Segmentation of production and security areas with SICK LMS 400

NECKAR PAVEL, ADAMEK MILAN, NECESAL LUBOS
Department of Security Engineering
Tomas Bata University in Zlín, Faculty of Applied Informatics
nám. T.G.Masaryka 5555, 760 01 Zlín
CZECH REPUBLIC
neckar@fai.utb.cz, adamek@fai.utb.cz, necesal@fai.utb.cz

Abstract: - Nowadays, the human safety and industrial material processing are connected. Using the laser scanner in combination with software solutions give an opportunity to create dual system, which increases the safety and development of production processes The proposed system uses distance data, which are helpful in decision-making whether the person is located in the area of production or not. It can also work in a production scale. The created software thus supports the dual function (production and safety).

Key-Words: - laser, scanner, segmentation, production line, security areas, human safety

1 Description of the laser scanner SICK LMS 400

The LMS 400 uses the principle of the phase shift (the continuous wave) with the wavelength 650 nm (the visible ray). The propagation time of the light and the wavelength uses the phase shift results between the ray sent and the ray received. This phase difference is converted to the frequency. The system determines the distance of the object from the zero point based on this frequency. The minimal and maximal measured range begins from 0.7 m to 3 m, but the period between 0m and 0,7m is a problematic range with a distance anomaly. The measurement of the maximum angle is set in the range of 70° but the construction has a stable angle range between 55° - 125°. [1]

2 Measuring accuracy¨

The SICK LMS 400 is a distance measurement system, and like every distance measurement system has a problem with distortion information, which shows us the quality of the measured value or the scan. This system has few typical measurement errors:

- **typical systematic measuring error** - is ± 4 mm
- **remission** - is the capability of a material to reflect the light back. The remission value expresses the signal strength with different object surfaces.
- **measured values time filtering** - information expresses how much computational time is available for the system to calculate the measured distance value.

The measuring accuracy is modified by the programming in the place where the LMS 400 will be used.[2]

3 Communication

Data transmission is provided only under the conditions that the device is connected to the computer and the communication software is running. The main control software creates a data stream between the LMS 400, and the function of this main software is supervising. The transmission is linked to the "Asking protocol" about the preparation for the connection and data exchange.[1]

The communication has three steps:

- First step – enquiry from the PC to the SICK LMS 400 about the readiness to make the data exchange.
- Second step – the main control software is waiting for receipt of the confirmation from the LMS 400, or receipt of the error message.
- Third step – without error message from the second step, the program receives distance values in the continuous stream.

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The error messages from the laser scanner show only the number of problems, but those are necessary to be found in the "Errors table" to find the solution.

Every message has a framework and data. Different types of messages are used as data.

4 The main control software principle

The system SICK LMS 400 is mostly used as a feedback in the production line. The range of the laser scanner system is mostly unfulfilled, because the laser scanner from the production of the SICK Company has the 3m measurement distance and the 70° angle range. In the production line application, this type of device is more than normal production need, but with full cover only for production areas in places where is not necessary creating relevant measurement. Segmentation of area on parts production and secure create the active area full utilizable and safer (Fig. 1).

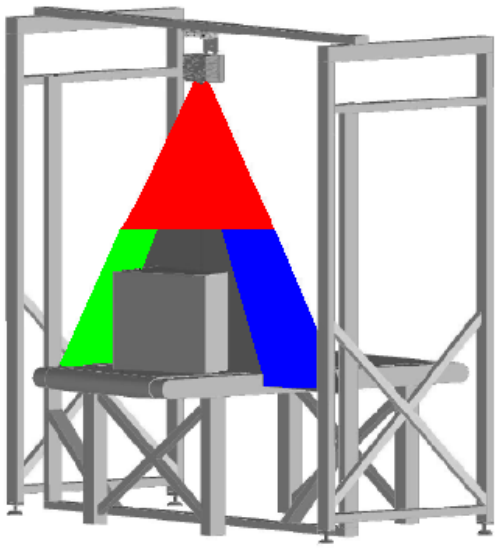

Fig. 1 Product line application with segmentation of production and safety area

The software for the SICK LMS 400 is made in the C# and the entire communication is incorporated to the software solution. In the start-up menu, by selecting the RS232 port a link between the computer and the laser scanner with a handshake is created. Received values from the SICK LMS 400 are displayed in the text box. Values are stored in hexadecimal distance values, followed by the computational algorithms processing. Filtered values are converted into the middle part of the software solution environment. After that, a graph of the measured distance values is created. (Fig. 2)

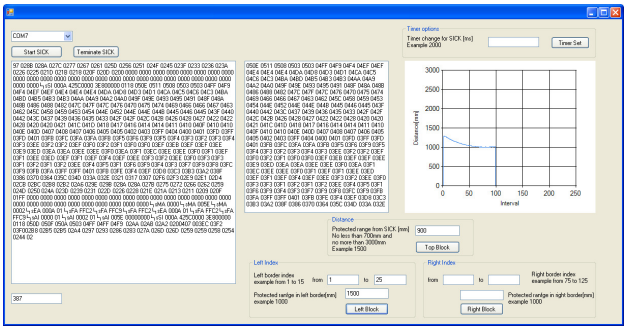

Fig. 2 Software window

Values from the graph support only visual orientation operators. The main advantage of this software is input values (borders) setup (Fig. 3).

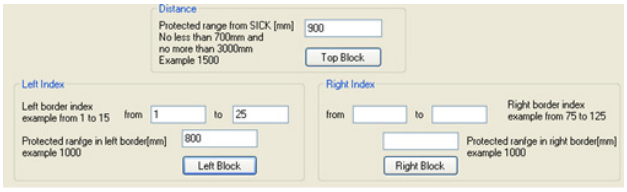

Fig. 3 Part of the window used for segmentation

Defining border inputs the software is able to decide on the relevance of the measurement, so that it designates which places are safety and which are the production place. The system calibration has to be made in the place where the system SICK LMS 400 is located. The main decision is to specify the products place, because this "active range" derives other safety places from this part of active range is derivative the other safety places. When the values of the safety place are out of the set range, the software creates an exception condition with possibility of dangerous on the production line. The human monitoring is not necessary in case of this application until the exception condition appears.

5 Conclusion

The main purpose for creation of this specific segmentation software with security elements is to define distance of the object in the active environment. The relevant aspects of measuring with the systematic calculations create a new combination of an industrial production and safety procedures supported by a single device. As a result, the intelligent measurement system for the production with safety features against the endangering of life and health of the work force is proposed.

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