'Foveated Imaging' from the 3D printer: Micro-optics with wide-angle and telephoto lens in a single device

TLB
Technologie-Lizenz-Büro
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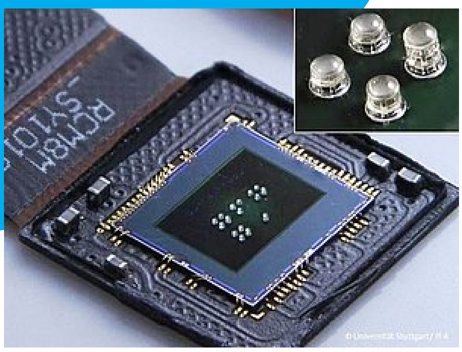
Foveated imaging for conventional image sensors with constant pixel pitch, cost-effectively manufactured in the smallest space. The functionality of these optics can be compared to that of an eagle eye: despite high-resolution focusing, the viewer has a wide peripheral field of vision. This technology could revolutionize the world of miniaturized digital cameras, e.g. for medical imaging, autonomous driving and flying, and microrobotics.

- Synthesis of different optics in one image
- High-resolution focusing with wide
- peripheral field of view
- Exact alignment and adjustment of the optics through production in a single step directly on the chip
- 'Foveated imaging' for conventional sensors with a constant pixel pitch
- Miniaturization of multi-aperture systems
- High reproducibility
- Flexibility in substrate selection (CMOS, IR)



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Development Status

TRL5 - Prototype

Patent Situation

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Service

TLB GmbH is in charge of the management of the invention till it is marketable and offers companies the opportunity of licensing or cooperation for advancements.

Fields of application

The development of digital imaging in recent years has been impressive. There is a trend towards snapshots taken with smartphones. Miniaturized cameras in drones and endoscopes are further examples of this development. Current models surprise with impressive image quality. Nevertheless, there are limits: the classic optical zoom lens still cannot meet small spatial requirements and as soon as you zoom into the picture digitally, the unloved pixels reappear. This could now change. Using microscopically small high-precision optics from the 3D printer, 'foveated imaging' could conquer new markets and enable a multitude of new applications.

Background

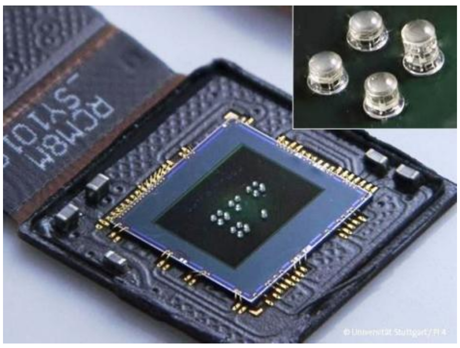
Although the concept of ‘foveated imaging’ has been known for quite some time and there are various approaches for realizing such systems, miniaturization has not been achieved until now.

Problem

Today's miniaturized digital cameras, as e.g. in smartphones, all have only a digital zoom function. There are no optical zoom lenses and the lens cannot be changed.

Solution

At the University of Stuttgart, an innovative technology was developed as part of a project funded by the Baden-Württemberg Stiftung gGmbH. This new technology uses a multiphoton polymerization technique to produce high-quality lens arrays in the micrometer range directly on a sensor chip. Since the various lens systems with a diameter of just a few 100 µm are printed directly onto the image sensor in a single step, chips are produced with optics that require no further adjustment. Thanks to digital image processing, the images of several lenses arranged directly next to each other and set to different focal lengths, respectively fields of view can be combined in one image. Such an image does not only cover a large field of view, it also has a high resolution in the focus area. The functionality of these systems can be compared to that of an eagle eye: despite high-resolution focusing, the viewer has a wide peripheral field of vision. This technology could revolutionize the world of miniaturized digital cameras once again, e.g. the imaging in medical technology, autonomous driving and flying and microrobotics, as it enables the cost-efficient realization of ‘foveated imaging’ for conventional image sensors with a constant pixel pitch in small constructed space.



CMOS sensor with several directly printed arrays of four lens systems, each with different focal lengths [University of Stuttgart].

Find out more

"3D-printed eagle eye: Compound microlens system for foveated imaging"

Simon Thiele, Kathrin Arzenbacher, Timo Gissibl, Harald Giessen, Alois M. Herkommer

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