# Single-Sensor 3D In-Cabin Monitoring

## Depth Sensing from a Single Image

In-cabin monitoring increasingly relies on depth information to better understand driver posture, head position, and occupant behavior. Depth adds robustness, but traditional 3D approaches often come with trade-offs: multiple sensors, active illumination, higher cost, and added integration complexity.

At CES 2026, Smart Eye demonstrates a simplified approach to 3D in-cabin monitoring using a single passive image sensor, combining Smart Eye's driver and occupant monitoring software with depth sensing technology from Airy3D. Depth information derived from one image sensor supports robust driver and occupant monitoring, with significantly reduced hardware complexity compared to conventional 3D solutions.

## Key System Characteristics

### Simplified Sensor Architecture
2D image and depth information from a single sensor, reducing component count and system complexity.

### Passive Depth Sensing Architecture
Avoids dedicated depth projectors or complex illumination hardware, keeping system cost and hardware requirements low.

### Lower Integration Complexity
Smaller footprint and greater flexibility for placement in the cabin, including compact modules and behind-glass integration.
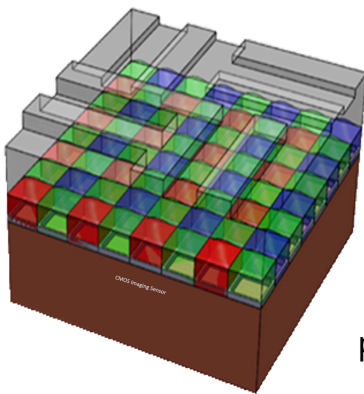
### Production-Oriented Scalability
A cost- and power-efficient path to bringing 3D in-cabin monitoring into high-volume vehicles.

## Supporting Passive Safety and Adaptive Restraints

The depth information generated by the system provides a more robust understanding of occupant position and posture. This supports passive safety functions such as adaptive restraint systems, where airbags and seat belts adjust based on who is in the seat and how they are positioned.

In scenarios where additional robustness is required, including pre-crash and crash situations, this depth-based information helps enable more accurate and adaptive safety responses.



## How Single-Sensor 3D is Achieved



The system combines a standard image sensor with Airy3D's DepthIQ™ depth-sensing technology, which uses a transmissive diffraction mask and low-compute processing to extract 3D information from a single image. Smart Eye's software then applies this depth data to eye tracking and body posture analysis inside the vehicle cabin. This architecture avoids the need for multiple cameras or active depth projection, while still providing meaningful depth information for driver and occupant monitoring.

## Technical Highlights

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| **Sensor** | ST Shibuya w/ Airy3D TDM |
| **Resolution** | 5.1 Megapixel |
| **Field of View** | 160 degrees |
| **Illumination** | 940nm LEDs |
| **Sunlight Immunity** | Compatible |
| **Application** | Automotive |



smart eye