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PRESS RELEASE
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Mirrorcle Technologies Unveils a 3D LiDAR System - “SyMPL”

Mirrorcle Technologies today announced its first laser-based environmental sensing system that expands the unique capabilities of the company’s patented MEMS Mirrors by adding time-of-flight (ToF) distance sensing. The new MEMS mirror-based 3D LiDAR system named “SyMPL” is a compact and lightweight plug-and-play solution offering programmable scanning that yields 3D point-cloud data for use with a variety of client applications in robotics and other industrial settings. The system works with a 905nm laser with very low average power, and yet it efficiently senses objects of varied materials and reflectance out to distances of ~30m with 1cm distance resolution. The solution enables users to easily control scanning over >10000x10000 discrete angles, allowing fast and versatile scans across the full field of regard or, if desired, to increase the density of points in specific regions of interest. SyMPL users can freely control and program desired aspect ratio, scan speeds, scan rotations, and distance range of interest. Dr. Veljko Milanovic, the company’s CEO explained the remarkable genesis of the new product amusingly: “Our off-the-shelf offerings such as our LiDAR MEMS Development Kit have enabled many teams to develop 3D LiDAR prototypes. We followed our own success at the subsystem level, leveraged our expertise from laser tracking systems, and developed a complete 3D sensing solution - and we were frankly amazed with the efficiency of development and resulting system performance.” He further added that the software development was exceptionally efficient given Mirrorcle’s extensive SDKs and related code examples.

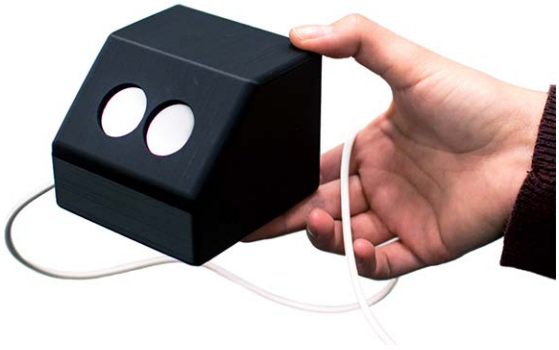

Figure 1. Mirrorcle Technologies compact and lightweight 3D LIDAR system “SyMPL”.

With this milestone, Mirrorcle remains on track for the company’s strategic realignment as a provider of total system solutions in light projection and laser-based sensors. At the same time, its Custom Solutions business unit continues to support existing customers with their needs at component and sub-system level. Iva Palmer, Mirrorcle’s Operations Manager noted: “Currently we have three active MEMS Mirror assembly facilities, with only one running at full capacity. Thus, we are poised to rapidly scale manufacturing for our OEM customers as well as for our new business units without significant new investments. As a mature and continually growing business, we naturally look at new opportunities more selectively. However, customers with ongoing serial production agreements with Mirrorcle can continue to enjoy high quality manufacturing and support.”

Pioneers in MEMS LiDAR since the mid-2000s

In the mid-2000s, a number of defense-related optical systems developers began to pursue new ways to reduce size, weight, power, and cost (or “SWaP-C”) of optical sensors. New technologies were demanded by the Department of Defense branches and laboratories such as the Army Research Laboratory (ARL) and also by related defense contractors. LiDAR systems for various small robotic platform DoD applications were being re-designed with the goal of major reduction in “SWaP-C”. At that same time, in 2005 Mirrorcle Technologies just came onto the scene with its Gimbal-less Two-Axis MEMS Mirrors which broke all the previous figure of merit barriers (for combined mirror size, tip-tilt angle, and speed). Replacement of galvanometer scanners in size/weight/power/cost-sensitive applications was no longer an academic discussion but a new commercial reality. Soon, the connection between the new generation LiDAR developers and Mirrorcle’s MEMS mirrors became inevitable. By 2010, successful designs were deployed by Areté, ARL, Spectrolab (Boeing), and a few years later by NGC Laser Systems and NASA GSFC. Those pioneering projects were enabled by Mirrorcle’s agile MEMS Mirrors. Just as importantly, Mirrorcle’s development strongly benefited from the demands and pressures of those projects, which were always commanding increases in the total figure of merit. By the mid-2010s, Mirrorcle’s MEMS mirrors enabled a whole genre of startups and developments of solid-state LiDAR technology proposed for autonomous driving applications and robotics.

Demand for Robotics Solutions Grows

Despite the numerous above-mentioned successful implementations of LiDAR technology, including some commercial cases, there have been no suitable products available with the key features requested by the growing robotics industry - production readiness and marketable cost. Thus, the industry continues to heavily rely on solutions that are camera-based which cannot meet many of the requirements for robotic applications despite all the progress made in camera vision technology. Dr. Lj. Ristic, Mirrorcle’s Chief of Business Development and Strategy commented: “It is not clear whether the autonomous car hype and extensive investments in LiDAR development for that application will spill over into robotics, but we are clearly seeing an unmet demand in the mid-range, low cost and low complexity LiDAR systems and Mirrorcle has responded to that demand with the cost effective and reliable solution.”

Compact, light-weight “SyMPL” 3D LIDAR System to Address the Demand

The SyMPL light imaging, detection and ranging system leverages Mirrorcle’s established MEMS devices which at the core are of single-crystal silicon construction equipped with electrostatic comb-drive actuators on each end of a dynamic tilt axis. The exclusively electrostatic actuation has many benefits compared to e.g. piezo or galvanometer scanning technologies, namely robustness, very low power consumption (<1mW) while offering a virtually limitless lifetime as there are no elements on device level that give wear and tear or degrade over time. Thus, such a LiDAR can be appropriately labeled as a solid-state LiDAR, limited only by the lifetime of its laser source. To solve the most challenging facet of the LiDAR industry – mass production readiness at marketable cost – Mirrorcle’s team designed a truly simple and low-cost arrangement of its own mass-produced MEMS Mirrors and off-the-shelf ToF laser ranging components. Fast, eye-safe laser range finders (LRFs) have become established in many formats and at low cost from many suppliers based on a number of reference designs offered to the designers. Optomechanically coupling them suitably with mirrors and driving the mirrors accurately results in extending their capability to 3D. With the addition of a compact and efficient Controller unit which provides an interface to software/APIs, the solution is complete and software-configurable.

Intuitive Software package supports “SyMPL” 3D LIDAR System

The SyMPL 3D LIDAR system is supported by an intuitive software package that enables programmable control of the LIDAR as well as detailed point cloud visualization – with SDKs for multiple computing platforms. Users will be able to immediately see and interact with a real-time, three-dimensional point cloud from the SyMPL, “straight out of the box.” The software package will allow the user to go beyond viewing the point cloud. Users can quickly begin incorporating the SyMPL solution into their own systems by interfacing with the easy-to-use server-client system. Extensive documentation and a lightweight communication protocol are critical to enabling integration of a LiDAR sensor into a guidance or mapping system. Ease of integration into existing systems is the core paradigm around which the software was built.

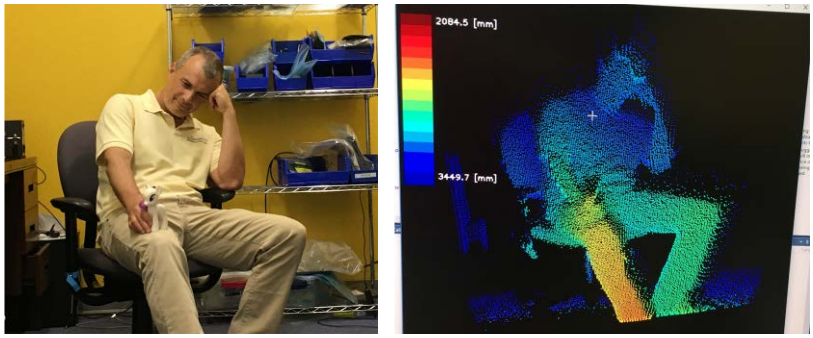

Figure 2. Mirrorcle Technologies CEO in a photo and acquired point cloud – example illustrates high resolution and precision of the sensor and software’s ability to subtract background points and show only data of interest.

“SyMPL” 3D LIDAR System available in DEMO-07 package

As with most Mirrorcle Technologies’ offerings, the journey begins with a plug-and-play Kit. “DEMO-07” is the Demonstrator Kit which ships a general version of the product with a very straightforward setup and software package for easy experimentation. Power and serial communication for DEMO-07’s LiDAR system is provided by a USB cable, from a Windows PC. The default setup offers a programmable 20° x 20° field of regard (FoR) with reconfigurable scanning. The system works with a 905nm laser with average power lower than that of average conference-room laser pointers. With the low power and background light filtering, it is suitable for use in any environment. Furthermore, the entire unit weighs less than 0.25kg and consumes approximately 1.25W of power making it ideal to integrate onto airborne (drone) platforms or small indoor mapping or delivery robots.

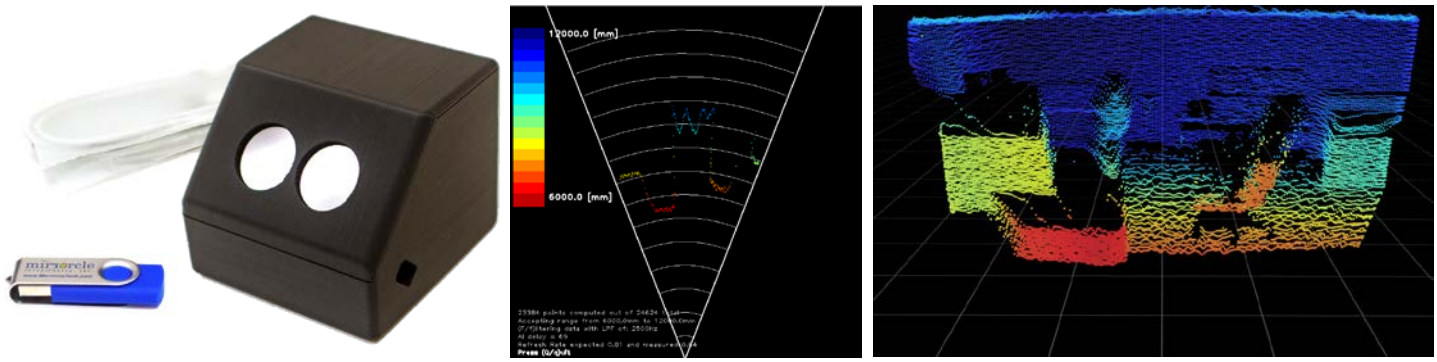

Figure 3. Mirrorcle Technologies DEMO-07 Demonstrator Kit system with two easy to use applications for point cloud visualization and analysis in “radar view” (middle) and 3D point-cloud explorer view (right) with MirrorcleCloud.

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About Mirrorcle Technologies, Inc.

Mirrorcle Technologies, Inc., founded in 2005, is a private California corporation that commercially provides products and laser systems based on its proprietary optical microelectromechanical system (MEMS) technology. Since its founding, and supported by its continuous investment in R&D, the company has been offering the world's fastest point-to-point (quasi-static) two-axis beam-steering MEMS Mirrors, as well as resonant-type micromirror devices with video rates. Mirrorcle 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. Mirrorcle products can be found today in 3D metrology systems, biomedical imaging systems, solid-state LiDARs, AR/VR prototypes, laser projectors, and classrooms. Mirrorcle’s system solutions include the world’s most compact vector graphics laser projectors and 3D LiDARs.
Mirrorcle maintains multiple cleanroom laboratories at its Richmond, California headquarters, and year-round, 24-7 access to a wafer-based CMOS and MEMS fabrication facility. Beyond its own facilities, the company has established high-volume manufacturing with leading MEMS wafer foundries and qualified opto-mechanical assembly houses.