

## Implementation issues in visual systems for wood quality testing

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**Abstract:** *“Implementation issues in visual systems for wood quality testing”*. The chosen problems in work were introduced during use of visional systems to investigation the quality of wood. It the problems were have the self - characterized was connected from wood material, with limited possibilities of devices how also with economy and the functioning the market.

*Keywords:* machine vision, wood quality, forest industry

### FOREWORD

Visual systems are more and more often used in various branches of industry due to a continuous development of automation, search for methods improving product quality and economic considerations. The process automation ensures higher production rates, cost reduction and better product quality. Visual quality control systems provide contact free, automatic control in a production, processing or assembly process. The systems provide real time monitoring, detection of parameters and defects, and data exchange with automatics enables elimination of defective products. A high quality control speed (up to several analyses per second) and 24 hour operation are two main merits of this solution. It provides near 100% accuracy, and significant reduction of unnecessary costs, as a consequence of production and sales of defective product. A possibility to use the system in locations, where people presence is required, in areas hazardous to health and where required by environmental protection considerations is also a great merit. Considering the benefits of the solution, a visual control of product quality is more often used also in the wood industry.

### TEST METHODS USING VISUAL SYSTEMS

The visual systems are used mainly for quality control and verification of production line operation. The systems may be used for various tasks.

Four main type tests are:

1. Verification of dimensions and validity. Verification of tolerance and shape. Comparison with reference standards.
2. Testing surface quality: cracking, roughness, texture, scratching, improving layer thickness, colour monitoring.
3. Verification of the assembly. Is the product assembled as intended and no components are missing?
4. Verification of product functions.  
Counting and 1D and 2D bar codes and ASCII characters reading systems.

### IMPLEMENTATION ISSUES IN VISUAL SYSTEMS FOR WOOD TESTING

#### Related to wood materials

The biggest issue with the coarse wood is its roughness. The falling light dissipates and casts shadows. For surface roughness measuring systems this effect is useful, and it presents

problems in other cases. The image analysing software may recognize shadows as defects or different wood tinge (if the feature is tested). There are also issues related to wood drying and storage that affect the image analysis process.

The wood changes colour when dried and the stains from spacers may occur. The algorithm may treat it as a defect. Changes in sun exposure and humidity may affect wood tinge in improper storage conditions. Also a location of material in packages and stacks, where lower layers may become darker after prolonged storage is of significance. Keeping the boards clean is a condition necessary for accurate defect detection. At all production stages, the boards are subject to incidental soiling, e.g. with sawdust, bark etc. A wood internal structure is also important. The features, such as spring or summer wood, reaction wood, transverse direction etc. may affect the image analysis.

### **Issues related to limited device capabilities**

The main issue is a complex wood structure. To create a general purpose knot detection system it is necessary to consider many species and create an extensive pattern data base using various algorithms depending on the type and kind of knot. The knots can be detected with various special filters, histograms, round area detection systems or density disturbances (X-ray). Each system must be adapted to specific production process, species and defect. Lighting, which present problems for each control method is still an unresolved issue. The layout of shadows in coarse material may affect image analysis, and is crucial at detection of shadows in wood and veneer, and suitable cameras and lighting are used to obtain reliable results by trial and error method.

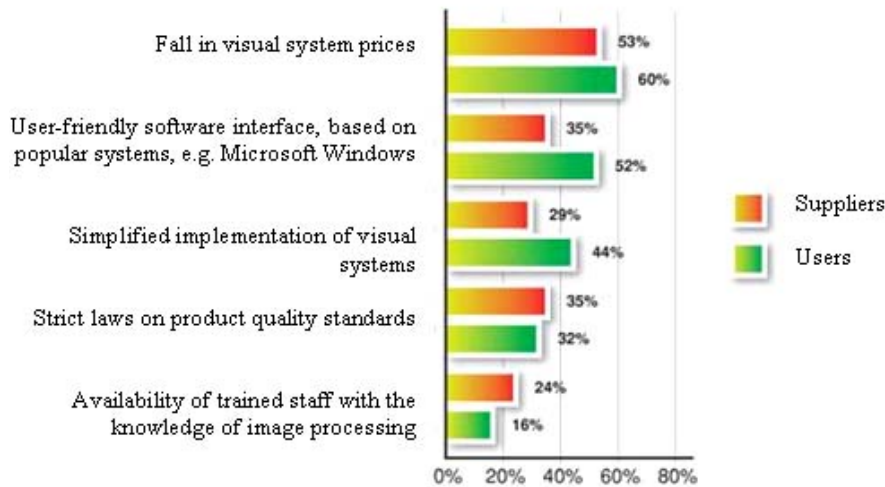
### **Issues related to economy and market operations**

The issue is related to the willingness of plant owners to install the visual systems. There are several foreign companies that specialize in implementation of devices in timber industry, including:

- Microtec – measurement of quantitative, geometrical and structural features of wood,
- Inx Systems – machines for sawmills and timber grading,
- Raute Wood – general purpose equipment,
- Sicam Systems – wood measurements at all production stages,
- Ultimizers, Inc – process optimization.

Microtec is the main distributor of the solutions in Poland. The first barrier is the cost. Prices from several thousand to a few hundred thousand Polish zlotys indicate that the solutions for different requirements and needs are available. The fear for misspending a large amount of money is greater than the prospective benefits. The second issue is the availability of the solutions. The offer of companies specializing in visual systems does not usually include the solutions tailored to wood industry.

### Reasons for the increase in visual system popularity



Graph no. 1 Reasons for the increase in visual system popularity in Poland.

(Source: Control Engineering Polska)

### SUMMARY

Visual systems are widely used in wood industry, mainly as a method for wood quality control. Nowadays, to maintain competitiveness of products, the use of visual systems is indispensable. The wide range of devices and manufacturer's experience provide visual systems compatible with almost every control process available. From optimization of measuring processes in sawmills to detailed control of wood surface at various processing stages. The systems perform well in quality control of veneers, and in combination with automatic defect cutter, the timber can be graded by tinge with simultaneous knot and heartwood detection. They can also be used in complex assessment of wood including measurement of dimensions, detection of surface defects and X-ray tests for detection of hidden defects. Visual systems require continuous improvements and further studies. The main issue is the structure of tested materials. The wood as an anisotropic material is available in a wide range of species, it is characterized by a great diversity and is hard to analyse considering the quality. The other issue is a constant development of production automatics where the discussed systems are an essential component.

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Streszczenie: „*Implementation issues in visual systems for wood quality testing*”. W pracy przedstawiono wybrane problemy podczas zastosowania systemów wizyjnych do badania jakości drewna. Scharakteryzowano problemy związane z materiałem drzewnym, z ograniczonymi możliwościami urządzeń jak również z ekonomią i funkcjonowaniem rynku.

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