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(54) DEVICE FOR POSITIONING A MARKER IN A 3D ULTRASONIC IMAGE VOLUME

VORRICHTUNG ZUR POSITIONIERUNG EINES MARKERS IN EINEM
3D-ULTRASCHALLBILDVOLUMEN

DISPOSITIF DE POSITIONNEMENT D'UN MARQUEUR DANS UN VOLUME D'IMAGE
ULTRASONORE 3D

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a device for positioning a marker in a 3D ultrasonic image volume, a system for positioning a marker in a 3D ultrasonic image volume, a method for positioning a marker in a 3D ultrasonic image volume, a computer program element for controlling such device for performing such method and a computer readable medium having stored such computer program element.

BACKGROUND OF THE INVENTION

[0002] For image-guided medical, in particular surgical procedures, often 3D ultrasound imaging is used. For example, WO 01/33251 (A1) discloses such ultrasonic diagnostic imaging system. An advantage of 3D ultrasound imaging is that it can be used in real-time during the surgical procedure. In e.g. cardiological procedure, trans-esophageal probes can be navigated right next to the heart, producing real-time volumetric images with anatomical details that are hardly visible with standard transthoracic ultrasound. A typical intervention is percutaneous valve repair (PVR) such as mitral clipping where 3D ultrasound imaging has been found helpful to monitor the placement of the tool/endoprosthesis with respect to the soft-tissue anatomy.

[0003] US 6 064 904 A discloses a device for positioning a marker in a 3D image volume, comprising an image provision unit, a marker unit, and a display unit, wherein the image provision unit is configured to provide a 3D image volume showing an object, wherein the marker unit is configured to position a marker in the 3D image volume, wherein the display unit is configured to display the 3D image volume and the marker in a first imaging view in a first imaging plane and in a second imaging view in a second, different imaging plane, and wherein the first and the second imaging views are rotated relative to each other.

SUMMARY OF THE INVENTION

[0004] There may be a need to provide an improved device for positioning a marker in a 3D ultrasonic image volume, which makes the positioning of the marker convenient for a user.

[0005] The problem of the present invention is solved by the subject-matters of the independent claims, wherein further embodiments are incorporated in the dependent claims. It should be noted that the aspects of the invention described in the following apply also to the device for positioning a marker in a 3D ultrasonic image volume, the system for positioning a marker in a 3D ultrasonic image volume, the method for positioning a marker in a 3D ultrasonic image volume, the computer program element, and the computer readable medium.

[0006] According to the present invention, a device for positioning a marker in a 3D ultrasonic image volume is presented. The device comprises an image provision unit, a marker unit and a display unit. The image provision unit is configured to provide a 3D ultrasonic image volume showing an object. The marker unit is configured to position a marker in the 3D ultrasonic image volume. The display unit is configured to display the 3D ultrasonic image volume and the marker in a first imaging view in a first imaging plane and in a second imaging view in a second, different imaging plane. The positioning of the marker is limited to be on a projection line. The first and the second imaging views are rotated relative to each other, so that the projection line has a first angle relative to the first imaging plane and a second, different angle relative to the second imaging plane.

[0007] Thereby, the device for positioning a marker in a 3D ultrasonic image volume according to the present invention provides a convenient way to place and/or replace a 3D marker in a scene. For example, the marker may be placed on an object's surface and may then be replaced to another point lying "behind" the object's surface and therefore within or behind the object. In other words, the marker unit may be configured to position the marker in the first ultrasonic image data in a first position and to reposition the marker in the second ultrasonic image data into a second, different position. The marker unit may be configured to position the marker in the first imaging view in a first position on a surface of the object and to reposition the marker in the second imaging view in a second position in the volume of the object. The first and second imaging views belong to one and the same 3D volume and are seen from different viewpoints. The 3D ultrasonic image volume can be static 3D or 3D video. The latter means, the volume can change depending on the time, which is sometimes also referred to as 4D data. The object may be a body part.

[0008] The positioning and repositioning of the marker is limited to a projection line, in other words, the marker can only slide along the projection line. Thereby, depth ambiguity when trying to position a 3D point using a single view is overcome. This is achieved in that the same 3D ultrasonic image volume is shown to the user in two different imaging views which are rotated relative to each other. Thereby, the projection line is shown with two different angles. In other words, the projection line extends in the first imaging view in a first direction and in the second imaging view in a second, different direction.

[0009] For example, in a first imaging view, the projection line may be displayed as a point or dot, and in the second imaging view as a straight or line. In the second imaging view, it is a lot easier for the user to move the marker along the line-shaped projection line than handling the point-shaped projection line in the first imaging view. The projection line may be defined using two points in 3D. By default, these two points could be the position of a virtual camera in 3D and a point at a surface of an object e.g. selected by the user. With this default setting,

the projection line will appear as a point, thus requiring rotating the view. The virtual camera is a virtual location in 3D of a camera viewing the volume. In other words, in a first view, the projection line is aligned with the camera, in the second view it is not.

[0010] It is further possible to remove (or make transparent) an element of the scene that hides or covers the projection line by cropping the volume using a vertical plane passing through the projection line. In other words, the marker unit is configured to crop a volume of the second imaging view to cut out an element covering the projection line. The marker unit may be further configured to crop the volume by means of a plane crossing the projection line. Thereby, the view is cleared to help the positioning of the marker.

[0011] In an example, the modification between the first and the second imaging view is a rigid transformation. In an example, the modification between the first and the second imaging view comprises a translation. In an example, the modification between the first and the second imaging view comprises a magnification or scaling. This means, the rotation between the first and second imaging views may further comprise a translation and/or a magnification.

[0012] There are several alternatives for the user to control the device according to the present invention. A user can click on a button to rotate a first view after positioning a marker. In a second, rotated view, the user can slide the marker along a projection line. Once the marker is in a correct or predefined position, the user may click the button again to come back to the original, first view.

[0013] Alternatively, the user can hold down the click to rotate the view when positioning the marker in 3D. In the second, rotated view, the point can slide along the projection line as long as the click is hold down. Then, the second view can come back to the original, first view. Also other alternatives are possible.

[0014] - According to the present invention, also a system for positioning a marker in a 3D ultrasonic image volume is presented. It comprises a device as described above and an ultrasonic probe which supplies data to the image provision unit of the device.

[0015] According to the present invention, also a method for positioning a marker in a 3D ultrasonic image volume is presented. It comprises the following steps, not necessarily in this order:

- a) providing a 3D ultrasonic image volume showing an object,
- b) positioning a marker in the 3D ultrasonic image volume, wherein the positioning of the marker is limited to be on a projection line, and
- c) displaying the 3D ultrasonic image volume and the marker in a first imaging view in a first imaging plane and in a second imaging view in a second, different imaging plane.

[0016] The first and the second imaging views are rotated relative to each other, so that the projection line has a first angle relative to the first imaging plane and a second, different angle relative to the second imaging plane.

[0017] The method further comprises a cropping of a volume of the second imaging view to cut out an element covering the projection line. The volume may be cropped by means of a plane crossing the projection line. Thereby, the view is cleared to help the positioning of the marker.

[0018] According to the present invention, also a computer program element is presented, wherein the computer program element comprises program code means for causing the device as defined in the independent claim to carry out the steps of the method as defined in the independent claim when the computer program is run on a computer controlling the device.

[0019] It shall be understood that the device, the method, the computer program element for controlling such device and the computer readable medium having stored such computer program element according to the independent claims have similar and/or identical preferred embodiments, in particular, as defined in the dependent claims. It shall be understood further that a preferred embodiment of the invention can also be any combination of the dependent claims with the respective independent claim.

[0020] These and other aspects of the present invention will become apparent from and be elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Exemplary embodiments of the invention will be described in the following with reference to the accompanying drawings:

Fig. 1 shows a schematic drawing of an example of a device for positioning a marker in a 3D ultrasonic image volume.

Fig. 2 shows schematically and exemplarily a positioning of a marker in the 3D ultrasonic image volume.

Fig. 3 shows also schematically and exemplarily a positioning of a marker in the 3D ultrasonic image volume.

Fig. 4 shows basic steps of an example of a method for positioning a marker in a 3D ultrasonic image volume.

DETAILED DESCRIPTION OF EMBODIMENTS

[0022] Fig. 1 shows schematically and exemplarily an embodiment of a system 10 for positioning a marker in a 3D ultrasonic image volume. It comprises a device as described in detail below and an ultrasonic probe 14 which supplies data to an image provision unit 11 of the device 1. Fig. 1 further shows the device 1 for positioning

a marker 2 in a 3D ultrasonic image volume 3 according to the invention (see also Fig. 2). The device 1 comprises the image provision unit 11, a marker unit 12 and a display unit 13. The image provision unit 11 provides a 3D ultrasonic image volume 3 showing an object 4. The object 4 is here a body part. The marker unit 12 positions a marker 2 in the 3D ultrasonic image volume 3. The display unit 13 displays the 3D ultrasonic image volume 3 and the marker 2 in a first imaging view 31 in a first imaging plane and in a second imaging view 32 in a second, different imaging plane. The positioning of the marker 2 is limited to be on a projection line 5. The projection line 5 may be defined to be between an ultrasonic probe and the object 4.

[0023] As shown in Fig. 2a, the marker 2 can be placed on an object's surface and can then be replaced, as shown in Fig. 2b, to another point 2' lying "behind" the object's surface and therefore within or behind the object 4. In other words, the marker unit 12 positions the marker 2 in the first ultrasonic image data in a first position (Fig. 2a) and repositions the marker 2 in the second ultrasonic image data into a second, different position (Fig. 2b). Here, the marker unit 12 positions the marker 2 in the first imaging view 31 in a first position on a surface of the object 4 and repositions the marker 2 in the second imaging view 32 in a second position in the volume of the object 4.

[0024] The positioning and repositioning of the marker 2 is limited to the projection line 5, in other words, the marker 2 can only slide along the projection line 5. The depth ambiguity is overcome as the projection line 5 is shown with two different angles. In this example, in the first imaging view 31 (Fig. 2a), the projection line 5 is displayed as a point or dot, and in the second imaging view 32 (Fig. 2b) as a straight or line. In the second imaging view 32, it is a lot easier for the user to move the marker 2 along the projection line 5 than handling the point-shaped projection line 5 in the first imaging view 31. The projection line may be defined using two points in 3D. By default, these two points could be the position of a virtual camera in 3D and a point at a surface of an object e.g. selected by the user. The virtual camera is a virtual location in 3D of a camera viewing the volume. With this default setting, the projection line will appear as a point, thus requiring rotating the view. In other words, in a first view, the projection line is aligned with the camera, in the second view it is not. In the example of Fig. 2, the projection line 5 has a first angle of 90° (degrees) relative to the first imaging plane of the first imaging view 31 and a second, different angle of e.g. 0° (degrees) relative to the second imaging plane of the second imaging view 32.

[0025] As a summary, the first and the second imaging views are rotated relative to each other, so that the projection line 5 has a first angle relative to the first imaging plane and a second, different angle relative to the second imaging plane. Thereby, a convenient way to place and/or replace a 3D marker 2 in a scene is provided. The

rotation between the first and second imaging views may further comprise a translation and/or a magnification.

[0026] In other words, Figs. 2a and 2b illustrate and solves the depth ambiguity when trying to position a 3D point using a single view. It is unknown where the marker 2 should be along the projection line 5, therefore the marker 2 is placed at the first surface crossed by the projection line 5, which is the object's surface. In detail, a point in Fig. 2a actually corresponds to a line in Fig. 2b. In Fig. 2a, the two points 2 and 2' are mingled, which is the reason why the projection line 5 appears as a single point. However, in Fig. 2b, the two points 2 and 2' are distinct and the projection line 5 "really" appears as a line. The dashed lines represent the intersection between the projection line 5 and the faces ABCD and EFGH of the shown cubes.

[0027] As shown in Fig. 3, an element of the scene that e.g. hides or covers the projection line 5 can be removed by cropping or cutting the volume using a vertical plane passing through the projection line 5. In other words, the marker unit 12 crops the volume of the second imaging view 32 to cut out the element covering the projection line 5. Thereby, the view is cleared to help the positioning of the marker 2.

[0028] Fig. 4 shows a schematic overview of steps of a method for positioning a marker 2 in a 3D ultrasonic image volume 3. The method comprises the following steps, not necessarily in this order:

- In a first step S1, providing a 3D ultrasonic image volume 3 showing an object 4.
- In a second step S2, positioning a marker 2 in the 3D ultrasonic image volume 3, wherein the positioning of the marker 2 is limited to be on a projection line 5.
- In a third step S3, displaying the 3D ultrasonic image volume 3 and the marker 2 in a first imaging view 31 in a first imaging plane and in a second imaging view 32 in a second, different imaging plane.

[0029] The first and the second imaging views are rotated relative to each other, so that the projection line 5 has a first angle relative to the first imaging plane and a second, different angle relative to the second imaging plane.

[0030] The method further comprises a cropping of a volume of the second imaging view 32 to cut out an element covering the projection line 5. The volume may be cropped by means of a plane crossing the projection line 5. Thereby, the view is cleared to help the positioning of the marker 2.

[0031] In another exemplary embodiment of the present invention, a computer program or a computer program element is provided that is characterized by being adapted to execute the method steps of the method according to one of the preceding embodiments, on an appropriate system.

[0032] The computer program element might therefore

be stored on a computer unit, which might also be part of an embodiment of the present invention. This computing unit may be adapted to perform or induce a performing of the steps of the method described above. Moreover, it may be adapted to operate the components of the above described apparatus. The computing unit can be adapted to operate automatically and/or to execute the orders of a user. A computer program may be loaded into a working memory of a data processor. The data processor may thus be equipped to carry out the method of the invention.

[0033] This exemplary embodiment of the invention covers both, a computer program that right from the beginning uses the invention and a computer program that by means of an up-date turns an existing program into a program that uses the invention.

[0034] Further on, the computer program element might be able to provide all necessary steps to fulfil the procedure of an exemplary embodiment of the method as described above.

[0035] According to a further exemplary embodiment of the present invention, a computer readable medium, such as a CD-ROM, is presented wherein the computer readable medium has a computer program element stored on it, which computer program element is described by the preceding section.

[0036] A computer program may be stored and/or distributed on a suitable medium, such as an optical storage medium or a solid state medium supplied together with or as part of other hardware, but may also be distributed in other forms, such as via the internet or other wired or wireless telecommunication systems.

[0037] However, the computer program may also be presented over a network like the World Wide Web and can be downloaded into the working memory of a data processor from such a network. According to a further exemplary embodiment of the present invention, a medium for making a computer program element available for downloading is provided, which computer program element is arranged to perform a method according to one of the previously described embodiments of the invention.

[0038] It has to be noted that embodiments of the invention are described with reference to different subject matters. In particular, some embodiments are described with reference to method type claims whereas other embodiments are described with reference to the device type claims. However, a person skilled in the art will gather from the above and the following description that, unless otherwise notified, in addition to any combination of features belonging to one type of subject matter also any combination between features relating to different subject matters is considered to be disclosed with this application. However, all features can be combined providing synergetic effects that are more than the simple summation of the features.

[0039] While the invention has been illustrated and described in detail in the drawings and foregoing descrip-

tion, such illustration and description are to be considered illustrative or exemplary and not restrictive. The invention is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing a claimed invention, from a study of the drawings, the disclosure, and the dependent claims.

[0040] In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfil the functions of several items recited in the claims. The mere fact that certain measures are re-cited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A device (1) for positioning a marker (2) in a 3D ultrasonic image volume (3), comprising:

- an image provision unit (11),
- a marker unit (12), and
- a display unit (13),

wherein the image provision unit (11) is configured to provide a 3D ultrasonic image volume (3) showing an object (4), wherein the marker unit (12) is configured to position a marker (2) in the 3D ultrasonic image volume (3), wherein the display unit (13) is configured to display the 3D ultrasonic image volume (3) and the marker (2) in a first imaging view (31) in a first imaging plane and in a second imaging view (32) in a second, different imaging plane, wherein the positioning of the marker (2) is limited to be on a projection line (5), wherein the first and the second imaging views are rotated relative to each other, so that the projection line (5) has a first angle relative to the first imaging plane and a second, different angle relative to the second imaging plane, and wherein the marker unit (12) is configured to crop a volume of the second imaging view (32) to cut out an element covering the projection line (5).

2. Device (1) according to claim 1, wherein the marker unit (12) is configured to position the marker (2) in the second imaging view (32) in the volume of the object (4).

3. Device (1) according to claim 1, wherein the marker

unit (12) is configured to position the marker (2) in the first imaging view (31) in a first position on a surface of the object (4) and to reposition the marker (2) in the second imaging view (32) in a second position in the volume of the object (4).

4. Device (1) according to one of the preceding claims, wherein the modification between the first and the second imaging view (32) comprises a translation.
5. Device (1) according to one of the preceding claims, wherein the modification between the first and the second imaging view (32) comprises a magnification.
6. Device (1) according to the preceding claim, wherein the marker unit (12) is further configured to crop the volume by means of a plane crossing the projection line (5).
7. A system (10) for positioning a marker (2) in a 3D ultrasonic image volume (3), comprising:
 - a device (1) according to one of the preceding claims, and
 - an ultrasonic probe (14),
 wherein the ultrasonic probe (14) supplies data to an image provision unit (11) of the device (1).
8. A method for positioning a marker (2) in a 3D ultrasonic image volume (3), comprising the following steps:
 - a) providing a 3D ultrasonic image volume (3) showing an object (4),
 - b) positioning a marker (2) in the 3D ultrasonic image volume (3), wherein the positioning of the marker (2) is limited to be on a projection line (5), and
 - c) displaying the 3D ultrasonic image volume (3) and the marker (2) in a first imaging view (31) in a first imaging plane and in a second imaging view (32) in a second, different imaging plane, wherein the first and the second imaging views are rotated relative to each other, so that the projection line (5) has a first angle relative to the first imaging plane and a second, different angle relative to the second imaging plane, and
 - d) cropping of a volume of the second imaging view (32) to cut out an element covering the projection line (5).
9. A computer program element for controlling a device (1) according to one of the claims 1 to 6, which, when being executed by a processing unit, is adapted to perform the method steps of the preceding claim.

10. A computer readable medium having stored the computer program element of the preceding claim.

5 Patentansprüche

1. Vorrichtung (1) zum Positionieren eines Markers (2) in einem 3D-Ultraschallbildvolumen (3), umfassend:

- eine Bildbereitstellungseinheit (11),
- eine Markereinheit (12) und
- eine Anzeigeeinheit (13),

wobei die Bildbereitstellungseinheit (11) konfiguriert ist, um ein 3D-Ultraschallbildvolumen (3) bereitzustellen, das ein Objekt (4) zeigt,

wobei die Markereinheit (12) konfiguriert ist, um einen Marker (2) in dem 3D-Ultraschallbildvolumen (3) zu positionieren,

wobei die Anzeigeeinheit (13) konfiguriert ist, um das 3D-Ultraschallbildvolumen (3) und den Marker (2) in einer ersten Bildgebungsansicht (31) in einer ersten Bildgebungsebene und in einer zweiten Bildgebungsansicht (32) in einer zweiten, unterschiedlichen Bildgebungsebene anzuzeigen,

wobei die Positionierung des Markers (2) darauf begrenzt ist, auf einer Projektionslinie (5) zu sein,

wobei die erste und die zweite Bildgebungsansicht in Bezug zueinander gedreht sind, sodass die Projektionslinie (5) einen ersten Winkel in Bezug auf die erste Bildgebungsebene und einen zweiten, unterschiedlichen Winkel in Bezug auf die zweite Bildgebungsebene hat, und

wobei die erste Markereinheit (12) konfiguriert ist, um ein Volumen der zweiten Bildgebungsansicht (32) zu stutzen, um ein die Projektionslinie (5) abdeckendes Element auszuschneiden.

2. Vorrichtung (1) nach Anspruch 1, wobei die Markereinheit (12) konfiguriert ist, um den Marker (2) in der zweiten Bildgebungsansicht (32) in dem Volumen des Objekts (4) zu positionieren.

3. Vorrichtung (1) nach Anspruch 1, wobei die Markereinheit (12) konfiguriert ist, um den Marker (2) in der ersten Bildgebungsansicht (31) an einer ersten Position auf einer Oberfläche des Objekts (4) zu positionieren und den Marker (2) in der zweiten Bildgebungsansicht (32) an einer zweiten Position in dem Volumen des Objekts (4) neu zu positionieren.

4. Vorrichtung (1) nach einem der vorhergehenden An-

sprüche, wobei die Modifikation zwischen der ersten und der zweiten Bildgebungsansicht (32) eine Translation umfasst.

5. Vorrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die Modifikation zwischen der ersten und der zweiten Bildgebungsansicht (32) eine Vergrößerung umfasst. 5
6. Vorrichtung (1) nach dem vorhergehenden Anspruch, wobei die Markereinheit (12) ferner konfiguriert ist, um das Volumen mittels einer Ebene zu stützen, die die Projektionslinie (5) kreuzt. 10
7. System (10) zum Positionieren eines Markers (2) in einem 3D-Ultraschallbildvolumen (3), umfassend: 15
 - eine Vorrichtung (1) nach einen der vorhergehenden Ansprüche, und
 - eine Ultraschallsonde (14), 20

wobei die Ultraschallsonde (14) der Bildbereitstellungseinheit (11) der Vorrichtung (1) Daten bereitstellt. 25

- 8. Verfahren zum Positionieren eines Markers (2) in einem 3D-Ultraschallbildvolumen (3), umfassend die folgenden Schritte: 30
 - a) Bereitstellen eines 3D-Ultraschallbildvolumen (3), das ein Objekt (4) zeigt,
 - b) Positionieren eines Markers (2) in dem 3D-Ultraschallbildvolumen (3) zu positionieren, wobei die Positionierung des Markers (2) darauf begrenzt ist, auf einer Projektionslinie (5) zu sein, und 35
 - c) Anzeigen des 3D-Ultraschallbildvolumens (3) und des Markers (2) in einer ersten Bildgebungsansicht (31) in einer ersten Bildgebungsebene und in einer zweiten Bildgebungsansicht (32) in einer zweiten, unterschiedlichen Bildgebungsebene, wobei die erste und die zweite Bildgebungsansicht in Bezug zueinander gedreht sind, sodass die Projektionslinie (5) einen ersten Winkel in Bezug auf die erste Bildgebungsebene und einen zweiten, unterschiedlichen Winkel in Bezug auf die zweite Bildgebungsebene hat, und 40
 - d) Stützen eines Volumens der zweiten Bildgebungsansicht (32), um ein die Projektionslinie (5) abdeckendes Element auszuschneiden. 45
- 9. Computerprogrammelement zum Steuern einer Vorrichtung (1) nach einem der Ansprüche 1 und 6, das dafür ausgelegt ist, die Verfahrensschritte des vorhergehenden Anspruchs durchzuführen, wenn es durch eine Verarbeitungseinheit ausgeführt wird. 50

10. Computerlesbares Medium, auf dem das Computerprogrammelement des vorhergehenden Anspruchs gespeichert ist. 55

Revendications

1. Dispositif (1) pour positionner un marqueur (2) dans un volume d'image ultrasonore 3D (3), comprenant :
 - une unité de fourniture d'image (11),
 - une unité de marquage (12), et
 - une unité d'affichage (13),
 - dans lequel l'unité de fourniture d'image (11) est configurée pour fournir un volume d'image ultrasonore 3D (3) représentant un objet (4),

dans lequel l'unité de marquage (12) est configurée pour positionner un marqueur (2) dans le volume d'image ultrasonore 3D (3),

dans lequel l'unité d'affichage (13) est configurée pour afficher le volume d'image ultrasonore 3D (3) et le marqueur (2) dans une première vue d'imagerie (31) dans un premier plan d'imagerie et dans une seconde vue d'imagerie (32) dans un second plan d'imagerie différent,

dans lequel le positionnement du marqueur (2) est limité à se trouver sur une ligne de projection (5),

dans lequel les première et seconde vues d'imagerie sont tournées l'une par rapport à l'autre, de sorte que la ligne de projection (5) a un premier angle par rapport au premier plan d'imagerie et un second angle différent par rapport au second plan d'imagerie, et

dans lequel l'unité de marquage (12) est configurée pour recadrer un volume de la seconde vue d'imagerie (32) pour découper un élément recouvrant la ligne de projection (5).
2. Dispositif (1) selon la revendication 1, dans lequel l'unité de marquage (12) est configurée pour positionner le marqueur (2) dans la seconde vue d'imagerie (32) dans le volume de l'objet (4).
3. Dispositif (1) selon la revendication 1, dans lequel l'unité de marquage (12) est configurée pour positionner le marqueur (2) dans la première vue d'imagerie (31) dans une première position sur une surface de l'objet (4) et repositionner le marqueur (2) dans la seconde vue d'imagerie (32) dans une seconde position dans le volume de l'objet (4).
4. Dispositif (1) selon l'une des revendications précé-

dentes, dans lequel la modification entre la première et la seconde vue d'imagerie (32) comprend une translation.

5. Dispositif (1) selon l'une des revendications précédentes, dans lequel la modification entre la première et la seconde vue d'imagerie (32) comprend un grossissement. 5
6. Dispositif (1) selon la revendication précédente, dans lequel l'unité de marquage (12) est en outre configurée pour recadrer le volume au moyen d'un plan traversant la ligne de projection (5). 10
7. Système (10) pour positionner un marqueur (2) dans un volume d'image ultrasonore 3D (3), comprenant : 15
 - un dispositif (1) selon l'une des revendications précédentes, et
 - une sonde à ultrasons (14), 20
 - dans lequel la sonde à ultrasons (14) fournit des données à une unité de fourniture d'image (11) du dispositif (1).
8. Procédé pour positionner un marqueur (2) dans un volume d'image ultrasonore 3D (3), comprenant les étapes suivantes consistant à : 25
 - a) fournir un volume d'image ultrasonore 3D (3) représentant un objet (4), 30
 - b) positionner un marqueur (2) dans le volume d'image ultrasonore 3D (3), dans lequel le positionnement du marqueur (2) est limité à se trouver sur une ligne de projection (5), et
 - c) afficher le volume d'image ultrasonore 3D (3) et le marqueur (2) dans une première vue d'imagerie (31) dans un premier plan d'imagerie et dans une seconde vue d'imagerie (32) dans un second plan d'imagerie différent, la première et la seconde vue d'imagerie étant tournées l'une par rapport à l'autre, de sorte que la ligne de projection (5) a un premier angle par rapport au premier plan d'imagerie et un second angle différent par rapport au second plan d'imagerie, et 40
 - d) recadrer un volume de la seconde vue d'imagerie (32) pour découper un élément recouvrant la ligne de projection (5). 45
9. Élément de programme informatique pour commander un dispositif (1) selon l'une des revendications 1 à 6, qui, lorsqu'il est exécuté par une unité de traitement, est adapté pour affectuer les étapes de procédé de la revendication précédente. 50
10. Support lisible par ordinateur sur lequel est stocké l'élément de programme informatique de la revendication précédente. 55

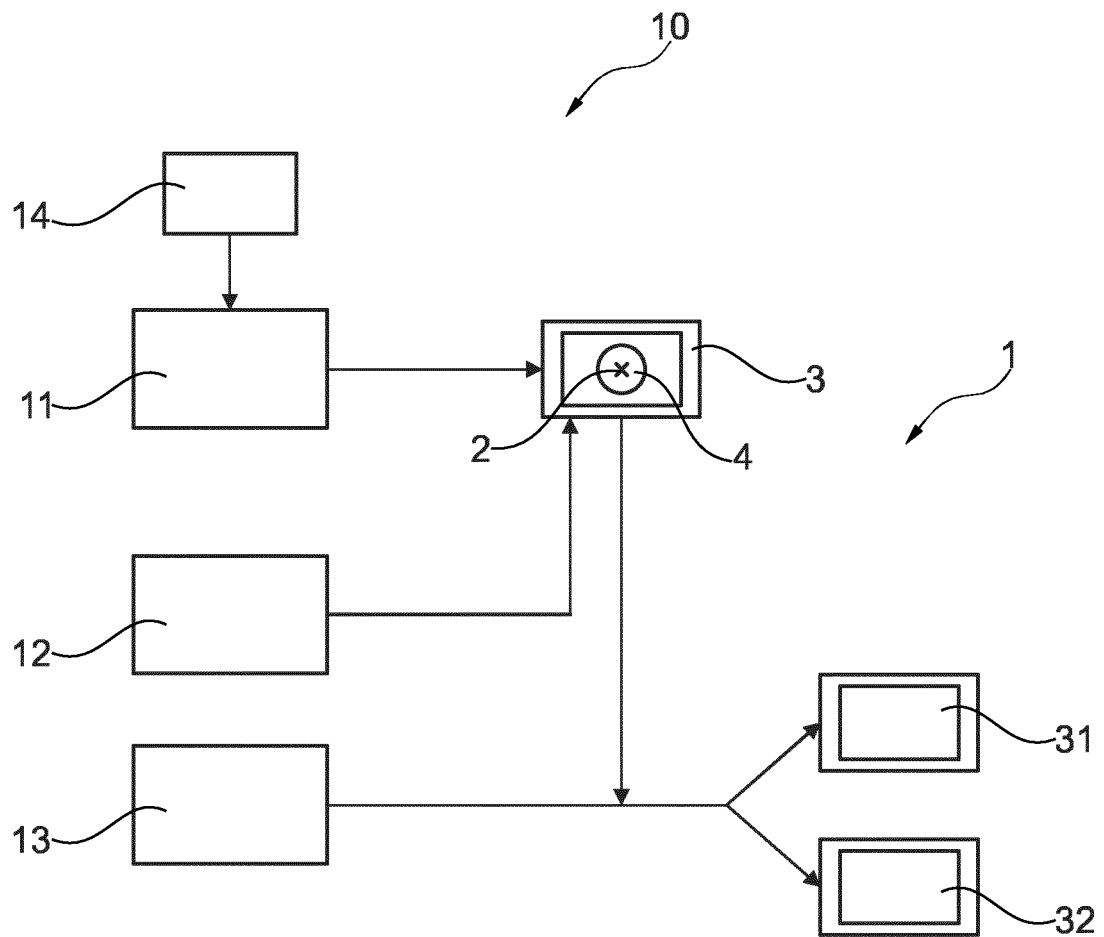


Fig. 1

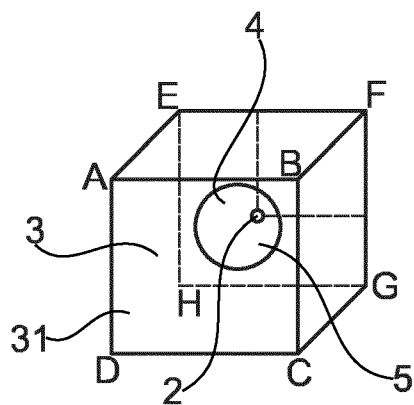


Fig. 2a

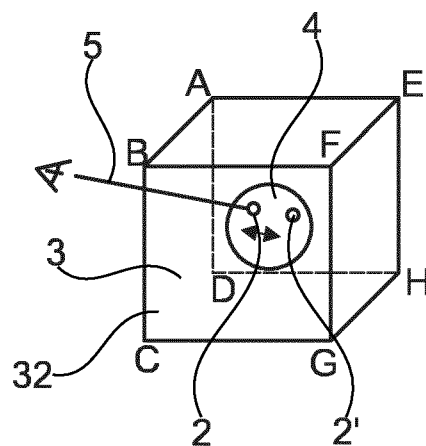


Fig. 2b

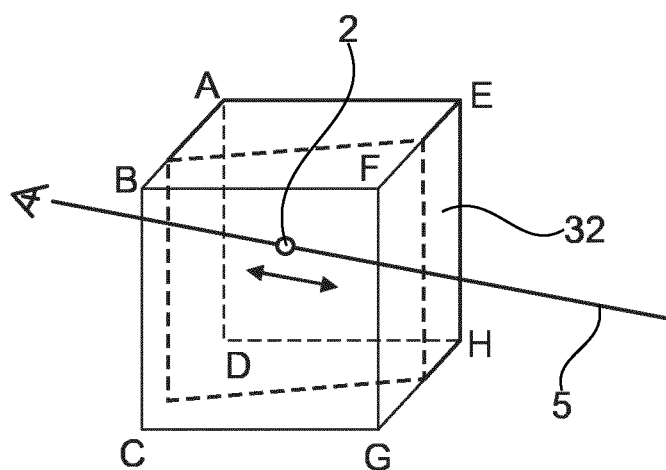


Fig. 3

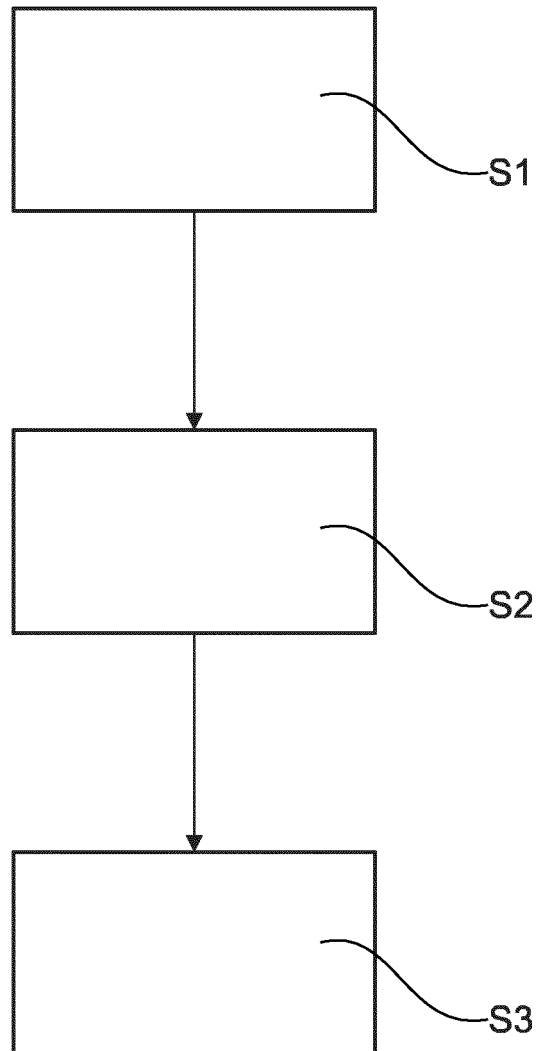


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 0133251 A [0002]
- US 6064904 A [0003]

专利名称(译)	用于将标记定位在3D超声图像体积中的装置		
公开(公告)号	EP3258852B1	公开(公告)日	2018-10-17
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[标]申请(专利权)人(译)	皇家飞利浦电子股份有限公司		
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IPC分类号	A61B8/14 A61B8/00 A61B90/00		
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优先权	2015305237 2015-02-17 EP		
其他公开文献	EP3258852A1		
外部链接	Espacenet		

摘要(译)

本发明涉及一种用于将标记(2)定位在3D超声图像体积(3)中的装置(1)，一种用于将标记(2)定位在3D超声图像体积(3)中的系统，一种用于定位的方法。3D超声图像体积(3)中的标记(2)，用于控制用于执行这种方法的这种设备(1)的计算机程序单元和具有存储的这种计算机程序单元的计算机可读介质。装置(1)包括图像提供单元(11)，标记单元(12)和显示单元(13)。图像提供单元(11)被配置为提供示出物体(4)的3D超声图像体积(3)。标记单元(12)被配置为将标记(2)定位在3D超声图像体积(3)中。显示单元(13)被配置为在第一成像平面中的第一成像视图(31)和第二成像视图(32)中显示3D超声图像体积(3)和标记(2)，不同的成像平面。标记(2)的定位限于在投影线(5)上。第一和第二成像视图相对于彼此旋转，使得投影线(5)具有相对于第一成像平面的第一角度和相对于第二成像平面的第二不同角度。

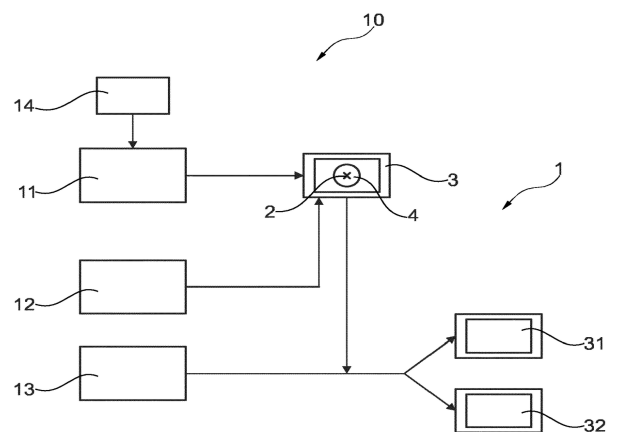


Fig. 1