PRODUCT

The *Asaphus Embedded Face Recognition Library* is a facial identification and head tracking software that is optimized for deployment in embedded systems. It is called by application-layer software via an API that offers interface functions for head tracking, eye-lid status, enrollment of new individuals, and identification of individuals.

01 HEAD TRACKING AND EYE-LID STATUS

- The *Asaphus Embedded Face Recognition Library* determines the origin and direction of the gaze vector in world coordinates;
- The software reports the area between upper and lower eye lids

02 FACE IDENTIFICATION

- The *Asaphus Embedded Face Recognition Library* requires 5-10 non-biometric images to register a new individual;
- The software then recognizes registered individuals and indicates impostors (unregistered individuals).
- Recognizion is robust against varying head poses, uncontrolled lighting conditions, and partial occlusions.

03 HARDWARE REQUIREMENTS

- The *Asaphus Embedded Face Recognition Library* is fully self-contained; it has its own memory management and does not contain references to external libraries. It is implemented in C++, works with Linux, QNX, and virtually any other operating system.
- The software runs at high frame rates on ARM Cortex M4, A8, A9, and other embedded processors.
- The software supports single or dual near-infrared cameras or time-of-flight cameras.

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Asaphus Vision GmbH

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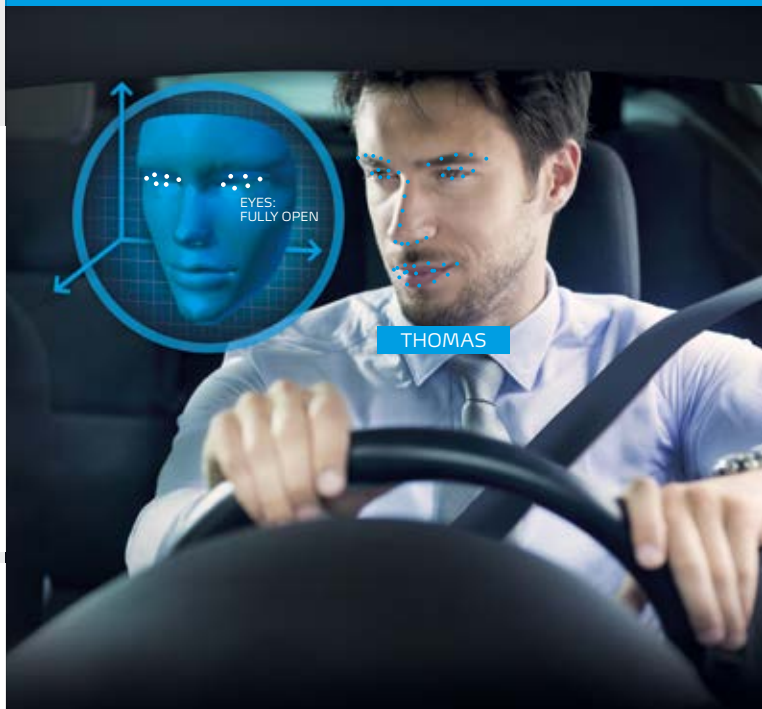
Amtsgericht Charlottenburg, HRB 160088

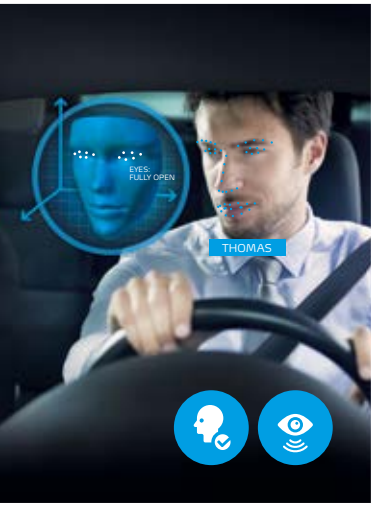
ASAPHUS VISION

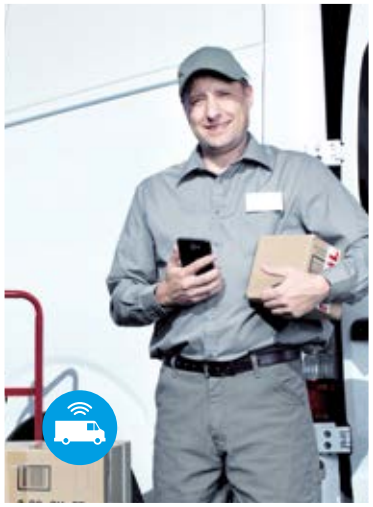
SAFETY, CONVENIENCE, INDIVIDUALITY

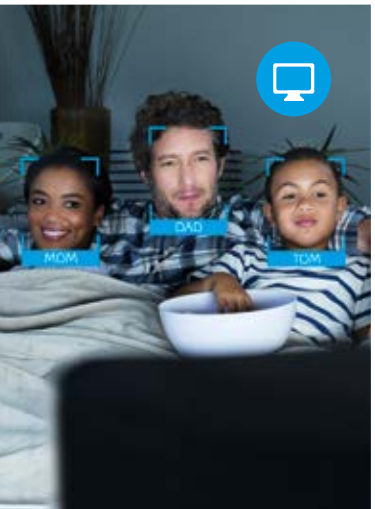


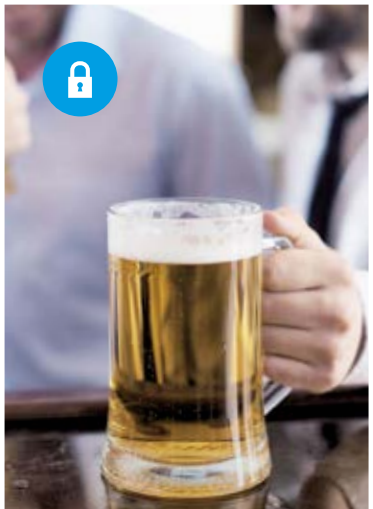
OUR VISION

At Asaphus Vision, we develop software that promotes the safety, convenience, and individuality of its users. We are the technology leader for embedded face recognition software. We are a university spin-off, have tight links to the research community, and provide our customers with the best-performing and most innovative solutions for facial recognition on embedded devices.









SOLUTIONS

Driver Identification for Passenger Cars

In order to offer a perfectly convenient and individual driving experience, your car has to recognize its driver. The *Asaphus Embedded Face Recognition Library* allows the car to adjust its infotainment and navigation settings, ambient temperature, and mirror positions to the driver's preferences. It allows the car to switch to valet mode or notify the owner when an unknown driver starts the car.

The *Asaphus Embedded Face Recognition Library* runs at a high frame rate embedded on a single core of any automotive CPU under any operating system. As input, it accepts a single or dual near-infrared camera images, or the amplitude image of a time-of-flight camera. It determines the driver's identity and calibrated probabilities.

Driver Distraction and Drowsiness Detection

Advanced driver assistance systems can allow the driver to take the hands off the steering wheel during autonomous operations. But they have to be aware of the driver's level of attention, in case control has to be handed back to the driver. Without the driver's hands on the wheel, the driver's attention can still be monitored by an interior camera.

The *Asaphus Embedded Face Recognition Library* tracks a large number of facial landmarks, and infers the 3D position of the driver's head and direction of gaze from a single near-infrared camera. It tracks the upper and lower eye lids and determines the eye-lid status. It runs at high frame rates on a single core of a typical automotive CPU and can easily follow eye blinks and quick head movements.

Commercial Vehicles

Facial identification provides a line of defense against the theft of delivery and utility vehicles that is robust against possible negligent behavior of drivers. Driver distraction and drowsiness detection software can help fleet operators reduce the risk of accidents as well as insurance costs. The *Asaphus Embedded Face Recognition Library* can be embedded into existing telematics hardware. For instance, it runs at high frame rate on a single A9 core under Linux.

Appliances

In order to offer the best possible user experience to each individual user, TV sets and other household appliances have to be aware who is using them. The *Asaphus Embedded Face Recognition Library* allows appliances to offer personalized recommendation, settings, and levels of user guidance. The *Asaphus Embedded Face Recognition Library* runs on a wide variety of embedded processors – such as an M4, A8, and A9 – and works under Linux, QNX, and any other operating system. It recognizes registered users and tracks their direction of gaze.

Ignition Interlock Devices

By verifying that a breath test is in fact taken by the registered user, facial recognition can improve road safety and eliminate the effort that today is spent on manual inspection of images. The *Asaphus Embedded Face Recognition Library* identifies users quickly on a wide variety of embedded processors – such as an M4, A8, and A9 – and works under Linux, QNX, and any other operating system. It determines calibrated identification probabilities and allows the system to adhere to defined false-positive rates. It can be integrated into existing systems that are equipped with a camera by way of a firmware update.