US 20180189992A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2018/0189992 A1**

PELISSIER et al. (43) **Pub. Date: Jul. 5, 2018**

(54) **SYSTEMS AND METHODS FOR GENERATING AN ULTRASOUND MULTIMEDIA PRODUCT**

(71) Applicant: **Clarius Mobile Health Corp.**, Burnaby (CA)

(72) Inventors: **Laurent PELISSIER**, North Vancouver (CA); **Kris DICKIE**, Vancouver (CA); **Clark VAN OYEN**, New Westminster (CA); **Shirley YIN**, Vancouver (CA)

(21) Appl. No.: **15/398,650**

(22) Filed: **Jan. 4, 2017**

Publication Classification

(51) **Int. Cl.**

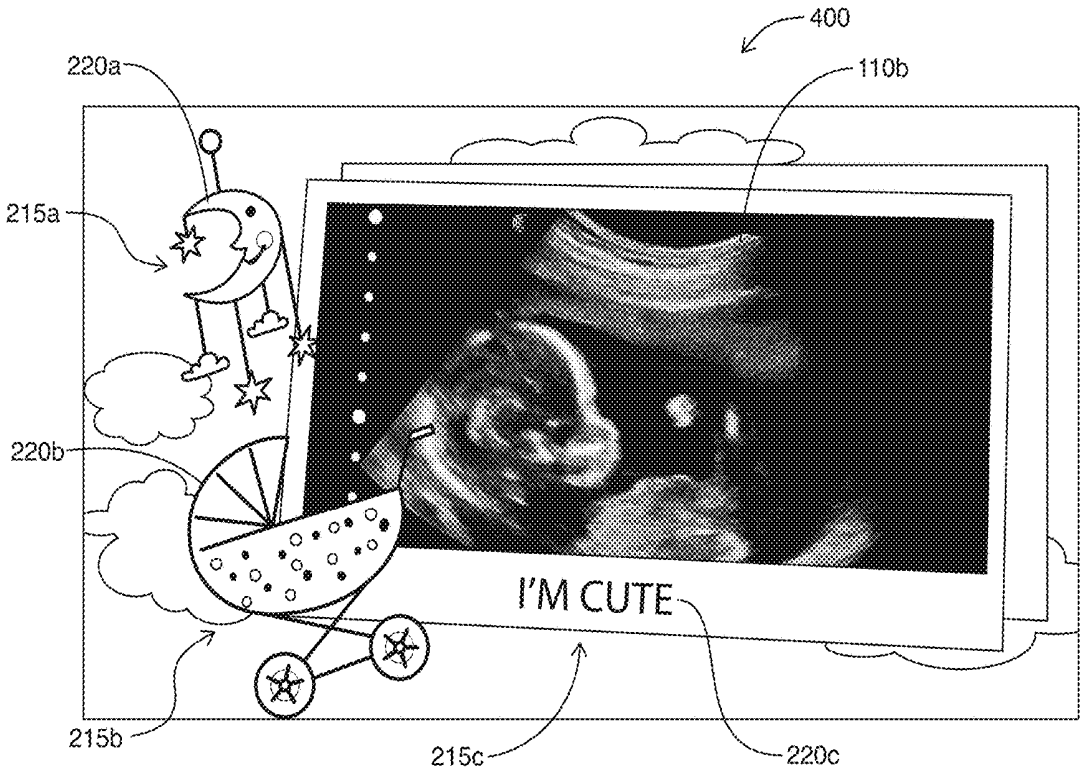
G06T 11/60	(2006.01)
A61B 8/08	(2006.01)
G06T 7/00	(2006.01)
G06K 9/32	(2006.01)

(52) **U.S. Cl.**

CPC ***G06T 11/60*** (2013.01); ***A61B 8/0866*** (2013.01); *G06F 3/0482* (2013.01); ***G06T 7/0014*** (2013.01); ***G06K 9/3258*** (2013.01); ***A61B 8/5292*** (2013.01)

(57) **ABSTRACT**

The present embodiments relate generally to systems and methods for generating a multimedia product. The embodiments may include: identifying a plurality of ultrasound media items from a fetal ultrasound scan, where each of the plurality of ultrasound media items have different respective attributes; and applying a theme to the plurality of ultrasound media items to generate the multimedia product. The theme may include an effect to be applied to at least one ultrasound media item of the plurality of ultrasound media items, and the applying may include adapting one of: the effect, and the attribute of the at least one ultrasound media item, to the other.



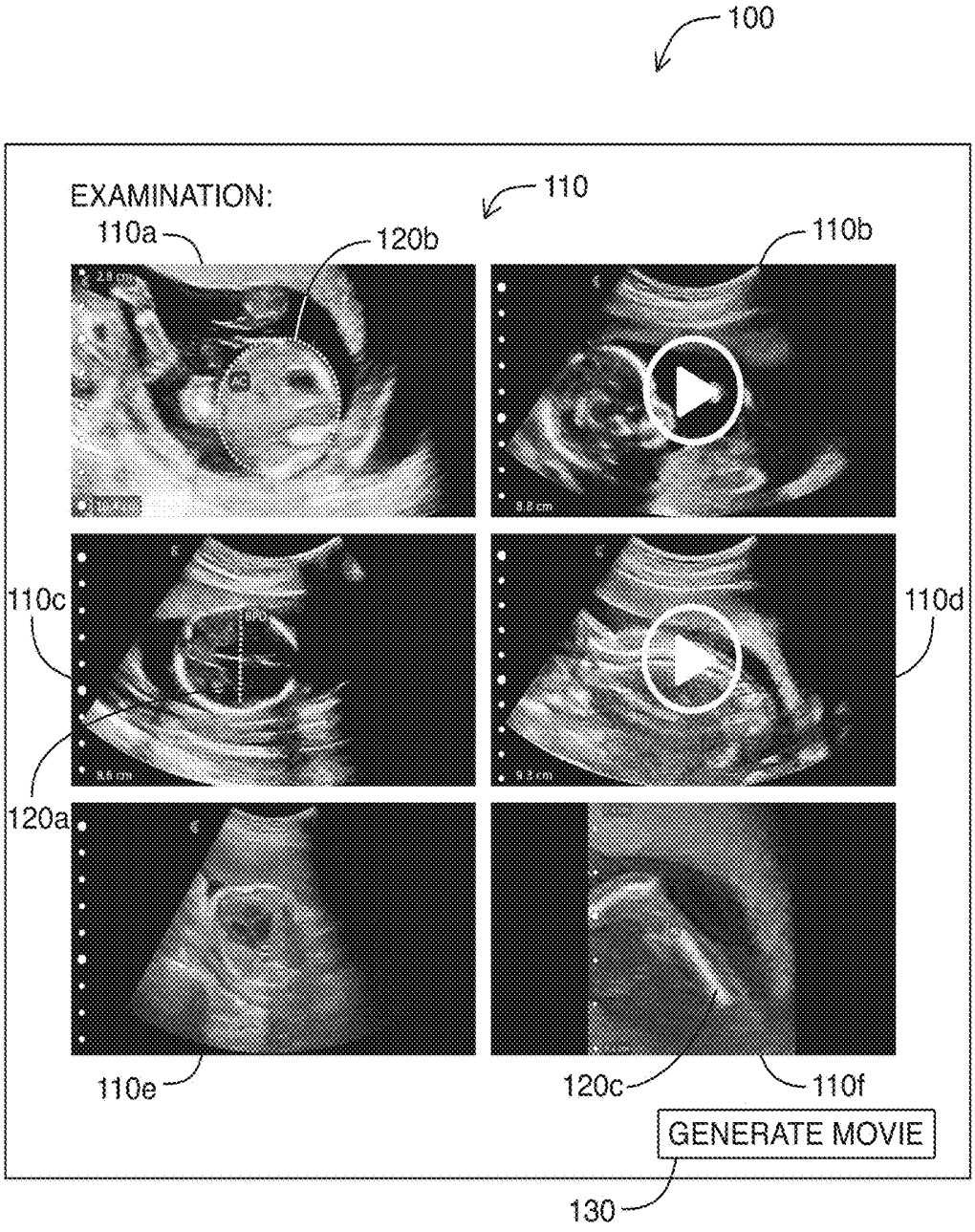

100
EXAMINATION:
110
110a
120b
110b
110c
110d
120a
110e
120c
110f
GENERATE MOVIE
130

FIG. 1

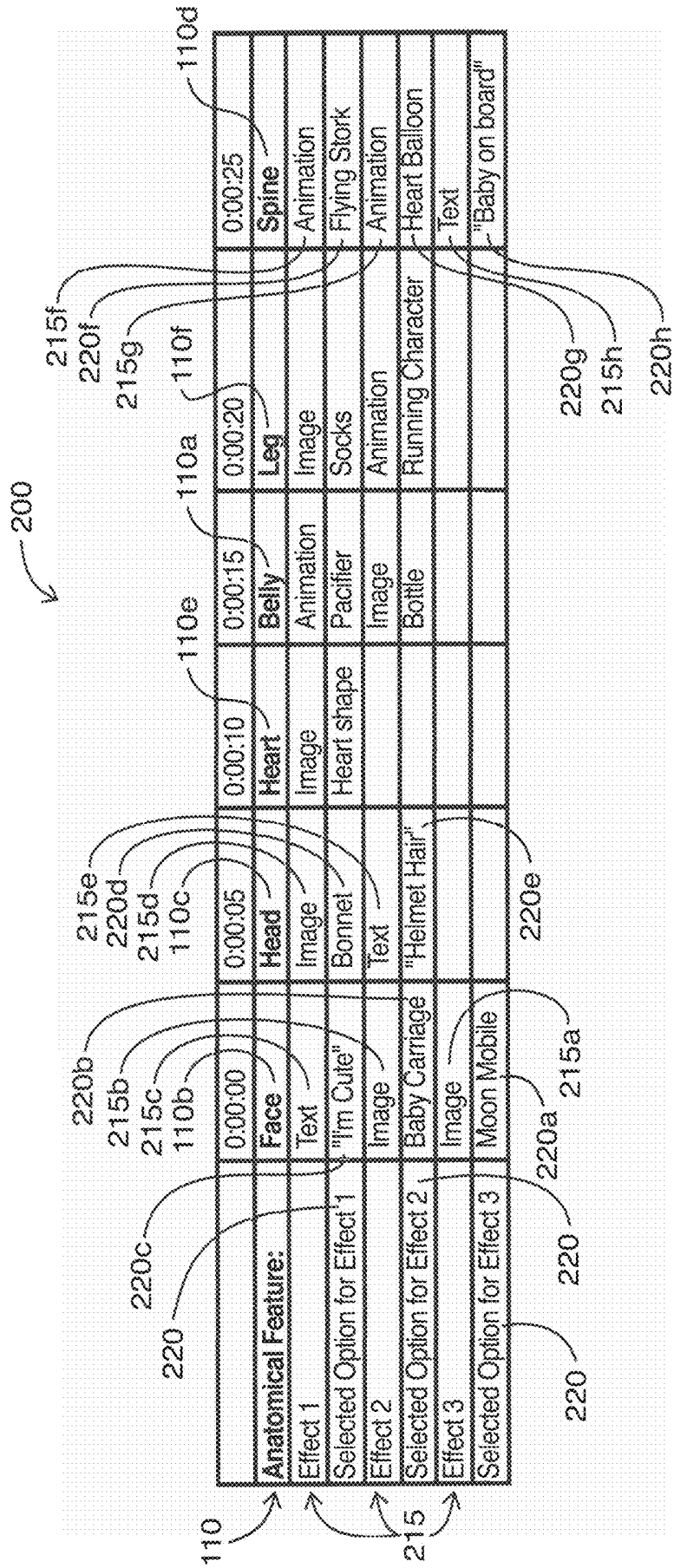

200
110
215
Anatomical Feature:
Effect 1
Selected Option for Effect 1
Effect 2
Selected Option for Effect 2
Effect 3
Selected Option for Effect 3
0:00:00
0:00:05
0:00:10
0:00:15
0:00:20
0:00:25
Face
Head
Heart
Belly
Leg
Spine
Text
Image
Image
Animation
Image
Animation
"I'm Cute"
Bonnet
Heart shape
Pacifier
Socks
Flying Stork
Image
Text
Animation
Image
Animation
Baby Carriage
"Helmet Hair"
Bottle
Running Character
Heart Balloon
Image
Text
Moon Mobile
"Baby on board"
110b
110c
110e
110a
110f
110d
215b
215c
215d
215e
215g
215f
215h
215a
220
220a
220b
220c
220d
220e
220f
220g
220h

FIG. 2

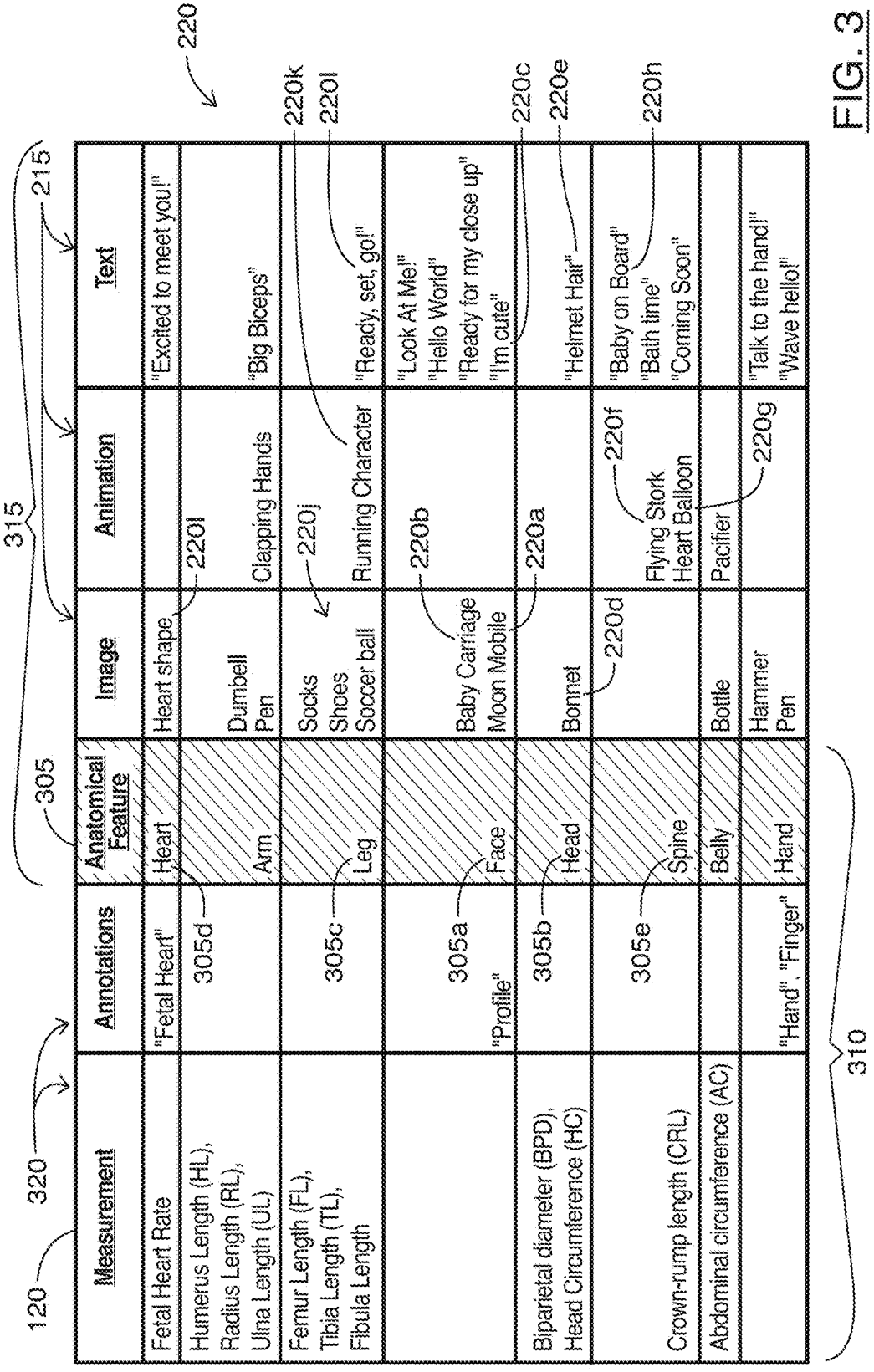

120
320
315
215
305
220
Measurement
Annotations
Anatomical Feature
Image
Animation
Text
Fetal Heart Rate
"Fetal Heart"
Heart
Heart shape
"Excited to meet you!"
Humerus Length (HL), Radius Length (RL), Ulna Length (UL)
305d
Arm
Dumbell
Pen
220l
Clapping Hands
"Big Biceps"
Femur Length (FL), Tibia Length (TL), Fibula Length
305c
Leg
Socks
Shoes
Soccer ball
220j
Running Character
220k
220l
"Ready, set, go!"
305a
Face
Baby Carriage
Moon Mobile
220b
220a
"Look At Me!"
"Hello World"
"Ready for my close up"
"I'm cute"
220c
"Profile"
Biparietal diameter (BPD), Head Circumference (HC)
305b
Head
Bonnet
220d
"Helmet Hair"
220e
Crown-rump length (CRL)
305e
Spine
Flying Stork
Heart Balloon
220f
"Baby on Board"
"Bath time"
"Coming Soon"
220h
Abdominal circumference (AC)
Belly
Bottle
Pacifier
220g
"Hand", "Finger"
Hand
Hammer
Pen
"Talk to the hand!"
"Wave hello!"
310

FIG. 3

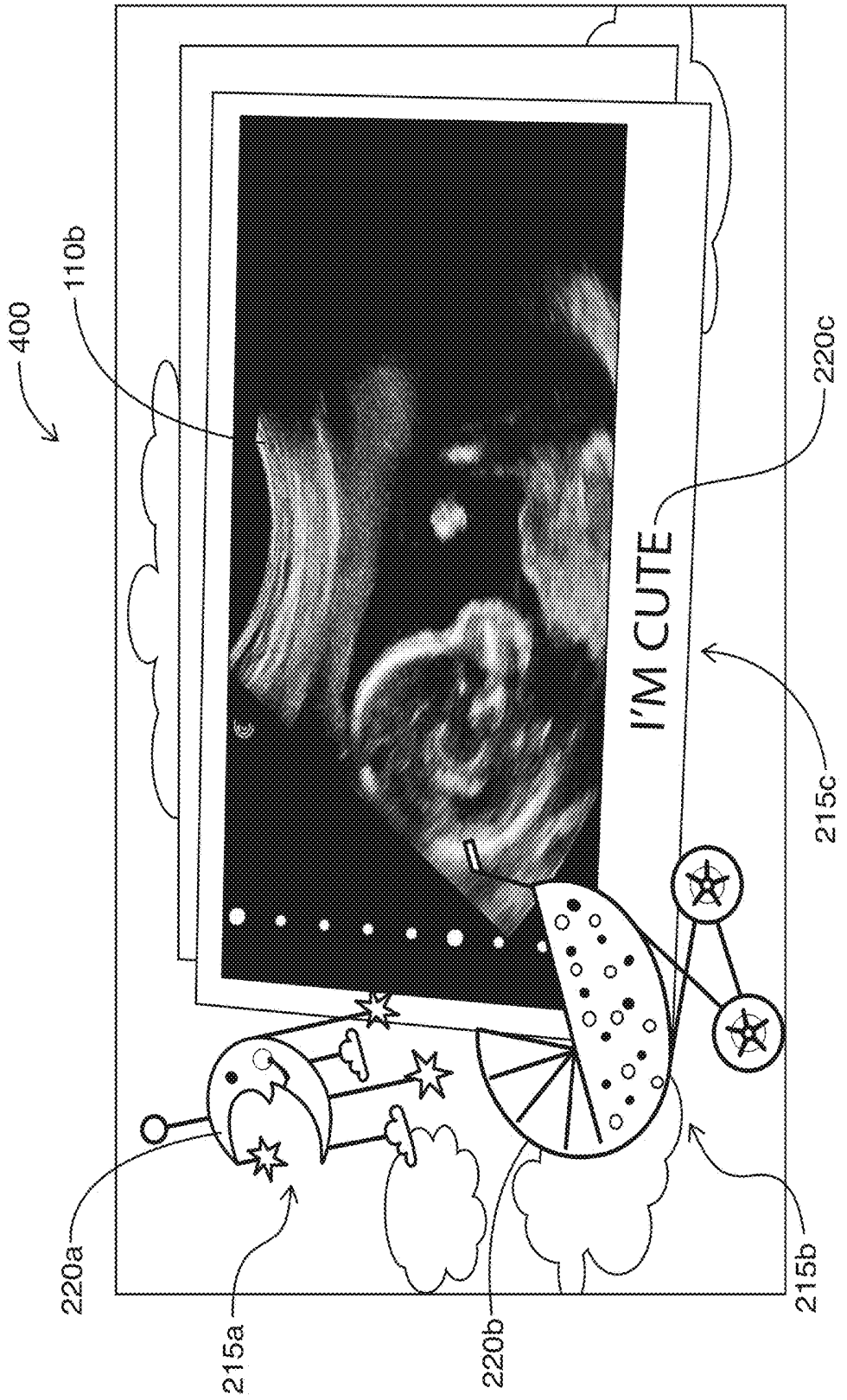


FIG. 4

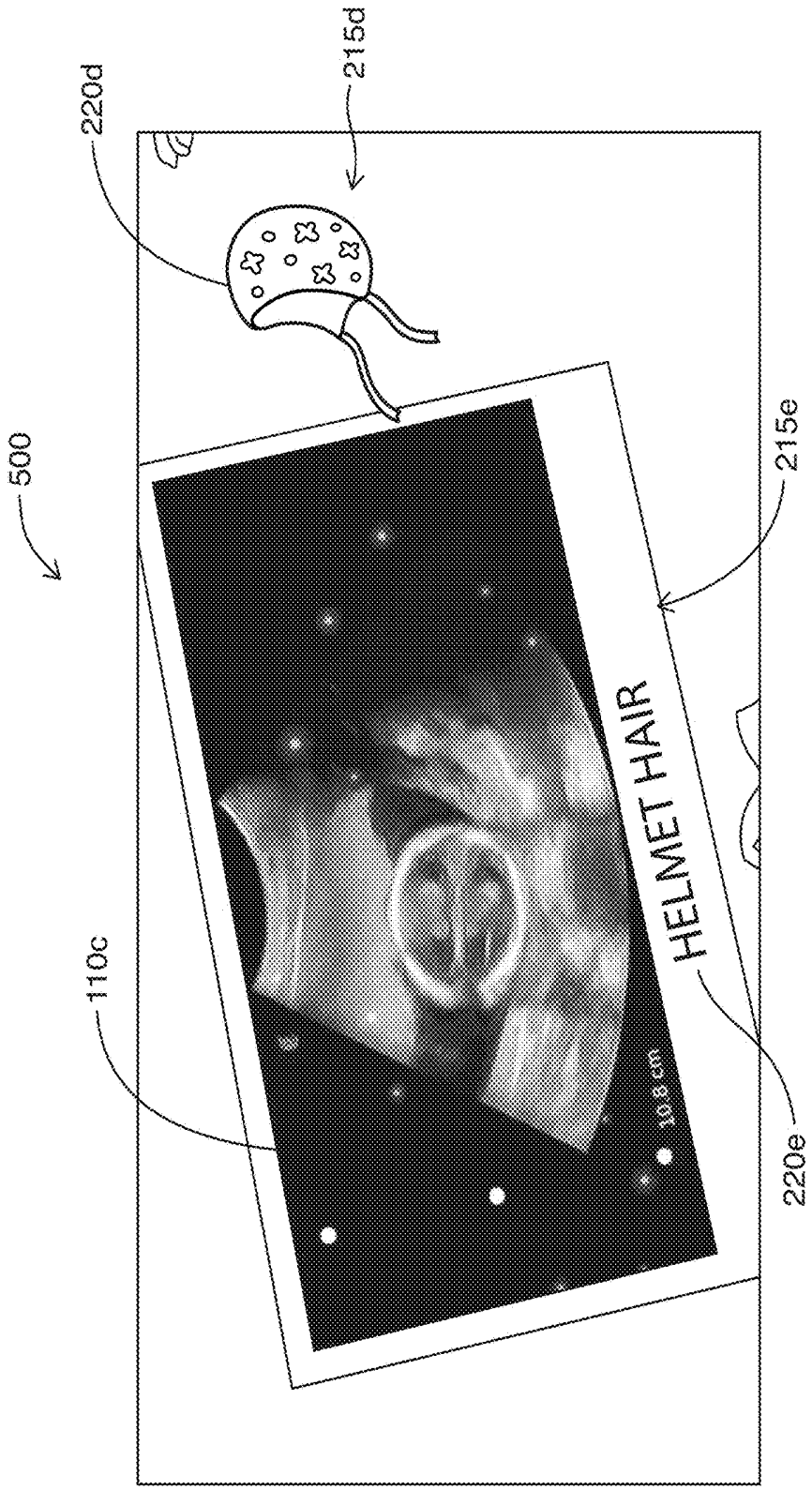


FIG. 5

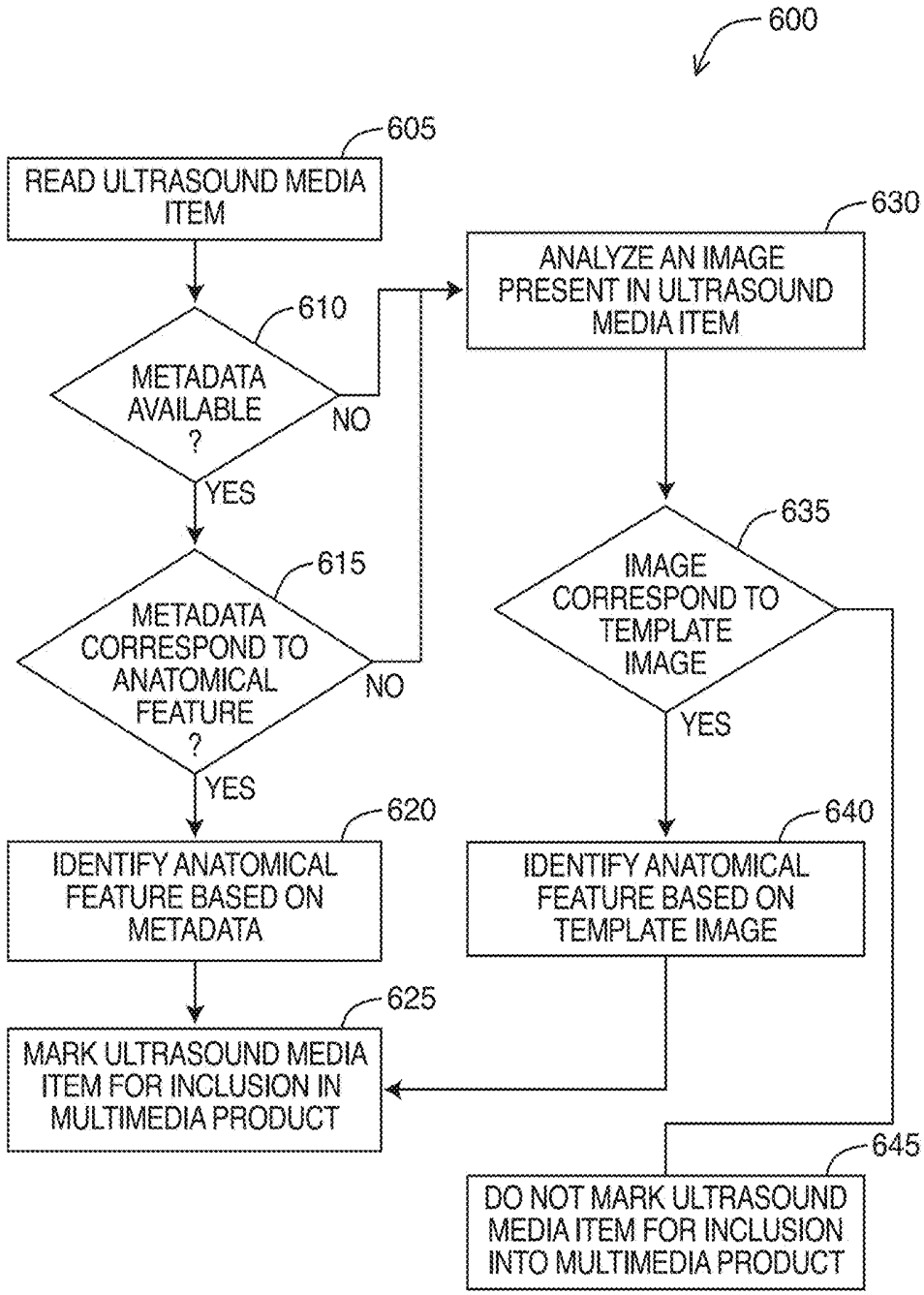

600
605
READ ULTRASOUND MEDIA ITEM
610
METADATA AVAILABLE ?
NO
YES
615
METADATA CORRESPOND TO ANATOMICAL FEATURE ?
NO
YES
620
IDENTIFY ANATOMICAL FEATURE BASED ON METADATA
625
MARK ULTRASOUND MEDIA ITEM FOR INCLUSION IN MULTIMEDIA PRODUCT
630
ANALYZE AN IMAGE PRESENT IN ULTRASOUND MEDIA ITEM
635
IMAGE CORRESPOND TO TEMPLATE IMAGE
YES
640
IDENTIFY ANATOMICAL FEATURE BASED ON TEMPLATE IMAGE
645
DO NOT MARK ULTRASOUND MEDIA ITEM FOR INCLUSION INTO MULTIMEDIA PRODUCT

FIG. 6

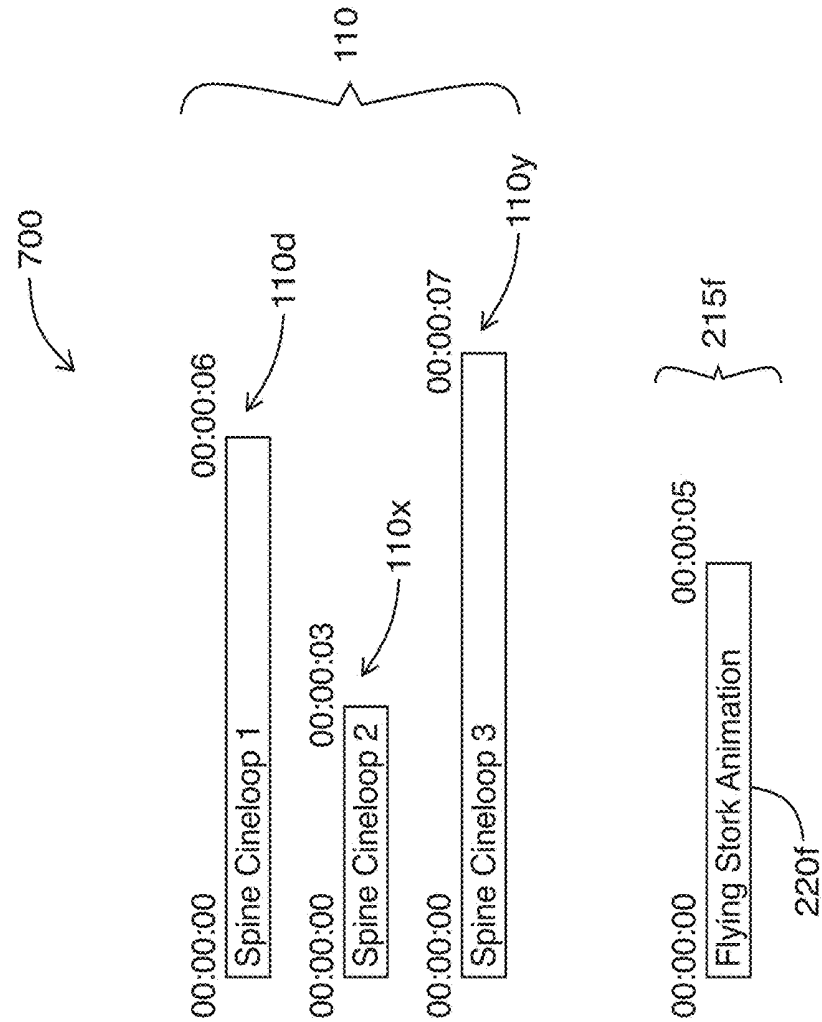

700
110
110d
110x
110y
215f
00:00:06
00:00:03
00:00:07
00:00:05
00:00:00
00:00:00
00:00:00
00:00:00
Spine Cineloop 1
Spine Cineloop 2
Spine Cineloop 3
Flying Stork Animation
220f

FIG. 7

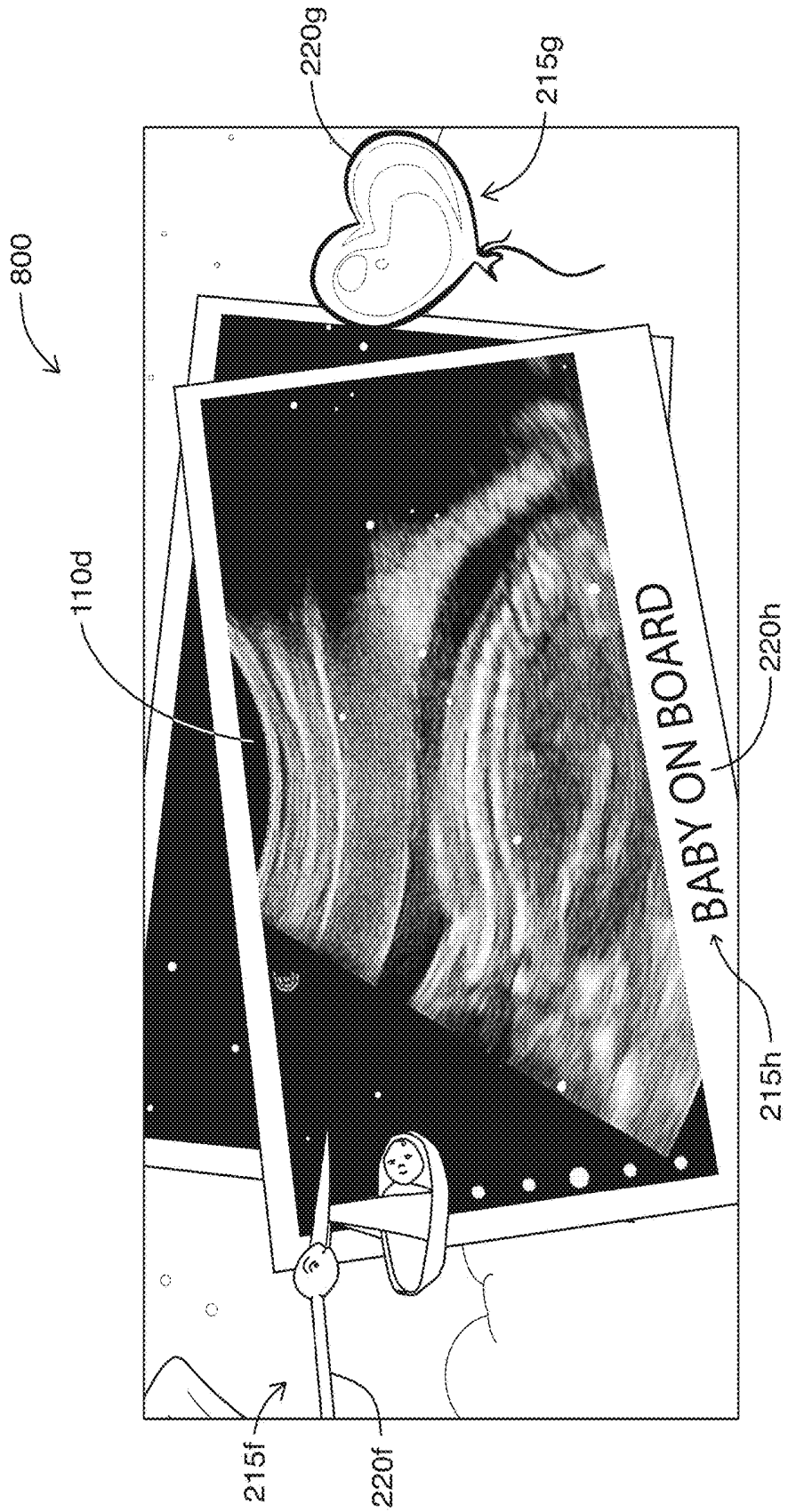


FIG. 8A

FIG. 8B

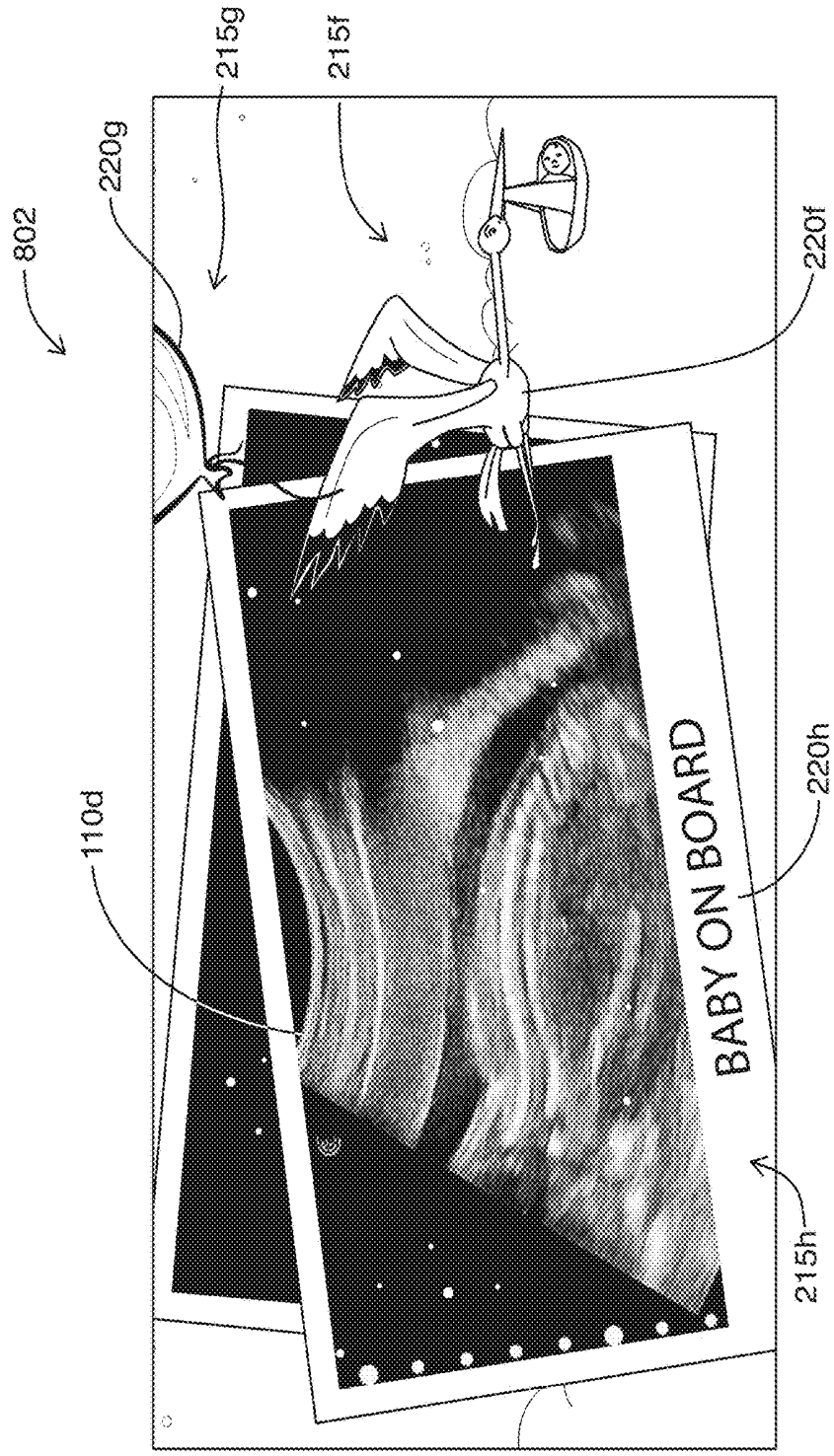


FIG. 8C

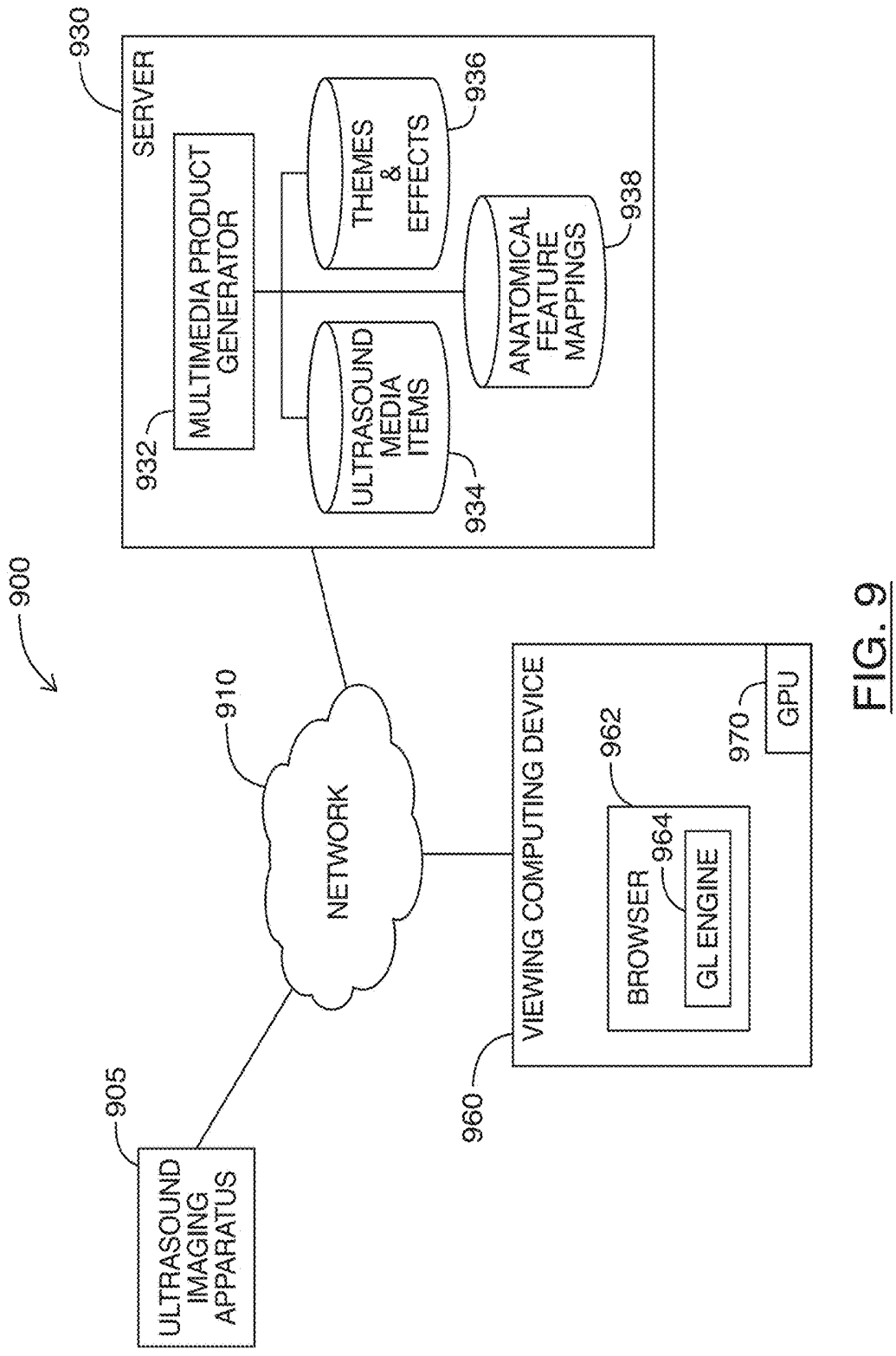

900
930
SERVER
932
MULTIMEDIA PRODUCT GENERATOR
934
ULTRASOUND MEDIA ITEMS
936
THEMES & EFFECTS
938
ANATOMICAL FEATURE MAPPINGS
910
NETWORK
905
ULTRASOUND IMAGING APPARATUS
960
VIEWING COMPUTING DEVICE
962
BROWSER
964
GL ENGINE
970
GPU

FIG. 9

SYSTEMS AND METHODS FOR GENERATING AN ULTRASOUND MULTIMEDIA PRODUCT

FIELD

[0001] The present disclosure relates generally to ultrasound imaging, and in particular, to systems and methods for generating an ultrasound multimedia product.

BACKGROUND

[0002] Ultrasound is commonly used in medical examinations. For example, obstetrics examinations typically involve ultrasound scans of a fetus. These scans produce media items (e.g., images, videos, cineloops) interpreted by medical professionals to assess the development of the fetus. Since these scans usually provide the first images of an unborn baby, the media items may carry particular emotional meaning for parents.

[0003] Given the nature of ultrasound media items, it may be difficult for parents to interpret them. To make the ultrasound media items more digestible, some traditional systems allow users to manually select the media items from an obstetrics examination for the purpose of combining with audio, visual or text effects to generate a multimedia product. Using these traditional systems, the multimedia product may be written to physical media (such as a Compact Disc-Recordable (CD-R) or a Digital Video Disc (DVD)) or made available online.

[0004] Using these traditional methods to generate an ultrasound multimedia product is cumbersome. Manual selection of desirable media items, audio, and/or text overlays may be required prior to a multimedia product being generated. In some cases, manual effort is also required to transfer the media items to a computer where the multimedia product can be generated.

[0005] There is thus a need for improved systems and methods for generating an ultrasound multimedia product. The embodiments discussed herein may address and/or ameliorate at least some of the aforementioned drawbacks identified above. The foregoing examples of the related art and limitations related thereto are intended to be illustrative and not exclusive. Other limitations of the related art will become apparent to those of skill in the art upon a reading of the specification and a study of the drawings herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Non-limiting examples of various embodiments of the present disclosure will next be described in relation to the drawings, in which:

[0007] FIG. **1** is a user interface showing example ultrasound media items from an obstetrics examination, in accordance with at least one embodiment of the present invention;

[0008] FIG. **2** shows a simplified view of a timeline for a generated multimedia product, in accordance with at least one embodiment of the present invention;

[0009] FIG. **3** shows example relationships between the metadata of ultrasound media items and anatomical features, and also example relationships between anatomical features and available options for various effects, in accordance with at least one embodiment of the present invention;

[0010] FIGS. **4-5** are example screenshots of an ultrasound media product that have effects combined with ultrasound media items, in accordance with at least one embodiment of the present invention;

[0011] FIG. **6** is a flowchart diagram showing steps of a method of selecting an ultrasound media item for inclusion into a multimedia product, in accordance with at least one embodiment of the present invention;

[0012] FIG. **7** is an example illustration of cineloops having different lengths that are to be adapted when combined with an effect with a standard duration, in accordance with at least one embodiment of the present invention;

[0013] FIGS. **8A-8C** are a sequence of example screenshots at various points in time of an ultrasound media product, in accordance with at least one embodiment of the present invention; and

[0014] FIG. **9** is a block diagram for a system of generating an ultrasound media product, in accordance with at least one embodiment of the present invention.

DETAILED DESCRIPTION

[0015] In a first broad aspect of the present disclosure, there is provided a method of generating a multimedia product. The method includes: identifying a plurality of ultrasound media items from a fetal ultrasound scan, wherein each of the plurality of ultrasound media items have different respective attributes; and applying a theme to the plurality of ultrasound media items to generate the multimedia product, the theme comprising an effect to be applied to at least one ultrasound media item of the plurality of ultrasound media items; wherein the applying comprises adapting one of: the effect, and the attribute of the at least one ultrasound media item, to the other.

[0016] In some embodiments, the different respective attributes correspond to viewable anatomical features, and the method further includes, prior to applying the theme, detecting an anatomical feature viewable on the at least one ultrasound media item. In some embodiments, the anatomical feature is selected from the group consisting of: heart, arm, leg, face, head, brain, spine, kidney, liver, sexual organ, digits, belly, feet and hand. In some embodiments, the effect includes multiple options, and the adapting comprises selecting an option from the multiple options based on the anatomical feature.

[0017] In some embodiments, the plurality of ultrasound media items include metadata, and the detecting includes determining the anatomical feature viewable on the at least one ultrasound media item based on the metadata associated with the at least one ultrasound media item. In some embodiments, the metadata includes measurements, and the determining the anatomical feature is performed based on a type of measurement associated with the at least one ultrasound media item. In some embodiments, the metadata includes annotations, and the determining the anatomical feature is performed based on text present in the annotations associated with the at least one ultrasound media item.

[0018] In some embodiments, the detecting the anatomical feature is performed by comparing images in the plurality of ultrasound media items to a template image of the anatomical feature. In some embodiments, the template image is derived from a plurality of pre-categorized images showing the anatomical feature.

[0019] In some embodiments, the plurality of ultrasound media items includes a plurality of cineloops, and the different respective attributes of the plurality of ultrasound media items correspond to respective lengths of each

cineloop. In some embodiments, the effect includes a duration of the effect. In some embodiments, the at least one ultrasound media item includes at least one cineloop, and the adapting comprises modifying one of: the length of the at least one cineloop and the duration of the effect.

[0020] In some embodiments, the effect is selected from the group consisting of: audio, animation, text, images, frames and borders. In some embodiments, the fetal ultrasound scan is performed for an obstetrics examination.

[0021] In some embodiments, prior to the identifying the plurality of ultrasound media items, the method further includes: displaying a user interface for displaying the plurality of ultrasound media items, the user interface providing a user-selectable option for generating the multimedia product; and receiving input that selects the user-selectable option for generating the multimedia product.

[0022] In another broad aspect of the present disclosure, there is provided a server including at least one processor and at least one memory storing instructions for execution by the at least one processor, wherein when executed, the instructions cause the at least one processor to: identify a plurality of ultrasound media items from a fetal ultrasound scan, wherein each of the plurality of ultrasound media items have different respective attributes; and apply a theme to the plurality of ultrasound media items to generate the multimedia product, the theme comprising an effect to be applied to at least one ultrasound media item of the plurality of ultrasound media items; wherein the applying comprises adapting one of: the effect, and the attribute of the at least one ultrasound media item, to the other.

[0023] In some embodiments, the different respective attributes correspond to viewable anatomical features, and the instructions further cause the processor to, prior to applying the theme, detect an anatomical feature viewable on the at least one ultrasound media item.

[0024] In some embodiments, the plurality of ultrasound media items comprises a plurality of cineloops, and the different respective attributes of the plurality of ultrasound media items correspond to respective lengths of each cineloop.

[0025] In another broad aspect of the present disclosure, there is provided a computing device comprising at least one processor and at least one memory storing instructions for execution by the at least one processor, wherein when executed, the instructions cause the at least one processor to: identify a plurality of ultrasound media items from a fetal ultrasound scan, wherein each of the plurality of ultrasound media items have different respective attributes; and apply a theme to the plurality of ultrasound media items to generate the multimedia product, the theme comprising an effect to be applied to at least one ultrasound media item of the plurality of ultrasound media items; wherein the applying comprises adapting one of: the effect, and the attribute of the at least one ultrasound media item, to the other.

[0026] In another broad aspect of the present disclosure, there is provided a computer readable medium storing instructions for execution by at least one processor, wherein when the instructions are executed by the at least one processor, the at least one processor is configured to: identify a plurality of ultrasound media items from a fetal ultrasound scan, wherein each of the plurality of ultrasound media items have different respective attributes; and apply a theme to the plurality of ultrasound media items to generate the multimedia product, the theme comprising an effect to be applied to at least one ultrasound media item of the plurality of ultrasound media items; wherein the applying comprises adapting one of: the effect, and the attribute of the at least one ultrasound media item, to the other.

[0027] For simplicity and clarity of illustration, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements or steps. In addition, numerous specific details are set forth in order to provide a thorough understanding of the exemplary embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein may be practiced without these specific details. In other instances, certain steps, signals, protocols, software, hardware, networking infrastructure, circuits, structures, techniques, well-known methods, procedures and components have not been described or shown in detail in order not to obscure the embodiments generally described herein.

[0028] Furthermore, this description is not to be considered as limiting the scope of the embodiments described herein in any way. It should be understood that the detailed description, while indicating specific embodiments, are given by way of illustration only, since various changes and modifications within the scope of the disclosure will become apparent to those skilled in the art from this detailed description. Accordingly, the specification and drawings are to be regarded in an illustrative, rather than a restrictive, sense.

[0029] Referring to FIG. **1**, shown there generally as **100** is a user interface illustrating example ultrasound media items from an obstetrics examination, in accordance with at least one embodiment of the present invention. In some embodiments, the fetal ultrasound scan is performed for a regular obstetrics examination during a pregnancy. As will be understood by persons skilled in the art, there are several standard views of a fetus that may be considered part of a standard ultrasound scan during pregnancy. These views may allow medical professionals to determine whether the growth of the unborn baby is proceeding as expected. During the scans, various media items may be obtained.

[0030] In FIG. **1**, an example user interface showing these various media items **110** is provided. Particularly, six example ultrasound media items **110** are shown: an image **110***a* showing the abdomen of the unborn baby, a cineloop **110***b* showing a side profile of the unborn baby with its face viewable, an image **110***c* showing the head of the unborn baby, a cineloop **110***d* showing the spine of the unborn baby, an image **110***e* showing the fetal heart of the unborn baby, and an image **110***f* showing the femur of the unborn baby.

[0031] As part of an obstetrics examination, the medical professional may perform various measurements based on the ultrasound media items **110** obtained. These measurements may, for example, assist the medical professional with dating a fetus. As illustrated, measurements may be performed on the ultrasound image **110***a* showing the abdomen of the unborn baby to obtain an abdominal circumference (AC) measurement. Similarly, in the image **110***c* showing the head, a biparietal diameter (BPD) measurement may typically be taken to determine the diameter between the two sides of the head. Further, in the image **110***f* showing the femur, a femur length (FL) measurement may be taken to determine the length of the bone. As the femur is the longest bone in the body, the FL measurement may help the medical professional to assess the longitudinal growth of the fetus.

[0032] On their own, the various media items **110** shown in FIG. **1** may be difficult to understand for parents of the unborn baby who are unfamiliar with reading ultrasound media. To assist with creating a multimedia product that is more easily understandable, the user interface **100** may provide a user-selectable option **130** for generating the multimedia product (shown as a button labeled "Generate Movie" in FIG. **1**). Upon receiving input that selects the user-selectable option **130** for generating the multimedia product, a corresponding computing device generating the user interface **100** may initiate execution of the methods of generating the multimedia product discussed below. Referring briefly to FIG. **9**, the computing device for generating the user interface **100** may be part of the ultrasound imaging apparatus **905**, and the initiation of the methods for generating the ultrasound media product may involve communicating with a remote server **930**. Additional details related to the components of system **900** are discussed below.

[0033] Referring back to FIG. **1**, upon selection of the user-selectable option **130**, a method of generating a multimedia product may be performed. The methods of generating a multimedia product discussed here may include: identifying a number of ultrasound media items from a fetal ultrasound scan; for example, as may be shown in the examination of FIG. **1**. The method may next apply a theme to the identified ultrasound media items to generate the multimedia product by imposing an order in which the media items **110** are to be displayed. In addition, the theme may involve applying various effects to the media items **110**.

[0034] Referring to FIG. **2**, shown there generally as **200** is an example simplified view of a timeline for a generated multimedia product, in accordance with at least one embodiment of the present invention. The timeline view is provided to illustrate various effects being applied to different media items **110**. As illustrated, the timeline view is provided in a simple table format where the timestamps are provided on the top row, and corresponding media items **110** that are being displayed during the time period between successive timestamps are shown in the second row. The one or more effects **215** associated with a given media item **110** when it is being displayed are then shown in successive rows below a given media item **110**. For each effect **215**, an example option **220** is shown below the listed effect. In discussing FIG. **2**, reference will simultaneously be made to the mappings in FIG. **3**, and the various screenshots shown in FIGS. **4-5**.

[0035] In various embodiments, applying a theme may include adapting a given effect to an attribute of a media item **110**, and/or conversely, adapting an attribute of a media item **110** to the to the given effect. Different media items **110** may have different respective attributes. For example, an anatomical feature viewable in a given media item **110** may be considered to be an attribute of the media item **110**. In other examples, the ultrasound media items **110** may be a number of different cineloops, and the attributes of the ultrasound media items **110** may be the respective lengths of the cineloops.

[0036] In some embodiments, the act of adapting an effect to an attribute of the media item **110** may include selecting an option for the effect to be used with a media item **110**. As shown in FIG. **2**, the applied theme may configure the media item **110***b* where the baby's profile and face is viewable to start play at the timestamp "0:00:00". The theme may also be configured to use an image-type effect **215***a* with the media item **110***b*. However, there may be many different image options available to be used.

[0037] To adapt the image effect **215***a* to the media item **110***b*, an option for the image effect **215***a* may be selected based on the anatomical feature that is viewable in the media item **110***b*. In some embodiments, this may be performed via a lookup in a database or other suitable data structure where anatomical features typically viewable in ultrasound media items **110** are mapped to predetermined options **220** for certain effects **215**. While these options **220** are predetermined at the particular time a lookup is made, it may be possible for the options **220** mapped to the effects **215** to be continually updated (e.g., as new options **220** are added).

[0038] Referring simultaneously to FIG. **3**, shown there generally as **315** are example relationships between anatomical features and some predetermined options **220** for a number of effects **215**. As shown, the example anatomical features are in column **305**, and effects **215** that may be used with media items **110** where the anatomical feature **305** are shown are provided on columns to the right of column **305**. Each row in column **305** shows an example anatomical feature that may be viewable in an ultrasound media item **110** and the options **220** mapped to that anatomical feature for a given effect **215**. For example, as illustrated, the "face" anatomical feature **305***a* is mapped to two options **220** for the image effect **215**: a "Moon Mobile" option **220***a* and a "Baby Carriage" option **220***b*.

[0039] As shown in table **315**, a limited number of example effects **215** (e.g., images, animations, and text) are shown for illustration purposes. However, in various embodiments, the effects **215** may include any suitable visual, audio or other effect that enhances viewing of the multimedia product to be generated. For example, additional effects **215** may include: audio, frames, borders, transitions and/or colors which can be used with ultrasound media items **110**. Also, a limited number of example anatomical features are shown in column **305** of FIG. **3** for illustration purposes. However, the embodiments discussed herein may be practiced with any other anatomical feature such as brain, spine, kidney(s), liver, feet, digits, and sexual organs.

[0040] Referring back to FIG. **2**, it can be seen that based on the options **220***a*, **220***b* mapped to the image effect **215** for the ultrasound media item **110***b* showing the "Face" anatomical feature, the "Moon Mobile" option **220***a* is selected for the image effect **215***a* that is to be used with the ultrasound media item **110***b* with the "Face" anatomical feature viewable. Similarly, a second image effect **215***b* to be used with the same media item **110***b* has the "Baby Carriage" option **220***b* selected.

[0041] Referring again to FIG. **3**, it can be seen that the text "I'm cute" **220***c* is one of the options that is mapped to the "Face" anatomical feature **305***a*. Accordingly, referring back to FIG. **2**, it can be seen that a text effect **215***c* is adapted to the media item **110***b* (with the "Face" anatomical feature viewable) to have the text "I'm cute" **220***c*.

[0042] Referring simultaneously to FIGS. **2** and **3**, it can be seen that based on the options **220***f*, **220***g*, mapped to the animation effect for the "spine" anatomical feature **305***e* in FIG. **3**, in FIG. **2**, the "Flying Stork" option **220***f* is selected for the animation effect **215***f* that is to be used with the ultrasound media item **110***d* with the "spine" anatomical feature viewable. Similarly, a second animation effect **215***g* to be used with the same media item **110***d* has the "Heart Balloon" option **220***g* selected.

[0043] In FIG. **3**, it can be seen that the text "Baby on Board" **220***h* is an option that is mapped to the "spine" anatomical feature **305***e* for a text effect **215**. Accordingly, referring back to FIG. **2**, it can be seen that a text effect **215***h* is adapted to the media item **110***d* (with the "spine" anatomical feature viewable) to have the text "Baby on Board" option **220***h* selected.

[0044] Referring to FIG. **4**, shown there generally as **400** is an example screenshot of an ultrasound media product that have effects combined with ultrasound media items, in accordance with at least one embodiment of the present invention. The illustrated example is of a screenshot from the multimedia product between the "0:00:00" timestamp and the "0:00:05" timestamp (as shown in FIG. **2**), where the effects noted above have been combined with the ultrasound media item **110***b*.

[0045] In the illustrated screenshot **400**, it can be seen that the ultrasound media item **110***b* with the "Face" anatomical feature viewable has a theme applied to it, so that a border has been placed around the ultrasound media item **110***b*. In addition, the three effects **215** that are mapped to the "Face" anatomical feature have been adapted to the ultrasound media item **110***b* so as to have particular options **220** selected based on the anatomical feature viewable in the ultrasound media item **110***b*. As illustrated, the image effect **215***a* with the "Moon Mobile" option **220***a* selected is shown as appearing with the ultrasound media item **110***b*. Similarly, the image effect **215***b* with the "Baby Carriage" option **220***b* selected is shown as appearing in the same screenshot **500**. Moreover, the text effect **215***c* is shown as being used with the text "I'm cute" option **220***c* selected.

[0046] Referring back to FIG. **3**, it can be seen that the different options **220** can be mapped to ultrasound media items **110** that have a certain type of anatomical feature **305** viewable. In various embodiments, the options **220** may be mapped to the effects **215** based on a random matching. Additionally or alternatively, the matching may be made based on certain criteria such as an even distribution of available options **220** amongst the different available anatomical features **305**.

[0047] In further embodiments, the matching may be made to associate certain options **220** with suitable anatomical features **305**. For example, as shown in FIG. **3**, for the "Head" anatomical feature **305***b*, a head-related option such as the "Bonnet" option **220***d* can be matched to the image effect **215**. Additionally, another head-related option (e.g., the text "Helmet Hair" **220***h*) can be matched to the "Head" anatomical feature **305***b* for the text effect **215**.

[0048] Referring again to FIG. **2**, it can be seen that the application of the theme has configured the ultrasound media item **110***c* with the "Head" anatomical feature viewable to be shown between the "0:00:05" timestamp and the "0:00:10" timestamp. It can also be seen that adapting the image effect **215***d* to the "Head" ultrasound media item **110***c* has resulted in the "Bonnet" option **220***d* being selected for the image effect **215***d*. Similarly, adapting the text effect **215***e* to the "Head" ultrasound media item **110***c* has resulted in the text "Helmet Hair" option **220***e* being selected for the text effect **215***e*.

[0049] Referring to FIG. **5**, shown there generally as **500** is another example screenshot of an ultrasound media product that have effects combined with ultrasound media items, in accordance with at least one embodiment of the present invention. The illustrated example is of a screenshot from the multimedia product between the "0:00:05" timestamp and the "0:00:10" timestamp (as shown in FIG. **2**), where the effects noted above have been combined with the "Head" ultrasound media item **110***c*.

[0050] In the screenshot **500**, it can be seen that the ultrasound media item **110***c* with the "Head" anatomical feature viewable has a theme applied to it, so that a border has been placed around the ultrasound media item **110***c*. In addition, the two effects **215** that are mapped to the "Head" anatomical feature shown in table **315** of FIG. **3** have been adapted to the ultrasound media item **110***c*. As illustrated in FIG. **5**, the image effect **215***d* with the "Bonnet" option **220***d* is shown as appearing with the ultrasound media item **110***c*. Similarly, the text effect **215***e* with the "Helmet Hair" option **220***e* selected is also shown as appearing in the same screenshot **500**.

[0051] Referring simultaneously to FIG. **5** and FIG. **1**, it can be seen that the ultrasound media items **110***c* showing the "Head" anatomical feature appears in both figures. In FIG. **1**, a BPD measurement is viewable on the ultrasound media item **110***c* when it forms part of a medical examination. However, in FIG. **5**, because the media item **110***c* is being added to a multimedia product intended for viewing by a non-medical audience, the BPD measurement is removed in the illustrated example screenshot. In some situations, the purpose and location of the measurement may raise questions or cause confusion for a non-medical audience, so its removal may potentially allow for more positive reception of the multimedia product (e.g., by parents of the unborn baby). Notwithstanding, measurements do not need to be moved, and it may be possible to include ultrasound media items **110** with measurements viewable in the multimedia product.

[0052] As can be seen in FIGS. **4-5**, the adapting of various effects to attributes of an ultrasound media item **110** may result in multimedia effects being displayed that make the ultrasound media items **110** more easily understandable by parents of an unborn baby. For example, as shown in FIG. **5**, the appearance of the "Head" anatomical feature in the ultrasound media item **110***c* may not be readily apparent to parents of the unborn baby who are typically not accustomed to viewing fetal ultrasound images. However, with the addition of the image effect **215***d* and text effect **215***e* that have each been adapted to the "Head" anatomical feature so that suitable effect options **220***d*, **220***e* are selected, parents viewing the multimedia product may more readily appreciate that the ultrasound image **110***c* has the "Head" anatomical feature viewable.

[0053] Referring back to FIG. **3**, it can be seen that for a given anatomical feature **305**, there can be a variety of suitable options **220** that can be mapped to an effect **215**. For example, in addition to the options **220** mapped to the various effects **215** discussed above for the "Face" anatomical feature **305***a* and the "Head" anatomical feature, there may be suitable options **220** mapped to effects **215** for a number of other anatomical features **305**. For example, for the "Leg" anatomical feature **305***c*, there may be leg-related or feet-related options **220** associated with it for various effects **215**. For example, as illustrated, for an image effect **215**, there may be options **220***j* of "Socks", "Shoes", or "Soccer ball" matched to the effect **215**; for the animation effect **215**, a "Running Character" option **220***k* may be matched to the effect **215**; and for a text effect **215**, the text "Ready, set, go!" option **220***l* may be matched to the effect

215. Moreover, also viewable in FIG. **3** is that for a heart anatomical feature **305***d*, a "Heart shape" option **220***l* is matched to the image effect **215**.

[0054] Referring back to FIG. **2**, it can be seen that application of a theme to the ultrasound media items **110***e*, **110***a*, **110***f* may result in a configuration where each of these ultrasound media items **110** are played at the timestamps "0:00:10", "0:00:1", and "0:00:20" respectively. To adapt the various effects **215** to these ultrasound media items **110**, it can be seen that suitable options **220** for the anatomical features viewable in each ultrasound media items **110***e*, **110***a*, **110***f* have been selected. For example, based on the options **220** matched to the anatomical features **305** shown table **315** of FIG. **3**, a "Heart Shape" option is selected for an image effect to be used in combination with an ultrasound media item **110***e* with the "Heart" anatomical feature viewable. Similarly, for the ultrasound media item **110***a* with the "Belly" anatomical feature viewable, a "Pacifier" option is selected for the animation effect to be used with the media item **110***a*; and a "Bottle" option is selected for the image effect to be used with the media item **110***a*. Further, for the "Leg" ultrasound media item **110***f*, a "Socks" option is selected for an image effect and a "Running Character" option is selected for an animation effect.

[0055] Referring briefly to FIG. **3**, it can be seen that "Pen" is an available option **220** for an image effect **215** to be used with both the "Arm" anatomical feature and the "Hand" anatomical feature. Depending on the nature of the ultrasound media items **110** to be included in the multimedia product, it may be possible that the same "Pen" option is selected and appears twice in a given generated multimedia product. To avoid the same effect options **220** from being repeated, in some embodiments, prior to selecting a given option **220** to be used with a given effect **215**, the method may involve performing a review of whether the same option has already been selected to be used. If so, an alternative unused option **220** may be selected.

[0056] Referring to FIG. **6**, shown there generally as **600** is a flowchart diagram for the steps of a method of selecting an ultrasound media item for inclusion into a multimedia product, in accordance with at least one embodiment of the present invention. As a number of the effects discussed above for applying to ultrasound media items **110** are anatomical feature-related, the method of FIG. **6** includes a number of acts related to detecting an anatomical feature viewable on at least one ultrasound media item **110**. In various embodiments, the method of FIG. **6** may be performed prior to applying the theme and/or effects discussed above.

[0057] In discussing the method of FIG. **6**, reference will also be made to the tables **310**, **315** shown in FIG. **3**. As discussed above, one embodiment of adapting an effect to an attribute of an ultrasound media item **110** may involve selecting options **220** suitable for given effects **215** based on anatomical feature(s) **305** viewable in the ultrasound media item **110**. In some embodiments, the anatomical features **305** viewable within a given ultrasound media item **110** may be determined in accordance with the method of FIG. **6**. Because the media items **110** have particular anatomical features viewable, they may be particularly suitable for inclusion into the multimedia product because they are more easily viewed and understood by non-medically trained individuals. Also, the media items **110** with particular anatomical features viewable may be suitable for automated adapting of various effects **215** in the manner noted above (e.g., the selection of particular options **220** for effects **215** that are suitable for given anatomical features).

[0058] At **605**, the method may involve reading an ultrasound media item **110**. For example, as discussed above, this may involve identifying various ultrasound media items from a medical (e.g., obstetrics) examination.

[0059] At **610**, a determination may be made as to whether metadata for the ultrasound media items **110** is available. The metadata may be any information associated with the ultrasound media item **110**, but is not the ultrasound media item **110** itself. For example, the metadata associated with an ultrasound media item **110** may be a measurement or an annotation made on the ultrasound media item **110**.

[0060] If there is metadata available (the 'YES' Branch at **610**), at **615**, a determination may be made as to whether the metadata corresponds to an anatomical feature. For example, different types of measurements or annotations may typically be associated with respective different types of anatomical features. Referring simultaneously to FIG. **3**, shown there generally as **310** are different example types of metadata **320** that may be associated with anatomical features **305**. As shown in FIG. **3**, table **310** shows example types of values that may be mapped to different anatomical features **305**. Each row in table **310** illustrates how different values for a given item of metadata **320** can be mapped to particular anatomical features **305**.

[0061] The mapping may provide a translation from common metadata values in medical examinations to the anatomical features that are typically viewable in such ultrasound media items **110**. In the example table **310** of FIG. **3**, there are a number of standard measurements that may be made during a regular fetal ultrasound scan. These measurements may allow a medical professional to assess the growth of the fetus in the womb. However, the measurements typically consist of specialized medical terminology or acronyms (e.g., related to internal anatomy such as bones) that is difficult for non-medically trained viewers of the generated multimedia product to understand or interpret.

[0062] For example, as illustrated in table **310** in FIG. **3**, a biparietal diameter (BPD) measurement may provide the diameter across a developing baby's skull. However, a non-medically trained person would not likely know that an ultrasound media item with a BPD measurement has the head of the unborn baby viewable. By mapping the BPD measurement to the "Head" anatomical feature, that ultrasound media item **110** may, as noted above, be marked for enhancement with various head-related effects **215** and included into the multimedia product.

[0063] Generally, the mapping between types of measurements to anatomical features may provide a mechanism to extrapolate from the specialized medical terminology (e.g., indicative of internal anatomy) to external anatomical features that would be more familiar to viewers of the multimedia product being generated. As shown in table **310** of FIG. **3**, a number of additional different measurements (and their associated acronyms, if applicable) are listed. For example, measurements of the humerus, radius, and/or ulna bones may be extrapolated to indicate that ultrasound media items **110** with such measurements have the arm of an unborn baby viewable. Similarly, measurements of the femur, tibia and/or fibula bones may be extrapolated to indicate that ultrasound media items **110** with such measurements have the leg of an unborn baby viewable.

[0064] The table **310** in FIG. **3** also shows another type of metadata **320** (annotations) that may be used to identify anatomical features viewable in ultrasound media items **110**. For example, various phrases, keywords and/or text that are used by medical professionals may commonly appear on ultrasound media items **110** having given anatomical features viewable. Such keywords may be mapped to their corresponding anatomical features so that in act **615** of FIG. **6**, the presence of any such text in the annotations of an ultrasound media item **110** may be used to determine that the corresponding anatomical feature is viewable in the ultrasound media item **110**. For example, as shown in FIG. **3**, the text "Profile" is mapped to the "Face" anatomical feature.

[0065] Referring back to FIG. **6**, if it is determined that the metadata associated with an ultrasound media item **110** corresponds to an anatomical feature (the 'YES' branch at act **615**), at act **620**, the method may proceed to identify the anatomical feature viewable in the ultrasound media item **110** based on the metadata. This may be based on the anatomical features **305** mapped to a given type of measurement or mapped to certain text present in the annotations.

[0066] At **625**, the method may proceed to mark the ultrasound media item **110** for inclusion into the multimedia product. Having identified a given ultrasound media item **110** as showing a particular anatomical feature, marking the media item **110** may allow the various anatomical feature-related effects **215** discussed above to be applied to the ultrasound media item **110**.

[0067] If metadata is not available (the 'NO' branch at **610**) or the metadata does not correspond to an anatomical feature (the 'NO' branch at **615**—e.g., if the types of measurements or text in the annotations of an ultrasound media item **110** do not correspond to any mapped anatomical features), the method may instead proceed to act **630**.

[0068] At **630**, an image present in the given ultrasound media item **630** may be analyzed to determine if an anatomical feature is viewable. For example, this analysis may involve comparing the ultrasound image to a template image that is predetermined to have a given anatomical feature viewable. This may involve performing various image analysis techniques to ascertain if certain shapes or image patterns that are present in a template image for a given anatomical feature are also present in the ultrasound media item **110** being analyzed.

[0069] Referring simultaneously back to FIG. **1**, the method of FIG. **6** may be performed on the various ultrasound media items **110** shown in the medical examination **100**. In an example where the method of FIG. **6** is being performed to determine if any of such ultrasound media items **110** have a fetal heart viewable, when act **630** of FIG. **6** is performed, the method may attempt to determine if a given ultrasound media item **110** in the medical examination **100** corresponds to a template image of a fetal heart. As will be understood by persons skilled in the art, a common feature of fetal ultrasound images is a multiple-chamber view of the fetal heart. Accordingly, image analysis may be performed on the various ultrasound images **110** to determine if they contain a similar multiple-chamber feature visible. While image analysis of many of the ultrasound media items **110** shown in FIG. **1** would not result in a match to a standard fetal heart template image, analysis of the particular media item **110***e* may result in a match because of the multiple-chamber view also appearing in such media item **110***e*. Accordingly, the ultrasound media item **110***e* may be identified as an ultrasound media item **110** with a fetal heart viewable.

[0070] In other examples, template images may be provided for the various other anatomical features. A similar process of comparing given ultrasound media items **110** to the template images may be performed to determine if any such other ultrasound media items **110** match the appearance of the template images.

[0071] The template images may be provided in various ways. For example, in some embodiments, the template image may be derived from a set of pre-categorized images showing given anatomical features. These pre-categorized images may be pre-populated or seeded into a library of classified images that can be referenced during the image analysis act **630** of FIG. **6**. Additionally or alternatively, as categorizations of ultrasound media items are **110** are being made from the performance of act **630** in FIG. **6**, the results of such categorizations may be added to the library of classified images. In some embodiments, various additional machine learning and/or computer vision techniques may be used to help refine the template image(s) that are used during image analysis operations.

[0072] Referring still to FIG. **6**, at **635**, a determination can be made as to whether the analyzed image in the ultrasound media item **110** corresponds to the template image. If a given ultrasound media item **110** does correspond (e.g., it matches the template image—the 'YES' branch at **635**), the anatomical feature viewable in the ultrasound media item **110** may be identified as the one that is associated with the template image (act **640**). The ultrasound media item **110** with the determined anatomical feature may then be marked for inclusion into the multimedia product (act **625**). Based on the determined anatomical feature, the various anatomical feature-related effects discussed above may then be applied to the ultrasound media item **110**.

[0073] If the result of the image analysis at act **630** is that no viewable anatomical feature can be identified (the 'NO' branch at **635**), the method may proceed to act **645**. At act **645**, the ultrasound media item **110** being analyzed is not marked for inclusion into the multimedia product. By performing the method of FIG. **6** to detect anatomical features prior to generating a multimedia product, the ultrasound media items **110** that are selected for inclusion into the multimedia product are more likely to be high-quality images that have clear anatomical features viewable. Additionally, as discussed above, the detection of ultrasound media items **110** with anatomical features may allow the effects **215** that are applied to be more suitable for the given ultrasound media items **110** so as to enhance their viewing by non-medically trained personnel.

[0074] In various embodiments, the methods described herein for generating a multimedia product may be implemented using a graphics library such as the three js library (which provides a JavaScript WebGL (Web Graphics Library) Application Programming Interface (API)). For example, a theme with a number of effects may be specified via a script that calls the available API calls in WebGL to set the order in which selected ultrasound media items **110** are to be played, and/or to set various visual parameters of the effects **215**. In some embodiments, one or more WebGL scenes may be set up for a theme, and each scene may have an associated WebGL camera (which may be the same across one or more scenes). When applying the theme,

various ultrasound media items **110** marked for inclusion into the multimedia product may be included as objects and added to a given scene. In various embodiments, if there are more ultrasound media items **110** marked for inclusion that available scenes in a theme, scenes may be reused when generating a multimedia product based on that given theme.

[0075] To add the effects **215** associated with a theme (e.g., as described above in relation to FIG. **2**), various additional objects may be added to a scene containing an ultrasound media item **110** object. For example, sprites corresponding to various options **220** may be selected for the animation and image effects **215**, and the placement and/or movement of the sprites may be specified using WebGL API calls. In various embodiments, the objects (e.g., sprites) added to a scene may be two-dimensional (e.g., a plane) and/or three-dimensional (e.g., with textures and geometry). In various embodiments, the position and/or rotation of these objects may be modified to create the best viewing experience for the multimedia product. In various themes, similar parameters for the camera may also be modified to create the best viewing experience for the multimedia product.

[0076] Referring to FIG. **7**, shown there as **700** is an example illustration of cineloops having different lengths that are to be adapted when combined with an effect with a standard duration, in accordance with at least one embodiment of the present invention. As noted above, the application of a theme to ultrasound media items **110** may include adapting a given effect to an attribute of a media item **110**, or vice versa. In some embodiments, the ultrasound media items **110** are a number of different cineloops, and the different respective attributes of the ultrasound media items **110** correspond to respective lengths of each cineloop.

[0077] Referring still to FIG. **7**, an animation effect **215***f* may be applied to an ultrasound media item **110**. However, the animation effect **215***f* may have a standard duration that is different from the lengths of the various cineloops to which the effect **215***f* may be applied. As shown in FIG. **7**, several example ultrasound media items **110** (e.g., cineloops) are illustrated as horizontal bars with timestamps: a first spine cineloop **110***d* with a duration of 6 seconds, a second spine cineloop **110***x* with a duration of 3 seconds, and a third spine cineloop **110***y* with a duration of 7 seconds. As discussed above in relation to FIGS. **2** and **3**, if it is determined that a given ultrasound media item **110** has the anatomical feature of a "spine" viewable, a "Flying Stork" option **220***f* may be selected for an animation effect **215***f* to be applied to the "Spine" cineloop **110***d*, **110***x*, **110***y*. However, as shown, the "Flying Stork" animation effect **215***f* may have a standard duration of 5 seconds. As such, some embodiments herein may involve adapting either the duration of the effect **215***f* to a length of a given cineloop **110***d*, **110***x*, **110***y* and/or adapting the length of the cineloop **110***d*, **110***x*, **110***y* to the duration of the effect **215***f*.

[0078] Various methods may be used to adapt the duration of an effect **215***f* to the length of a given cineloop **110***d*, **110***x*, **110***y*, or vice versa. In various embodiments, there may be different implementations depending on whether a cineloop length is longer than the standard duration of the effect **215***f* (e.g., cineloop **110***d*, **110***y*) or whether the cineloop length is shorter than the standard duration of the effect **215***f* (e.g., cineloop **110***x*).

[0079] In one example embodiment where the cineloop length is longer than the standard duration of the effect **215***f*, the scripting of the animation effect **215***f* (e.g., using WebGL) may be provided in several components: a first part that configures the sprite sliding or animating into the screen so that it can be viewed. Then, the sprite can be configured to appear as if it drifts for a period of time that depends on the length of the cineloop **110***d*, **110***y* (e.g., until the cineloop **110***d*, **110***y* is complete or almost complete). After, the visible sprites can be configured to slide off the screen (e.g., with or without the cineloop **110***d*, **110***y* itself).

[0080] In various embodiments, the drifting of the sprites (e.g., during the interim period that accounts for the unknown duration of a cineloop **110***d*, **110***y*) may be configured to look random and/or based on mathematical functions. For example, during the drifting, the positioning of the sprite on the screen may be continually modified based on a mathematical function of time (e.g., the Cartesian coordinates of the sprite may be modified according to a function for a circle such as X position=cos(t), Y position=sin(t), where 't' is time). In embodiments where multiple objects are provided in a scene, the drifting paths of each object may be configured to be different. For example, this may allow each of the objects to appear independent of each other, so as to be more visually engaging. In one example embodiment, the Cartesian coordinates for each of the objects may be configured as follows: X position=sin(t/a)+sin(2t/b); Y position=sin(t/c)+sin(2t/d), where T is time, and 'a', 'b', 'c', and 'd' are random integers for each object on the screen.

[0081] In situations where the cineloop length is shorter than the standard duration of the effect (e.g., if the "Flying Stork" animation effect **215***f* is to be used with the second spine cineloop **110***x*), the cineloop length may be adapted to the standard duration of the effect **215***f*. For example, the animation effect **215***f* may be configured to have a minimum scene length that matches the standard duration of the effect **215***f*. In these scenarios, upon completion of a cineloop **110***x*, the cineloop **110***x* may freeze on the last screen until the animation completes. Alternatively, the cineloop **110***x* may loop until the animation effect **215***f* completes.

[0082] Referring to FIGS. **8**A-**8**C, shown there generally as **800**-**802** are a sequence of example screenshots at various points in time of an ultrasound media product that have effects combined with ultrasound media items, in accordance with at least one embodiment of the present invention. In discussing FIGS. **8**A-**8**C, reference will also be made to FIGS. **2** and **7**. The illustrated example is of screenshots from the timeline of the multimedia product illustrated in FIG. **2**, starting at the "0:00:25" timestamp, where various effects have been combined with the ultrasound media item **110***d* with the "spine" anatomical feature viewable. Further to the discussion above in relation to FIG. **7**, FIGS. **8**A-**8**C also illustrate how the duration of the "Flying Stork" animation effect **215***f* can be adapted to length of the spine cineloop **110***d*.

[0083] FIG. **8**A shows a screenshot generally as **800** at a first point in time. The screenshot **800** is similar to that which is shown in FIGS. **4** and **5** in that the ultrasound cineloop **110***d* with the "spine" anatomical feature viewable has a theme applied to it, so that a border has been placed around the ultrasound media item **110***d*. With simultaneous reference to FIG. **2**, it can be seen that the three effects **215** that are mapped to the "spine" anatomical feature has also been used with this ultrasound media item **110***d*. As illustrated, the animation effect **215***f* with the "Flying Stork" option **220***f* selected is shown entering the screen on the left

side. Also, the animation effect **220***g* with the "Heart Balloon" option **220***g* selected is viewable on the right side of the screen. Further, the text effect **215***h* is shown being applied with the text "Baby on Board" **220***h* selected and viewable. With respect to the adapting of the duration of the animation effect **210***f* to the cineloop **110***d*, the sprite **220***f* for the flying stork character may enter the screen as the spine cineloop **110***d* begins to play.

[0084] FIG. **8**B shows a screenshot generally as **801** at a second point in time. In this screenshot, it can be seen that the "Spine" ultrasound media item **110***d* remains viewable. However, the various animation effects **215***f*, **215***g* has progressed part way through their respective animations. In particular, it can be seen that for the first animation effect **215***f* with the "Flying Stork" option **220***f* selected, the "Stork" character has progressed from the left side of the screen (as shown in FIG. **8**A) to the middle of the screen. Similarly, for the second animation effect **215***g* with the "Heart Balloon" option **220***g* selected, the "Heart Balloon" image has progressed upward from the middle of the right side of the screen (as shown in FIG. **8**A) towards the top of the of the screen. Further, the text effect **215***h* with the mapped "Baby on Board" text **220***h* option selected remains viewable.

[0085] Referring simultaneously to FIG. **7**, since the spine cineloop **110***d* has a longer length than the 5 second standard duration of the flying stork animation **215***f*, it can be seen in FIG. **8**B that the flying stork character animation has now completed its first component by sliding into the middle of the screen. At this point, the stork character may be configured to drift (e.g., pursuant to a mathematical function for X, Y coordinates) until the cineloop **110***d* is complete or almost complete.

[0086] In the example screenshot shown in FIG. **8**B, the path of "Stork" character is shown as overlapping with the appearance of the ultrasound media item **110***d* (e.g., so as to block the appearance of the ultrasound media item **110***d* temporarily). In some embodiments, when making the mathematical calculations of the animation path, the coordinates of the viewable area of the ultrasound media item **110***d* may be taken into account so as to configure the animation path to not intersect with such area. This may allow the animated character to not block the appearance of an ultrasound media item **110**.

[0087] Referring to FIG. **8**C, shown there generally as **802** is a screenshot at a third point in time after the screenshot of FIG. **8**B. In this screenshot, it can be seen that the ultrasound media item **110***d* previously viewable in FIGS. **8**A and **8**B continues to remain viewable. However, as illustrated, the animation effects **215***f*, **215***g* that have been used with the cineloop **110***d* have progressed further. Particularly, the first animation **215***f* with the "Flying Stork" option **220***f* selected has progressed to the right side of the screen. Also, the second animation **215***g* with the "Heart Balloon" option **220***g* selected has similarly progressed further so that it is now mostly no longer viewable on the screen. The text effect **215***h* with the text "Baby on Board" option **220***h* selected again remains viewable in this screenshot. Referring simultaneously to FIG. **7**, after the sprite for the stork character has been configured to drift until the cineloop **110***d* is complete or almost complete, the stork character may be configured to continue on its flight path in a direction that will eventually remove the stork character from the screen.

[0088] Referring to FIG. **9**, shown there generally as **900** is a block diagram for a system of generating an ultrasound media product, in accordance with at least one embodiment of the present invention. The system **900** may include an ultrasound imaging apparatus **905**, a server **930**, and a viewing computing device **960**; each communicably connected to network **910** (e.g., the Internet) to facilitate electronic communication.

[0089] In one example embodiment, the ultrasound imaging apparatus **905** may be provided in the form of a handheld wireless ultrasound scanner that is communicably coupled to an Internet-enabled computing device configured to transmit the ultrasound media items **110** (as shown above in relation to FIG. **1**) to the server **930**. In other embodiments, the ultrasound imaging apparatus **905** may be provided in the form of a unitary ultrasound machine that can scan, store, and transmit the ultrasound media items **110** from a medical examination to the server **930**. In further embodiments, the ultrasound imaging apparatus **905** may simply store ultrasound media items **110** already acquired from a medical examination, and provide functionality to transmit such ultrasound media items **110** to the server **930**. In various embodiments, the ultrasound imaging apparatus **905** may be configured to display a user interface **100** similar to what is shown in FIG. **1**, and which provides a user-selectable option **130** that, when selected, causes the ultrasound imaging apparatus to communicate with the server **930** to cause the methods for generating a multimedia product discussed herein to be performed.

[0090] The server **930** may be configured to provide a multimedia product generator **932** to perform various acts of the methods discussed herein. The server **930** may be configured to communicate with the ultrasound imaging apparatus **905** to receive and store ultrasound media items **110** into a corresponding suitable storage mechanism such as database **934**. The server **930** may also provide a multimedia product generator **932** that is configured to generate an ultrasound media product as discussed herein. For example, the multimedia product generator **932** may be configured to read ultrasound media items **110** from the corresponding database **934**; mappings amongst metadata **320**, anatomical features **305**, and effect options **220** (e.g., as shown in tables **310**, **315** of FIG. **3**) stored in the anatomical feature mappings database **938**; and data from the themes and effects database **936** which can store underlying data (e.g., sprites, bitmaps, and the like) that are to be used when generating a multimedia product. In various embodiments, the multimedia product generator **932** may be provided in the form of software instructions (e.g., a script) configured to execute on server **930** and/or transmitted from server **930** to a viewing computing device **960** for execution thereon. As noted above, in one example embodiment, the software instructions may be provided in the form of a script written in a scripting language that can access the WebGL API.

[0091] Although illustrated as a single server in the block diagram of FIG. **9**, the term "server" herein may encompass one or more servers such as may be provided by a suitable hosted storage and/or cloud computing service. Further, in various embodiments, the databases illustrated may not reside with the server **930**. For example, the data may be stored on managed storage services accessible by the server **930** and/or the viewing computing device **960** executing a script.

[0092] In some embodiments, the server **930** may also be communicably coupled to a billing or accounting system for the a medical professional associated with the ultrasound imaging apparatus **905**. In such embodiments, upon generating the multimedia product, the server **930** may communicate with the billing or accounting system so as to add a charge to a patient for creation of the ultrasound multimedia product.

[0093] The viewing computing device **960** can be any suitable computing device used to generate the multimedia product and/or access the multimedia product generated by the server **930**. For example, in the embodiment where the multimedia product generator **932** of server **930** is provided in the form of a script that can make WebGL API calls, the script may be transmitted to the viewing computing device **960** so that the multimedia product may be generated when the script is executed in browser **962**. A graphics library (GL) engine **964** may interpret the script and live render the multimedia product for viewing at the viewing computing device **960**. In some embodiments, the live render of the multimedia product may involve processing by a Graphics Processing Unit (GPU) **970** provided on the viewing computing device **960**.

[0094] In some embodiments, the server **930** may be configured to execute WebGL API calls such that a script (or portion thereof) may be executed at the server **930** to perform pre-rendering. For example, this may allow for more flexible distribution of a generated multimedia product. For example, the multimedia product generator **932** may be configured to generate a standalone multimedia file (e.g., a Motion Picture Experts Group (MPEG)-4, or MP4 file) that can be transmitted from server **930** to the viewing computing device **960** for displaying thereon (e.g., for playing using a media player (not shown)). As used herein, the term "multimedia product" may refer to a pre-rendered multimedia experience (e.g., a generated video file) and/or any multimedia experience that is dynamically generated each time.

[0095] In various embodiments, the multimedia product may be configured to be interactive. For example, when a given ultrasound media item is displayed during the playback of a generated multimedia product, the multimedia product may be configured to receive user input to zoom in or otherwise highlight the ultrasound media item being displayed. Additionally or alternatively, the multimedia product may be configured to provide gallery controls on the display of various frames of the generated multimedia product. For example, these gallery controls may be configured to receive "next" or "previous" input during the display of a given ultrasound media item, so as to allow a user to advance forward to the next ultrasound media item, or navigate back to a previously-viewed ultrasound media item. In various embodiments, the interactivity may be implemented using API calls available in WebGL.

[0096] In various embodiments, the multimedia product may be configured to have an introduction screen that is displayed prior to the display of ultrasound media items. In various embodiments, the introduction screen may be configured to display text that by default is set to the patient's name entered during the medical examination. In various embodiments, the clinician may be provided with the ability to customize this text. In embodiments where the multimedia product is provided in the form of a dynamically generated video file and/or multimedia experience (e.g., from the execution of a script), the introductions screen may be displayed during the time it takes to load/transmit the script from a server **930** to a viewing computing device **960**.

[0097] The various embodiments discussed herein may help automate generation of a fetal ultrasound multimedia product. Whereas traditional methods of creating an ultrasound multimedia product typically require manual identification of the media items **110** to be included, the present embodiments may help automate selection of the particular ultrasound multimedia items **110** that are suitable for inclusion (e.g., those which show particular anatomical features). Additionally, traditional ultrasound multimedia product creation methods typically require manual identification of the effects (e.g., text, animations, audio) that are suitable for the selected media items. In contrast, the present embodiments may help automate the identification of the suitable effects to be used with given ultrasound media items **110** by selecting options **220** for given effects **215** based on the anatomical features viewable in the ultrasound media items **110**. Moreover, the present embodiments provide various methods of adapting a duration of effect **215** to various lengths of ultrasound media items **110**, or vice versa, to further facilitate the automated creation of the multimedia product. In various embodiments, these features may be practiced individually, or by combining any two or more of the features.

[0098] As noted above, in some embodiments, the multimedia product generated from ultrasound media items **110** obtained during a regular medically-necessary examination. For example, in the case of fetal ultrasound scans, the ultrasound media items **110** may be obtained during regular obstetrics examinations where medical professionals assess the health of the unborn baby. By using ultrasound media items **110** from a medically-necessary examination to generate the multimedia product, the ALARA (As Low As Reasonably Achievable) principle can be followed with respect to avoiding unnecessary exposure to ultrasound energy.

[0099] While a number of exemplary aspects and embodiments have been discussed above, those of skill in the art will recognize that may be certain modifications, permutations, additions and sub-combinations thereof. While the above description contains many details of example embodiments, these should not be construed as essential limitations on the scope of any embodiment. Many other ramifications and variations are possible within the teachings of the various embodiments.

Interpretation of Terms

[0100] Unless the context clearly requires otherwise, throughout the description and the claims:

[0101] "comprise", "comprising", and the like are to be construed in an inclusive sense, as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to";

[0102] "connected", "coupled", or any variant thereof, means any connection or coupling, either direct or indirect, between two or more elements; the coupling or connection between the elements can be physical, logical, or a combination thereof;

[0103] "herein", "above", "below", and words of similar import, when used to describe this specification, shall refer to this specification as a whole, and not to any particular portions of this specification;

[0104] "or", in reference to a list of two or more items, covers all of the following interpretations of the word: any of the items in the list, all of the items in the list, and any combination of the items in the list;

[0105] the singular forms "a", "an", and "the" also include the meaning of any appropriate plural forms.

[0106] Unless the context clearly requires otherwise, throughout the description and the claims:

[0107] Words that indicate directions such as "vertical", "transverse", "horizontal", "upward", "downward", "forward", "backward", "inward", "outward", "vertical", "transverse", "left", "right", "front", "back", "top", "bottom", "below", "above", "under", and the like, used in this description and any accompanying claims (where present), depend on the specific orientation of the apparatus described and illustrated. The subject matter described herein may assume various alternative orientations. Accordingly, these directional terms are not strictly defined and should not be interpreted narrowly.

[0108] Embodiments of the invention may be implemented using specifically designed hardware, configurable hardware, programmable data processors configured by the provision of software (which may optionally include "firmware") capable of executing on the data processors, special purpose computers or data processors that are specifically programmed, configured, or constructed to perform one or more steps in a method as explained in detail herein and/or combinations of two or more of these. Examples of specifically designed hardware are: logic circuits, application-specific integrated circuits ("ASICs"), large scale integrated circuits ("LSIs"), very large scale integrated circuits ("VLSIs"), and the like. Examples of configurable hardware are: one or more programmable logic devices such as programmable array logic ("PALs"), programmable logic arrays ("PLAs"), and field programmable gate arrays ("FPGAs")). Examples of programmable data processors are: microprocessors, digital signal processors ("DSPs"), embedded processors, graphics processors, math co-processors, mobile computers, mobile devices, tablet computers, desktop computers, server computers, cloud computers, mainframe computers, computer workstations, and the like. For example, one or more data processors in a control circuit for a device may implement methods as described herein by executing software instructions in a program memory accessible to the processors. In another example, a tablet computer or other portable computing device having a touchscreen may implement methods as described herein by having processors provided therein execute software instruction in a program memory accessible to such processors.

[0109] For example, while processes or blocks are presented in a given order herein, alternative examples may perform routines having steps, or employ systems having blocks, in a different order, and some processes or blocks may be deleted, moved, added, subdivided, combined, and/or modified to provide alternative or subcombinations. Each of these processes or blocks may be implemented in a variety of different ways. Also, while processes or blocks are at times shown as being performed in series, these processes or blocks may instead be performed in parallel, or may be performed at different times.

[0110] The invention may also be provided in the form of a program product. The program product may include any non-transitory medium which carries a set of computer-readable instructions which, when executed by a data processor (e.g., in a controller, ultrasound processor in an ultrasound machine, and/or a processor in an electronic display unit), cause the data processor to execute a method of the present embodiments. Program products may be in any of a wide variety of forms. The program product may include, for example, non-transitory media such as magnetic data storage media including floppy diskettes, hard disk drives, optical data storage media including CD ROMs, DVDs, electronic data storage media including ROMs, flash RAM, EPROMs, hardwired or preprogrammed chips (e.g., EEPROM semiconductor chips), nanotechnology memory, or the like. The computer-readable signals on the program product may optionally be compressed or encrypted.

[0111] Where a component (e.g. a software module, processor, assembly, device, circuit, etc.) is referred to above, unless otherwise indicated, reference to that component (including a reference to a "means") should be interpreted as including as equivalents of that component any component which performs the function of the described component (i.e., that is functionally equivalent), including components which are not structurally equivalent to the disclosed structure which performs the function in the illustrated exemplary embodiments of the invention.

[0112] Specific examples of systems, methods and apparatus have been described herein for purposes of illustration. These are only examples. The technology provided herein can be applied to systems other than the example systems described above. Many alterations, modifications, additions, omissions, and permutations are possible within the practice of this invention. This invention includes variations on described embodiments that would be apparent to the skilled addressee, including variations obtained by: replacing features, elements and/or acts with equivalent features, elements and/or acts; mixing and matching of features, elements and/or acts from different embodiments; combining features, elements and/or acts from embodiments as described herein with features, elements and/or acts of other technology; and/or omitting combining features, elements and/or acts from described embodiments.

[0113] It is therefore intended that the following appended claims and claims hereafter introduced are interpreted to include all such modifications, permutations, additions, omissions, and sub-combinations as may reasonably be inferred. The scope of the claims should not be limited by the preferred embodiments set forth in the examples, but should be given the broadest interpretation consistent with the description as a whole.

1.-20. (canceled)

21. A system for generating a multimedia product comprising:

a viewing computing device; and

a server, storing:

a plurality of ultrasound media items having associated metadata, the plurality of ultrasound media items being generated from a fetal ultrasound scan;

a mapping of metadata values to anatomical features of a fetus;

a mapping of the anatomical features of a fetus to options for one or more multimedia effects;

underlying data associated with the options for the one or more multimedia effects; and

a multimedia product generator comprising software instructions executable by at least one processor at the server or at the viewing computing device,

wherein when the instructions are executed by the at least one processor, the at least one processor is configured to:

read metadata associated with at least one ultrasound media item of the plurality of ultrasound media items;

based on the mapping of metadata values to anatomical features of a fetus, determine an anatomical feature of a fetus, corresponding to the read metadata, that is viewable in the at least one ultrasound media item;

based on the mapping of the anatomical features of a fetus to options for the one or more multimedia effects, identify an option for a multimedia effect of the one or more multimedia effects; and

apply the multimedia effect, with the identified option, to the at least one ultrasound media item, to generate one or more frames of the multimedia product;

wherein the generated one or more frames of the multimedia product show the at least one ultrasound media item with the applied multimedia effect, and the applied multimedia effect has the option that matches the anatomical feature of a fetus determined to be viewable in the at least one ultrasound media item.

22. The system of claim **21**, wherein the multimedia product generator is provided as a script that is transmittable to the viewing computing device for execution, and wherein when the script is executed at the viewing computing device, the viewing computing device generates the multimedia product.

23. The system of claim **22**, wherein during display of the generated multimedia product, the multimedia product retrieves, from the server, the underlying data associated with the identified option of the applied multimedia effect.

24. The system of claim **22**, wherein the script is written in a scripting language that can access a Web Graphics Library (Web GL) Application Programming Interface (API).

25. The system of claim **21**, wherein the underlying data comprises one of: a bitmap and a sprite.

26. The system of claim **21**, wherein the metadata comprises measurements, and the mapping of metadata values to anatomical features of a fetus maps types of measurements to the anatomical features of a fetus.

27. The system of claim **26**, wherein the mapping of metadata values to anatomical features of a fetus maps multiple types of measurements to a single anatomical feature of a fetus.

28. The system of claim **21**, wherein the metadata comprises annotations, and the mapping of metadata values to anatomical features of a fetus maps text in the annotations to the anatomical features of a fetus.

29. The system of claim **21**, wherein the anatomical feature of a fetus determined to be viewable in the at least one ultrasound media item is selected from a group consisting of: heart, arm, leg, face, head, brain, spine, kidney, liver, sexual organ, digits, belly, feet and hand.

30. The system of claim **21**, wherein the mapping of the anatomical features of a fetus to options for the multimedia effect maps a single anatomical feature of a fetus to multiple options for the multimedia effect.

31. The method of claim **21**, wherein the multimedia effect is selected from the group consisting of: audio, animation, text, images, frames and borders.

32. The method of claim **21**, wherein the multimedia product generator further configures the at least one processor to:

display a user interface for displaying the plurality of ultrasound media items, the user interface providing a user-selectable option for generating the multimedia product; and

receive input that selects the user-selectable option for generating the multimedia product.

33. A method of generating a multimedia product, comprising:

identifying a plurality of ultrasound media items from a fetal ultrasound scan;

reading metadata associated with at least one ultrasound media item of the plurality of ultrasound media items;

based on a mapping of metadata values to anatomical features of a fetus, determining an anatomical feature of a fetus, corresponding to the read metadata, that is viewable in the at least one ultrasound media item;

based on a mapping of the anatomical features of a fetus to options for a multimedia effect, identifying an option for the multimedia effect; and

applying the multimedia effect, with the identified option, to the at least one ultrasound media item, to generate one or more frames of the multimedia product;

wherein the generated one or more frames of the multimedia product show the at least one ultrasound media item with the applied multimedia effect, and the applied multimedia effect has the option that matches the anatomical feature of a fetus determined to be viewable in the at least one ultrasound media item.

34. The method of claim **33**, wherein the metadata comprises measurements, and the mapping of metadata values to anatomical features of a fetus maps types of measurements to the anatomical features of a fetus.

35. The method of claim **34**, wherein the mapping of metadata values to anatomical features of a fetus maps multiple types of measurements to a single anatomical feature of a fetus.

36. The method of claim **33**, wherein the metadata comprises annotations, and the mapping of metadata values to anatomical features of a fetus maps text in the annotations to the anatomical features of a fetus.

37. The method of claim **33**, wherein the anatomical feature of a fetus determined to be viewable in the at least one ultrasound media item is selected from a group consisting of: heart, arm, leg, face, head, brain, spine, kidney, liver, sexual organ, digits, belly, feet and hand.

38. The method of claim **33**, wherein the mapping of the anatomical features of a fetus to options for the multimedia effect maps a single anatomical feature of a fetus to multiple options for the multimedia effect.

39. The method of claim **33**, wherein the multimedia effect is selected from the group consisting of: audio, animation, text, images, frames and borders.

40. The method of claim **33**, wherein prior to the identifying the plurality of ultrasound media items, the method further comprises:

displaying a user interface for displaying the plurality of ultrasound media items, the user interface providing a user-selectable option for generating the multimedia product; and

receiving input that selects the user-selectable option for generating the multimedia product.

* * * * *

专利名称(译)	用于生成超声多媒体产品的系统和方法		
公开(公告)号	US20180189992A1	公开(公告)日	2018-07-05
申请号	US15/398650	申请日	2017-01-04
[标]申请(专利权)人(译)	CLARIUS移动医疗		
申请(专利权)人(译)	Clarius移动健康公司		
当前申请(专利权)人(译)	Clarius移动健康公司		
[标]发明人	PELISSIER LAURENT DICKIE KRIS VAN OYEN CLARK YIN SHIRLEY		
发明人	PELISSIER, LAURENT DICKIE, KRIS VAN OYEN, CLARK YIN, SHIRLEY		
IPC分类号	G06T11/60 A61B8/08 G06T7/00 G06K9/32		
CPC分类号	G06T11/60 A61B8/0866 A61B8/5292 G06T2207/30044 G06K9/3258 G06F3/0482 G06T2207/10132 G06T7/0014 A61B8/46 G06F16/40 G16H30/20 G16H40/63		
外部链接	Espacenet USPTO		

摘要(译)

本实施例一般涉及用于生成多媒体产品的系统和方法。实施例可以包括：从胎儿超声扫描中识别多个超声媒体项，其中多个超声媒体项中的每一个具有不同的相应属性;将主题应用于多个超声媒体项以生成多媒体产品。主题可以包括要应用于多个超声媒体项中的至少一个超声媒体项的效果，并且应用可以包括：将效果和至少一个超声媒体项的属性调整为以下之一：其他。