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Industry 4.0: safety glasses off, data glasses on!

Safety helmets with built-in microdisplays and multifunction data glasses will soon monitor production lines, advise workers of dangers, and display storage locations. The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP is developing OLED microdisplays and sensors as the foundation for intelligent data glasses in the sectors of medicine, vehicle production, entertainment, and for Industry 4.0. The respective display design and parameters such as resolution, pixel size, and supplementary functions can be varied and combined depending on the application, such as for monitoring manufacturing processes or in logistics. The range of displays runs from high-resolution microdisplays in extended full HD for AR/VR applications to variants with ultra-low power consumption for consumer wearables. Evaluation kits are available from Fraunhofer FEP as development tools.

Industry 4.0 is defined by intelligent factories, known as "Smart Factories". As a result, the way in which industrial production and work will be carried out in Germany will be transformed in the future. Production and logistical processes will be intelligently interlinked in order to make these processes more efficient and adaptable. Augmented and virtual reality (AR, VR) are becoming increasingly important.

The scientists at Fraunhofer FEP in Dresden specialize in the development of custom microdisplays for AR and VR data glasses. The microdisplays take advantage of OLED-on-silicon technology. In contrast to other display types, no supplementary illumination is required for OLED microdisplays, as they are themselves luminescent. Thanks to that, they facilitate the design of simplified optics, a more compact design, and considerably higher contrast ratios. In addition, a camera can be integrated directly onto the microdisplay, facilitating control by tracking the eye's position and motion.

"The compact displays are particularly suitable for use in industrial applications. For example, they can be mounted in glasses and thus provide production personell or machinery operators with all the information needed, like picking station or part numbers," explains Dr. Uwe Vogel, head of the Microdisplays and Sensors division at the Fraunhofer FEP.

Fraunhofer FEP has been developing OLED microdisplays and sensors for a wide range of applications for over 10 years. One of the recent highlights is a new design for innovative ultra-low-power OLED microdisplays. This was developed in a strategic internal FEP project and later adapted to the French industrial partner MICROOLED. The mission of the researchers was to transfer the highly innovative ultra-low-power OLED microdisplay

The joint project "Glass@Service" is funded by the German Federal Ministry for Economic Affairs and Energy.
Funding reference: 01MD16008C

Bundesministerium für Wirtschaft und Energie

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technology to the commercial sector so that it can be integrated into end-user applications and produced en masse. These efforts were recognized at the end of last year with the Franco-German Business Prize.

Currently Fraunhofer FEP is working together with partners in the joint project "Glass@Service", which include Siemens, UVEX, and Ubimax among others, on use cases for data glasses in Industry 4.0.. Logistics represents one of the major fields of application. Thanks to data glasses, a warehouse clerk can have both hands free for activities and is continuously guided through individual processes via the display in the glasses. The clerk can be dedicated entirely to the primary task at hand, while all the data – what has been picked, packed, and where it goes next – is simultaneously transferred.

Set-up can also be considerably simplified with the aid of data glasses. The AR application displays the machine in its completed set-up state, with the parts to be installed in the machine blended directly into the field of vision. Differences between machine parts that have already been installed and those still needing to be replaced can likewise be displayed.
The scientists at the Fraunhofer FEP offer evaluation kits as development tools for suitable applications of OLED-on-silicon technology in data glasses. Customer-specific OLED microdisplays can also be developed that are specially adapted to a display's purpose.

However, the researchers see unsolved challenges ahead that they want to tackle, especially for microdisplays in consumer-ready Augmented Reality (AR) glasses: higher brightness, good yield for large (chip) areas, curved surfaces for more compact optics, irregular pixel matrices with even higher pixel densities, integrated eye tracking, and transparent substrates.

"Set-Up" use case © Siemens AG
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