Sorting Workstation with Colour Sensors

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Abstract: The submitted article deals with the issues of component sorting based on the use of their surface colour under experimental conditions.

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1 Introduction

The manufacturing process consists not only of the production itself, but also the product inspection. According to the type of manufactured part the inspection is carried-out on the basis of the accuracy of its finish, colour, functionality, etc. During the inspection various sensors are used, which ensure the objective inspection of the component status. Suitability of the choice of corresponding sensors is decided by the type of inspection which a component is to undergo. The Department uses a camera system with a simple web camera and a computer for these purposes. A new piece of equipment for the inspection of parts is the application of the CZ-11 colour sensor together with the CZ-K1(P) assessment unit.

2 Sorting Workstation

Currently the department of production technology and robotics has various workstations focusing on the use of up-to-date elements. One of these workstations is a sorting cell. It is fitted with two obsolete MX001 pneumatic manipulators with two degrees of mobility. One of them takes components out of the container and places them onto a chain conveyer. The conveyer serves for the transport of components to individual workstation elements. Another manipulator is designated for the withdrawal of components from the conveyer and its placement into a pre-prepared container if the component has been marked as suitable by the recognition device. When it has not been so marked the component

is transported by the system to the conveyer end where it falls into an end container Fig. 1.

Currently the sorting workstation is fitted with a web camera which serves to recognise good and bad components. The camera is connected to a computer via a television card. A programme in Visual Basic has been created to process the image received from the web camera. The programme was able to recognise good and bad components but it was not supported by a computer output. This means that the workstation control system, which is based on "Logo!" automated machines could not obtain information about a recognised component. As currently the programme source code for recognition is not available we decided to fit the workstation with another recognising element. To eliminate the necessity of using a camera with a problematic television card we have selected a recognition sensor for industrial use. Based on price and technical properties considerations we have decided on the Keyence CZ-11.

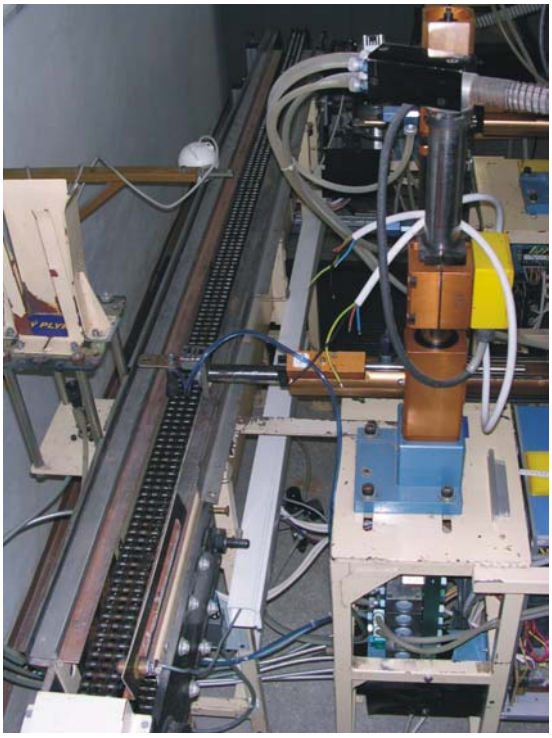

Figure 1
Sorting workstation with web camera

The CZ-11 optical unit detection range is between 3 and 15 mm while the smallest point diameter which can be detected is from 0.9 to 1.5mm. Information from the sensor is processed in the CZ-K1(P) evaluation unit, Fig. 2. The unit is able to

sense and save 8 colours in its memory. These are saved in the so called memory-banks. Information about a sensed object is saved depending on the adjusted mode according to:

- coloured components (R,G,B)
- coloured components and intensity
- only according to the intensity of the received light

Comparison of a sensed object with corresponding values in the memory-banks is carried-out by means of external inputs controlled by outputs from the pneualpha automated machine. The sorting workstation is controlled by two Logo!24RCL automatic machines. The capacities of these automatic machines are fully used and so it has been necessary to use an independent control member to control the colour sensor. The pneualpha automatic machine enables the connection of 12 input signals to the input terminal connector. The number of output relay terminal connectors is 8. By means of three CZ-K1(P) inputs we have the possibility to select individual memory-banks and compare the sensed values with the real one. Based on the evaluation the CZ-K1(P) unit sends a signal concerning the concordance or non-concordance of colours. Using a change-over switch on the evaluation unit we can select the value represented by the output signal in the case of the colour concordance. The sensing of colours can be synchronised through the external input. The calibration of the CZ-K1(P) unit can be done manually by means of a push-button or by means of an external input which is connected to the pneualpha automatic machine. During the installation of the CZ-11 sensor it is necessary to maintain its orientation.

Figure 2
Colour Sensor CZ-11 and evaluation unit CZ-K1(P)

In cases where we wish to select the fast way of searching for colours we can choose the HSPD MODE which provides the answer within 300 milliseconds.

Otherwise, if we prefer the more accurate way of colour detection, we can opt for the FINE MODE.

To verify the colour sensor functionality we have selected two groups of samples. In the first group there were glittering multicoloured samples, the other group contained matt samples. Neither of the groups contained samples of the same colour. In the first experiment we have used the standard "C" mode adjustment. In this mode the sensor had problems recognising colours with the glittering samples. With the other sample it was much better but the sensor was not able to differentiate two shades of the same colour. That is why we have adjusted the mode to "C + I". This sensor mode in both cases displayed good results the sensor recognised coloured samples and did not have problems with recognising two shades of one colour. The third mode"I" did not display any improvement compared with the "C" mode.

Conclusions

The installation of the coloured sensor into the sorting workstation at the Department of production technology and robotics has enabled the elimination of the obsolete web camera and computer. Both these devices have been replaced by a colour sensor which also enables more simple adjustment and manipulation with the sensor. At the same time, the sensor, which recognises up to 8 colours and belongs to the up-to-date elements, can also be applied to other areas of automated workstations. Thus students are offered the possibility to test this type of optical element on real objects.

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