device or development board, or upload your existing datasets - Show options". Below it, a summary shows "DATA COLLECTED" with 6 items and 2 labels. A table lists the samples with columns for Sample Name, Labels, Added, and Length. The table includes rows for canary-1.jpg, robin-4.jpg, canary-5.jpg, canary-4.jpg, robin-5.jpg, and canary-3.jpg. To the right, a "Record new data" section indicates no devices are connected, and a "RAW DATA" section with a button "Click on a sample to load..." is shown.



Workshop FAB16 - Introducing ... just4give/balena-ei-linux-bird Create impulse - FAB16 - Edge

https://studio.edgeimpulse.com/studio/44463/create-impulse

## CREATE IMPULSE (FAB16)

An impulse takes raw data, uses signal processing to extract features, and then uses a learning block to classify new data.

**Image data**

Axes  
image

Image width 320 Image height 320

Resize mode Fit shortest axis

For object detection transfer learning blocks, use a 320x320 image size.

**Image**

Name Image

Input axes  image

**Object Detection (Images)**

Name Object detection

Input features  Image

Output features 2 (canary, robin)

**Output features**

2 (canary, robin)

Save Impulse

Add a processing block

Add a learning block

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Workshop FAB16 - Introducing just4give/balena-ei-linux-bird > Image - FAB16 - Edge Impulse

https://studio.edgeimpulse.com/studio/44463/dsp/image/3

gy4nt

IMAGE (FAB16)  
#1 ▾ Click to set a description for this version

Parameters Generate features

Raw data

canary-1.jpg.2cfs4ju2 (canary)

Raw features

0x263032, 0x263032, 0x273133, 0x283234, 0x293335, 0x293335, 0x2a3435, 0x2a3435, 0x2...

Parameters

Image

Color depth RGB Save parameters

DSP result

Image

Processed features

0.1490, 0.1882, 0.1961, 0.1490, 0.1882, 0.1961, 0.1529, 0.1922, 0.2000, 0.1569, 0.1...

On-device performance



Workshop FAB16 - Introducing ... just4give/balena-ei-linux-bird ... Image - FAB16 - Edge Impulse

https://studio.edgeimpulse.com/studio/44463/dsp/image/3/generate-features

EDGE IMPULSE

IMAGE (FAB16)  
#1 ▾ Click to set a description for this version

Parameters Generate features

Training set

Data in training set 6 items  
Classes 2 (canary, robin)

Generating features...

Feature explorer

No features generated yet.

Feature generation output Cancel

Creating job... OK (ID: 1217971)  
Scheduling job in cluster...  
Job started  
Creating windows from 6 files...

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Workshop FAB16 - Introducing ... just4give/balena-ei-linux-bird ... Image - FAB16 - Edge Impulse

https://studio.edgeimpulse.com/studio/44463/dsp/image/3/generate-features

gy4nt

IMAGE (FAB16)

#1 ▾ Click to set a description for this version

Parameters Generate features

Training set

Data in training set 6 items

Classes 2 (canary, robin)

Generate features

Feature generation output

```
Sun Aug 8 16:00:11 2021 Construct embedding
completed 0 / 500 epochs
completed 50 / 500 epochs
completed 100 / 500 epochs
completed 150 / 500 epochs
completed 200 / 500 epochs
completed 250 / 500 epochs
completed 300 / 500 epochs
completed 350 / 500 epochs
completed 400 / 500 epochs
completed 450 / 500 epochs
Sun Aug 8 16:00:13 2021 Finished embedding
Reducing dimensions for visualizations OK
Job completed
```

Feature explorer (6 samples)

X Axis Y Axis Z Axis

Visualization layer 1 Visualization layer 2 Visualization layer 3

canary robin

On-device performance

PROCESSING TIME 9 ms.

PEAK RAM USAGE 4 KB



back to my fleet

balena dashboard | mean-stream

https://dashboard.balena-cloud.com/devices/21b2603d367ea6af227356d1c82cd23b/envvars

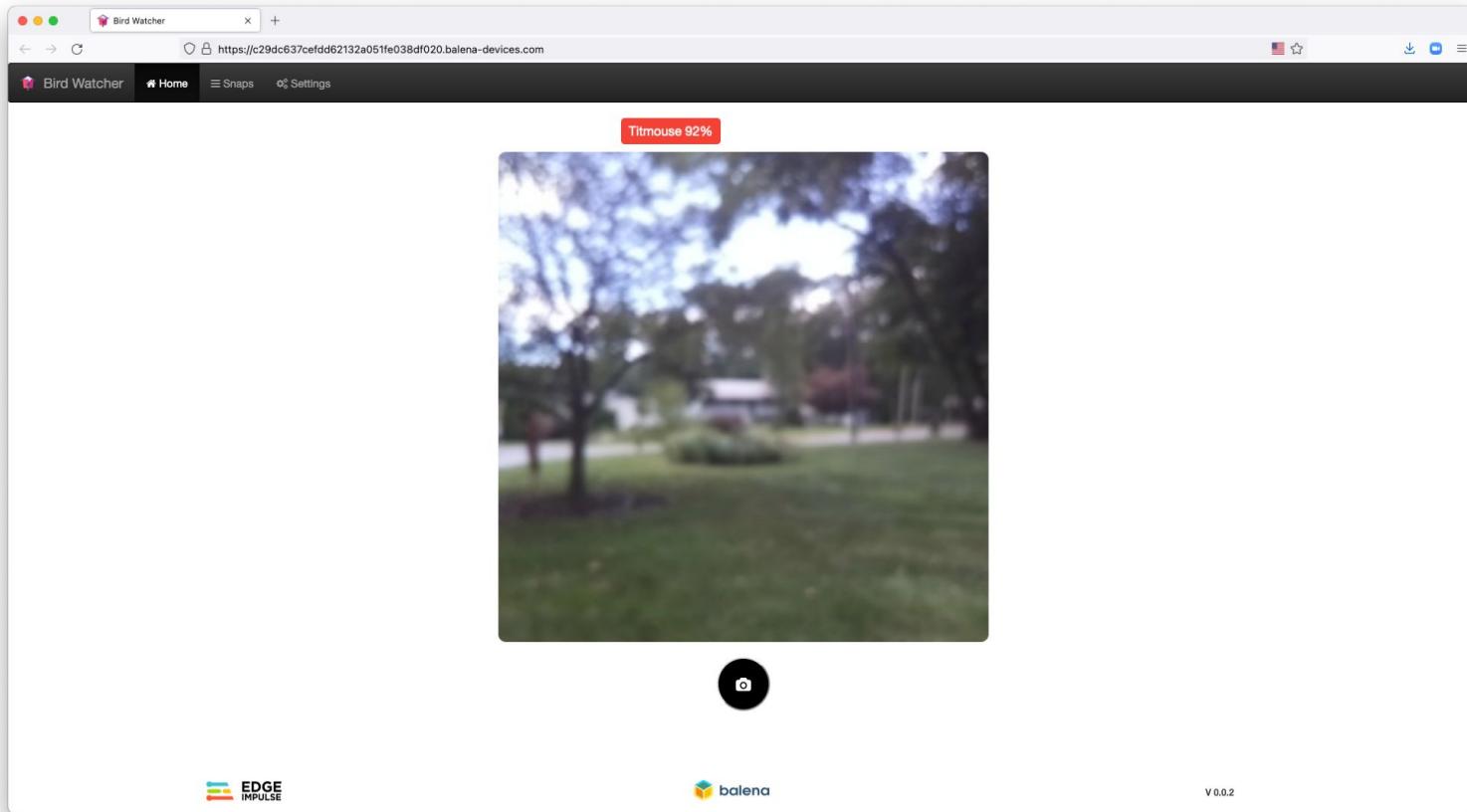
Getting Started Docs Forums Status Marc Pous MP

Add variable Add filter Search entries... Views

Name	Fleet value	Device Value	Service name	Actions
AUTH_TOKEN	7p1MdkIeaX6c34u0a0ABtQ7ZHGCCJ5NR	override	All services	
EI_API_KEY_IMAGE	put_your_EI_apl_key	ei_52e9e2c16407b65bdcf99650b0caa38be5abb4...	All services	
EI_COLLECT_MODE_IMAGE	0	override	All services	
ENABLE_MOTION	Y	override	All services	
ENABLE_TG	N	override	All services	
PASSWORD	birdwatcher	override	All services	
PIXEL_THRESHOLD	75000	override	All services	
TG_CHAT_ID	put_your_telegram_chatbot_id	override	All services	
TG_DISABLE	Y	override	All services	
TG_KEY	put_your_telegram_key	override	All services	
USERNAME	birdwatcher	override	All services	

1 - 11 of 11





<http://birdwatcher.local>



Bird Watcher

https://c29dc637cefdd62132a051fe038df020.balena-devices.com

Home Snaps Settings

Sparrow  
30/9/2021, 17:50:37

Train Edge Impulse Delete

Sparrow  
30/9/2021, 17:50:36

Train Edge Impulse Delete

Sparrow  
30/9/2021, 17:50:35

Train Edge Impulse Delete

Titmouse 55  
30/9/2021, 17:47:59

Train Edge Impulse Delete

Titmouse  
30/9/2021, 17:47:14

Train Edge Impulse Delete

Titmouse  
30/9/2021, 17:47:10

Train Edge Impulse Delete

<http://birdwatcher.local>



Bird Watcher

birdwatcher.local

Bird Watcher Home Snaps Settings LOGOUT

Motion Detection

Enable motion to capture birds not classified by the ML model and retrain the system

Update Motion Detection

Telegram Notification

Telegram Chat ID: 256949909  
Telegram API key: 1415420286:AAFK9eESCPbAUwwjwwWqAt7wqKwjI8FWpbc

Update Telegram credentials

Edge Impulse API Keys

Edge Impulse API key: ei\_52e9e2c16407b65bdcf99650b0caa38be5abb47941464ee7

Update Edge Impulse API key

Position your BirdWatcher or leave it 0, 0 if you want to stay private

Latitude: 41.410  
Longitude: 2.226

Geolocate your BirdWatcher

Website Credentials

Username: birdwatcher

<http://birdwatcher.local>



# Let's add a Telegram bot

<https://core.telegram.org/bots>

The screenshot shows a web browser window with the URL <https://core.telegram.org/bots>. The page title is "Bots: An introduction for developers". The main content area has a heading "Bots: An introduction for developers" followed by a paragraph about what bots are and how they work. Below this, there are several numbered sections: "1. What can I do with bots?", "2. How do bots work?", "3. How do I create a bot?", "4. How are bots different?", "5. Bot perks", and "6. BotFather". Each section contains a brief description and a link to more information. To the right of the main content, there is a sidebar with a list of links. At the bottom of the page, there is a note about the Bot API and a link to its detailed description.

**Bots: An introduction for developers**

Bots are third-party applications that run inside Telegram. Users can interact with bots by sending them messages, commands and [inline requests](#). You control your bots using HTTPS requests to our [Bot API](#).

## 1. What can I do with bots?

To name just a few things, you could use bots to:

- Get customized notifications and news. A bot can act as a smart newspaper, sending you relevant content as soon as it's published.
- Integrate with other services. A bot can enrich Telegram chats with content from external services.  
[Gmail Bot](#), [GIF bot](#), [IMDB bot](#), [Wiki bot](#), [Music bot](#), [Youtube bot](#), [GitHubBot](#)
- Accept payments from Telegram users. A bot can offer paid services or work as a virtual storefront. [Read more >](#)  
[Demo Shop Bot](#), [Demo Store](#)
- Create custom tools. A bot may provide you with alerts, weather forecasts, translations, formatting or other services.  
[Markdown bot](#), [Sticker bot](#), [Vote bot](#), [Like bot](#)
- Build single- and multiplayer games. A bot can offer rich [HTML5 experiences](#), from simple arcades and puzzles to 3D-shooters and real-time strategy games.  
[GameBot](#), [Games](#)
- Build social services. A bot could connect people looking for conversation partners based on common interests or proximity.
- Do virtually anything else. Except for dishes — bots are terrible at doing the dishes.

## 2. How do bots work?

At the core, Telegram Bots are special accounts that do not require an additional phone number to set up. Users can interact with bots in two ways:

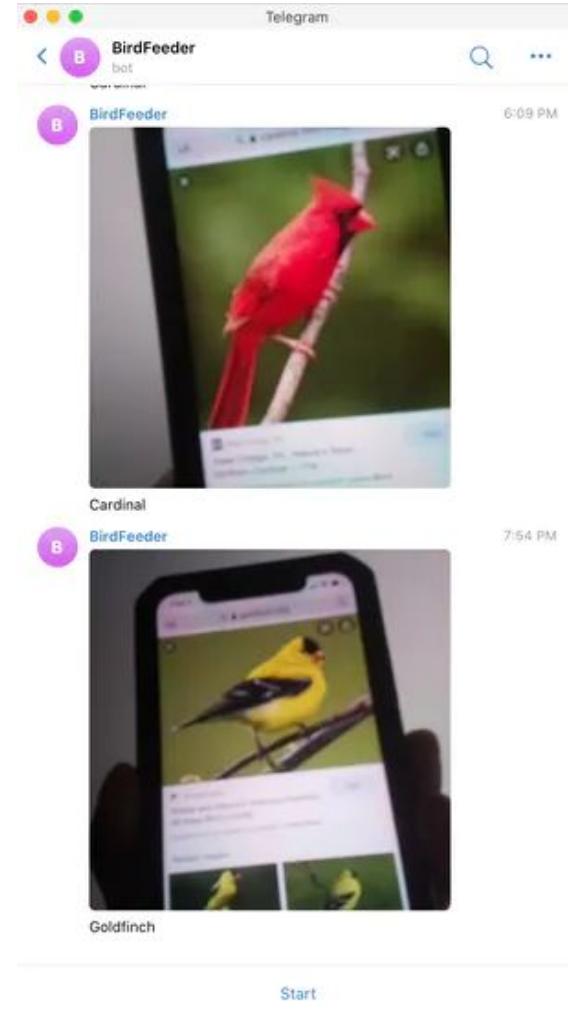
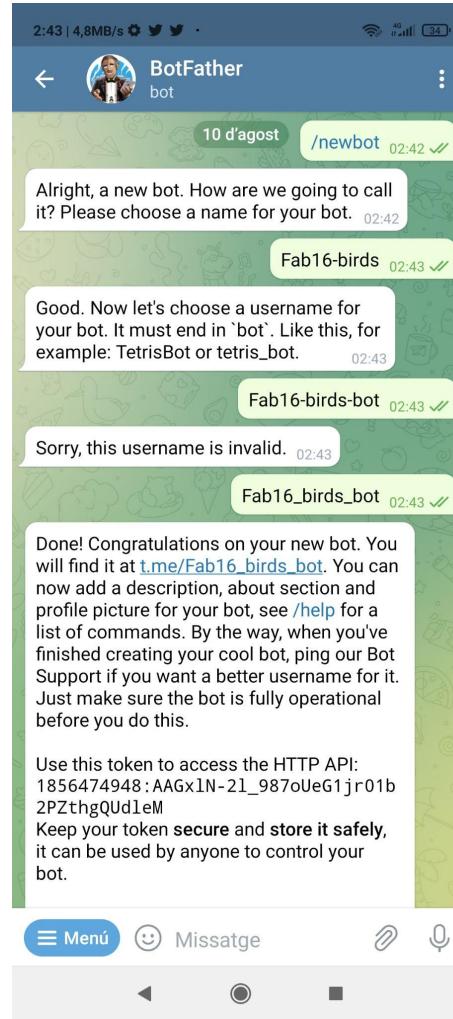
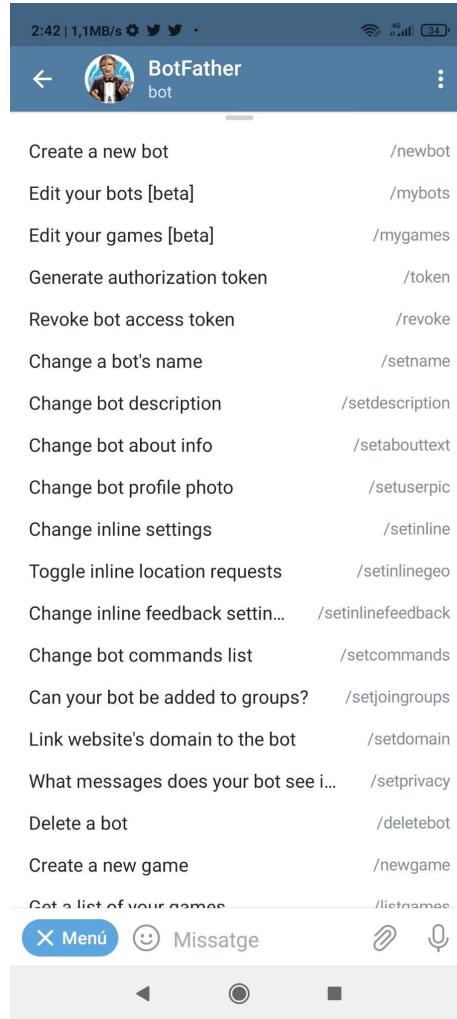
- Send messages and [commands](#) to bots by opening a chat with them or by adding them to groups.
- Send requests directly from the input field by typing the bot's @username and a query. This allows sending content from [inline bots](#) directly into any chat, group or channel.

Messages, commands and requests sent by users are passed to the software running on our servers. Our intermediary server handles all encryption and communication with the Telegram API for you. You communicate with this server via a simple HTTPS-interface that offers a simplified version of the Telegram API. We call that interface our [Bot API](#).

A detailed description of the Bot API is available on [this page](#) »

**1. What can I do with ...**  
2. How do bots work?  
3. How do I create a b...  
4. How are bots differ...  
5. Bot perks  
6. BotFather





but... where is my Python?

birdwatcher/Dockerfile.template

```
FROM balenalib/nbALEXA_MACHINE_NAME:debian-node:12
# Install dependencies
RUN apt-get update && \
    apt-get install -yq \
    gcc g++ make build-essential \
    wget \
    git \
    python3 \
    python3-dev \
    python3-dip \
    python3-setuptools \
    libatlas-base-dev libportaudio2 libportaudiocpp0 portaudio19-dev \
    gstreamer-1.0 \
    pkg-config libglib2.0-dev libexpat1-dev v4l-utils libjpeg62-turbo-dev \
    sox gstreamer1.0-tools gstreamer1.0-plugins-good gstreamer1.0-plugins-base gstreamer1.0-plugins-base-apps \
    libopenvc-dev \
    libavdevice-dev \
    libavfilter-dev \
    libavcodec-dev \
    libopus-dev \
    libvpx-dev \
    librtp2-dev \
    librtls3-base \
    librtls3-base-dev \
    libuvformat-dev \
    libuvscale-dev \
    libtgui \
    libtgui4 \
    libt4-test \
    libavdevice-dev \
    libavfilter-dev \
    libavcodec-dev \
    python3-six \
&& apt-get clean && rm -rf /var/lib/apt/lists/*
# Compile libvips
RUN cd /tmp && \
    wget https://github.com/libvips/libvips/releases/download/v8.10.5/vips-8.10.5.tar.gz && \
    tar xf vips-8.10.5.tar.gz && \
    cd vips-8.10.5 && \
    ./configure && \
    make -j && \
    sudo make install && \
    sudo ldconfig
RUN npm config set user root && sudo npm install edge-impulse-linux -g
RUN pip3 install --upgrade pip
RUN pip3 install numpy opencv-python requests imutils
RUN pip3 install edge_ impulse_linux -i https://pypi.python.org/simple
RUN pip3 install Flask flask-socketio=4.3.2 flask_cors flask_basicauth
RUN pip3 install RPi.GPIO adafruit-blinks
WORKDIR /usr/src/app
EXPOSE 8080
COPY ./app/ /usr/src/app/
CMD ["/usr/src/app/ei_run.sh"]
```



# openCV

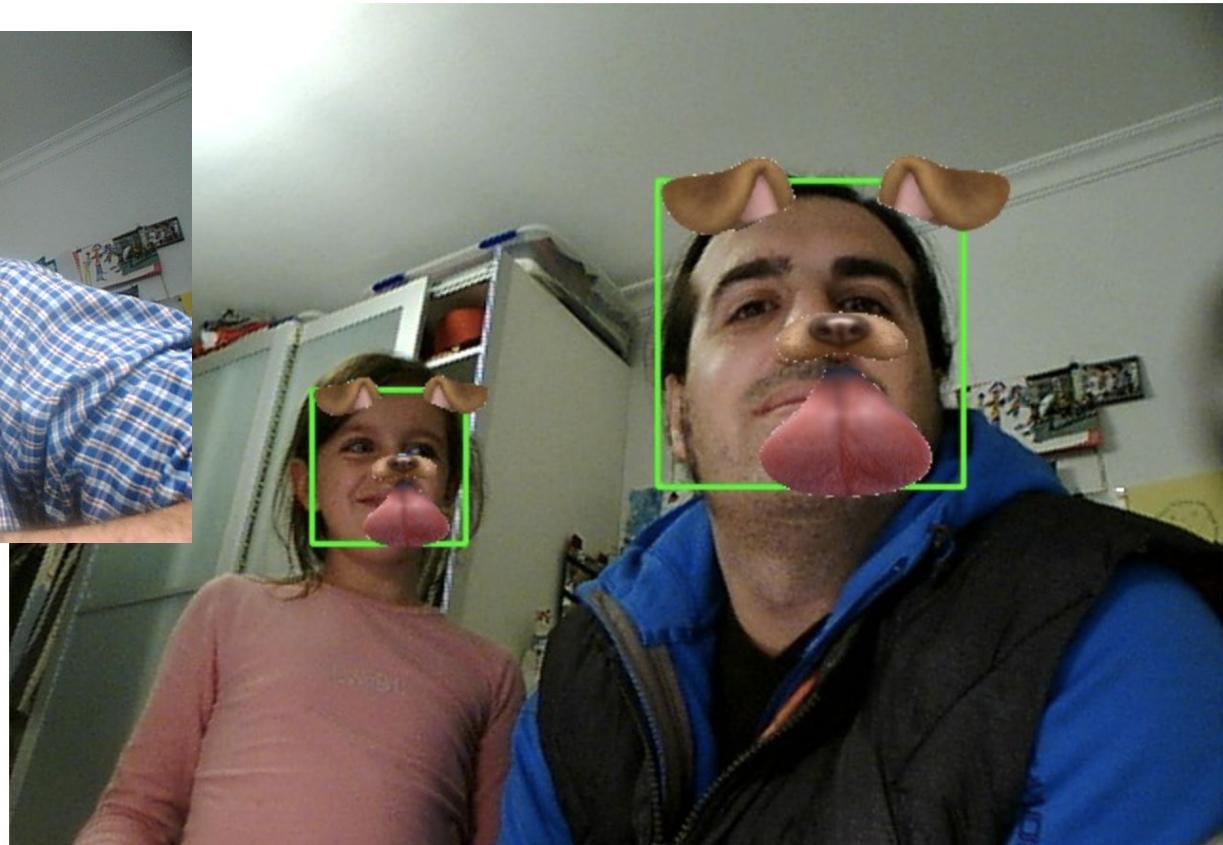
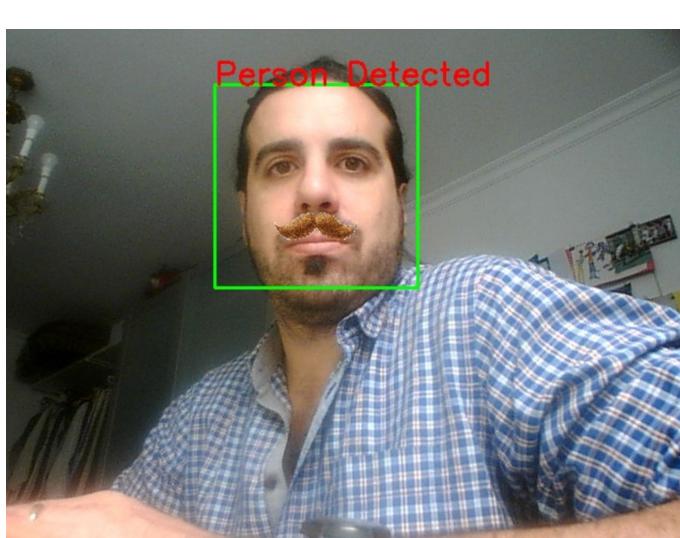
Opencv is an open source library which is very useful for computer vision.

It's widely used on applications such as video analysis, CCTV footage analysis and image analysis.

```
pip3 install opencv-python
```

```
import cv2  
print(cv2.__version__)
```





birdwatcher/ei\_run.sh at master · just4give/birdwatcher

https://github.com/just4give/birdwatcher/blob/master/ei-processing/app/ei\_run.sh#L15

master · birdwatcher / ei-processing / app / ei\_run.sh

mpous · Update ei\_run.sh ✓

Latest commit f83a448 on 16 Oct · History

1 contributor

Executable File | 34 lines (25 sloc) | 687 Bytes

Raw Blame

```
1 #!/bin/sh
2
3 if [[ ! -z $CHECK_CONN_FREQ ]]
4 then
5     freq=$CHECK_CONN_FREQ
6 else
7     freq=120
8 fi
9
10 if [ $EI_COLLECT_MODE_IMAGE = "Y" ];
11 then
12     edge-impulse-linux --api-key $EI_API_KEY_IMAGE --disable-microphone
13 else
14     edge-impulse-linux-runner --api-key $EI_API_KEY_IMAGE --download modelfile.eim
15     python3 classify.py
16 fi
17
18 sleep 5
19
20 while [[ true ]]; do
21     echo "Checking internet connectivity ..."
22     wget --spider --no-check-certIFICATE 1.1.1.1 > /dev/null 2>&1
23
24     if [ $? -eq 0 ]; then
25         echo "Your device is connected to the internet."
26     else
27         echo "Your device is not connected to the internet."
28     fi
29
30 fi
31
32
```



birdwatcher/classify.py at f83aa · just4give/birdwatcher · GitHub

```
359 def main():
360     global video_frame
361     global videoCaptureDeviceId
362     global ENABLE_TG
363
364     model = '/usr/src/app/modelfile.eim'
365     last_sent = 0
366
367     dir_path = os.path.dirname(os.path.realpath(__file__))
368     modelfile = os.path.join(dir_path, model)
369
370     print('MODEL: ' + modelfile)
371
372     with ImageImpulseRunner(modelfile) as runner:
373         try:
374             model_info = runner.init()
375             print('Loaded runner for "' + model_info['project']['owner'] + ' / ' + model_info['project']['name'] + '"')
376             labels = model_info['model_parameters']['labels']
377
378             port_ids = get_webcams()
379             if len(port_ids) == 0:
380                 raise Exception('Cannot find any webcams')
381
382             videoCaptureDeviceId = int(port_ids[0])
383
384
385             camera = cv2.VideoCapture(videoCaptureDeviceId)
386             ret = camera.read()[0]
387             if ret:
388                 backendName = camera.getBackendName()
389                 w = camera.get(3)
390                 h = camera.get(4)
391                 print("Camera %s (%s x %s) in port %s selected." %(backendName,h,w, videoCaptureDeviceId))
392                 camera.release()
393             else:
394                 raise Exception("Couldn't initialize selected camera.")
395
396             next_frame = 0 # limit to ~10 fps here
397
398             for res, img in runner.classifier(videoCaptureDeviceId):
399                 img = cv2.cvtColor(img, cv2.COLOR_RGB2BGR)
400                 video_frame = img
401                 #video_frame = img.copy()
402                 #video_frame = cv2.cvtColor(video_frame, cv2.COLOR_RGB2BGR)
403                 stream(video_frame)
404
405
406                 if (next_frame > now()):
407                     time.sleep((next_frame - now()) / 1000)
```

<https://github.com/just4give/birdwatcher/blob/master/ei-processing/app/classify.py>



The screenshot shows a web browser displaying the Edge Impulse documentation for the Linux Python SDK. The page has a red header bar with the Edge Impulse logo, a navigation menu, and a search bar. The main content area is titled "Linux Python SDK" and contains sections for installation guides, collecting data, and examples.

**Documentation**

- Getting Started
- API and SDK references
- What is embedded ML, anyway?
- Frequently asked questions

**Development Boards**

- Overview
- ST B-L475E-IOT01A
- Arduino Nano 33 BLE Sense
- Eta Compute ECM3532 AI Sensor
- Eta Compute ECM3532 AI Vision
- OpenMV Cam H7 Plus
- Himax WE-I Plus
- Nordic Semi nRF52840 DK
- Nordic Semi nRF5340 DK
- Nordic Semi nRF9160 DK
- Nordic Semi Thingy:91
- SiLabs Thunderboard Sense 2
- Sony's Spresense
- Syntiant TinyML Board
- TI CC1352P Launchpad
- Arduino Portenta H7 + Vision shield (preview)
- Raspberry Pi 4
- NVIDIA Jetson Nano
- Mobile phone
- Porting guide

**Community Boards**

**Linux Python SDK**

This library lets you run machine learning models and collect sensor data on [Linux](#) machines using Python. The SDK is open source and hosted on GitHub: [edgeimpulse/linux-sdk-python](https://github.com/edgeimpulse/linux-sdk-python).

### Installation guide

1. Install a recent version of [Python 3](#) (>=3.7).
2. Install the SDK:  
**Raspberry Pi**

```
$ sudo apt-get install libatlas-base-dev libportaudio0 libportaudio2 libportaudiocpp0 portaudio19-dev
$ pip3 install edge_ impulse_linux -i https://pypi.python.org/simple
```

**Jetson Nano**

```
$ sudo apt-get install libatlas-base-dev libportaudio2 libportaudiocpp0 portaudio19-dev
$ pip3 install edge_ impulse_linux
```

**Other platforms**

```
$ pip3 install edge_ impulse_linux
```
3. Clone this repository to get the examples:

```
$ git clone https://github.com/edgeimpulse/linux-sdk-python
```

### Collecting data

Before you can classify data you'll first need to collect it. If you want to collect data from the camera or microphone on your system you can use the Edge Impulse CLI, and if you want to collect data from different sensors (like accelerometers or proprietary control systems) you can do so in a few lines of code.

[Collecting data from the camera or microphone](#)

<https://docs.edgeimpulse.com/docs/linux-python-sdk>



A screenshot of a GitHub repository page for the project `edgeimpulse / linux-sdk-python`. The repository is public and has 1 issue, 4 pull requests, and 5 forks. The master branch is selected, showing a commit history from 8 months ago. The commits are:

File	Message	Date
<code>__init__.py</code>	Initial commit	8 months ago
<code>audio.py</code>	Allows selection of device ID 0 (#9)	3 months ago
<code>image.py</code>	Added conversion from BGR to RGB (#8)	4 months ago
<code>runner.py</code>	Initial commit	8 months ago

The page includes standard GitHub navigation links like Pull requests, Issues, Marketplace, Explore, and a search bar. At the bottom, there's a footer with links to GitHub's Terms, Privacy, Security, Status, Docs, Contact GitHub, Pricing, API, Training, Blog, and About.

[https://github.com/edgeimpulse/linux-sdk-python/tree/master/edge\\_impulse\\_linux](https://github.com/edgeimpulse/linux-sdk-python/tree/master/edge_impulse_linux)



A screenshot of a GitHub repository page for the project `edgeimpulse / linux-sdk-python`. The repository is public and has 1 issue, 4 pull requests, and 5 forks. The master branch is selected, showing a commit history:

Commit	Message	Date
<code>__init__.py</code>	Initial commit	8 months ago
<code>audio.py</code>	Allows selection of device ID 0 (#9)	3 months ago
<code>image.py</code>	Added conversion from BGR to RGB (#8)	4 months ago
<code>runner.py</code>	Initial commit	8 months ago

The page includes standard GitHub navigation links like Pull requests, Issues, Actions, Projects, Wiki, Security, and Insights. The footer contains links to GitHub's Terms, Privacy, Security, Status, Docs, Contact GitHub, Pricing, API, Training, Blog, and About.

[https://github.com/edgeimpulse/linux-sdk-python/tree/master/edge\\_impulse\\_linux](https://github.com/edgeimpulse/linux-sdk-python/tree/master/edge_impulse_linux)



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# Share it, contribute and inspire others



Time to install it :-)  
Please send feedback



# Contribute on the open source project!

<https://github.com/just4give/birdwatcher>



Ok! Let's wrap-up!

# Take aways

- Learn about Machine Learning and image recognition.
- Create your IoT / Edge AI fleet, the easy way.
- Contribute and re-train the ML model.





# CHALLENGE

Submit your IoT project now

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# Questions?



## Run an AI-Powered Bird Watcher with Python, balena and Edge Impulse

PyDay Barcelona - 27th of November 2021

