

# The billboard of the future: A large-scale glasses-free 3D display

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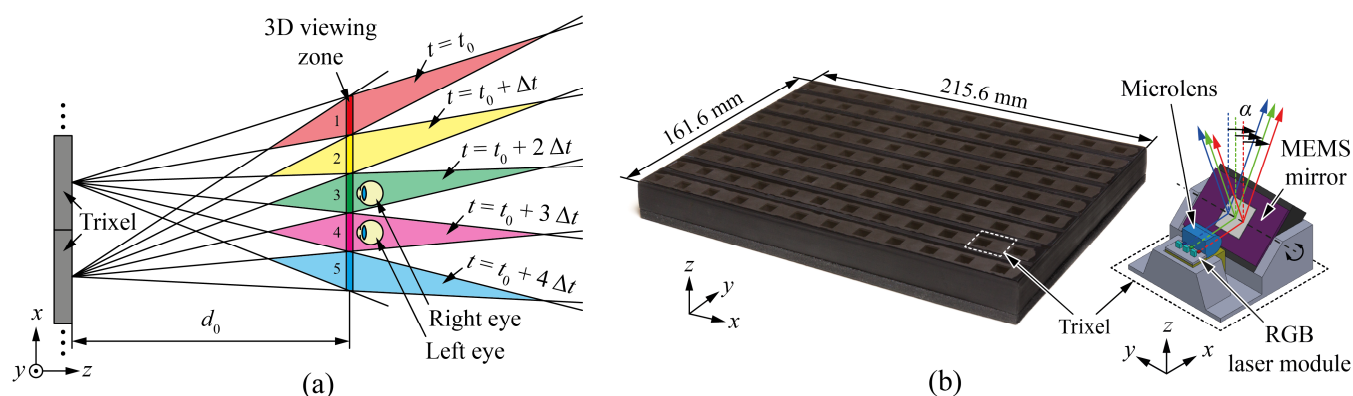
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We have developed a large-scale 3D (three-dimensional) display for outdoor applications like billboards, where the viewers are not required to wear any special glasses in order to perceive a 3D effect [1]. Fig. 1(a) shows the basic principle of our approach. Each display element—a so-called “trixel”—contains three laser diodes, a common microlens, as well as a micro-electro-mechanical systems (MEMS) mirror. The cylindrical microlens collimates the three laser beams only in the horizontal  $x$ -direction, generating narrow vertical stripes in the far field. These stripes are scanned in the  $x$ -direction by the oscillating 1D MEMS mirror. By modulating the optical output powers of the laser diodes during scanning, different image information can be sent to different directions in a time-multiplexed manner. This not only generates a stereo parallax, i.e., a viewer can see a different image with each eye, but also a movement parallax, i.e., a viewer can see different images when moving his head.

In this paper we present the latest prototype generation of our display, which unlike the first prototype from [1] is completely modular, i.e., an array of  $12 \times 9$  trixels including all corresponding driver electronics is contained in a so-called “trixel module” (cf. Fig. 1(b)). A large number of such trixel modules can be arranged seamlessly, which imposes no upper limit in terms of the overall display size. The present prototype contains trixels with highly compact hermetically sealed RGB laser modules, where each module contains a red, a green, and a blue laser diode, a driver ASIC with integrated photodiodes, as well as the common cylindrical microlens [2]. The trixel module will enable large 3D billboards with sunlight readable luminance, up to 1024 3D viewing zones, and a 3D viewing distance of up to 70 meters.



**Fig. 1. (a) Basic principle of the time-multiplexed autostereoscopic multi-view laser display with  $\Delta t$  as the time interval between the subsequent illumination of adjacent 3D viewing zones and (b) trixel module with an array of  $12 \times 9$  RGB trixels (inset: schematic of a trixel).**

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## References

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