

PRESS RELEASE

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Truly-wearable Augmented-reality – closer to reality by combining highly efficient see-through optics and ultra-low power OLED microdisplay technologies

LetinAR, Korean startup that develops an optical solution for Augmented-reality (AR) glasses, and Fraunhofer FEP, German specialist for the customized development of OLED microdisplays for wearables will present together the future of AR eyewear technology by their first joint demonstrator of the PinMR™ lens sets with an ultra-low-power OLED microdisplay at the Mobile World Congress (MWC) in Barcelona, Spain, from February 25th to 28th, 2019, at booth no. CS80 (Hall Congress Square).

Augmented-reality (AR) and the necessary technology is penetrating more and more areas of life. Even in the toy industry, AR has started to appear, creating virtual worlds on toy carpets with the help of appropriate devices, or driving the good old toy train virtually over the rails in today's children's rooms. In industry AR has already arrived – more and more companies will in future rely on AR solutions for a wide range of applications. For large logistics companies and car manufacturers, wearables for displaying production data or storage locations are already part of the inventory and everyday working life. Various wearable devices in the form of data glasses or other display solutions on the head or body of the worker in logistics or on the production line are already on the market.

However there are still some hurdles to face especially for user-friendly solutions with glasses, which help to work hands-free and without taking eye-focus off the work. The currently available AR glasses still lack the decisive parameters necessary for user-friendliness and ergonomics for long-term use on humans. Form factor, oversized “boxes” in front of your eyes due to complicated optics elements and displays, a narrow field of view, short battery lifetime, complicated and expensive production processes and unprecise color resolution are some of the main facts, which delay a breakthrough of AR glasses.

LetinAR is a Korean startup company, which is specialized in the development of novel optics for AR glasses. LetinAR's PinMR™ technology will set new standards for the production of these wearables. Therefore they have applied the so-called “Pinhole Effect” to tiny mirrors and embedded them with eyeglass lenses. Respective PinMR™ reflects the light generated by a microdisplay and guides it into human pupils. Users may view the virtual image created via microdisplay equipped with magnifying see-th-

In cooperation with:

LetinAR

rough optics as well as the image from the real world at ease. Human eyes cannot detect the mirrors, which are smaller than pupils. Only the virtual image formed by the light reflected by those mirrors is visible.

This specially developed Pin Mirror optic (PinMR™) has now been combined with Fraunhofer FEP's ultra-low-power OLED microdisplay technology, known for its ultra-low power consumption. The extremely small size of the ultra-low power OLED microdisplay is perfectly suited for small, miniaturized and lightweight systems that are wearable and simple to integrate into glasses, caps, or helmets. The display's OLED technology enables sharp images with very high contrasts and brightness over very wide dynamic range (monochrome green so far, yet basically expandable to full-color). In addition, an extra, innovative Bluetooth concept now makes it possible to communicate with the wearable/display in an energy-saving manner. Data transmission from, for example, scanner data to storage locations or filling levels can be transmitted directly to the AR glasses of a picker in logistics. And this without having to interrupt the work shift for loading times of the glasses.

Jeonghun Ha, CTO at LetinAR says, "It is an honor to collaborate with the world-renowned specialist for the customized development of OLED microdisplays, Fraunhofer FEP," and "The co-operation between LetinAR and Fraunhofer FEP will break down the technical barriers that have long hindered the commercialization of 'True' Augmented Reality (AR) glasses. LetinAR and Fraunhofer FEP are looking forward to expand the co-operation for multiple AR applications."

Dr. Uwe Vogel, Division Director Microdisplays and Sensors at Fraunhofer FEP explains the advantages: "We are very pleased to introduce the world's first demonstrator with the promising PinMR™ optics lens set of LetinAR together with our ultra-low power microdisplays at MWC in Barcelona. The co-operation shows what our know-how in combination with the latest technology of LetinAR's optical specialists can bring about. This fusion of technologies will hopefully soon lead to extremely small, lightweight and electro-optically efficient devices for data glasses and other wearables, enabling significantly improved battery life and reduced recharge cycles, thus always-on capability such as today's smartphones, which they can wirelessly connect to."

The demonstrator convinces by a very high optical efficiency of the LetinAR technology, at present no comparably efficient transparent optics are available on the market. In combination with the extremely small-sized OLED microdisplay the scientists present a novel system, that can bring future AR glasses a big step forward – ergonomic and compact designs could become reality soon. The simple controllability of OLED microdisplays also scores well with system developers. Overall, the combination of the two technologies can overcome some of the current hurdles and pave the way for new AR wearables into daily use. In the future, the developers of both entities intend to push the presented technologies ahead in a customized way together with manufacturers of AR systems and wearables of tomorrow.

For the presentation of the concepts and for discussions on possible technology developments and transfers, both entities will present a first joint technology demonst-

rator of highly efficient transparent optics with OLED microdisplays during the Mobile World Congress 2019, in Barcelona, Spain at the booth of LetinAR, Nr. CS80 (Hall Congress Square).

LetinAR team is also available to provide insight into the AR market and technology trends. Jaehyeok Kim, CEO of LetinAR will present news conference "Why can't we have true Augmented Reality glasses, yet?: Bold suggestion to tackle the AR optics problem" at February 25, 2019 10:30AM in CC4.2, 4G30, Hall 4. Attendees will be able to experience LetinAR PinMR™ Smartglasses demo at the conference. Private meetings, conference slots and press interviews can be booked by visiting <https://letin.com>.

About LetinAR (www.letin.com):

LetinAR is located in Seoul/South Korea and focuses on developing optical systems for Augmented Reality (AR) smartglasses. LetinAR has applied the so-called "Pinhole Effect" to tiny mirrors and demonstrated the whole-new term "PinMR™". It aims to replace traditional AR optical systems such as Half-mirror, Diffractive Optical Elements (DOEs), and waveguides with its own trademarked PinMR™ technology.

LetinAR plans to supply PinMR™ Lens as a complete module, which consists of PinMR™ lens and a microdisplay from external partners. LetinAR will begin providing PinMR™ Lens samples to limited customers in late 2019, making it possible for smart glasses manufacturers to evaluate the potential of using PinMR™ lens for their own products.

LetinAR has raised \$700,000 seed money from Naver, the biggest portal site and search engine operator in South Korea. LetinAR went on to receive \$5.4 million in Series A funding from another internet giant, Kakao Ventures, KB Investment, Naver as a follow-up, and three other Korean VCs.

About Fraunhofer FEP (www.fep.fraunhofer.de):

The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP is located in Dresden/Germany and focuses on developing innovative solutions, technologies and processes for surface modification and organic electronics. Along with strong experience in electron beam and plasma technology Fraunhofer FEP is the leading independent applied R&D service provider which combines organic electronics technology with silicon CMOS integrated circuitry (IC) design and process integration. Its aim is to transfer the results of R&D in the field of combined silicon-organic micro-electronic devices towards production by focusing on specific process development, components, system integration and applications based on OLED-on-Silicon technology. Therefore we are continuously seeking partners to further develop and commercialize recent achievements and topics, such as unique OLED microdisplay architectures, large-area OLED microdisplays for VR, ultra-low power, low-latency and

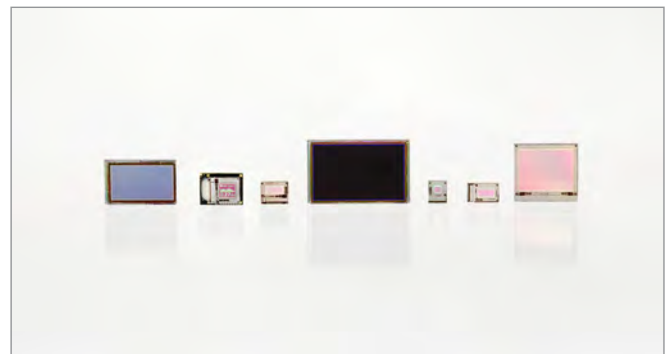
'bi-directional' micro-displays combining image display with embedded image sensing for AR, or micro-patterning for improved power efficiency and color of RGB OLED displays. Beyond that the technology and design expertise also becomes applied to opto-electronic sensor solutions making use of silicon-CMOS-based and/or organic photodetectors (OPD) and embedded illumination for interactive optical fingerprint or surface topology imaging sensors, single-chip reflection light barriers, optical sensors requiring embedded illumination (such as slope, stray light, wave front sensors), lab-on-chip modules with embedded microfluidics, or bio- and environmental monitoring.



LetinAR PinMR™ Lens

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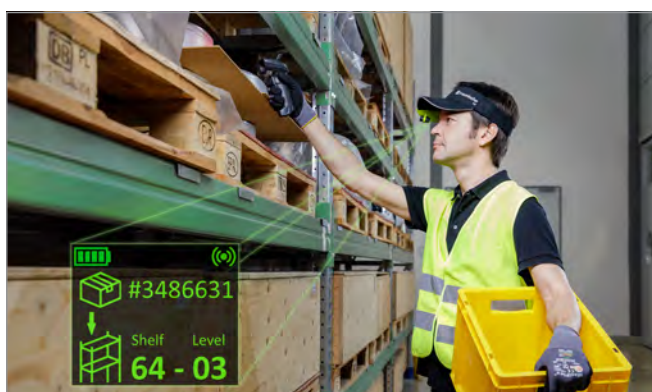
Picture in printable resolution: www.fep.fraunhofer.de/press



OLED microdisplays in various sizes and resolutions

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0.19" 304x256 ultra-low power OLED microdisplays for wearables in logistics

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