An Electro-Acoustic Devices Recognition Detection System Based on Machine Vision

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Abstract. Aiming at a series of problems, such as low efficiency, low quality and high error detection rate, in the manufacturing process of various electro-acoustic devices, a recognition and detection system based on machine vision technology is proposed. Electroacoustic device were collected to patch the image threshold segmentation, feature points of the special points and electroacoustic device noise in image segmentation, and then to get the edge detection and binarization image set according to the characteristics of characteristics of electro-acoustic device patch contour recognition and extraction, realize the automatic recognition and detection of electroacoustic device. The system has successfully carried out the identification and detection test of electro-acoustic devices, and has high identification and detection efficiency and accuracy, high stability of the system, which has great practical application and promotion value.

1. Introduction

With the development of science and technology, the image recognition technology in the working intelligence has been widely used in people's life. As a sign of the development of information technology, the image recognition technology in the working intelligence has occupied an important position in the information development. The important principle of image recognition technology in artificial intelligence is pattern recognition of pictures. Pattern recognition is not only an important part of the principle of image recognition, but also an important part of artificial intelligence technology. Machine vision technology is a comprehensive technology involving computer science, optics, pattern recognition and other fields [1]. Machine vision technology is a subject of analog optical signal acquisition, analysis and processing. Image-based bar code recognition belongs to the research category of pattern recognition and is mainly applied to intelligent terminal, object classification and other fields [2]. Image of the detected object can be acquired by image sensor CCD or CMOS. At the same time, computer simulation of human recognition method is fully utilized to analyze and identify images. Computer vision technology, with its characteristics of non-contact, easy to use, low cost, by the widespread attention [3-4], in the past few years, the machine vision technology has been from the
With the rapid development of computer technology, machine vision technology has been widely used in all walks of life. Appearance detection, product sorting, product identification and other typical application areas [5-7]. With the rapid development of industrial automation, the demand for computer vision detection technology will surely increase in the coming years. Meanwhile, with the mass production of machine vision products and the continuous improvement of visual processing methods and technologies, sophisticated visual detection and processing equipment will also be largely integrated into real life.

With the rapid development of electronics manufacturing, loudspeakers are increasingly widely used in automobile, communication, transportation and other fields [8]. With the rapid development of China's economy and society and the evolution of global economic integration, foreign high-tech industries are gradually occupying China's manufacturing market, the competition among loudspeaker enterprises becomes more and more fierce. However, for an important section of the production line, layered packing is far from reaching the automatic standard [9-10]. At present, the traditional method of manually stratified packing has great defects. That is, in the packing process, because of human factors caused by the phenomenon of leakage. Application of machine vision in detection of industrial products, industrial products quality is very important for people's life, at the same time it is also a huge demand for food, how to ensure the quality of food at the same time increase the productivity of the product to become enterprises focus on problems, due to the low efficiency of artificial detection of food quality, computer vision detection instead of artificial detection has become the developing trend in food testing. Machine vision technology has been deeply applied in tobacco, surface inspection, printing, pharmaceutical packaging, PCB board, automotive lights and other industries. Relevant requirements such as detection and measurement are also constantly emerging. Machine vision technology has gradually become an indispensable link in the production process of all walks of life.

Therefore, a recognition and detection system of electro-acoustic devices based on machine vision technology is proposed. Real-time recognition and detection of electro-acoustic devices in the production process are carried out by machine vision technology, and the results of recognition and detection are fed back to the control end in real time, realizing automatic and intelligent identification and detection of electro-acoustic devices.

2. Overall framework design of identification system

Electroacoustic devices are characterized by small volume, black surface color and mass production, which requires that the identification and detection system must have high identification and detection stability, real-time and accuracy. The identification and detection system of electro-acoustic devices developed and designed is mainly composed of hardware part and software part. The communication between hardware part and software part and between software system and control end is mainly conducted through gigabit network to ensure real-time identification and detection of the system.

![Figure 1. Identifies the overall framework of the software system](image-url)
3. Hardware design

3.1. Industrial cameras
Electro-acoustic devices are characterized by small volume, mostly black surface, and a large number of electro-acoustic devices, which require high identification and detection timeliness. Through comprehensive analysis, an industrial camera with a planar array of 2 million pixels is selected. The specific model is mv-ged200m-T, in which the pixel size is 4.4um and the frame rate is 31fps.

![Real picture of camera](image1)

**Figure 2.** Real picture of camera

In order to ensure the accuracy of later identification and detection of electro-acoustic devices, the determined industrial camera is a black and white camera, and the spectral characteristic curve of the camera is shown in FIG. 3.

![Spectrogram of the camera](image2)

**Figure 3.** Spectrogram of the camera

3.2. Industrial lens
In order to obtain high quality characteristic images of electro-acoustic devices, it is very important to match the industrial lens of the camera. Combined with the determined camera model parameters, the pixel of the lens used by the software system with the camera is 3 million FA lens, the focal length is 50mm, and the lens distortion rate is less than or equal to 0.8%. Figure 4 shows the real picture of the lens.

![Real picture of lens](image3)
3.3. The light source
Light source is a very important component in machine vision system, and it is also the key to the success of machine vision system. According to the characteristics that the surface of electro-acoustic devices is mostly black, the light source in this system is red light source, which can effectively overcome part of the ambient light and improve the image quality to the greatest extent. Therefore, this software system determines that the type of red light source is LED light source of mv-hlh-50r/G/B/W45, with lamp bead Angle of 45° and outer diameter of 120mm. Figure 5 shows the real picture of the light source.

4. Software design

4.1. Overall framework of software system
The proposed intelligent identification and detection software system of electro-acoustic devices based on machine vision technology can identify and detect electro-acoustic devices in real time, and display the results of identification and detection in real time at the control end. For those unqualified in identification and detection, signals will be sent, and finally it will be eliminated. The process flow chart of the whole software system is shown in figure 6.
Rapid and automatic identification and inspection of electro-acoustic devices can be carried out in real time, and the results can be fed back to the control end in real time. This requires that the designed and developed software system has a high stability and reliability, as shown in figure 7, the main interface of the electro-acoustic device identification and detection software system.
5. Experiment and analysis
In order to further verify the stability, reliability and accuracy of identification check of the system, improve the comprehensive performance of the developed and designed software system. In the production of the same batch of electro-acoustic devices, 100 pieces of electro-acoustic devices were selected, and two groups of tests were carried out in the same environment, each group of tests were carried out for 6 times, and the test results were recorded successively. The specific usage results are shown in Table 1.

Table 1. Experimental data

| Number of test | Measurement category | Time /s | Qualified products | Mistakenly identified product | Error detection rate /% |
|---------------|----------------------|---------|--------------------|-------------------------------|-------------------------|
| 1             | a                    | 298     | 99/100             | 1                             | 1                       |
|               | b                    | 293     | 98/100             | 2                             | 2                       |
| 2             | a                    | 294     | 98/100             | 2                             | 2                       |
|               | b                    | 317     | 97/100             | 3                             | 3                       |
| 3             | a                    | 287     | 97/100             | 3                             | 3                       |
|               | b                    | 243     | 97/100             | 3                             | 3                       |
| 4             | a                    | 319     | 99/100             | 1                             | 1                       |
|               | b                    | 292     | 98/100             | 2                             | 2                       |
| 5             | a                    | 329     | 98/100             | 2                             | 2                       |
|               | b                    | 291     | 99/100             | 1                             | 1                       |
| 6             | a                    | 285     | 98/100             | 2                             | 2                       |
|               | b                    | 286     | 98/100             | 2                             | 2                       |

From the above test results, distribution of the two groups of 100 pieces of electro-acoustic device image recognition detection, a set of the maximum time for 329 seconds, two groups used maximum time for 317 seconds, the time is near, a set of error detection rate was 3%, the biggest two groups error detection rate was 3%, the largest visible identification check stability of the system is higher, identify the inspection accuracy is higher.

6. Conclusion
The designed identification and detection system of electro-acoustic devices has good identification and detection performance of electro-acoustic devices. Through test and verification, it is found that the identification and inspection system has high identification and detection efficiency, and the error detection rate is 3%. The identification and inspection accuracy is high, which meets the requirements of automatic identification and inspection production line of electro-acoustic devices. It has a high practical value of promotion and application and a broad market prospect.

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