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EPFL tests out self-driving delivery service on Swiss university campus

Image: EPFL

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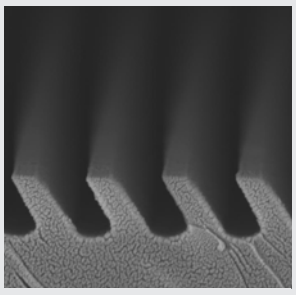

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OXFORD INSTRUMENTS

Virtual necessity augments restricted reality experience

Welcome to the latest issue of AR|VR|MR Focus, the magazine (and free download from optics.org) that covers all aspects of augmented, virtual and mixed reality technologies, produced by the team that brings you optics.org.

The editorial focus of this issue is prototype applications of the latest augmented and virtual reality technologies – from a "smart", automated delivery system, to AR-enhanced surgery broadcasts, to JOYCE, "the first humanoid robot developed by the computer vision community to help machines gain human-like perception and beyond."

Highlights in this issue

Swiss research institute EPFL is testing a new self-driving goods transportation service on its Lausanne campus. The prototype system employs 15 sensors, 5 cameras, a touch screen and a satellite antenna. It can deliver hot food and even collect the dirty dishes so will likely be a hit with residents, whether they are isolating or just too busy to wash up *(page 4)*.

Berlin's Fraunhofer HHI has enabled the broadcasting of certain surgical procedures as an AR-enhanced 3D live stream. In our case study, the precise details of a cochlear implantation operation are transmitted as part of a health pilot project called Telepresence for Surgical Assistance and Training using Augmented Reality *(page 6)*.

Immervision, the Montreal, Canada-based developer of wide-angle intelligent vision solutions, has introduced JOYCE, which it describes as "the first humanoid robot developed by the computer vision community to help machines gain human-like perception and beyond" *(page 7)*.

Mixed fortunes for optical systems developer Lumentum, which says it is "seeding" automotive applications to drive future VCSEL sales. But the reported boom in 3D sensing technology in the company's latest quarter results has been offset by 5G push-outs and weak demand for industrial lasers *(page 8)*.

CEA LETI has printed pixelated holograms on a miniature 6 x 6mm component. The achievement by the French research group opens the door to holograms being presented on augmented reality glasses *(page 9)*.

Analog Devices and Microsoft are working together to mass-produce 3D imaging solutions. The partners are aiming to leverage Microsoft's 3D time-of-flight sensor technology *(page 10)*.

A new type of "smart" contact lens is said to offer improved vision correction. Belgium-based research center imec's artificial iris based on liquid crystals is capable of dynamically changing pupil size *(page 12)*.

Apple has launched its iPhone 12 featuring LiDAR and 5G capabilities. The A14 Bionic design features a "pro camera system", LiDAR scanner and the tech giant's largest yet Super Retina XDR display *(page 14)*.

SPIE Fellow Bernard Kress, Partner Optical Architect on the HoloLens Team at Microsoft, and formerly Principal Optical Architect at Google X, has been elected to serve as the 2021 Vice President of SPIE, the international society for optics and photonics and publisher of this magazine *(page 16)*.

Matthew Peach, Editor in Chief.

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- Smart contact lens offers improved vision correction
- Apple launches iPhone 12 with LiDAR and 5G capabilities
- Microsoft's Bernard Kress elected to SPIE presidential chain

plus the latest product launches from within the industry

Photo: Immersion.

Immervision, the Montreal-based developer of wide-angle intelligent vision solutions, has introduced JOYCE, which it describes as "the first humanoid robot developed by the computer vision community.
See article page 7.

EPFL tests out self-driving delivery service on Swiss university campus

Prototype delivery system employs 15 sensors, 5 cameras, a touch screen and a satellite antenna.

Since October, 2020, the campus of the École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, has served as a testing ground for a high-tech delivery service that uses a self-driving van, integrated with an AI management system and various cameras and sensors. EPFL describes it as "a pioneering initiative that is set to develop further."

Most of the research conducted at EPFL takes place deep inside a laboratory, far from the public eye – but not all of it. That's because the EPFL campus itself is a living lab. Through mid-December, 2020, researchers will use this living lab to test out the self-driving delivery service. The delivery van will be hard to miss – bright yellow with giant screens on the front and back and small boxes on the sides. It will follow a route from the Esplanade to the Rolex Learning Center, Estudiantines student housing complex and EPFL Innovation Park.

The research project – called ADORE, for Autonomously Delivered Orders from Restaurants at EPFL – is designed to explore the various aspects of self-driving technology: robotics, machine vision, computer science, mechanical engineering, telecommunications and interactions with road users. It is coordinated jointly by the EPFL Sustainability office and the Catering, Shops and Hotels unit, and involves using self-driving electric vehicles to deliver meals and other products. The pilot test will be rolled out over several weeks. More information is available at epfl.ch/campus/mobility/mobility-transport/adore-project/

Photo: EPFL

Special delivery: EPFL's automated vehicle relies on multiple sensors and an AI management system.

Multiple cameras and sensors

The electric-powered delivery van measures 1 meter wide x 3 meters long x 1.8 meters high and it is equipped with over 15 sensors, 5 cameras, a touch screen and a satellite antenna that employs new technology allowing the vehicle to be continuously located. It is not designed to carry passengers, but can carry food and other goods in its 11 side boxes, which are locked with a code. Although the van can theoretically travel at up to 50 km/h, its speed will be limited to 6 km/h on campus and a student will always accompany it. The electric vehicle was designed by Chinese firm Neolix and has been made available for the pilot test by Swiss Post.

Three phases of test

The pilot test is scheduled to take place in three phases. The first will last around two weeks, during which the operators will familiarize themselves with the vehicle and the EPFL community will be informed about this newcomer to campus. The van will operate under its regular self-driving conditions on a route programmed into its navigation system; the route will span the Esplanade, Rolex Learning Center, Starling hotel and the Estudiantines. Stops with informative billboards have been set up at the planned delivery and presentation points. Members of the EPFL community will be able to learn more about this new service at these points from Monday to

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EPFL tests out self-driving delivery service on Swiss university campus

Thursday from 11am to 1pm, when they will be able to play a guessing game to win small prizes.

The second phase will also last two weeks and will entail delivering meals to a test group of users. The van will pick up meals independently (but with a student observing nearby) at the university's Takinoa restaurant in the Rolex Learning Center and deliver them to the Esplanade, Starling hotel, Estudiantines and Innovation Park. Users can select a delivery time and place, and when the van is around 300 meters from the stop, it will send a text message containing the code for opening the box where the meal is stored. Another text message will be sent out when the van arrives at the stop. Users can put their dirty dishes from the previous day back in the box. This phase is intended to test out the technical components of the service (e.g., the systems for managing orders, pick-up and delivery locations, and delivery times) and evaluate the overall user experience.

Pioneering venture

If the first two phases go well, the service will be expanded in the third phase to the entire EPFL community, and may include other products besides food. "Our campus is a genuine living lab, and we wanted to use that opportunity to test out a novel transportation and delivery system while promoting healthier, locally sourced food, in association with our project partner," said Luca Fontana, who is managing the EPFL Sustainability office's role in the initiative.

Other research teams may join the venture (from EPFL or another research institution) to test out related technology such as for optimizing the van's trajectory, enhancing the security of data transfer, analyzing images or promoting the acceptance of autonomous systems. Self-driving vehicles have already been tested on Lausanne's Ecublens campus in 2015, but for the ADORE project, the research team had to get fresh approval from public officials. Depending on the outcomes of the various phases, the pilot test could last between two and four months.

Meals on wheels: The delivery system can transport hot meals – and collect dirty dishes.

Project partners are Mobility Lab (a joint initiative between EPFL, HES-SO Valais-Wallis, Swiss Post, the City of Sion and the Canton of Valais), Neolix, FixPosition and Takinoa. At EPFL, the units involved are the Sustainability Office, the Catering, Shops and Hotels unit (RESCO) and the Transportation Center (TRACE).

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Fraunhofer HHI broadcasts surgery as AR-based 3D live stream

Precise details of cochlear implantation operation transmitted part of EIT Health pilot project TeleSTAR.

Fraunhofer Heinrich Hertz Institute (HHI), based in Berlin, Germany, has used an augmented reality (AR)-based 3D live stream to broadcast a cochlear implantation as part of the EIT Health pilot project "Telepresence for Surgical Assistance and Training using Augmented Reality" (TeleSTAR).

As the viewing of live surgeries is a key component of medical education, this groundbreaking technology was shown to be a promising tool for remote teaching and learning, say the team behind the broadcast.

Image: Fraunhofer HHI.

Novel application: Fraunhofer HHI broadcasts surgery as AR-based 3D live stream.

The live stream is novel because it combines AR-based enhancement with audio commentaries, while featuring an intraoperative annotation mode. The latter enables surgeons to overlay visual information (e.g., sketches, references, and image-based anatomy measurements) on the live stream to explain aspects of the procedure.

The 90-min surgery, which was performed at the ENT clinic of Charité Berlin, was followed in real time by 35 spectators at TU Delft in the Netherlands, including ear–nose–throat (ENT) surgeons and master's students of the "Biomedical Engineering" faculty.

Suitable subject

Cochlear implantation is a standard ENT procedure that addresses hearing impairment or deafness. The procedure is particularly suitable for demonstrating and evaluating AR technologies because it can be performed within a predictable time window.

The fully digital surgical microscope "ARRISCOPE" from Munich Surgical Imaging (formerly ARRI Medical), which provided visualizations, offers high-resolution 3D images, radiation-free image-based measurement of the anatomy, and multi-spectral image data acquisition.

"This technology provides an unparalleled quality of remote teaching and communication, which is particularly valuable given the current Covid-19 pandemic," comments Dr. Florian C. Uecker, leading senior physician in the ENT clinic at Charité Berlin. "I am pleased to have the support of EIT Health for this project and to have access to the world's leading digital 3D microscope—ARRISCOPE."

"Students and clinical trainees need to experience the full spectrum of modern medical technology. TeleSTAR offers surgical trainees and medical technology developers this important exposure," adds Prof. Dr. John v.d. Dobbelsteen, faculty of Biomedical Engineering at TU Delft.

"Augmented reality using artificial intelligence and computer vision algorithms in combination with digital processing chains are key technologies for new intra-operative assistance tools fostering clinical decision support and facilitate remote education through providing a new level of surgical transparency," explains Jean-Claude Rosenthal, research associate at Fraunhofer HHI.

The live stream, which was continuously broadcast in a 10-Mbit 3D live stream with AR and depth visualization, is part of the EIT Health pilot project TeleSTAR. EIT Health is an EU-funded initiative of the European Institute of Innovation and Technology (EIT).

The research project, which runs until December 2020, develops novel training concepts for healthcare professionals using mixed reality- (MR) and AR-based approaches. TeleSTAR project partners include Fraunhofer HHI, Munich Surgical Imaging, the ENT clinic at Charité Berlin, and the department of biomedical engineering (BME) at TU Delft.

The next 3D/AR live operation will be broadcast from Berlin to several locations and is scheduled for 14 and 15 November.

More information can be found at http://telestar.health.

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Immervision launches JOYCE: 'first humanoid robot with intelligent vision'

JOYCE has been developed by the computer vision community.

Photo: Immersion.

Immervision, the Montreal-based developer of wide-angle intelligent vision solutions, has introduced JOYCE, which it describes as "the first humanoid robot developed by the computer vision community to help machines gain human-like perception and beyond."

The purpose of JOYCE is to further advance computer vision technologies by inviting the wider technology community to help JOYCE gain a better understanding of her environment by upgrading her optics, sensors and AI algorithms.

To support the realization of this complex task, Immervision is also unveiling the JOYCE Development Kit for engineers and AI developers. This "JOYCE IN A BOX" development kit is equipped with three ultra-wide-angle panomorph cameras calibrated to give 2D hemispheric, 3D stereoscopic hemispheric or full 360 x 360 spherical capture and viewing of the environment.

This kit uses data-In-picture technology so that each of her video frames can be enriched with data from a wide array of sensors providing contextual information to AI and neural networks, computer vision and SLAM algorithms to help increase her visual perception.

Moreover, JOYCE will be streaming live so that people can, not only follow the evolution of her capabilities, but also look through her eyes while she travels around the world, skydives, visits a business conference or a computer vision lab.

Immervision InnovationLab

JOYCE stems from the Immervision InnovationLab which mission is to accelerate the emergence of new innovative solutions and help build the next generation of intelligent vision systems for a wide range of industry devices.

"At Immervision, we strongly believe in the value of bringing together the computer vision community to break down the silos that are slowing the innovation cycle. Instead, let's push forward the boundaries of machine perception through cross-pollination. We believe that JOYCE will help develop extremely innovative solutions to resolve complex industry challenges," said Pascale Nini, President and CEO of Immervision.

Potential applications of the new robot include:

- Enhancing the performance of smart home devices such as vacuum cleaners, lighting systems and home appliances.
- Improving optics technologies to ensure driver safety in assisted driving and autonomous cars.
- Improving fire fighters' ability to detect people and objects over trees and see through smoke.
- Improving medical diagnostics to better identify cancer tumors or other conditions on a CT scan.
- Help identifying early signs of crop diseases, and many more.

To follow JOYCE's progress and collaboration within the community, she may be visited at joyce.vision and she also has several social media channels.

About Immervision

Immervision enables intelligent vision in any device. Its Deep Seeing technology and experience in wide-angle optical design and image processing enables smart devices with "superhuman" eyes to capture high quality visual and contextual data. The company also invents, customizes and licenses wide-angle lenses and imaging software technology for AI, machine vision and user applications, from capture to display, in the mobile, automotive, robotics, security, and other industrial and consumer product industries.

www.immervision.com

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Lumentum 'seeds' automotive applications to drive future VCSEL sales

Boom in 3D sensing technology in latest quarter offset by 5G push-outs and weak demand for industrial lasers.

Photonics company Lumentum has posted sales of $452 million in its latest quarter, reflecting a sharp sequential increase on booming demand for its optical 3D sensing technology.

Although that overall revenue figure was in line with its August forecast, Lumentum said that the underlying results were more complex. Fast-growing sales of 3D sensing products based around its vertical cavity surface-emitting lasers (VCSELs) were offset by a weaker picture in telecoms relating to push-outs of 5G deployments.

Commercial laser sales were also down sharply year-on-year, reflecting the ongoing weakness in the industrial sector, while Lumentum CEO Alan Lowe said that sales to Huawei were set to shrink rapidly following the latest restrictions imposed by the US government.

Despite that, the company was able to deliver a pre-tax profit of $84 million in the quarter - up from $53 million in the equivalent period last year.

VCSEL sensing upgrades

With Lowe promising to continue investing heavily in research and development to exploit future opportunities, Lumentum's innovation pipeline looks to be delivering results.

"We have multi-year product and technology roadmaps aligned with our consumer electronics customers," Lowe told investors discussing the latest financial results, suggesting that higher levels of photonic integration would enable sub-screen 3D cameras.

"We are optimistic about 3D sensing demand in the coming quarters and years," Lowe added, pointing out that having now passed $1.5 billion in cumulative 3D sensing sales, there would be plenty more to come.

"In addition to increasing content, we believe there's potential for a strong consumer upgrade cycle driven by new features, including 5G, augmented and virtual reality, and computational photography," he said. Key customer Apple uses VCSEL-based lidar arrays in its latest iPhone 12 models to support new AR/VR and computational photography features.

While larger and higher-density VCSEL arrays for improved 3D imaging and new lasers are in development for the consumer electronics sector, it appears that automotive applications - both inside and outside the cabin - may soon present major opportunities for VCSELs and 3D sensing.

Planting automotive 'seeds'

Describing the latest company activity as "planting seeds for growth in markets beyond consumer electronics", Lowe said:

"In the past quarter, our VCSEL arrays have completed the important AEC [Automotive Electronics Council] automotive qualification through a module partner, and we expect initial deployments of these products to be [for] automobile in-cabin applications."

On top of the opportunity in driver monitoring systems, the CEO said that Lumentum was also now sampling high-power VCSEL arrays for qualification in external lidar systems for driver assistance and autonomous driving.

"According to our customers, these 'last-mile' applications could be one of the largest lidar opportunities in the next several years," Lowe noted.

Beyond phones and cars, Lowe said that Lumentum was now shipping VCSEL-based sensors in volume for facial recognition systems in payment kiosks.

"We are engaged with providers of security and access control systems who are looking to add 3D sensing to enable touchless or contactless high-security access control," he explained. "These applications are also accelerating due to public health and safety concerns."

5G push-outs and Huawei restrictions

While the picture looks overwhelmingly positive in 3D sensing, the immediate outlook doesn't look quite as bright in the telecoms sector, where Covid-related delays to 5G infrastructure build-out and the thorny issue of Huawei sales are having a negative impact.

Despite the 5G slowdown, demand for

Photo: Apple.

Apple's iPhone 12 Pro models feature a new lidar scanner for immersive augmented reality (AR) experiences. Lumentum is a key supplier of VCSEL sensors to the consumer electronics giant.

Lumentum's photonics products in data center applications remains extremely strong, even outstripping the firm's manufacturing capacity.

"As such, we are continuing to aggressively expand our wafer fab capacity based on long-term demand trends and expectations," Lowe said. "On the new product front, we are working closely with our lead customers on their needs for future 800G [and higher] datacom transceivers."

Switching focus to Huawei, the CEO outlined a complex picture concerning exactly which products Lumentum could and couldn't now ship to the Chinese communications giant - the upshot of which is that Huawei no longer represents a "10 per cent customer". In the fiscal year ending June 2019, sales to the Chinese firm represented 15 per cent of Lumentum's total annual sales.

But the regulations imposed by the Trump administrations will see that contribution shrink further in the current quarter and beyond, with Lowe saying that Huawei would soon account for less than 5 per cent of Lumentum's turnover.

Despite that and another sharp contraction in sales of commercial lasers, Lowe struck a positive note overall, telling investors:

"The world is accelerating its shift to increasingly digital and virtual approaches to work, entertainment, education, healthcare, social interaction, and commerce - which all drive increasing needs for our differentiated products and technology."

• CEO Lowe and his executive team said that sales in the current quarter should rise to around $475 million. Lumentum's stock price, little changed following the latest update, continues to trade close to its all-time high. At around $84 on the Nasdaq, the company's market capitalization stands at more than $6 billion.

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https://optics.org/news/11/11/5

CEA LETI prints pixelated hologram on miniature 6 x 6mm component

Achievement by French research group opens the door to holograms being presented on augmented reality glasses.

What if tomorrow holograms could be displayed on augmented reality glasses? French research institute CEA-Leti says it has achieved a major step towards this aim by printing pixelated holograms on a "postage stamp format" component, measuring only 6 x 6 mm2).

Augmented reality glasses allow viewers to observe a real scene, while viewing additional information relevant to the scene: explanatory text, instructions, diagrams, photos, and the like.

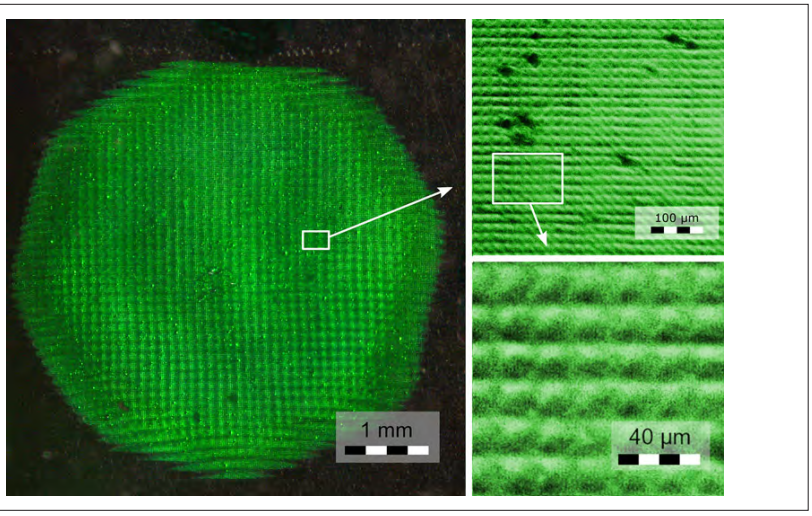
CEA-Leti's ambition is to use holograms, or volumetric optical components, in micro- and nano-photonic manufacturing processes for AR applications and beyond.

To avoid reducing the visual field, these holograms must be displayed in an approximately postage stamp size area; a few tens of square millimeters.

Laser illuminated

Specifically, this involves printing on this surface holographic pixels or "hoels" to reconstruct a coherent image in the back of the eye, when illuminated by laser microsources. This technological challenge has now been met.

Motifs are printed within a transparent photopolymer volume.



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The holographic effect is achieved by engraving hoels on a hundred 200 nm layers featuring angular disparities.

Motifs are printed within a transparent photopolymer volume.

Christophe Martinez, manager of CEA-Leti's Retina Projection Program, commented, "In practice, we print these hoels, several microns in diameter, within a 16-micron-thick transparent photopolymer volume using a 532 nm laser.

The holographic effect is obtained by engraving them on around one hundred 200 nm layers featuring angular disparities. The writing process is totally repeatable to control hoel size, period and pitch."

This success, complemented by the registering of a patent, represents a first step. The researchers now plan to evaluate several photopolymers because printing quality depends closely on material characteristics.

Moreover, they are currently limited to static holograms but want to "go dynamic" by activating and deactivating hoels by component external then internal illumination. This is the subject of a number of doctoral cooperations with the University of Haute Alsace, in Mulhouse, France.

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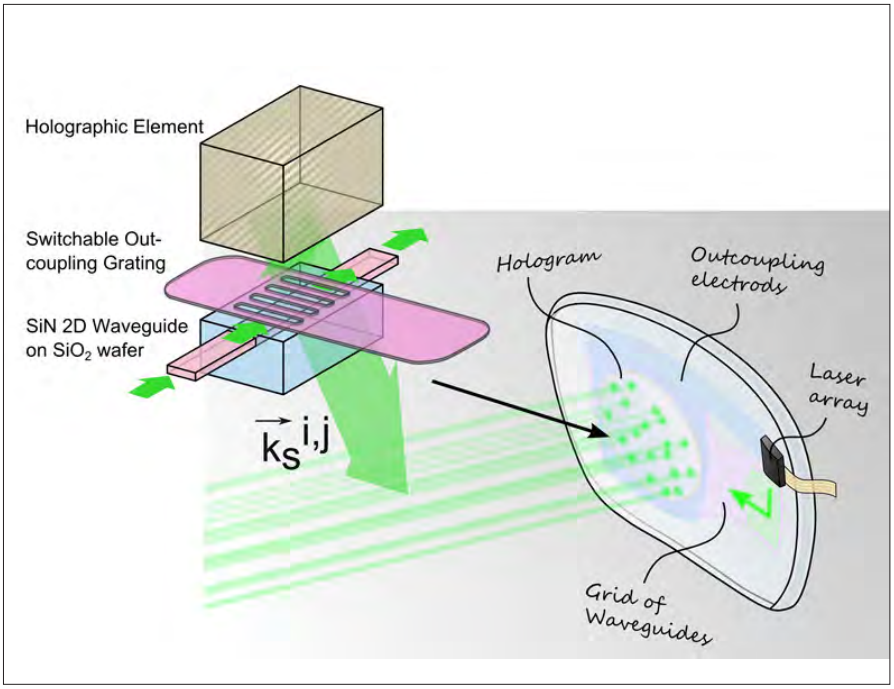
https://optics.org/news/11/9/66



© CEA-Leti.

Motifs are printed within a transparent photopolymer volume.

Analog Devices and Microsoft collaborate to mass-produce 3D imaging solutions

Partners aiming to leverage Microsoft's 3D time-of-flight sensor technology.

Diversified technology company Analog Devices (ADI) has announced a strategic collaboration with Microsoft to leverage Microsoft's 3D time-of-flight (ToF) sensor technology.

The partners' statement said they intend "to enable customers to easily create high-performance 3D applications that bring higher degrees of depth accuracy and work regardless of the environmental conditions in the scene."

ADI's technical expertise will build upon Microsoft Azure Kinect technology to deliver ToF solutions to broader audience in application areas such as Industry 4.0, automotive, gaming, augmented reality, computational photography and videography.

Market opportunities

"Currently," state the companies, "the industrial market is seeing a push for 3D imaging systems that can be used in harsh environments where cutting-edge applications such as human-collaboration robots, room mapping, and inventory management systems are required to bring Industry 4.0 to life. ToF applications are also needed to create safer automobile experiences for drivers and passengers by outfitting vehicles with occupancy detection and driver monitoring capabilities."

Duncan Bosworth, General Manager, Consumer Business Unit, at Analog Devices, commented, "Our customers want depth image capture that is as easy as taking a photo. Microsoft's ToF 3D sensor technology used in the HoloLens mixed-reality headset and Azure Kinect Development Kit is seen as the industry standard for time-of-flight technologies.

"Combining this technology with custom-built solutions from ADI, our customers can easily deploy and scale the next generation of high-performance applications they demand, out of the box."

ADI is designing, manufacturing, and selling a new product series of 3D ToF imagers, laser drivers, software and hardware-based depth systems that will provide the best depth resolutions in the market with millimetre accuracy. The company says it will start building full systems wrapped around CMOS imagers to deliver imaging with greater 3D detail and operating over greater distances.

Cyrus Bamji, Microsoft Partner Hardware Architect, said, "This collaboration will expand market access of our ToF sensor technology and enable the development of commercial 3D sensors, cameras, and related solutions, which will be compatible with a Microsoft ecosystem built on top of Microsoft depth, Intelligent Cloud, and Intelligent Edge platforms."

ToF 3D sensor technology projects precisely controlled laser light in durations of nanoseconds, which then reflect from the scene onto a high-resolution image sensor giving a depth estimate for every pixel in the image array.

ADI's new CMOS ToF products based on Microsoft's technology enables highly accurate depth measurement, low noise, high robustness to multipath interference, and calibration solutions for ease of manufacturing. ADI's products and solutions are already being sampled and the first 3D imaging products using Microsoft technology are expected to release by the end of 2020.

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https://optics.org/news/11/9/42

Source: ADI.

New suite: Analog Devices' 3D Time of Flight systems. 3D Time of Flight, or 3D ToF, is a type of scannerless LIDAR (Light Detection and Ranging) that uses high power optical pulses in durations of nanoseconds to capture depth information (typically over short distances) from a scene of interest. Source: Analog Devices. ADI offers industry leading products and solutions to directly enhance the capabilities of 3D ToF systems, including processing, laser drivers, and power management, along with development boards and software/firmware to aid in quick implementation of 3D ToF solutions. In addition, ADI also offers modules from our design services partners.

Smart contact lens offers improved vision correction

Imec artificial iris based on liquid crystals is capable of dynamically changing pupil size.

Smart contact lenses, containing integrated electronics and in direct contact with the eye, are potentially valuable in vision correction and augmented reality applications.

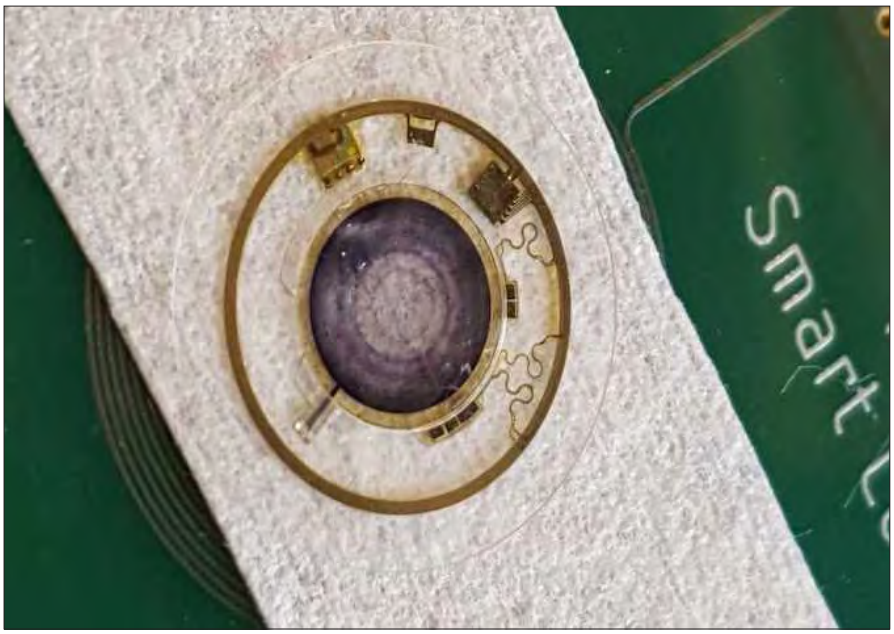
A project at Belgium's Center for Microsystems Technology (CMST), an imec-associated research lab at Ghent University, has now developed a smart contact lens said to mimic the action of the human iris, as a potential route to combating eye deficiencies.

This research, published in Scientific Reports, involved the use of guest-host liquid crystal cells (GH-LCD), in which an additional guest dye in the structure along with the host liquid crystals allows greater control of light transmission when the orientation of both sets of molecules is electrically controlled.

In the imec lens, the GH-LCD architecture offers a way to actively modify both the transmittance of the contact lens and the effective pupil size. This potentially brings back two levels of functionality of the eye, light adaptation and expanded depth-of-focus.

As an active, rather than passive, device, such an artificial iris embedded in a contact lens could be a non-invasive way to modulate light reaching the retina without excessive blur or high-order aberrations, and do so more effectively than current solutions using contact lenses with a fixed iris or artificial iris implants.

The new study set out to measure, for the first time according to the project, the light transmission of such a GH-LCD smart contact lens and the corresponding visual simulations at different light conditions, by carrying out a simulated performance assessment using real data from a patient exhibiting anirida, a condition in which the human eye lacks an iris.



Credit: imec.

An artificial iris embedded in a smart contact lens could help treat several eye conditions.

A customized lens matched to the curvature and dimensions of the patient's eye was manufactured, using GH-LCDs fabricated on polyethylene terephthalate (PET) substrates 50-microns-thick, separated by 10-microns-thick cylindrical spacers. The smart platform, consisting of the GH-LCD and electronics, would be embedded inside a conventional rigid gas permeable scleral contact lens, to protect the eye from the device and vice-versa.

Surpass current optical solutions

In bench-top trials, the optical quality and visible light transmittance of the active GH-LCD cells were assessed and validated. Visual simulations at different light conditions demonstrated the theoretical capacity of the artificial iris smart contact lens to expand the depth-of-focus and decrease the optical aberrations, in particular the spherical aberration, according to the project.

The data suggests that the level of adjustable light transmission demonstrated by the lens may be sufficient to offer a solution to presbyopia, by expanding the depth-of-focus to 3D under photopic daylight light levels, achieving a vision correction that the project believes could surpass current optical solutions.

"By combining our expertise on miniaturized flexible electronics, low-power design and hybrid integration, we have demonstrated the capacity to develop a solution for people who suffer from iris deficiencies, higher order aberrations and photophobia, a common yet debilitating symptom seen in many neuro-ophthalmic disorders," said Andrés Vásquez Quintero of imec and Ghent University.

Having demonstrated a proof-of-concept prototype, the technology will now be further developed into a medical device by Azalea Vision, a spin-out incubation initiative from imec and Ghent University.

"The Azalea Vision initiative adds to our longstanding track record of creating spin-offs in the photonics and microsystems area," commented Rik Van de Walle of Ghent University. "Many of these new companies target important medical problems and several more startup initiatives are in preparation."

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Apple launches iPhone 12 with LiDAR and 5G capabilities

A14 Bionic design features "pro camera system", LiDAR scanner and largest yet Super Retina XDR display.

Apple has this week announced its iPhone 12 Pro and iPhone 12 Pro Max, offering a range of improved optical features including a so-called "pro camera system" and a LiDAR scanner.

The Pro Max model features what Apple calls "the largest Super Retina XDR display, the largest ever on iPhone, protected by the all-new Ceramic Shield front cover, which provides the biggest jump in durability on iPhone."

The Apple-designed A14 Bionic chip, claimed to be the fastest chip in a smart phone, supports computational photography features including the new Apple ProRAW™ package for more creative control in photos, and enables the first end-to-end Dolby Vision video experience, at up to 60 frames per second.

The camera systems include an ultra wide camera, a telephoto camera with an even longer focal length on the iPhone 12 Pro Max model, and new wide cameras to capture professional-quality images and video in bright and low-light environments, says the launch release from Apple.

LiDAR scanner

The iPhone 12 Pro models also introduce a new LiDAR scanner, said to enable "immersive augmented reality experiences" and the MagSafe™ feature, which offers high-powered wireless charging.

The iPhone 12 Pro and iPhone 12 Pro Max will be available in four stainless steel finishes, including graphite, silver, gold, and pacific blue. Pre-orders for iPhone 12 Pro begin this Friday, October 16th, with availability beginning Friday, October 23rd. iPhone 12 Pro Max will be available for pre-order Friday, November 6, and in stores beginning Friday, November 13.

"This is a huge leap for iPhone, bringing the best 5G experience in the market and delivering our most advanced technologies to users who want the absolute most from their iPhone," said Greg Joswiak, Apple's senior vice president of Worldwide Marketing.

"Each generation of iPhone has changed what we expect from a smart phone, and now with 5G, iPhone 12 Pro provides a new generation of performance. Our integration of hardware and software enables incredible computational photography features like the expansion of night mode to more cameras, and introduces support for HDR video with Dolby Vision.

Realistic AR experience

Of the new LiDAR scanner, Joswiak said it is "a state-of-the-art LiDAR Scanner, which means users can experience AR like never before. It also offers benefits to the camera with faster autofocus in low light and the introduction of night mode portraits. These experiences and so much more make this the best iPhone lineup ever."

The new LiDAR Scanner offers the ability to measure light distance and use pixel depth information of a scene. This technology delivers faster, more realistic AR experiences and improves autofocus by a factor of six in low-light scenes for more accuracy and reduced capture time in photos and videos. This hardware, combined with the power of the Neural Engine of A14 Bionic, also unlocks night mode portraits, rendering a beautiful low-light bokeh effect.

Image: Apple / Business Wire.

iPhone 12 Pro and iPhone 12 Pro Max feature enhanced optics; the latter a LiDAR scanner for immersive augmented reality experiences.

Author:
Matthew Peach, Editor-in-Chief, optics.org
https://optics.org/news/11/10/5

Microsoft's Bernard Kress elected to SPIE presidential chain

New vice president is technology industry leader in augmented, virtual and mixed reality development.

SPIE Fellow Bernard Kress, Partner Optical Architect on the HoloLens Team at Microsoft, and formerly Principal Optical Architect at Google X, has been elected to serve as the 2021 Vice President of SPIE, the international society for optics and photonics.

With his election, Kress joins the SPIE presidential chain, and will serve as President-Elect in 2022 and as the Society's President in 2023.

SPIE 2020 President John Greivenkamp of the University of Arizona's Wyant College of Optical Sciences made the announcement along with other SPIE election results at this year's Annual General Meeting of the Society on 24 August during the SPIE Optics + Photonics Digital Forum (ongoing through August 28th). Terms begin on 1 January 2021.

Kress has served on numerous SPIE committees including Nominating, Strategic Planning, and Symposia. He was an elected member of the SPIE Board of Directors from 2017-2019. A longtime SPIE course instructor, field guide and book author, and member of various technical committees, he has chaired many conferences and is the founding chair of the popular SPIE AR/VR/MR Symposium held concurrently with SPIE Photonics West.

He received his Habilitation to Direct Research from the University of Haute-Alsace, Mulhouse, his doctorate in Photonic Systems from the University of Strasbourg in conjunction with UC San Diego, and his "Grande Ecole d'Ingénieur" degree in Physics from the École Nationale Supérieure de Physique de Strasbourg.

'Unprecedented challenges'

"I am very grateful to the SPIE membership for the trust they have invested in me by electing me to the presidential chain of the Society," said Kress. "The Society stands today at a crossroad with unprecedented challenges but also unprecedented opportunities. My goal is to help steer the Society's message and services to fully take advantage of the opportunities to better serve a very diverse optics and photonics community in all professional levels and geographical sectors."

Alongside Kress, David Andrews, a professor at the University of East Anglia, UK, will serve as 2021 SPIE President. Jason Mulliner, Chief Financial Officer at Alluxa Inc., was elected to serve as the 2021 SPIE Secretary/Treasurer.

The following newly elected Society Directors will serve three-year terms from 2021-2023:

- Ruth Houbertz, CEO and Managing Director, Multiphoton Optics GmbH
- Elizabeth Krupinski, Professor and Vice Chair of Research, Emory University School of Medicine
- Kyle Myers, Director, Division of Imaging, Diagnostics, and Software Reliability, Office of Science and Engineering Laboratories, Center for Devices and Radiological Health, US Food and Drug Administration

Images: SPIE.

From left to right: Kress, Mulliner, Houbertz, Simpson, Krupinski, and Myers.

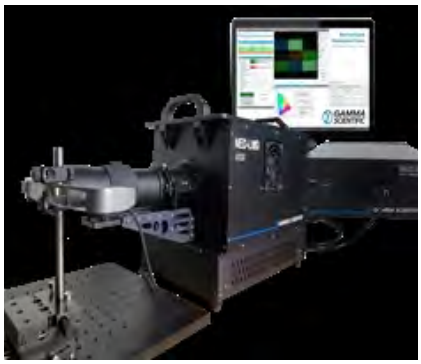
- M. Cather Simpson, Chief Science Officer, Engender Technologies Ltd. and Professor of Physics and Chemical Sciences, University of Auckland, New Zealand

The SPIE nominating committee accepts recommendations for the election slate on an ongoing basis. Directors, who serve a three-year term, are expected to attend and participate in three board meetings each year.

Daneet Steffens,
Public Relations Manager, SPIE
https://optics.org/news/11/8/32

Product Announcements

Highly Precise, Accurate, and Sensitive NED-LMD Near Eye Display Measurement System for Production Lines



Gamma Scientific announces the launch of a new program with a key-player in the consumer electronics industry. A new line of the NED-LMD Near-Eye Display Measurement System is currently being developed for this program, which will assist the user with obtaining a 158° wide field-of-view characterization of upcoming Augmented Reality, Virtual Reality, Mixed Reality, and Heads-up Displays (AR, VR, MR and HUDs), by also conforming to the NED metrology standards being developed by the ICDM committee of the SID and IEC.

Specifically, this new NED-LMD system offers high-accuracy and high-speed test solutions for near-eye displays. Its small 5mm entrance pupil emulates the human eye, while a motorized focus lens is utilized to automatically focus on the virtual image between infinity to 25cm. It is coupled with the proven GS-1290 Spectroradiometer from Gamma Scientific which ensures high spectral precision and color accuracy with high sensitivity and a high dynamic range. Its robust design and intuitive software allows it to be easily integrated on production lines.

For over 50 years, Gamma Scientific has delivered highly unique, state-of-the-art measurement solutions for manufacturers and users of light sources, sensors and displays. Products include high precision spectroradiometers, calibration light sources, goniophotometers, integrating spheres, thin film measurement systems, and LED testers and sorters. The company also operates an ISO 17025, NVLAP accredited laboratory for calibration and testing.

For more information click **here.**

Production-Level Inspection System for In-Headset AR/VR Display Testing

Test the visual performance of displays in augmented & virtual reality headsets using a scientific-grade imaging system with the size and efficiency needed for production inspection. The Radiant Vision Systems AR/VR Lens solution is designed to simplify display measurement in VR headsets, AR smart glasses, and head-mounted displays without complex setup or programming. Featuring an aperture at the front of the lens, the imaging system's entrance pupil can be positioned at the same point as the human eye within headsets to capture a full 120° horizontal/80° vertical field of view in a single measurement image. This enables quick and comprehensive analysis of all visual characteristics of the display that may be seen by the user, without rotating the imaging system or device.

The solution is equipped with AR/VR measurement software featuring a unique test suite for measuring the qualities of

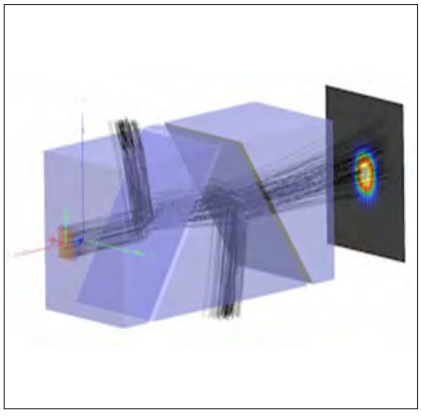
displays viewed in head-mounted devices. This automated visual inspection software controls test images displayed within the headset, and runs pass/fail analyses on virtual projections to evaluate brightness, color, contrast, distortion, MTF, focus, uniformity, and more. The lens system can be integrated into production lines using factory communications for fully automated testing, as well as used in the lab for display characterization.

Key features of the AR/VR Lens solution:

- Aperture positioned at the front of the lens simulates the human eye's entrance pupil, capturing a full field of view (FOV) of near-eye display projections through headsets
- Aperture size (3.6 mm) simulates human eye pupil size
- Lens FOV (120° horizontal, 80° vertical) captures immersive displays in a single image for evaluation
- Designed to be positioned at the eye relief location
- Pairs with any Radiant Vision Systems ProMetric® imaging colorimeter or photometer
- Easy-to-use automated measurement control and analysis software (TT-ARVR™ Software)
- Combination of low cost, high performance, and flexibility, designed for R&D and quality assurance in production

Want to know more? Click **here.**

LightTools v9.0 Brings Expanded Stray Light Analysis, Polarization Modeling, and Backlight Optimization



LightTools version 9.0, now available, introduces valuable new tools to help optical engineers and stray light analysts pinpoint and correct stray light issues early in the product design process, saving time and money. The release also includes new capabilities to model polarizing elements with birefringent materials, which are increasingly used in advanced applications such as AR/VR headsets and biomedical instruments. LightTools offers optimization tools created especially to solve the unique requirements of illumination system design. In version 9.0, the LightTools Backlight Pattern Optimization utility allows designers to optimize performance of display systems with curved panel shapes.

Contact us today for a demo and trial version. Email **optics@synopsys.com** or click **here.**

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