



TYZX IN 3D

systems that see

T = TIME
Y = WIDTH
Z = DEPTH
X = HEIGHT

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TYZX has created a platform of hardware, software and services to build products that see the world in three dimensions.

AUTO INDUSTRY



DEFENSE, AGRICULTURE & ROBOTS



PHYSICAL SECURITY



CONSUMER ELECTRONICS



TYZX DeepSea G2 Stereo Vision System

TYZX has created a platform of hardware, software and services to build products that see the world in three dimensions. This platform makes it possible to design fast, affordable, small footprint, 3D vision for systems that must perform in a wide range of rapidly changing environments. No other platform delivers 3D vision for high volume applications at such low cost.

TYZX was founded by scientists from Harvard, Stanford and MIT, who began researching the core technology more than 15 years ago. Their original breakthroughs occurred at the world-famous Xerox PARC research lab and were further developed at Interval Research in Palo Alto, California. The first 3D vision systems these scientists created required two supercomputers to run them. Today, TYZX has packed the power of its technology into a circuit board that fits in the palm of your hand.

The 3D vision technology industry itself has been expanding over the past several years, and TYZX has been at the forefront of that expansion. The year 2006 brought several exciting new developments for TYZX, including new funding, new partnerships, a new product, and new markets. The theme of growth and change continues for us in 2007, beginning with our move to new headquarters in January. We've seen a lot of growth and market expansion recently, and 2007 promises to bring much more.

Funding News

TYZX received a \$4 million investment from Takata Corp. in 2006. Takata is one of the world's largest suppliers of complete automotive safety systems, producing seatbelt systems and components, airbag modules and inflators, electronic sensor units and modules, and steering wheels and clock springs. Takata calls its investment in TYZX the latest demonstration of its commitment to industry innovation.

Industry experts believe that vehicles with 3D vision safety features can help better protect drivers and passengers in collisions, help cars avoid accidents, keep vehicles in appropriate road lanes, and prevent many accidental backup injuries and fatalities, among other benefits. The European Union and Japan have already passed legislation mandating more "pedestrian friendly vehicles." Future regulations will require additional measures to prevent pedestrian injury and could drive the need for systems that incorporate vision technology as developed by TYZX and Takata.



In January 2007, TYZX moved into new headquarters at:

3715 Haven Avenue, Suite 110
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NEW WEB SITE

We're excited to announce the launch of our new Web site this month.

Please visit us at
<http://www.tyzx.com>.

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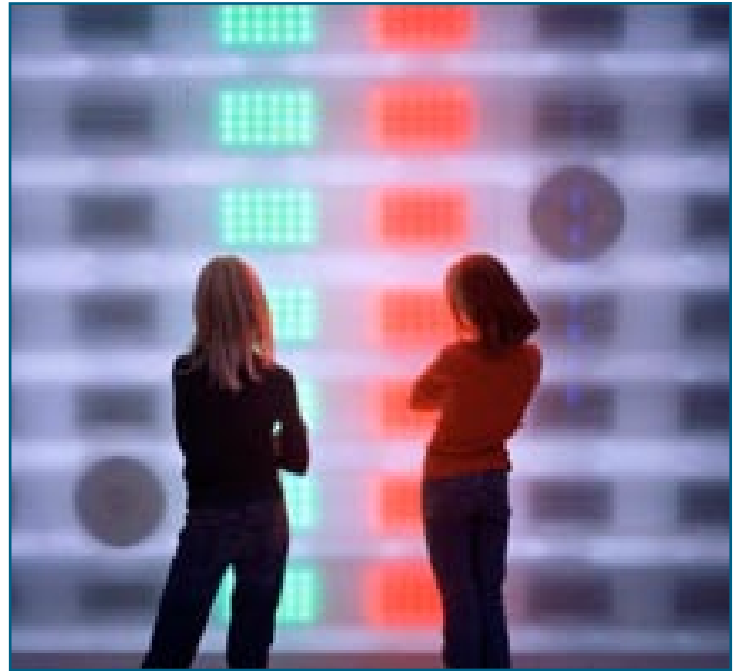


TYZX . . . And The Visual Arts?

Cutting edge 3D stereo vision technology is driving applications that exist beyond the realm of industrial, defense and consumer products. In 2006, TYZX twice supplied the underlying technology to power interactive visual art displays created by **Electroland**, the artistic group led by Cameron McNall and Damon Seeley. Electroland creates large-scale public art projects and electronic installations. Each Electroland project is site-specific and employs a broad range of media, including light, sound, images, motion, architecture and interactivity.

Electroland is working at the forefront of new technologies to create interactive experiences where visitors can interact with buildings, spaces and each other in new and exciting ways, and TYZX technology has added its 3D person tracking capabilities to expand upon this unique brand of artistic expression.

Electroland used TYZX 3D vision technology to create the Target Interactive Breezeway, a unique experimental space for environmental interactivity, located on the Top of the Rock Observation Deck on the 69th floor of Rockefeller Center.



Target Breezeway photos courtesy of Electroland

TYZX 3D vision technology helped achieve revolutionary sensing and visitor tracking in the Breezeway, tracking as many as thirty visitors with great accuracy and a very low error rate. This level of individual tracking is unprecedented in public interactivity, and allows for great precision in translating visitor motions into an engaging interactive experience.

LUMEN

TYZX 3D stereo vision technology is now being featured in Electroland's latest installation: LUMEN for the 2006 National Design Triennial, on display at the Smithsonian Institution's Cooper-Hewitt National Design Museum in New York City through July 2007.

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"No other vision technology we evaluated could handle the challenges caused by the dynamic lighting conditions of our project," says Damon Seeley of Electroland. "Thanks to TYZX, we were able to create a spectacular interactive experience that is easy to appreciate and rewarding for all ages and types of visitors."



NASA Robotics Uses TYZX G2 Stereo Vision System



Photo Courtesy of NASA

2006 NASA Desert Field Test, Meteor Crater, Arizona

Intelligent Robotics Group, Intelligent Systems Division at NASA Ames Research Center, is in the development stages of hardware accelerated 3D modeling and real-time robot navigation, incorporating TYZX 3D stereo vision technology in both.

HARDWARE ACCELERATED 3D MODELING

NASA required digital 3D terrain models for visualization of topographic features, mission planning and mission operations. NASA used Tyzx DeepSea hardware to accelerate the NASA Ames Stereo Pipeline to rapidly produce 3D models of Mars and the Moon.

REAL-TIME MOBILE ROBOT NAVIGATION

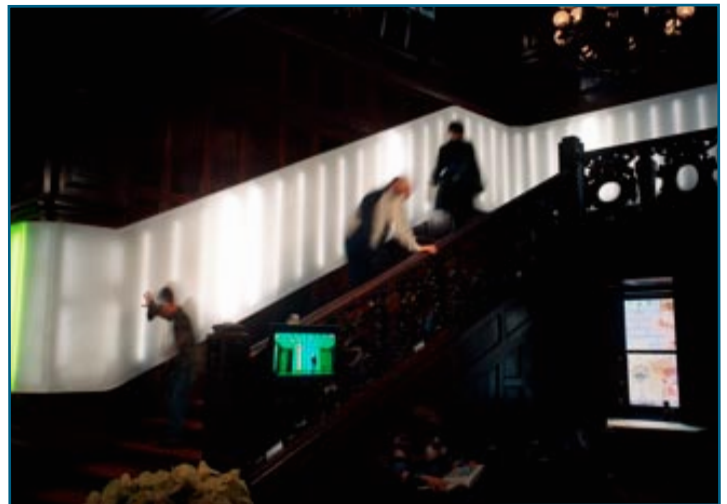
One of the key challenges for NASA is determining which areas of the local environment are safe for driving. NASA used the Tyzx G2 camera to identify regions that are hazardous, to detect obstacles to avoid, etc. Currently, NASA Ames is developing a Vehicle Navigation Toolkit that incorporates TYZX 3D stereo vision technology.

VISUAL, from p. 2



LUMEN is another interactive piece that achieves revolutionary sensing and visitor tracking throughout the main stairwell of the Cooper-Hewitt Museum. The exhibit itself is a seventy-foot-long translucent light box that immerses visitors in sound and light as individuals ascend and descend the stairs. A single light avatar follows each person, triggering various patterns at different points of passage and through interactive play with the light box as they move up and down the stairwell.

To view more photos and videos of Electroland's Target Interactive Breezeway and LUMEN installations, please visit the Electroland Web site at <http://electroland.net/flash.php>.



LUMEN photos courtesy of Electroland

UPCOMING TYZX EVENTS

RoboBusiness Conference <http://www.roboevent.com/>
Boston, MA
May 14-15, 2007

International Robots & Vision Show
http://www.robots-vision-show.info/robots_vision_show_info.html
Donald E. Stephens Convention Center, Chicago, IL
June 12-14, 2007

CVPR 2007 - IEEE Computer Society Conference on Computer Vision and Pattern Recognition <http://www.cvpr.org/>
Minneapolis, MN
June 18-23, 2007

Freescale Technology Forum <http://www.freescale.com/webapp/sps/site/homepage.jsp?nodeId=0525779036>
Orlando, FL
June 25-28, 2007



On The 3D Horizon

The demand for 3D vision is burgeoning, and many opportunities are only now emerging as the technology's cost-performance curve begins to meet the needs of different high volume mass markets, such as automotive, consumer electronics, robotics and security.

Systems that see in three dimensions offer many product advantages and benefits. For human-computer interfaces, 3D vision systems allow completely intuitive gesture control of games, computers, and consumer electronic devices. For navigation, they allow automated robots, cars, farm machinery and even smart systems in hostile environments such as deep space or on a battlefield. For tracking, they allow intelligent security systems, retail traffic flow measurement, and monitoring of unattended pools, home care rooms, and elder care facilities.

In the future, Tyzx envisions a host of vision-enabled consumer products, including inexpensive motion capture for video games, autonomous vacuum cleaners and lawn mowers, and safer automobiles. Existing applications in factory automation and surveillance will become much more robust through the expanded use of real-time 3D technology where it was cost and performance-prohibitive before.

Photonics Spectra, "3-D Vision Gets Real"
by Ron Buck, CEO, TYZX, December 2006



Next-generation technology sees and interacts in three dimensions.

by Ron Buck, Tyzx Inc.

Many classes of commercial and consumer products would benefit from the ability to visually sense their environment and react to what is happening around them. These products would have to operate in dynamic, variable real-world environments. Robust sensing would require accurate visual analysis, which often entails three-dimensional data and high frame rates with low latency. In addition, the sensing system would have to be compact and low-cost, with low power demands. Although these requirements seem challenging, new technology is enabling affordable real-world products that see and interact with the world in three dimensions.

One application of visual sensing is a distributed person-tracking system that uses networks of smart sensors mounted on walls and ceilings. Electrical of Los Angeles — a center of cooperative and satellite-

technology urban projects and scenarios — has prepared for Target Corp. an interactive installation in the new observation deck of Rockefeller Center in New York (Figure 1). People entering the space are assigned a "personality" and an individualized light pattern follows them around the space. The participants can influence and change the illuminated patterns in the room simply by moving around and by making various gestures.

The exhibit uses a 3-D vision system that can track up to thirty visitors with high accuracy and a very low error rate. This allows for precise flow to 4 cm in translating individual visitors into an engaging interactive experience. Person tracking with a 3-D stereo camera can provide the location and movement of each individual precisely, even in a crowded environment. Although this particular application is primarily for entertainment, the same

technology also is being tested for homeland security and other surveillance and defense-related applications.

Benefits of 3-D tracking

Many vision-based tracking systems have traditionally relied only on 2-D data, which is adversely sensitive to changing lighting. In contrast, 3-D evidence can be derived from nonparametric stereo correlation, which is essentially a comparison of left and right images using pixel relative intensity and texture information. The result is that lighting and apparent color can be changing constantly without degrading tracking results.

The Douglas G2 stereo vision system from Tyzx Inc., of Menlo Park, CA, employs low-cost, rugged CMOS chips and sophisticated 3-D cameras (Figure 2). The 3-D data is much easier to segment into discrete subjects, which means that people

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