SMART MIRROR

VEDLIoT
Very Efficient Deep Learning in IoT

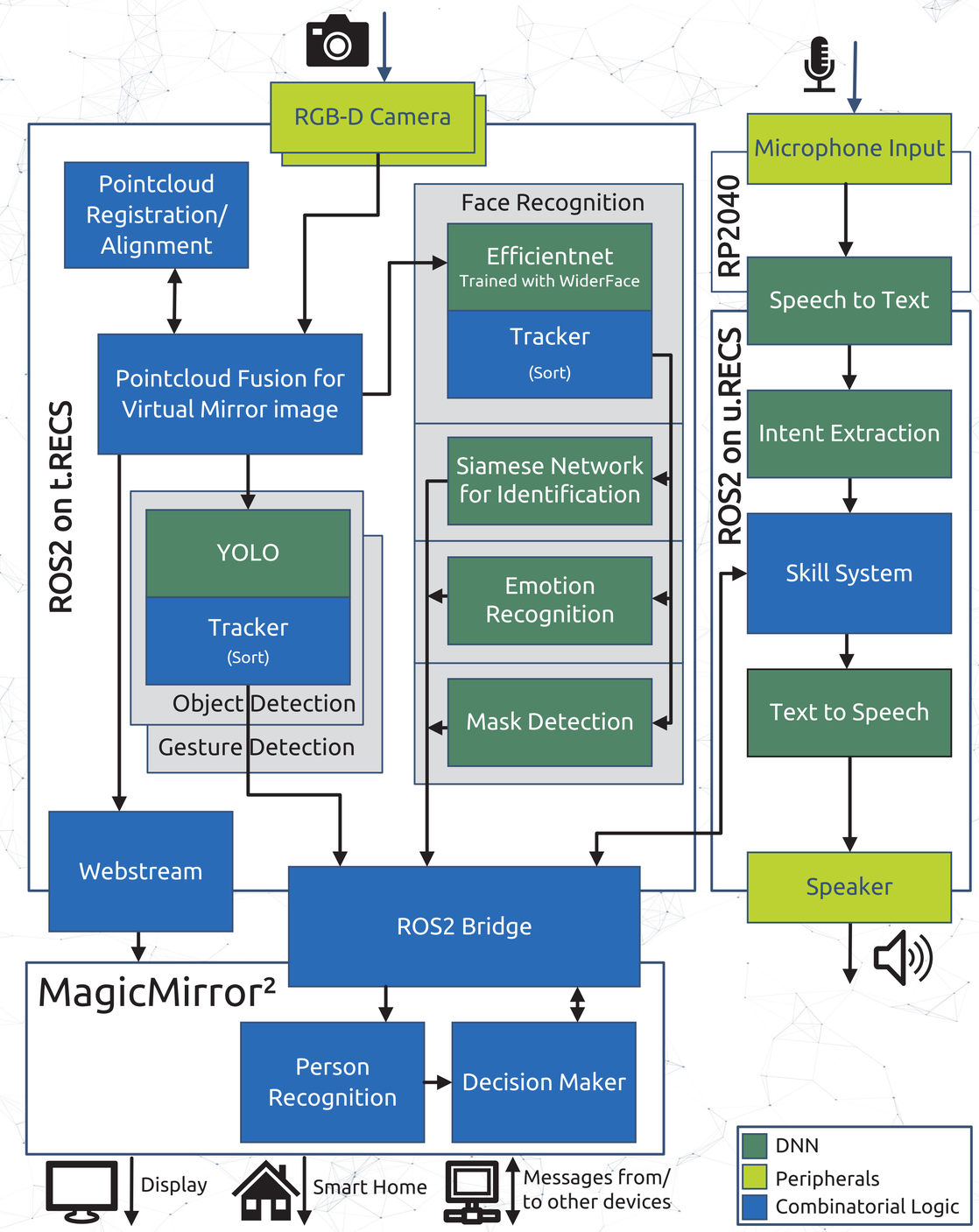
AN INTUITIVE INTERACTION INTERFACE

OVERVIEW

The smart mirror was developed as an intuitive interface to assist the interaction in smart home environments with a strong focus on local processing for data privacy.
It shows a mirror image of the user and displays personalized information and the status of the smart home. Based on the reconstructed virtual mirror image generated from depth imaging cameras, the user's face is recognized, and simple hand gestures are used for intuitive control. In addition, a voice recognition system, supported by natural language processing (NLP), enables an interaction via a voice assistant. In principle, all computations are performed locally on the device using open-source software, ensuring maximum privacy as no data is transferred to the cloud and to third-party service providers.
One of the significant challenges in this project is combining multiple techniques in machine learning. The methodology developed within the VEDLIoT project helps to keep up with high performance and also maintaining a low energy consumption. Newest techniques for security ensure that the high requirements with respect to privacy are met.

Smart Mirror running on the heterogeneous near edge computing platform

t.RECS



ACCELERATED MACHINE LEARNING

In order to achieve the different needed detections, multiple neural networks are combined via the common middleware ROS2. This facilitates more effortless interchangeability or other distribution of the computation components. Every subsystem can be calculated in parallel on the used heterogeneous hardware platforms t.RECS, utilizing different hardware accelerators available. In this example, the smart mirror software architecture is distributed on two NVIDIA Jetson AGX Xavier microservers to share the load of computing YOLOv4 for object detection, YOLOv4-tiny for gesture recognition, a feature extractor and a Siamese network for face recognition. The current setup achieves a performance of 16 FPS with an power consumption of about 150 Watts, which is to be further improved within the project's scope. A local voice assistant is implemented on the far edge computing platform u.RECS, which also utilizes the ROS2 middleware. The input of a microphone using an RP2040 microprocessor as a pre-processor. This smart microphone can send recorded voice information or recognize simple keywords extracted by a hot word detection. This is intended to protect the user's privacy to the maximum extent possible.

t.RECS near edge computing platform with one x86-based COM-HPC server and two NVIDIA Jetson Xavier AGX accelerators

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