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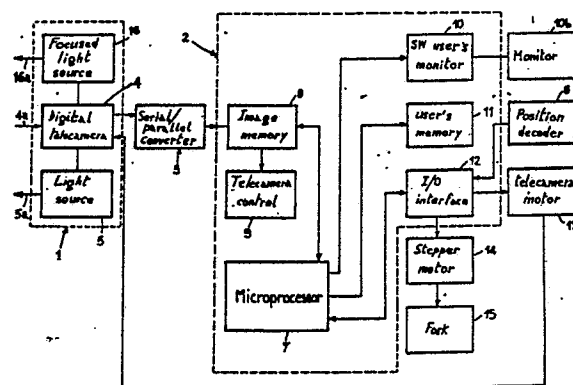
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54 **Electronic device for the automatic count of stacked objects.**

57 The present invention falls within the technical field of electronic control devices and relates particularly to an electronic device for the automatic count of stacked objects, including a first detection group where are located linear digital telecamera and oscillating laser source associated, through a serial/parallel converter, to a second group for the effective count of stacked objects and image analysis, in which second group are located a microprocessor, a telecamera control circuitry a memory for images and threshold light reference, a count memory, a control software governing the telecamera monitoring, and finally an I/O interface for transferring data from the motor actuating the telecamera to the stepper motor of a fork which, in case of automatic pick up, is used for picking up the stacked objects.

In alternative, a second equal telecamera may be mounted, and a rotating base may be provided which supports the stacked objects, so that it may be rotated upon command of above referred microprocessor, in case the stacked objects are inverted by groups.



ELECTRONIC DEVICE FOR THE AUTOMATIC COUNT OF STACKED OBJECTS

The present invention relates to an electronic device for the automatic count of stacked objects.

As it is known, in the field of publishing, a device for the count of stacked objects, such as books, magazines, newspapers, etc. doesn't exist.

Count and distribution of various items, e.g. in case of kiosks, bookshops and so on, is performed manually, with a considerable waste of time and high costs.

In the postal field, on the contrary, the detection of envelope outline is followed by address reading, then by unit count of items and finally by sorting.

From the above it is evident that the problems related to the count of books, magazines, newspapers, parcels etc., already stacked and ready-made for the sorting towards various destinations, have not been solved yet.

This operation, as said, is performed by several persons, manually and very slowly, due to the need of physical pick up single pieces, and with high service costs.

Therefore, it is necessary to find a solution which allows service flexibility as well as reliability and quickness in the count, without picking up single pieces.

The main object of the present invention is to eliminate the above mentioned drawbacks connected with solution used at the present time and realize an electronic device for the automatic count of stacked objects, capable to perform a quick and reliable count operation without picking up pieces one by one, with a limited manual intervention, and/or even by automatizing both the count and the pick-up procedures, so that the whole procedure becomes fully automatic, without any human intervention except for supervision purposes.

This and other objects, which will become apparent from the following description, are achieved, according to the present invention, by an electronic device for the automatic count of stacked objects, characterized in that it comprises in combination a first optical detection group including a linear digital telecamera associated with a punctiform light source emitting a beam whose reflex on the stacked objects is detected by the linear digital telecamera; a second group for converting signals from the telecamera; and, moreover, a third group for the actual count and for the image analysis, which group comprises a microprocessor for the general control, a first memory for images and for threshold brightness value, a telecamera control circuit for incoming images digitization, a control software monitoring the user's terminal, a second memory defining the count parameters, a parallel interface I/O for transferring data from the motor actuating

the telecamera to a stepper motor actuating a drawing fork of the stacked objects, said motors being enabled only in case of automatic drawing.

Further characteristics and advantages of the invention will become apparent from the detailed description of a preferred, but not exclusive, embodiment of an electronic device for the automatic count of stacked objects, chosen by way of a not limitative example, illustrated as a whole in the single figure of the accompanying drawing by way of a block diagram along with its circuit elements as characterized according to this invention.

Referring now to such figure, a first group 1, shown in a block form, represents a lighting and optical detection group.

Such group is interfaced to a second group 2, which represents the count and image analysis group, via a third group 3 which is an interface consisting of a serial/parallel converter.

The group 1 comprises at least a digital telecamera, structurally associated with a punctiform light source 5, preferably an oscillating laser source emitting a concentrated beam 5a towards the stacked objects, not shown in the figure.

The discontinuity of the reflected light track, between two adjacent objects, is detected as a signal variation 4a by telecamera 4, then is digitized and sent to interface 3 of count and analysis unit 2.

The position of the telecamera is also detected by position decoder 6 and transmitted to I/O interface 12 of unit 2.

The group 1 is interfaced to group 2 through a serial/parallel converter 3, which receives signals from the digital telecamera 4 and sends them to an image memory 8, which, in turn, is circuitally associated to a telecamera control circuit 9, whose function will be described later on.

A software program 10 controls the user's station monitor, this latter being represented in the figure by the block 10b.

A memory 11, indicated in the figure as user memory, is used to define the count parameters.

The actuating motor of telecamera 4 is represented in figure by the block 13, which is interfaced with a microprocessor system 7, governing the whole image control count device, via an I/O interface 12 which performs the interfacing function for a stepper motor 14 actuating a fork 15 in case of automatic drawing of stacked objects.

In alternative to fork 15, there is provided a focused light source 16, integral with the telecamera and used as piece counter in case of manual drawing.

The operation of the device according to the

present invention, whose structure has been described above, is as follows:

The image scanned by the digital telecamera 4 is converted into numeric vectors.

Such numeric vectors, interpreted as a vectorialized information of the signal from the telecamera, are transferred to the image control and count group 2, through the serial/parallel interface 3.

Inside group 2, and precisely in the image memory 8, there are stored numeric vectors corresponding to a given light intensity level (reference point) prefixed before the start of the operation.

The values picked off by the telecamera, and then considered as values read by the telecamera, are compared with a light intensity level, intended as a reference or threshold point.

The comparison is performed by means of telecamera control 9.

The comparison between the read value, namely the image picked off and transmitted by telecamera 4 to count and image analysis group 2, and the value stored by the user in the image memory 8, according to prefixed values, establishes if the two compared values are equal or not.

If the values are equal, there is a scanning discontinuity which corresponds to the identification of a counted object.

Once a determined count value still prefixed by the user has been reached, the drawing process is started.

The numeric value of counted objects is fixed in user memory 11 which acts just to define the count parameters. The user can display the count in progress on monitor 10b. Monitor software 10 controls such display.

As soon as the prefixed count value is reached, the drawing process step is performed.

Such drawing can be performed manually, in which case the stepper motor 14, the fork 15 and telecamera motor 13 are cut out and the operation is performed by an operator.

Moreover, in this case, the focused light source 16 points out, with its beam 16a, the drawing line where the operator must intervene in order to remove the stacked objects.

On the contrary, in case of automatic drawing, the feed of telecamera 4 is performed through the telecamera motor 13 and such count is governed by microprocessor 7 of the count group 2. The telecamera motor 13 is a stepper motor connected to a decoder 6, and the number of steps which cause the feed of telecamera motor 13 is provided, through the decoder, also as an information useful to actuate another stepper motor 14 of fork 15.

In case the stacked objects are not grouped homogeneously, but have a reversed orientation. it

is possible to operate the count in two different ways.

A first embodiment includes a further telecamera and light source group (1) located in a position diametral to the pile of objects and which is enabled once the first telecamera detects the reversal of stacked objects. However such embodiment is highly expensive.

A second embodiment provides for a rotary base underneath the stacked objects, which is rotated a half turn (180°) so that the pile may turn up newly as an homogeneous group of stacked objects facing the telecamera.

Thus the invention achieves the intended objects. In fact, the discontinuity detected by the image control and count group allows to determinate the number of the objects forming the pile, and the movement, by means of motor 13, of digital telecamera 4, provides for "pointing" exactly to a reference on the pile of objects, in order that the light discontinuity corresponds to the number of counted steps, taking into consideration the number of counted objects already programmed. In summary, the optic reference on the stacked objects corresponds to a discontinuity between two adjacent objects and such information is interpreted as a number of steps counted by the count group, which steps number is transferred as an information to the drawing actuation group represented by the stepper motor 14 and fork 15, these latter operating upon command of microprocessor 7. Once the pointed target is reached, the fork 15 moves forward slipping between two grooves of the piled objects so as to lift the relative pile portion.

In this way, even considering the eventuality of a situation, as hereinbefore mentioned, in which groups of objects are stacked with a reversed orientation, it is possible to automate the whole control procedure of stacked objects and related drawing without manual intervention, at low costs and in a faster way.

Moreover, being the whole control group formed by a combination of well tested circuit elements, the entire device may be considered, as a whole, highly reliable from all functional and structural angles.

Obviously, other embodiments are also possible, as well as both structural and parametric modifications of the whole device, all falling within the scope of the present invention.

For instance, a code reader, not shown in the figure, suitable to read eventual codes (e.g. bar codes) reproduced on the edges of the stacked objects, may be associated to group 1.

Claims

1. Electronic device for the automatic count of stacked objects, characterized in that it comprises in combination a first optical detection group (1) including at least a linear digital telecamera associated with a punctiform light source emitting a beam whose reflex on the stacked objects is detected by the telecamera; a second group (3) for converting signals from the telecamera; and moreover, a third group (2) for the actual count and for the image analysis, which group (2) comprises a microprocessor for the general control, a first memory for images and for threshold brightness value or discontinuity, a telecamera control circuit capable to compare the input values, a control software monitoring the user's terminal, a second memory defining the count parameters, a parallel interface I/O for transferring data from the motor actuating the telecamera to a stepper motor actuating a drawing fork of stacked objects, said motors being enabled only in case of automatic drawing.

2. Electronic device for the automatic count of stacked objects according to claim 1, characterized in that said group converting signals coming from the telecamera consists of a serial/parallel converter.

3. Electronic device for the automatic count of stacked objects according to claim 1, characterized in that there is provided a support base for stacked objects which, in case the stacked objects are piled by groups with reversed orientation, is rotated 180° upon command of the microprocessor of actual count and image analysis group.

4. Electronic device for the automatic count of stacked objects, as hereinbefore described and illustrated and for the above specified objects.

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