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Research on Intelligent Control Positioning Detection System Based on Machine Vision

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Abstract. In recent years, China's economic level and technology level have been significantly improved, so people have developed an intelligent control positioning detection system based on machine vision. The generation and application of this positioning system effectively improve the accuracy of positioning, and its stability is also very high. Therefore, the emergence of this system has met the current high-efficiency production requirements of the manufacturing industry and has a positive impact on the development of the manufacturing industry. In this paper, the intelligent control positioning detection system based on machine vision is deeply analyzed, and the author's own opinions are presented for reference.

1. Introduction

The machine vision system mainly uses photoelectric imaging, computer image processing, and pattern recognition technology to detect and locate objects. Compared with traditional manual and mechanical detection and positioning, the advantage lies in its ability to perform non-contact detection. At the same time, the positioning is more accurate, the use cycle and production efficiency are improved, and the requirements for high-efficiency production in modern manufacturing are met. Machine vision technology is an emerging science with obvious advantages, great development potential, and open interface. Programmers can improve according to needs. Compared with the original detection and positioning system, this system has higher accuracy and its life span is also longer, so the emergence of this system is of great significance.

2. The composition of the intelligent control positioning detection system

2.1. Components of machine vision

Machine vision is composed of many parts, among which the important and common parts are lens, monitor, light source, etc., as shown in Fig. 1. Machine vision is a comprehensive technology, so it contains many aspects of technology, such as mechanical engineering technology, optical imaging technology, etc. Machine vision focuses on practicality, requiring it to be used in harsh environments, and also has safety and versatility; in short, machine vision must have high strength, high precision and practicality.

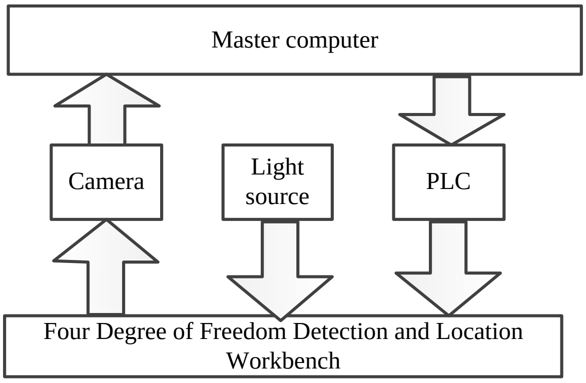

Figure. 1 Machine vision system components

2.2. The architecture and main components of intelligent control positioning detection system

The intelligent control positioning detection system is composed of two parts, namely machine vision and motion control. Machine vision mainly consists of a light source, a charge-coupled device, etc. First, the CCD is used to convert the positioning object into an image signal. After that, the image signal can be converted into a digital signal by A/D, and then the digital signal is transmitted to the image processing system; this system extracts the characteristics of the object through accurate calculation based on the brightness and color and other related information. The operation control part mainly includes Mitsubishi servo motor and motion control card [1].

3. The working principle of the system

3.1. The principle of image processing

In the visual part of this intelligent control positioning detection system, there is a Japanese industrial-grade camera with 800,000 pixels and a Japanese industrial-grade camera with 300,000 pixels. There is also a research-grade lens with 12x zoom and 12mm fine-tuning focus function and a CCS Co., Ltd. machine vision special light source. The system is driven by the use of a screw. When the screw is rotated once, it can be forwarded 5mm. The encoder pulse is set to 4000 per circle. The pixel accuracy of visual positioning is 839.84375nm [6]. Image processing flow is shown in Fig. 2.

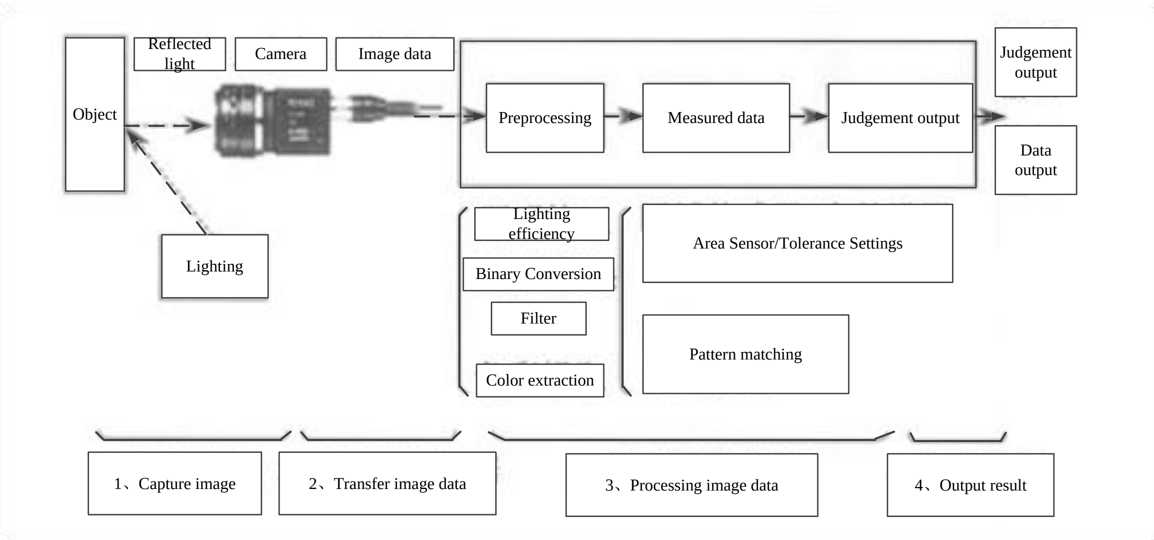

Figure. 2 Image processing flow charts

3.2. Determination of the Mark cross

The first step is to build a simple worktable model. The worktable itself has complexity, so it is extremely difficult to determine its characteristics. In this case, this paper constructs a relative coordinate axis outside the worktable, where the xOy plane is the coordinate axis and the O point is the origin. When the worktable changes, the origin coordinates are not changed. On the outside of the worktable, you need to translate the coordinate axis and then construct the relative coordinate axis x'Oy'. Based on the above, the following relationship can be derived:

$$\begin{cases} x' = x + \Delta x \\ y' = y + \Delta y \end{cases} \tag{1}$$

Through (1), we can know that the position of the worktable is (x,y), then we can get:

$$\begin{cases} x = x' - \Delta x \\ y = y' - \Delta y \end{cases} \tag{2}$$

In this paper, O is the origin of the coordinates, so we use it as the cross Mark. If you assume Δy 0 at this time, you can get:

$$\begin{cases} x = x' - \Delta x \\ y = y' \end{cases} \tag{3}$$

From the above, it can be found that the O point and the O’ point are on a horizontal line. It is much easier to determine the cross Mark at this time. The position of the center of the worktable can be determined by determining the characteristics of the Mark [2]. The following picture shows a simple worktable model:

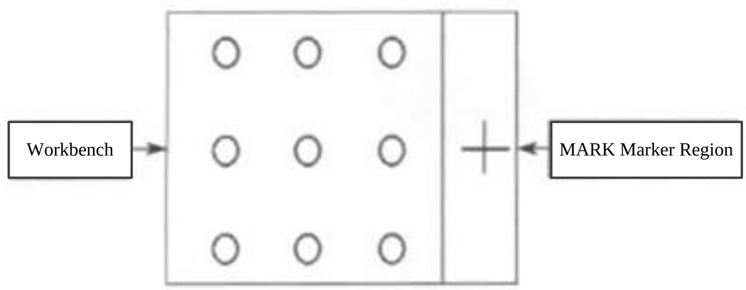

Figure. 3 Simple worktable model

Due to the complexity of the worktable, its characteristics are not well defined, and it is not easy to judge its center position. To this end, the study simplifies the complex problem, establishes the absolute coordinate axis on the worktable, and establishes a relative coordinate axis outside the worktable, as shown in Fig. 4. The xOy plane is the coordinate axis of the worktable, and the O point is called the absolute coordinate origin. Regardless of how the worktable changes, the coordinate origin is always maintained. Outside the worktable, its relative coordinate axis x'Oy' is established by translating the absolute coordinate axis (as shown in the imaginary axis of Fig. 4).

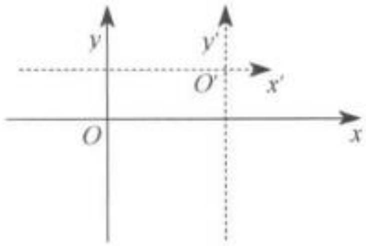

Figure. 4 Coordinated axes model

3.3. The realization of detection and positioning

First, as shown in Fig. 5, the cross Mark (the region of interest, that is, the positioning point, the positioning can be matched by a standard template, or matched by geometric features) on the surface of the worktable on the base platform is learned and the template is saved. Save the position information (the center coordinates of the template and the angle of the template offset) of the template at this time to prepare for the later positioning recognition.

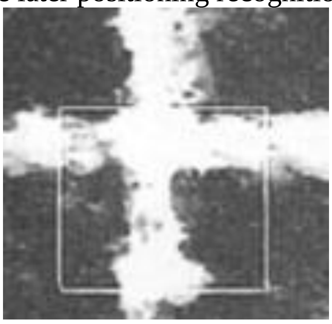

Figure. 5 Extracted Mark

Second, extract the template that was previously prepared, and let the template labeled 0-3 carry out the zero return action. When this action is over, move the 0-2 axis. At this time, the cross Mark point will appear in the shooting range of the camera. Secondly, the shooting is performed, and the image is processed after the shooting. Again, the center coordinates and the angle information of the cross Mark are presented for the initial positioning, and finally the second positioning is performed [4].

Third, compare the image processing information with the information saved by the template, find out the gap, and then use motion control to make up, and finally insert the pin into the jack.

Fourth, after the above steps are completed, the image analysis can draw a clear conclusion, and the conclusion is sent to the external control system to carry out the insertion and dialing work of the plug-in [5].

4. Conclusion

In summary, the intelligent control positioning detection system based on machine vision is more advantageous than the original positioning system. Therefore, relevant personnel should further study the system to make it more perfect, and in actual positioning and more accurate in actual positioning, so as to play its role to promote the development of manufacturing industry. For the development of the manufacturing industry, and considering the complexity of engineering practice, when it is difficult to use machine vision, consider simplifying complex problems and use the concepts of absolute coordinates and relative coordinates to complete the development of more degrees of freedom and more intelligent positioning detection systems.

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