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Anderson

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(54) **AUTOMATICALLY STORING AND PRESENTING DIGITAL IMAGES USING A SPEECH-BASED COMMAND LANGUAGE**

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(52) **U.S. Cl.** **704/275**; 704/235
(58) **Field of Search** 704/270, 272, 704/275, 251, 231, 235, 200

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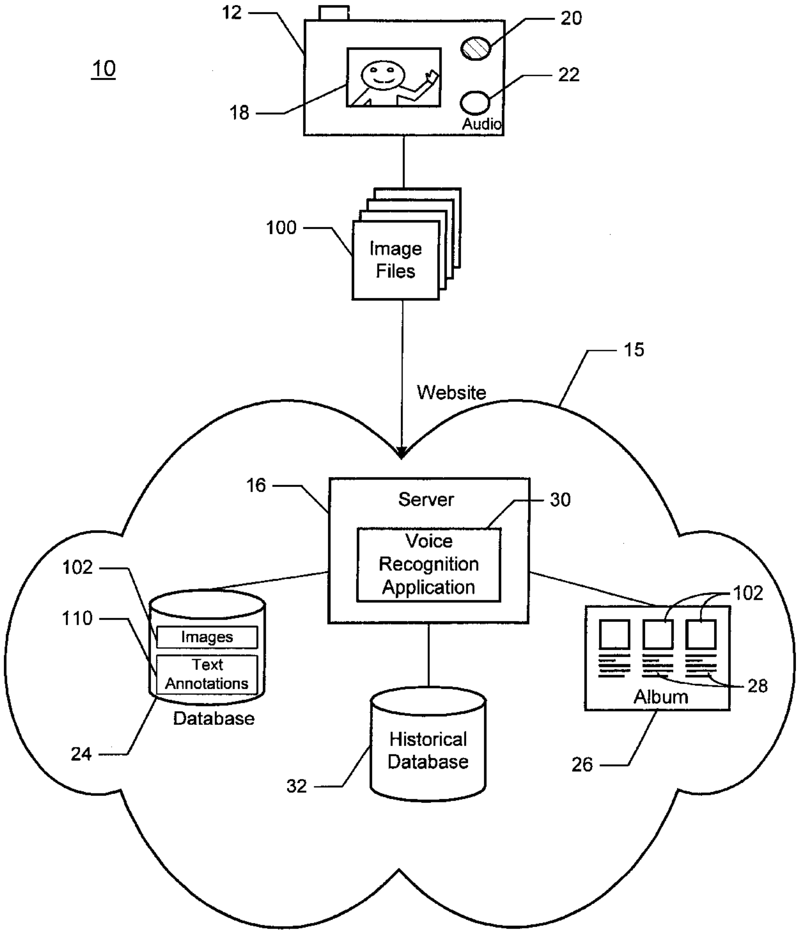
(57) **ABSTRACT**

A method for automatically storing and presenting digital images is disclosed. The method includes capturing digital images with a digital camera and storing the images in an image file, where the file includes at least one speech field and at least one text-based tag. A categorization process is then initiated whereby a user speaks at least one category voice annotation into the digital camera to categorize an image, and the category voice annotation is stored in the speech field of the corresponding image file. The category voice annotation is then translated into at a text annotation using voice recognition, and the image and the text annotation are automatically stored in a database. An album may then be dynamically created by retrieving selected images and corresponding text annotations from the database in response to a request from the user, and displaying each image on the album along with the text annotations.

36 Claims, 4 Drawing Sheets



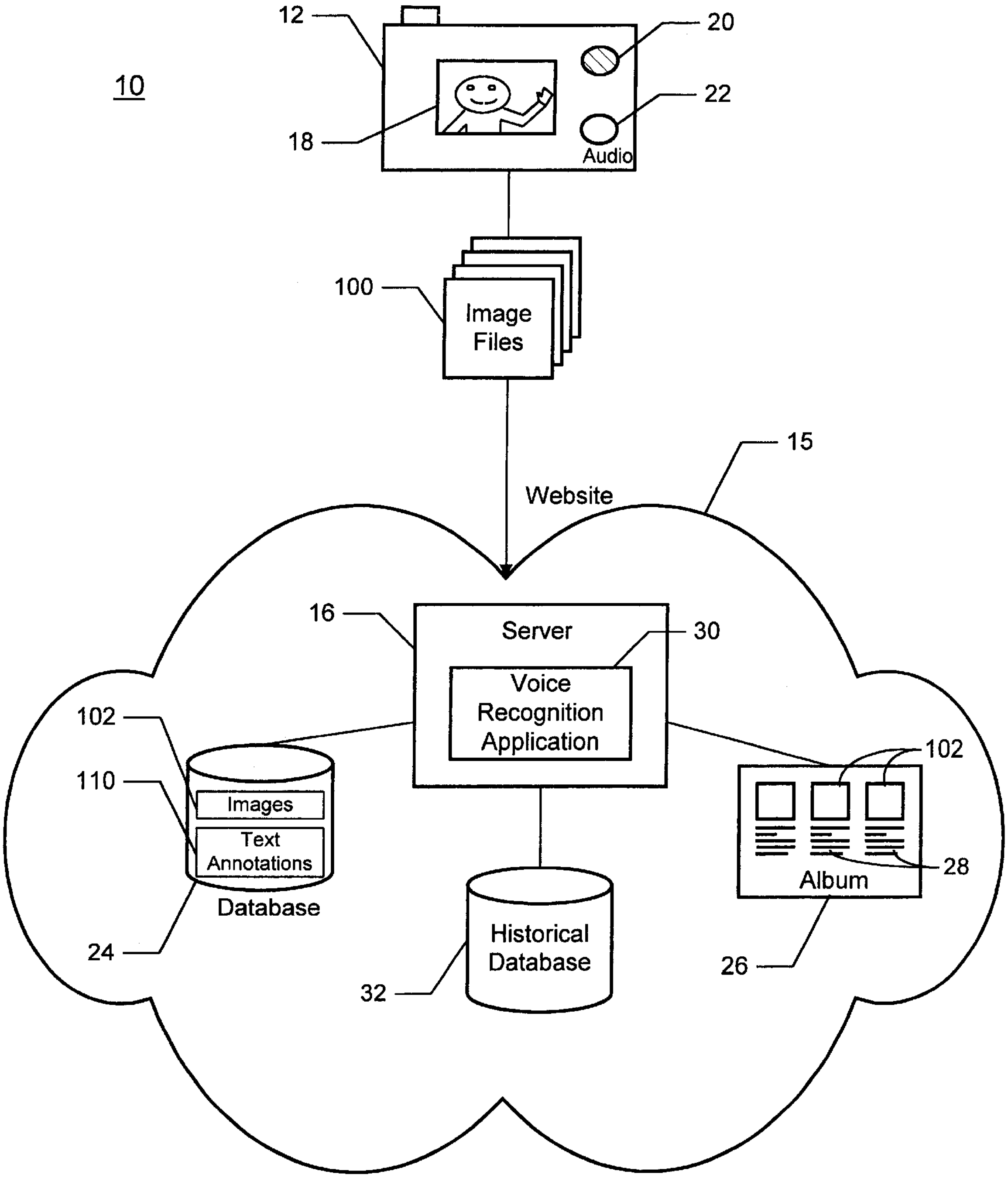

10
12
20
22
18
Audio
100
Image
Files
15
Website
16
Server
30
Voice
Recognition
Application
102
110
Images
Text
Annotations
Database
24
102
Album
28
26
Historical
Database
32

FIG. 1

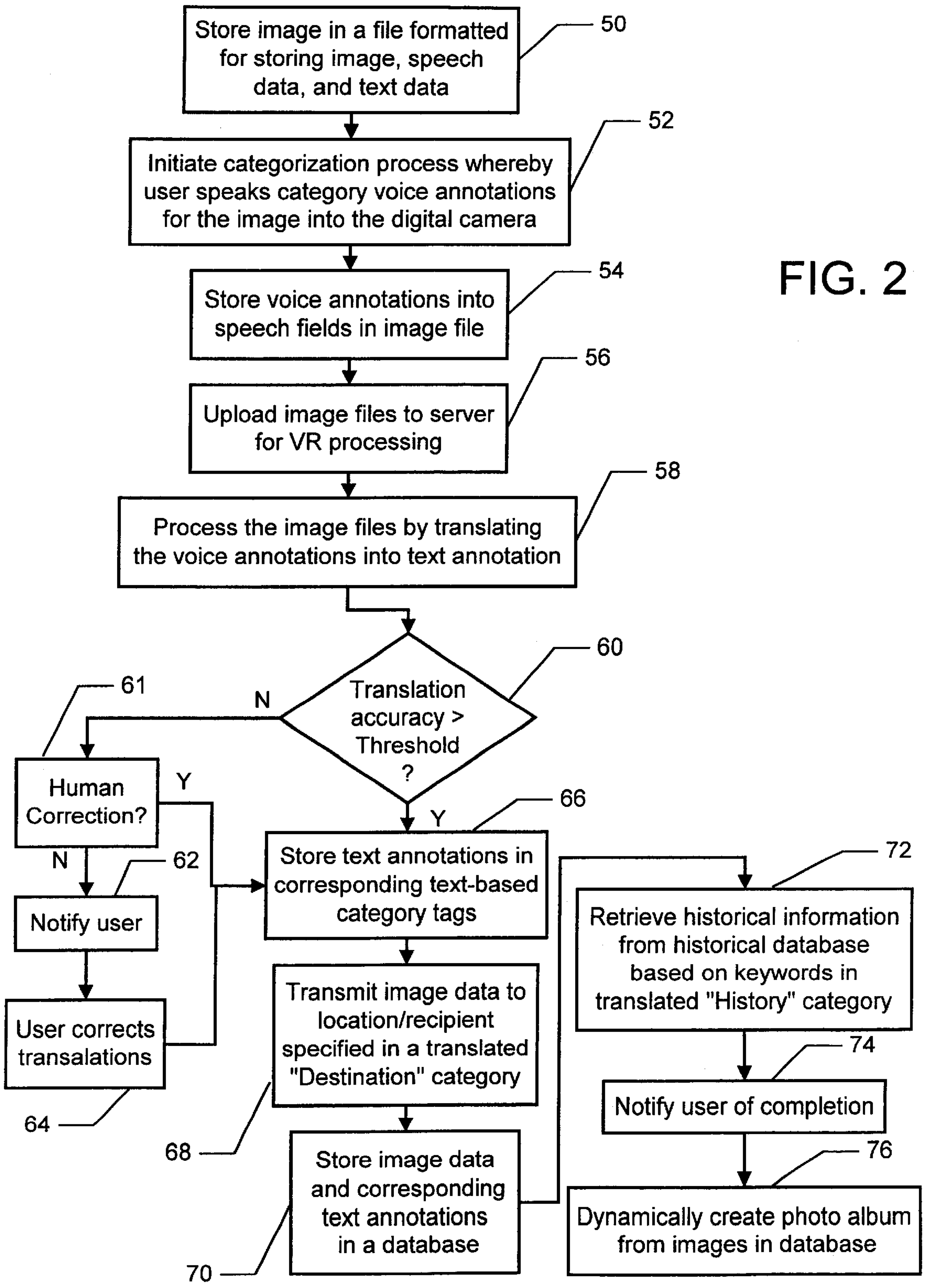

Store image in a file formatted for storing image, speech data, and text data
50
Initiate categorization process whereby user speaks category voice annotations for the image into the digital camera
52
Store voice annotations into speech fields in image file
54
Upload image files to server for VR processing
56
Process the image files by translating the voice annotations into text annotation
58
Translation accuracy > Threshold ?
60
N
61
Human Correction?
Y
N
62
Notify user
User corrects transalations
64
Y
66
Store text annotations in corresponding text-based category tags
Transmit image data to location/recipient specified in a translated "Destination" category
68
Store image data and corresponding text annotations in a database
70
72
Retrieve historical information from historical database based on keywords in translated "History" category
74
Notify user of completion
76
Dynamically create photo album from images in database

FIG. 2

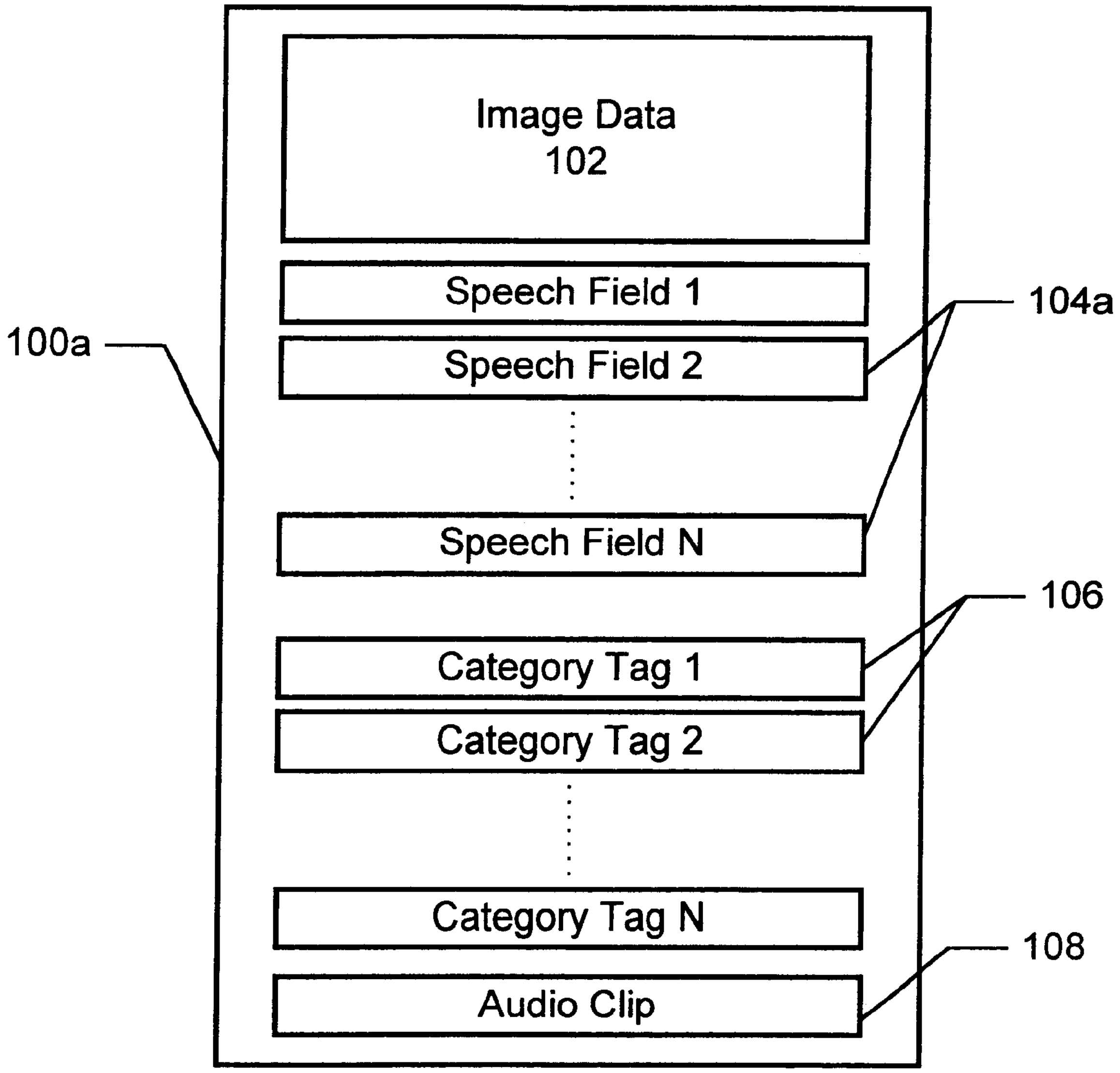


Image Data
102
Speech Field 1
Speech Field 2
Speech Field N
104a
100a
106
Category Tag 1
Category Tag 2
Category Tag N
108
Audio Clip

FIG. 3A

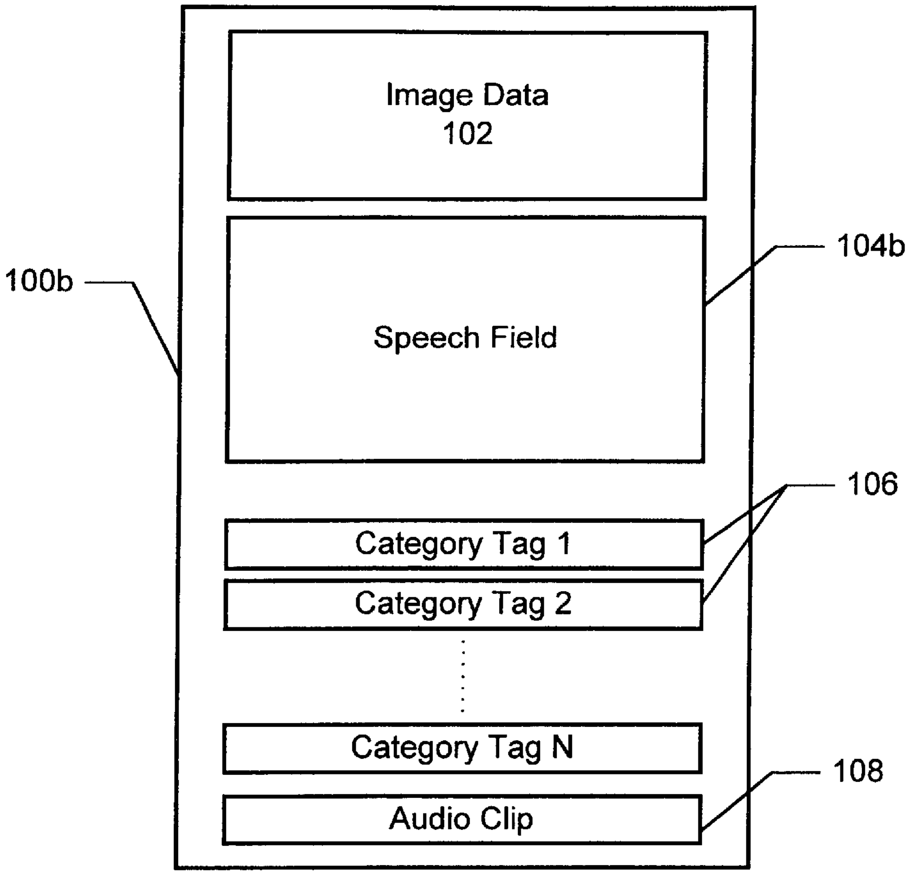


Image Data
102
100b
104b
Speech Field
106
Category Tag 1
Category Tag 2
Category Tag N
108
Audio Clip

FIG. 3B

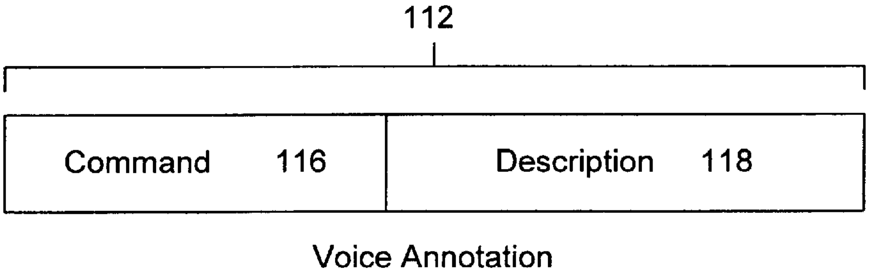

112
Command 116
Description 118
Voice Annotation

FIG. 4

AUTOMATICALLY STORING AND PRESENTING DIGITAL IMAGES USING A SPEECH-BASED COMMAND LANGUAGE

FIELD OF THE INVENTION

The present invention relates to digital images, and more particularly to a method and system for automatically categorizing, storing, and presenting the images using a speech-based command language on a web server and a digital camera.

BACKGROUND OF THE INVENTION

As digital photography and the digitization of old photographs become more and more prevalent, the number of digital images that are stored and archived will increase dramatically. Whether the digital images are stored locally on a user's PC or uploaded and stored on a Web photo-hosting site, the number of images will make it increasingly difficult for a user to find desired images.

To alleviate this problem, some digital cameras allow a user to categorize images according to a single subject category, such that when the images are downloaded to a host computer, the images having the same category are stored in the same file folder (U.S. Pat. No. 5,633,678-Electronic Still Camera For Capturing And Categorizing Images).

Although categorizing images with a single subject matter category is useful for very high-level sorting, for searching a large number of images and for more powerful searching, multiple categories are required. However, selecting and/or entering information for multiple categories on a digital camera would be cumbersome and tedious for the user.

One solution is to first upload the images from the digital camera to a PC, and then categorize the images on the PC using an image management application, such as PhotoSee Pro by ACD Systems, for example. Such image management applications typically display thumbnail images and allow the user to enter properties, such as caption, date, photographer, description, and keywords, for each thumbnail image. The user may then search the entire photo collection by entering desired properties.

Although programs such as PhotoSee Pro, and image database programs in general, allow the categorization of images using multiple categories, these programs have major drawbacks. One problem is that when categorizing the images, the user must retype the category information for each image. When categorizing a large amount of images, manually entering category information for each image is extremely tedious and time-consuming.

Another problem with uploading the images to a PC and categorizing the images on the PC is that the user must remember all the pertinent information for each image, which may not be an easy task, especially if a significant amount of time has past between capturing the images and categorizing them. A further problem is that all the category information entered for a series of images is generally only used for indexing. That is, it may be difficult for the user to view the category information when the images are presented for viewing and/or printing.

Accordingly, what is needed is an improved method for automatically categorizing, storing, and presenting digital images. The present invention addresses such a need.

SUMMARY OF THE INVENTION

The present invention provides a method for automatically storing and presenting digital images is disclosed. The method includes capturing digital images with a digital camera and storing the images in an image file, where the file includes at least one speech field and at least one text-based tag. A categorization process is then initiated whereby a user speaks at least one category voice annotation into the digital camera to categorize an image, and the category voice annotation is stored in the speech field of the corresponding image file. The category voice annotation is then translated into at a text annotation using voice recognition, and the image and the text annotation are automatically stored in a database. An album may then be dynamically created by retrieving selected images and corresponding text annotations from the database in response to a request from the user, and displaying each image on the album along with the text annotations.

According to the system and method disclosed herein, the present invention allows a user to categorize images at the time of capture with multiple categories of information by merely speaking into the camera. And since the user's voice annotations are automatically recognized, translated, and stored in a database, the need for the user to manually enter categorization information is eliminated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram illustrating a system for automatically categorizing, storing, and presenting digital images in accordance with a preferred embodiment of the present invention.

FIG. **2** is a flow chart illustrating the process of automatically categorizing and storing digital images on a computer using a speech-based command language in a digital camera.

FIGS. **3A** and **3B** are block diagrams illustrating two image file formats in accordance with the present invention.

FIG. **4** is a block diagram illustrating the format of the speech-based command language in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION

The present invention relates to categorizing, storing and presenting digital images. The following description is presented to enable one of ordinary skill in the art to make and use the invention and is provided in the context of a patent application and its requirements. Various modifications to the preferred embodiment and the generic principles and features described herein will be readily apparent to those skilled in the art. Thus, the present invention is not intended to be limited to the embodiment shown but is to be accorded the widest scope consistent with the principles and features described herein.

FIG. **1** is a block diagram illustrating a system for automatically categorizing, storing, and presenting digital images in accordance with a preferred embodiment of the present invention. The system **10** includes a digital camera **12** for capturing digital images **14** and a website **15** for storing and presenting the images. The digital camera **12** includes an LCD screen **18** for displaying captured images, and a microphone **20** and audio button **22** for recording sound. After capturing a series of images, a user may upload files **100** containing the images to the website **15**. The website **15** includes a web server **16** equipped with a voice recognition application **30**, and a database **24** in which the images **100** are stored. The present invention provides the user with an automated method for storing the images on the website and for having the images categorized.

By contrast, categorizing images in a conventional system would require the user to load the images on a computer, such as a PC, and use an image management application to enter the category information. Not only is the user forced to remember all the categorization information for each image because categorization takes place well after the images are captured, but the user must also type in the category information for every image during the categorization.

The present invention solves both problems by allowing the user to categorize images on the camera itself at the time of capture by recording category-specific voice annotations on the camera **12**. The voice annotations, which are associated with the image, are then translated by voice recognition into text annotations, and the image and corresponding text annotations are automatically stored in the database **24** on the web site **15**. The images are also indexed in the database **24** by the translated text annotations so that the images may be found more easily. An album **26**, either web-based or printed, may automatically be generated from selected images in the database **24**, where both the images **102** and the image's text annotations **28** are displayed.

FIG. **2** is a flow chart illustrating the process of automatically categorizing and storing digital images on a computer using a speech-based command language in a digital camera. The first step of the process is in response to capturing an image, storing the image in an image file that includes a format for storing image data, speech data, and text data in step **50**.

FIG. **3**A shows one preferred embodiment of an image file **100** in accordance with the present invention. The image file **100***a* includes image data **102**, multiple speech fields **104***a*, multiple text-based category tags **106**, and an audio clip field **108**. The image data **102** is the data comprising a captured image in compressed form, such as JPEG format. The speech fields **104***a* store the category voice annotations spoken by the user, and the textbased category tags **106** store text translations of those category voice annotations, as explained further below. The audio clip field **108** is for storing sound recorded for the image data **102**, such as ambient audio recorded at the time of capture, a speech annotation, or music.

FIG. **3**B shows a second preferred embodiment of an image file **100***b*, where the like components from FIG. **3**A have like reference numerals. The format of image file **100***b* is similar to the format of image file **100***a*, except that the multiple speech fields are replaced with one large contiguous speech field **104***b*.

Referring again to FIG. **2**, after an image is stored, a categorization process is initiated whereby the user speaks at least one category voice annotation for that image into the camera in step **52**. According to the present invention, a speech-based command language is provided that enables the user to speak category information for multiple categories. The command language enables the server and/or the digital camera to associate the spoken information with a particular category.

FIG. **4** is a block diagram illustrating the format of the speech-based command language in accordance with a preferred embodiment of the present invention. The speech-based command language defines a voice annotation **112** as a command **116** identifying a particular category, which is followed by a description **118** within that category pertaining to the current image.

The command language may include a vocabulary to identify any number categories. Example command/categories include "Occasion", "Location", "Caption", "Destination", and "History", for instance. The "Occasion" category allows the user to speak the name of occasion or event during which the current image was captured. The "Location" category allows the user to speak a location of where the current image was captured. The "Caption" category allows the user to speak details about the image.

According to one aspect of the present invention, two command/categories, "Destination" and "History", are provided with functional characteristics. The "Destination" category allows the user to identify a destination or person (e.g., email address) to whom the current image is to be sent. The terms spoken for the "History" category are used by the server **16** to search a historical database **32** so that relevant articles may be retrieved and associated with the image.

Assume, for example, the user wishes to categorize an image taken at the Acropolis in Athens, Greece. The user might record the following voice annotations for this image:

"Occasion: vacation in Greece"

"Location: the Acropolis in Athens"

"Caption: the east side of the Parthenon"

"Destination: mom@home.com"

"History: Greek mythology"

The categorization process on the digital camera **12** using the speech-based command language may be implemented in a variety of ways. In a preferred embodiment, the categorization process may be automatically initiated immediately after image capture, or manually initiated by the user after a series of images have been taken.

In addition, the voice annotations **112** may be recorded individually or continuously in a series. A user may continuously record a voice annotation by pressing the audio button **22** to begin a recording session and speaking a voice command identifying a category (e.g., "Caption"), followed by a description; speaking a second voice command identifying another category (e.g., "Location") followed by a description, and so on for each category the user wishes to annotate. To help with this process, the camera **12** could display a sequence of prompts reminding the user to annotate particular categories. Rather than displaying a text prompt, the camera **12** could play a voice prompt requesting that the user speak a phrase for a particular category. For example, the camera could ask the user "In What Location Was This photo Taken?" In response, the user speaks a voice annotation, which is then recorded by the camera **12** under the "Location" category.

During this sequential recording, the user may need to pause to think about what they wished to record. Therefore, the user may also record each category voice annotation **112** individually in a series of discrete recording sessions. A user may individually record a voice annotation **112** by beginning and ending a recording session for each annotation **112**. For example, the user may press the audio button **22** and speak "Caption" followed by a description, and then press the audio button **22** again to end the recording session. The user may then begin a second recording session by pressing the audio button **22** and speaking "Location", speaking a description, and then pressing the audio button **22** again to end the session.

Referring again to FIG. **2**, after the voice annotations **112** are recorded, the voice annotations **112** are stored in the speech fields **104** of the image file **100** in step **54**. In a preferred embodiment, if the voice annotations **112** are recorded individually, then each voice annotation **112** may be stored in the separate speech fields **104***a* of the image file **100***a* (FIG. **3**A). If the voice annotations **112** are recorded as a continuous series, then the series of voice annotations **112** may be stored in the single speech field **104***b* of image file **100***b* (FIG. 3B). Although in a preferred embodiment, the voice annotations **112** are stored along with the image in an image file **100**, the voice annotations may also be stored in a file separate from the image file **100**.

After the user has finished categorizing images with voice annotations **112**, the image files **100** are uploaded to the server **16** for processing and voice recognition in step **56**.

In a preferred embodiment, the images are uploaded by either directly connecting the camera **12** to the Internet via a modem or wireless technology, or by uploading the images to a PC first and then uploading them to the server **16** over the Internet. In an alternative embodiment, the images may be uploaded to a local computer for processing, rather than a Web server. In this case, the images are transferred to the computer via serial, USB, IEEE 1394, wireless, or by inserting a memory card from the camera into a computer card slot.

During uploading process, the user preferably identifies him or herself with an account number, and requests a voice processing service to identify that the image files **100** have voice annotations that need translating. The user may also specify parameters controlling the processing, such as selecting a photo album format, a title for the photo album, and whether the photo album will include historical information from the "History" category, and so on. In a preferred embodiment, the title for the photo album, or album name, may be provided as one of the commands so that the user may speak an album name for each image.

After the image files **100** are received by the server **16**, the image files **100** that the user has identified for voice recognition are processed by translating each of the voice annotations **112** in the image file **100** into a text annotation **28** in step **58**.

A threshold test is then performed to determine whether the probability of translation accuracy for each image exceeds an acceptable threshold in step **60**. In a preferred embodiment, the threshold test is performed by the server **16**, and if the test fails, then a human operator attempts to manually correct any mistranslations in step **61**. If the human operator cannot correct the mistakes, then the translation will fail the threshold test. The presence of the human operator may be an option chosen by the user, where electing not to have a human operator lowers the cost of the overall service.

If the translation fails the threshold test in step **60** and/or step **61**, then the user is notified by e-mail or instant messenger and requested to correct the translations in step **62**. The user may then correct the translations via reply e-mail or through the Web site in step **64**.

Once the text annotations **28** pass the threshold test or are corrected, the text annotations **28** are stored in corresponding text-based category tags **106** within the image file **100** in step **66**. Optionally, the voice annotations **112** may be deleted after being translated and stored in the category tags **106** to reduce storage requirements.

According to the present invention, if the "Destination" category has been translated, then the server **16** transmits the image data **102** to the specified location and/or recipient in step **68**. The destination specified could be an e-mail address, a fax number, or a department name within a company, for instance.

According to another aspect of the present invention, the image data **102** and corresponding text annotations **28** are also stored in the database **24** in step **70**. Preferably, the image data **102** and the text annotations **28** are saved under the name of the photo album specified by the user during the image upload process. In a preferred embodiment, the image file **100** is parsed, and the image data **102** is stored on a file server, while the text annotations are stored in a relational database. Also stored are the user's profile, a list of all the images uploaded by the user, the location of the images and the category tags, and the names of the photo albums to which they belong.

The voice annotation for the "Caption" category may be the same as the voice annotation entered for the "History" category (e.g., speaking "San Francisco" for both "Caption" and "History" for an image taken in San Francisco), or they may be different. The difference is that the words in the "History" category are used as keywords for searching the historical database **32**. The historical information retrieved from the historical database **32** based on those keywords may then be stored in the database **24** with the corresponding image data **102** as a historical category tag in step **72**.

After all the image files **100** have been processed and stored in the database **24**, the user is notified in step **74**. In response to the user visiting the website **15** and selecting a photo album name, all the images in the database **24** indexed under the album name are retrieved to dynamically create the album **26** in real-time in step **76**. The server **16** automatically generates the necessary markup language (e.g., HTML and XML) and inserts all the images indexed under the album name from the database **24**. The text annotations **28** from the category tags for each image are also inserted into the HTML. The HTML of the Web-based photo album **26** is then provided to be the user's Web browser. The user may also choose to have the album **26** printed as well.

In a second embodiment, the user may manually create the photo album **26** from selected images by visiting the Web site and entering keywords into a database search field. In response, all the images from the database **24** having matching keywords in the text annotations **28** are displayed on the photo album **26** along with their corresponding text annotations **28**. For example, the user may log onto the website **15** and instruct the server **16** to create a photo album **26** comprising all images taken while at the "Beach" on "Vacation". The server **16** will then use those keywords and return to all the images in the database having matching keywords.

As described above, the preferred embodiment of the present invention takes advantage of the processing power of the server **16** to perform the voice recognition. In an alternative embodiment, however, if the digital camera **12** is provided with sufficient memory and processing power, then the voice recognition could be performed on the camera **12** to translate the voice annotations **112** into text. In this case, the server **16** would only need to store the image **102** and the category tags **106** in the database.

A method and system for automatically categorizing, storing, and presenting digital images has been disclosed. The present invention has been described in accordance with the embodiments shown, and one of ordinary skill in the art will readily recognize that there could be variations to the embodiments, and any variations are would be within the spirit and scope of the present invention. Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the appended claims.

What is claimed is:

1. A method for automatically storing and presenting digital images, comprising the steps of:

(a) storing a digital image on a digital camera in an image file that includes at least one speech field and at least one text-based tag;

(b) initiating a categorization process whereby a user speaks at least one category voice annotation into the digital camera;

(c) storing the category voice annotation in the speech field of the image file;

(d) providing the digital camera with a voice recognition application and translating the category voice annotation into a text annotation on the digital camera using the voice recognition application;

(e) automatically storing the image and the text annotation in a database; and

(f) dynamically creating an album by retrieving selected images and corresponding text annotations from the database in response to a request from the user, and by displaying each image on the album along with the text annotations.

2. A method for automatically storing and presenting digital images, comprising the steps of:

(a) storing a digital image on a digital camera in an image file that includes at least one speech field and at least one text-based tag;

(b) initiating a categorization process whereby a user speaks at least one category voice annotation into the digital camera;

(c) storing the category voice annotation in the speech field of the image file;

(d) translating the category voice annotation into at a text annotation using a voice recognition application and recognizing at least one voice command within the voice annotation, wherein the at least one voice command identifies a category;

(e) automatically storing the image and the text annotation in a database; and

(f) dynamically creating an album by retrieving selected images and corresponding text annotations from the database in response to a request from the user, and by displaying each image on the album along with the text annotations.

3. The method of claim 2 wherein step (d) further includes the step of:

(iii) providing a destination voice command that identifies a location/recipient of where the voice annotation should be sent; and

(iv) transmitting the image and the text annotation to the identified location/recipient.

4. The method of claim 3 wherein step (f) further includes the step of:

(i) retrieving the selected images based on the album name supplied by the user.

5. The method of claim 2 wherein step (d) further includes the step of:

(v) providing a history voice command; and

(vi) using keywords from the text annotation to retrieve articles from a historical database.

6. The method of claim 5 wherein step (f) further includes the step of:

(ii) providing a web page to the user including the retrieved images and the text annotations.

7. The method of claim 5 wherein step (f) further includes the step of:

(ii) printing a photo album including the retrieved images and the text annotations.

8. A method for automatically storing and presenting digital images, comprising the steps of:

(a) receiving an image and a plurality of image tags associated with the image, wherein the plurality of image tags include voice annotations and at least one text-based image tag;

(b) translating the first plurality of voice annotations into a first plurality of text annotations;

(c) storing the image and the plurality of text annotations in a database, wherein the database includes previously stored images and corresponding text annotations; and

(d) dynamically creating an album of a subset of images stored in the database by retrieving selected images and corresponding text annotations from the database in response to a database query from the user, wherein the database query identifies one or more selection criteria for the plurality of text annotations, and displaying each image on the album along with the text annotations that has corresponding text annotations satisfying the database query.

9. The method of claim 8 wherein step (a) further includes the step of:

(i) receiving a photo album name for the image.

10. The method of claim 9 wherein step (a) further includes the step of:

(ii) providing the plurality of voice annotations with at least one voice command identifying a category.

11. The method of claim 10 wherein step (b) further includes the step of: translating the plurality of voice annotations using a voice recognition application.

12. The method of claim 11 wherein step (b) further includes the step of:

(ii) recognizing the at least one voice command within the plurality of voice annotations; and

(iii) storing the plurality of text annotations into the at least one text-based image tag.

13. The method of claim 12 wherein step (d) further includes the step of:

(i) retrieving the selected images based on the photo album name supplied by the user.

14. The method of claim 13 wherein step (f) further includes the step of:

(ii) providing a web page including the retrieved images and the text annotations.

15. The method of claim 13 wherein step (f) further includes the step of:

(ii) printing a photo album including the retrieved images and the plurality of text annotations.

16. A system for automatically storing and presenting digital images, comprising:

a server for receiving image files containing digital images from a user, wherein each image file includes a first plurality of speech fields and at least one text-based tag, wherein the speech fields store a second plurality of category voice annotations spoken by the user where the voice annotations categorize the respective digital image;

a voice recognition application for translating each of the category voice annotations stored in speech fields of the image files into text annotations;

a database for storing each image and the corresponding text annotation, wherein each image is indexed according to its text annotations; and

album creation means for dynamically creating an album of a subset of the image files stored in the database in response to a user's database query, wherein the database query identifies one or more selection criteria, by retrieving selected images and corresponding text annotations from the database, wherein each image is displayed on the album along with the text annotations and wherein the displayed images have corresponding text annotations satisfying the database query.

17. The system of claim **16** wherein the text annotations are automatically stored in the at least one text-based tag in the image file.

18. The system of claim **17** wherein the server receives the image files and an album name to which the images are to be associated with.

19. The system of claim **18** wherein the server receives the image files directly from a digital camera.

20. The system of claim **19** wherein each category voice annotation comprises at least one voice command that identifies a category, followed by a description.

21. The system of claim **20** wherein a first voice command comprises a destination command that identifies a location/recipient, and the server transmits the image and the text annotation to the identified location/recipient.

22. The system of claim **20** wherein a second voice command comprises a history command, wherein words in the description are used to retrieve articles from a historical database.

23. The system of claim **16** wherein the album creation means retrieves the selected images based on the album name supplied by the user.

24. The system of claim **16** wherein the album creation means provides a web page to the user including the retrieved images and the text annotations.

25. The system of claim **16** wherein a category voice annotation comprises at least one voice command.

26. A method for processing digital images, comprising the steps of:

(a) storing a digital image on a digital camera in an image file that includes one or more speech fields and one or more text-based tags;

(b) initiating a categorization process whereby a user speaks a plurality of category voice annotations into the digital camera;

(c) storing the plurality of category voice annotations in the one or more speech fields of the image file;

(d) translating the plurality of category voice annotations into a plurality of text annotations; and

(e) automatically storing the image and the plurality of text annotations in a database using the plurality of text annotations as a plurality of database searchable fields to the digital image.

27. The method of claim **26** further comprising the step of:

(f) dynamically creating an album of a subset of image files stored in the database by retrieving one or more images from the database in response to a database query from the user, wherein the database query identifies one or more selection criterion using the database searchable fields and the retrieved one or more images having corresponding text annotations that satisfy the database query.

28. The method of claim **27** wherein step (f) further includes retrieving text annotations corresponding to the retrieved one or more images.

29. The method of claim **28** wherein step (f) further includes the step of:

(g) displaying the one or more images of the album and the corresponding one or more text annotations.

30. The method of claim **27** wherein step (f) further includes the step of:

(g) displaying the one or more images of the album.

31. The method of claim **26** wherein a text annotation includes a voice command and step (d) further comprises executing the voice command after it is translated.

32. The method of claim **31** wherein the voice command includes a destination voice command and the execution of the destination voice command results in transmittal of the digital image to a preselected destination.

33. The method of claim **32** wherein the destination voice command identifies a location/recipient and the preselected destination includes the location/recipient.

34. The method of claim **31** wherein the voice command includes an information voice command and the execution of the information voice command results in retrieval of preselected information.

35. The method of claim **34** wherein the information voice command includes a historical voice command.

36. The method of claim **35** wherein the preselected information includes historical information from a historical database.

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