

In focus, right down the middle

USB camera system centers high-quality lenses for varifocal eyeglasses

Specially tempered, super antireflective, highly refractive and featuring the lotus effect – When you buy eyeglasses these days, you're getting a high-tech product. But even the best eyeglass lens is of little use if it's not positioned optimally. A new system from Ollendorf centers varifocal lenses using a high-resolution camera from IDS.



*Figure 1:
Modern varifocal lenses
have to be positioned
with half-millimeter pre-
cision*

*Figure 2:
Thanks to its compact
and elegant design, the
camera system was
honored with the iF
product design award*

The use of eyeglasses as a visual aid can be traced back 800 years. They have existed in their current form since the 18th century, but current models hardly have anything in common with the examples from back then. The eyeglasses of the 21st century feature lenses which are optimally adapted for the customer and which are produced using state-of-the-art tools from the initial grind to the final shape.

Image processing plays an important role in this process. Extra precision is required for positioning the lens in the frame. A deviation of just 1 millimeter between the eye and the lens is enough to make vision unclear. Ollendorf Messsysteme offers opticians the visuReal System, a tool for centering eyeglass lenses. The integrated high-resolution camera from IDS Imaging Development Systems supplies detailed color pictures for image evaluation.

Today, "freeform" varifocal lenses are the pinnacle of lens production from a technological stand-point. These lenses are ground differently for each individual customer. The varifocal lenses are divided into several zones for near- and far-sightedness with soft transitions, whereby the areas for near and far vision are

sometimes only 11 mm apart on the lens. For this precision to reach the eye, opticians have to center the lenses with half-millimeter precision. The visuReal System from Ollendorf is even able to achieve a level of precision down to +/- 0.2 mm thanks to its integrated camera.

The "iF product design award 2010"-winning solution is comprised of a slim, 130 cm-high metal column on which the camera head is mounted. The USB 2.0 interface of the compact uEye-series camera ensures that the video-centering system can easily be used with any PC or laptop.

The camera and lens unit features motor-driven vertical adjustability and automatically adjusts to the customer's body using the "autoMove" function. The customer wears an eyeglass frame of their choice without lenses and then positions him-/herself in front of the camera at a distance of about 1.5 m. The camera head is then moved upward until the software has determined the correct position via face recognition. The field of view of the 25 mm lens is approximately two to three times as large as the customer's face. Previous video centering systems based on analog cameras used motor-driven zoom lenses to achieve the required resolution for precise determination of the edge of the eyeglasses. By utilizing the uEye USB camera from IDS, Ollendorf is the first company to use high-resolution digital cameras which can supply precise image data even without the mechanical lens.

Model 1551SE-C is a compact USB 2.0 camera with 2.1 megapixel resolution. The CMOS color sensor transmits up to 18 frames per second over the USB interface, which means that the camera offers a good balance between speed and resolution. In addition to carrying out measurements, the camera's live image feature also has another use. With the visuMovie function, the customer can view his or her appearance with different frames in short videos. The selected lenses are then added to the image via computer for a true-to-life impression.

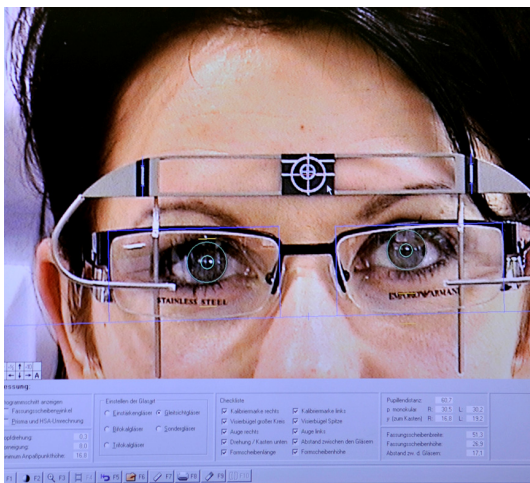
In comparison to the mechanical pupillometers used in the past, camera-based video centering has multiple uses. Precision is increased, while at the same time handling is made considerably easier. The video-based solution is also a powerful service tool that makes it much easier for the customer to select the right pair of eyeglasses.



Figure 3:
The PCB version of the USB uEye with 2.1 megapixel resolution is located in the movable camera head.

Opticians who use this system gain the major advantage of independence from the lens manufacturer. The Saxony-Anhalt-based company equips the visuReal software with a database containing all the major lens manufacturers that is updated regularly. Ollendorf also maintains close contact with companies manufacturing optical lenses. This enabled the company to secure a long-term partnership in 2008 with the Hoya company, one of the world's leading producers of eyeglass lenses. The mid-sized operation is especially proud of this distinction.

Another feature that characterizes Ollendorf's solution is precision. Highly precise results are not achieved with high image resolution alone. Several other corrective measures are also required here. For example, the customer wears a forward-tilt sensor mounted to the eyeglass frame. This sensor determines the tilt angle of the head, which allows visuReal to calculate a correction factor for centering. The final measurement result is available in about 20 seconds and can be relayed to the lens manufacturer or an on-site grinding machine.



Despite this scope of functions, the visuReal system's manufacturer calls it "the centering solution with the least material expenditure out there."

Even the installed camera supplied by IDS is a special version with no housing and with an adapted USB connection PCB. Since an important criterion when

Figure 4:
The sighting tool supplies measurement marks for precisely determining the head position

selecting the camera was small size, the Ollendorf engineers were accommodated with this compact OEM version of the USB uEye SE. The image quality of the CMOS model was also convincing. "Out of all the cameras we tested, the uEye definitely provided the best image quality," explained CEO and company founder Hans-Joachim Ollendorf.

The developers, who make up one third of the workforce at Ollendorf, wrote their own algorithms for evaluating image data. For camera integration, they use the "uEye SDK" software development kit, which is part of the comprehensive software package included with the uEye. Using this programming interface, all the parameters of the camera can be addressed with around 150 functions. The commonly used programming languages C++, C# and VB .NET are also supported, as are the standard interfaces DirectShow and ActiveX. The large number of programming examples available makes it possible to get started developing individualized applications very quickly. Hans-Joachim Ollendorf confirmed this: "The uEye SDK is very powerful and easy to use."

The measurement technology specialist developed the visuReal system to make the optician's work easier and enable precise adaptation of eyeglass lenses. Thanks to state-of-the-art camera technology and powerful software, eyeglass wearers once again have the "right perspective" in no time at all.

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Contact:

www.ids-imaging.com
info@ids-imaging.com