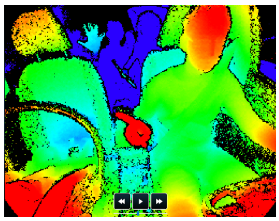
Application brief

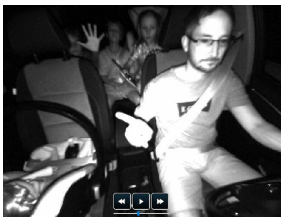
3D in-cabin sensing

Using the REAL3™ Time-of-Flight imager IRS2877A(S)

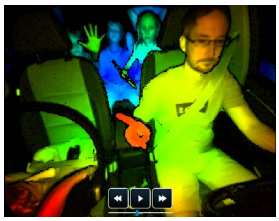
With increasing degrees of automated driving, the driver is more and more released from the original driving tasks and becomes a passenger. As such the car turns into a living place with completely new interior concepts to offer entertainment and possibilities to work or relax and to seamlessly connect to all kind of data. How to support such new HMI concepts including secure authentication? How to ensure high passive safety standards for changing seat positions? The solution is an intelligent car that knows what's happening inside. A Time-of-Flight (ToF) camera is the best option for driver and in-cabin monitoring. It provides the most robust and feature rich data of the interior: highly accurate depth data in each pixel and simultaneously a sunlight independent amplitude picture.



Depth data



Amplitude data



ToF: depth + amplitude

The reliable 3D ToF data supports many use-cases to enhance comfort and occupant safety:

- Gesture control
- Secure 3D face authentication with anti-spoofing
  - Payment services
  - Seamless connectivity to private data or cloud services
  - Car-unlock by 3D face-ID
- Driver head tracking, eye-closure, gaze tracking for area segmentation
- Occupant detection and seat allocation
- Occupant classification: exact size and weight estimates
- Fastened seat belt detection
- Smart airbag: adapt pressure or switch-off depending on situation
  - Head position to airbag (e.g. changed seat positions such as lean back during autonomous driving)
  - Rear-facing baby seat
  - Object on seat or carried by passenger
- Driver out of position; driver distraction; hands on steering wheel detection

Key features

The Infineon ToF solution based on IRS2877A provides:

- Small form factor with high pixel resolution
  - 4 mm image circle at VGA system resolution
  - Two standard supply rails only
  - Partly integrated eye-safety circuitry
- Best performance in strong sunlight conditions
  - 5th generation ToF pixel design
  - Suppression of Background Illumination (SBI) circuitry in every pixel
- Reliable mass production
  - Standard soldering process: plastic BGA package without need of underfiller material
  - AEC-Q100 grade 2 qualified
  - Fast and easy once-in-a-lifetime camera calibration

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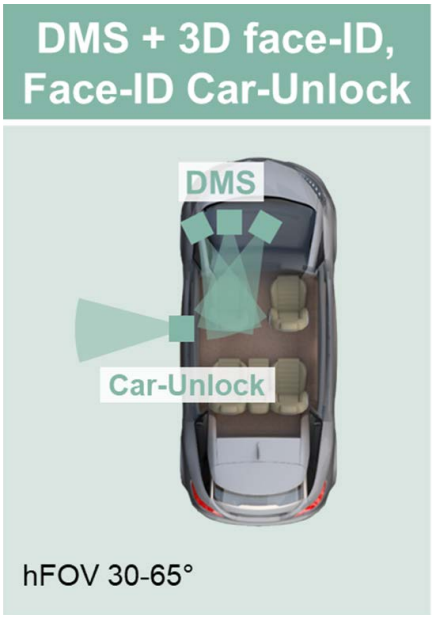
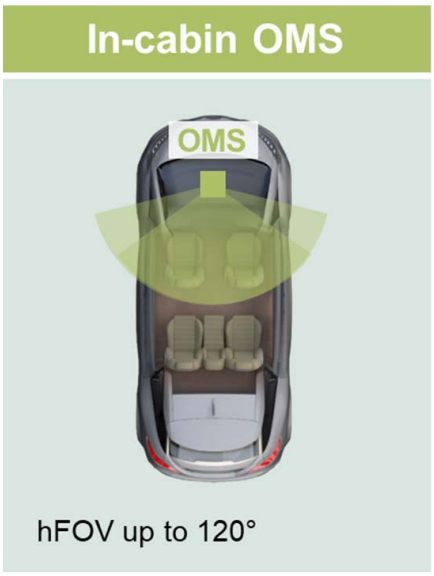
Secure 3D face authentication

Smartphones and point of sales terminals have shown that the highest level of anti-spoofing can only be ensured with added depth-sensing technology. The automotive grade 3D Time-of-Flight imager IRS2877A with its VGA system resolution now offers this functionality for automotive applications as well. The significant difference to standard 2D based face-ID solutions is the sunlight independent gray scale image simultaneously available with the distance information for each pixel. The first is used for robust face identification and the latter for anti-spoofing. Sunlight robust and secure 3D face-ID could allow safe car un-locking or functions requiring authentication like payment services and seamless connectivity to private data or cloud services like music streaming. Additionally, the high system resolution of IRS2877A enables basic driver monitoring (DMS) features like head tracking, eye closure and gaze area segmentation, serving regulations and NCAP requirements to detect driver distraction and fatigue. Thus, offering a driver monitoring system including 3D face-ID with just one camera is feasible now – with ToF.



Occupant Monitoring Systems (OMS)

Car cockpits become more and more important for OEM brand differentiation with features like larger displays, more services and a higher degree of freedom for the driver like changing seat positions during autonomous driving. In order to handle the increasing complexity with an intuitive and less distractive HMI and to ensure passive safety, occupant monitoring systems become an essential part of the cabin. The 3D depth data of a ToF system offers the most reliable and robust implementation of key use cases. The VGA system resolution of IRS2877A enables wide field-of-view cameras to monitor the complete front row. 3D body models allow for exact passenger size and weight estimates and for smart airbag deployment depending on the exact position of the passenger and the seat. Such smart airbag applications can be realized with IRS2877AS as an ISO26262 ASIL-B compliant product, developed for functional safety use-cases. Besides of that, the 3D data enables comfort features like gesture control or intuitive interior lighting following passenger movements.



Infineon has a strong partner ecosystem to evaluate above application use cases. In order to find the right partner or ToF reference camera for your application requirements please contact us.

www.infineon.com

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