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abinsula

# HW-SW management using a

lightweight Yocto-based OS on a ZCU102

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**ABSTRACT** This work presents the development of a lightweight OS based on Yocto, extended to support the transparent management of HW accelerators. The accelerator is defined using MDC tool [1], which also automatically generates the co-processor and a set of dedicated APIs. This procedure is validated in the context of Comp4Drones ECSEL JU project, implementing and accelerating a soil segmentation algorithm on the ZCU102 FPGA architecture. [1] https://github.com/mdc-suite



#### Motivation

- How to minimize the OS footprint?
- How to customize the system?
- How to generate the HW?
- How to connect HW and SW?
- How to manage the final system?



https://mdc-suite.github.io/miscellaneous/yoctofpga



### • Yocto flow:

- Select the target architecture
- Select the layers to be included
- o Bitbake
- MDC flow
  - Create the dataflow-based HW accelerator

**FPGA flow:** 

- Include the accelerator in Vivado
- Generate the bitstream and the binary file

# • Yocto flow:

- Burn the SD card
- o Use it

# Validation and future work



- Validation:
- Box-based Soil Segmentation on ZCU102
- Same accuracy (HW vs SW) in precision agriculture context
- $\circ~$  Speedup up to 1.55× (HW vs SW) with different box sizes



- Future work:
- Validation with the whole Use-Case + on other fields (e.g. automotive)
- OS connection with autopilot + Multithreading support