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(54) EMBEDDING BARCODE DATA IN AN AUXILIARY FIELD OF AN IMAGE FILE

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See application file for complete search history.

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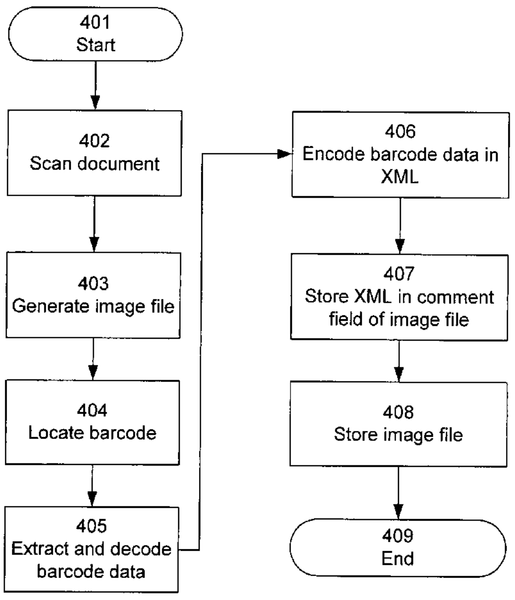
(57) **ABSTRACT**

Information decoded from a barcode or other machine-readable code within an image file is stored as character-based data in an auxiliary field, such as a comment field, of the image file. Subsequently, the information can be extracted from the auxiliary field so as to avoid the need to repeat the image analysis and decoding operation. In one aspect, the extracted data is validated to ensure that it is consistent with the machine-readable code.

84 Claims, 6 Drawing Sheets


401 Start
402 Scan document
403 Generate image file
404 Locate barcode
405 Extract and decode barcode data
406 Encode barcode data in XML
407 Store XML in comment field of image file
408 Store image file
409 End

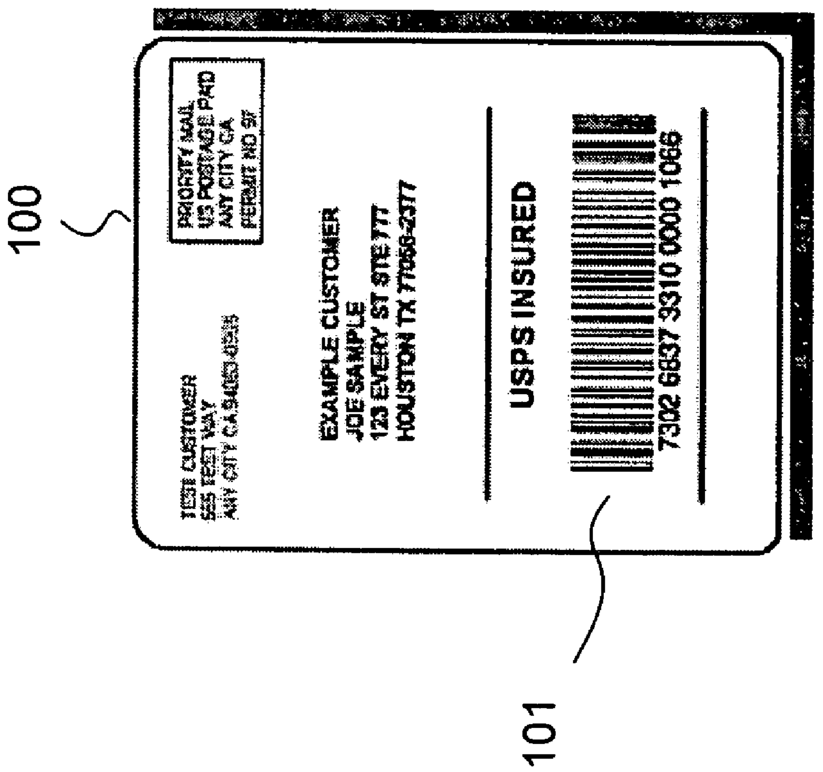

100
TEST CUSTOMER
555 TEST WAY
ANY CITY CA 94053-0535
PRIORITY MAIL
US POSTAGE PAID
ANY CITY CA
PERMIT NO 97
EXAMPLE CUSTOMER
JOE SAMPLE
123 EVERY ST STE 777
HOUSTON TX 77056-2377
USPS INSURED
7302 6837 3310 0000 1066
101

FIG. 1

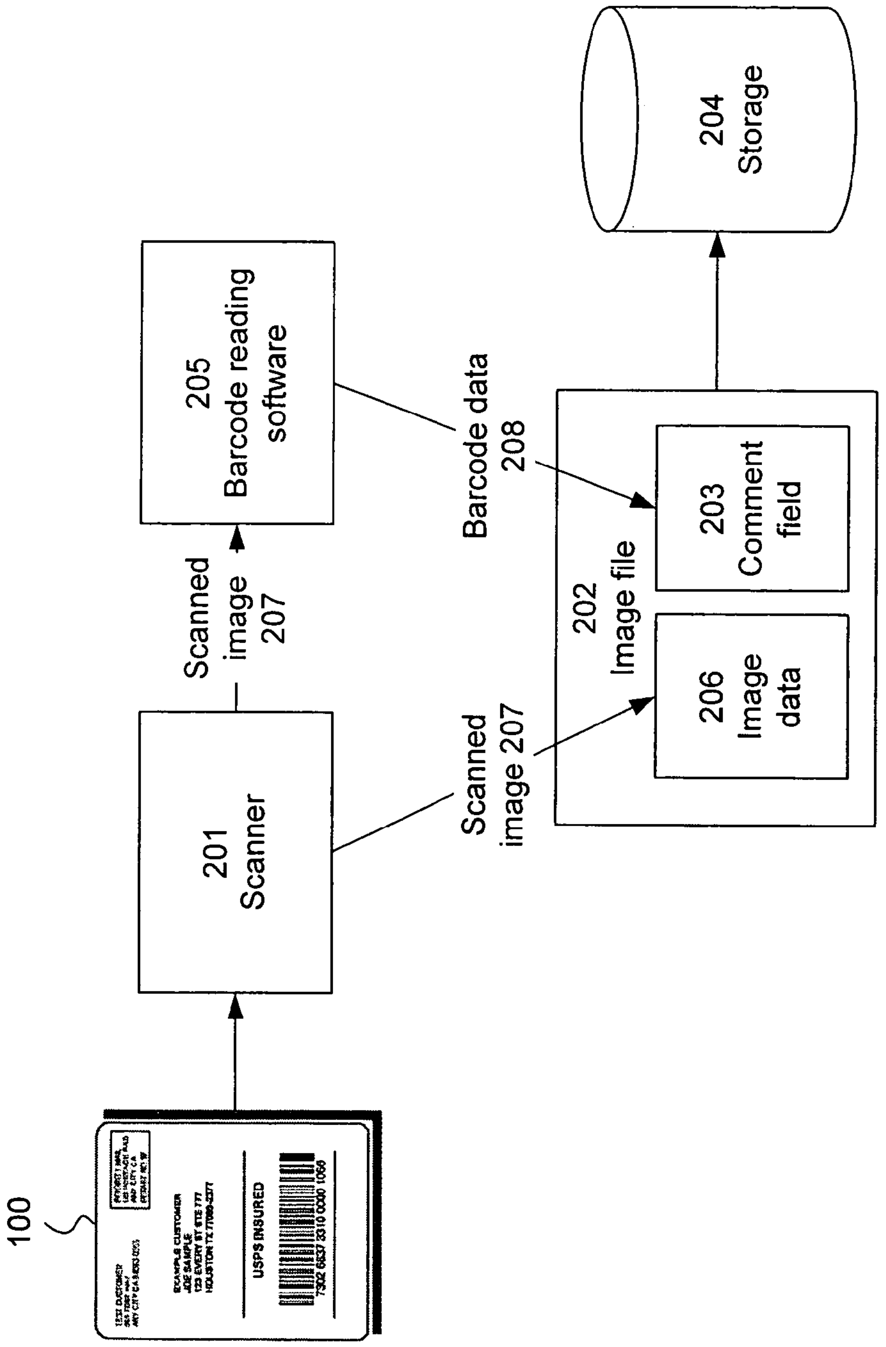

100
USPS INSURED
201 Scanner
Scanned image 207
205 Barcode reading software
Barcode data 208
Scanned image 207
202 Image file
203 Comment field
206 Image data
204 Storage

FIG. 2

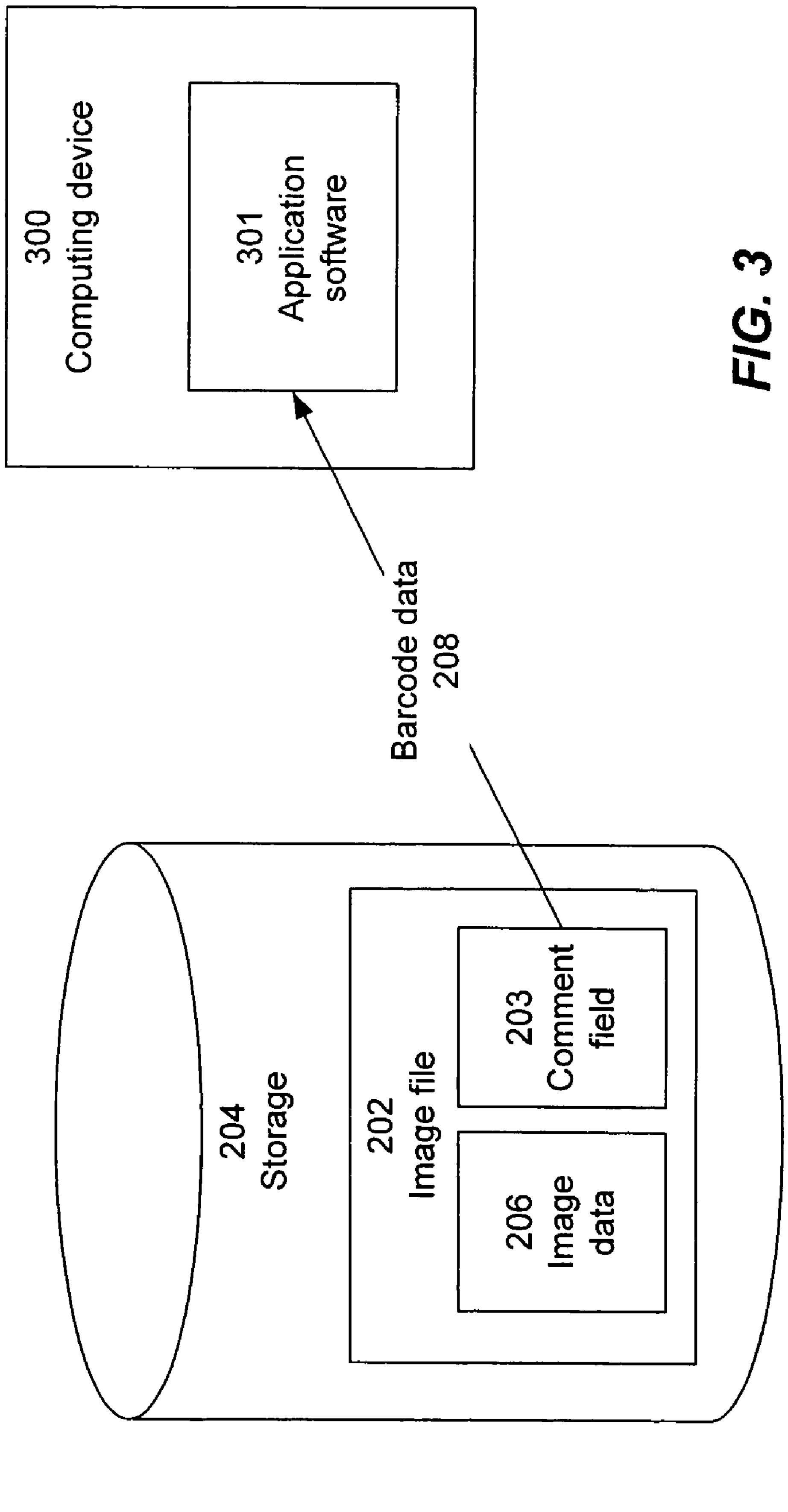

300
Computing device
301
Application software
Barcode data
208
204
Storage
202
Image file
206
Image data
203
Comment field

FIG. 3

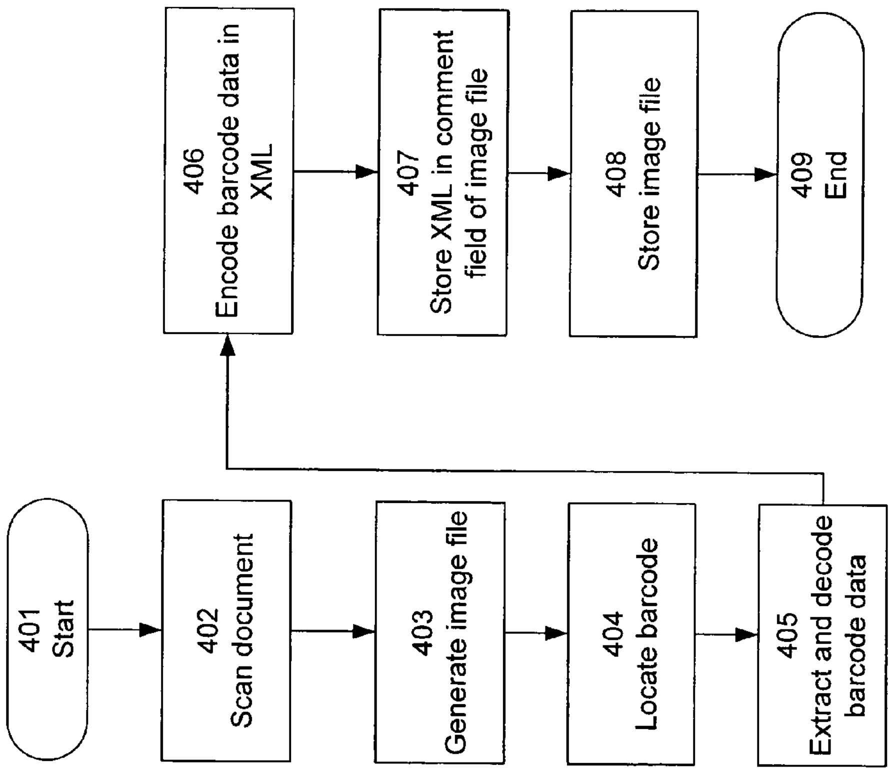

401
Start
402
Scan document
403
Generate image file
404
Locate barcode
405
Extract and decode barcode data
406
Encode barcode data in XML
407
Store XML in comment field of image file
408
Store image file
409
End

FIG. 4

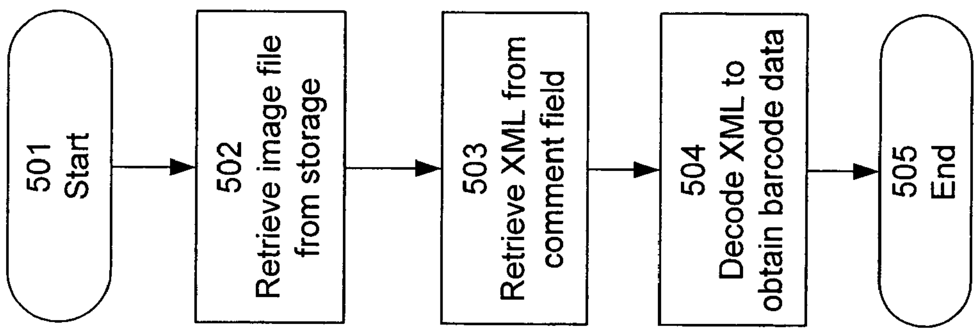

501
Start
502
Retrieve image file from storage
503
Retrieve XML from comment field
504
Decode XML to obtain barcode data
505
End

FIG. 5

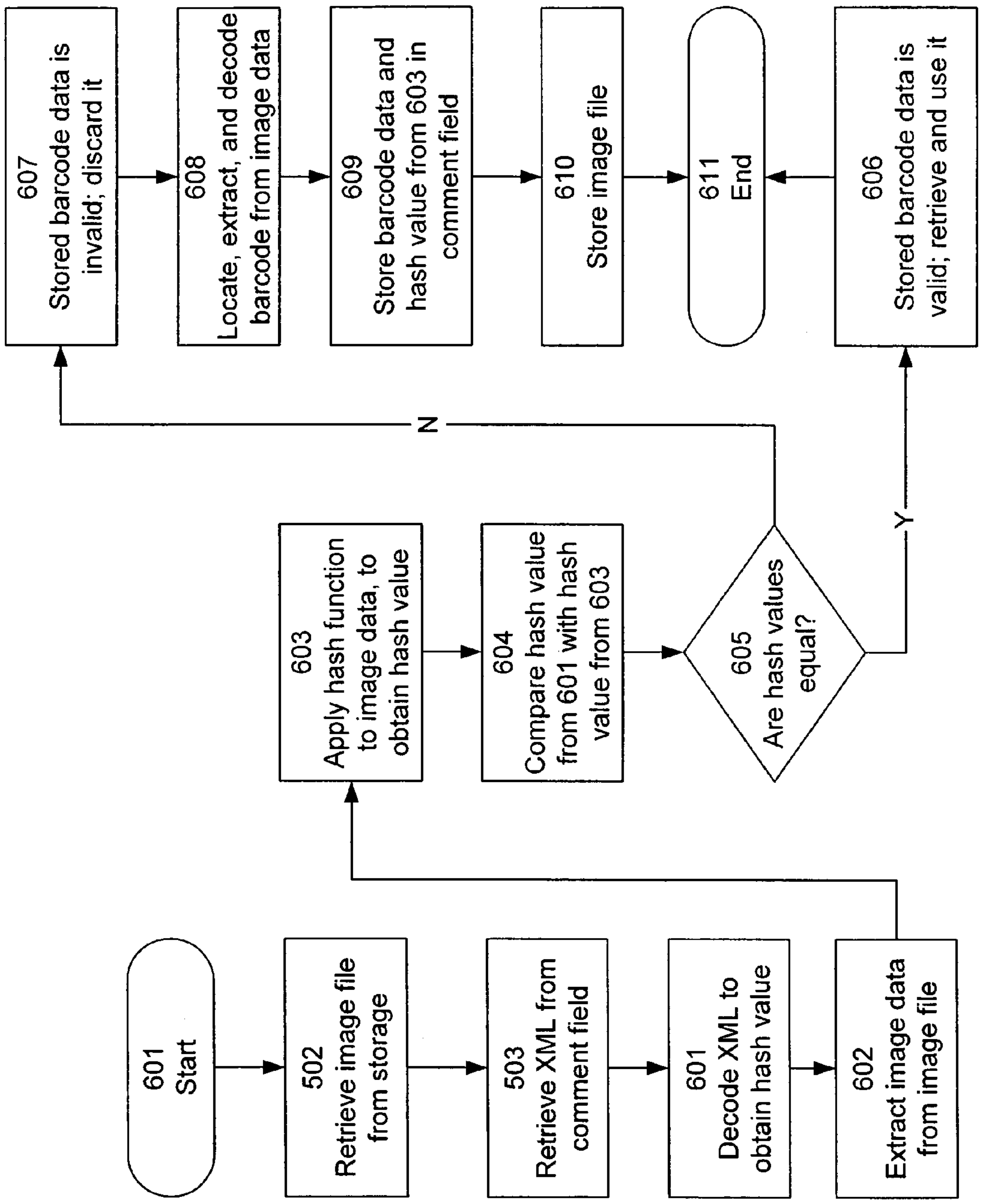

601
Start
502
Retrieve image file from storage
503
Retrieve XML from comment field
601
Decode XML to obtain hash value
602
Extract image data from image file
603
Apply hash function to image data, to obtain hash value
604
Compare hash value from 601 with hash value from 603
605
Are hash values equal?
Y
N
606
Stored barcode data is valid; retrieve and use it
607
Stored barcode data is invalid; discard it
608
Locate, extract, and decode barcode from image data
609
Store barcode data and hash value from 603 in comment field
610
Store image file
611
End

FIG. 6

EMBEDDING BARCODE DATA IN AN AUXILIARY FIELD OF AN IMAGE FILE

FIELD OF THE INVENTION

The present invention relates generally to reading and processing machine-readable data such as barcode data, and more particularly to a method, system, and computer program product for embedding such data in an auxiliary field of an image file.

BACKGROUND OF THE INVENTION

Barcodes and other machine-readable codes are used extensively in industrial applications for shipment tracking, document workflow, medical applications, surveys, tracking documents, and associating paper with electronic media. In many such applications, linear and/or two-dimensional barcodes are read and decoded from electronic images that are obtained by scanning hard-copy documents. Thus, reading and decoding a barcode entails locating the barcode within an image. Such a task can often require a large amount of memory and can take a significant amount of processing time. Some devices, such as portable or handheld computers, do not have the processing power or available memory to perform such operations, and are therefore unable to decode and read barcodes from images. Other devices have the capability to perform such operations, but may do so more slowly than is desired, or may unduly task their resources in doing so.

In general, in order to read a barcode, a computer system must have enough random access memory (RAM) to load a scanned image containing the barcode, and must further have special software for locating and decoding the barcode within the scanned image. Letter-sized pages scanned at a typical resolution of 600 dpi have 5100×6600 pixels (over 33 million pixels). An image of this size can consume up to 4 megabytes of memory, or more. Finding barcodes in such a large image can take a significant amount of time and processing power.

What is needed, therefore, is a method, system, and computer program product for reading barcode data and other machine-readable data from an image file without requiring large amounts of memory and processing power. What is further needed is a method, system, and computer program product that avoids the need to read such data from a raw image file, and that takes advantage of auxiliary fields available in many image file formats. What is further needed is a method, system, and computer program-product that avoids the need to read barcode data more than once.

SUMMARY OF THE INVENTION

According to the techniques of the present invention, once barcode data has been read from an image file, it is stored as a character string within an auxiliary field of the image file. An example of such an auxiliary field is a comment field of a Tagged Image File Format (TIFF) or JPEG File Interchange Format (JFIF, commonly called JPEG) file; such comment fields are generally available in many image file formats. Subsequently, the data can be read from the auxiliary field, thus avoiding the need to use considerable processing power and memory resources to extract the encoded data. The present invention thus facilitates access to barcode data by devices and applications that would otherwise lack the hardware and/or software resources to read and decode barcode data.

Once a barcode has been initially read and decoded, several facts are known about the barcode, including its location, the symbology used, and the data represented by the barcode. Additional information can also be extracted, such as the rotation of the barcode, the width of the smallest line (the x-width), and the contrast or difference in brightness between the lines and spaces. Depending on the particular application, some or all of this information might be considered useful; for example, some applications might only need the barcode data, while other applications may need some of the other information listed above.

According to the techniques of the present invention, once a barcode has been read, any or all of the information is encoded as a character string, for example in Extended Markup Language (XML) format, and stored in an auxiliary field or in a separate file that is somehow associated with or linked to the image file. Then, any other application requiring access to the barcode data can read the data from the auxiliary field or separate file instead of searching the image and decoding the barcode itself.

Since parsing an XML file (or other representation of the barcode) is significantly less processor- and memory-intensive than barcode data decoding, the present invention provides an effective mechanism for improving the efficiency of extracting and reading such information from image files.

In addition, in some situations the installation of barcode reader software entails a fee or royalty. The present invention avoids repeated reading of the same barcode; once the barcode is read a first time on one device, it need not be read again on a second device, since the barcode data is available from an auxiliary field. Thus, the user of the present invention can avoid paying a royalty each time the barcode data is needed on a separate device.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate several embodiments of the invention and, together with the description, serve to explain the principles of the invention.

FIG. **1** is an example of a printed document including a barcode.

FIG. **2** is a system architecture for embedding barcode data in an auxiliary field of an image file according to one embodiment of the present invention.

FIG. **3** is a system architecture for extracting barcode data from an auxiliary field of an image file according to one embodiment of the present invention.

FIG. **4** is a flowchart depicting a method of embedding barcode data in an auxiliary field of an image file according to one embodiment of the present invention.

FIG. **5** is a flowchart depicting a method of extracting barcode data from an auxiliary field of an image file according to one embodiment of the present invention.

FIG. **6** is a flowchart depicting a method of authenticating data in an auxiliary field using a hash function, according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The present invention is now described more fully with reference to the accompanying Figures, in which several embodiments of the invention are shown. The present invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather these embodiments are provided so that this disclosure will be complete and will fully convey the invention to those skilled in the art.

In particular, while the following description sets forth the invention in terms of barcode data, one skilled in the art will recognize that the techniques of the present invention can be used with any other type of machine-readable data that can be transformed into a string of characters for storage in an auxiliary field. Accordingly, the term “barcode data” as used herein is intended to refer to any type of machine-readable data.

Referring now to FIG. **1**, there is shown an example of a printed document **100** including a barcode **101**. According to the techniques of the present invention, as described below, printed document **100** is scanned, an electronic image file is created, and barcode **101** is read. The data from barcode **101** is embedded in an auxiliary field of the electronic image file. One skilled in the art will recognize that the techniques of the present invention can be applied to any machine-readable code, and is not limited to barcodes or to any particular type of document, image, coding scheme, or the like. Thus, the document **100** and barcode **101** of FIG. **1** are merely examples of the type of document **100** and barcode **101** that can be processed according to the techniques described herein.

Referring now to FIG. **2**, there is shown an example of a system architecture for embedding barcode data in an auxiliary field of an image file according to one embodiment of the present invention. Referring also to FIG. **4**, there is shown a flowchart depicting a method of embedding barcode data in an auxiliary field of an image file according to one embodiment of the present invention. One skilled in the art will recognize that the particular system components shown in FIG. **2**, and the particular method steps and sequence shown in FIG. **4**, are merely exemplary and that many other variations are possible without departing from the essential characteristics of the invention.

Scanner **201**, which may be a conventional commercially available scanner, scans **402** printed document **100** and generates an electronic representation of document **100**, referred to as a scanned image **207**. In one embodiment, scanner **201** is implemented as part of a multi-function peripheral (MFP) for performing various operations on paper documents. Such an MFP is available, for example, from Ricoh Company, Ltd of Tokyo, Japan.

Image file **202** is generated **403** from scanned image **207** according to well-known techniques. In one embodiment, image file **202** is created using Java Advanced Imaging software and APIs available from Sun Microsystems, Inc. of Santa Clara, Calif. In one embodiment, image file **202** is a compressed representation of scanned image **207**, such as a JFIF (PEG) image or a TIFF image, generated according to well-known compression methods.

In another embodiment, the techniques of the present invention are applied to an image file **202** that has already been generated from a scanned image, or has been otherwise created. For example, image file **202** may be generated using a word processing or document creation program (such as Adobe Acrobat), rather than being scanned.

Barcode reading software **205** locates **404**, extracts, and decodes **405** barcode **101** according to well-known barcode reading techniques. In one embodiment, this step is performed using Tasman barcode reading software available from Tasman Software of Leeds, United Kingdom, for locating and decoding barcodes in images. In one embodiment where a compressed image is used, barcode **101** is extracted before image file **202** is compressed; in another embodiment, image data **206** is compressed but other portions of image file **202** are not compressed; in another embodiment, image file **202** (or just image data **206**) is decompressed before barcode **101** is extracted.

Once barcode data **208** has been extracted and decoded by software **205**, it is encoded **406** (for example in XML format) and stored **407** in a comment field **203** of image file **202**. Most image file formats include some form of comment field or other auxiliary field that is used to store information about the image. For example, the JFIF GPEG), Exchangeable Image File Format (EXIF), and TIFF all support storage of text comments within the image file. These text comment fields are generally used, for example, to store captions or descriptive information to accompany the digital image. According to one embodiment of the present invention, barcode data **208** is stored in comment field **203** in the XML data format, although one skilled in the art will recognize that any format can be used.

In one embodiment, where TIFF is used, barcode data **208** is stored in an “ImageDescription” field corresponding to Image File Directory (IFD) tag #**270**, as is known in the TIFF standard. One skilled in the art will recognize, however, that other available fields can be used for storing barcode data **208** according to the techniques of the present invention.

One advantage of storing the info in some field of image file **202** is that an application that does not know anything about barcode data **208** can copy image file **202**, and barcode data **208** will be copied with it automatically. Regular file operations will not destroy barcode data **208** or the association between barcode data **208** and image data **206**.

Image file **202** is stored **408** in data storage **204**, which in one embodiment is a conventional hard drive storage device or other storage medium.

There are many ways to associate extracted barcode data **208** with image data **206**. In one embodiment, as described above, barcode data **208** and image data **206** are stored together in a single file **202**. In an alternative embodiment, decoded barcode data **208** is stored in a separate file (not shown) that is associated with or referenced by image file **202**. For example, decoded barcode data **208** can be stored as a separate file in the same directory as an image file **202** containing image data **206**; the two files can have the same name with different extensions, so as to indicate their relationship to one another. In another example, decoded barcode data **208** and image data **206** are stored together as separate files within an archive file. Any of these approaches can be used without departing from the essential characteristics of the present invention.

Once image file **202** has been stored in storage **204**, it can be retrieved, and barcode data **208** can be read from image file **202** without requiring the use of a scanner or of barcode reading software. An application that needs barcode data **208** looks in comment field **203** of image file **202** before attempting to scan barcode **101** according to conventional means. If the barcode data is found in the comment field **203**, the application will have saved processing time and memory by avoiding the need to perform a barcode scanning operation. In addition, devices (such as PDAs) that do not have the capability to locate and decode barcode data **208** can, using the techniques of the present invention, access and use barcode data **208** without having to search the image. In embodiments where image data **206** is compressed, barcode data **208** can be retrieved from image file **202** without being required to decompress image data **206**.

Another advantage of the present invention in such an embodiment is that it avoids the possibility of data loss resulting from compression. If lossy compression is used, barcode **101** can be blurred or otherwise made difficult or impossible to read; by extracting barcode data **208** and storing it in comment field **203**, the present invention provides a mechanism by which barcode data **208** remains readable and usable even where the original barcode **101** has been rendered unusable because of compression of image data **206**.

In one embodiment, barcode **101** can be read from scanned image **207** while document **100** is still being scanned; thus, in such an embodiment barcode reading software **205** need not wait for the entire document **100** to be scanned before extracting and processing barcode data **208**.

Referring now to FIG. **3**, there is shown an example of a system architecture for extracting barcode data **208** from an auxiliary field, such as comment field **203**, of image file **202** according to one embodiment of the present invention. Referring now to FIG. **5**, there is shown a flowchart depicting a method of extracting barcode data from an auxiliary field of an image file according to one embodiment of the present invention. One skilled in the art will recognize that the particular system components shown in FIG. **3**, and the particular method steps and sequence shown in FIG. **5**, are merely exemplary and that many other variations are possible without departing from the essential characteristics of the invention.

A computing device **300**, such as a conventional personal computer, peripheral, personal digital assistant (PDA), or the like, runs application software **301** that makes use of barcode data. For example, application software **301** may be software for interfacing with a database to determine the current location of a package that is being shipped. Computing device **300** retrieves **502** image file **202** from storage **204** according to conventional file retrieval methods. The previously extracted barcode data **208** is read from comment field **203** and provided to application software **301**. In one embodiment, this is accomplished by retrieving **503** XML-encoded data from comment field **203** and decoding **504** the XML data to obtain barcode data **208**. Application software **301** uses and/or processes barcode data **208** in the same manner as though data **208** had been scanned from document **100**. Thus, according to the techniques of the present invention, computing device **300** is able to make use of barcode data **208** without necessarily having to expend the processing time and memory required to read barcode **101** from document **100**.

Barcode data **208** can be stored in comment field **203** (or in another auxiliary field) according to any known data format. It is advantageous for data **208** to be stored in a standardized format that does not require large amounts of processing power or memory to read. In one embodiment, barcode data **208** is stored in the XML format. XML parsing libraries are available for virtually every major programming and scripting language, often at little or no cost.

In one embodiment, the following XML format for barcode data **208** is used:

Attribute Name	Definition
type	Linear or 2D
symbology	Barcode symbology used (one of Code39, Code128, PDF417, DataMatrix, UPC, or the like)
x	x location of upper-left corner of bounding rectangle
y	y location of upper-left corner of bounding rectangle
width	width of rotated bounding rectangle
height	height of rotated bounding rectangle (see angle)
spe1	(x, y) location of starting point of leading edge of barcode
tpe1	(x, y) location of terminating point of leading edge of barcode
spe2	(x, y) location of starting point of trailing edge of barcode
tpe2	(x, y) location of terminating point of trailing edge of barcode
angle	Rotation angle of bounding rectangle in radians
data	Data encoded in the barcode
xwidth	Minimum width of the lines in the barcode
errorfactor	Optional confidence value (1–10).
md5sum	MD5 sum of the data in the image file. As described in more detail below, other hash function techniques can be used

The following is an example of barcode data **208** stored in XML format:

```
<?xml version="1.0" encoding="UTF-8"?>
<embeddedcodes>
<barcode type="linear"
symbology="Code128"
x="3508" y="117"
width="754" height="170"
angle="–0.078"
spe1="3508, 117"
tpe1="3492, 308"
spe2="4250, 175"
tpe2="4233, 325"
data="0123456789"
xwidth="17"
md5sum="fd58035de2c6ab58f8a8c0741343f01b" />
</embeddedcodes>
```

As shown in the example, in addition to storing the raw barcode data, such a format provides the ability to also store information describing the position, orientation, and other visual characteristics of the original barcode **101** as it appears in printed document **100**. In some embodiments and applications, such information can be useful in extracting meaning from barcode data **208**. In other embodiments, however, only the raw data is stored in comment field **203**.

In one embodiment, data verification is performed to confirm that barcode data **208** stored in comment field **203** matches barcode **101**. This data verification step may be useful, for example, when there is reason to suspect that barcode data **208** stored in comment field **203** may have been tampered with, corrupted, or otherwise altered. This step may also be useful when there is a possibility that the position or characteristics of barcode **101** are changed, but that comment field **203** may not have been correspondingly updated. Such a situation may take place, for example, if an image processing program is used to crop or otherwise alter image file **202** without being aware that corresponding changes need to be made to barcode data **208** in comment field **203**. In either of these cases, there is a possibility that barcode data **208** in comment field **203** does not accurately reflect barcode **101**. Data verification can be useful to detect such a situation, so that document **100** can be rescanned and comment field **203** updated accordingly.

In one embodiment, data verification is performed by applying a security scheme, such as one using public/private key pairs as is known in the art, so that unauthorized tampering with barcode data **208** stored in comment field **203** can be detected.

In another embodiment, a one-way hash function (such as md5 sum, SHA1 secure hash, or the like) is applied to image data **206** and/or comment field **203**, so that changes to either or both can be detected. The result of the one-way hash function is included in the data stored in comment field **203**. Application software **301**, or another component of computing device **300**, performs a hash function on image data **206** and compares the result with the hash function result stored in comment field **203**. If the results match, there is a high degree of confidence that image data **206** has not been tampered with. If the results do not match, either image data **206** or comment field **203**, or both, have been tampered with or otherwise altered. Appropriate action can then be taken, including for example ignoring barcode data **208** in comment field **203**, rescanning image file **202**, issuing an alert, flagging data **208** as invalid, prompting the user for further instructions, or the like.

In one embodiment, the hash function is applied to image data **206** after image data **206** has been compressed. Thus, application software **301** can perform its hash verification without having to decompress image data **206**.

Referring now to FIG. **6**, there is shown a flowchart depicting a method of authenticating data in comment field **203** (or other auxiliary field) using a hash function, according to one embodiment of the present invention. As described above in connection with FIG. **5**, computing device **300**, such as a conventional personal computer, peripheral, personal digital assistant (PDA), or the like, runs application software **301** that makes use of barcode data. Computing device **300** retrieves **502** image file **202** from storage **204** according to conventional file retrieval methods, and retrieves **503** XML-encoded data from comment field **203**. Computing device **300** decodes **601** the XML data to obtain a stored hash value. Computing device **300** also extracts image data **206**, or some portion of image data **206**, from image file **202**. In one embodiment, where image data **206** is encoded as TIFF, computing device **300** extracts one or more strips of image data **206**. In one embodiment, image data **206** is in compressed form when extracted; the steps of FIG. **6** can be performed without decompressing data **206**, if desired.

Computing device **300** applies **603** a hash function to image data **206** (or portion thereof), to obtain a hash value. The hash value obtained in **601** is compared **604** with the hash value obtained in **603**. If the hash values are equal to one another, the stored barcode data **208** in comment field **203** is valid; computing device retrieves **606** and uses the stored data according to the techniques described above in connection with FIG. **5**.

If the hash values are not equal to one another, the stored barcode data **208** in comment field **203** is invalid and is discarded **607**. Computing device **300** locates, extracts, and decodes **608** barcode data **208** from image data **206** according to techniques described above in connection with FIG. **4**, and stores **609** the barcode data **208** in comment field **203**. If necessary, computing device **300** decompresses image data **206** in order to perform this step. If computing device **300** is unable to perform this step, it can transmit the image data **206** to another device to perform the step.

Computing device **300** stores **610** image file **202** including barcode data **208** embedded in comment field **203**.

In one embodiment, step **609** includes encoding the barcode data in XML format as described above in connection with FIG. **4**.

In the above description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the invention. It will be apparent, however, to one skilled in the art that the invention can be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to avoid obscuring the invention.

Reference in the specification to “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase “in one embodiment” in various places in the specification are not necessarily all referring to the same embodiment.

Some portions of the detailed description are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the discussion, it is appreciated that throughout the description, discussions utilizing terms such as “processing” or “computing” or “calculating” or “determining” or “displaying” or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system’s registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

The present invention also relates to an apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general-purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and each coupled to a computer system bus.

The algorithms and modules presented herein are not inherently related to any particular computer or other apparatus. Various general-purpose systems may be used with programs in accordance with the teachings herein, or, it may prove convenient to construct more specialized apparatuses to perform the method steps. The required structure for a variety of these systems will appear from the description below. In addition, the present invention is not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the invention as described herein. Furthermore, as will be apparent to one of ordinary skill in the relevant art, the modules, features, attributes, methodologies, and other aspects of the invention can be implemented as software, hardware, firmware or any combination of the three. Of course, wherever a component of the present invention is implemented as software, the component can be implemented as a standalone program, as part of a larger program, as a plurality of separate programs, as a statically or dynamically linked library, as a kernel loadable module, as a device driver, and/or in every and any other way known now or in the future to those of skill in the art of computer programming. Additionally, the present invention is in no way limited to implementation in any specific operating system or environment.

It will be understood by those skilled in the relevant art that the above-described implementations are merely exemplary, and many changes can be made without departing from the true spirit and scope of the present invention. Therefore, it is intended by the appended claims to cover all such changes and modifications that come within the true spirit and scope of this invention.

What is claimed is:

1. A method for storing data obtained from a machine-readable code, comprising:

obtaining image data comprising a machine-readable code;

retrieving the machine-readable code;

decoding the machine-readable code to obtain data; and

storing the obtained data, in a non-image format, in a field in an image file comprising the image data.

2. The method of claim **1**, wherein obtaining image data comprises obtaining an image file comprising image data.

3. The method of claim **1**, wherein the image data comprises data from a scanned document.

4. The method of claim **1**, wherein obtaining image data comprises scanning a document.

5. The method of claim **1**, wherein the machine-readable code comprises a barcode.

6. The method of claim **1**, wherein storing the obtained data in a field in the image file comprises storing the data in a comment field in the image file.

7. The method of claim **1**, wherein storing the obtained data in a field of the image file comprises embedding the data in the image file.

8. The method of claim **1**, wherein storing the obtained data in a field of the image file comprises storing the data in a text field in the image file.

9. The method of claim **1**, wherein storing the obtained data comprises storing the data as a character string.

10. The method of claim **1**, wherein storing the obtained data comprises storing the data in XML format.

11. The method of claim **1**, further comprising storing at least one of:

the position of the machine-readable code in the image data;

the orientation of the machine-readable code in the image;

a visual characteristic of the machine-readable code.

12. The method of claim **1**, further comprising applying a hash function to the obtained data and storing the result of the hash function.

13. The method of claim **1**, further comprising applying a hash function to the image data and storing the result of the hash function.

14. The method of claim **1**, further comprising encrypting the obtained data, and wherein storing the obtained data comprises storing the encrypted data.

15. A method for retrieving stored data representing a machine-readable code in an image, comprising:

obtaining an image file comprising image data, the image data comprising a machine-readable code; and

retrieving, from a first field in the image file, a representation of the machine-readable code in non-image format.

16. The method of claim **15**, wherein the image file comprises a scanned document.

17. The method of claim **15**, wherein the machine-readable code comprises a barcode.

18. The method of claim **15**, wherein the image file comprises a data field, and wherein retrieving the representation of the machine-readable code comprises retrieving the representation from the data field.

19. The method of claim **15**, wherein the image file comprises a comment field, and wherein retrieving the representation of the machine-readable code comprises retrieving the representation from the comment field.

20. The method of claim **15**, wherein the image file comprises a text field, and wherein retrieving the representation of the machine-readable code comprises retrieving the representation from the text field.

21. The method of claim **15**, wherein the representation of the machine-readable code comprises a character string.

22. The method of claim **15**, wherein the representation of the machine-readable code comprises data in XML format.

23. The method of claim **15**, further comprising retrieving, from a second field of the image file, at least one of:

the position of the machine-readable code in the image represented by the image file;

the orientation of the machine-readable code in the image; and

a visual characteristic of the machine-readable code.

24. The method of claim **15**, further comprising:

retrieving, from the image file, a first hash function value;

applying a hash function to at least a portion of the image data to obtain a second hash function value; and

comparing the first hash function value with the second hash function value to determine validity of the representation of the machine-readable code.

25. The method of claim **24**, further comprising, responsive to the representation not being valid:

retrieving the machine-readable code from the image data;

decoding the machine-readable code to obtain data; and

storing the obtained data, in a non-image format, in a second field in the image file.

26. The method of claim **24**, wherein the image data is compressed, and wherein applying the hash function comprises applying the hash function to at least a portion of the compressed image data.

27. The method of claim **24**, wherein the image data is compressed, and wherein applying the hash function comprises decompressing the image data and applying the hash function to at least a portion of the decompressed image data.

28. The method of claim **15**, wherein the image data is compressed, and wherein retrieving the representation of the machine-readable code comprises retrieving the representation without decompressing the image data.

29. A computer program product for storing data obtained from a machine-readable code, comprising:

a computer-readable medium; and

computer program code, encoded on the medium, for:

obtaining image data comprising a machine-readable code;

retrieving the machine-readable code;

decoding the machine-readable code to obtain data; and

storing the obtained data, in a non-image format, in a field in the image file comprising the image data.

30. The computer program product of claim **29**, wherein the computer program code for obtaining image data comprises computer program code for obtaining an image file comprising image data.

31. The computer program product of claim **29**, wherein the image data comprises data from a scanned document.

32. The computer program product of claim **29**, wherein the computer program code for obtaining image data comprises computer program code for scanning a document.

33. The computer program product of claim **29**, wherein the machine-readable code comprises a barcode.

34. The computer program product of claim **29**, wherein the computer program code for storing the obtained data in a field of the image file comprises computer program code for storing the data in a comment field in the image file.

35. The computer program product of claim **29**, wherein the computer program code for storing the obtained data in a field of the image file comprises computer program code for embedding the data in the image file.

36. The computer program product of claim **29**, wherein the computer program code for storing the obtained data in a field of the image file comprises computer program code for storing the data in a text field in the image file.

37. The computer program product of claim **29**, wherein the computer program code for storing the obtained data comprises computer program code for storing the data as a character string.

38. The computer program product of claim **29**, wherein the computer program code for storing the obtained data comprises computer program code for storing the data in XML format.

39. The computer program product of claim **29**, further comprising computer program code for storing at least one of:

the position of the machine-readable code in the image data;

the orientation of the machine-readable code in the image;

a visual characteristic of the machine-readable code.

40. The computer program product of claim **29**, further comprising computer program code for applying a hash function to the obtained data and storing the result of the hash function.

41. The computer program product of claim **29**, further comprising computer program code for applying a hash function to the image data and storing the result of the hash function.

42. The computer program product of claim **29**, further comprising computer program code for encrypting the obtained data, and wherein the computer program code for storing the obtained data comprises computer program code for storing the encrypted data.

43. A computer program product for retrieving stored data representing a machine-readable code in an image, comprising:

a computer-readable medium; and

computer program code, encoded on the medium, for:

obtaining an image file comprising image data, the image data comprising a machine-readable code; and

retrieving, from a first field in the image file, a representation of the machine-readable code in non-image format.

44. The computer program product of claim **43**, wherein the image file comprises a scanned document.

45. The computer program product of claim **43**, wherein the machine-readable code comprises a barcode.

46. The computer program product of claim **43**, wherein the image file comprises a data field, and wherein the computer program code for retrieving the representation of the machine-readable code comprises computer program code for retrieving the representation from the data field.

47. The computer program product of claim **43**, wherein the image file comprises a comment field, and wherein the computer program code for retrieving the representation of the machine-readable code comprises computer program code for retrieving the representation from the comment field.

48. The computer program product of claim **43**, wherein the image file comprises a text field, and wherein the computer program code for retrieving the representation of the machine-readable code comprises computer program code for retrieving the representation from the text field.

49. The computer program product of claim **43**, wherein the representation of the machine-readable code comprises a character string.

50. The computer program product of claim **43**, wherein the representation of the machine-readable code comprises data in XML format.

51. The computer program product of claim **43**, further comprising computer program code for retrieving, from a second field of the image file, at least one of:

the position of the machine-readable code in the image represented by the image file;

the orientation of the machine-readable code in the image; and

a visual characteristic of the machine-readable code.

52. The computer program product of claim **43**, further comprising computer program code for:

retrieving, from the image file, a first hash function value;

applying a hash function to at least a portion of the image data to obtain a second hash function value; and

comparing the first hash function value with the second hash function value to determine validity of the representation of the machine-readable code.

53. The computer program product of claim **52**, further comprising computer program code for, responsive to the representation not being valid:

retrieving the machine-readable code from the image data;

decoding the machine-readable code to obtain data; and

storing the obtained data, in a non-image format, a second field of the image file.

54. The computer program product of claim **52**, wherein the image data is compressed, and wherein the computer program code for applying the hash function comprises computer program code for applying the hash function to at least a portion of the compressed image data.

55. The computer program product of claim **52**, wherein the image data is compressed, and wherein the computer program code for applying the hash function comprises computer program code for decompressing the image data and applying the hash function to at least a portion of the decompressed image data.

56. The computer program product of claim **43**, wherein the image data is compressed, and wherein the computer program code for retrieving the representation of the machine-readable code comprises computer program code for retrieving the representation without decompressing the image data.

57. A system for storing data obtained from a machine-readable code, comprising:

an image input device, for obtaining image data comprising a machine-readable code;

an image processor, coupled to the input device, for retrieving the machine-readable code from the image data;

a decoder, coupled to the image processor, for decoding the machine-readable code to obtain data; and

a storage device, coupled to the decoder, for storing the obtained data, in a non-image format, in a field in the image file comprising the image data.

58. The system of claim **57**, wherein the image input device obtains an image file comprising image data.

59. The system of claim **57**, wherein the image data comprises data from a scanned document.

60. The system of claim **57**, wherein image input device comprises a document scanner.

61. The system of claim **57**, wherein the machine-readable code comprises a barcode.

62. The system of claim **57**, wherein the storage device stores the data in a comment field in the image file.

63. The system of claim **57**, wherein the storage device embeds the data in an image file.

64. The system of claim **57**, wherein the storage device stores the data in a text field in the image file.

65. The system of claim **57**, wherein the storage device stores the data as a character string.

66. The system of claim **57**, wherein the storage device stores the data in XML format.

67. The system of claim **57**, wherein the storage device further stores at least one of:

the position of the machine-readable code in the image data;

the orientation of the machine-readable code in the image;

a visual characteristic of the machine-readable code.

68. The system of claim **57**, further comprising a hash function application module, coupled to the image input device, for applying a hash function to the obtained data, and wherein the storage device stores the result of the hash function.

69. The system of claim **57**, further comprising a hash function application module, coupled to the image input device, for applying a hash function to the image data, and wherein the storage device stores the result of the hash function.

70. The system of claim **57**, further comprising an encryption module, coupled to the image input device, for encrypting the obtained data, and wherein the storage device stores the encrypted data.

71. A system for retrieving stored data representing a machine-readable code in an image, comprising:

an image file receiver, for obtaining an image file comprising image data, the image data comprising a machine-readable code; and

a reader, coupled to the image file receiver, for retrieving, from a first field of the image file, a representation of the machine-readable code in non-image format.

72. The system of claim **71**, wherein the image file comprises a scanned document.

73. The system of claim **71**, wherein the machine-readable code comprises a barcode.

74. The system of claim **71**, wherein the image file comprises a data field, and wherein the reader retrieves the representation of the machine-readable code from the data field.

75. The system of claim **71**, wherein the image file comprises a comment field, and wherein the reader retrieves the representation of the machine-readable code from the comment field.

76. The system of claim **71**, wherein the image file comprises a text field, and wherein the reader retrieves the representation of the machine-readable code from the text field.

77. The system of claim **71**, wherein the representation of the machine-readable code comprises a character string.

78. The system of claim **71**, wherein the representation of the machine-readable code comprises data in XML format.

79. The system of claim **71**, wherein the reader further retrieves, from a second field of the image file, at least one of:

the position of the machine-readable code in the image represented by the image file;

the orientation of the machine-readable code in the image; and

a visual characteristic of the machine-readable code.

80. The system of claim **71**, wherein the reader further retrieves, from the image file, a first hash function value, the system further comprising:

a hash function application module, coupled to the reader, for applying a hash function to at least a portion of the image data to obtain a second hash function value; and

a comparison module, coupled to the function application module, for comparing the first hash function value with the second hash function value to determine validity of the representation of the machine-readable code.

81. The system of claim **80**, further comprising:

a code reader, for, responsive to the representation not being valid, retrieving the machine-readable code from the image data;

a decoder, coupled to the code reader, for decoding the machine-readable code to obtain data; and

a storage device, coupled to the decoder, for storing the obtained data, in a non-image format.

82. The system of claim **80**, wherein the image data is compressed, and wherein the hash function application module applies the hash function to at least a portion of the compressed image data.

83. The system of claim **80**, wherein the image data is compressed, the system further comprising a decompression module for decompressing the image data;

and wherein the hash function application module applies the hash function to at least a portion of the decompressed image data.

84. The system of claim **71**, wherein the image data is compressed, and wherein the reader retrieves the representation of the machine-readable code without decompressing the image data.

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