

Basler pilot GigE Cameras Make 3D Medical Surgery System See



Scan viewed from two angles, taken with Pathfinder laser range scanner

Customer

- Customer: Pathfinder Therapeutics Inc.
- Location: Nashville, TN, USA
- Industry: Medical Devices
- Year of Project Realization: 2010

Application

Pathfinder designs and manufactures an image guided surgery system for use in various abdominal surgical procedures. Image guided surgery is a GPS-like system whose goal is to accurately map the position of the surgical instrument (the "car") onto the pre-operative CT or MR data (the "map"). Feature-rich 3D models of the organs, blood vessels, and tumors can be created from the pre-operative data, and these models provide the surgeon with the ability to see through the organ before and while he resects, ablates, or performs some other procedure. The magic step is performing the positioning that allows the instrument to be accurately registered onto the pre-operative data and 3D models.

When working with rigid anatomy such as bone, this registration procedure is straightforward. Fiducial markers that can be readily identified in a scan are attached to the patient before any pre-operative scans are taken. When the patient is brought into the operating room, these points are touched with a tracked surgical instrument (the "car") and the physical and image spaces can be co-registered. In most abdominal surgery, though, the organ being operated on is not in a fixed position relative to rigid anatomy. Pathfinder's solution to this

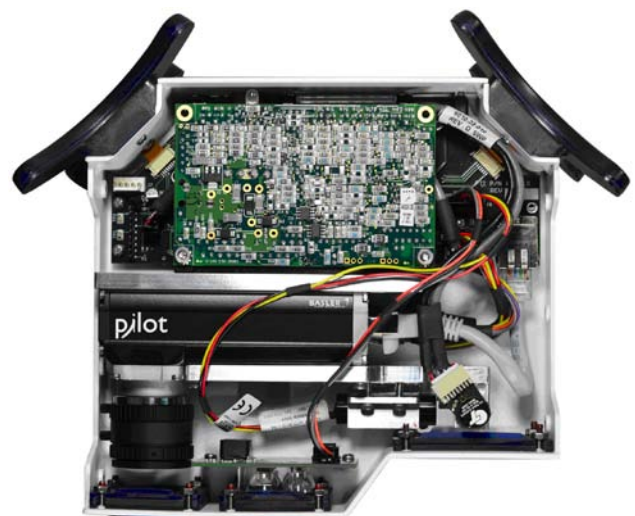
problem is to register using the surface of the organ in question.

A method was needed to acquire a large set of 3D points on the surface of the organ. A laser range scanner was chosen to perform this task. This scanner remains stationary while moving a laser line across the organ and simultaneously recording the position of the line using a CCD. Using triangulation, a 3D surface can be reconstructed. Pathfinder

previously used an off-the-shelf 3D laser scanner to perform this function, but it took approximately 30 seconds to acquire enough surface to perform the registration. This was mainly due to the scanner CCD operating at 15 frames per second (fps) and communicating over USB 1.1.

Solution and Benefits

Under contract from Vanderbilt University, Pathfinder pursued the development of a custom laser range scanner. The primary requirements for the scanner were that it be able to capture both range and color texture information from the same CCD and lens. In addition, Vanderbilt needed a high resolution scanner while Pathfinder needed a much

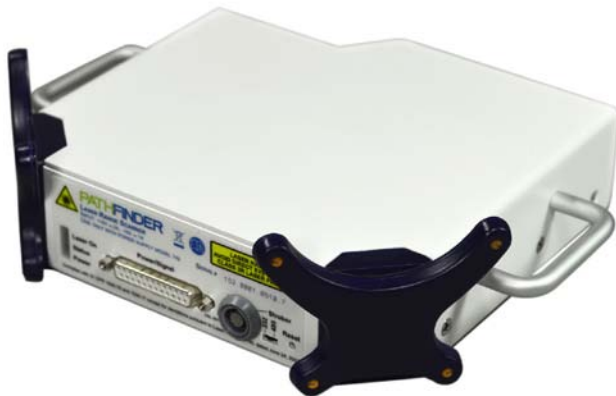


Laser range scanner with enclosure lid off. Shows camera, laser, galvanometer, galvanometer driver board, LED light source, and motherboard (hidden)



Laser range scanner, front view

faster scanner. After exploring several options, the Basler pilot series camera was chosen. For Vanderbilt's needs, a 1920 x 1080 color camera running at 32 fps was chosen. For Pathfinder's needs, a 640 x 480 color camera running at 210 fps was chosen. The fact that both cameras have the same footprint and electrical requirements allowed the company to design a single platform on which to use both cameras, minimizing development efforts.



Laser range scanner, rear view

Regulatory requirements in medical devices are quite strict, and the resulting laser range scanner passed both IEC 60601-1 safety and IEC 60601-1-2 electromagnetic compatibility testing without modification. Considering the speed of both the CCD readout and GigE interface, this was an unexpected result based on prior experience with other board-level cameras used.

Technologies Used

- Basler pilot GigE piA1900-32gc and piA640-210gc cameras
- Diode Laser Concepts uniform laser line module
- Cambridge Technologies galvanometer (for sweeping the laser line across the target organ)
- Cypress Semiconductor PSoC microcontroller
- Windows-based PC running custom image processing algorithms

More Information

<http://www.pathsurg.com>



Basler AG
Germany, Headquarters
 Tel. +49 4102 463 500
 Fax +49 4102 463 599
 bc.sales.europe@baslerweb.com
 www.baslerweb.com

USA
 Tel. +1 610 280 0171
 Fax +1 610 280 7608
 bc.sales.usa@baslerweb.com

Asia
 Tel. +65 6425 0472
 Fax +65 6425 0473
 bc.sales.asia@baslerweb.com

