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ANDANTE

**AI for New Devices And Technologies at
the Edge**

D5.7 Demonstrations of the domain “Digital Industry”

Deliverable No.	D5.7	Due Date	<i>31-Jan-2024</i>
Type	Demonstrator	Dissemination Level	<i>Confidential</i>
Version	1.1	Status	Final
Description	This document describes the final implementation of the demonstrators related to the Use Case Domain 1 / Digital Industry, i.e. the ANDANTE Use Cases UC1.1A/B/C and UC1.2.		
Work Package	WP5 – Application Integration and Evaluation.		

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Abstract (Published Summary)

This document serves as proof for the completion of the demonstrator deliverable 5.7 “Demonstrations of the domain “Digital Industry””. Furthermore, it describes the final setup of demonstrators as well as components for the implementation of the setups that were not developed in other WPs for the use cases in the Digital Industry domain, in the context of WP5 Task 5.1 of the ANDANTE project. Within this task, two use cases were defined: use case 1.1 for “Indoor Positioning Recognition and People Counting”, which has been realized with 3 different setups by the partners IFAG, EESY, TUD, HEI and FHG, and use case 1.2 for “Color Classification at the Edge for Quality Control” implemented by IFAG. The demonstrators for these use cases described in this deliverable are leverage for the evaluation by the corresponding partners that is documented in D5.12.

The details of the three variants of use case 1.1 are as follows:

- **Setup A:** IFAG and EESY implemented a demonstrator based on platform 4.2, the Multi-SNN-ASIC platform developed by IFAG in the project, and radar sensors. Besides the setup itself, the partners discuss in this deliverable the specific implementations of single SNN models and SNN ensembles used for the demonstrator and the evaluation of the platform 4.2. Furthermore, they provide information about the scenarios executed in this use case and the data-gathering parts of the setup. With all of this the partners prove the completion of the achievement of realizing a full people counting and tacking demonstrator based on distributed SNN algorithms as well as hybrid distributed AI-algorithms. The later means that different types of AI models like SNNs and CNNs are combined into one ensemble.
- **Setup B:** TUD implemented a version of use case 1.1 based on the data of IFAG and EESY generated with Setup A and SpiNNaker2. Besides the description of the setup, details about SpiNNaker 2 evaluation board and RANnet, the algorithms developed for this use case, are provided. With this TUD proves the achievement of realizing a SpiNNaker 2 based setup for people counting and tracking that has the following advantages over other implementation:
 - Direct processing of raw radar data with a DNN model.
 - Combining data of multiple frames from multiple sensors to enhance the prediction ability.
 - Alleviating downstream tasks, e.g. counting and tracking, by accurate predictions.
 - Real-time sensing with efficient model implementation on neuromorphic hardware.
- **Setup C:** For the evaluation of ASIC 3.1b, FHG and HEI realized a demonstrator that tracks and counts people based on a thermopile camera of HEI. The partners describe besides the setup itself, the algorithm, YOLOv3-tiny, its development and the pre-processing implemented for this use case as well as the corresponding data. With this the partners prove the achievement of completing a variant of demonstrator for people counting and tracking based on thermopile camera and accelerators with FeFET memory.

Compared to use case 1.1, the use case 1.2 was worked on only by IFAG. They implement a color-classification demo based on board 4.1 and ASIC 3.2, the analog neural network ASIC developed by IFAG in ANDANTE. All components of this demonstrator were developed in WP3 and WP4 or are off-the-shelve components. Hence, IFAG describes in this deliverable only the overall composition and architecture of the demonstrator and no additional information regarding components are provided. Nevertheless, IFAG shows with this that they completed an evaluation environment for software and hardware for extreme edge applications.