Lochn releases LBS-based diffractive waveguide AR module

One of the key challenges for augmented reality is the development of ultra-compact, lightweight, low-power near-to-eye display solutions with good image quality. Laser Beam Scanning (LBS) technologies can meet these key requirements and deliver form-factors that enable light weight, fashionable, all-day wearable AR smart glasses with the ability to scale resolution and field-of-view (FoV) with low power consumption.

As the first company from Mainland China to join the LaSAR Alliance, Lochn, in collaboration with STMicroelectronics, has re-designed diffractive waveguides, and optimized the fabrication process, to maximize the performance for LBS based optical light engines. More recently, Lochn publicly announced the development of prototype AR glasses based on these key technologies and anticipate mass production readiness by end-of-2022. In figure 1 the AR glasses prototype design is shown and figure 2 shows the quality of the image as seen through the waveguide.

Figure 1: Prototype AR glasses based on LBS optical engine

Figure 2: AR image taken from the waveguide

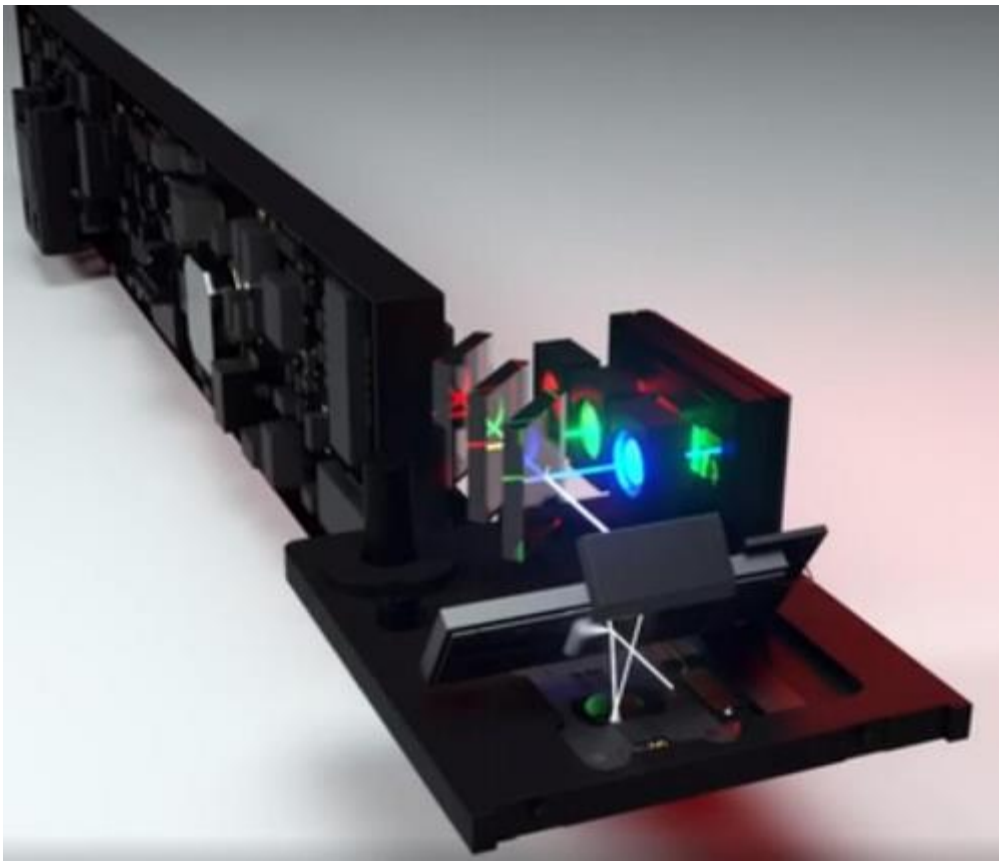

Figure 3: Diagram showing the operating principle of the LBS optical engine (Courtesy of STMicroelectronics)

Figure 4: Comparison of important parameters among mainstream optical engines

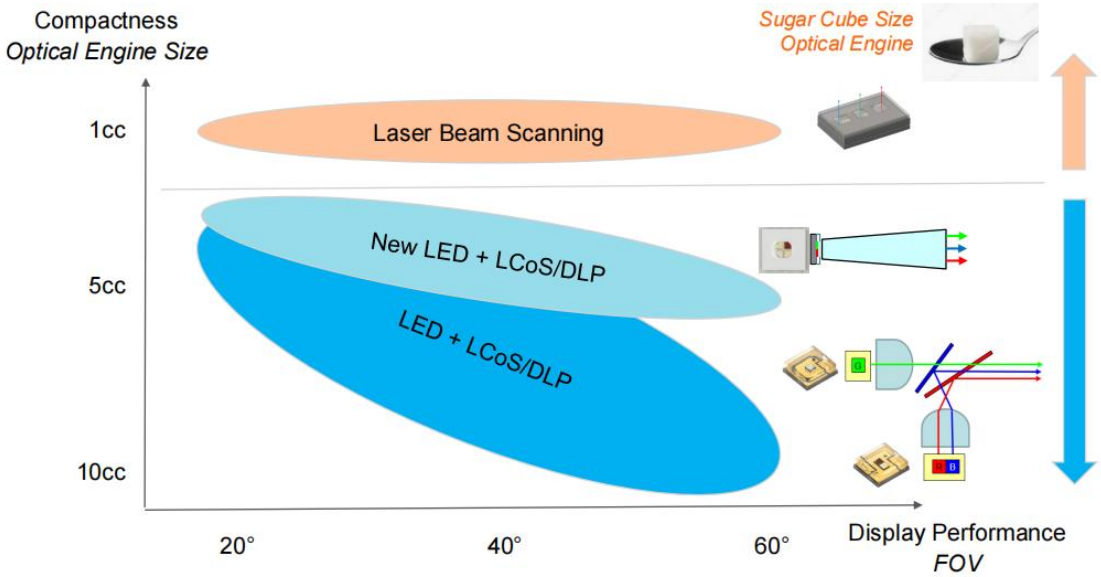

Figure 5: Volume comparison among different solutions (Courtesy of OSRAM)

The key characteristics of the LBS-based solution are as follows:

1. Volumetrically miniscule. Existing solutions for AR uses fixed-pixel panel display technologies (such as LCoS, DLP or microOLED) which are larger in area than the miniature micromirrors that enables LBS. Additionally, the optical design of LBS-based light engines enable an overall opto-mechanical architecture that is much more compact in volume than other display technologies. Moreover, LBS-based design can scale for resolution, FoV and/or power whereas fixed-pixel displays are more constrained. Figure 3 shows an illustration of the operating principles of LBS which is capable of delivering ultracompact form factors across a broad range of FoV, in contrast to other display technologies, as depicted in Figure 5.

2. Large FOV. The solution supports up to 56° FOV (diagonal, optical scan angle) using two piezoelectrically actuated MEMS micromirrors generating a raster scanned image. It supports mechanical scan angles of ±14° scanning in the horizontal direction and ±9° in the vertical direction.

3. High brightness. Reflective display technologies, such as LCoS or DLP, generally have significant constraints on the total brightness that can be delivered. However, LBS-based solutions adopts a laser light source that easily exceeds 1,000,000 nits with very high efficiencies.

4. Low power consumption. The power consumption of this solution is significantly lower than that of the other existing solutions, at about 350mW for typical content in the use cases for AR. This is due to the fact that unlike fixed-pixel, reflective displays where the entire display panel is illuminated at all times, LBS based system illuminate only the pixels that are "on" or active and modulates each pixel to its corresponding brightness value.

5. Higher contrast. LCoS and DLP solutions suffers from stray light which impacts the contrast ratio. LBS, on the other hand, due to the inherent nature of per-pixel modulation delivers much higher contrast ratios.

These points are amplified in figure 4 where LBS architectures allows optimization of the performance of the system and suitable tradeoffs between FoV, brightness, power and size. Overall, LBS-based solutions deliver small form-factor, light weight and low power designs enabling all-day wearable AR glasses, which is a key requirement to drive mass market adoption.

In Mar. 2021, STMicroelectronics established the LaSAR Alliance (Laser Scanning for Augmented Reality), whose members include device and materials developers, optical design and manufacturing companies, and other key stakeholders interested in furthering the advancement and use of LBS for AR applications. Members of the alliance share information about laser scanning technology, and pursue in-depth cooperation on materials, components, equipment and technologies. Lochn saw tremendous value to be an active participant with this impressive groups of companies and to contribute through the design, development and manufacturing of advanced diffractive waveguides.

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