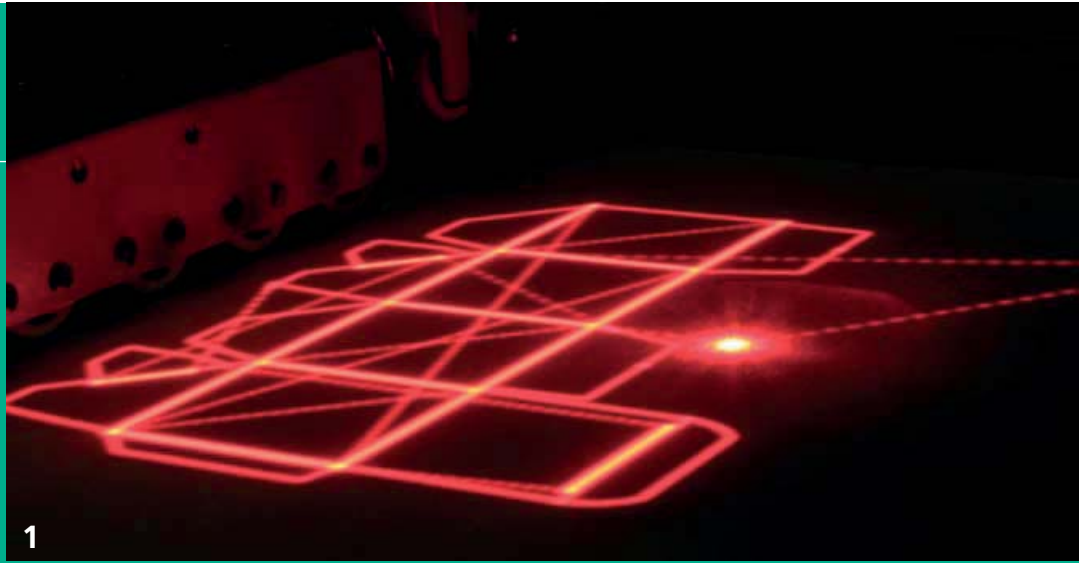

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MULTIFUNCTIONAL CONTROL PLATFORM FOR LASER REMOTE APPLICATIONS

THE TASK

Galvanometer scanners have outstanding dynamic properties. In the field of laser materials processing they are used for fast contour cutouts as well as high frequency beam shaping. The use of these beam positioning techniques increase the efficiency and flexibility of joining and cutting processes. This in turn leads to reduced manufacturing costs. If laser remote processes replace the conventional stamping, it is not necessary to build shape specific stamping tools. Substantial time is saved throughout the overall process from the drawing to the prototype, since the laser beam positioning can be freely programmed.

Highly dynamic galvanometer scanners also enable certain processes such as the welding of mixed material joints. This opens up new possibilities in laser materials processing since without scanners these materials could not be welded. A high frequency scanner based beam shaping optics with small oscillation amplitudes allows for the tailored adjustment of melt pool size and dynamics, which is used to optimize outgassing and solidification processes.

An essential component for this application is a powerful and application-specific control software. The requirements strongly vary, depending on customer and process. Thus the control software has to be flexible and scalable. The challenge lies in the integration of the scanners into a broad spectrum of control systems for various processes and solutions.

OUR SOLUTION

At the Fraunhofer IWS most modern object oriented software development tools and scalable software architectures were deployed to develop a software platform, which abstracts the control and process logic layers so that they are separated from the hardware components. The development of complex processing steps and process control regimes is thus possible, independent from hardware.

In industry many different systems from various manufacturers are used. This includes control systems, galvanometer scanners and even the cameras for image processing. To interact with such components, it is impossible to avoid the need for adaptation. However, by decoupling the hardware it is possible to limit the adaptation to the implementation of a few interfaces, which keeps costs and development times low while flexibility and quality improve due to the standardized approach and software modules. The method makes it possible to reuse, modify and expand previously developed laser remote applications for nearly any customer system with reasonable time and adaptation effort.

RESULTS

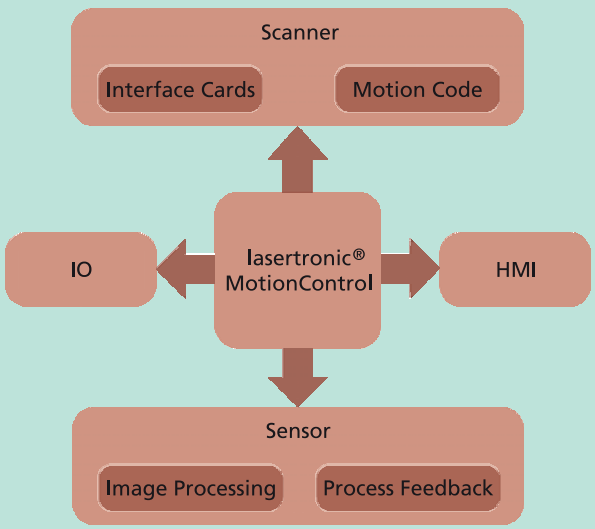
The IWS application platform "lasertronic®MotionControl" consist of 4 basic building blocks (Fig. 2). The "Scanner" module controls the scanner electronics via control boards from various manufacturers. The hardware is connected dynamically via plug-in, which makes the software completely independent from the specific product.

The scanning path is programmed and graphically visualized. Several command sets are already implemented such as the G-Code, which is common in the world of NC programming. Expansions are possible based on specific customer requirements.

The communication with peripheral components such as memory programmable controllers, is handled by the "IO" submodule. All common bus systems are supported as well as digital and analog inputs and outputs.

Another software is called "Sensor", which supports the connection to process sensors ("Process Feedback") and the control of cameras as well as the evaluation of the acquired camera images ("Image Processing"). The information can be used for path correction or for process verification.

Module overview of the platform "lasertronic®MotionControl"



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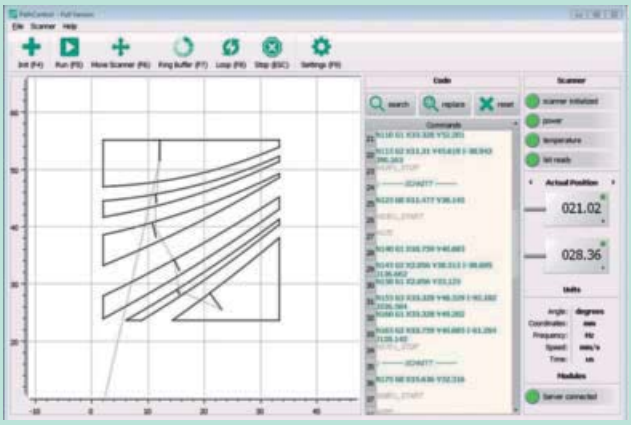
The "HMI" module offers editors for manipulating the command lists. It also has interactive graphics elements to visualize the cut patterns. Camera images can be integrated and the corresponding data from image processing can be displayed. The Fraunhofer IWS Dresden software "PathControl" was developed to realize laser remote applications. It implements functionalities to create, visualize and edit processing programs as well as their execution on the used galvanometer scanner (Fig. 3). The use of the software for various applications with many products from established manufacturers have demonstrated the multifunctional capability of this control platform and realized the strict and successful decoupling of hard- and software.

Software system for the implementation of laser remote applications



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1 *Highly dynamic laser cutting and laser grooving of cardboard*

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