Case Study

3D Scanning for Custom Footwear and Orthotics

Intel® RealSense™ Technology Enables Precise Measurements for Unique Retail Experiences

Spotlight on Aetrex

Aetrex, Inc. is a global leader in foot scanning technology, orthotics and comfort footwear. The company's state-of-the-art 3D scanning devices are engineered to accurately measure feet and determine foot type and pressure points. The scanners use pressure sensors and Intel® RealSense™ depth cameras to make orthotic and shoe recommendations based on each customer's unique needs.

At a Glance

- Aetrex has developed a unique 3D foot scanning system that helps people determine the optimal fit footwear and orthotics based on their unique 3D foot measurements and pressure data. Its market-leading Albert 2 Pro foot scanning system can capture both static and dynamic pressure, as well as 360 degree measurements of the foot.

- To construct the computer vision system for Albert 2 Pro, Aetrex integrated four Intel® RealSense™ depth camera D415 systems and 5,184 gold plated sensors, enabling precise 3D scanning capabilities. With a rolling shutter on the depth sensor, the Intel RealSense cameras offer very high depth quality per degree.

Challenge

Accurately develop a three-dimensional profile of each customer's foot, including measurements of the length, width, instep, arch height, girth, arch type, and other parameters.

Solution

Intel® RealSense™ depth camera D415 puts an Intel module and vision processor into a small form factor, which is ideal for the development and productization of the revolutionary Aetrex Albert 2 Pro scanner.

Result

In 20 seconds or less, Albert 2 Pro uses Intel RealSense technology to capture a three-dimensional, 360- degree representation of each foot, helping customers select correctly fitting footwear and orthotics.

Introduction: Innovative Technology Leads to the Best Fit

At Aetrex, finding the right fit for shoes and orthotics begins with a three-dimensional profile of each customer's foot. Intel® RealSense™ depth camera D415s are a key part of the foot-scanning process.

"We chose Intel RealSense for its superior accuracy, premium quality, and ease of use," says Larry Schwartz, CEO at Aetrex. "The 3D profile obtained from the cameras is used to recommend the best shoe styles and the best size within those styles, allowing Aetrex to penetrate the market for shoe fitting."

Since 2002, Aetrex has placed over 12,000 scanners in department stores, warehouse stores, independent running shoe stores, comfort shoe stores, and other retail outlets around the world. Aetrex also features the scanners in company-owned Digital Orthotic Stations (DOS), which are dedicated foot-scanning kiosks found in shopping malls and other locations.

Aetrex has forged a reputation as an industry leader with its Albert 2 Pro Scanner, Albert 3DFit Scanner, and Albert Pressure Scanner. According to Schwartz, competing scanners can only show feet with a grid or mesh view because they don't capture as much data. The Aetrex scanners use Intel RealSense technology to create a complete 3-D reconstruction of each foot. In addition to precise physical measurements, the scanning process can capture both static and dynamic pressure from the pressure sensors. These readings allow the system to understand the pressure distribution under the foot so the correct orthotics can be recommended to alleviate foot conditions.

An Aetrex Digital Orthotic Station in Burlington, Massachusetts

Putting Intel RealSense to Work

Each Albert 2 Pro device uses four Intel® RealSense™ depth camera D415s to gather depth, color, and infrared images. The device processes the data to reconstruct a 3-dimensional model that informs specific recommendations for shoe size, style, and orthotic inserts. The objective is to ensure maximum comfort, support, and a better overall fit.

"Our mission to help people stay comfortable, active, and in-jury-free," Schwartz reiterates. "When evaluating cameras for our foot scanners, we considered accuracy of depth measurements, ease of software implementation, and the quality of vendor support. Intel RealSense met our needs in all three categories."

The Albert 2 Pro Scanner

An Integrated Machine Vision Solution

The Intel® RealSense™ depth camera D415 combines Intel's latest depth-sensing hardware and software into a highly con-figurable, easy-to-integrate solution that includes vision pro-cessors, turnkey modules, cameras, software development kits (SDKs), and computer vision libraries.

According to Kumar Rajan, senior vice president of engineer-ing at Aetrex, this integrated solution is well suited for high accuracy 3D scanning applications. He and his team use the Intel RealSense open-source software libraries to control many aspects of the cameras such as initialization, device reset, camera setting, control stream, and frame capturing. These libraries shield developers from low-level system knowledge, which speeds up development.

"The Intel RealSense SDK is integrated into the software that operates the scanner," Rajan says. "We use the tools provided by the SDK to capture the depth, infrared, and color images. This helps us get the best performance out of the cameras by utilizing the optimal camera settings."

The color images are used to apply texture to the reconstruct-ed 3D feet to render them in their natural form. The infrared images are used to identify the calibration pattern that is painted on the base of the scanner using nano-material.

The small form factor of the Intel RealSense depth cameras allowed the Aetrex hardware team to minimize the overall size of the Albert 2 Pro scanners. This is an important consideration for retail showrooms, where space is often limited. The depth cameras are seamlessly integrated into the towers surround-

Intel RealSense depth camera D415.

ing the scanner bed, allowing for precise, high-quality measurements. Dual rolling shutter sensors support up to 90 frames per second (FPS) depth streaming, which represents a very high depth quality per degree.

Intel worked closely with Rajan and his team to develop a proprietary algorithm for Aetrex's particular needs. "The Intel RealSense SDK allowed for a smooth integration process, and the support team helped us overcome any challenges that we confronted," Rajan recalls. "Intel has been a fantastic partner. The Intel RealSense team always makes sure that we are creating the best products we can with the technologies that are available. They helped us develop an accurate calibration procedure, and the Intel support team has stepped up to offer assistance whenever we needed it."

Personalized Footwear and Orthotic Recommendations

Aetrex's FitGenius AI platform, available within the Albert software and as a plug-in for retailers' websites, can dramatically reduce e-commerce footwear returns and create a more personalized customer experience. It works by matching a customer's unique 3D foot profile and fit preference data with the shoe purchase history of similar profiles to help shoppers get the right fit on the first try.

The process begins with a 3D foot scan in the store. Consumers can instantly view their 3D measurements and receive their unique foot profile data via email. Retailers who fully integrate the program can then have FitGenius recommendations appear wherever the consumer shops—whether in store, on the website, or through email blasts and social media channels.

"We are able to provide a unique and exciting in-store experience with the Albert 2 Pro," says Shawn O'Neill, senior vice president at Comfort Management Corporation, a footwear retailer that offers sandals, shoes, flats, athletic footwear, boots, clogs, and other related products for men and women. "We are up 16.5% in Aetrex Orthotic sales, largely because customers are excited to learn about their foot measurements,

and they see us as the authority to provide them with that information."

"The Albert 3D foot scanner allows us to take our service to a completely different level," adds Justin Kehrwald, president and CEO at Tradehome Shoes, a footwear retailer with locations in many parts of the United States. "People are immediately impressed with the speed of the scan, the accuracy of the scanning results, and the next-step options provided by the technology."

Based on these and other testimonials from its B2B partners, it is clear that the Albert 2 Pro has dramatically changed the retail experience. "There is no other company on the market that is doing what we are doing, with complete 3D measurements as well as pressure readings," Schwartz concludes. "People are amazed that they can stand on something and get so much information about their feet. Intel RealSense cameras are an essential part of this process. Intel has exceeded our expectations in terms of performance, reliability, and ease of use."

Technical Components of Solution

- Intel® RealSense™ technology is a suite of depth and tracking solutions designed to give machines and devices the ability to 'see' and understand their surroundings.

- Albert 2 Pro combines cutting edge Computer Vision, Machine Learning, Natural Language Processing, and Cloud Analytics to deliver a state-of-the-art, easy-to-use foot scanner.

Awards:

- CES Innovation Honoree Award, 2023

Learn More

- Aetrex: https://www.aetrex.com

- Intel RealSense: https://www.intelrealsense.com

Watch a Video on the Albert 2 Pro's Accuracy

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