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DEVELOPMENT AND IMPLEMENTATION OF MACHINE VISION SYSTEMS FOR AUTOMATIC PRODUCT QUALITY CONTROL

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In conditions of fierce competition, when consumers are becoming more demanding, ensuring consistently high quality is not only a desirable goal, but also an urgent necessity for the successful operation of any enterprise. Traditional approaches to quality control based on manual labor have a number of significant drawbacks: subjective assessments, limited processing speed, high cost and the influence of the human factor. That is why automation of quality control processes using machine vision systems is a promising and relevant direction [1].

Machine vision is, in fact, the ability of a computer to ‘see’ and analyze images like a human, but with greater accuracy, speed, and objectivity.

A typical machine vision system includes:

Cameras: capture images of a controlled object.

Optics: generates an image on the camera sensor.

Lighting: provides optimal conditions for obtaining high-quality images.

Computing unit: processes images using specialized software.

Software: implements algorithms for processing, feature extraction, classification, and decision-making.

For example, in the automotive industry, systems can track the geometry of the car body, the quality of welds and paintwork. In the electronics industry, they ensure the integrity of printed circuit boards and microcircuits. In the pharmaceutical industry, machine vision is used to check the size and integrity of tablets, as well as the correctness of labeling and packaging.

In the food, beverage, pharmaceutical, and many other industries, all products must have the manufacturer's code, batch number, and product code, as well as the dates of manufacture and packaging. Labeling can combine 1D or 2D codes and plain text to provide information about the product and manufacturer.

Incorrect information on the label can lead to the rejection of an entire batch of goods, so it is very important to check the availability and correctness of the data indicated on the label.

Machine vision systems use optical character recognition (OCR) technology to verify the correctness of the date, product code, batch, and other symbolic information. And if one-dimensional or two-dimensional codes are present in the marking, algorithms for recognizing any modern codes are used [2].

The prospects for the development of this technology are directly related to advances in artificial intelligence. The use of deep neural networks opens up new possibilities for recognizing complex defects, adapting to changing lighting conditions, and continuous data-driven learning. This allows you to create systems that are not only faster and more accurate than humans, but also capable of self-improvement, constantly increasing the efficiency of their work [3].

An analysis of the advantages and disadvantages allows us to conclude that machine vision is a promising field. His influence on the industry will only grow. Most of the disadvantages are related to the current level of technology development and will be eliminated as further progress is made. The development of uniform standards will stabilize the market and increase sales. In addition, machine vision is the most promising area for improving quality standards and automating enterprises [3].

References

1. Мошкин, В.И. Техническое зрение роботов / В. И. Мошкин, А.А. Петров, В.С. Титов, Ю.Г. Якушенков ; под ред. Ю.Г. Якушенкова. – М. : Машиностроение, 1990. – 336 с.

2. Szeliski, R. Computer vision: algorithms and applications / R. Szeliski. – Springer Science & Business Media, 2010. – 812 p.

3. Иванов, П. В. Области применения систем машинного зрения / П.В. Иванов, А.В. Бойков // Записки Горного института. – 2011. – Т. 192. – С. 190.