
ELISA
Enabling Linux in
Safety Applications
WORKSHOP
ELISA Workshop
Lund, Sweden
May 7-9, 2025
Co-hosted with Volvo Cars

The European Open Source Academy

The Academy was founded to bring key stakeholders and experts from the broader open source ecosystem and provide thought leadership for policy makers and industry in how legislations and strategies need to be tailored to rightly and proactively care for the risks and opportunities that open source technology can bring.

- Recognises European leaders in the annual European Open Source Awards.
- Organises Masterclass Workshops and CEO Roundtables.
- Acts as a brain trust for European policy making in open source.

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ELISA
Enabling Linux in Safety Applications

WORKSHOP

David J. Cuartielles

Arduino AB
Head of Research
Malmö University
Head Full Stack Laboratory

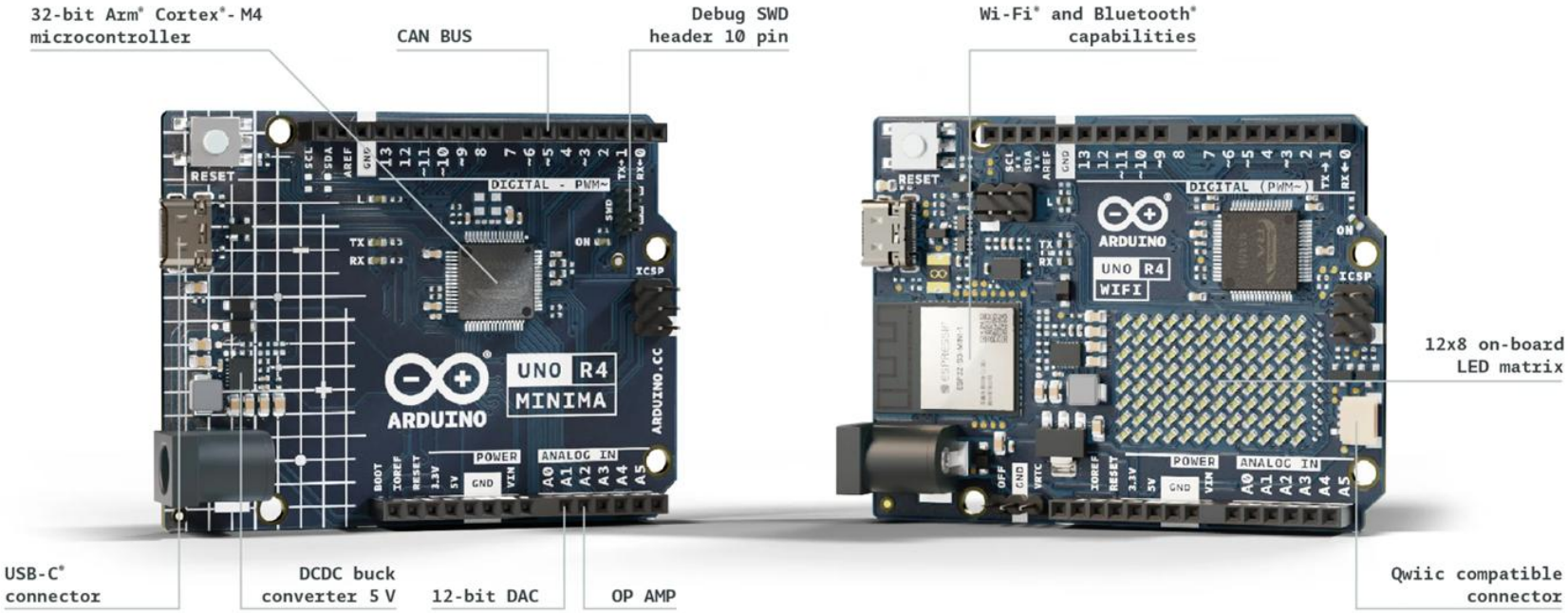
ELISA
Enabling Linux in Safety Applications

WORKSHOP

Arduino Porte a X8

a communit nce hardware for safe systems

INCLUDING SUSTAINABILITY ISSUES


32-bit Arm® Cortex®- M4 microcontroller
CAN BUS
Debug SWD header 10 pin
Wi-Fi® and Bluetooth® capabilities
12x8 on-board LED matrix
USB-C® connector
DCDC buck converter 5 V
12-bit DAC
OP AMP
Qwiic compatible connector
UNO R4 MINIMA
UNO R4 WIFI
ARDUINO
DIGITAL - PWM~
DIGITAL (PWM~)
POWER
ANALOG IN
RESET
ICSP

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karlsoderby Add license + update readme

Preview Code Blame 175 lines (89 loc) · 18.3 KB

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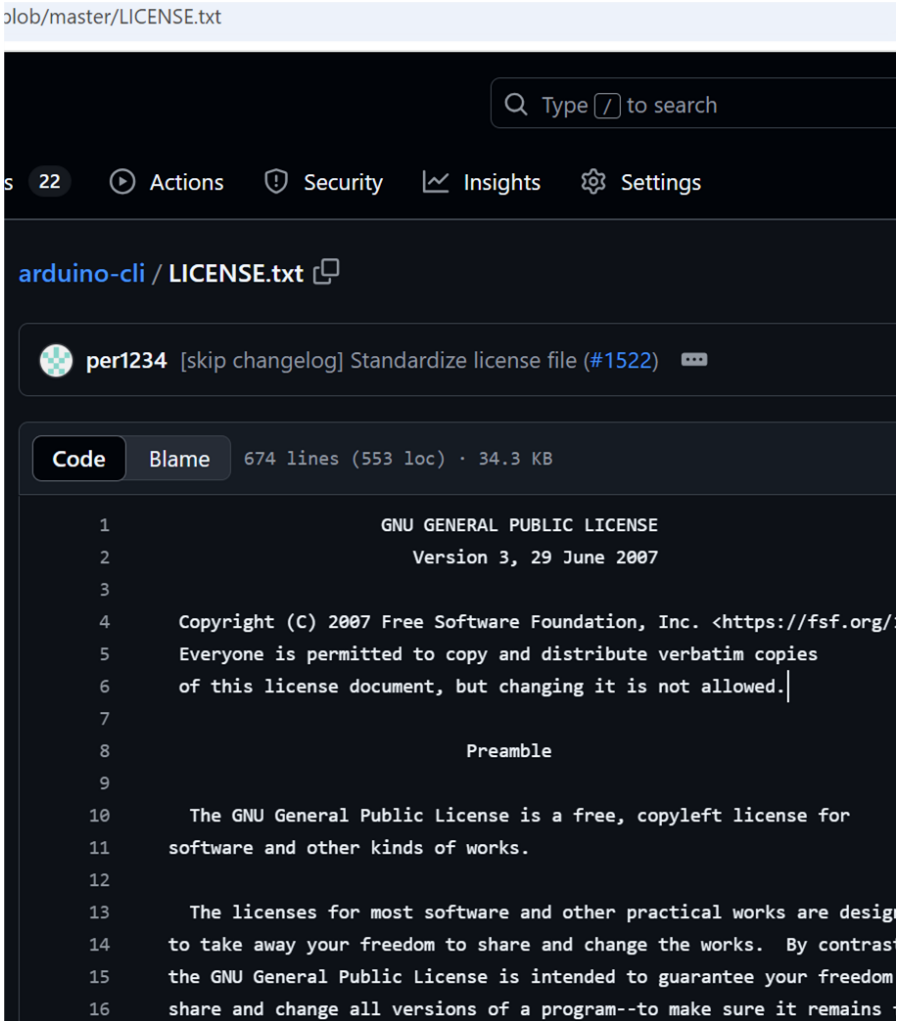
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Blame
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Blink | Arduino IDE 2
Arduino Zero (Native USB Port)
DEBUG
Arduino
THREADS
R... PAUSED ON BREAKPOINT
CALL STACK
loop@0x00002... Blink.ino 35:0
main@0x0000... main.cpp 53:0
VARIABLES
Local
Global
WATCH
BREAKPOINTS
Blink.ino /private/var/f... 33
Blink.ino /private/var/f... 35
CORTEX PERIPHERALS
Blink.ino
// the setup function runs on
void setup() {
// initialize digital pin L
pinMode(LED_BUILTIN, OUTPUT
}
// the loop function runs ove
void loop() {
digitalWrite(LED_BUILTIN, H
delay(200);
digitalWrite(LED_BUILTIN, L
delay(200);
}
Output
Arduino
Ln 35, Col

← All docs

Libraries

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Sort by Stars

Found 6 libraries

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FaBo GPIO40 PCA9698 ☆ 4 Stars 5 Forks V1.0.0

A library for FaBo GPIO.

FaBo<info@fabo.io> Akira 01/03/2019

UNCATEGORIZED

FaBo PWM PCA9685 ☆ 2 Stars 2 Forks V1.0.0

A library for FaBo PWM.

FaBo<info@fabo.io> Akira 12/11/2018

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FaBo 206 UV Si1132 ☆ 2 Stars 3 Forks V1.1.0

A library for FaBo UV I2C Brick

FaBo<info@fabo.io> Akira 12/17/2018

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FaBo Motor DRV8830 ☆ 1 Stars 2 Forks V1.0.0

A library for FaBo Motor.

FaBo<info@fabo.io> Akira 12/19/2018

SENSORS

FaBo 223 Gas CCS811 ☆ 1 Stars 2 Forks V1.0.0

A library for CCS811 that getting values of CO2 and TVOC.

FaBo<info@fabo.io> Akira 1

Help

Funded by
the European Union

Social housekeeping through intercommunicating appliances and shared recipes merged in a pervasive web-services infrastructure

Fact Sheet | Reporting | Results

Project description

Future Internet Research and Experimentation (FIRE)

Show the project objective

Fields of science (EuroSciVoc)

natural sciences > computer and information sciences > **internet**

social sciences > psychology > **cognitive psychology**

Suggest new fields of science

Project Information

SOCIAL&SMART

Grant agreement ID: 317947

Project closed

Start date
1 November 2012

End date
31 July 2015

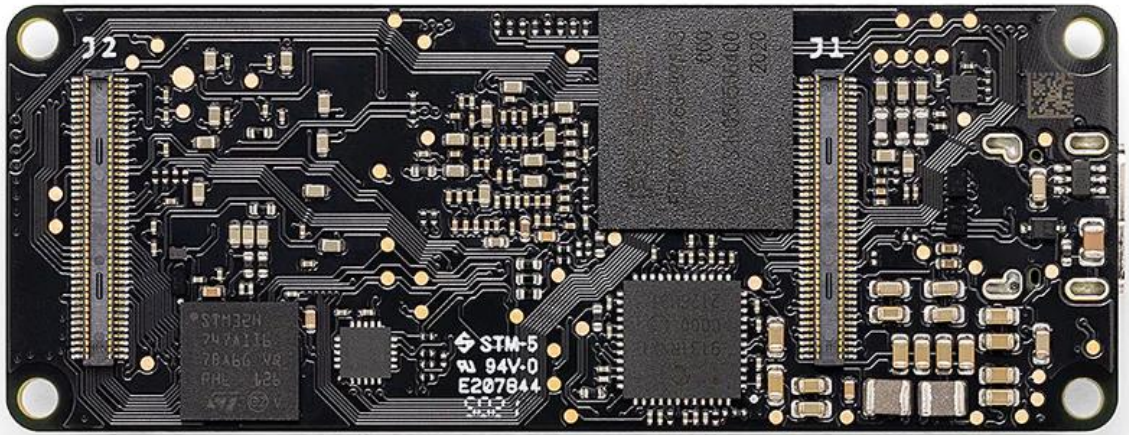
Funded under
Specific Programme "Cooperation": Information and communication technologies

Total cost
€ 1 956 128,00

EU contribution
€ 1 449 662,00

Coordinated by

Funded by
the European Union



Funded by
the European Union

HORIZON 2020

Decentralised Citizens Owned Data Ecosystem

CORDIS provides links to public deliverables and publications of HORIZON projects.

Links to deliverables and publications from FP7 projects, as well as links to some specific result types such as dataset and software, are dynamically retrieved from OpenAIRE.

Deliverables

Project Information

DECODE

Grant agreement ID: 732546

Project website

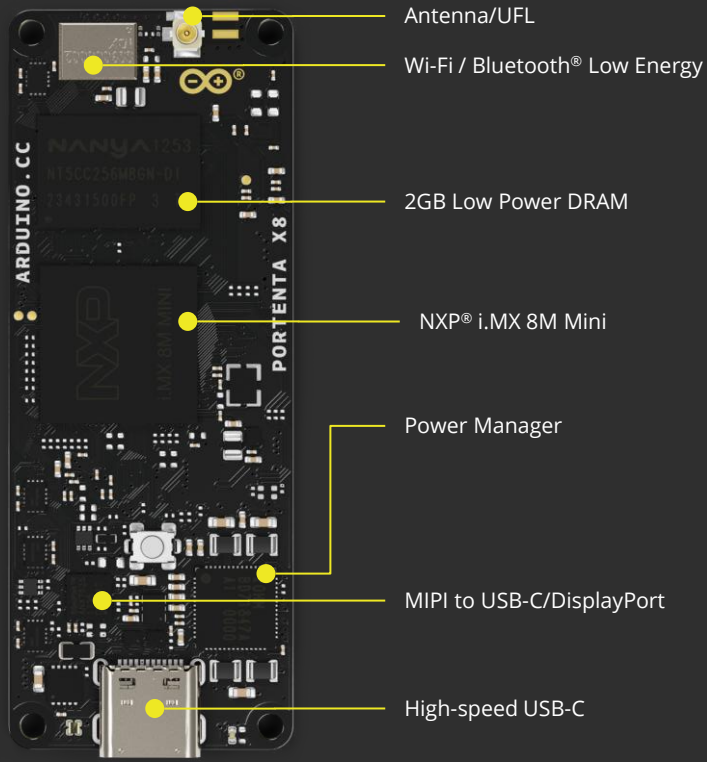
In a nutshell

- industrial-grade SOM
- Linux OS preloaded
- modular container architecture
- real-time applications through Arduino IDE
- Wi-Fi/Bluetooth® Low Energy
- OS/application OTA updates
- Hardware ID

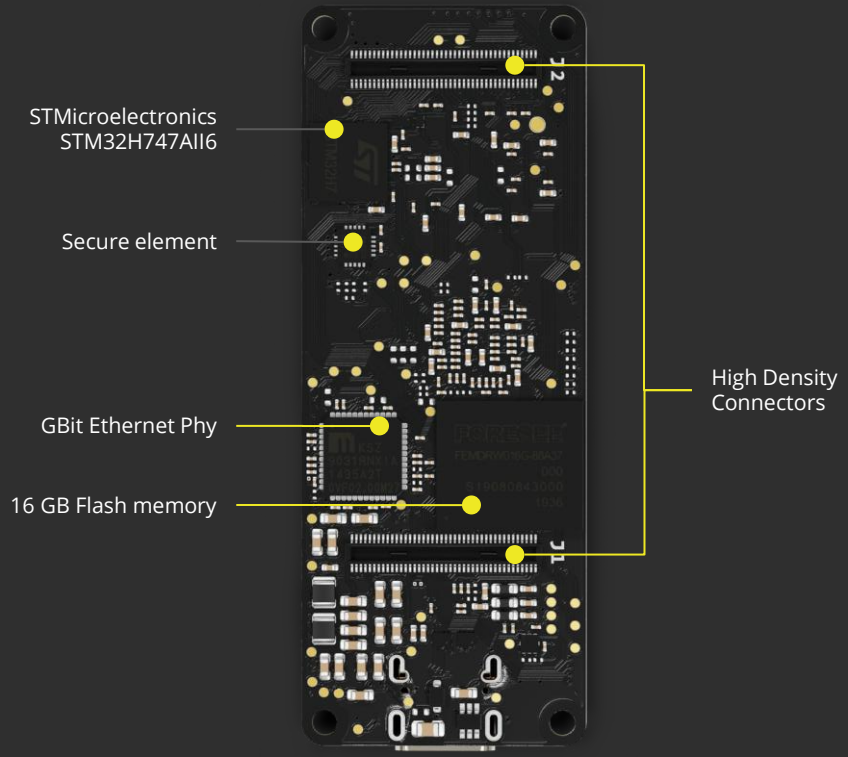
Technical Specs

Processor	NXP® i.MX 8M Mini: 4x ARM® Cortex® -A53 core up to 1.8GHz 1x ARM® Cortex® -M4 core up to 400 MHz	**Dimensions**	66,04 mm x 25,40 mm	
Microcontroller	STMicroelectronics STM32H747AII6 Dual ARM® Cortex® M7/M4 IC: 1x ARM® Cortex® -M7 core up to 480 MHz 1x ARM® Cortex® -M4 core up to 240 MHz	**Certifications**	• PSA from ARM® • Arm® SystemReady IR (multiple distributions)	
External Memories	• 2 GByte Low Power DDR4 DRAM • 16 GByte eMMC	**Interfaces**	• CAN • PCIe • SAI • MIPI • DSI	• SPI • I2S • I2C • UART • PDM
USB-C	• USB-C High Speed • DisplayPort output • Host and Device operation • Power Delivery support	**Operating Temperatures**	-40° C to +85° C (-40° F to 185°F)	
Connectivity	• 1Gbit Ethernet interface (PHY) • Wi-Fi • Bluetooth® Low Energy	**Security**	• NXP® SE050C2 Crypto on a separate secure bus	

Technical Specs



Top View



Bottom View

Linux? Sure!

- We support Yocto
- Develop in your system, deploy as Docker containers
- OTA through Foundries I/O
- Fleet management
- Link (RPC) to the microcontroller

Arduino IDE

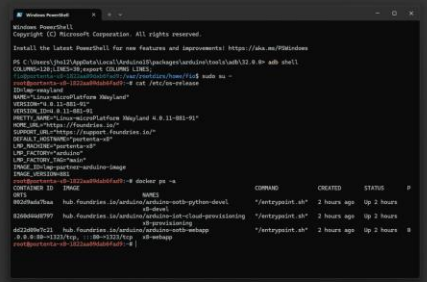
- Real-time control and I/O operations
- Communicates with Linux layer via RPC

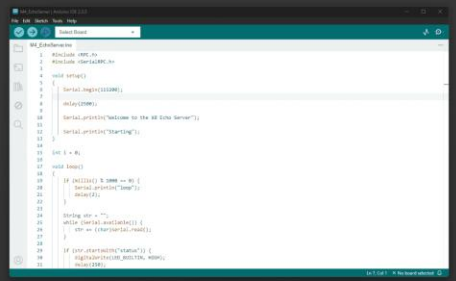
Interface via SSH

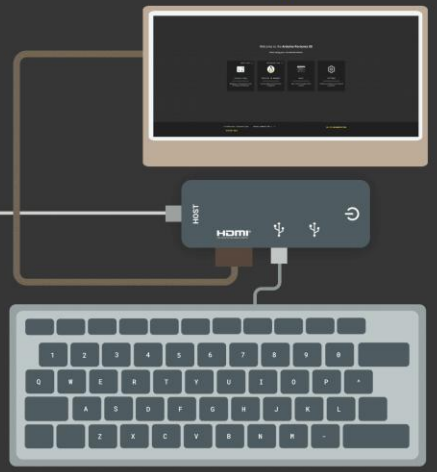
- SSH for remote Interaction with Portenta X8

ADB Shell (Yocto Linux)

- Embedded Linux OS (Yocto)
- Handles networking and security
- Docker container management
- Provides APIs and system services





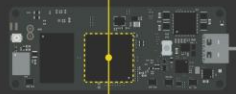


ARDUINO® CLOUD

Arduino Cloud Interface

- Remote management via Arduino Cloud
- IoT data and device control

Portenta X8 Top



Portenta X8 Bottom

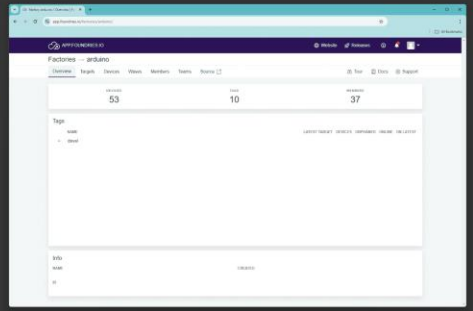
Remote Procedure Call Mechanism (RPC) by M7 Core

NXP® i.MX 8M Mini ⟷ **STMicroelectronics STM32H747XI**

TCP Port Forward

Portenta X8 Board Manager

- Firmware & OS updates
- Device & fleet management



Out-of-the-Box Home Screen

- Friendly GUI to configure Portenta X8 features
- Embedded Python-Alpine container shell

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Hardware

05. Managing Containers with Docker on Portenta X8

06. Using FoundriesFactory® Waves Fleet Management

07. Deploy a Custom Container with Portenta X8 Manager

08. How To Build a Custom Image for Your Portenta X8

09. How To Update Your Portenta X8

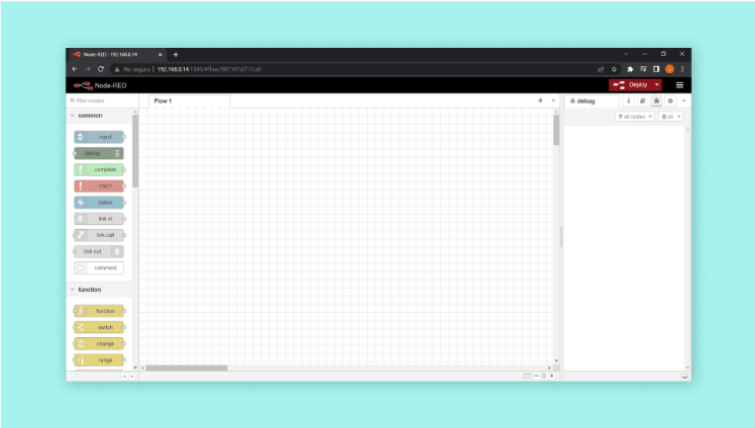
10. Data Logging with MQTT, Node-RED, InfluxDB and Grafana

11. Output WebGL Content

container, the container will run in the background.

Testing Node-RED

Let's browse to `http://{your-portenta-ip}:1880`; this will open the Node-RED desktop as shown in the image below:



Node-RED graphical user interface (GUI).

Node-RED desktop is a GUI that lets us work with Node-RED flows

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Overview
Goals
Required Hardware and Software
IoT Architecture Basics
Installing Mosquitto
Testing Mosquitto
Installing Node-RED
Testing Node-RED
Installing InfluxDB
Installing Grafana
Sending Data Using the MKR WiFi 1010 Board
Conclusion

Help

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Hardware

09. How To Update Your Portenta X8

10. Data Logging with MQTT, Node-RED, InfluxDB and Grafana

11. Output WebGL Content on a Screen

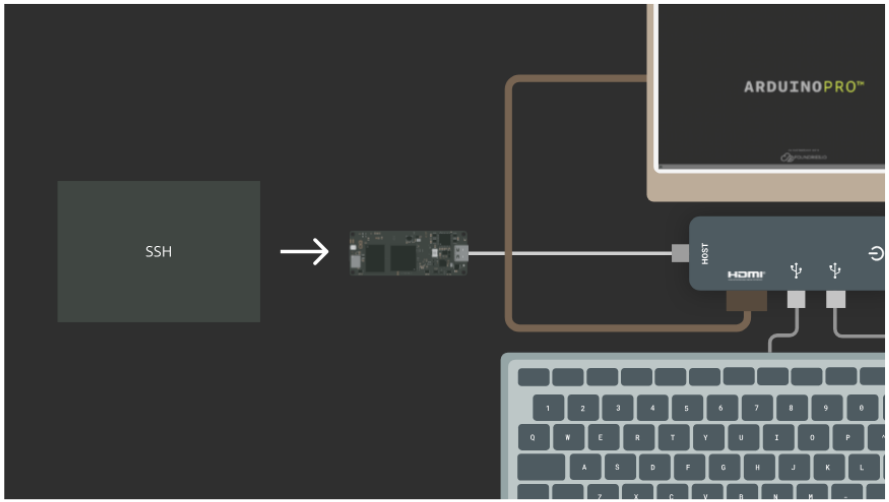
12. Multi-Protocol Gateway With Portenta X8 & Max Carrier

13. Running WordPress & Database Containers on Portenta X8

14. Portenta X8 Firmware Release Notes

15. Edge AI Flow Monitoring

video connector to a display, and the power supply USB to your computer. It is optional, but we could connect a USB mouse to the hub. The setup should look like as follows:



As a reference, a list of validated USB-C® to HDMI hubs that you can use are: TPX00145 and TPX00146.

By default, if you connect the board to a display, you will see the "home

ON THIS PAGE

13. Running WordPress & Database Containers on Portenta X8

Learn how to run a database and WordPress container on the Portenta X8

Author • Benjamin Dannegård

Last revision • 09/25/2024

Overview

The Arduino Portenta X8's robust features are ideally complemented by Docker containers, simplifying various applications. This tutorial demonstrates how to deploy a WordPress web server on the Portenta X8, leveraging containers for web service and database management.

You will learn to set up and access a WordPress site hosted on the X8 via a web browser

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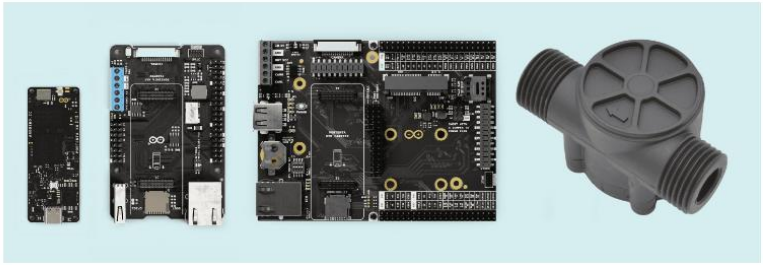
Hardware

10. Data Logging with MQTT, Node-RED, InfluxDB and Grafana
11. Output WebGL Content on a Screen
12. Multi-Protocol Gateway With Portenta X8 & Max Carrier
13. Running WordPress & Database Containers on Portenta X8
14. Portenta X8 Firmware Release Notes
15. Edge AI Flow Monitoring on Portenta X8 with Docker

- Share all collected data and classification results to Arduino Cloud for remote monitoring.

Hardware and Software Requirements



Required hardwares

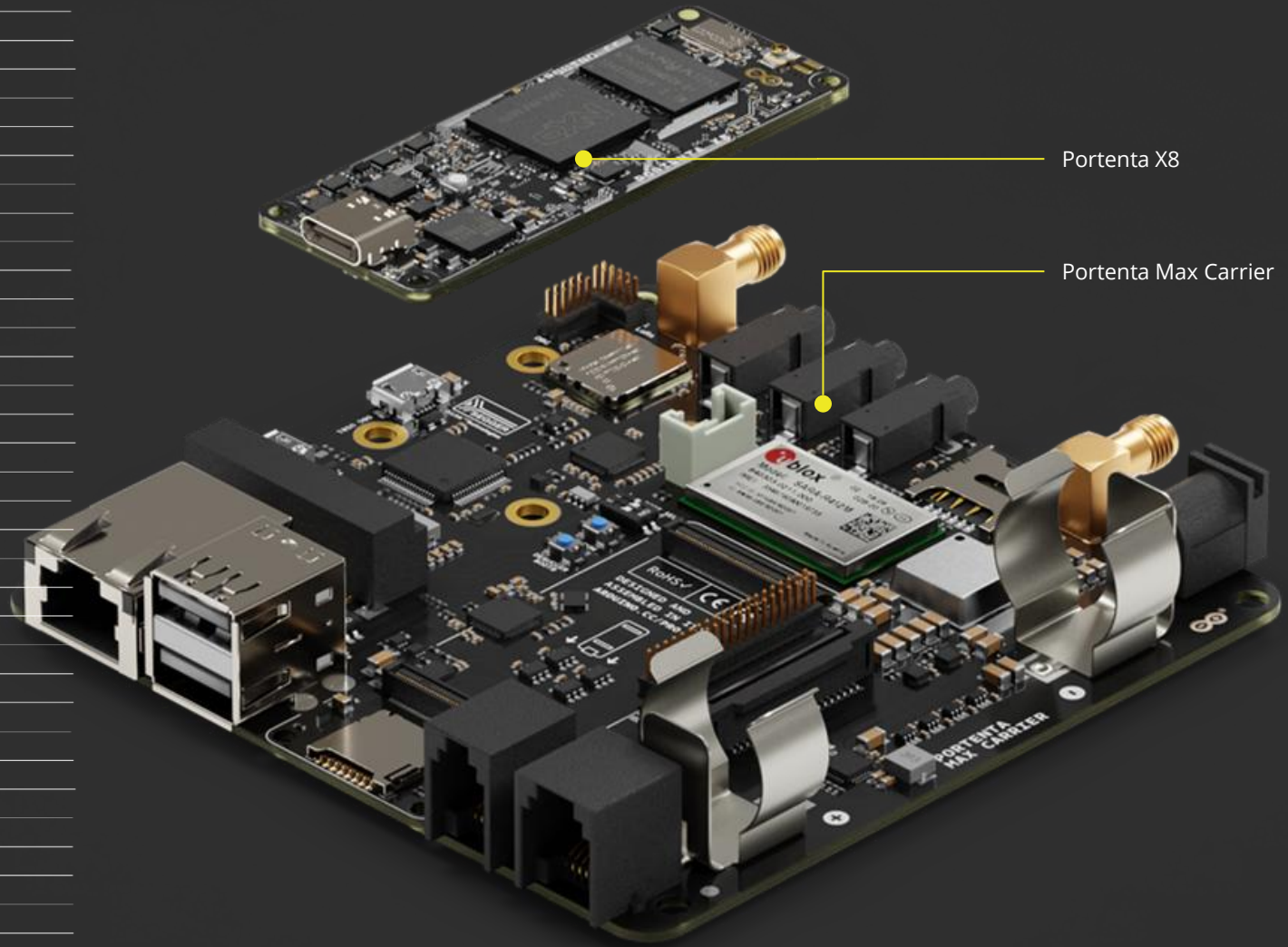
Hardware Requirements

This application note uses the Portenta X8, integrating a flow sensor for real time fluid monitoring. The required hardware includes:

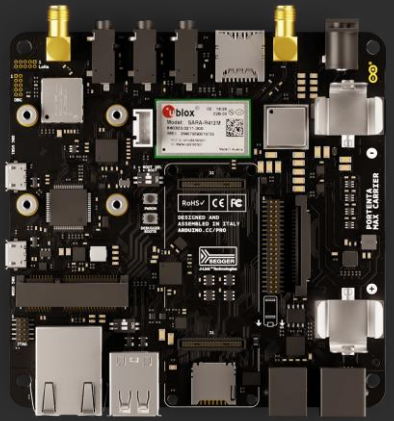
- Portenta X8 (x1)

ON THIS PAGE

Overview
Goals
Hardware and Software Requirements
Hardware Requirements
Software Requirements
Download the Project Code
Machine Learning Model for Flow Anomaly Detection
Anomaly Detection System Setup
Flow Anomaly Detector Model Development
System Architecture and D Flow
Running Flow Rate Inference with Docker

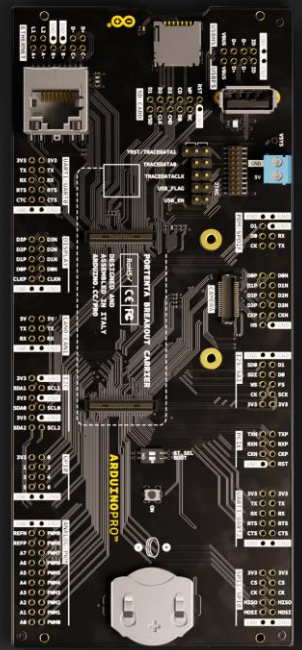

Portenta X8
Portenta Max Carrier

Related Products

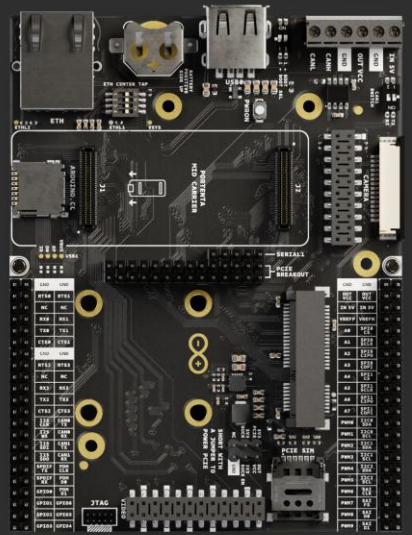


Portenta Max Carrier

Portenta Vision Shield



Portenta Breakout



Portenta Mid Carrier

That much for a sales pitch …

DESIRE 4EU

Funded by
the European Union

DESIgning and REcycling sustainable Electronic boards for a EUropean circular economy

Project information
Fact sheet
Participants
Deliverables

Project information

Acronym
DESIRE4EU

Project ID
101161251

Status
Ongoing

3 999 995,00
Overall budget

3 999 995,00
EU contribution

Start date
01 September 2024

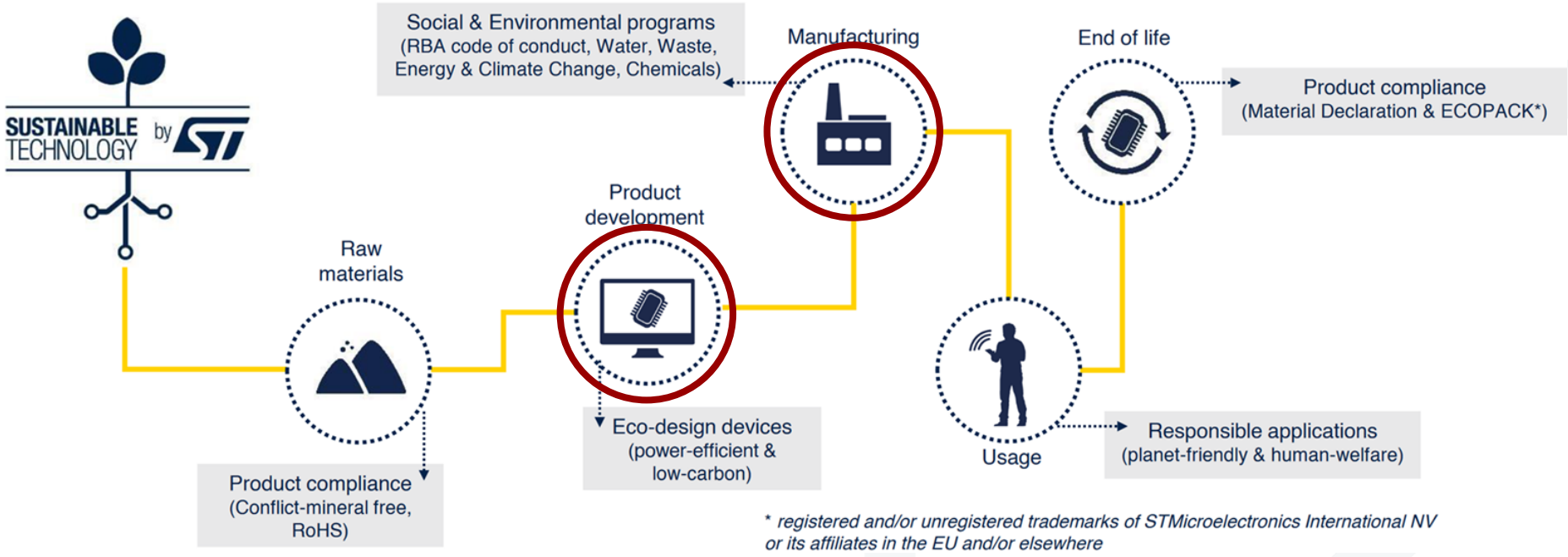
End date
31 August 2028

Coordinated by
INSTITUT POLYTECHNIQUE DE GRENOBLE

Funded under
Horizon Europe (HORIZON)

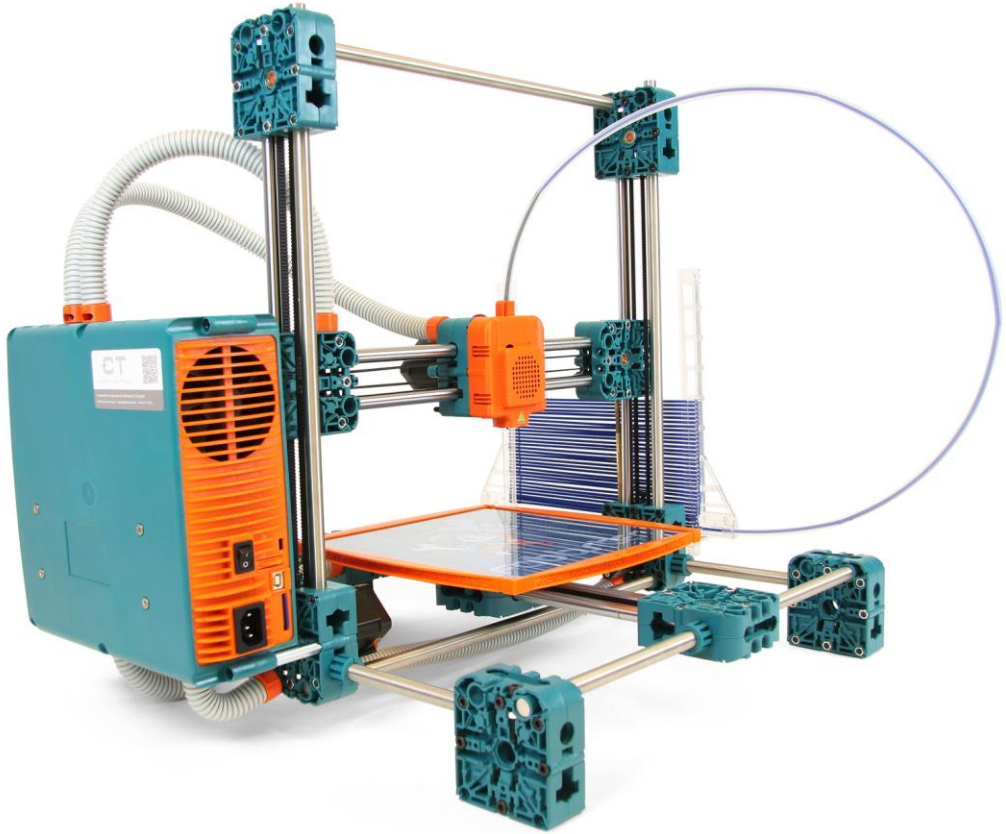
CORDIS
View project on CORDIS

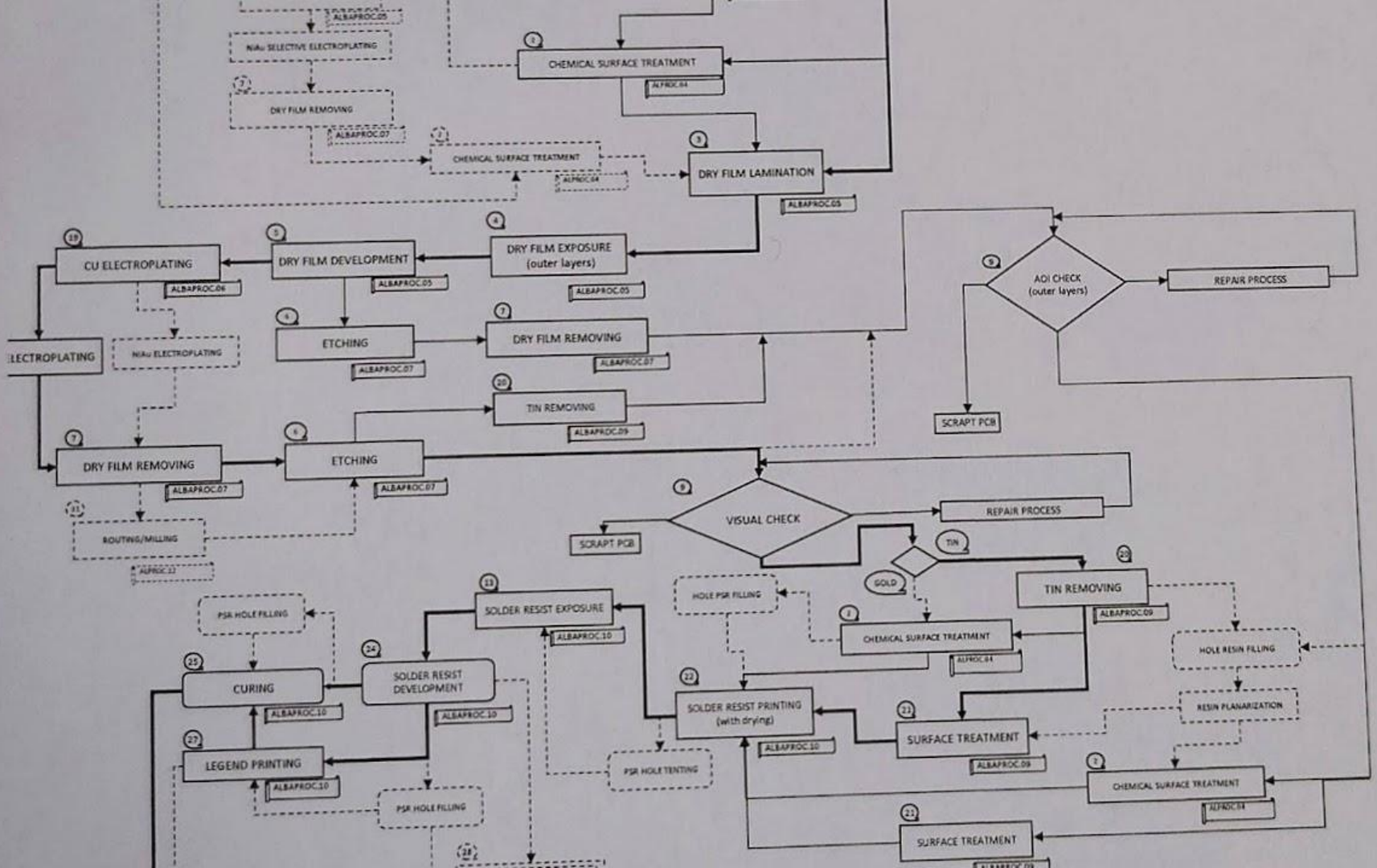

SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS



Source: ST Microelectronics

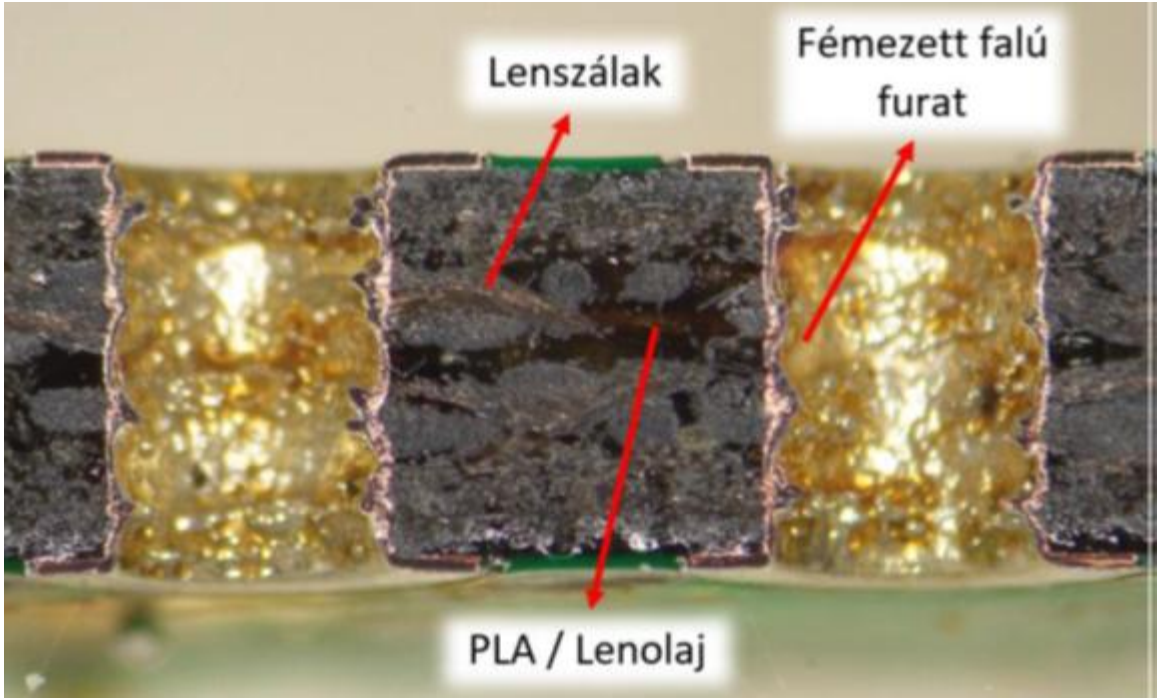
Goal: change substrate for bio-based material, PLA-Flax in this case.




NiAu SELECTIVE ELECTROPLATING
DRY FILM REMOVING
CHEMICAL SURFACE TREATMENT
DRY FILM LAMINATION
DRY FILM EXPOSURE (outer layers)
DRY FILM DEVELOPMENT
CU ELECTROPLATING
ETCHING
DRY FILM REMOVING
TIN REMOVING
AOI CHECK (outer layers)
REPAIR PROCESS
SCRAPT PCB
VISUAL CHECK
TIN
GOLD
ROUTING/MILLING
SOLDER RESIST EXPOSURE
SOLDER RESIST DEVELOPMENT
SOLDER RESIST PRINTING (with drying)
CURING
LEGEND PRINTING
PSR HOLE FILLING
PSR HOLE TENTING
HOLE PSR FILLING
HOLE RESIN FILLING
RESIN PLANARIZATION
SURFACE TREATMENT
ALBAPROC.04
ALBAPROC.05
ALBAPROC.06
ALBAPROC.07
ALBAPROC.09
ALBAPROC.10


BLOCK 0
STEP 0
X 0.000
Y 400.000
Z 14.000
pluritec
industries


"SHADOW" LINE
Mod. 650/05/P-50
CCLEPPO

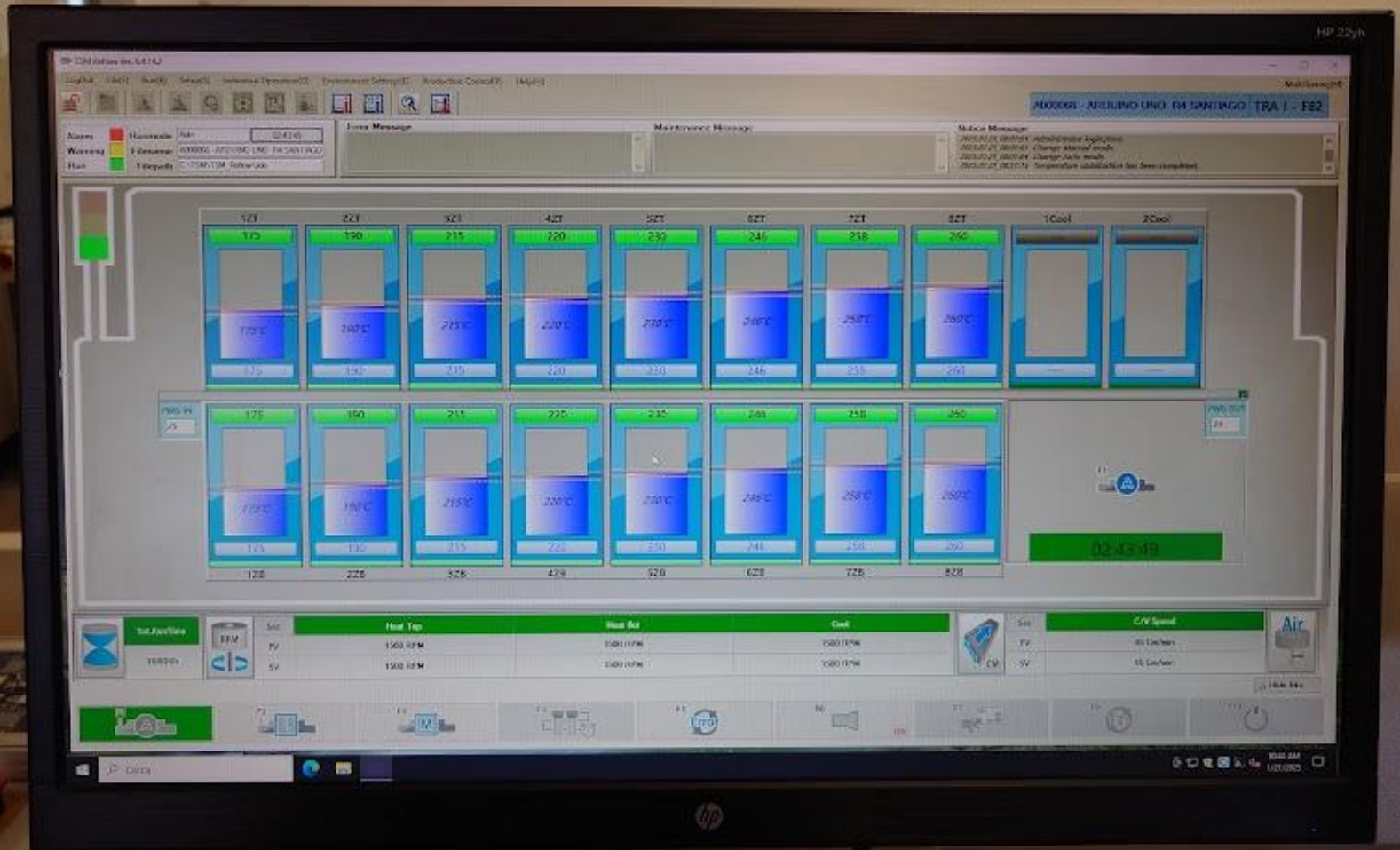


MESHINING Engineering

meshlin

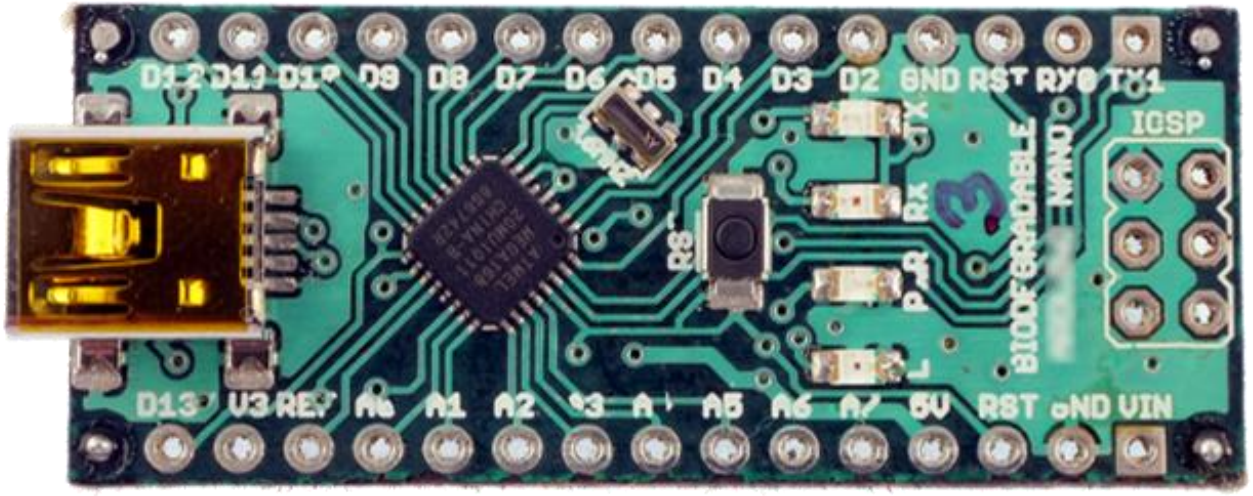

BRIDGE


31
RUN


1ZT
2ZT
3ZT
4ZT
5ZT
6ZT
7ZT
8ZT
1Cool
2Cool
175
190
215
220
230
245
258
260
1ZB
2ZB
3ZB
4ZB
5ZB
6ZB
7ZB
8ZB
Heat Top
Heat Bot
Cool
1500 RPM
C/V Speed
Air


giga
MEDEA

With all of this, here is where we are at today


D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 GND RST RX0 TX1
ICSP
TX
RX
PWR
L
NANO
BIOLOGRADABLE
D13 3V3 REF A0 A1 A2 A3 A4 A5 A6 A7 5V RST GND VIN


UNO

Bio-based PCB

Rough design guidelines

2 layers

Copper trace 10 mil

Copper to copper 8 mil

Edge keepout 0.4 mm

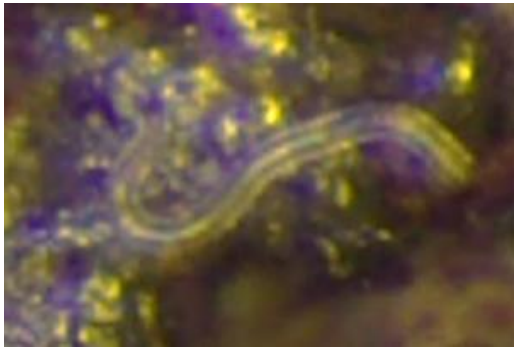
Min component pitch 0.5 mm

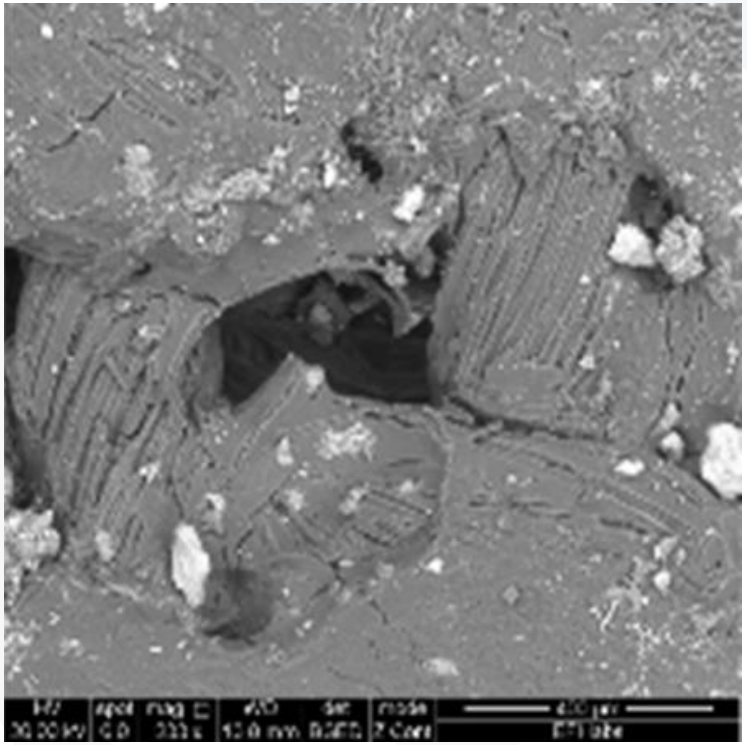
Min via diameter 0.5 mm

Avoid orphans, multiple vias recommended

There is research to be done, yet

Composting: lab vs garden





Bio-compatible

≠

Biodegradable

A change is needed

- Dielectric behaves differently at electrical level. Need to revise some of the basic assumptions of high-freq design.
- The roughness of the material requires revisiting the basic design rules.

https://ieeexplore.ieee.org/document/10168477

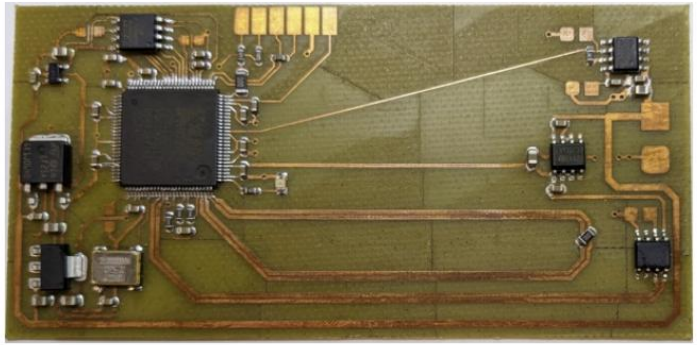


Fig. 5. Assembled FR4 test board (without connectors).

- LVDS lines #1 and #2 are of respective length 85 mm and 124 mm. Their impedance is set to 100 Ω, in the range of LVDS electrical standard.

In Fig. 5 and Fig. 6, one can notice that in the end, layout differences are only about matched lines. Please note that

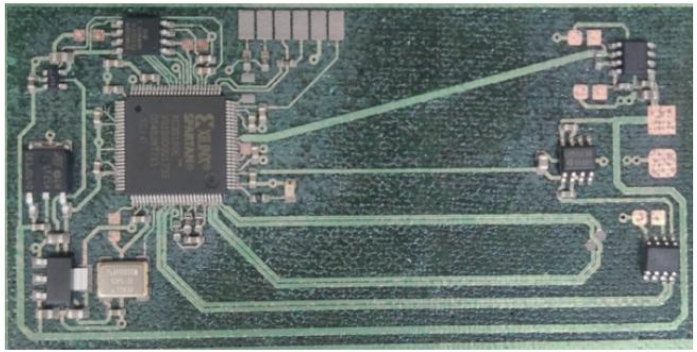


Fig. 6. Assembled PLA/flax test board (without connectors).

Since you people like details …

- It is possible to solder components below 200C (even by hand)
- PLA-based sub… behave l…
- While there… done, this … solution

V. Grennerat el at, "High-Speed Digital Electronics Board on a Novel Biobased and Biodegradable Substrate," 2023 46th International Spring Seminar on Electronics Technology (ISSE), Timisoara, Romania, 2023, pp. 1-5, doi: 10.1109/ISSE57496.2023.10168477.

Both circuits were etched with an LPKF Protolaser ST engraver. Because of the lower fusion temperature of the PLA, the laser beam command parameters were accurately tuned to avoid local melting of the substrate. The LPKF delamination of copper strips technology […]s immediate copper retrieving[1] but leaves […]t correctly set. A few strip residues […]ally. Still, in the end, the […] parameters led to an etching […]ned on the FR4 reference […]

[…]ass transition temperature of the PLA […]ponents soldering was carried out by […] phase soldering oven, at the temperature of […], with a reflow profile adapted for this material (Fig. 7). […]0 °C peak temperature in vapor phase was obtained […]ing HT170 Galden. The solder paste used to assemble the PCB is a low melting temperature (138 °C) alloy: Sn42/Bi57.6/Ag0.4 from ChipQuik. Solder mask was applied to limit substrate wettability and enhance the quality of the soldering process (roughness of substrate tends to ease adherence of solder paste residues).

This alloy was also functional for manual soldering (connectors assembly), with an iron set to less than 200 °C, with no visual damage to the substrate.

This brings us to formulate 2 principles of secure & sustainable electronics

Cold manufacturing: referred to lowering the production temperature

Just enough technology: the quality and reliability should be just enough for the job

Question:

Can we consider standard pin-outs to be used by different vendors?

Can we design technology from the perspective of real and not expected use?

Credits

BME, Dr Attila Gezcy and his team for making the board designs, creating design guidelines, and material degradation tests

Meshlin and Meshining for the PLA-Flax based substrate

Alba PCB and Omaric for the factory images

Grenoble INP, Dr Pascal Xavier and his team leading DESIRE4EU

Arduino teams in IT, SE & ES

That's a wrap! 

ELISA
Enabling Linux in Safety Applications

WORKSHOP

David J. Cuartielles

Arduino AB
Head of Research
Malmö University
Head Full Stack Laboratory

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