

20 soccer fields with perfect parquet flooring

Fast system with USB cameras checks natural wood parquet



Just pieces of wood? No way! The production of parquet flooring puts high demands on the quality of the raw material. A fast system from ATB Blank

checks parquet wood with five USB cameras from IDS. The results are impressive and make German-made wood flooring profitable.

The Reinlein Parkett company, located in Geiselwind, Franconia, utilizes its premises to the fullest. Large stacks of wood fill up almost all of the unbuilt space. Enough wood for a good half a year of production is lying there to dry. The path to the inspection system at ATB Blank passes numerous machines in the large hall which process the raw material. They saw debarked trunks into planks and then saw these planks into boards for various wood flooring types. Boards of low quality end up as 16 cm long, 3 cm wide pieces of wood, i.e. puzzle pieces for composite or mosaic parquet.

"Mosaic parquet is actually made from wood scraps. If it can't be used whole, it's sawed into blocks," explained Georg Blank. This means that a parquet manufacturer has to check closely to determine which of the so-called slats are suitable for the classy floor covering. The CEO of the image processing specialists lists the test criteria of "dimensional stability, color, sapwood, knots and cracks". If a piece of wood exhibits a flaw, it may at best still be acceptable for industrial parquet laid edgewise.

Previously, Reinlein Parkett sorted the pieces of wood by eye and by hand. The blocks drop onto a conveyor belt, and up to three employees separate them into three lanes according to their quality. Additional employees carry out follow-up checks to ensure that flawed pieces don't end up in the final product. This is a

tedious process and only takes one side into consideration. Cracks in the end faces or knot holes on the underside can slip through undetected.

In late 2009, ATB began constructing the ARGUS Spectra system, which checks each piece of wood with five IDS cameras to increase the cycle rate and production quality. "The Reinlein company is one of the last manufacturers of mosaic parquet in Germany," related Blank. "The price pressure from abroad is enormous. Thanks to the testing system, efficiency has increased considerably, and 'made in Germany' quality remains affordable." The system has to check about 140,000 square meters of parquet annually, an area that corresponds to 20 soccer fields. And not even the smallest detail can slip through the cracks.

The conveyor belt pushes up to ten pieces per second through the testing system under the watch of the cameras. The uEye SE USB 2.0 cameras and image processing could even run at twice this speed, but the system can't physically feed and unstack wood pieces faster than this.

Two light barriers forward an electrical trigger signal to all the cameras as soon as a piece of wood moves into the field of view. The image field of the CCD and CMOS sensors is limited in height by an AOI function (Area Of Interest), whereas the full image width is utilized. This increases the speed and reduces the data quantity and computer load at the same time. The software and all image processing algorithms are created entirely by ATB. George Blank proudly showed the low CPU usage during image capture and evaluation. At a rate of 50 images to be processed per second, the programs only use up about half of a conventional PC's resources.

One color camera and four monochrome cameras capture every piece. The movements are fast, which is why the light-sensitive sensors are only exposed for a few hundred microseconds. Four rails with white LEDs light up all the sides of the wood strips. Two CCD models of type UI-2230-M monitor the long sides. Their primary task is to detect cracks, which are almost indistinguishable from the natural grain of the wood. The XGA sensors resolve details of the wood structure down to 0.16 mm using their 1,024 x 768 pixels. Whether or not the dimensional stability is in line with the required 100 µm is also checked on all sides.

Blank chose two CMOS cameras for the short ends of the slats. Both UI-1220-Ms feature global-shutter sensors, which is important for capturing quick movement. Through the smaller field of view, the 768 pixel-wide image capturing device achieves speeds four times higher than the other three cameras.

To Georg Blank, precision is not only a question of resolution. Just as important is the workmanship of the camera, so as to ensure that the flange focal length is correct and the sensor is positioned precisely on the focal plane. The engineer praises the precise and robust uEye housing design. On other cameras, the sensors were apparently mounted too low, which caused the image to be blurry. "We've never had this happen with IDS cameras," he confirmed.

The fifth USB uEye supplies color images of the top, which will later form the visible parquet surface and must therefore be flawless. But what is a flaw, and what's just a variation of the wood grain? Georg Blank's answer almost sounded like a lesson in botany. "It really is a science," he remarked with a wink. Different criteria apply for different wood types. Indeed, about two thirds of all natural wood parquet flooring is made of oak, but about 20 other tree types are also available. Each type is checked using its own program. The customer can teach in new types themselves if they have enough time and experience. The system builder suggests that five thousand pieces of wood be used to teach in a wood type. While the user ranks each piece in categories such as "exquisite", "natural" and "rustic", the system learns to differentiate between pieces on its own.

The detection of so-called sapwood is especially challenging. These parts are too soft for parquet flooring and are characterized by discoloration in the wood blocks. In addition to checking the color of the entire piece of wood, the ATB Blank system evaluates other criteria, such as the distribution and variation of color and the local arrangement of discoloration. Depending on the structure of discoloration, it can be reliably determined whether or not the wood is sapwood.

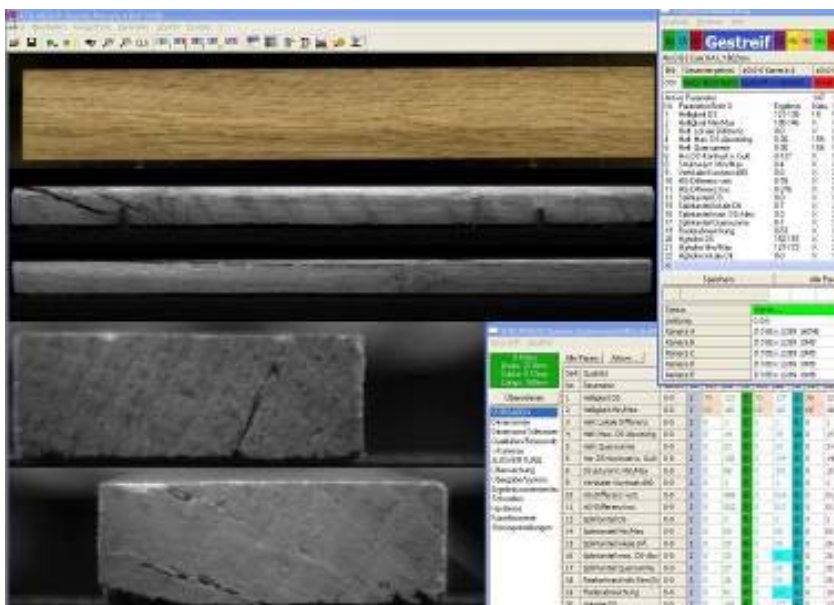


Figure 2: The testing of pieces of wood for color, size and flaws uses each pixel for more than 20 different calculations

For such evaluations, it is critical that the camera be able to reproduce colors consistently and true-to-life. Swabian camera manufacturer IDS attaches great importance to high quality during the development process, both with regard to the housing and the software as well. Every CCD camera produced undergoes adapted sensor calibration, where various parameters are adjusted for optimum image reproduction. The camera driver includes a color correction matrix for all models, which is determined with color tables under defined conditions. This makes true-to-life image capture by the cameras possible.

The ATB Blank company is one of IDS' pioneering customers and has been using frame grabber cards from the Swabian manufacturer for over 12 years – even today, when high-resolution sensors are not a requirement. The switch to digital image capture was an easy one to make for the system engineer, as the software interface of the uEye series is largely identical to frame grabber control. All that is necessary is to adjust a few parameters after the hardware is changed.

Blank is also satisfied with the business relationship above and beyond the technical aspects. "Cooperation with IDS has always gone very well. Contact is direct, delivery times are quick and they are very flexible," he summed up in closing.

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