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(54) Title: METHOD AND SYSTEM FOR STABILIZATION AND REFRAMING

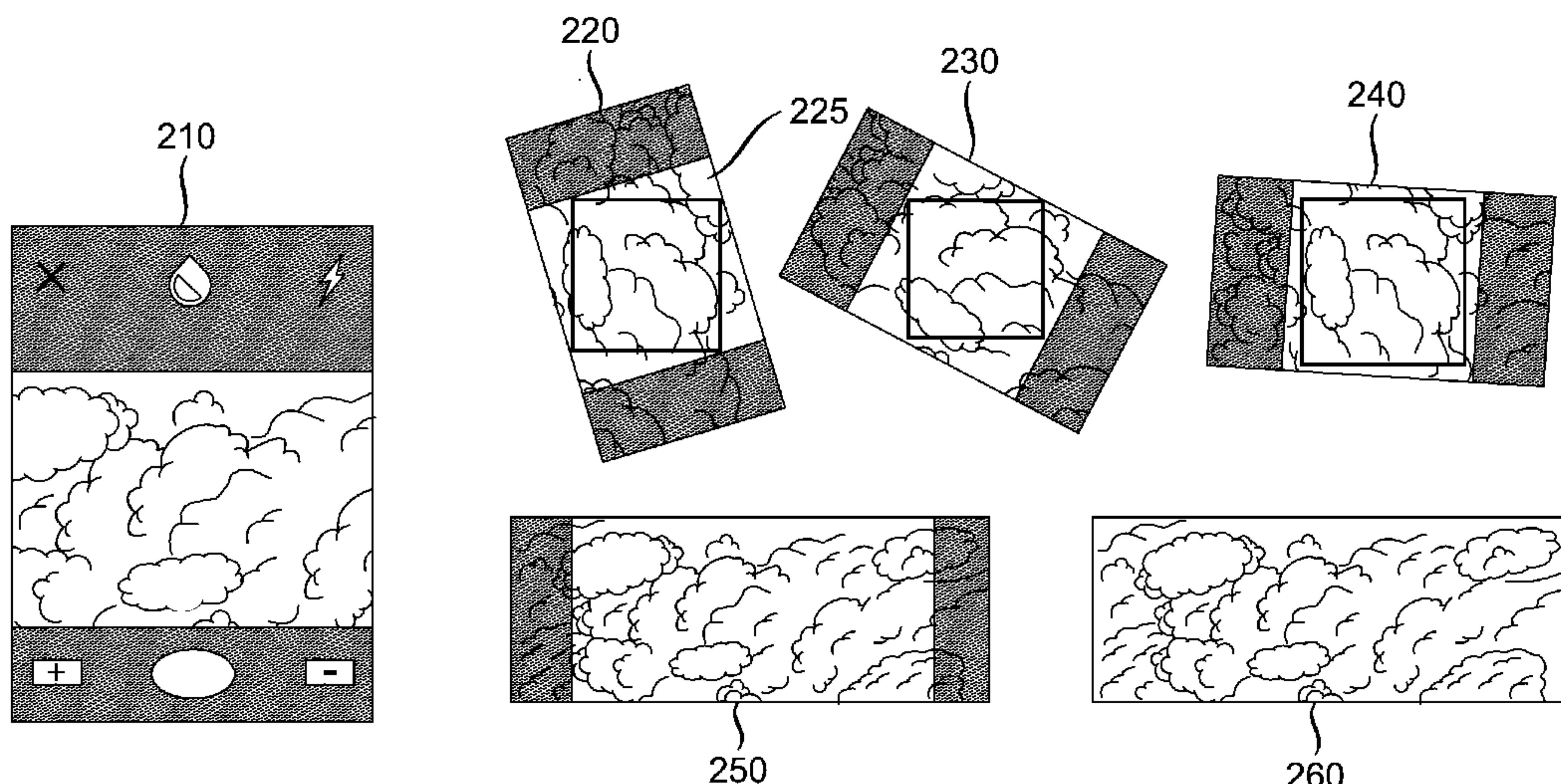


FIG. 2

(57) Abrégé/Abstract:

A method and apparatus for dynamically maintaining a horizontal framing of a video. The system permits the user to freely rotate the device while filming, while visualizing the 5 final output in an overlay on the device viewfinder or screen during shooting. The resulting recording is subsequently corrected to maintain a single orientation with a stable horizon. The system and method is operative display an overlay over a captured representation of the captured video wherein the overlay indicates a modified image with respect to said orientation.

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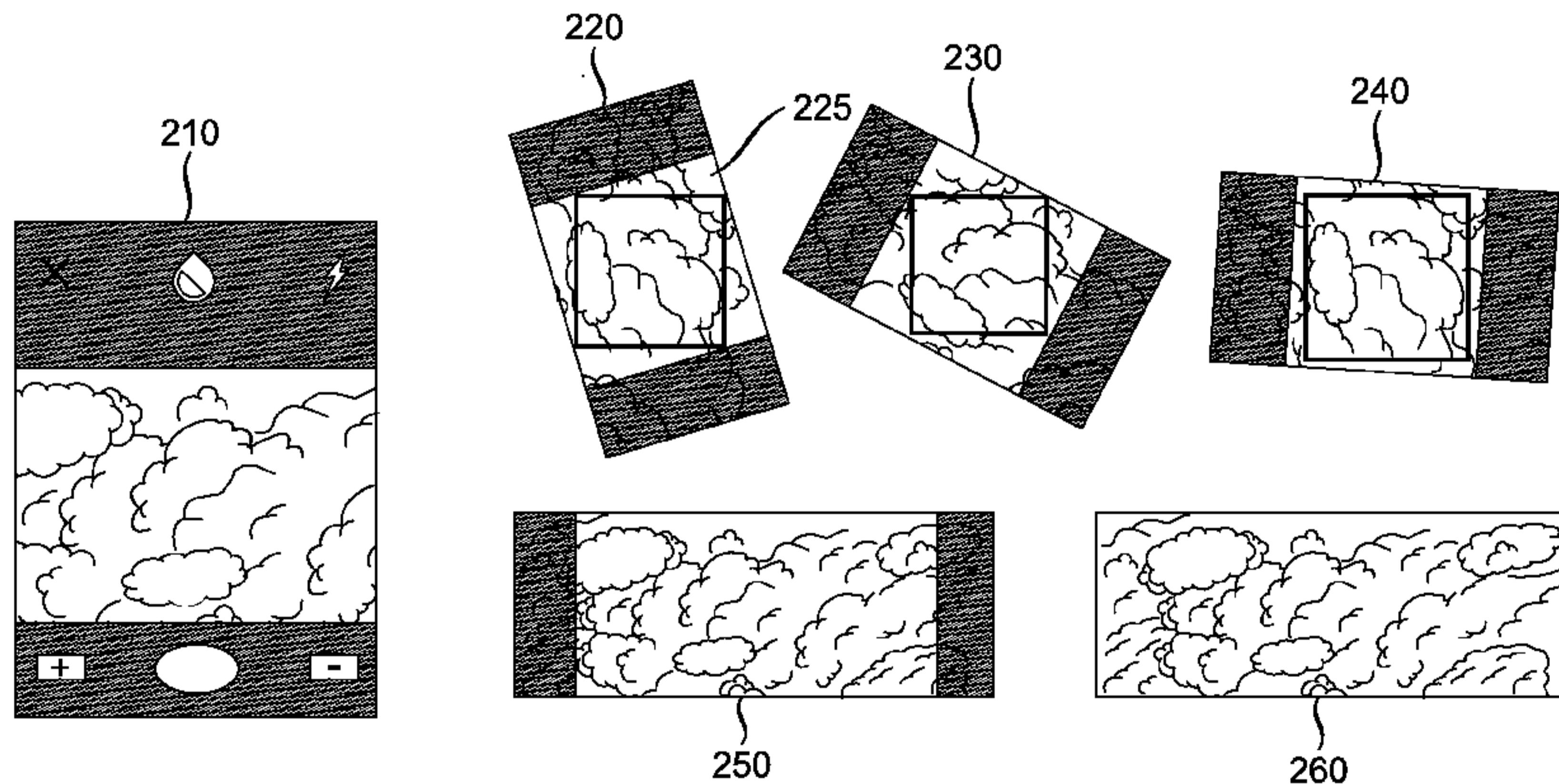


FIG. 2

(57) **Abstract:** A method and apparatus for dynamically maintaining a horizontal framing of a video. The system permits the user to freely rotate the device while filming, while visualizing the 5 final output in an overly on the device viewfinder or screen during shooting. The resulting recording is subsequently corrected to maintain a single orientation with a stable horizon. The system and method is operative display an overly over a captured representation of the captured video wherein the overlay indicates a modified image with respect to said orientation.

METHOD AND SYSTEM FOR STABILIZATION AND REFRAMING

This application claims priority from U.S. Provisional Application No. 61/775,324 filed March 8, 2013.

5

BACKGROUND OF THE INVENTION

Portable electronic devices are becoming more ubiquitous. These devices, such as mobile phones, music players, cameras, tablets and the like often contain a combination of devices, thus rendering carrying multiple objects redundant. For example, current touch screen mobile phones, such as the Apple iPhone or Samsung Galaxy android phone contain video and still cameras, global positioning navigation system, internet browser, text and telephone, video and music player, and more. These devices are often enabled an multiple networks, such as wifi, wired, and cellular, such as 3G, to transmit and received data.

10

15 The quality of secondary features in portable electronics has been constantly improving. For example, early "camera phones" consisted of low resolution sensors with fixed focus lenses and no flash. Today, many mobile phones include full high definition video capabilities, editing and filtering tools, as well as high definition displays. With this improved capabilities, many users are using these devices as their primary photography devices. Hence, there is a demand for even more improved performance and professional grade embedded photography tools.

20

25 For example, many videos on mobile devices are recorded in a manner where the user may inadvertently rotate the mobile device, thereby tilting the video horizon the vertical orientation of the video for the viewer. In an extreme case, a user may start filming with the camera in a vertical orientation and change to a horizontal orientation.

This would result in a video which starts our oriented properly, but ends up rotated 90 degrees when being displayed to a viewer. To correct this problem, post processing is required, which is an undesirable option for a user wishing to directly share the video via a social network.

5

Additionally, recording a video with the mobile device in a vertical position often results in a video which is taller than it is wide. This end result is not optimal for consumption on most displays, such as television screens, which are typically wider than they are tall. In many cases users shoot video without specific attention to horizontal 10 orientation, especially when filming a social activity, live event or other subject matter where the user is engaged in the experience that takes their focus off the device they are recording with. Further, most mobile phones are designed to be used in a vertical orientation. Thus, a user may start using the device in its intended orientation, only to realize later that video should be filmed in a horizontal orientation.

15

Thus, it is desirable to overcome these problems with current video cameras embedded in mobile electronic devices.

SUMMARY OF THE INVENTION

20 A method and apparatus for dynamically maintaining a horizontal framing of a video. The system permits the user to freely rotate the device while filming, while visualizing the final output in an overly on the device viewfinder or screen during shooting. The resulting recording is subsequently corrected to maintain a single orientation with a stable horizon. The system and method is operative display an overly 25 over a captured representation of the captured video wherein the overlay indicates a modified image with respect to said orientation.

In one aspect, the present invention involves a method of saving image data comprising the steps of receiving data representing a first image having a first orientation, receiving data representing a second orientation indicating a device vertical orientation with respect to gravity, reorienting said first image such that said second orientation becomes a vertical orientation of said first image to generate a reoriented image; and saving said reoriented image.

In another aspect, the present invention also involves a method of processing a video stream comprising the steps of initializing a video capture mode, receiving a first data representing a video stream, displaying a representation of said video stream, receiving a second data representing an aspect ratio, receiving a third data representing a rotational position; and overlaying a graphic representative of said aspect ratio and said rotational position over said representation of said video stream.

In another aspect, the present invention also involves an apparatus comprising an image sensor for capturing an image data having a first orientation, a rotational sensor for determine a rotational value, a processor for determining a second orientation in response to said rotational value and for reorienting said image data in response to said second orientation to generate a reoriented image; and storing said reoriented image.

DETAILED DESCRIPTION OF THE DRAWINGS

These and other aspects, features and advantages of the present disclosure will be described or become apparent from the following detailed description of the preferred embodiments, which is to be read in connection with the accompanying drawings.

In the drawings, wherein like reference numerals denote similar elements throughout the views:

FIG. 1 shows a block diagram of an exemplary embodiment of mobile electronic device;

FIG. 2 shows an exemplary mobile device display having an active display
5 according to the present invention;

FIG. 3 shows an exemplary process for image stabilization and reframing in accordance with the present disclosure;

FIG. 4 shows an exemplary mobile device display having a capture initialization
400 according to the present invention;

10 FIG. 5 shows an exemplary process for initiating an image or video capture 500
in accordance with the present disclosure;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

15 The exemplifications set out herein illustrate preferred embodiments of the invention, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

Referring to FIG. 1, a block diagram of an exemplary embodiment of mobile
20 electronic device is shown. While the depicted mobile electronic device is a mobile phone 100, the invention may equally be implemented on any number of devices, such as music players, cameras, tablets, global positioning navigation systems etc. A mobile phone typically includes the ability to send and receive phone calls and text messages, interface with the Internet either through the cellular network or a local wireless network,
25 take pictures and videos, play back audio and video content, and run applications such

as word processing, programs, or video games. Many mobile phones include GPS and also include a touch screen panel as part of the user interface.

The mobile phone includes a main processor 150 that is coupled to each of the
5 other major components. The main processor, or processors, routes the information
between the various components, such as the network interfaces, camera 140, touch
screen 170, and other input/output I/O interfaces 180. The main processor 150 also
processes audio and video content for play back either directly on the device or on an
external device through the audio/video interface. The main processor 150 is operative
10 to control the various sub devices, such as the camera 140, touch screen 170, and the
USB interface 130. The main processor 150 is further operative to execute subroutines
in the mobile phone used to manipulate data similar to a computer. For example, the
main processor may be used to manipulate image files after a photo has been taken by
the camera function 140. These manipulations may include cropping, compression,
15 color and brightness adjustment, and the like.

The cell network interface 110 is controlled by the main processor 150 and is
used to receive and transmit information over a cellular wireless network. This
information may be encoded in various formats, such as time division multiple access
20 (TDMA), code division multiple access (CDMA) or Orthogonal frequency-division
multiplexing (OFDM). Information is transmitted and received from the device through a
cell network interface 110. The interface may consist of multiple antennas encoders,
demodulators and the like used to encode and decode information into the appropriate
formats for transmission. The cell network interface 110 may be used to facilitate voice
25 or text transmissions, or transmit and receive information from the internet. This
information may include video, audio, and or images.

The wireless network interface 120, or wifi network interface, is used to transmit and receive information over a wifi network. This information can be encoded in various formats according to different wifi standards, such as 802.11g, 802.11b, 802.11ac and 5 the like. The interface may consist of multiple antennas encoders, demodulators and the like used to encode and decode information into the appropriate formats for transmission and decode information for demodulation. The wifi network interface 120 may be used to facilitate voice or text transmissions, or transmit and receive information from the internet. This information may include video, audio, and or images.

10

The universal serial bus (USB) interface 130 is used to transmit and receive information over a wired like, typically to a computer or other USB enabled device. The USB interface 120 can be used to transmit and receive information, connect to the internet, transmit and receive voice and text calls. Additionally, this wired link may be 15 used to connect the USB enabled device to another network using the mobile devices cell network interace 110 or the wifi network interface 120. The USB interface 120 can be used by the main processor 150 to send and receive configuration information to a computer.

20

A memory 160, or storage device, may be coupled to the main processor 150. The memory 160 may be used for storing specific information related to operation of the mobile device and needed by the main processor 150. The memory 160 may be used for storing audio, video, photos, or other data stored and retrieved by a user.

25

The input output (I/O) interface 180, includes buttons, a speaker/microphone for use with phone calls, audio recording and playback, or voice activation control. The

mobile device may include a touch screen 170 coupled to the main processor 150 through a touch screen controller. The touch screen 170 may be either a single touch or multi touch screen using one or more of a capacitive and resistive touch sensor. The smartphone may also include additional user controls such as but not limited to an on/off 5 button, an activation button, volume controls, ringer controls, and a multi-button keypad or keyboard

Turning now to FIG. 2 an exemplary mobile device display having an active display 200 according to the present invention is shown. The exemplary mobile device 10 application is operative for allowing a user to record in any framing and freely rotate their device while shooting, visualizing the final output in an overlay on the device's viewfinder during shooting and ultimately correcting for their orientation in the final output.

According to the exemplary embodiment, when a user begins shooting their 15 current orientation is taken into account and the vector of gravity based on the device's sensors is used to register a horizon. For each possible orientation, such as portrait 210, where the device's screen and related optical sensor is taller than wide, or landscape 250, where the device's screen and related optical sensor is wider than tall, an optimal target aspect ratio is chosen. An inset rectangle 225 is inscribed within the overall sensor 20 that is best-fit to the maximum boundaries of the sensor given the desired optimal aspect ratio for the given (current) orientation. The boundaries of the sensor are slightly padded in order to provide 'breathing room' for correction. This inset rectangle 225 is transformed to compensate for rotation 220, 230, 240 by essentially rotating in the inverse of the device's own rotation, which is sampled from the device's integrated 25 gyroscope. The transformed inner rectangle 225 is inscribed optimally inside the maximum available bounds of the overall sensor minus the padding. Depending on the

device's current most orientation, the dimensions of the transformed inner rectangle 225 are adjusted to interpolate between the two optimal aspect ratios, relative to the amount of rotation.

5 For example, if the optimal aspect ratio selected for portrait orientation was square (1:1) and the optimal aspect ratio selected for landscape orientation was wide (16:9), the inscribed rectangle would interpolate optimally between 1:1 and 16:9 as it is rotated from one orientation to another. The inscribed rectangle is sampled and then transformed to fit an optimal output dimension. For example, if the optimal output 10 dimension is 4:3 and the sampled rectangle is 1:1, the sampled rectangle would either be aspect filled (fully filling the 1:1 area optically, cropping data as necessary) or aspect fit (fully fitting inside the 1:1 area optically, blacking out any unused area with 'letter boxing' or 'pillar boxing'). In the end the result is a fixed aspect asset where the content framing adjusts based on the dynamically provided aspect ratio during correction. So for 15 example a 16:9 video comprised of 1:1 to 16:9 content would oscillate between being optically filled 260 (during 16:9 portions) and fit with pillar boxing 250 (during 1:1 portions).

Additional refinements whereby the total aggregate of all movement is 20 considered and weighed into the selection of optimal output aspect ratio are in place. For example, if a user records a video that is 'mostly landscape' with a minority of portrait content, the output format will be a landscape aspect ratio (pillar boxing the portrait segments). If a user records a video that is mostly portrait the opposite applies (the video will be portrait and fill the output optically, cropping any landscape content that falls 25 outside the bounds of the output rectangle).

Referring now to FIG. 3, an exemplary process for image stabilization and reframing 300 in accordance with the present disclosure is shown. The system is initialized in response to the capture mode of the camera being initiated. This initialization may be initiated according to a hardware or software button, or in response 5 to another control signal generated in response to a user action. Once the capture mode of the device is initiated, the mobile device sensor 320 is chosen in response to user selections. User selections may be made through a setting on the touch screen device, through a menu system, or in response to how the button is actuated. For example, a button that is pushed once may select a photo sensor, while a button that is 10 held down continuously may indicate a video sensor. Additionally, holding a button for a predetermined time, such as 3 seconds, may indicate that a video has been selected and video recording on the mobile device will continue until the button is actuated a second time.

15 Once the appropriate capture sensor is selected, the system then requests a measurement from a rotational sensor 320. The rotational sensor may be a gyroscope, accelerometer, axis orientation sensor, light sensor or the like, which is used to determine a horizontal and/or vertical indication of the position of the mobile device. The measurement sensor may send periodic measurements to the controlling processor 20 thereby continuously indicating the vertical and/or horizontal orientation of the mobile device. Thus, as the device is rotated, the controlling processor can continuously update the display and save the video or image in a way which has a continuous consistent horizon.

25 After the rotational sensor has returned an indication of the vertical and/or horizontal orientation of the mobile device, the mobile device depicts an inset rectangle

on the display indicating the captured orientation of the video or image 340. As the mobile device is rotated, the system processor continuously synchronizes inset rectangle with the rotational measurement received from the rotational sensor 350. The user may optionally indicate a preferred final video or image ratio, such as 1:1, 9:16, 16:9, or any 5 ratio decided by the user. The system may also store user selections for different ratios according to orientation of the mobile device. For example, the user may indicate a 1:1 ratio for video recorded in the vertical orientation, but a 16:9 ratio for video recorded in the horizontal orientation. In this instance, the system may continuously or incrementally rescale video 360 as the mobile device is rotated. Thus a video may start out with a 1:1 10 orientation, but could gradually be rescaled to end in a 16:9 orientation in response to a user rotating from a vertical to horizontal orientation while filming. Optionally, a user may indicate that the beginning or ending orientation determines the final ratio of the video.

Turning now to FIG. 4, an exemplary mobile device display having a capture 15 initialization 400 according to the present invention is shown. An exemplary mobile device is shown depicting a touch tone display for capturing images or video. According to an aspect of the present invention, the capture mode of the exemplary device may be initiated in response to a number of actions. Any of hardware buttons 410 of the mobile device may be depressed to initiate the capture sequence. Alternatively, a software 20 button 420 may be activated through the touch screen to initiate the capture sequence. The software button 420 may be overlaid on the image 430 displayed on the touch screen. The image 430 acts as a viewfinder indicating the current image being captured by the image sensor. An inscribed rectangle 440 as described previously may also be overlaid on the image to indicate an aspect ratio of the image or video be captured.

25 Referring now to FIG. 5, an exemplary process for initiating an image or video capture 500 in accordance with the present disclosure is shown. Once the imaging

software has been initiated, the system waits for an indication to initiate image capture. Once the image capture indication has been received by the main processor 510, the device begins to save the data sent from the image sensor 520. In addition, the system initiates a timer. The system then continues to capture data from the image sensor as 5 video data. In response to a second indication from the capture indication, indicating that capture has been ceased 530, the system stops saving data from the image sensor and stops the timer.

The system then compares the timer value to a predetermined time threshold 540. The predetermined time threshold may be a default value determined by the 10 software provider, such as 1 second for example, or it may be a configurable setting determined by a user. If the timer value is less than the predetermined threshold 540, the system determines that a still image was desired and saves the first frame of the video capture as a still image in a still image format, such as jpeg or the like 560. The system may optionally chose another frame as the still image. If the timer value is 15 greater than the predetermined threshold 540, the system determines that a video capture was desired. The system then saves the capture data as a video file in a video file format, such as mpeg or the like 550. The system then may then return to the initialization mode, waiting for the capture mode to be initiated again. If the mobile device is equipped with different sensors for still image capture and video capture, the 20 system may optionally save a still image from the still image sensor and start saving capture data from the video image sensor. When the timer value is compared to the predetermined time threshold, the desired data is saved, while the unwanted data is not saved. For example, if the timer value exceeds the threshold time value, the video data is saved and the image data is discarded.

25 It should be understood that the elements shown and discussed above, may be implemented in various forms of hardware, software or combinations thereof. Preferably,

these elements are implemented in a combination of hardware and software on one or more appropriately programmed general-purpose devices, which may include a processor, memory and input/output interfaces. The present description illustrates the principles of the present disclosure. It will thus be appreciated that those skilled in the art 5 will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the disclosure and are included within its scope. All examples and conditional language recited herein are intended for informational purposes to aid the reader in understanding the principles of the disclosure and the concepts contributed by the inventor to furthering the art, and are to be construed as 10 being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the disclosure, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any 15 elements developed that perform the same function, regardless of structure. Thus, for example, it will be appreciated by those skilled in the art that the block diagrams presented herewith represent conceptual views of illustrative circuitry embodying the principles of the disclosure. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudocode, and the like represent various 20 processes which may be substantially represented in computer readable media and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

CLAIMS:

1. A method of saving image data comprising the steps of:
 - receiving data representing a first image having a first orientation;
 - receiving data representing a second orientation indicating a device vertical orientation with respect to gravity;
 - reorienting said first image such that said second orientation becomes a vertical orientation of said first image to generate a reoriented image; and
 - saving said reoriented image.
- 10 2. The method of claim 1 further comprising the steps displaying said first image and displaying an indicator indicating said second orientation.
3. The method of claim 2 wherein said indicator is a graphic representative of an aspect ratio and said second orientation, wherein said indicator is overlaid over said first image in a manner representative of said reoriented image.
- 15 4. The method of claim 3 wherein said aspect ratio changes in response to said second orientation.
5. The method of claim 1 wherein said first image is a frame of a video.
6. An apparatus comprising;
 - an image sensor for capturing an image data having a first orientation;
 - a rotational sensor for determine a rotational value;

- a processor for determining a second orientation in response to said rotational value and for reorienting said image data in response to said second orientation to generate a reoriented image; and
- storing said reoriented image.

5 7. The apparatus of claim 6 further comprising a display for displaying said image and displaying an indicator indicating said second orientation.

8. The apparatus of claim 7 wherein said indicator is a graphic representative of an aspect ratio and said second orientation, wherein said indicator is overlaid over said image in a manner representative of said reoriented image.

10 9. The apparatus of claim 8 wherein said aspect ratio changes in response to said second orientation.

10. The apparatus of claim 5 wherein said image is a frame of a video

11. A method comprising the steps of:

- initializing a capture mode;
- receiving a data representing an image;
- receiving data representing a rotational position;
- deactivating said capture mode;
- rotating said image in response to said rotational position to generate a rotated image; and
- storing said rotated image.

20

12. The method of claim 11 further comprising the steps displaying said image and displaying an indicator indicating said rotational position.

13. The method of claim 12 wherein said indicator is a graphic representative of an aspect ratio and said rotational position, wherein said indicator is overlaid over said image in a manner representative of said rotated image.

5

14. The method of claim 13 wherein said aspect ratio changes in response to said rotational position.

15. The method of claim 11 wherein said image is a frame of a video.

16. A method of processing a video stream comprising the steps of:

10

- initializing a video capture mode;
- receiving a first data representing a video stream;
- displaying a representation of said video stream;
- receiving a second data representing an aspect ratio;
- receiving a third data representing a rotational position; and

15

- overlaying a graphic representative of said aspect ratio and said rotational position over said representation of said video stream.

17. The method of claim 16 wherein said aspect ratio changes in response to said rotational position.

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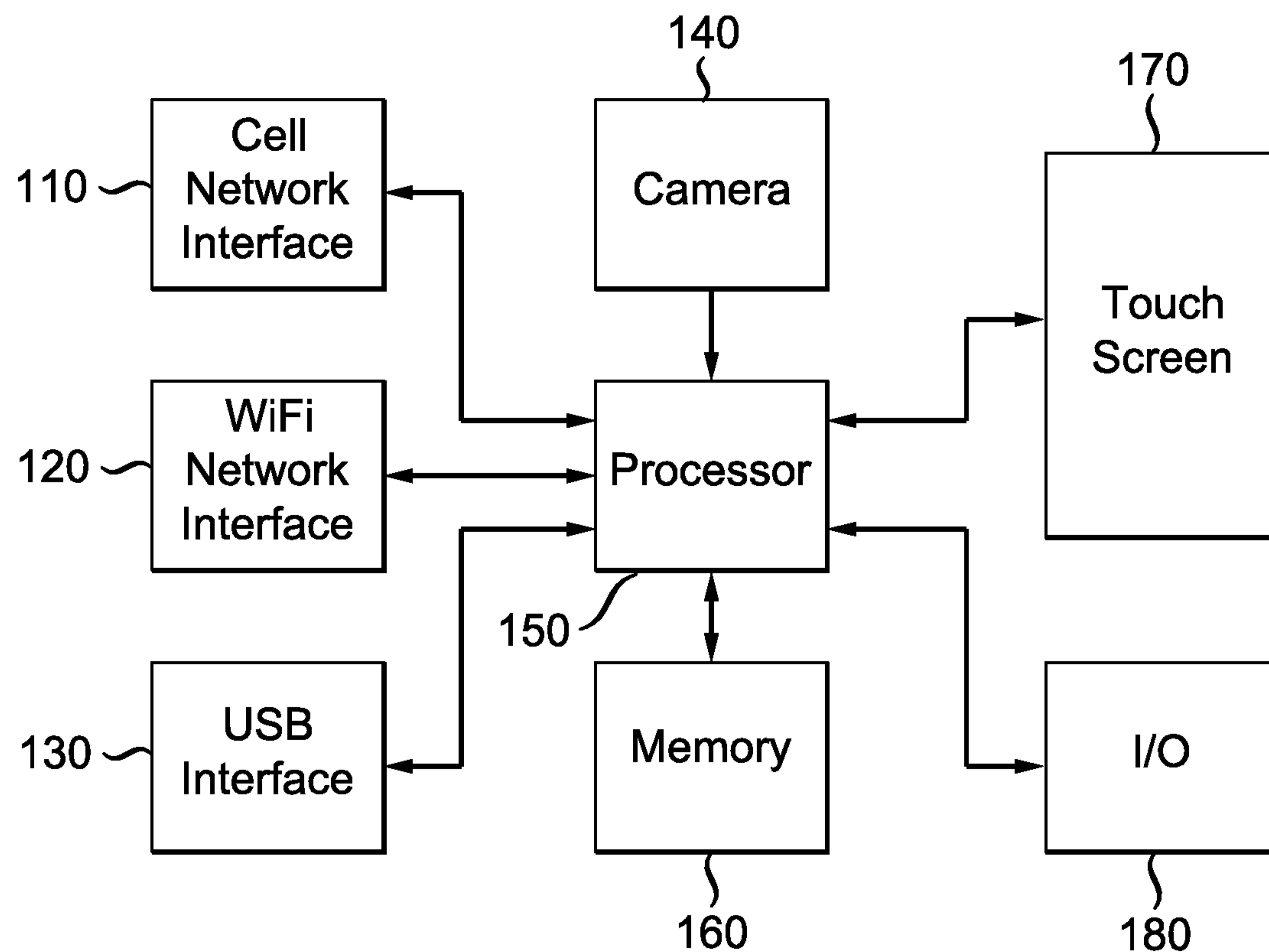


FIG. 1

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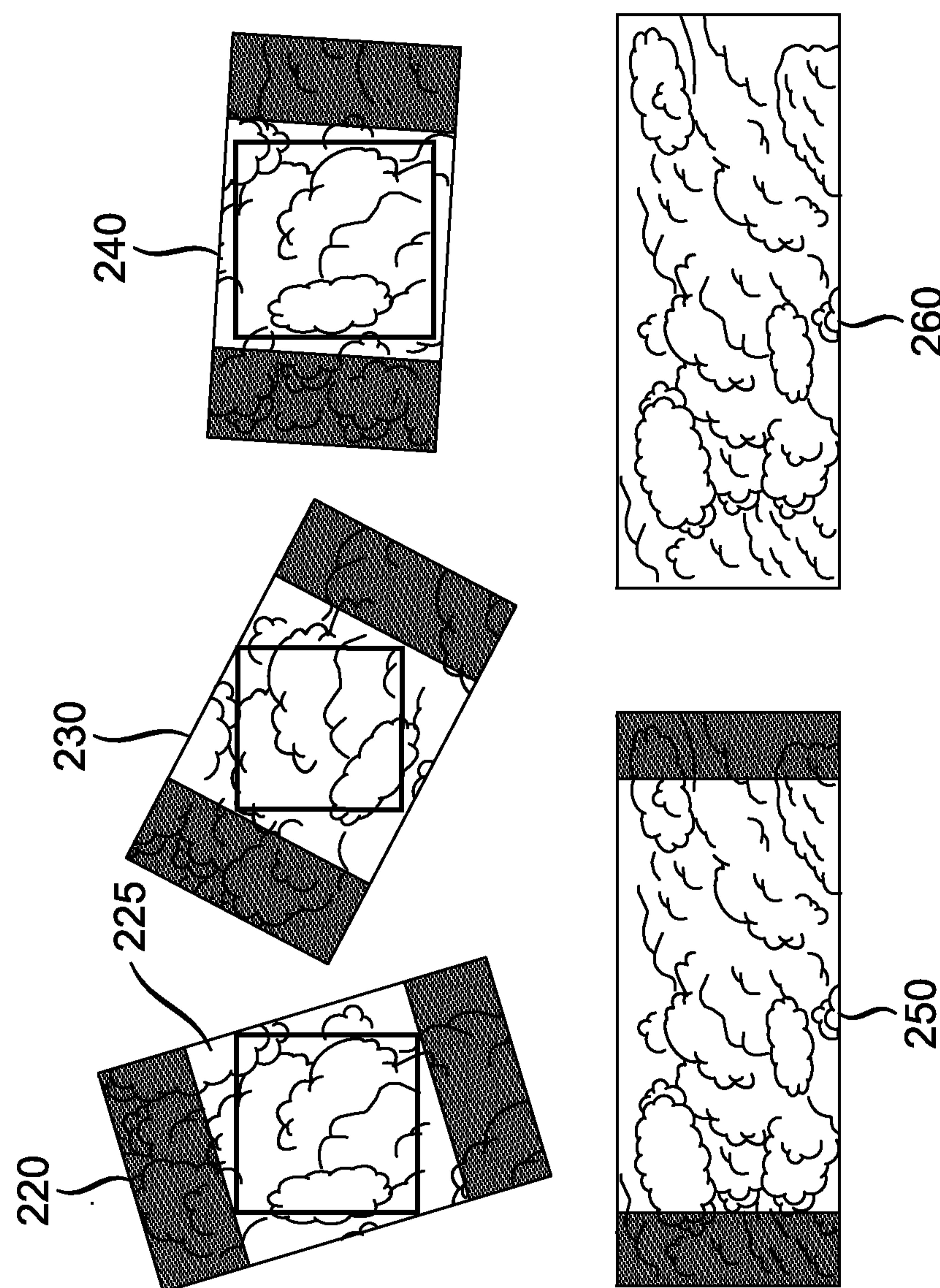
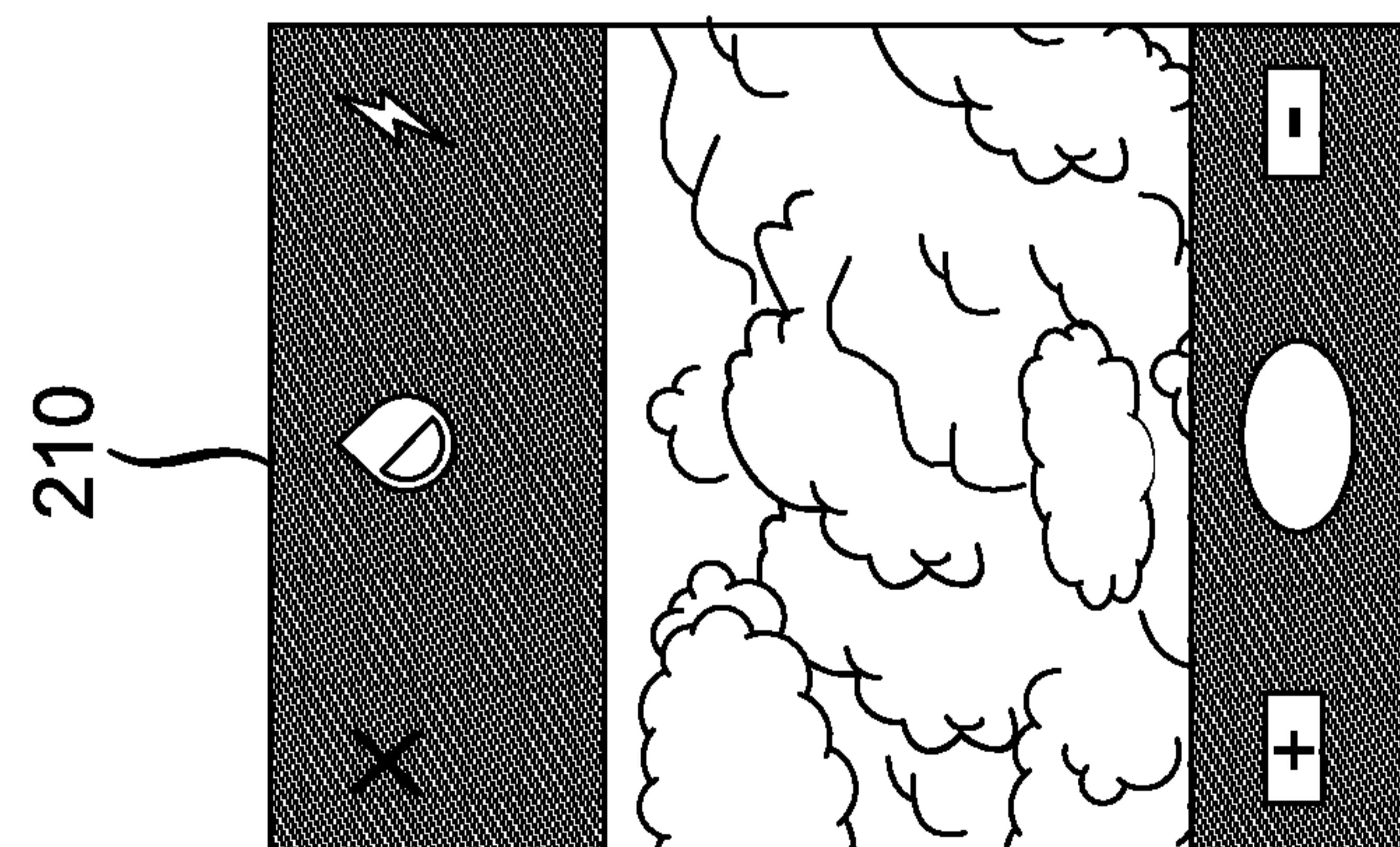
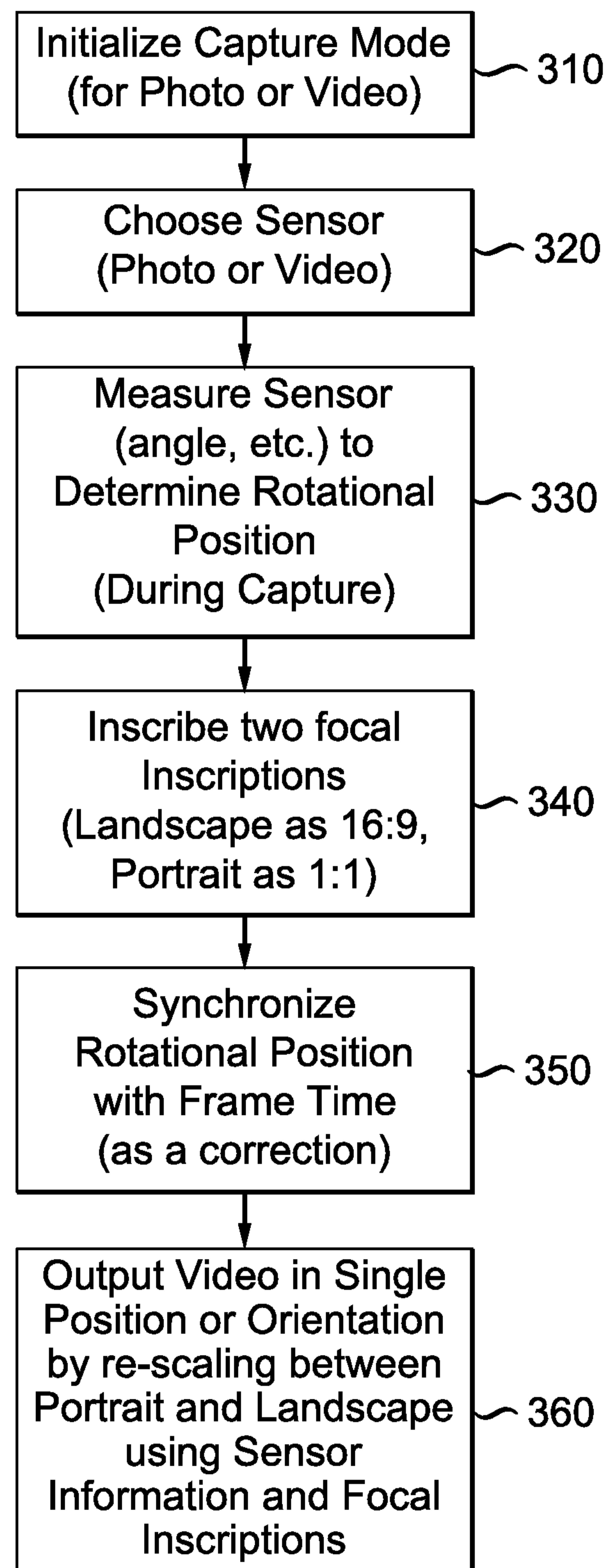


FIG. 2



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300*FIG. 3*

4/5

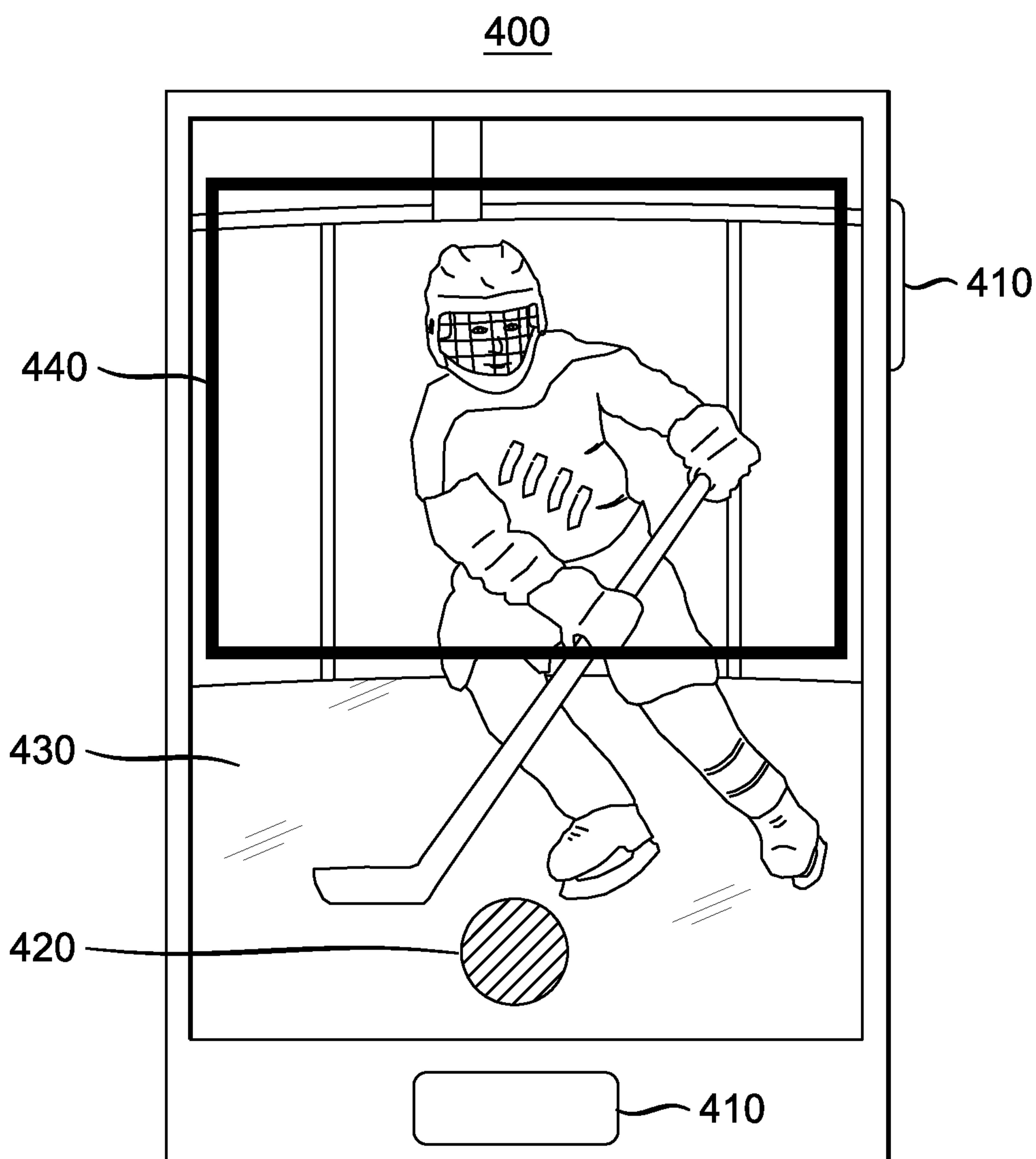


FIG. 4

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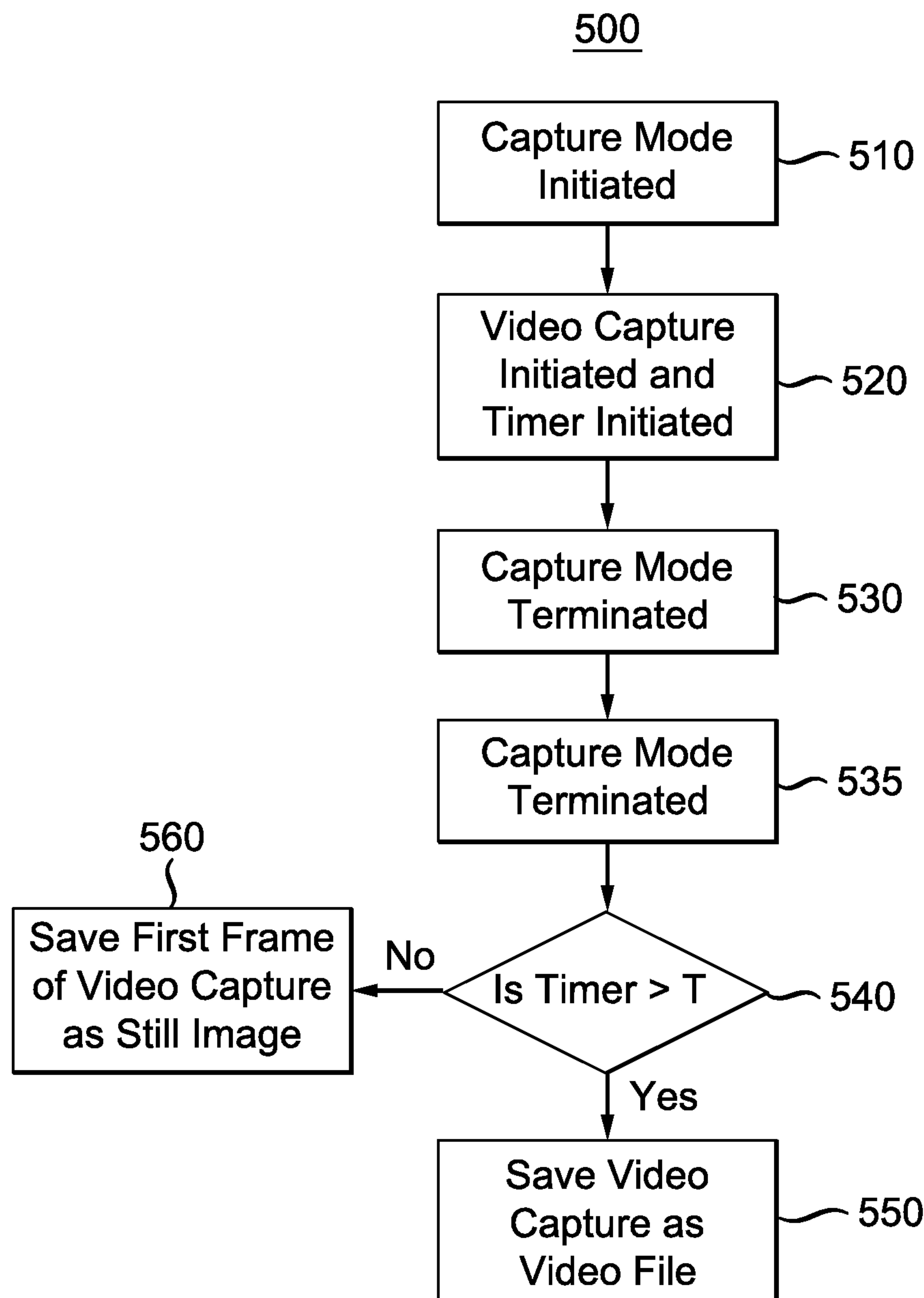


FIG. 5

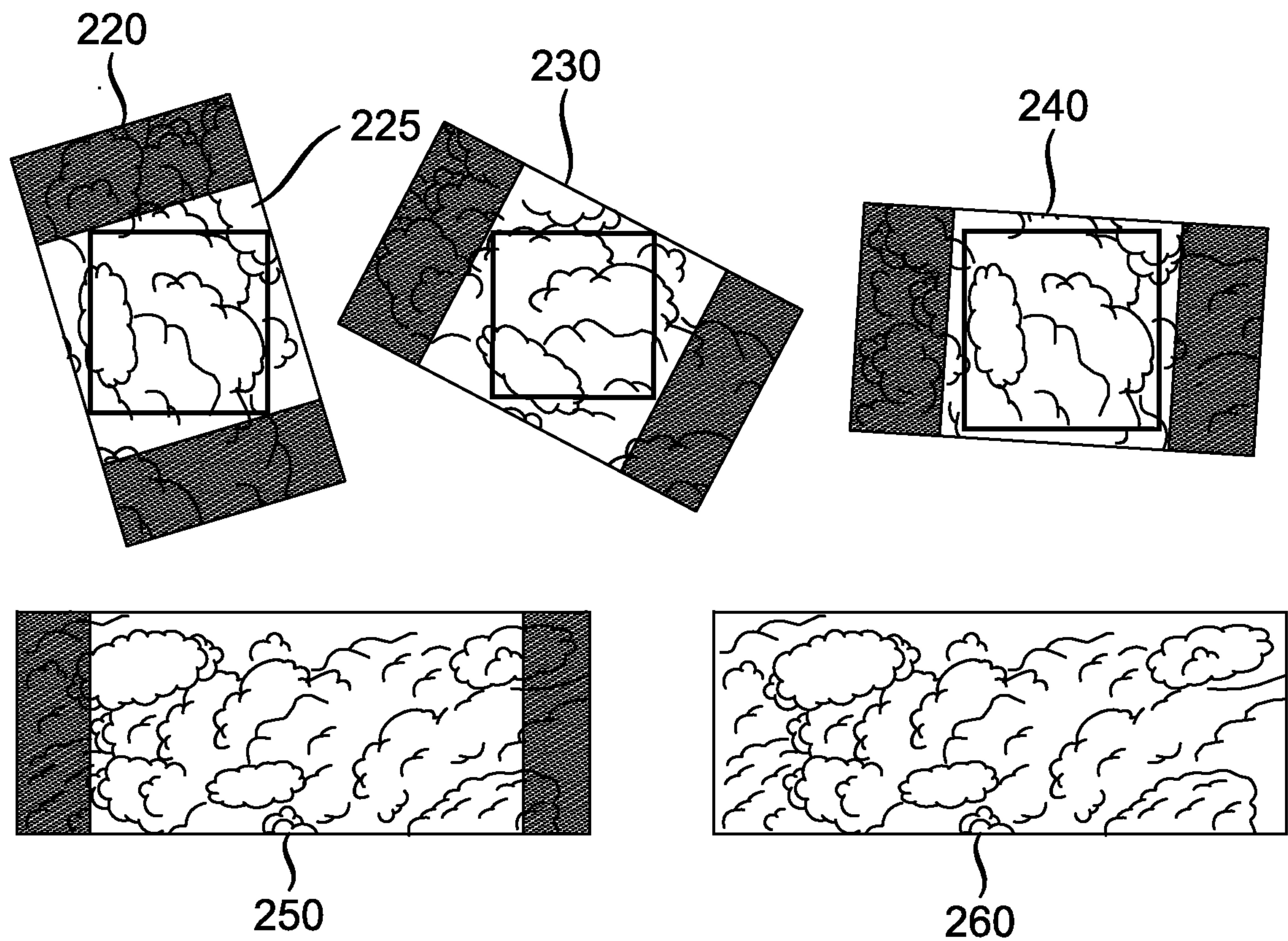
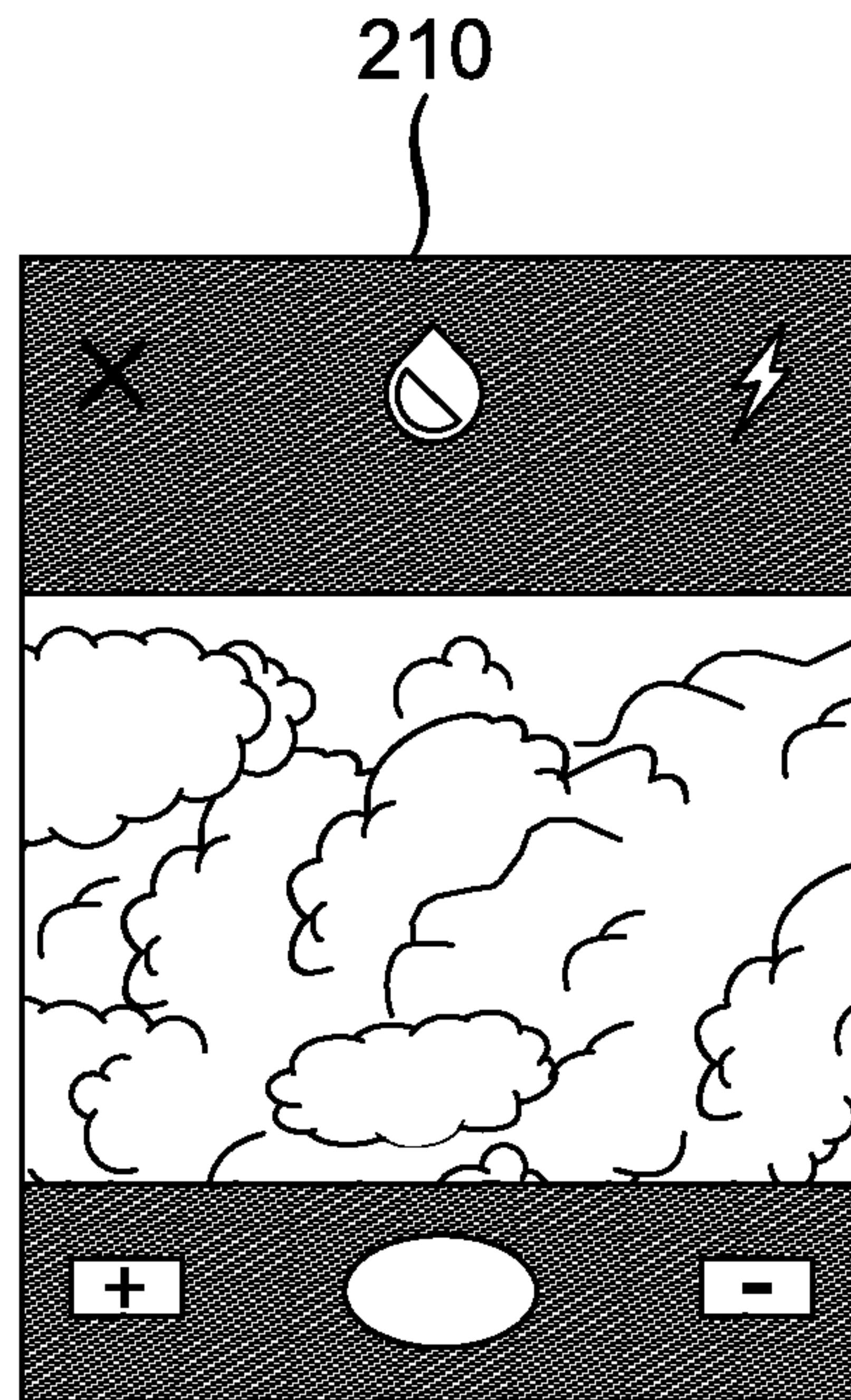


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