

3D Sensing Systems

The first generation of 3D sensing systems worked much like human 3D recognition in nature. VIAVI was a pioneer in the development of this technology for the Microsoft Kinect gaming systems. In the 10 years since the development of this technology, 3D sensing systems have become more sophisticated and moved from gaming applications into mobile handsets and beyond.

How 3D Sensing Works

3D sensing systems works much like human 3D recognition in nature. A light source, such as the sun, bathes an object in a full spectrum of light. The eye senses reflected light, but only a limited portion of the spectrum. The brain compares a series of these reflections and computes movement and relative location.

In Near Infrared (NIR) based 3D sensing the emitted light is shaped by a light shaping optic that illuminates a scene such as a face in the case of a face recognition system. The light reflects back to the device and optical filters screen out spurious and ambient light, letting only the near- infrared spectra through to the light sensor. Firmware interprets differences in the light bouncing back from different parts of the scene to create an electronic 3D map. This map can then be used for facial recognition, biometrics, AR/VR, as well as other use cases.



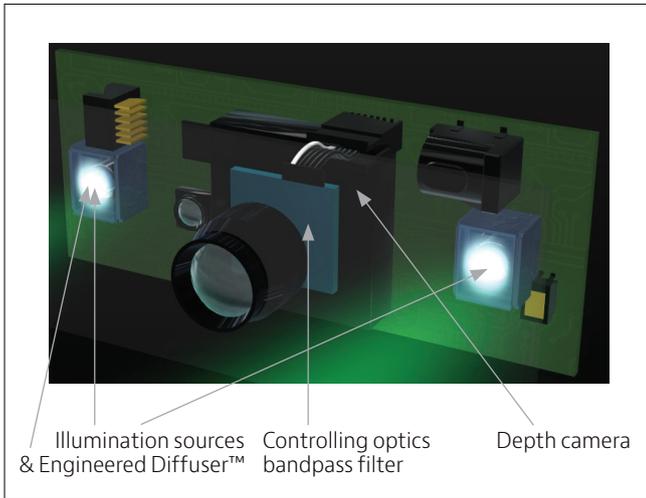
Basic 3D Sensing System Components

3D sensing systems all share a basic component list, and VIAVI is a major supplier of optical filters and engineered diffusers.

- **Illumination Sources** — LEDs or laser diodes are typically used to generate infrared or near-infrared light. This light isn't normally noticeable to users and is often optically modulated to improve the resolution performance of the system.
- **Light Shaping Optics/Engineered Diffusers™** – VIAVI Engineered Diffusers put light where the customer needs it. Engineered/tailored light beam distribution with no zero order (direct) beam—eliminates eye safety concerns.
- **Controlling Optics** — optical lenses help optimally illuminate the environment and focus reflected light onto the detector surface. A bandpass filter lets only reflected light that matches the illuminating light frequency reach the light sensor, eliminating ambient and other stray light that would degrade performance. VIAVI is a

major supplier of controlling optics.

- Depth camera — a high performance optical receiver detects the reflected, filtered light, turning it into an electrical signal for processing by the firmware.
- Firmware — very-high-speed ASIC or DSP chips processes the received information and turns it into a format which can be understood by the end-user application such as video game software.



Light Shaping Optics

The light emitted by NIR light sources has the characteristics of a point source and is, as such, not useful for 3D sensing. The beam needs to be shaped into a field of light with a customized shape, irradiance and intensity. The light shaping optic is also critical for eye safety through suppression of all zero order light.

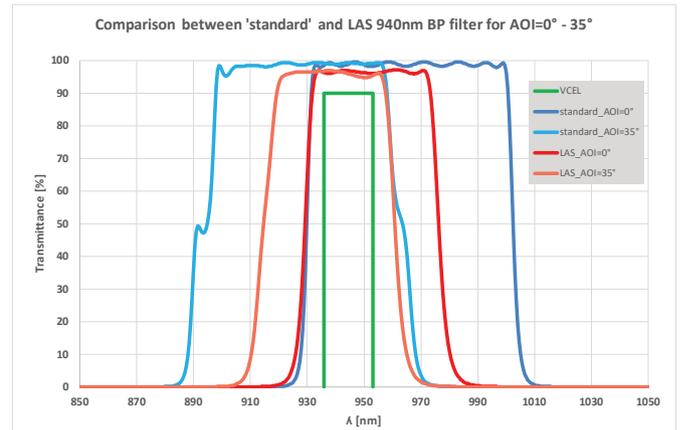
Controlling Optics

Optical filters are critical components in controlling optics for 3D sensing. Typically, these are narrow bandpass near-infrared filters with very high signal-to-noise ratios in the desired band and thorough blocking elsewhere. Limiting the light that gets to the sensor

eliminates unnecessary data unrelated to the 3D sensing task at hand. Combined with noise-reducing software algorithms, this dramatically reduces the processing load on the firmware. The VIAVI patented Low Angle Shift (LAS) filter technology provides significantly improved signal-to-noise ratio for improved system performance.

As with the light sources, high-volume manufacturability is a complicating factor. Through multiple generations of increasing performance and decreasing cost, VIAVI remains the industry's leading supplier of high-performance filters for 3D sensing systems. VIAVI has successfully delivered more than 1 billion filters in to the consumer electronics market.

VIAVI optical components optical filters, optical coatings, and engineered diffusers play equally important roles in enabling 3D sensing systems.



*'LAS' is defined as 'Low Angle Shift'