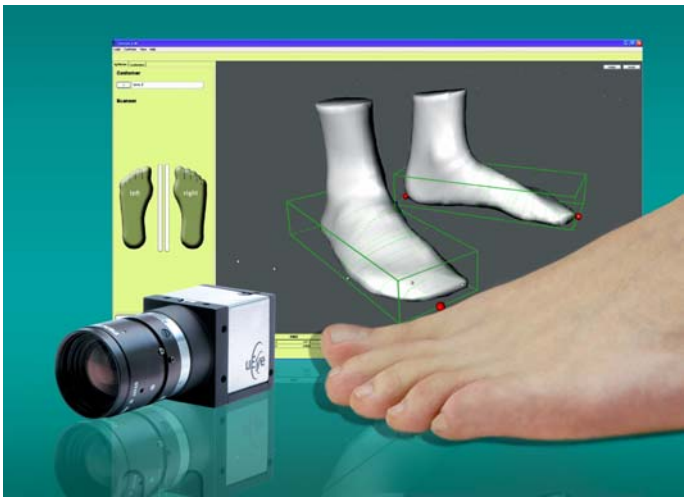
Affordable custom shoes instead of blister plasters

Foot scanner measures feet in seconds



Approximately 150 different steps are required to craft a custom made shoe. A separate last must be formed for each shoe, for which the shoemaker takes measurements in 35 places. This elaborate procedure can now be handled by a foot scanner that not only speeds up the manufacturing process, but also makes it less expensive.

Be it running, skiing or hiking, it can't be done without shoes. But they have to fit properly; otherwise the result is more pain than pleasure. Custom shoes are the answer, but they are expensive. That's why most consumers settle for a compromise of "Oh well, I guess it fits alright". But now Stuttgart company corpus.e has developed an affordable 3D foot scanner they say will change all that. Their lightbeam scanner is lightweight, compact and economic, on the one hand it because it doesn't operate with expensive laser projection, but instead uses a special stocking, and on the other hand because it employs a USB2.0 (Universal Serial Bus) industrial camera instead of expensive stereo cameras.

Special stocking supplies measuring points

A special stocking with photogrammetric markings, the patented ›MagicalSkin‹ stocking (Fig. 1) is pulled over the customer's foot. Then the customer steps onto the scanner platform, and a click of the mouse starts the measuring process. The camera records the photogrammetric markings and transfers them to the PC in approximately 25 seconds. The image processing software delivers a precise, three-dimensional representation of the foot (cover photograph).

Small, swift, high-resolution camera

According to IDS Imaging Development Systems, IDS was one of the first companies to use USB 2.0 interfaces in industrial image processing, and can today point to a wide range of products and experience. Thanks to its USB2.0 connection, the ›uEye‹ camera (Fig. 2) can be connected directly to a laptop or PC without requiring additional hardware. The high bus bandwidth allows a data transfer rate of up to 480 Mbps. If necessary, images from several cameras can be simultaneously recorded and displayed on the PC. The necessary power is also supplied through the Universal Serial Bus. With a resolution of up to 3.1 megapixels, the cameras can record up to 75 frames per second in full mode. Higher frame rates are possible in Area of Interest (AOI) mode. Both monochrome and colour cameras (using Bayer Mosaic colour conversion) with rolling or global shutter are available, optionally supplied with or without memory. The cameras use CMOS sensors whose photosensitivity, according to the manufacturer, almost reaches that of CCD cameras. Functionalities such as windowing, binning, subsampling and horizontal/vertical image mirroring are integrated. Resolution ranges from 640 x 480 pixels to 2048 x 1536 pixels, depending on the camera type. All models are equipped with a universal, optically decoupled trigger input and an also optically decoupled output that can be used, for example, to activate a flash. The range of models will be

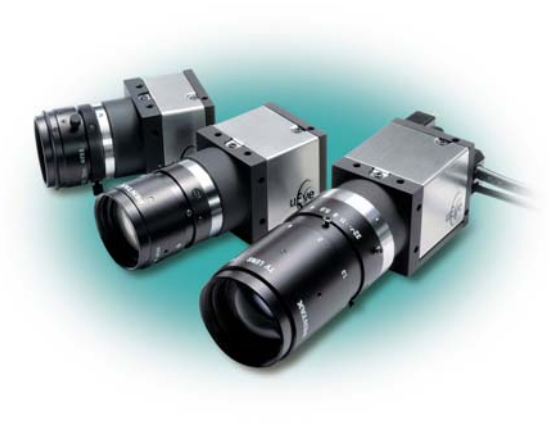
extended by CCD models in the near future. Dirk Rutschmann, CEO of corpus.e, explains why the company chose cameras by IDS: “Mobility, easy handling and the cost factor of the device were what we focused on when we were developing the lightbeam 3D foot scanner. Based on the IDS industrial cameras, we are able to offer a solution that only costs a fifth of the price of conventional laser scanners to buy. They also eliminate the maintenance expense for the regular calibration laser scanners require."

Flexible and lightweight in practical application

Apart from the foot scanner and the patented MagicalSkin special stocking, all an orthopaedic footwear specialist or shoemaker needs for on-site measuring is a PC. With a click of the mouse, the camera starts recording the 3D outline in a circular motion, so that heel, toes and the arch of the foot are recorded simultaneously in a single scanning process. At a net weight of 16 kg, the camera is not only comparatively light, allowing for mobile use, but also small, due to the small uEye VGA camera (24 x 32 x 27.4 mm³ in standard housing without memory).

Freely accessible source code

All uEye cameras support the current Windows operating systems and Linux. A software development kit (SDK) with demo programs for image recording and analysis, and the source code for them, written in C/C++, are supplied free with each camera. Developers can adapt the source code to specific requirements or integrate it into programs of their own. Users can set all camera-specific parameters with the SDK. It additionally allows memory management using ring, buffer and double-buffer management. The Direct Draw Interface enables flicker-free insertion of individual information such as date, time or images into live video. A TWAIN driver, an ActiveX component and a WDM are available to users of standard software solutions. For popular machine vision programs, such as ActivVision Tools, Common Vision Blox, HALCON or NeuroCheck, direct interfaces are available. Their modular design and wide-ranging software support allow individual requirements and customer-specific solutions to be implemented in a very short time, as the example of lightbeam shows.



Conclusion

lightbeam is a development that many people with foot problems will welcome. In future, custom shoes for congenital foot problems or feet deformed by accident or illness will be faster and cheaper to manufacture and adapt to individual needs. And as every foot is an individual masterpiece of 28 bones, 19 muscles and 107 tendons, many healthy feet will also be grateful for shoes with a perfect fit. lightbeam brings computer-aided made to measure manufacturing, already common in the clothing industry, to shoemaking.

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