



Low-power Embedded Systems

Project Info

Low-power Embedded Systems

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Project Work – Main Evaluation for the Course

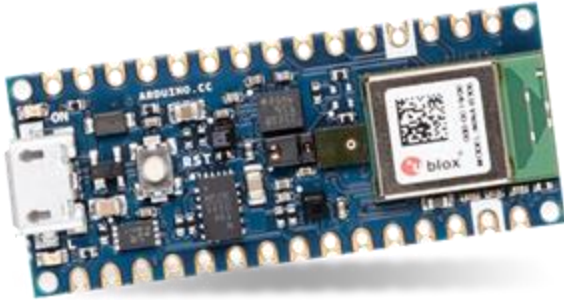
- Develop a practical project – with some
 - Source Code (or Design Documents)
 - Github repository – with all necessary explanations for reproducing your project.
 - Experiments and evaluation
 - A technical report
 - *Maximum 4 pages in latex.*
- **Group work:** 2 members (single member is also possible)

Project Work – Main Evaluation for the Course

- We will evaluate your paper and project demo, which will be the main part of your course evaluation.
- Define what you would like to do.
 - You will not be alone since we will support you.

Embedded AI on Microcontrollers

- Use low-power MCUs and design an embedded AI application.
 - Optimize it for energy-efficient inference/operation...



Arduino Nano 33 BLE Sense

<https://docs.edgeimpulse.com/docs/edge-ai-hardware/mcu/arduino-nano-33-ble-sense>



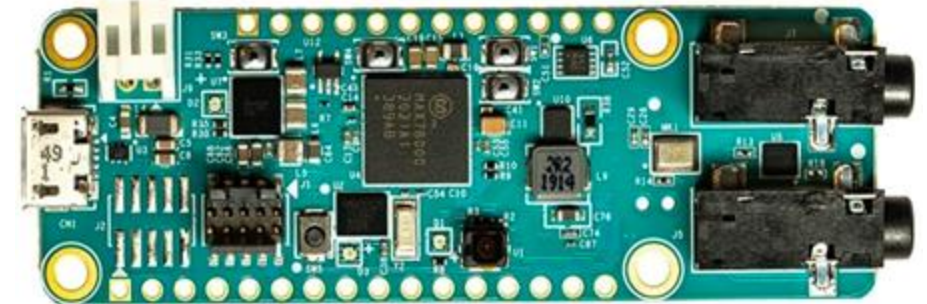
STM32 Nucleo-64

<https://www.st.com/en/evaluation-tools/nucleo-f401re.html>



Espressif ESP-EYE

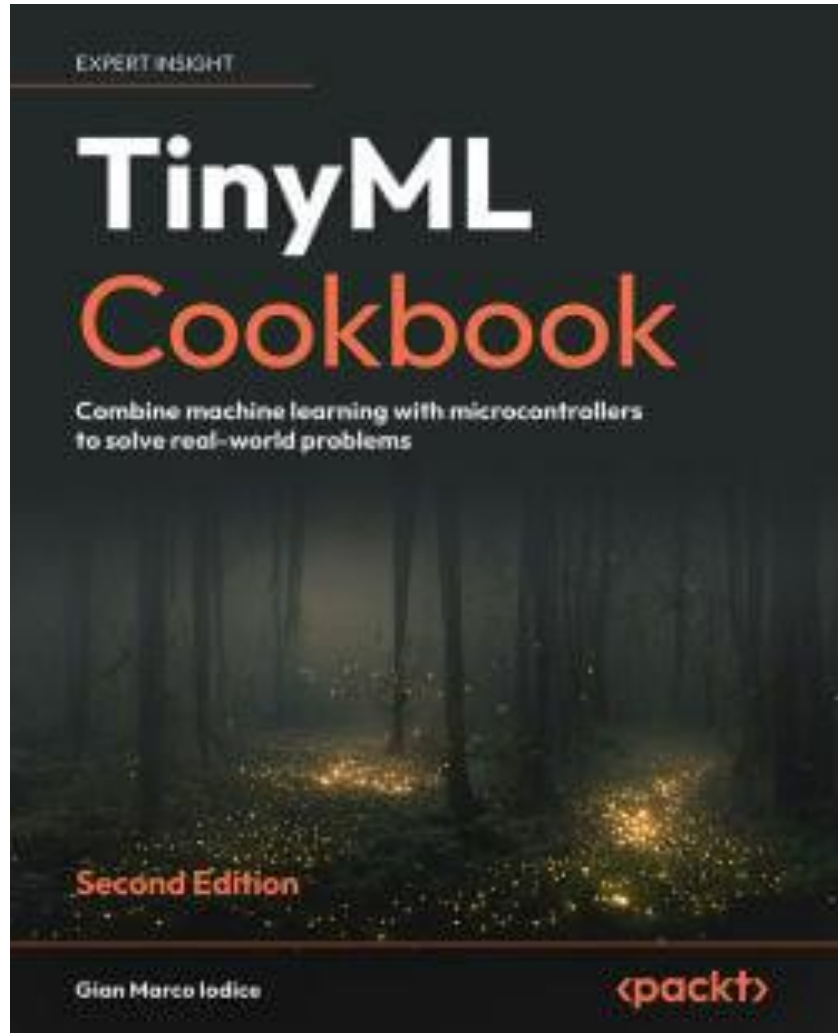
<https://docs.edgeimpulse.com/docs/edge-ai-hardware/mcu/espressif-esp32>



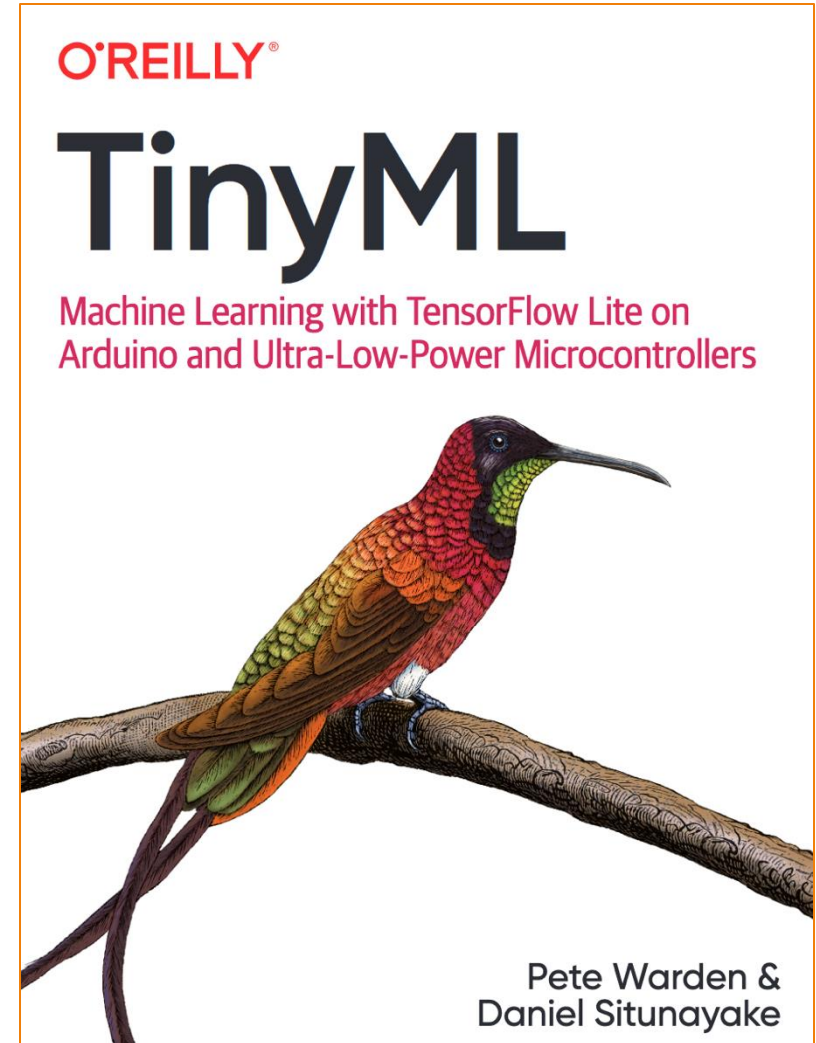
MAX78000

https://github.com/analogdevicesinc/MaximAI_Documentation

Two Sources for Your Projects



https://github.com/PacktPublishing/TinyML-Cookbook_2E



<https://tinymlbook.com/>

More on TinyML

- Exploring Compression and Pruning approaches
- Quantization
- Neural Architecture Search
- New Architectures

A project on Low-power Electronics

- You are going to design a circuit (PCB) that can support intermittent computing or ML (or both):
 - For instance, capacitor bank design and improvements
 - Timekeeping circuitries
- Energy harvesting
 - Comparison of different approaches
- Required knowledge:
 - LTSpice/PCB design

A project on Intermittent Computing

- Intermittent Inference on MCUs
- Software support for Approximate Computing...
- Real-time Scheduling
- Compiler support/analysis...
- Multicore intermittent computing.

Design of Low-power/Low-Energy Accelerator

- You are going to design/evaluate a DNN/ML accelerator:
- We can select a theme application for these networks:
 - Keyword spotting (KWS)
- You can add additional flavors:
 - E.g., exploiting sparsity or making it power-failure resilient for intermittent computing
- Required knowledge:
 - Background on digital design and FPGAs

Pure Research

- Pick a research paper (we will give it to you) (e.g., on intermittent computing):
 - Re-engineer their design - Propose your improvements.
- Required knowledge:
 - Background on C, MCUs, digital design, FPGAs, LTSpice...

Research Project

- A topic that will eventually be a research paper...

Others...

- Something from your side!

Inform me about your choice!

- **Decision deadline:** mid-April.
 - Please send me an email about your idea and preference to organize a kick-off meeting.
- During your project implementation, you need to arrange 2 meetings with me till your final demo.
 - I.e., 2 milestones.