

PRESS RELEASE

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Mirrorcle Technologies Demonstrates MEMS Mirror Applications at CES 2019

Mirrorcle Technologies, the manufacturer of MEMS-based optical beam-steering (scanning) mirrors and related products presents application examples at the Consumer Electronics Show (CES) 2019 in Las Vegas. The company's CEO, Dr. Veljko Milanovic and staff join friends at the Microchip booth where visitors can experience Mirrorcle's MEMS mirror-based systems in action. For example, the company's "Programmable Light System" or "PLS" is a versatile dynamic solid-state lighting (DSSL) white light vector graphics projector. It is slated for dynamic automotive headlights and for a variety of possible programmable lighting solutions for commercial or private spaces. Also on display at CES are multiple versions of the 'Playzer' – a programmable pocket-sized laser projector which is available with a variety of different colors (wavelengths). Playzer implements Mirrorcle Vector Graphics Laser Projection Architecture, e.g. in bright outdoor signage solutions on or around a vehicle.



Figure 1. Mirrorcle CES delegation joins the Microchip team at Microchip Technology's CES 2019 booth MP26166 to demonstrate world-leading MEMS mirrors-based laser projection systems. From Right to Left - Dr. Veljko Milanovic, Donald Humbert (Microchip), Wafa Iqbal (Microchip), Daniel Lovell, Abhishek Kasturi.

"We are grateful to Microchip for the opportunity to present a small selection of our latest technologies at their booth here at CES," Dr. Milanovic said. "It reflects the strong collaboration that Mirrorcle Technologies and Microchip have established over the past years of working together toward complete customer-driven solutions. This again illustrates that globally established industry leaders place their trust into our world-leading MEMS mirror technologies." A number of scheduled meetings were held at Microchip's private meeting

rooms where exciting opportunities and new applications were discussed with existing and prospective customers. "We are happy about our presence here in Las Vegas," Milanovic commented. "So far, we believe that we've tied the knot on some very interesting projects and we are excited to tackle some new applications by offering customized MEMS mirrors tailored to customers' specific needs."

Mirrorcle Vector Graphics Laser Projection Architecture tailored for Automotive Use is Showcased

Mirrorcle unveiled its Vector Graphics Laser Projection Architecture at CES2019, recently tailored to a number of different automotive applications both inspired and demanded by automotive sector customers. These include dynamic headlights, head-up ('HUD') and other displays, and courtesy lighting around the (parked) vehicle. The Architecture utilizes fast point-to-point laser projection to maximize brightness and contrast of the displayed content. Optimized vector graphics or glyphs convey information and entertain the viewer, but also have the lowest intrusion and attention requirement from viewers and are a particularly good match for automotive uses - especially in active driving cases. Comparing Playzer to other display technologies, such as a standard video PicoProjectors, shows that the Playzer can achieve 10X higher levels of brightness and contrast. This high brightness and high contrast ratio of the displayed content makes Playzer suitable for outdoor and daylight conditions – a requirement in automotive display applications. Mirrorcle's solutions for these emerging needs all employ the complete system-level stack up of optical and electronics hardware, firmware, and software. The hardware includes the Scan Modules and Controllers which are supported by a chipset from Microchip Technology. Compact Scan Modules incorporate laser sources, laser beam shaping and wide-angle projection optics and the fast gimbal-less dual-axis MEMS mirror into a single athermalized housing. Within this housing, the scan module can be customized with different laser powers, wavelengths or MEMS mirrors with desired performance to fit any application. Demos shown at CES include the Programmable Light Source (PLS) and a number of Playzers with different wavelengths, all battery powered and all capable of USB-based control or wireless control from Android devices.



Figure 2. Mirrorcle Technologies' application demonstration examples at CES 2019 in Las Vegas, NV. (a) a Scan Module demonstrates the compact opto-mechanical setup of a MEMS mirror laser and optics with a 40° FoV and the compact USB battery powered OCCIE MEMS controller, (b) PLS powered by a USB battery displays a Chinese greeting in bright white light. The smaller white box contains a regular pocket-sized Playzer laser projector with a battery and wireless controller.

Controlling the MEMS mirror and lasers is the Microchip PIC32MZ MCU-based controller and Microchip high-voltage ICs-supported smart MEMS driver. When integrated together, it provides high voltage for MEMS driving, capability of mirror position and temperature sense, 1- to 8-bit analog control of the one or three lasers (for RGB), inputs and outputs to host systems via USB, CAN bus or wirelessly, and on-board Flash memory for stand-alone operation with pre-stored graphics. Alongside the MEMS Mirror and its supporting hardware, Mirrorcle provides application-specific implementation of the MEMS mirror through its proprietary firmware and extensive software API. Mirrorcle software is available on multiple platforms and with multiple languages to allow engineers and developers complete control of the MEMS Mirrors staggering speed, accuracy, and repeatability. This API is tailored to the Vector Graphics Laser Projection Architecture, resulting in high brightness and contrast content for any display solution.

Mirrorcle-based products on display throughout CES 2019

While the Mirrorcle demo-systems attract much attention at Microchip's CES booth, multiple stationary and mobile solutions showcased at CES by other companies are 'Powered by Mirrorcle'. Many of these solutions are quite new and the sharing of information is restricted, and in many cases the use of MEMS mirrors is not obvious or apparent. "We are excited to see our MEMS mirrors being successfully used in many solid-state LiDARs at this show," said Abhishek Kasturi, Sr. Electronics Engineer at Mirrorcle. "It is great to see our products in use throughout CES 2019. Mirrorcle is a pretty unique company in the sense that our solutions enable so many big names at this show while we maintain a low profile in providing those key products and services." Finally, he added "We are looking forward to presenting additional demos at our booth at the upcoming Photonics West exhibition in San Francisco." SPIE Photonics West visitors will be welcomed by the friendly staff of Mirrorcle Technologies at booth No. 4221.

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About Mirrorcle Technologies, Inc.

Mirrorcle Technologies, Inc. (MTI), founded in 2005, is a California corporation that commercially provides products and services based on its proprietary optical microelectromechanical system (MEMS) technology. Since its founding, and supported by its continuous investment in R&D, MTI has been offering the world's fastest point-to-point (quasi-static) two-axis beam-steering mirrors, as well as resonating-type micromirror devices with rates up to HD video display. MTI is globally the only provider of tip-tilt MEMS actuators in combination with mirrors from submillimeter to several mm in diameter, offering customers a wide selection of specifications to optimize their paths to successful commercialization.

MTI maintains a laboratory at its headquarters and has year-round, 24-7 access to wafer-based CMOS and MEMS fabrication facilities. MEMS mirror fabrication, wafer-level and die-level testing, packaging and outgoing inspections are all performed in clean-rooms. MTI has an established manufacturing service cooperation with a leading MEMS wafer foundry ensuring streamlined, high-quality volume production.

As a privately held company, MTI is able to act efficiently, offering creative and highly responsive service to customers. The company provides highest-quality products and support to facilitate customers' product development and successful commercialization. The team draws on several decades of combined experience in MEMS design, fabrication, and testing.