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DOI: 10.15199/180.2023.4.4

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SENSOR CHARACTERISTICS

CHARAKTERYSTYKA SENSORÓW

Summary: *The present paper is the second part of our consideration of the following problem: an attempt to compare the work of the detection sensor with the visual ZFV vision system in the packaging labelling project*

Keywords: *sensor, detection, ZFV vision system, packaging labelling project*

Streszczenie: *Niniejsza praca stanowi drugą część rozważań nad następującym problemem: próba porównania pracy czujnika detekcyjnego z wizualnym systemem wizyjnym ZFV w projekcie oznakowania opakowań.*

Słowa kluczowe: *czujnik, detekcja, system wizyjny ZFV, projekt oznakowania opakowań*

Introduction

Processing of a given physical size into easily measurable electrical quantity is obtained by the sensors. The modern optical sensors are getting smaller and, at the same time, they are characterized by a greater working space and more precise possibilities of determining the switching points as compared to the older models. Greater and greater challenges lead to production of more and more complex vision sensors which detect not only the presence, colour or patterns but also, markers. At present, the sensor is more and more frequently equipped also with the interface for digital communication networks.

Sensor characteristics

The diversity of available solutions from among the sensors forces the need of classifying the sensors. The basic classification – according to the principle of sensor functioning – is as follows:

- mechanical
  - lever-type
  - toothed
  - spring
  - lever-spring
- optical
  - opticators
  - interferential sensors
  - optimeters
- electrical
  - electro-contact
  - induction
  - capacitive
  - photoelectrical
- pneumatic.

Due to the energy source of measuring signal, i.e. activation, the sensors are classified into:

- passive,
- active.

According to the application, we can distinguish the sensors of:

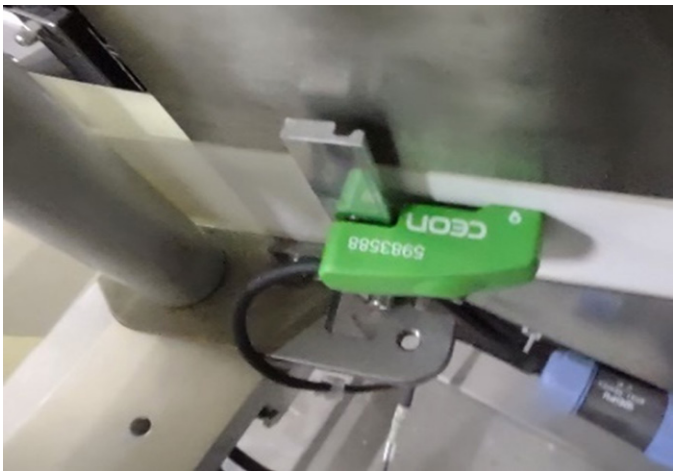
- label
- product.

The sensors can be also classified according to the generated signal:

- generative, and
- parametric.

There will be presented below the examples of the sensors, employed in labelling process: labels, product and colour.

The intelligent sensor of labels CEON as being visible in photos 1 and 2 allows the reliable identification and a precise



Fot. 1. Label sensor mounted on the measuring station

positioning of labelled materials. It is dedicated to paper labels as well as also for thin, transparent of metallised labels. The coins with the nominated value of 5 PLN, as presented in photos 2 and 4, were aimed at the presentation of the size of the sensors.

Fot. 2. Comparison of the size of the CEON sensor and the coin

The discussed sensor is positioned in such a way that the presence of the label is signalized. Diode of the sensor inform about the current state of the switch, i.e. it emits light in during the detection of labels and is extinguished in the breaks in this process what enables the current control of the correctness of the sensor's work. The discussed equipment is self-learning unit, equipped with the mode of work and mode of adjusting. All adjustments are performed using one button.

The sensor of the product, as being illustrated in photos 3 and 4, is responsible for supply of information on the presence of the labelled product on the transporter of the labelling machine. It sends the signal allowing the start of labelling head.

The most common applications of the mentioned above sensor include the detection of a foreign body placed in a certain

Fot. 3. Product sensor mounted on the measuring station

Fot. 4. Comparison of the size of the Pepperl+Fuchs sensor and the coin

area. In the discussed system, the sensor is linked with a light source which is a transmitter, being often integrated in one casing. If any object is found on the optical route between the transmitter and receiver, the change in light intensity will take place and it may be detected. Depending on the construction of optical path, the light stream becomes interrupted, reflected or dispersed. We use often synchronic diodes working at infrared as transmitter; owing to this fact, the output signal is greatly independent on the external light because the visible light can be easily filtered out. Under the difficult conditions, there are employed the reflection sensors of light barrier, working with the red light, emitted by light diode because it is easy to notice such light stream and the point which it falls on.

For such purposes, we may employ visible light, laser light as well as infrared light. The scheme of its functioning is given in Fig. 1.

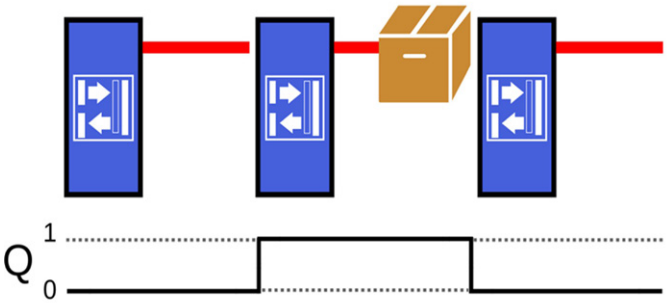


Fig.1. The principle of operation of the product's sensor

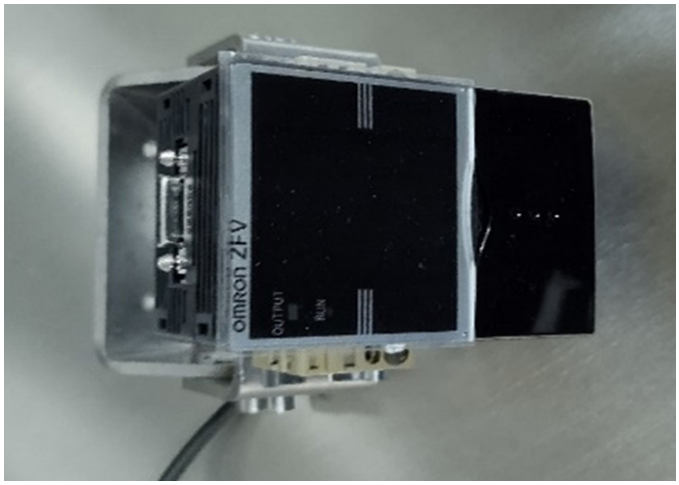
Gradually, when the labels become more and more sophisticated and the shape of packaging is more differentiated, a difficulty appears with obtaining the univocal response from the sensor: whether a given product is found in the appropriate position in relation to labelling head. In such situation, we use detection of the image or detection of its edges. To increase the entropy, i.e. quantity of information transmitted by the image,

the discussed method employs – to a certain degree – the tools of clearing (sharpening) the image, facilitating its automatic analysis. The colour sensors, illustrated in photo 5 play the mentioned role with a success. They are able to detect the colour of the image surface as well as its shape [1]. The sensors emit the red, green and blue light to the controlled objects, calculate the chromatic coordinates of the reflected radiation and compare them with the earlier memorized default (reference) values. If the colour values are found within the set tolerance band, the switching exit is activated.

Fot. 5. KEYENCE colour sensor

The vision system contain also the set of image sensor and converter of images' analysing, being commonly called camera which is illustrated at photo 6. Its application together with the converter given in photo 7 enables the storage of few detectable images in the memory. It is also possible to use a few measuring methods of colour, considering its positions, range, mark, width and brightness.

Fot. 6. Omron ZFV camera



Fot. 7. Omron ZFV Converter

Summing up

The discussed sets enable detection of the products which are difficult to be analysed when using photoelectric colour sensors. The problem is, however, that the complexity of their construction has a greater market value and affects a final price of the labelling equipment. Due to these reasons, it is worthy to determine the profitability limit of the application o the particular positioning systems.

Literature:

[1] https://www.sick.com/pl/pl/zadania/monitorowanie-i-kontrola/jakosc/czujniki-koloru/c/g113666 [Access: 16 October 2021]

Article reviewed
Received: 18.07.2023 r./Accepted: 31.07.2023 r.