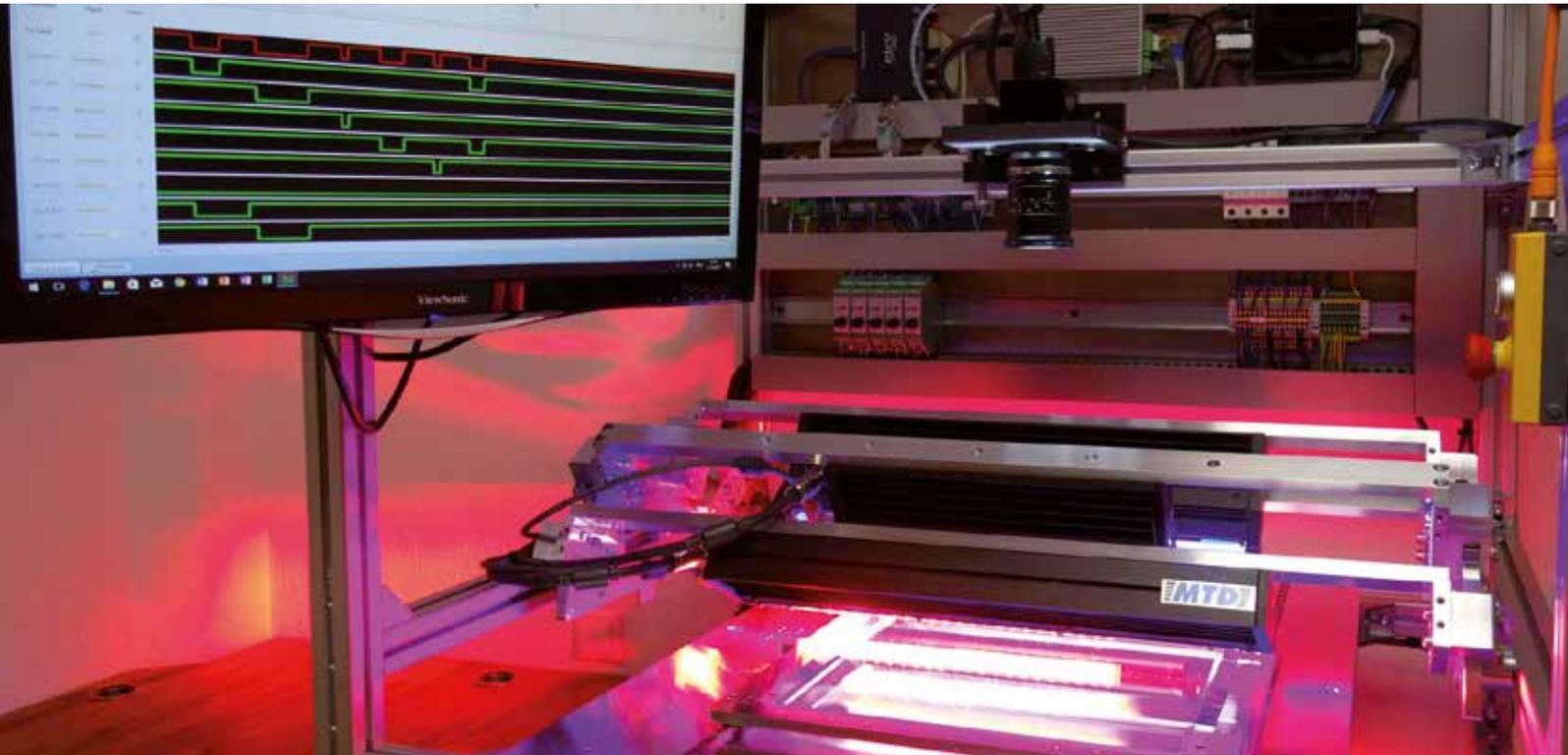




MultiChannel2Go with Exact Timing

More Potential with VisualApplets-Programmed Application

Realizing image processing systems with different illumination situations is often bound up with high expenditure. MultiChannel2Go is a ready-to-go, compact and portable image processing system from MSTVision that, using a single monochrome line scan camera, acquires images with different illuminations as separate events in a single pass. This technology can be readily expanded to several cameras to increase inspection width. Especially unique to this solution are interchangeable standard components and preconfigured, easily parametrized software. Complex multichannel applications such as radiometric stereo (shape from shading) and multispectral imaging can thus be realized quickly and cost effectively.



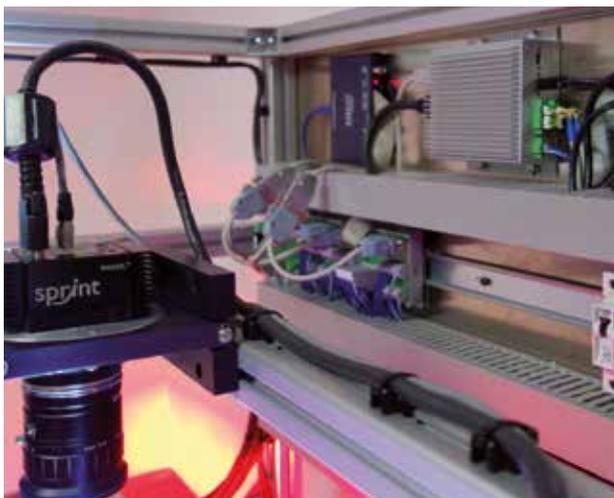
Multichannel construction with interchangeable components and software for parametrizing the timing performance/ Source: MSTVision GmbH

The MultiChannel system enables multichannel image capture of an object with up to eight different illumination types, i.e., from different angles or with different wavelength, in only one pass. Only standardized components with no special electronics are used in this system. Comprehensive configuration possibilities enable realization of

diverse applications. Customers can implement their own applications quickly and without in-depth expertise. However, if they have no appropriate (testing) installations at their disposal, they must first establish a suitable one. The necessary know-how and the effort such a task entails can represent a not insignificant hurdle for many cus-

tomers; MultiChannel2Go was developed for just such cases.

This image processing system simplifies things for users; it consists of standard hardware such as up to eight triggerable line lights, a line scan camera with easy cabling, as well as a moveable linear axis with a transparent table. The lighting construction is flexibly interchangeable and can consist, for example, of a blue and a UV incident light as well as a white transmitted light with two oblique radiating line lights. Any light sources and controllers that can be square wave signal triggered can be installed. With the installed mechanics, all lights are already in the correct position. A user-friendly camera mount stands ready for precise camera alignment. The system exploits the installed components' limits, using exact timing of lighting situations, thus achieving very short line scan camera exposure times.



*Programmable external frame grabber (center) and Intel NUC Mini PC (right)/
Source: MSTVision GmbH*

Instead of a traditional PC with an integrated image acquisition board (frame grabber), one possible system configuration uses the LightBridge 2 external frame grabber from Silicon Software with a programmable FPGA (Field-Programmable Gate Array) processor for image acquisition and preprocessing as well as a small Intel NUC (Next Unit of Computing) mini PC directly at the image source. The NUC-PC is a small full-fledged PC that takes over final image processing and analysis all the way through to image output. The FPGA on the frame grabber allows synchronous triggering of

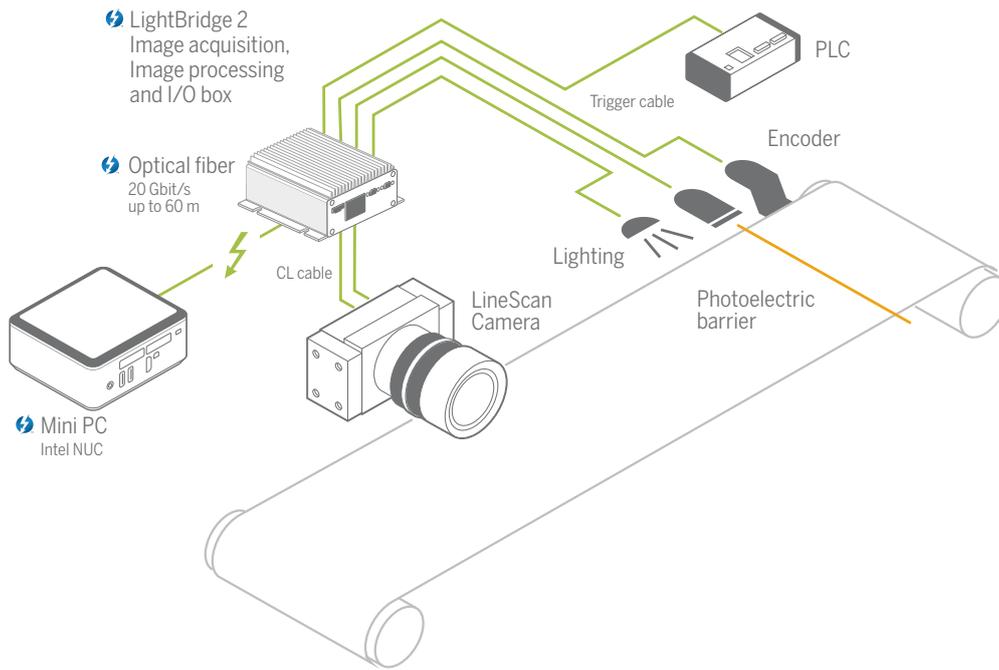


Arrangement of line lighting along the linear axis/ Source: MSTVision GmbH

the illumination and the camera as well as sorting of the acquired image data in real time, markedly reducing the NUC PC's CPU load. In place of the NUC-PC, an optional industrial PC can be connected with long Thunderbolt™ glass fiber cables to the physically separated external frame grabber, making the system especially well suited for installation in manufacturing environments.

Image Processing System for Versatile Uses

Since the upper section of the system, consisting of illumination, camera, NUC PC and the external frame grabber, is detachable, it can be easily and flexibly integrated into other image processing systems. "Here, numerous architectures are conceivable, such as use of one or more infrared line scan cameras (for example, multispectral imaging with InGaAs cameras) for imaging various wavelengths in multispectral applications, but also for inspection structures based on transmitted light or synchronous use of several frame grabbers to raise the system's bandwidth", explained Michael Stelzl, Managing Director of MSTVision and devel-



LightBridge 2 as multiple control center for image and signal processing/ Source: Silicon Software GmbH

oper of the Multichannel2Go system. Currently, monochrome line scan cameras for Camera Link are supported; further interfaces are to come.

The entire system is easy to transport and use, and needs no major outlay for modifications. Users are able to carry out evaluations in little time and to use hardware components of their choice without building complex systems or being reliant upon individual manufacturers. Depending upon the camera sensor, a large variety of wavelengths can be used in illumination, which users themselves can test in advance using this flexible system. Moreover, they have the opportunity to rent a system for a limited period of time that is already modified for their usual applications, or to purchase it outright for long-term operation in their own testing laboratory and thus, with no modifications, generate sound feasibility analyses, including high-quality image material, for their own customers.

Graphically Programmed Hardware Applet

For image and signal control of the camera(s) and illumination, MSTVision developed a hardware applet for multichannel applications using the VisualApplets development environment. Building upon an existing image acquisition design for

Camera Link cameras, the applet was created in a short time using the graphical user interface and ported onto the external frame grabber's FPGA. Using the applet, timing and illumination duration, as well as the camera triggering and exposure time synchronized thereto are precisely determined. If, for example, smartphone surfaces are analyzed for various defects such as bubbles, scratches or inclusions, individual defects can be detected using an appropriate illumination situation. The multichannel applet assigns the recorded lines for each lighting situation to a single image channel without loading the CPU. Since the individual pixels of all the image channels are acquired exactly in sync, no algorithms are necessary to correct the position of individual images.

The applet is preconfigured ready to use and parametrizable on a easy-to-operate software surface, allowing users to flexibly modify the timing for their own applications. For easy settings control, the expected signal timing at the outputs is visualized. To integrate the applet into the customer's own software environment, the preprogrammed SDK (Software Development Kit) sample code is provided. Interfaces exist for all widely-used image processing libraries. For further camera interfaces, the applet can be ported onto other hardware platforms.

Different wavelengths can be used with this image processing system; different angles, time delays, and light intensities can be installed and multispectral imaging or radiometric stereo (shape from shading) with up to 200 kHz at very high resolution can be realized, to name a few examples. In so doing, a wide variety of applications can be implemented ranging from 3D, sorting, UV and surface inspection up to thermography. Even examination of band material up to 5 meters wide is an image processing task easily solved, as the system can be expanded to the necessary number of cameras which all operate time-synchronized. The system can be implemented in industrial environments as well as in many other fields.

Flexible and High Performing with Reduced System Costs

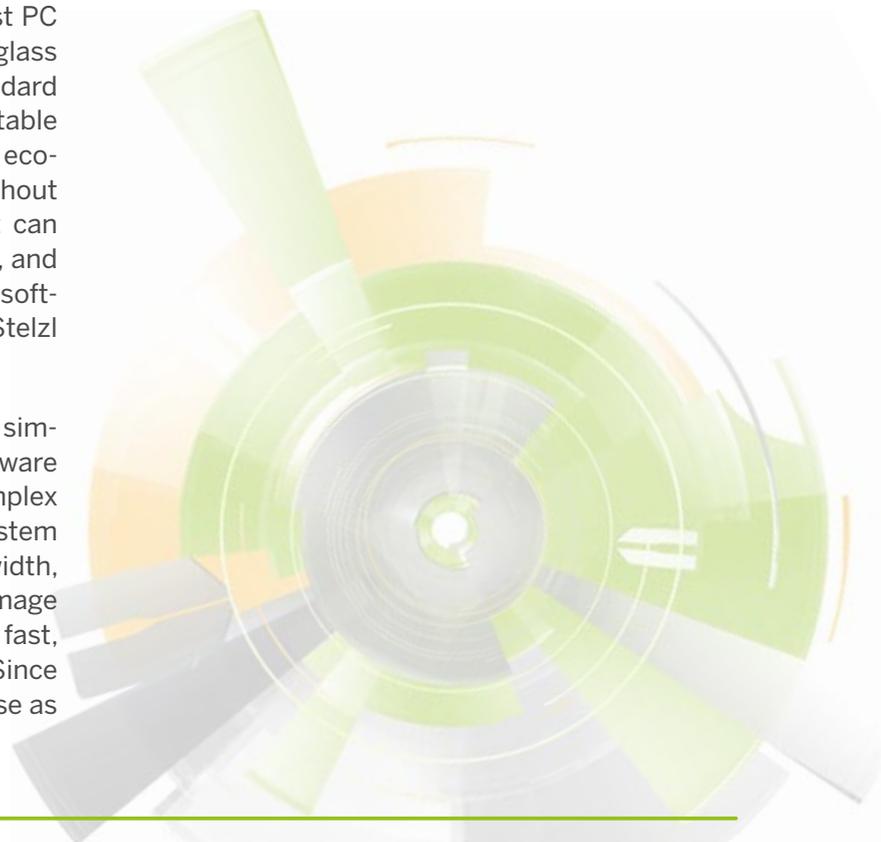
The combination of different lighting with one or several line scan cameras and the programmable frame grabber reduces complexity and overall system costs. Hardware is extremely reduced and freely selectable and interchangeable. The optionally realizable physical separation of image acquisition using the external frame grabber on the one hand and the image evaluation using the host PC on the other using their connection via long glass fiber cables is a further plus. "Due to the standard components, this immediately implementable image processing system is markedly more economical overall and available long term without being bound to individual manufacturers, it can be evaluated in one's own test environments, and be modified with little effort both hard- and software-side without sacrificing performance", Stelzl emphasized.

As a result, migration to multichannel is very simple, since hardly any alterations to the hardware platform or the software are needed. Complex software is omitted entirely. "The entire system achieves its high performance in data bandwidth, speed, and precision for signal control and image processing by using the frame grabber and fast, easy FPGA programming via VisualApplets. Since LightBridge 2 functions in this application case as



LightBridge 2 external frame grabber with Thunderbolt™ cable connections/ Source: Silicon Software GmbH

an intelligent control center, a very compact PC could be used", explained Stelzl. "Multichannel is the easiest path to line scan camera applications with multiplexed illumination situations." For the future, he is planning to port the multichannel system and applet onto further camera interfaces such as CoaXPress and newer, more powerful frame grabber series to even more efficiently control applications such as sorting with outlet nozzles.



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