The second module of the program takes care of the FrFT and of its order optimization. Computation of FrFT of an image of 1024x1024 pixels takes 1 minute. In the optimization process, FFrFT is used just for one line containing 1024 pixels. In this case, scanning for optimization purposes in the range from -1 to 0 with a step of 0.01 takes three seconds.

Conclusions

An algorithm is proposed for calculation of light diffraction in the Fresnel zone by finding the most suitable value of the FrFT order in one cross-section and its subsequent use for computing the whole image. Results are shown from test image processing for each stage of the algorithm. For the sake of obtaining the best visualization processing is carried out only along one axis.

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DEVICE FOR COUNTING OF THE GLASS BOTTLES ON THE CONVEYOR BELT

Ventseslav Draganov, Georgi Toshkov, Dimcho Draganov, Daniela Toshkova

Abstract: In the present paper the results from designing of device, which is a part of the automated information system for counting, reporting and documenting the quantity of produced bottles in a factory for glass processing are presented. The block diagram of the device is given. The introduced system can be applied in other discrete productions for counting of the quantity of bottled production.

Keywords: device for counting, automated information system

ACM Classification Keywords: J.2 Physical Sciences and Engineering

Introduction

In all discrete productions it is needed the ready production to be counted as well as reporting and documenting of the received data. In the present paper a device for counting the quantity of the produced glass bottles, moving on conveyor belt and which is designed by the authors is presented. It is a part of the automated information system for reporting and documenting of the ready production in a factory for glass processing [Draganov, 2006]. The information system has to meet following requirements: collecting data for the ready production, moving in one direction on the conveyor belts; archiving the data for each shift; reporting the quantity of the production for a shift (eight hours).

Different company developments of production counting systems are known [Solid Count, 2006; Fast Counts, 2006; Patent 0050111724, 2005]. One of them is the system SolidCount™ [Solid Count, 2006], which is designed for an automatic collecting of data for the ready mixed (of different kinds) production from a single production line, reporting the quantity of the production and receiving statistical data for the production in real time. The system Fast Count™ [Fast Counts, 2006] serves for: collecting data from several lines; reporting of the quantity of the production in different formats; monitoring of the productivity; archiving of the data; statistics and diagnostics in real time. For counting of the ready production a method and apparatus for counting is suggested in [Patent 0050111724, 2005]. The data for the ready production are received by comparison between the image of the product on programmable zoned arrays of light sources and photo detectors and known images.

The software and hardware products, which are considered, are of general use. They are expensive, very complicated and less reliable. These disadvantages are avoided in the system for counting, reporting and documenting of ready production, moving in unidirectional way on four conveyor belts as well as the entire production of the factory for glass from the four conveyor belts. The system is developed by the authors and it is introduced in a factory for glass.

Structural Diagram of the Automated Information Systems

The structural diagram of the automated information system in the factory for glass is depicted in Fig.1.

Each of the four input conversion devices (ICD) feeds an electric impulse to the device for counting control and indication (DCCI) when a ready production unit passes the conveyer belt in front of the input conversion device.

In DCCI information about the quantity of the impulses, which have come from the four ICD, is gathered. On the basis of this information the necessary signals for control of the indications I1÷I5 are depicted. In the presence of danger of overflow of any of the counters, registering the input impulses, DCCI sends a signal for overflow ($\overline{O}$) to the device for printing control (DPC). The last also receives information for the state of all counters in DCCI (Q). DPC gives a command to the printing device (PD) for printing the results and after that to DCCI – a command to clear the counters (R). The printing with consequent clearing is also accomplished by external signal from an operator through clearing button, lying on the command panel, which is a part from the DCCI, at the end of the shift. In case of power failure DPC saves the current information and after restoring the electricity supply the necessary commands for printing and clearing are passed to PD.

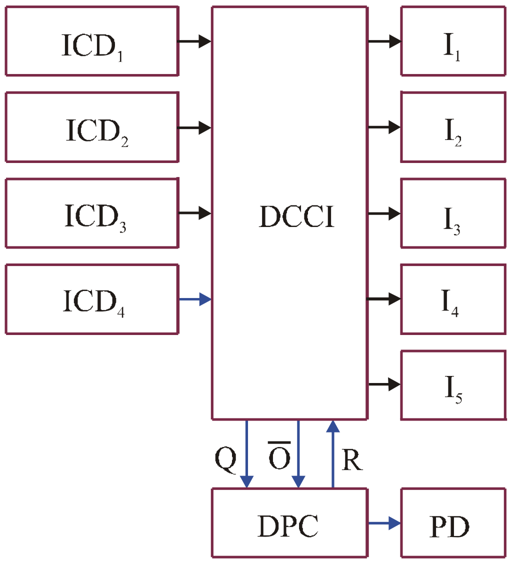

Fig.1 Structural diagram of automated system for counting of bottles on conveyor belt

Scheme Solution of the Device for Counting of Bottles

To receive reliable information for the quantity of the produced glass bottles it is necessary each input converting device from the automated information system for reporting and documenting of the quantity of ready production to be designed. The device has to meet the following requirements: to convert the information for the number of the glass bottles, which move on the conveyor belt separately or in groups in electrical impulses with TTL level in contactless way; the number of the electrical impulses to correspond strictly to the number of the passing glass bottles and errors, caused by bottles, which are contiguous one to another or by the uneven optical density of the glass from which the bottles are made or by vibrations of the conveyor belt have to be expelled; the device to be simple and cheap at most and with high reliability of the scheme solution; the construction to be with high mechanical stability and manifacturability.

The main goal of the work is to design a device, which meets the attached requirements and free of the indicated disadvantages.

Devices for counting of objects, based on electro-contactable, capacitive, inductive and other principles are known. One of the most perspective one is the photo-converting principle, which has following advantages: broad field of application; contactless way of operation; high reliability and long exploitation time; high promptitude; low feeding voltages and small consumption of electrical power; broad temperature range of operation; possibility for miniaturization and integration and etc.

The photo-converting devices frequently operate in a mode of transmission [Bergmann, 1980], in which the counted objects cross and modulate a ray, emitted from light source to a light receiver, situated on the other side of the object. There is a possibility for operating in another mode – mode of reflection [Bergmann, 1980], in which the light source and the light receiver are situated on one and the same side of the moving object, reflecting directly or diffusely part of the light, emitted by the light source to the light receiver. An operation in a mode of autonomous emitting [Bergmann, 1980] at which the object itself is a light source is possible.

The photo-converters may operate with unmodulated and modulated light [Bergmann, 1980]. The schemes of the photo-converters with unmodulated light are simplified but they are adversely influenced by the disturbing light – daylight or artificial, emitted by other sources of light. The photo converters with modulated light are protected from the influence of the disturbing light in a high degree, but their scheme solution is complicated and expensive.

In the designed device the photo converting principle of operation, based on mode of transmission of the unmodulated light is used. Thus a simplified scheme solution is obtained.

The disadvantages of principle of the devices operating with unmodulated light are not substantial in the concrete case as the application of the device to be designed is characterized by a small distance between the light source and the light receiver and lack of parasitic lighting. For the purpose an appropriate construction is developed.

The possible errors, caused by vibrations of the conveyor belt and by the uneven density of the bottles may be avoided by transmission of light ray at the height of the mouth of the bottles. But even in this case the light ray is discontinued repeatedly when a single bottle is passing and the number of the obtained output impulses is arbitrary.

Scheme solutions by which this disadvantage may be avoided – with using of integrator, by their processing with monostable multivibrator are known. The difficulty in using them in the concrete case is caused by their irregular movement of the conveyor belt because of the vibrations, which strongly hampers the specifying of the time constant of the delay circuitry.

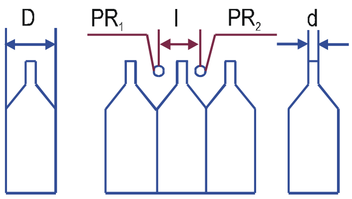

Fig.2 Scheme solution of the device for counting of bottles.

The problem is solved by using of $\overline{R}$ - $\overline{S}$ trigger, to which both inputs impulses are entering from the both photoconverters (Fig.2). Each photoconverter contains emitter and receiver. When the mouth of the bottle passes between the source and the receiver of the first photoconverter PR_1, the light ray is discontinued repeatedly. The obtained output impulses enter the first (for example "S") input of the trigger. The first impulse fixes a certain state - in the case logical "1" at its output and the succeeding ones do not change the output state regardless their number. When the second light ray crosses the mouth of a bottle, the obtained output impulses from the second photo receiver PR_2 enter the second ("R") input of the trigger. The first one of them alters the output state of the trigger into logical "0" and the succeeding ones are not of importance. Thus the obtaining of only one output impulse when a bottle passes is guaranteed.

The chosen scheme solution is characterized by extremely high reliability, high stability, simplicity and lack of necessity of adjustment at producing and in the process of exploitation.

The main problem in designing of the construction is the right choice of the distance l between both photoconverters. In order the impulses not to enter the both inputs of the $\overline{R}$ - $\overline{S}$ trigger simultaneously this distance has to be as big as possible. But its excessive augmentation would lead to errors from missing of bottles if they do not move closely one to another. From Fig.2 it can be seen that if the ray diameter is small enough following condition has to be fulfilled:

$$d < l < D \quad (1)$$

where d - maximal diameter of the mouth of the bottle; D – minimal diameter of the body of the bottle.

On the basis of the described principle the entire block scheme of the device for counting of glass bottles on the conveyor belt (Fig.3) is developed.

Two identical channels, each one including light source (LS_1 and LS_2), light receiver (LR_1 and LR_2), source of reference voltage (SRV_1 and SRV_2), comparator (C_1 and C_2) and matching device (MD_1 and MD_2) are used.

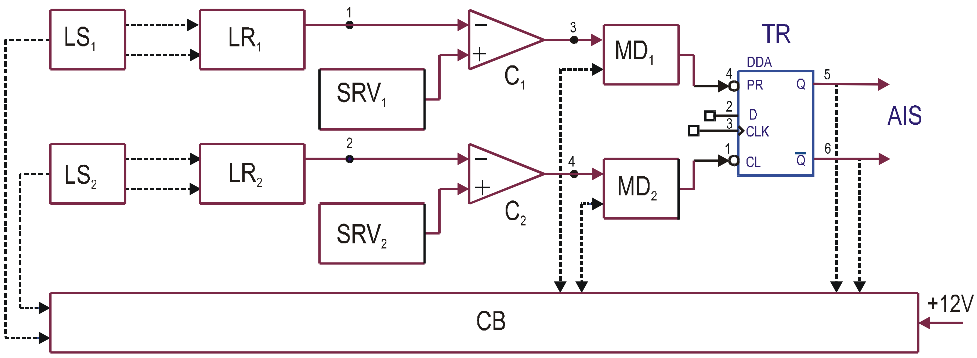

Fig.3. Structural scheme of the device for counting of bottles

The principle of operation is illustrated through the time diagram from Fig. 4. When the light receiver LR is lighted up, the voltage of the inverting input of the comparator C is higher than the reference one (Ur). The corresponding output voltage of the comparator is low. At the output of the amplifier MD a high TTL - level is obtained as the amplifier is an inverting one. When the light receiver LR_1 is shaded by a passing bottle at the output of the comparator C_1 a high level is obtained and at the output of MD_1 – low level. The $\overline{R}$ - $\overline{S}$ trigger TR is established in condition "logical 1". When the light receiver LR_2 is shaded analogous processes occur and the trigger TR is cleared. The trigger TR eliminates the influence of the winkings.

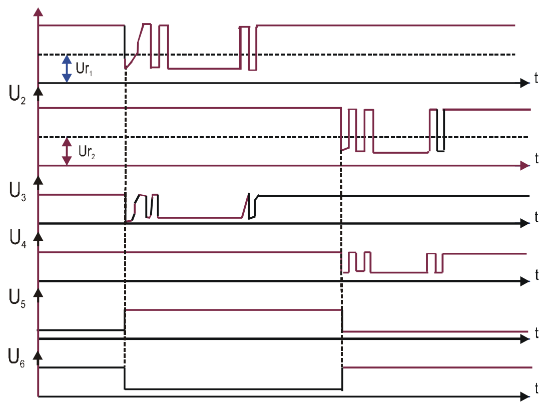

Fig.4. Operation time diagram

The device has a symmetrical output. This enables sharp decreasing of the disturbances, which may penetrate through the line, connecting the output of the device to the input of the Automated information system (AIS) as well as for possible errors, caused by the disconnecting of the connecting wires at their connecting to "ground" etc. For the purpose in the receiving block of AIS a circuitry "sum of modulus two" is connected.

A control block (CB) for diagnostics and control of the normal operation [Marinov, 1980] is provided as a part of the device and through which the good working order of the LS_1 and LS_2; the output signals of the comparators, received from MD_1 and MD_2; the signals, received from the outputs of the trigger; the presence of supply voltage are supervised.

Conclusion

The designed device is a composite part of the automated information system for control, reporting and documenting the quantity of produced glass bottles, which is introduced in the factory for glass processing in town of Elena. The device enables the counting of empty bottles, discolored or of different coloring, of different form and size. It also may be successfully applied for counting of full bottles regardless the content and it level. These qualities of device provide its comparatively wide application in different branches of industry.

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ABOUT METHODS OF MATHEMATICAL MODELLING IN THE DEVELOPMENT OF INFORMATION SYSTEMS

Maria Eremina

***Abstract**: This article describes the approach, which allows to develop information systems without taking into consideration details of physical storage of the relational model and type database management system. Described in terms of graph model, this approach allows to construct several algorithms, for example, for verification application domain. This theory was introduced into operation testing as a part of CASE-system METAS.*

***Keywords:** information system, database, metadata, mathematical model, graph.*

***ACM Classification Keywords**: H.2.4 Systems - Relational databases; D.2.2 Design Tools and Techniques - Computer-aided software engineering (CASE).*

Introduction

The necessity in development of large information heterogeneous system is essentially increasing now. As is well known, *information system* is a complex of information recourses, technologies of getting and processing data, and keeping it in actual and consistent state. This definition is formulated from the point of user's view, but from the realization point of view information system is a complex combination management and technological solutions, hardware and software, and also information content.