

DepthIQ

At-a-Glance

Airy3D's DepthIQ™ depth-sensing platform is a versatile and straightforward solution that is far more computationally efficient than other approaches, while also being significantly lower in cost. DepthIQ is also “sensor agnostic” meaning it can be customizable to any given CMOS sensor specification.

ADVANTAGES:

- Simple. A single sensor solution for both imaging and depth.
- Drop in solution that is CMOS sensor agnostic.
- Versatile for a wide range of applications.
- Dramatic savings in hardware cost, footprint, computation, and power consumption.

“Airy3D’s novel technology is unrivaled by any other player in the 3D sensor space. The company has immense potential in many different markets, such as Augmented and Virtual Reality, automotive, drones, and robotics. We believe in the capabilities of this technology to disrupt various billion dollar markets.”

Jeff Yu

Investment Principal at Robert Bosch Venture Capital GmbH

A simple and versatile solution for 3D Sensing

No sensor technology can deliver both depth and 2D images, especially in a single device. Active solutions (structured light, time-of-flight) measure depth but do not generate 2D images. Multi-camera solutions (stereo, depth-by defocus) rely on light intensity data only to create 2D images but do not directly measure depth. Consequently, they all require multiple components and heavy computation leading to significant compromises.

Our advantage begins with light itself

The ideal 3D sensing solution would be a single-sensor system that directly measures the entire light field without excessive computational or manufacturing complexity. Fortunately, it is available today, in what we call DepthIQ™. Airy3D's DepthIQ platform uses a Transmissive Diffraction Mask (TDM) to directly generate a unique dataset of an inherently integrated 2D image and depth information. Airy3D's proprietary computational imaging algorithms bring this uniquely complete and compressed data set to life, eliminating the computational complexity involved in image reconstruction and depth mapping.

Unlike infrared or multi-camera solutions, DepthIQ offers:

Single Sensor, 3D Solution

DepthIQ is underpinned by a transmissive diffraction mask (TDM) made with standard semiconductor technology. TDMs take advantage of diffraction, which inherently reveals the phase and direction of light to measure depth directly. Moreover, diffraction is conservative with no light loss. This unique and globally patented solution can transform any CMOS image sensor into a 3D sensor for cameras used in numerous cutting-edge applications such as AR/VR, ADAS, drones and other UAVs, robots, and IoT, as well as next-generation smartphones.

Significantly Lower Hardware and Computational Costs

DepthIQ is a drop in solution for existing CMOS sensors that requires no change to other hardware or assembly. Computational processing is fast and straightforward using minimal power. Both the image and depth information are captured simultaneously without any comparative analysis of multiple images or complex sensor fusion algorithms. In contrast, competing solutions require several components (e.g., infrared emitters and receivers; multiple cameras) that add up to a higher bill of materials, manufacturing complexity, and high computational demands.

Small Size

Today's consumers expect their smartphones to have the latest features with a footprint small enough to fit in their pockets. This requirement places a heavy burden on end manufacturers and their suppliers to deliver the highest quality and functionality with the fewest number of parts. To this end, DepthIQ minimizes the number of components and manufacturing complexity. It is customizable to any given sensor specification with effectively no increase in the height of the camera sensor stack.

What is a Transmissive Diffraction Mask?

The Airy3D TDM is a diffraction grating array; being transmissive, it neither blocks nor loses light. This array consists of individual grating tiles aligned with banks of pixels on top of a camera sensor stack, above the microlens and color filter layers as shown in Figure 1. In DepthIQ, TDMs take advantage of diffraction to inherently reveal the phase or direction of light.

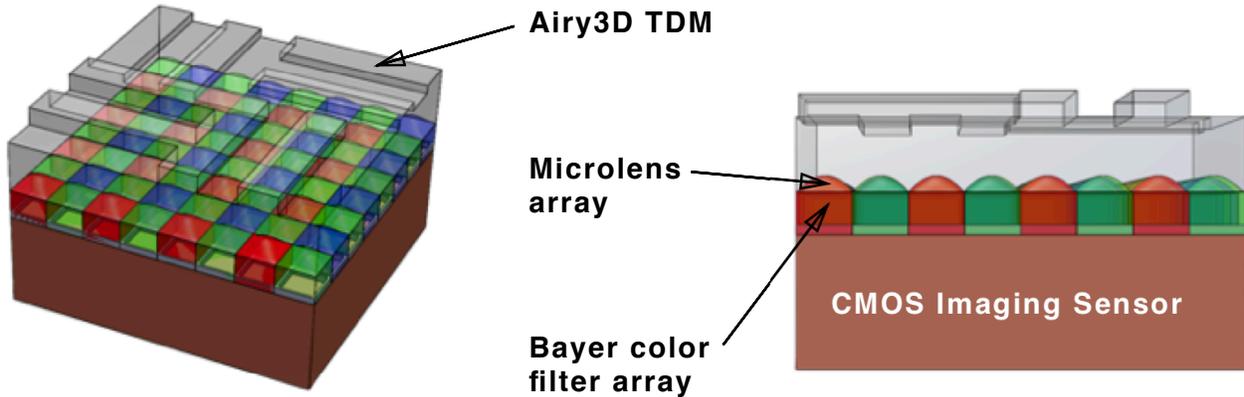


Figure 1. An Airy3D TDM comprised of multiple grating

How does it work?

A classic example of diffraction is when light is incident on a pair of slits. It will extend around their profiles and be visibly modulated in the far field, as shown in Figure 2a. These interference patterns are caused by the overlapping phase-fronts of light ‘wavelets.’ As such, any shift in the incidence angle of light will result in a phase shift of the interference pattern, as shown in Figure 2b. Phase shifts caused by a TDM are detected by the underlying CMOS sensor.

How do we use it?

The addition of a TDM – on top of the microlens/color filter stack – is all it takes to turn a standard CMOS 2D sensor into a 3D sensor. The TDM is only a few microns thick and is straightforward to manufacture. Therefore, no other changes are required to CMOS design, packaging, lens systems, or module design to accommodate an Airy3D TDM.

DepthIQ provides embedded software that processes the raw image data from the sensor, passing through the full-frame RGB image data from the sensor to a standard Image Signal Processor (ISP) while simultaneously generating depth map/point cloud data that can be queried by the provided API.

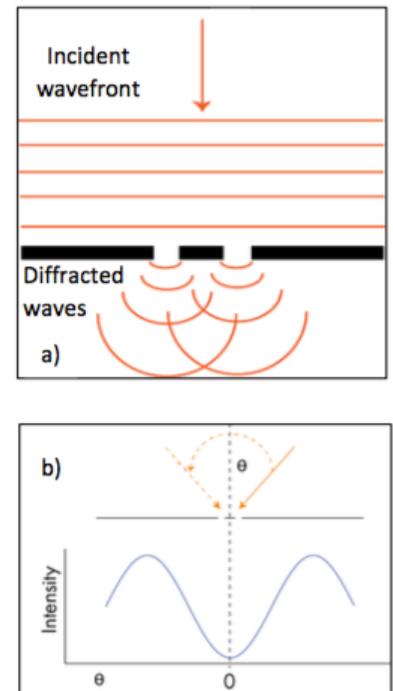


Figure 2.



Find out more.

Learn more about why DepthIQ is the ideal solution for depth sensing by emailing info@airy3d.com to obtain a copy of our white paper, “The DepthIQ Platform for 3D Computer Vision”.