

Basler Camera in Car Headlamp Testing and Adjusting Machine

Customer

- Car headlamp manufacturer; worldwide locations
- Automotive industry
- Delivered several machines of the same type

Application

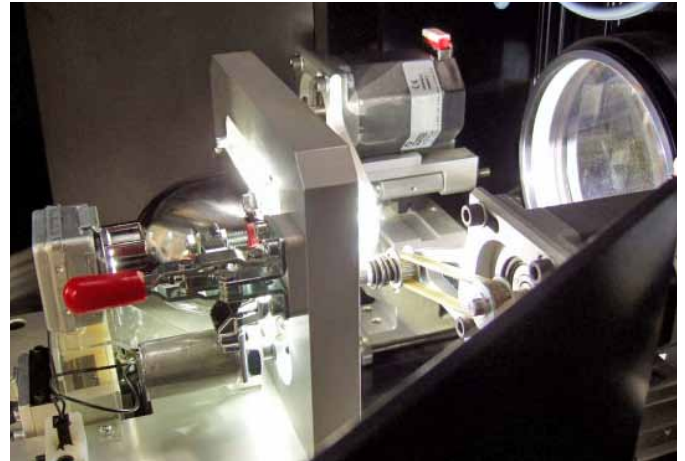
The challenge was to build a stand-alone production and test machine for the automatic adjustment of car headlamps in order to achieve specific color rendition on the upper edge of the light cone. The tester is a fully automated machine with all necessary mechanics and electronics. A machine vision system performs mathematical evaluation of an image projected on a focusing screen. Based on this evaluation, the machine vision system controls stepper motors that adjust the diaphragm of the headlamp to meet the requirements.

Solution and Benefits

The machine is used to analyze the image on a projection screen lighted by a car headlamp and for adjusting the headlamp according to the results of the analysis. Several types of headlamps can be tested and/or adjusted. The machine is built from aluminum profiles and cast aluminum parts, and its mechanical concept is open so that other types of headlamps can be tested in the future.

The implemented software, which is based on National Instruments LabVIEW(tm) with the NI Vision Development Module, controls both the machine vision task via a Basler scout camera and the mechanics and electronics of the machine. The PC also serves as an operator console.

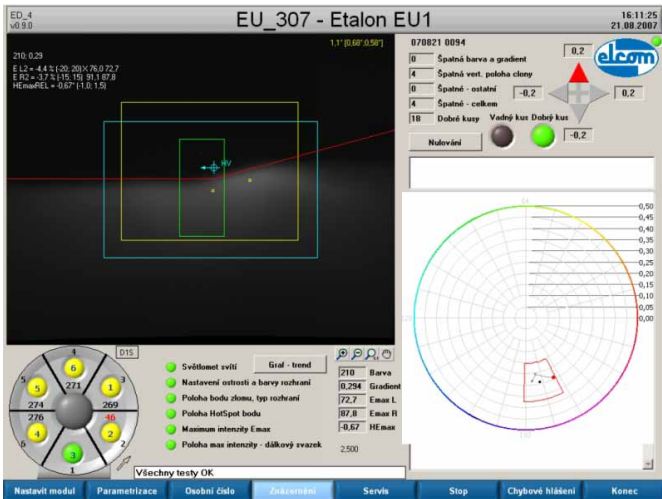
To keep the machine size within reasonable limits, the focusing distance between the light cone and the headlamp is shortened to approximately 180 centimeters by using a large achromatic objective and then reflecting the light upwards using a diagonal mirror.



The headlamps are manually installed in replaceable fixtures (six pieces) positioned on a rotary table. The fixtures can be changed in a few minutes as production progresses. In the first position on the rotary table, the lamp is switched on and keeps burning until the light becomes stable (the light color changes as the light starts burning). In the adjustment position, two stepper-motor-powered screwdrivers move toward the headlamp until they meet the adjustment screws. Based on information from the vision system, the screwdrivers rotate the screws in order to adjust the color. When the color is correct, the screws are released. In the last position on the rotary table, the headlamp is signed if it was successfully adjusted. Adjustment of one headlamp takes about 40 seconds.

The headlamp light cone edge color evaluation is based on analysis of an image of the edge area that is projected onto a screen. The difference between the actual color and the required color is given as an angle between the two colors on the color circle circumference. The edge sharpness is an average steepness (derivation) of the luminance across vertical lines rectangular to the border.





The machine adjusts the edge characteristics by turning adjusting screws on the headlamp. Internally, the stepper motors driving the screwdrivers get a command to move a number of steps that is proportional to the color and sharpness difference between the actual and the desired state. The adjusting algorithm is iterative, using multiple small steps. It does not use one step adjustments because there is no linear relationship between the color difference and the tightening angle. After the edge test, the machine performs a brightness test in dark and bright fields. The software application changes the exposure parameters of the camera via NI Vision Acquisition Software – the software driver is fully compatible with all Basler cameras.

Thanks to the seamless integration of Basler cameras and the flexibility of the software and hardware tools from National Instruments, highly complex machines are easy to design and maintain.

Technologies Used

- Basler scA640-70fc camera
- National Instruments LabVIEW™ with the NI Vision Development Module and NI Vision
- Acquisition Software (IEEE 1394, GigE, and analog camera driver)
- Industrial grade PC with MS Windows 2000™ OS

More Information

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