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Design and Development of a Teaching Equipment for Machine Vision Teaching

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Abstract

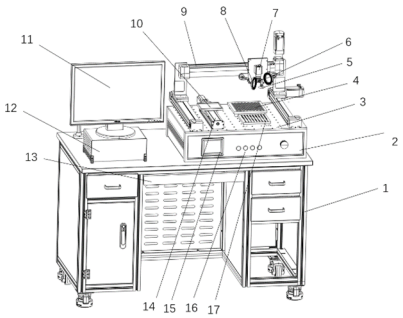
Aiming at the more and more popular machine vision technology, a machine vision teaching innovation platform is designed. The platform includes Cartesian coordinate robot, executive module, electrical control module, electric cylinder sliding table and vision calibration grid module. Industrial camera, light source and single sucker are all located on the end effector of Cartesian coordinate robot; The items to be detected are transported by electric cylinder slide, photographed by industrial camera, analyzed by visual software and sorted by suction cup. The teaching equipment takes the application of machine vision detection as the core, combines with robot technology, positioning, calibration, image processing, measurement, recognition, development of a set of teaching and research in one machine vision equipment.

Keywords

machine vision; Cartesian coordinate robot; teaching equipment.

1. Preface

The machine vision teaching innovation platform equipment has camera cognition and basic use, the existing machine vision teaching products lack application scenarios, and the vision processing operators are insufficient. There is an urgent need for a platform with a wide range of vision processing fields and executable vision processing results. Therefore, the design , Developed a machine that can realize PLC and camera control and communication, light source selection and adjustment, camera picture acquisition and processing, and can realize image acquisition, positioning, image processing, calibration, measurement, identification, logic control, communication and other existing machines Visual function. The overall picture of the equipment is shown in Figure 1.



1-aluminum profile training platform, 2-electrical control module, 3-optical flat plate, 4-visual calibration grid module, 5-single suction cup, 6-Light source 1, 7-camera, 8-light source 2, 9-rectangular coordinate robot, 10-raw material conveying tray, 11-programming software, 12-control inheritance module (including light source controller), 13-keyboard box, 14-electric cylinder sliding table, 15-human-computer interaction interface, 1 6-button, 17 - material storage module

Figure 1. The overall structure of machine vision teaching equipment

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2. Technical Solution

The purpose of this design is to facilitate the majority of students to use for theoretical verification and some small experiments after learning machine vision knowledge. In order to achieve the above objectives, the following technical solutions are provided: the machine vision teaching innovation platform includes a Cartesian coordinate robot, a vision detection and execution module, a control integration module, an electrical control module, an electric cylinder slide, an optical flat panel, and a vision calibration grid module; The vision detection and execution module includes industrial camera, light source one, light source two, single suction cup, and machine vision software; single suction cup, industrial camera, light source one, and light source two are installed at the end of the Cartesian robot and move together with the end; where the light source 1. The two light sources are ring light sources with adjustable angles; the camera is calibrated in the visual calibration grid module to complete the conversion from the camera coordinate system to the Cartesian coordinate robot coordinate system; the material is placed on the raw material conveying tray, and the camera video capture is completed in sequence. Image analysis and recognition, suction cups perform sorting and storage.

The suction cup, industrial camera, light source one and light source two are all installed at the end of the Cartesian robot. The light source one is located on one side of the camera and the suction cup, and the light source two is located on the other side of the camera and the suction cup. The camera is fixed at the end of the Cartesian robot. The height of is higher than the height of the suction cup fixed at the end of the Cartesian coordinate robot to realize image collection.

The first light source is an adjustable-angle ring light source located at the end of the right-angled robot, wherein the connecting rod for connecting the end of the right-angled robot and the light source one is a double hinge structure, the connecting rod is hingedly connected with the end of the right-angled coordinate robot, and the connecting rod and the ring light source Hinge connection realizes adjustable light source angle.

The material conveying tray is located on the electric cylinder sliding table to realize material movement. The electrical control module is composed of a start button, a stop button, a single-direction movement button of the electric cylinder slide, a start/stop button and a man-machine interaction interface for equipment status.

3. Specific Implementation

The technical solutions in the embodiments of the design solution will be described clearly and completely below. Obviously, the described embodiments are only a part of the embodiments of the design solution, rather than all the embodiments. Based on the embodiments in this design scheme, all other embodiments obtained by those of ordinary skill in the art without creative work belong to this design.

A machine vision teaching innovation platform. Single suction cup, industrial camera, light source one and light source two are all installed at the end of the Cartesian robot. Light source one is located on one side of the camera and suction cup, and light source two is located on the other side of the camera and suction cup. The height of the end position fixed at the Cartesian coordinate robot is higher than the height of the suction cup fixed at the end position of the Cartesian coordinate robot, realizing clear image collection.

The first light source is an adjustable-angle ring light source located at the end of the right-angled robot. The connecting rod used to connect the end of the right-angled robot and the light source one is a double hinge structure. The connecting rod is hingedly connected with the end of the rectangular coordinate robot, and the connecting rod is hingedly connected with the ring light source. , The angle of the light source can be adjusted; the second light source is an

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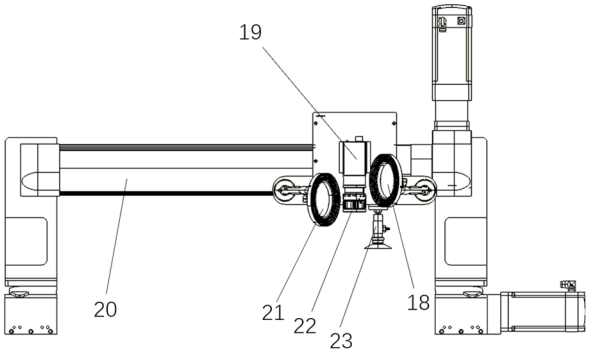
adjustable-angle ring light source located at the end of the right-angled robot, wherein the connecting rod used to connect the end of the right-angled robot and the second light source is a double hinge structure, and the connecting rod is hinged with the end of the right-angled robot Connect, the connecting rod is hingedly connected with the ring light source to realize the adjustable angle of the light source.



18—Light source 1, 19—Camera, 20—Cartesian robot, 21—Light source 2, 22—Lens, 23—Single suction cup

Figure 2. Partial details of the machine vision teaching innovation platform

The raw material conveying tray is located on the electric cylinder sliding table, which can realize the reciprocating dynamic state of the material. Or realize the static state maintenance of the material on the pallet and perform visual static material identification. The electrical control module is composed of a start button, a stop button, a single-directional movement button of the electric cylinder slide, a start/stop button and a man-machine interface for equipment status. Complete the start, stop and manual operation of the equipment.

4. Conclusion

This paper designs a machine vision teaching innovation platform for teaching, which has the characteristics of novel structure, convenient operation, and many kinds of experiments. It can simulate product quality sorting and integrated application. Featured scenes can be used for camera identification and detection of products in dynamic or static conditions. At the same time, further innovation and research and development in machine vision can also be carried out through this equipment.

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