QUALITY INSPECTION

KVANT®

CONTENT

ABOUT US

WE FOUNDED THE KVANT COMPANY IN 1995 (PAVOL KUBOSEK AND LUBOMIR MACH) AS YOUNG SCIENTISTS WHO WORKED AT THE SLOVAK ACADEMY OF SCIENCES IN BRATISLAVA AFTER ALREADY HAVING WORKED AS FREELANCERS FOR THREE YEARS IN THE FIELD OF LASER OPTICAL SETS, SEMICONDUCTOR LASERS AND HOLOGRAPHY DEVELOPMENT. OUR MISSION IS TO TRANSFER THE LATEST SCIENTIFIC KNOWLEDGE AND TECHNOLOGICAL SOLUTIONS INTO PRACTICE. OUR ACTIVITIES HAVE EXPANDED GRADUALLY ALLOWING US TO CREATE SEVERAL DEPARTMENTS WITHIN OUR COMPANY. THE AMOUNT OF OUR OWN PRODUCTS, SUCCESSFULLY EXPORTED ABROAD, IS CONSTANTLY INCREASING. YEARLY WE REALIZE MORE THAN 3000 PROJECTS AND BUSINESS CASES AT HOME AND ABROAD.

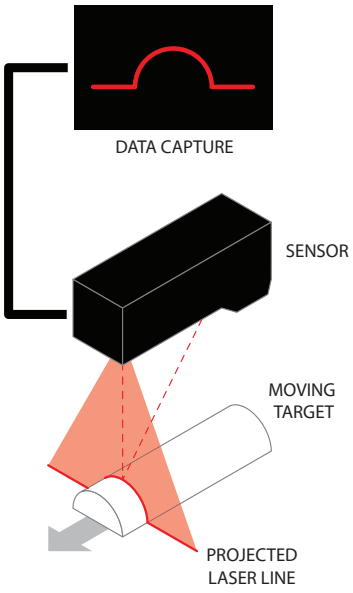
THANK YOU FOR YOUR COOPERATION AND TRUST!

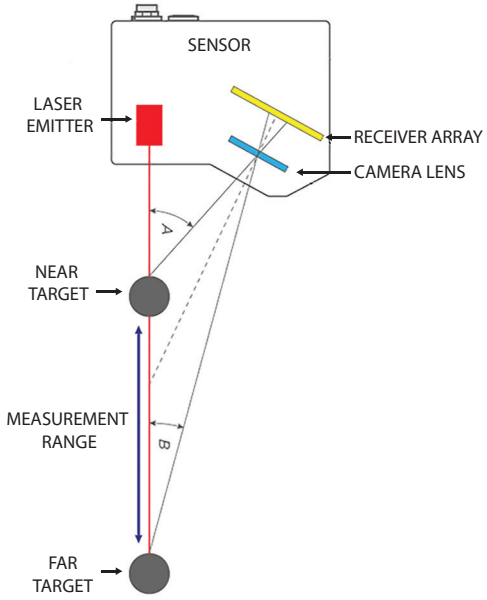
Ľubomír Mach

Pavol Kubošek

LASER TRIANGULATION

Is a method which measures the distance between two points whose position is precisely known. It is actually scanning the object's surface using laser light. The camera is positioned above the object under a known angle for scanning a picture of object. A row of profile is generated during this process and throughout triangulation process a three-dimensional image is made. In this measurement laser light is used in order to achieve sufficiently high light level of the subject at lower exposure times. Deviation from the deformed laser beam is used to create a 3D image. The obtained information differentiate in color in the so-called. 2.5D map. When we convert the range 2.5D to 3D cloud points, we can rotate the profile in all directions. When scanning, it may happen that the profile on the object will create shade. This can be solved by second sensor camera.





The use of this technology is ideal for scanning moving objects. Benefits can be used with high speed acquisition of 3D profiles and during the control of different surface structure.

Benefits

Useful for acquiring high speed 3D profiles

Effective in inspecting surfaces with varying texture, color and reflectivity as well as soft, wet or delicate surfaces where contact is not possible

Can be used in virtually any lighting condition

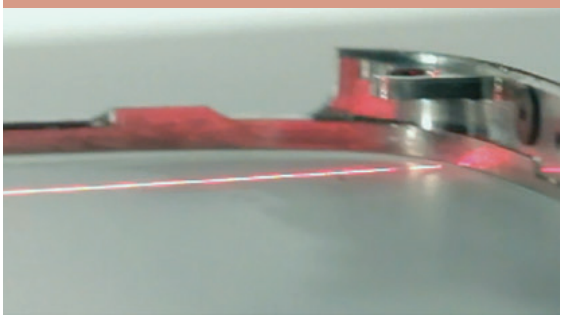
Narrow bandwidth optical filter positioned in front of the imager effectively eliminates ambient light

Provides excellent depth resolution to measure detailed features, compound curves, cracks, scratches etc.

Limitations

"Speckle" effect poses limitations on resolution and accuracy (down to a few microns)

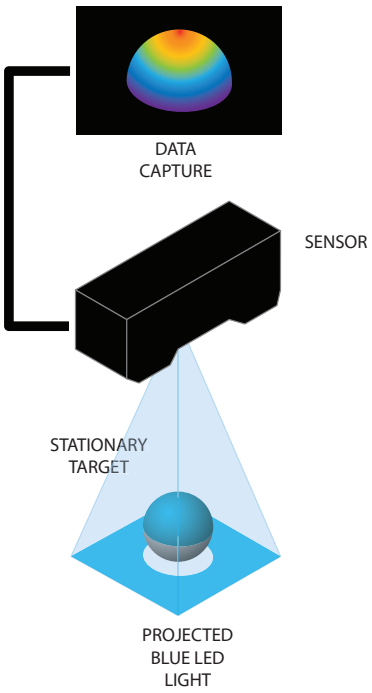
Laser light should be used with precaution (lasers are generally not eye safe unless power is < 1mW)

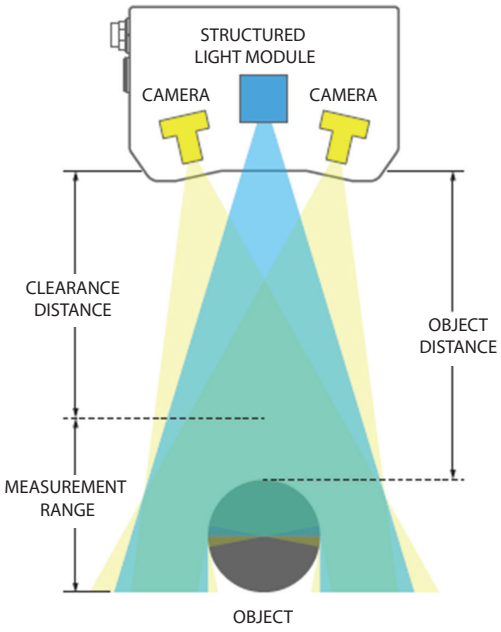


STRUCTURED LIGHTS

It is light, laser or LED, which reflects a known pattern to the object. Then this known pattern is deformed on the object and it is recorded by a camera. The collected information is evaluated and the distance of each point is calculated. After processing the scanned are image displays in the 3D format.

The main advantage of structured light is that we can use it for quick checking of several things at once (screws, surface, space etc. The ability of scanning the visual field at the same time eliminates the problem of disruption of movement. Another advantage is easy integration into the existing system and it is ideal for robotic and stationary quality control.





Benefits

Easy to setup and integrate into existing systems

Acquires a full 3D point cloud in a single snapshot

Provides high degree of accuracy

No speckle effect

Fast when measuring objects with many low-curvature surfaces

Excellent lateral resolution along two axes

Ideal for robotic and stationary inspection systems

Easy sensor setup

Eye safe

Limitations

Cannot be used to scan highly reflective, mirror like surfaces

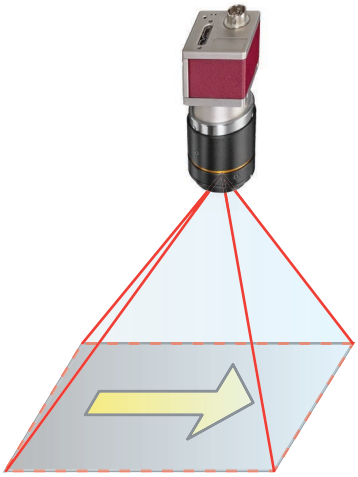
Lower intensity LED lighting can lead to longer exposure times and hence slower overall acquisition

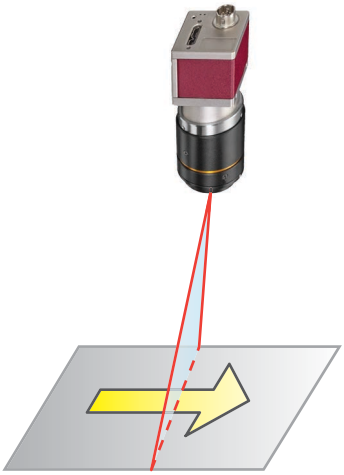
Generally higher cost base than laser triangulation

TYPES OF CAMERA AREA / LINE

One of the main tasks in designing quality control in machine vision is to select the right components. If a camera is used during the inspection, it is important to select the camera with the correct parameters. This is not an easy task, as there are many cameras on the market. The first task is to decide whether to use a LINE or a classic AREA camera. Even though they both perform a similar task, the principle of the image-capturing technology is different.

AREA cameras are very similar, but also diametrically different from LINE cameras. The sensor consists of a matrix consisting of a large number of pixels arranged in rows and columns. The principle is that all horizontal and vertical dots are captured during one exposure cycle.
Compared to LINE cameras, the main difference is that the picture as such is no longer necessary to assemble. The resolution of such a camera can be easily determined by multiplying rows and columns. An example is the ON Semi PYTHON 25K sensor, which has 5120 x 5120 active pixels.



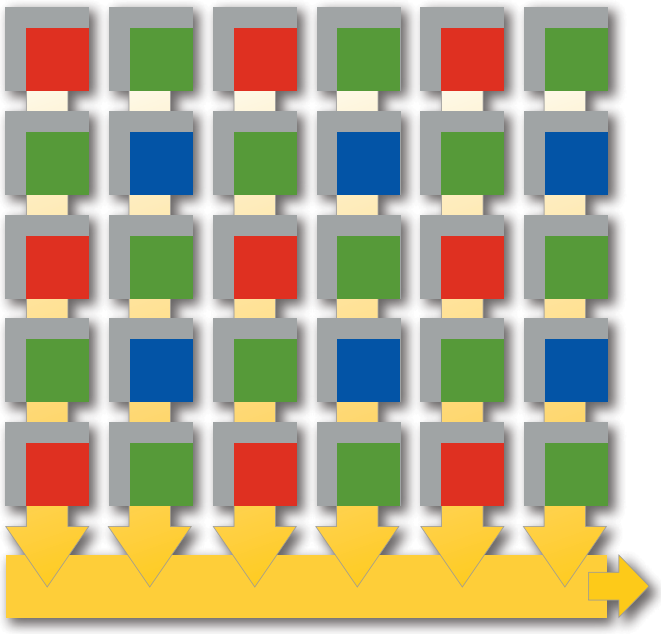


LINE cameras work by taking pictures using a sensor that only scans one line of pixels. This means that the image consists only of moving objects under the camera sensor. The advantage of these cameras is a scanning speed of 16 to 300 kHz. Basically, these cameras have no limited image capture in the axis of the moving object. It is used, for example, in paper mills for optical inspection of paper and the like.

TYPES OF SENSORS

In the case of cameras, the focus is on selecting the appropriate sensor type. The basic division is according to the chip itself. There are two basic types - CMOS and CCD. The difference between them is in image processing and imaging technology.

CCD



Benefits

Low noise

High image quality

High sensitivity to light

High sensitivity in the NIR band

Excellent global shutter

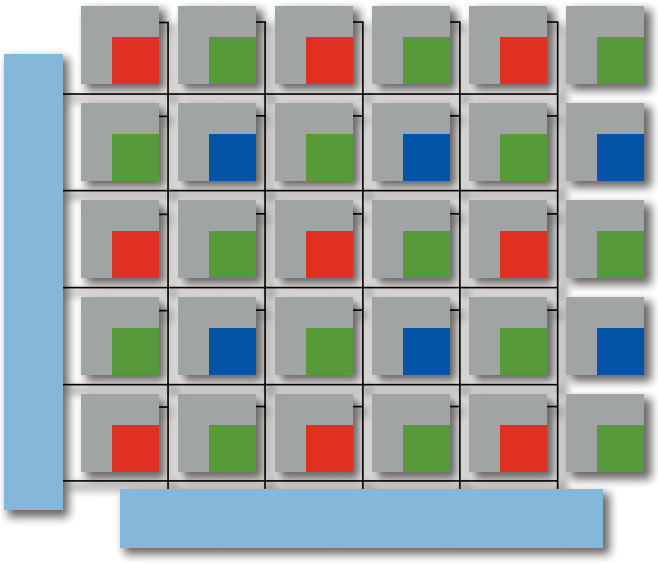
Sufficient signal quality at low light intensity

Limitations

Cells are connected to one bus and rows are sent sequentially - limited number of output nodes

More energy-intensive

CMOS



Benefits

Each cell has its own output and voltage converter

Less power consumption

High frame rate

No flowering

Higher resolution

HDR mode

Less expensive compared to CCD

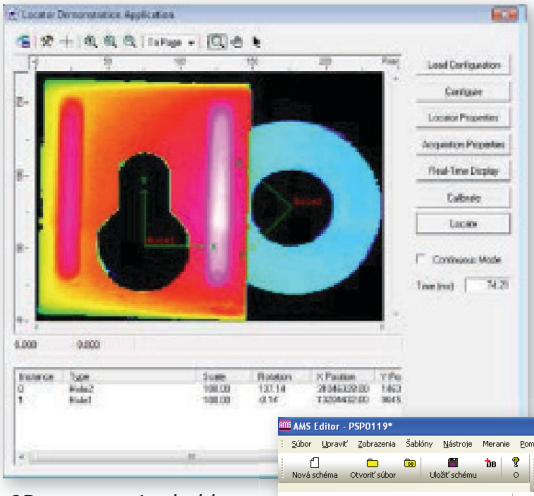
Limitations

Susceptible to noise

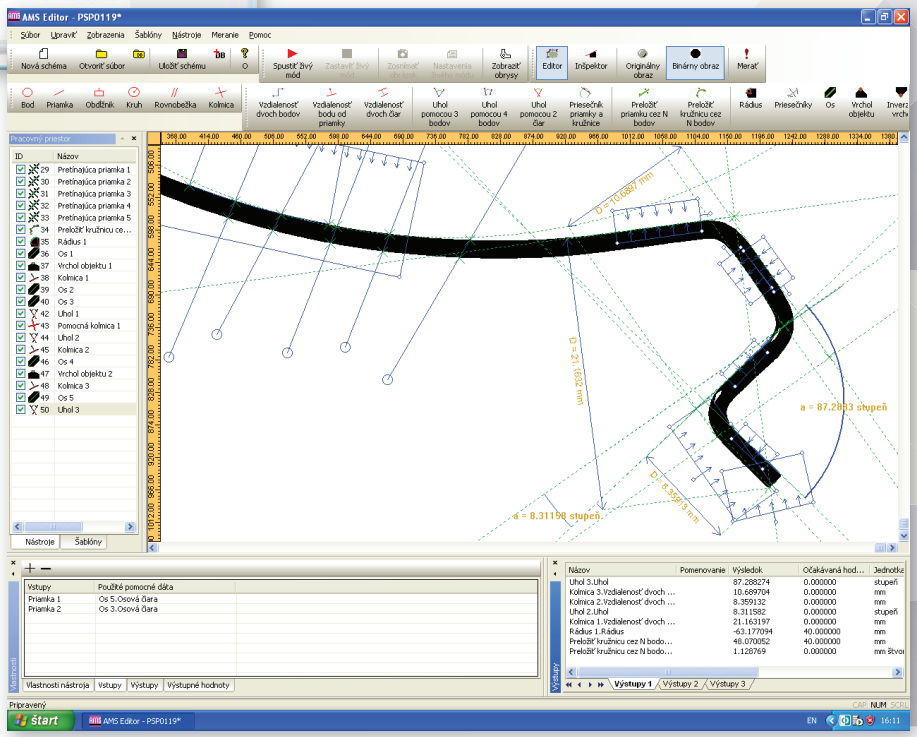
2D SCANNING

2D scanning is based on scanning of objects and subsequent imaging and evaluating of the scanned images. The principle consists of finding the contrast between shades of gray (grayscale) or colored images (color scanning). This control system is used, for example, when checking the geometric shapes of objects (arcs, angles, distances etc.), detection of surface defects (cracks), controling barcode (located on the right place, readability), etc.

This scanning may be used in a random check or as automatic measuring system (equipment may be placed on the automatic production line and system scans automatically each object). The main advantages are versatility, openness, objectivity and reliability of measurement. For serial measurements it is necessary to maintain the positioning of the measured objects in a certain tolerance.



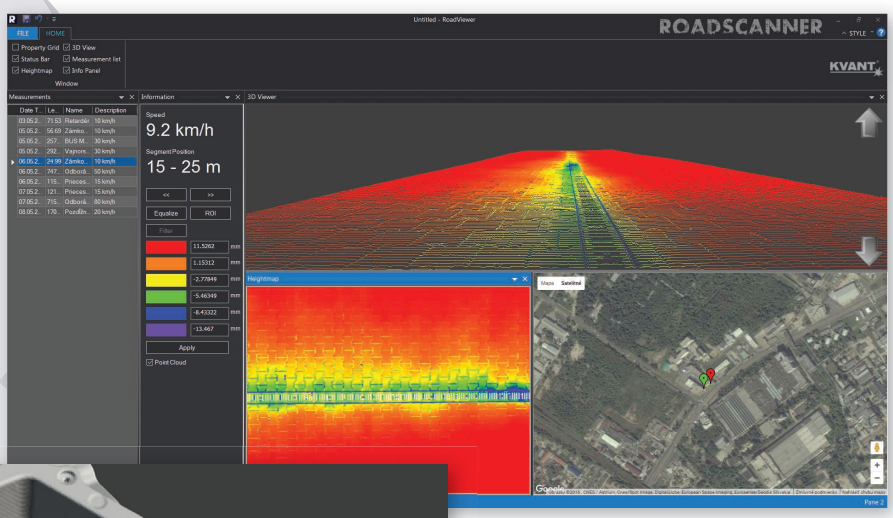
2D scan - engine holder



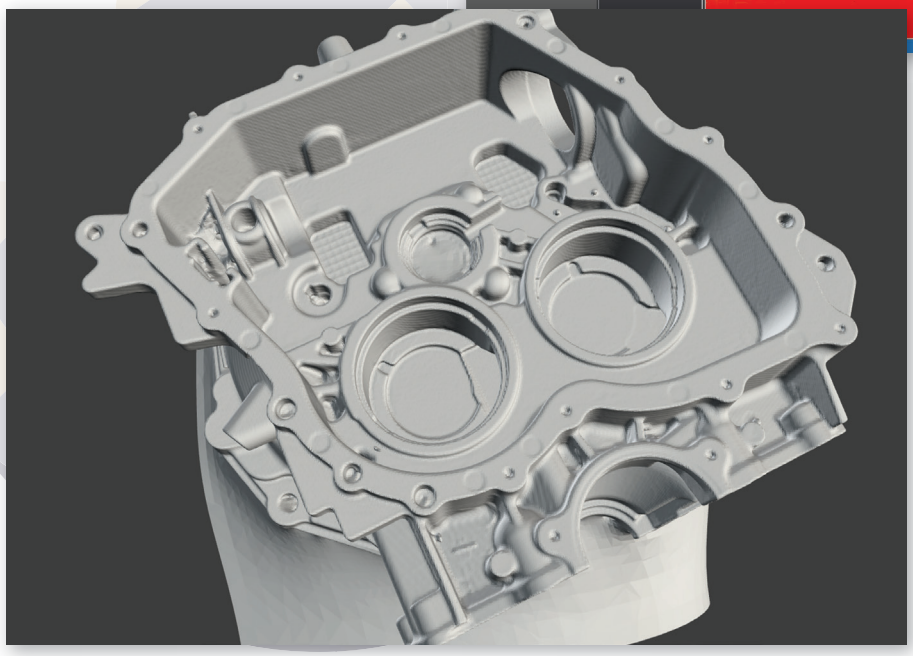
2D scan with measurements

3D SCANNING

Using 3D scanning we get information that with 2D scanning cannot be obtained. This means that we can get the exact shape of the scanned object on which we can measure all surface roughness and the total volume as well. The objects can be moved anywhere in the visual field of the sensor, because the errors caused by incorrect placement are automatically compensated. It means that construction where are placement 3D systems are cheap and easy repairable. The great advantage of 3D scanning is joining cloud points - the ability to capture much larger objects. This is enabled by suitably located and interconnected 3D scanners connected to one system. In this scanning, the principle of triangulation or structured light are used.



3D scan - road surface



3D model - engine cover

METHODOLOGY OF OPTICAL MEASUREMENT

Optical method represents contactless method of measurement and evaluation of geometric parameters of shapes and objects. Optical method allows users to measure geometric parameters that cannot be measured easily using standard mechanical measuring devices. This method allows users to measure faster, more precisely and more reliable in comparison with mechanical methods in addition. The measurement consists of image capturing operation, image processing operations
and camera calibration as follows.

1. Image capturing

The measured object should be placed between digital camera and light source. For the case of optical measurement, using black and white digital camera is the best solution. Illuminated object is projected by lens on the light sensitive chip. The light sensitive chip is located inside of digital camera and it consists of the light sensitive elements (pixels). The light sensitive pixels are sensitive on the light intensity. The light intensity depends on light transmittance of the measured object and background. For each pixel, the light intensity is processed electronically to obtain 8-bit digit value, which represents 256 levels of the light intensity. So we have a light image that consists of the pixels and each pixel has got color in frame of grey scale (0-256), depending on light intensity.

2. Binarisation

The light image is processed by software in the next step. For the light intensity, the threshold value is chosen (e.g. 100) and the color of the each pixel is changed in dependence of intensity value. If the light intensity is lower than threshold value, color will be changed to black and white for the others. This method allows user to separate object and background, so user can obtain the best contrast between measured object and background. This process is called binarisation.

3. Camera calibration

After the binarisation, we have a light image of the measured object and background, which consists of the pixels and each pixel, has black and white color, depending on the light intensity and threshold level. It is easy to count how many pixels belong to each geometric parameter of the measured object. According to previous, if the object with the known geometric parameters is placed between digital camera and light source, it is easy to calculate how many pixels belong to each parameter. So we have got a pixel dimensions. This process is called calibration of the measurement.

If the object, which geometric parameters are unknown, is placed between camera and light source, we can easily calculate unknown parameters, because we know pixel dimensions and count of pixels. It is really required to keep distance between measured object, camera and light source, because of calibration. In the other case the image size is changed. For the case of optical measurement, it is recommended to place the measured object as far away from the digital camera as it is possible, because of image distortion. In the other case the image distortion take a part and measurement is effected. If there are no possibilities to place the measured object as far away from the digital camera as it is possible, the telecentric lens should be used. When angular measurements are required, the camera calibration is not needed.

USED IN THE FIELD

CLOTHING

PHARMACY

WOOD INDUSTRY

AUTOMOTIVE

PAPER AND CELLULOSE INDUSTRY

FOOD INDUSTRY

TRAFFIC

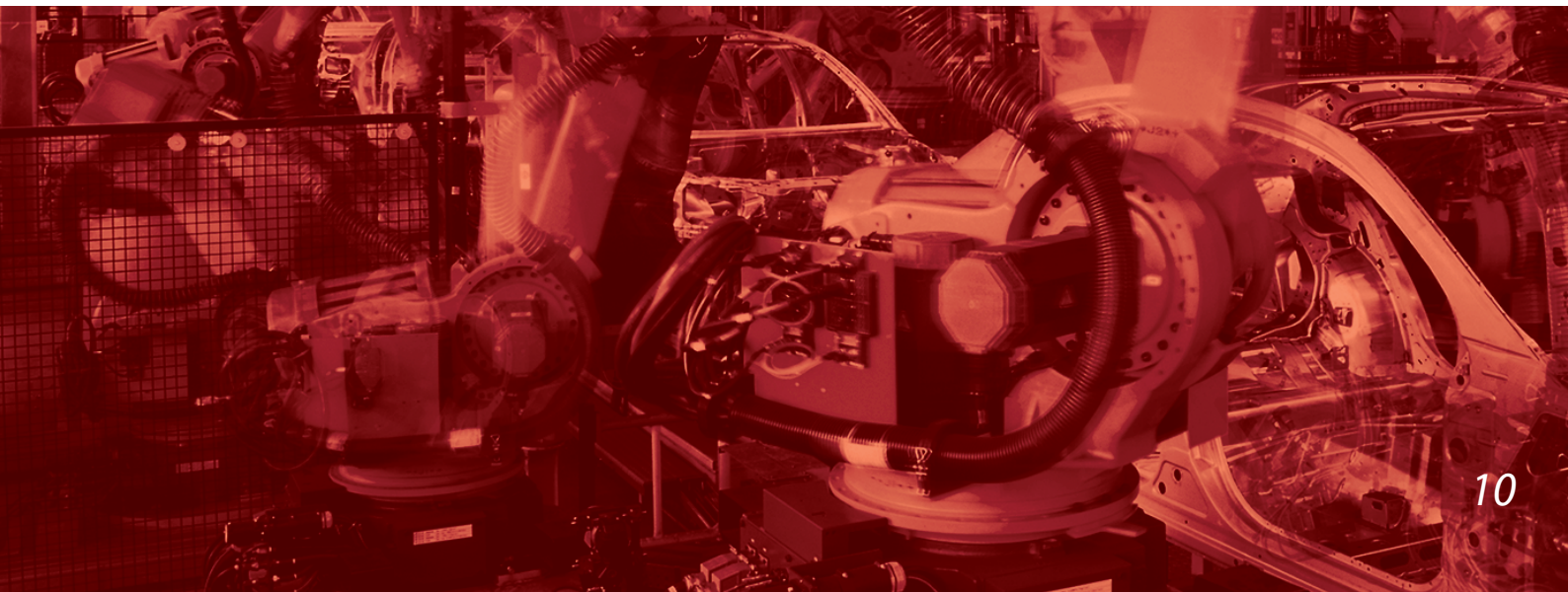
ELECTROTECHNICAL INDUSTRY

ENGINEERING INDUSTRY

TEXTILE INDUSTRY

RUBBER INDUSTRY

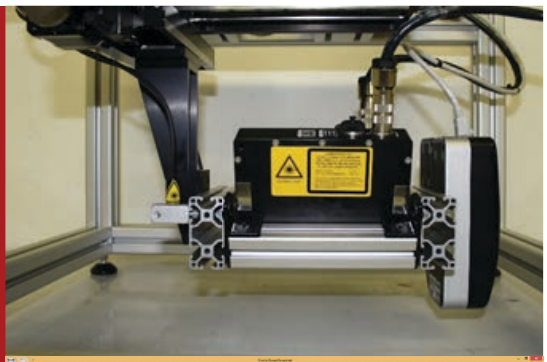
BUILDING INDUSTRY

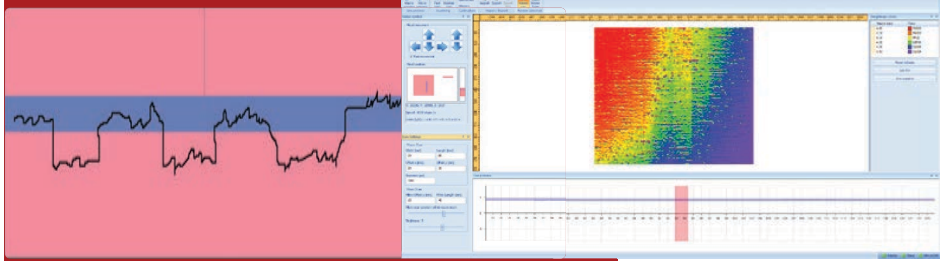


REAL APPLICATION

STATIC SCANNER THE ROAD SURFACE

Hardware equipment and software applications scan the road surface at high resolution. For scanning 3D model of surface and its evaluation.



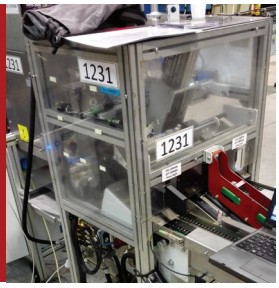


AUTOMATIC QUALITY INSPECTION OF SLIDING BEARINGS

The system operates in real time, using a algorithm of correlation is suitable for deployment directly in a production line. Quality of parameters are visually checked with his basic structural elements.

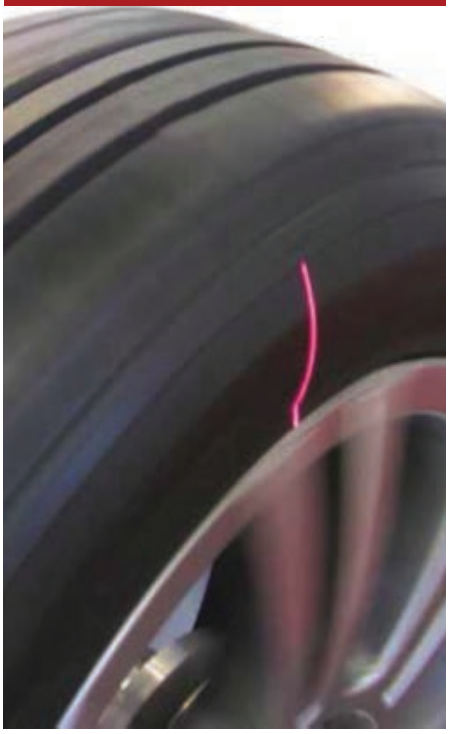
CONTROL OF SHAFT SURFACE

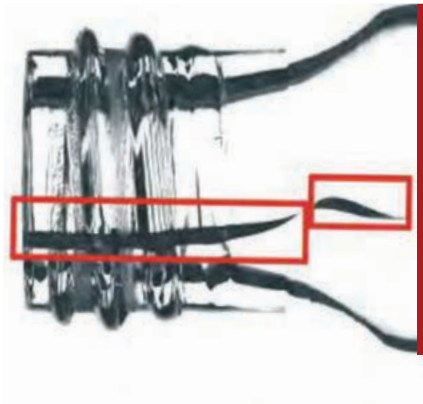
The system evaluates the roughness of individual parts and sorts them according to the quality of working.



MEASUREMENT TIRES PROFILE

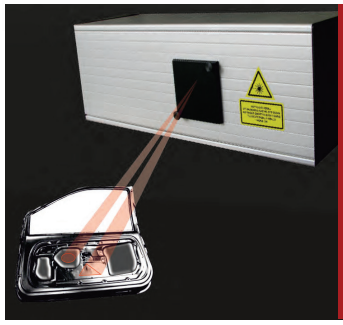
System with using of 2D triangulation measurement profiles of automobile tires. Implementation using a laser profilometer.





INSPECTION OF CRACKS IN THE NECK OF VIALS

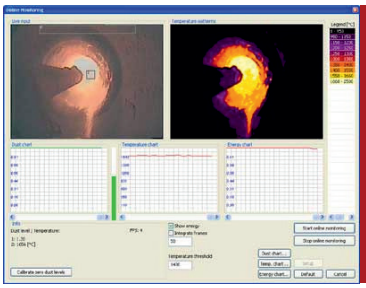
Check for the presence of cracks in the neck glass bottles. The system achieves high speed and reliability evaluation (cycle 0.6 seconds)



NAVIGATOR

Is a device that is used for laser projection. Can be deployed anywhere where you need to repeatedly place parts, artwork or where you need to replace mechanical templates.

REAL APPLICATION

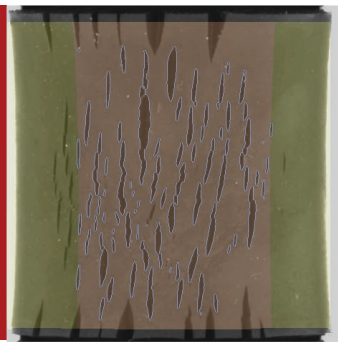


MONITORING THE CONSUMPTION PROCESS

Flame Analyze is a system designed to monitor the firing process in a rotary kiln in a cement plant. It allows the evaluation of temperature and dust throughout the territory in defined areas, as well as the radiation energy of the system.

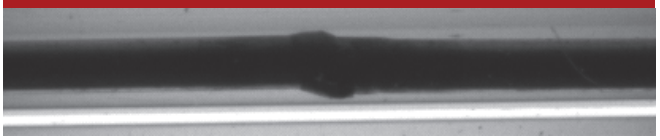
INSPECTION OF MICROCRACKES ON RUBBER SAMPLES

EOL (end of line) tester for sample control. The samples are exposed to ozone to simulate the aging of the tire. The sample is then placed in a tester where, using optical inspection methods, cracks are evaluated and classified with micrometer accuracy. The system uses 5 industrial cameras and laser modules, with a total resolution of 25 Mpix.



GLASS POSITIONING AND CONTROL TUBE

The system is used to position a metal object inside the glass tube. The PLC outputs enable precise positioning using sub-pixel logic. The system also evaluates cracks in the glass tube. Two laser projectors and a camera system are used. The program works in real time and is deployed in production for in-process quality control.

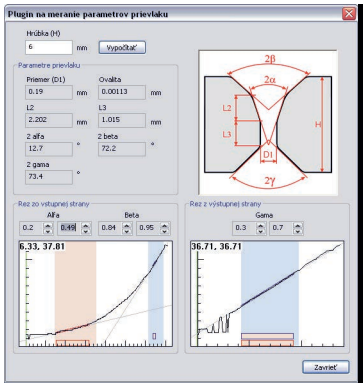


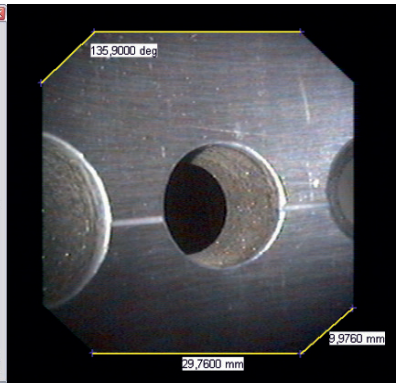
METEOR OBSERVATION SYSTEM

The system consists of a full-sky fish-eye lens, an optoelectronic amplifier unit, and an imaging section with a digital video camera. It contains temperature, rain, wind and sky light sensors. It is intended for observation of meteors, eventually for meteorological, geophysical, aerial and satellite observations.

HIGH DEFINITIONS SENSING

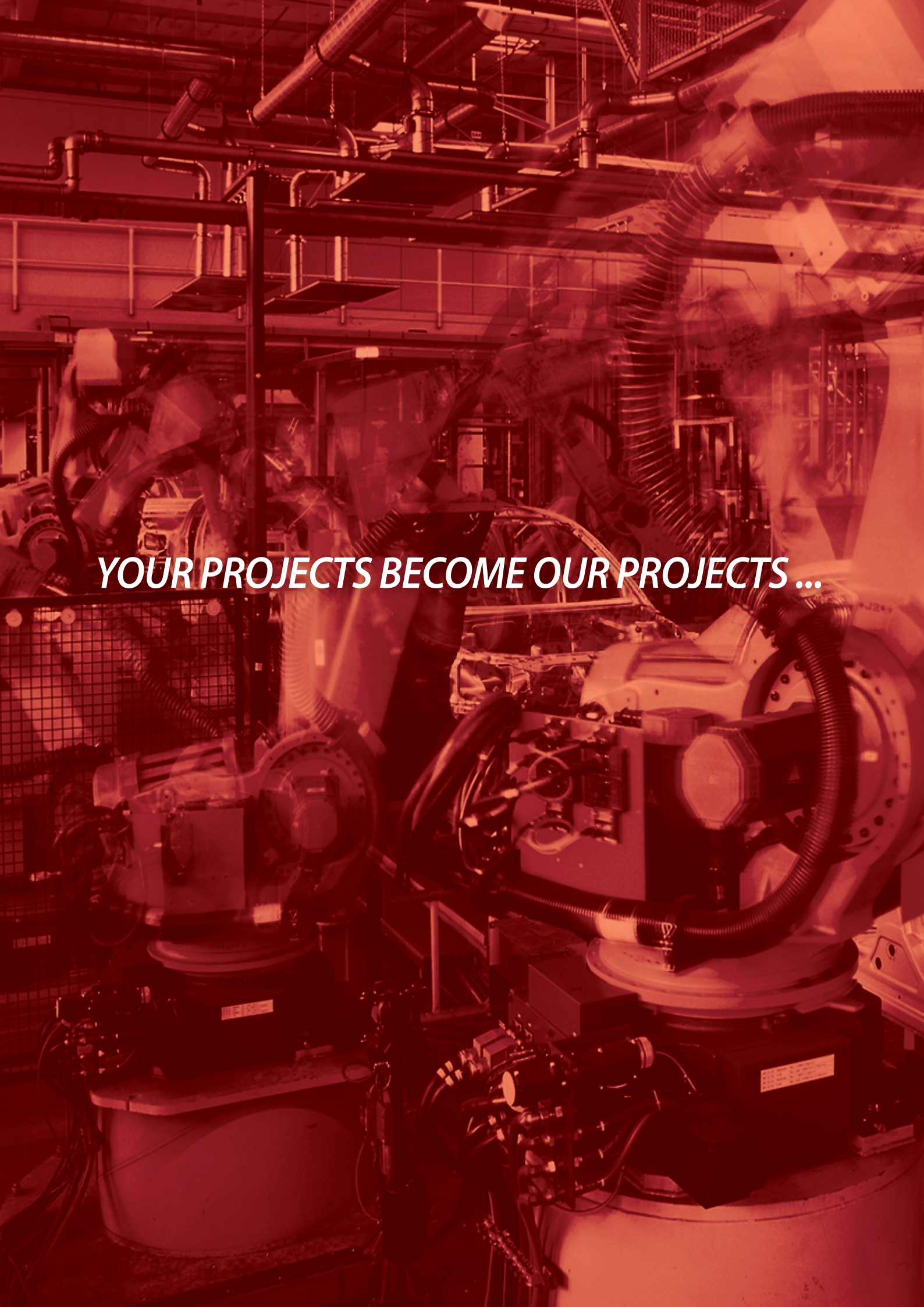
The MicroFocuScan (MFS) system is used to reconstruct a three-dimensional model of the surface of microscopic bodies. Can create a surface model along with a colored surface texture. The measured data can be further processed and displayed in 3D view.





LIST OF IMPLEMENTED QUALITY CONTROL SYSTEMS

- Dynamic scanning the road surface
- Static scanning the road surface
- Measurement of Interior lighting
- Measurement of vehicle profile.
- Measurement of body color
- 3D scanner
- System for recording high definition video
- The system for control of surface roughness and waviness under the waterjet
- The system for classifying objects in microscopic examination
- Ballistic system for the comparison of fingerprints
- Measurement semi-automatic quality inspection of frames cans.
- Scanning of diagnostic strips
- High-speed measurement
- Automated System AMS
- Automated System AMS Designer
- MicrofocusScan (MFS)
- The system for checking the presence of design elements for plain bearings.
- Quality inspection of ampoule
- Compact laser profilometer LPM
- Inspection of cracks in the neck of vials
- Automatic quality inspection for 2D profile rubber bands
- Off-line system for optical measurement of dimensions of the spring
- The automatic vibration control engine output
- The automatic monitoring of the flame in the furnace
- The system for measuring the profile of the tire


YOUR PROJECTS BECOME OUR PROJECTS ...

KVANT®

KVANT spol. s r.o.
Odborarska 21
831 02 Bratislava
Slovakia

Contact:
qi@kvant.sk
+421 260 297 885