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Development of an Automated System of Terminal Access to Production Equipment Using Computer Vision

Svitlana Maksymova¹, Artem Velet¹

1. CITAM Department, Kharkiv National University of Radio Electronics, UKRAINE,
Kharkiv, Nauki Ave. 14., e-mail: igor.nevliudov@nure.ua

Abstract: In this article authors propose an overview of the main approaches to solving computer vision problems, with an emphasis on the development of an automated system for terminal access to production equipment using computer vision technologies.

Keywords: Computer Vision, OpenCV, Arduino, Access Control System.

I. INTRODUCTION

Significant growth in the computing power of computers and the emergence of new mathematical models and algorithms in recent years has made it possible to achieve significant progress in the field of computer vision. New technologies based on machine learning make it possible to create reliable solutions for complex tasks of visual image recognition. Many of these solutions have practical applications in the market, and therefore attract more and more investments.

It is the facts given above that explain the relevance of using computer vision in access control systems, because it speaks not only about the high reliability of this technology, but also about the high quality of work

II. ANALYSIS OF THE TASK FIELD

Computer Vision, also known as Machine Vision, is a scientific field engaged in research in the field of automatic fixation and various types of image processing (detection, tracking, identification) using a computer [1].

The increase in the quality of computer vision technology has made it possible to actively use it in various branches of industry and business. For example, many modern conveyors are equipped with automatic mechanisms for checking the quality of parts, correct marking, alignment of parts and other tasks. Also, an example of the use of computer vision technology is the use of company employee identification when entering the work area, thus outsiders will not be able to enter the premises.

The main goal of computer vision is to obtain useful information from an image or a series of images. Tasks can be such as [1]:

- calibration of optical systems, adjustment and synchronization of camera settings,
- determination of the movement of objects (Motion Tracking),
- object recognition task,
- the scene reconstruction task (usually a 3D scene from one or more 2D frames),
- the task of comparing images and identifying changes.

Planned researches will consider the industrial field of application and will develop an automated control system for terminal access to production equipment using image recognition technology - identification of a QR code with information and a face in a photo (Fig. 1-2).



Figure 1. - Employee Identification System



Figure 2. - Access Control System on the Equipment

Physically, computer vision systems consist of an image capture device (a camera or multiple cameras) and a general-purpose computer used for image processing. At the same time, special software tools are used. Many software tools can work "in the cloud", remotely, which allows scaling computer vision systems and centralizing their management [2].

For the effective implementation of the computer vision system, a convenient software platform – OpenCV was selected. It is the most popular free and open source package. It is a library of mathematical algorithms for image analysis, implemented in C++, but has APIs for many popular programming languages, such as Python, Java, Matlab and others.

Following the tradition of the Arduino programming language, you can configure a ready-made version of the equipment access control system.

Following the tradition of the Arduino programming language, you can configure a ready-made version of the equipment access control system.

Algorithms and methods of computer vision can be conditionally divided into two groups:

- "Classic" computer vision, applied when it is necessary to obtain some quantitative information about the image (related to color, shape, number of objects, etc.). It works most reliably in tasks that can be formalized and broken down into subtasks. Most of the methods in this group first obtain useful features from the image and then work with them to solve the problem. QR code recognition refers to the "classical" method [2].

- Machine learning systems, in particular deep machine learning (neural networks). These are complex systems that are much more demanding on computing resources and data volumes, but have been developing rapidly in recent years. Systems of this kind partially imitate human abilities to perceive an image, and therefore allow extracting much more complex information from an image. It makes sense to use such systems in cases where the breakdown of the task and assembly is extremely time-consuming or completely impossible. This method is suitable for face recognition [3].

Computer vision is a growing field of research that is already transforming many industries, as well as everyday human life. The accuracy of pattern analysis and recognition is steadily increasing, enabling the creation of increasingly complex commercial applications. The main trends in the development of computer vision can be summarized as follows:

- Expanding the use of computer vision in industrial systems. Computer vision is increasingly used in medicine and pharmaceuticals, in the production of food products, in the conveyors of technically complex industrial processes and allows to organize a system of control of access to equipment or entrance to an institution.

- Cloud systems. Increasing requirements for computer performance in deep learning systems creates a demand for renting cloud servers for computing, which allows you to perform the necessary calculations faster.

- Robotics. The increase in the use of industrial robots inevitably leads to an increase in the demand for computer vision systems.

III. CONCLUSION

In the course of the work, an analysis was made of modern access control systems.

Authors plan to consider the industrial field of application and will develop an automated control system for terminal access to production equipment using image recognition technology - identification of a QR code with information and a face in a photo.

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