an image may be determined. The region of interest in an image may be captured as a medical dose preparation image that eliminates at least a portion of image data not within the region of interest.

Thus, the amount of image data stored in memory may be reduced without a reduction in resolution of the corresponding image and/or the resolution of a captured image may be increased while maintaining or reducing the amount of corresponding image data stored in memory. That is, for a given image resolution, the amount of corresponding image data may be reduced by reducing the size of the image. Thus, with little hardware resources, e.g., little memory capacity, a large amount of data can be stored. Moreover, with little hardware resources, e.g., little processing power, image data can be processed.

Additionally or alternatively, for a given amount of image data, a higher resolution image may be stored if the corresponding image data is only that of a cropped portion of the image. Accordingly, if the amount of image data is reduced, the computational overhead required to process, store, or otherwise take action with respect to the image may be reduced such that work flows at the work station may occur more quickly. Additionally or alternatively, if the resolution of an image is increased, a review of the image may be improved by allowing for capture of finer details (e.g., to allow for magnification of the image during a review by a pharmacist or the like).

In this regard, a first aspect described herein includes an apparatus for processing medical dose preparation image data in a system for medical dose preparation management. The system includes an imaging device (e.g., a digital camera) having an imaging field encompassing a medical dose preparation staging region. The imaging device is operable to output digital image data (e.g., corresponding to still digital images, a digital video data stream, and/or other forms of digital image data) of the imaging field including the medical dose preparation staging region. The system also includes a processor in operative communication with the imaging device to receive the digital image data of the imaging field. The system allows for automation of documenting medical dose order preparation and/or delivery. In particular the system may allow for such automation at a very high speed and/or increased image resolution which would otherwise not be possible by a human person. In other words, the system advantageously combines digital image processing with medical dose order preparation and/or drug delivery that would otherwise not have been done, since, according to this application, data processing may be carried at a high speed and/or with increased image resolution.

The system of the first aspect alsomay includes a display that is in operative communication with the processor to receive the digital image data of the imaging field and display a corresponding image that is perceivable by a user. The processor is operable to

process the digital image data to identify at least one region of interest within the imaging field corresponding to at least one medication receptacle disposed in the medical dose preparation staging region. As such, in the event a display is utilized as described above, the region of interest is defined by a bounding area that is~~may be~~ visually differentiated on the display by the processor in a manner visually perceivable by the user. Hence, by the system, without the need of physically controlling the imaging device or accessing one or more medication receptacles at the medical dose preparation staging region, by a human person, it is possible to allow for the high level of documentation desired in medical dose preparation and/or delivering. In other words, the system allows relieving the human person from and/or assisting the user in the task of manual steps to obtain detailed documentation (e.g., detailed image data). Even more, since the documentation is machine aided or even completely carried out by the machine, namely the system described in this application, the documentation is more reliably or trustworthy as compared to the documentation by a human person. It may even only be possible to assure such documentation since the system strictly follows machine rules without deviation such as are possible for a human person.

The system of the first aspect further ~~may also~~ includes a user control device that is controllable by the user and in operative communication with the processor to initiate the capture of a medical dose preparation image data from the digital image data at the processor. Other embodiments may include other mechanisms for initiating the capture of a medical dose preparation image. In any regard, the medical dose preparation image data ~~may~~ includes image data corresponding to at least a portion of the region of interest and ~~may~~ excludes other image data corresponding with another~~at least a~~ portion of the imaging field (e.g., corresponding to a portion of the image data outside the region of interest). The system ~~may~~ also includes a memory in operative communication with the processor to receive and store the medical dose preparation image data. The user control device provides for improved man machine interaction due to, e.g., in connection with the processor automatically processing the image.

A number of feature refinements and additional features are applicable to the first aspect. These feature refinements and additional features may be used individually or in any combination. As such, each of the following features that will be discussed may be, but are not required to be, used with any other feature or combination of features of the first aspect.

In an embodiment, the processor may be operable to analyze the digital image data to identify the region of interest. For example, the processor may be operable to analyze a predetermined subset of the digital image data (e.g., a subset of the pixels of the digital image data) to identify the region of interest. The subset may correspond to a

plurality of adjacent corresponding pixels from the background image. In this regard, insignificant variations related to the discrepancies disclosed above may be disregarded in the analysis.

In an application, the identified location resulting from the comparison of intensity data between the digital image data and the background image may correspond to one of a minimum and/or maximum threshold difference along the grid lines in a first direction and/or in a second direction. That is, two threshold differences may be identified in either or both of the first and second direction corresponding to the extents of the medication receptacle in the width and/or height dimension. In still another application, the identified location may be selected to correspond to the next most remote grid line of the grid exterior to the threshold difference in the first direction and in the second direction along the grid line. As such, if a portion of the medication receptacle extends beyond a grid line along which a threshold difference is identified, the full portion of the receptacle may still be contained in the region of interest if the identified location is selected as the next remote grid line. Summarizing the above, the system provides an improved man machine interaction, e.g., by relieving the user from and/or assisting the user in the manual and/or mental task to control the imaging device or manipulate one or more medication receptacles.

A second aspect described herein includes a method for processing and capturing medical dose preparation image data. The method includes encompassing a medical dose preparation staging region in an imaging field of an imaging device. The method further includes obtaining digital image data of the imaging field. The method also includes identifying, at a processor in operative communication with the imaging device, a region within the imaging field corresponding to at least one medication receptacle disposed in the medical dose preparation staging region. The method may also include displaying the digital image data on a display, wherein the region ~~of interest may be~~ is defined by a bounding area that is visibly distinguished by the processor on the display in a manner that is perceivable by a user.

The method of the second aspect ~~may~~ also includes receiving an input from a user control device controllable by a user to initiate capture of medical dose preparation image data from the digital image data at the processor. The medical dose preparation image data includes image data corresponding to at least a portion of the region and excludes other image data corresponding with another portion of the imaging field. The method further includes storing the medical dose preparation image data in a memory. In various method embodiments, the method may employ a system comprising any of the system features described herein.

According to yet another embodiment~~aspect~~, a computer program product is provided that can be stored on a computer readable medium and/or can be implemented as computer processable data stream, wherein the computer program product comprises computer processable instructions, which instructions when read in the memory of a computer and

CLAIMS

What is claimed is:

1. A system (30) for medical dose preparation management, the system comprising:

an imaging device (80) having an imaging field (84) encompassing a medical dose preparation staging region (86), the imaging device (80) being operable to output digital image data of the imaging field (84) including the medical dose preparation staging region (86);

a processor (70) in operative communication with the imaging device (80) to receive the digital image data of the imaging field (84);

a display (110) in operative communication with the processor (70) to receive the digital image data of the imaging field (84) and display a corresponding image that is perceivable by a user, wherein the processor (70) is operable to process the digital image data to identify at least one region of interest within the imaging field (84) corresponding to at least one medication receptacle (100, 100a, 100b) disposed in the medical dose preparation staging region (86), wherein the region of interest is defined by a bounding area (360) that is visually differentiated on the display (110) by the processor (70) in a manner visually perceivable by the user;

a user control device (130) controllable by the user and in operative communication with the processor (70) to initiate the capture of a medical dose preparation image data from the digital image data at the processor (70), wherein the medical dose preparation image data includes image data corresponding to at least a portion of the region of interest and excludes other image data corresponding with another portion of the imaging field; and

a memory (120) in operative communication with the processor (70) to receive and store the medical dose preparation image data.

2. The system (30) according to Claim 1, wherein the digital image data comprises a video data stream.

3. The system (30) according to Claim 2, wherein the processor (70) is operable to analyze the video data stream comprising the digital image data to identify the region of interest.

4. The system (30) according to Claim 1, wherein the excluded portion of the imaging field (84) is outside the region of interest.

5. The system (30) according to Claim 1, wherein the processor (70) is operable to analyze a predetermined subset of the digital image data to identify the region of interest.

6. The system (30) according to Claim 5, wherein the analysis includes comparing the digital image data to a background image of the medical dose preparation staging region (86).

7. The system (30) according to Claim 6, wherein the background image does not include any medication receptacle (100, 100a, 100b) in the medical dose preparation staging region (86).

8. The system (30) according to Claim 7, wherein the predetermined subset of the digital image data is compared to a corresponding subset of the background image.

9. The system (30) according to Claim 8, wherein the predetermined subset corresponds to a plurality of pixels of the digital image data.

10. The system (30) according to Claim 9, wherein the plurality of pixels extend across substantially the entire digital image data in at least a first direction.

11. The system (30) according to Claim 10, wherein the plurality of pixels extend across substantially all of the digital image data in a second direction perpendicular to the first direction.

12. The system (30) according to Claim 9, wherein the plurality of pixels form a grid over the digital image data.

13. The system (30) according to Claim 12, wherein the grid comprises grid lines (210) that are spaced in relation to a known size of medication receptacles (100, 100a, 100b).

14. The system (30) according to Claim 13, wherein the bounding area (360) is defined by a plurality of edges.

15. The system (30) according to Claim 14, wherein each of the plurality of edges is disposed at an identified location of the predetermined subset of the digital image data at least partially based on a threshold difference between the digital image data and the background image at the identified location.

16. The system (30) according to any one of Claims 9-15, wherein the processor (70) is operable to calculate intensity data for each pixel of the predetermined subset of the digital image data and for each pixel of the corresponding predetermined subset of the background image.

17. The system (30) according to Claim 16, wherein said intensity data is filtered.

18. The system (30) according to Claim 17, wherein said intensity data undergoes at least one of high pass filtering.

19. The system (30) according to Claim 16, wherein the threshold difference comprises a predetermined difference in intensity data between the predetermined subset of the digital image data and the background image.

20. The system (30) according to Claim 16, wherein each pixel of the predetermined subset is compared to a plurality of adjacent corresponding pixels from the background image.

21. The system (30) according to Claim 15, wherein the identified location corresponds to one of a minimum or maximum threshold difference along the grid lines (210, 212) in the first direction or in the second direction.

22. The system (30) according to Claim 21, wherein the identified location is selected to correspond to the next most remote grid line (210, 212) of the grid exterior to the threshold difference in the first direction and in the second direction along the grid line.

23. A method for processing and capturing medical dose preparation image data, the method comprising:

encompassing a medical dose preparation staging region (86) in an imaging field of an imaging device (80);

obtaining digital image data of the imaging field;

identifying, at a processor (70) in operative communication with the imaging device (80), a region within the imaging field corresponding to at least one medication receptacle (100, 100a, 100b) disposed in the medical dose preparation staging region (86);

displaying the digital image data on a display (110), wherein the region is defined by a bounding area (360) that is visibly distinguished by the processor (70) on the display (110) in a manner that is perceivable by a user;

receiving an input from a user control device (130) controllable by a user to initiate capture of medical dose preparation image data from the digital image data at the processor (70), wherein the medical dose preparation image data includes image data corresponding to at least a portion of the region and excludes other image data corresponding with another portion of the imaging field; and

storing the medical dose preparation image data in a memory (120).

24. The method according to Claim 23, wherein the digital image data comprises a video data stream.

25. The method according to Claim 24, wherein the identifying occurs more rapidly than a refresh rate of the video data stream.

26. A method according to Claim 24, utilizing a system (30) according to any one of Claims 1-22 or 27.

27. The system (30) according to Claim 14, wherein the bounding area (360) is represented by at least one of a superimposed box, and as an area displayed in a manner different than that of an area outside of the bounding area (360).

CLAIMS

What is claimed is:

1. A system for medical dose preparation management, the system comprising:

an imaging device having an imaging field encompassing a medical dose preparation staging region, the imaging device being operable to output digital image data of the imaging field including the medical dose preparation staging region;

a processor in operative communication with the imaging device to receive the digital image data of the imaging field;

a display in operative communication with the processor to receive the digital image data of the imaging field and display a corresponding image that is perceivable by a user, wherein the processor is operable to process the digital image data to identify at least one region of interest within the imaging field corresponding to at least one medication receptacle disposed in the medical dose preparation staging region, wherein the region of interest is defined by a bounding area that is visually differentiated on the display by the processor in a manner visually perceivable by the user;

a user control device controllable by the user and in operative communication with the processor to initiate the capture of a medical dose preparation image data from the digital image data at the processor, wherein the medical dose preparation image data includes image data corresponding to at least a portion of the region of interest and excludes other image data corresponding with another portion of the imaging field; and

a memory in operative communication with the processor to receive and store the medical dose preparation image data.

2. The system according to Claim 1, wherein the digital image data comprises a video data stream.

3. The system according to Claim 2, wherein the processor is operable to analyze the video data stream comprising the digital image data to identify the region of interest.

4. The system according to Claim 1, wherein the excluded portion of the imaging field is outside the region of interest.

5. The system according to Claim 1, wherein the processor is operable to analyze a

predetermined subset of the digital image data to identify the region of interest.

6. The system according to Claim 5, wherein the analysis includes comparing the digital image data to a background image of the medical dose preparation staging region.

7. The system according to Claim 6, wherein the background image does not include any medication receptacle in the medical dose preparation staging region.

8. The system according to Claim 7, wherein the predetermined subset of the digital image data is compared to a corresponding subset of the background image.

9. The system according to Claim 8, wherein the predetermined subset corresponds to a plurality of pixels of the digital image data.

10. The system according to Claim 9, wherein the plurality of pixels extend across substantially the entire digital image data in at least a first direction.

11. The system according to Claim 10, wherein the plurality of pixels extend across substantially all of the digital image data in a second direction perpendicular to the first direction.

12. The system according to Claim 9, wherein the plurality of pixels form a grid over the digital image data.

13. The system according to Claim 12, wherein the grid comprises grid lines that are spaced in relation to a known size of medication receptacles.

14. The system according to Claim 13, wherein the bounding area is defined by a plurality of edges.

15. The system according to Claim 14, wherein each of the plurality of edges is disposed at an identified location of the predetermined subset of the digital image data at least partially based on a threshold difference between the digital image data and the background image at the identified location.

16. The system according to any one of Claims 9-15, wherein the processor is operable to calculate intensity data for each pixel of the predetermined subset of the digital image data and for each pixel of the corresponding predetermined subset of the background image.

17. The system according to Claim 16, wherein said intensity data is filtered.

18. The system according to Claim 17, wherein said intensity data undergoes at least one of high pass filtering.

19. The system according to Claim 15, wherein the threshold difference comprises a predetermined difference in intensity data between the predetermined subset of the digital image data and the background image.

20. The system according to Claim 16, wherein each pixel of the predetermined subset is compared to a plurality of adjacent corresponding pixels from the background image.

21. The system according to Claim 15, wherein the identified location corresponds to one of a minimum or maximum threshold difference along the grid lines in the first direction or in the second direction.

22. The system according to Claim 21, wherein the identified location is selected to correspond to the next most remote grid line of the grid exterior to the threshold difference in the first direction and in the second direction along the grid line.

23. A method for processing and capturing medical dose preparation image data, the method comprising:

encompassing a medical dose preparation staging region in an imaging field of an imaging device;

obtaining digital image data of the imaging field;

identifying, at a processor in operative communication with the imaging device, a region within the imaging field corresponding to at least one medication receptacle disposed in the medical dose preparation staging region;

displaying the digital image data on a display, wherein the region is defined by a

bounding area that is visibly distinguished by the processor on the display in a manner that is perceivable by a user;

receiving an input from a user control device controllable by a user to initiate capture of medical dose preparation image data from the digital image data at the processor,

wherein the medical dose preparation image data includes image data corresponding to at least a portion of the region and excludes other image data corresponding with another portion of the imaging field; and

storing the medical dose preparation image data in a memory.

24. The method according to Claim 23, wherein the digital image data comprises a video data stream.

25. The method according to Claim 24, wherein the identifying occurs more rapidly than a refresh rate of the video data stream.

26. A method according to Claim 24, utilizing a system according to any one of Claims 1-22 or 27.

27. The system according to Claim 14, wherein the bounding area is represented by at least one of a superimposed box, and as an area displayed in a manner different than that of an area outside of the bounding area.