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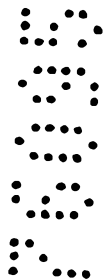
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(56) Related Art
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BIOPTICS BAR CODE READER

ABSTRACT

5 A bioptics bar code reader has first and second windows (1,2) disposed at an angle to each other, a first imager (3) for the first window (1) and a second imager (4) for the second window (2) and first and second optics for directing light from a bar code (B) in a reading area between the windows (1,2) to the first and second imagers (3,4). The two imagers (3,4) each obtain an image of the bar code (B) in the reading area.



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COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

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Invention Title: Bioptics Bar Code Reader

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

BIOPTICS BAR CODE READER

BACKGROUND OF THE INVENTION

The present invention relates to the reading of dataforms, such as bar codes, by
5 the use of imagers in slot or presentation mode scanners.

The reading of bar codes by imagers is known, and imagers, such as charge coupled detector (CCD) arrays or CMOS sensors, have been disclosed in U.S. Patent 5,319,181, the disclosure of which is incorporated herein by reference. Such imagers are also referred to as cameras, sensors and the like.

10 It is proposed that the use of two images of the same bar code from two different views will aid in the speed and reliability of decoding bar codes which have been captured as an image in an imager.

Moreover, although two-dimensional bar codes have been increasing in use, there are currently no presentation or slot scanners available in the market today that can
15 read a two-dimensional bar code from two sides of a package.

SUMMARY OF THE INVENTION

A preferred object of the present invention is to improve the slot cameras that are presently available.

20 Another preferred object of the present invention is to provide a bioptics reader which reads bar codes using area sensor cameras which can process the signals in sequence or in parallel with the capability of taking and storing one-dimensional pictures and increasing the reliability of the system by eliminating any moving parts.

Another preferred object of the present invention is to provide a bioptics scanner
25 or reader for a slot or presentation mode which is capable of reading one and two-dimensional bar codes.

The invention provides a reader for electro-optically reading a bar code symbol on a target, comprising:

(a) a first light-transmissive window and a second light-transmissive
30 window disposed at an angle to each other and bounding a reading area in which the target bearing the symbol to be read is situated during reading;

(b) a first imaging system including first capture optics for optically capturing light from the symbol passing in a first direction through the first window, and a first two-dimensional imager having a first field of view and operative for imaging a

first two-dimensional image of the entire symbol from the light captured by the first capture optics; and

(c) a second imaging system including second capture optics for optically capturing light from the symbol passing in a second direction through the second window, and a second two-dimensional imager having a second field of view overlapping the first field of view and operative for imaging a second two-dimensional image of the entire symbol from the light captured by the second capture optics;

(d) wherein said first and second two-dimensional images are of the same entire symbol but captured by light passing in said first and second directions which are different and at an angle to each other.

The invention yet further provides a reader for electro-optically reading a bar code symbol on a target, comprising:

(a) a first light-transmissive window and a second light-transmissive window disposed at an angle to each other and bounding a reading area in which the target bearing the symbol to be read is situated during reading;

(b) first capture optics for optically capturing light from the symbol passing in a first direction through the first window;

(c) second capture optics for optically capturing light from the symbol passing in a second direction through the second window;

(d) a common mirror movable between a first position and a second position; and

(e) a common two-dimensional imager for imaging a first two-dimensional image of the entire symbol from the light captured by the first capture optics and directed to the imager by the mirror in said first position, and for imaging a second two-dimensional image of the entire symbol from the light captured by the second capture optics and directed to the imager by the mirror in said second position;

(f) wherein said first and second two-dimensional images are the same entire symbol but captured by light passing in said first and second directions which are different and at an angle to each other.

Embodiments of the invention result in one frame of a scanner having two views of the different sides of the package. To increase the speed of operation, one can either start decoding a particular odd or even field while the other is being read out or one can process the two at once. The current transport speed of the package can be 50 inches per

second, however, higher speeds can be achieved by optimizing the hardware and software of the system.

BRIEF DESCRIPTION OF THE DRAWINGS

5 In the drawings:

Fig. 1 is a partial sectional view of a bioptics slot or presentation mode scanner in accordance with the present invention;

Fig. 2 is a schematic of the circuitry of the scanner Fig. 1;

10 Fig. 3 is a schematic of an alternative embodiment of a bioptics scanner according to the present invention; and

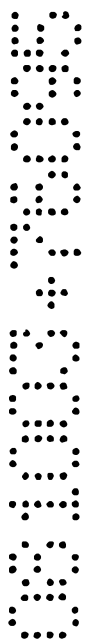


Fig. 4 is a timing diagram showing the sequence of events of operation for the scanner of Fig. 3.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Figs. 1 and 2, a first embodiment of the bioptics scanner according to the present invention is disclosed.

In a slot and/or presentation mode scanner, there are two windows 1 and 2 which are at an angle to each other. Although the windows 1 and 2 are at a 90° angle in Fig. 1, other angles can be used. In Fig. 1, window 1 is a horizontal window and window 2 is a vertical window, however, other orientations can also be used within the scope of the invention.

Behind the windows 1 and 2 are two dimensional array cameras 3 and 4 respectively which are positioned with regard to mirrors 5 and 6 so that their fields of view cover a three-dimensional space where a bar code B can be presented on a three-dimensional object or an identification document, such as a coupon, might be presented.

Mirrors 5 and 6 are stationary mirrors which reflect light from the bar code B onto imagers 3 and 4 respectively.

In order to improve the depth of focus of the imagers 3 and 4, illumination lights 7 and 8 are disclosed behind the windows and optionally utilized light condensers 9 and 10 respectively. Mirrors 5 and 6 are light dividing mirrors, so that light from the light sources 7 and 8 can pass therethrough and light returning from the bar code can be

reflected to the cameras or imagers 3 and 4. By use of the illumination lights, the cameras can have their numerical apertures optimized to obtain the maximum depth of focus.

In a preferred embodiment of the present invention, LCD or other conventional displays 11 and 12 are associated with the imagers 3 and 4, so that the operator can see the views of the cameras or imagers 3 and 4 respectively.

The outputs of the imagers 3 and 4 are also connected to a decoder 13 which has the capability of processing the signals from the two imagers either sequentially or in parallel. The decoder 13 can perform the decoding in parallel by having two duplicate circuits, each servicing one imager.

Fig. 3 illustrates another embodiment of the present invention, wherein two windows 21 and 22 have two fixed mirrors 23 and 24 associated therewith and a single imager 26. A moveable mirror 25 is disposed between the mirrors 23 and 24 and is moveable between two positions marked A and B in Fig. 3. The output of the imager 26 is fed to a decoder 27.

With reference to Fig. 4, the operation of the embodiment of Fig. 3 will now be explained. The imager 26 is preferably an interlaced image sensor which has even fields, i.e., lines 2, 4, 6, 8, 10..., and odd fields, i.e., lines 1, 3, 5, 7, 9.... When the mirror is in position A, the even field of the imager is exposed and an image of the side of the package facing the horizontal scanning window 21 is obtained. When the mirror is in the position B, the odd field of the imager 26 is exposed resulting in an image of the

packaging facing the vertical scanning window 22. This results in one frame of the scanner having two views of the different sides of the package.

Once the images are obtained, the bar code and the image can be located and decoded by decoder 27. To increase the speed of operation, one can start decoding a particular (odd or even) field while the other is being read out, as is shown in Fig. 4. The transport speed of the package for the present invention is 50 inches per second, however, higher speeds can be achieved by optimizing the hardware and software.

It is understood that the embodiments described hereinabove are merely illustrative and are not intended to limit the scope of the invention. It is realized that various changes, alterations, rearrangements and modifications can be made by those skilled in the art without substantially departing from the spirit and scope of the present invention.

The claims defining the invention are as follows:

1. A reader for electro-optically reading a bar code symbol on a target, comprising:

5 a) a first light-transmissive window and a second light-transmissive window disposed at an angle to each other and bounding a reading area in which the target bearing the symbol to be read is situated during reading;

b) a first imaging system including first capture optics for optically capturing light from the symbol passing in a first direction through the first window, and a first two-dimensional imager having a first field of view and operative for imaging a first two-dimensional image of the entire symbol from the light captured by the first capture optics; and

10 c) a second imaging system including second capture optics for optically capturing light from the symbol passing in a second direction through the second window, and a second two-dimensional imager having a second field of view overlapping the first field of view and operative for imaging a second two-dimensional image of the entire symbol from the light captured by the second capture optics;

d) wherein said first and second two-dimensional images are of the same entire symbol but captured by light passing in said first and second directions which are different and at an angle to each other.

2. The reader of claim 1, wherein each of the two-dimensional imagers is a charge coupled device (CCD) array extending along mutually orthogonal rows and columns.

3. The reader of claim 1, wherein each system includes an illuminator for illuminating the symbol through a respective window.

4. The reader of claim 1, and a decoder operatively connected to the first and the second imaging systems, for processing the respective two-dimensional images.

5. The reader of claim 7, wherein the decoder is operative for sequentially or simultaneously processing the first and the second images.

6. The reader of claim 1, wherein each of the first and the second capture optics is a stationary fold mirror.

7. A reader for electro-optically reading a bar code symbol on a target, comprising:
- a) a first light-transmissive window and a second light-transmissive window disposed at an angle to each other and bounding a reading area in which the target bearing the symbol to be read is situated during reading;
 - b) first capture optics for optically capturing light from the symbol passing in a first direction through the first window;
 - c) second capture optics for optically capturing light from the symbol passing in a second direction through the second window;
 - d) a common mirror movable between a first position and a second position; and
 - e) a common two-dimensional imager for imaging a first two-dimensional image of the entire symbol from the light captured by the first capture optics and directed to the imager by the mirror in said first position, and for imaging a second two-dimensional image of the entire symbol from the light captured by the second capture optics and directed to the imager by the mirror in said second position;
 - f) wherein said first and second two-dimensional images are of the same entire symbol but captured by light passing in said first and second directions which are different and at an angle to each other.
8. The reader of claim 7, wherein the imager is a charge coupled device (CCD) array extending along mutually orthogonal rows and columns.
9. The reader of claim 7, the imager generates a frame having even image lines interlaced with odd image lines, and wherein the first two-dimensional image is contained within the even image lines, and wherein the second two-dimensional image is contained within the odd image lines.
10. The reader of claim 9, and a decoder for sequentially or simultaneously processing the first and the second images.
11. The reader of claim 7, wherein each of the first and the second capture optics is a stationary fold mirror.

12. A bioptics bar code reader substantially as described herein with reference to the accompanying drawings.

5

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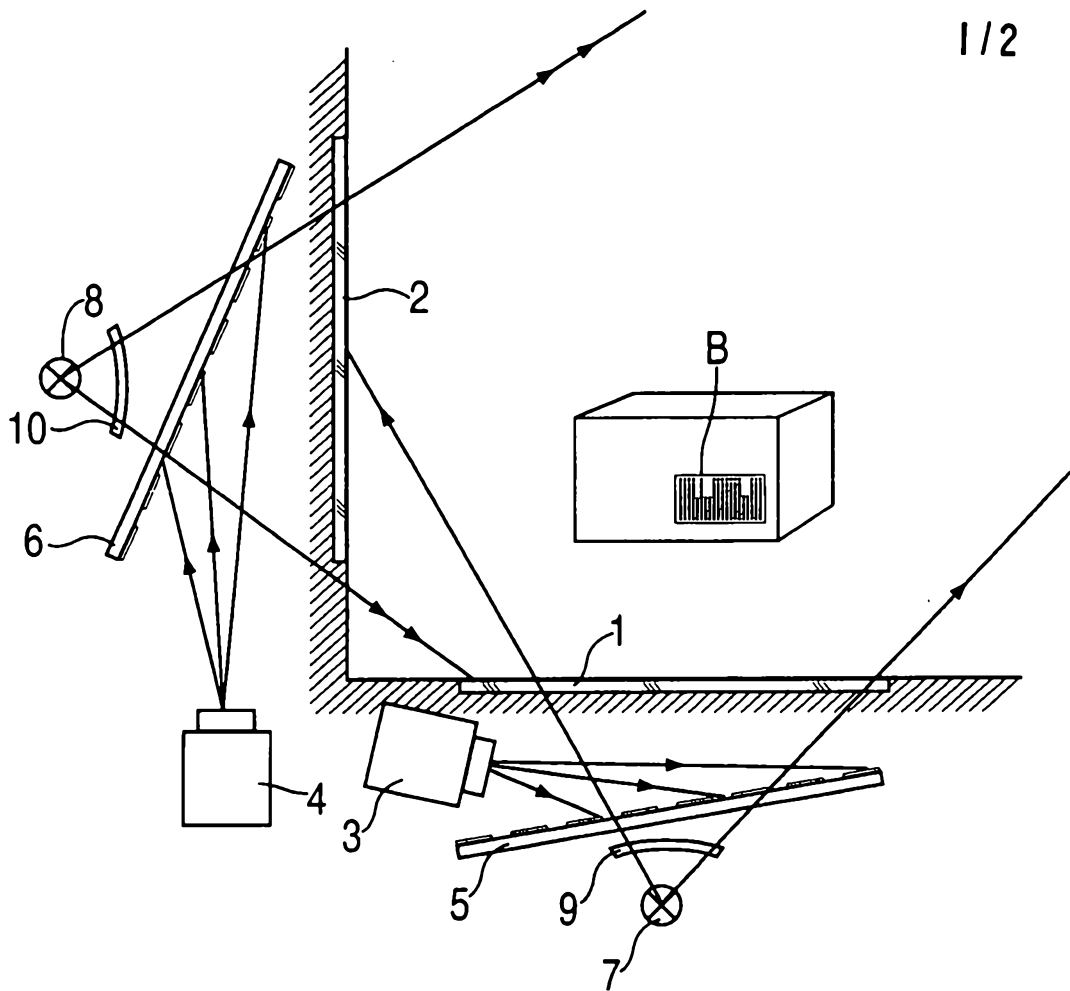


FIG. 1

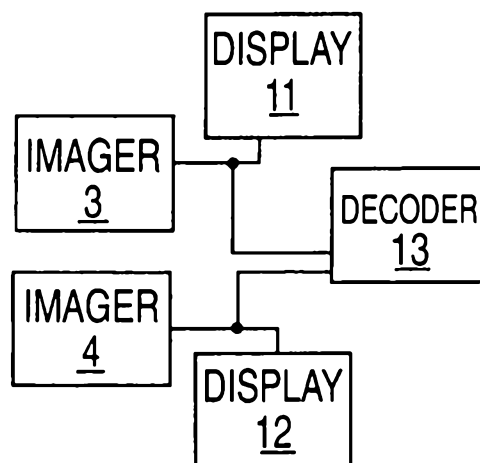


FIG. 2

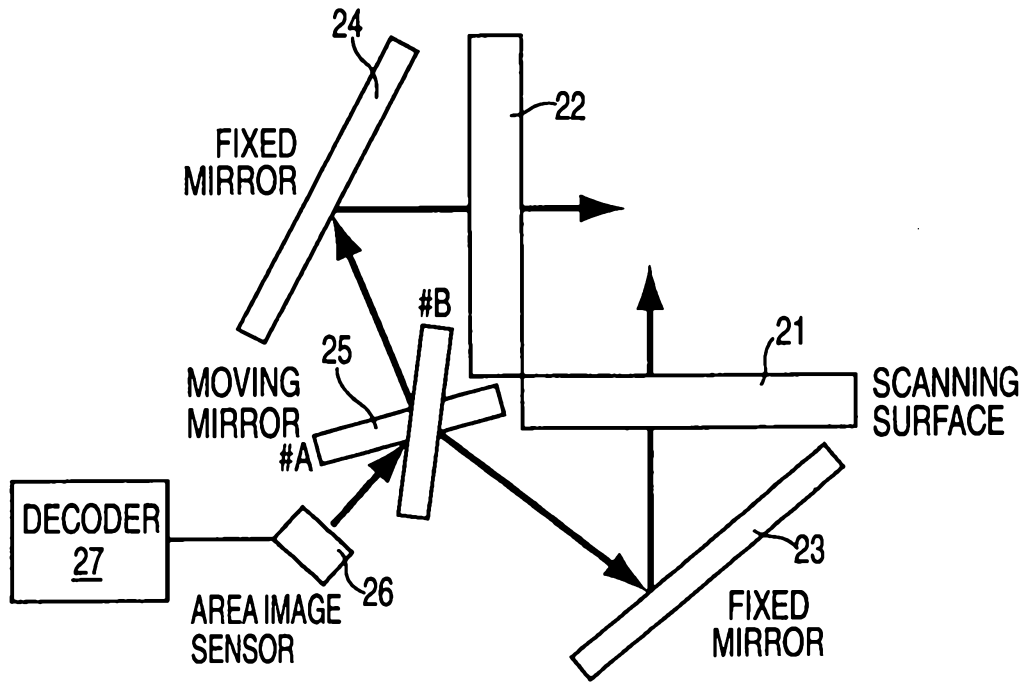


FIG. 3

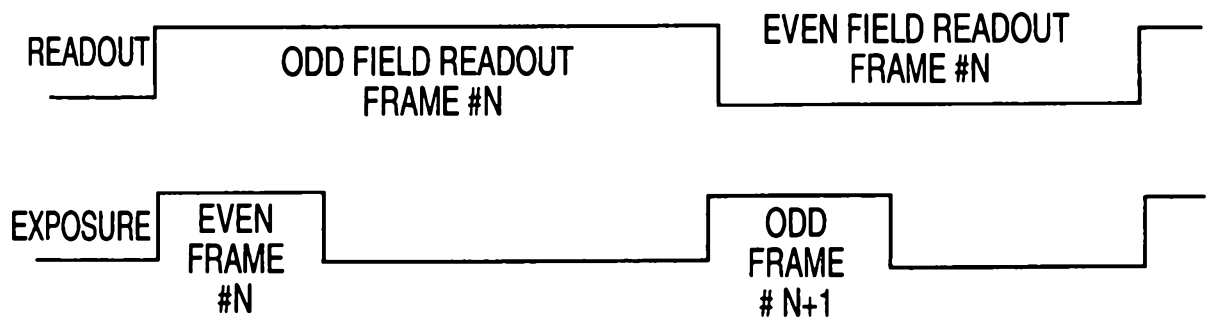


FIG. 4