ALLNAMES:("NavVis GmbH")

25 results   **Offices** all   **Languages** en   **Stemming** true   **Single Family Member** false   **Include NPL** false

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1. **20200167382** VISUAL LOCALIZATION METHOD   US – 28.05.2020

Int.Class G06F 16/583   **Appl.No** 16775850   **Applicant** NavVis GmbH   **Inventor** Mohammad Abu-Alqumsan

There is provided a visual localization method comprising: [a] transmitting data representative of one or more detected visual features from a mobile device to a server; [b] estimating the location of the mobile device at the server based on the visual features received from the mobile device; [c] transmitting reference data associated with the estimated location from the server to the mobile device; and [d] the mobile device determining its location based on the reference data received from the server.

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2. **20210182334** VISUAL LOCALIZATION METHOD   US – 17.06.2021

Int.Class G06F 16/583   **Appl.No** 17179899   **Applicant** NavVis GmbH   **Inventor** Mohammad Abu-Alqumsan

There is provided a visual localization method comprising: [a] transmitting data representative of one or more detected visual features from a mobile device to a server; [b] estimating the location of the mobile device at the server based on the visual features received from the mobile device; [c] transmitting reference data associated with the estimated location from the server to the mobile device; and [d] the mobile device determining its location based on the reference data received from the server.

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3. **20190155837** VISUAL LOCALIZATION METHOD   US – 23.05.2019

Int.Class G06F 16/583   **Appl.No** 16259618   **Applicant** NavVis GmbH   **Inventor** Mohammad Abu-Alqumsan

There is provided a visual localization method comprising: [a] transmitting data representative of one or more detected visual features from a mobile device to a server; [b] estimating the location of the mobile device at the server based on the visual features received from the mobile device; [c] transmitting reference data associated with the estimated location from the server to the mobile device; and [d] the mobile device determining its location based on the reference data received from the server.

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4. **20180189327** VISUAL LOCALIZATION METHOD   US – 05.07.2018

Int.Class G06F 17/30   **Appl.No** 15910247   **Applicant** NavVis GmbH   **Inventor** Mohammad Abu-Alqumsan

There is provided a visual localization method comprising: [a] transmitting data representative of one or more detected visual features from a mobile device to a server; [b] estimating the location of the mobile device at the server based on the visual features received from the mobile device; [c] transmitting reference data associated with the estimated location from the server to the mobile device; and [d] the mobile device determining its location based on the reference data received from the server.

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5. **20170212911** VISUAL LOCALIZATION METHOD   US – 27.07.2017

Int.Class H04W 4/02   **Appl.No** 15473284   **Applicant** NavVis GmbH   **Inventor** Mohammad Abu-Alqumsan

There is provided a visual localization method comprising: [a] transmitting data representative of one or more detected visual features from a mobile device to a server; [b] estimating the location of the mobile device at the server based on the visual features received from the mobile device; [c] transmitting reference data associated with the estimated location from the server to the mobile device; and [d] the mobile device determining its location based on the reference data received from the server.

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6. **20210350629** VISUAL LOCALISATION   US – 11.11.2021

Int.Class G06T 19/00   **Appl.No** 17383613   **Applicant** NAVVIS GMBH   **Inventor** Eckehard Steinbach

In an embodiment of the invention there is provided a method of visual localization, comprising: generating a plurality of virtual views, wherein each of the virtual views is associated with a location; obtaining a query image; determining the location where the query image was obtained on the basis of a comparison of the query image with said virtual views.

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7. **20150243080** VISUAL LOCALISATION   US – 27.08.2015

Int.Class G06T 19/00   **Appl.No** 14430327   **Applicant** NAVVIS GMBH   **Inventor** Eckehard Steinbach

In an embodiment of the invention there is provided a method of visual localization, comprising: generating a plurality of virtual views, wherein each of the virtual views is associated with a location; obtaining a query image; determining the location where the query image was obtained on the basis of a comparison of the query image with said virtual views.

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8.   **2711670**   VISUAL LOCALISATION   EP - 26.03.2014

Int.Class G01C 21/20   **Appl.No** 12006628   **Applicant** NAVVIS GMBH   **Inventor** STEINBACH ECKEHARD PROF DR-ING

In an embodiment of the invention there is provided a method of visual localisation, comprising: generating a plurality of virtual views, wherein each of the virtual views is associated with a location; obtaining a query image; determining the location where the query image was obtained on the basis of a comparison of the query image with said virtual views.

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9.   **3502621**   VISUAL LOCALISATION   EP - 26.06.2019

Int.Class G01C 21/20   **Appl.No** 19154035   **Applicant** NAVVIS GMBH   **Inventor** STEINBACH ECKEHARD

A method of visual localisation, comprising recording localised reference images of an environment along a mapping trajectory; determining information on the 3D structure of the environment, detecting planes in the environment; generating a plurality of new views, wherein each of the new views is associated with a location and orientation, comprising: using the planes to represent portions or regions of the environment; and using the planes in computing the new views from the reference images, wherein a viewpoint change from a first camera view corresponding to a reference view to a second camera view corresponding to a new view is simulated by applying a projective transformation to a reference image of the first camera, wherein the projective transformation is a function of pose and calibration of the first and second cameras and plane position in space and the projection of a plane from the reference view to the new view is represented by a homography; obtaining at least one query image; and determining the location where the query image was obtained on the basis of a comparison of the query image with said new views.

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10.   **20190287293**   VISUAL LOCALISATION   US - 19.09.2019

Int.Class G06T 19/00   **Appl.No** 16388988   **Applicant** NAVVIS GMBH   **Inventor** Eckehard Steinbach
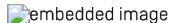
In an embodiment of the invention there is provided a method of visual localization, comprising: generating a plurality of virtual views, wherein each of the virtual views is associated with a location; obtaining a query image; determining the location where the query image was obtained on the basis of a comparison of the query image with said virtual views.

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11.   **WO/2014/044852**   VISUAL LOCALISATION   WO - 27.03.2014

Int.Class G01C 21/20   **Appl.No** PCT/EP2013/069750   **Applicant** NAVVIS GMBH   **Inventor** STEINBACH, Eckehard

In an embodiment of the invention there is provided a method of visual localisation, comprising: generating a plurality of virtual views, wherein each of the virtual views is associated with a location; obtaining a query image; determining the location where the query image was obtained on the basis of a comparison of the query image with said virtual views.

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12.   **102019120702**   GESTELL FÜR ZUMINDEST EINE SCANEINRICHTUNG UND RAUMERFASSUNGSVORRICHTUNG MIT   DE - 04.02.2021
ZUMINDEST EINER SCANEINRICHTUNG

Int.Class F16M 13/04   **Appl.No** 102019120702   **Applicant** NavVis GmbH   **Inventor** Christensen Nils

Die vorliegende Erfindung betrifft ein Gestell [1] für zumindest eine Scaneinrichtung zum Tragen der Scaneinrichtung mittels des Körpers einer Person [49], wobei das Gestell [1] eine Trageeinrichtung [2] zum Anlegen und Tragen des Gestells [1] durch die Person [49] umfasst. Die Trageeinrichtung [2] umfasst eine Schulterauflage [2-1] zum Anlegen des Gestells [1] auf den Schultern [50] der Person [49]. Ferner umfasst das Gestell [1] einen oberen Gestellabschnitt [5], an dem eine erste Halterung [6] für die zumindest eine Scaneinrichtung befestigt ist, wobei sich die erste Halterung [6] oberhalb des Kopfes der Person [49] befindet, wenn die Person [49] das Gestell [1] mittels der Trageeinrichtung [2] trägt. Das erfindungsgemäße Gestell [1] ist dadurch gekennzeichnet, dass die Trageeinrichtung [2] ferner ein Anlegeteil [2-2] umfasst, welches über einen Ausleger [7] mit der Schulterauflage [2-1] verbunden ist, wobei sich das Anlegeteil [2-1] in der Höhe des Bereichs der Hüfte [51] der Person [49] befindet, wenn die Person [49] das Gestell [1] mittels der Trageeinrichtung [2] trägt. Des Weiteren betrifft die Erfindung eine Raumerfassungsvorrichtung [30] mit zumindest einer Scaneinrichtung und einem solchen Gestell [1].

embedded image

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13.   **WO/2021/018900**   FRAME FOR AT LEAST ONE SCANNING APPARATUS AND SPATIAL CAPTURING DEVICE HAVING   WO - 04.02.2021
AT LEAST ONE SCANNING APPARATUS

Int.Class G01S 7/481   **Appl.No** PCT/EP2020/071289   **Applicant** NAVVIS GMBH   **Inventor** CHRISTENSEN, Nils

The present invention relates to a frame [1] for at least one scanning apparatus for carrying the scanning apparatus by means of the body of a person [49], the frame [1] comprising a carrying apparatus [2] for the donning and carrying of the frame [1] by the person [49]. The carrying apparatus [2] comprises a shoulder support [2-1] for laying the frame [1] on the shoulders [50] of the person [49]. Furthermore, the frame [1] comprises an upper frame portion [5], to which a first retainer [6] for the at least one scanning apparatus is fastened, the first retainer [6] being located above the head of the person [49] when the person [49] carries the frame [1] by means of the carrying apparatus [2]. The frame [1] according to the invention is characterized in that the carrying apparatus [2] also comprises an application part [2-2], which is connected to the shoulder support [2-1] by means of a jib [7], the application part [2-1] being at the height of the region of the hip [51] of the person [49] when the person [49] carries the frame [1] by means of the carrying apparatus [2]. The invention further relates to a spatial capturing device [30], comprising at least one scanning apparatus and a frame [1] of this type.

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14.   **4004586**   FRAME FOR AT LEAST ONE SCANNING APPARATUS AND SPATIAL CAPTURING DEVICE HAVING AT LEAST   EP - 01.06.2022
ONE SCANNING APPARATUS

Int.Class G01S 7/481   **Appl.No** 20750209   **Applicant** NAVVIS GMBH   **Inventor** CHRISTENSEN NILS

The present invention relates to a frame [1] for at least one scanning apparatus for carrying the scanning apparatus by means of the body of a person [49], the frame [1] comprising a carrying apparatus [2] for the donning and carrying of the frame [1] by the person [49]. The carrying apparatus [2] comprises a shoulder support [2-1] for laying the frame [1] on the shoulders [50] of the person [49]. Furthermore, the frame [1] comprises an upper frame portion [5], to which a first retainer [6] for the at least one scanning apparatus is fastened, the first retainer [6] being located above the head of the person [49] when the person [49] carries the frame [1] by means of the carrying apparatus [2]. The frame [1] according to the invention is characterized in that the carrying apparatus [2] also comprises an application part [2-2], which is connected to the shoulder support [2-1] by means of a jib [7], the application part [2-1] being at the height of the region of the hip [51] of the person [49] when the person [49] carries the frame [1] by means of the carrying apparatus [2]. The invention further relates to a spatial capturing device [30], comprising at least one scanning apparatus and a frame [1] of this type.

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15.   **102018108141**   MOBILE VORRICHTUNG UND VERFAHREN ZUM ERFASSEN EINES OBJEKTRAUMS   DE - 10.10.2019

Int.Class G01B 11/24   **Appl.No** 102018108141   **Applicant** NavVis GmbH   **Inventor** Maidt Mandolin

Die vorliegende Erfindung betrifft eine mobile Vorrichtung [1] zum Erfassen eines Objektraums. Die mobile Vorrichtung [1] weist ein Gestell [2] und zumindest einen an dem Gestell [2] montierten Einzelscanner [13] und einen oberhalb von dem Einzelscanner [13] an dem Gestell [2] montierten Mehrfachscanner [16] auf. Dieser umfasst eine Vielzahl von in einem Bauteil integrierten Emissionseinheiten [31], einen Empfänger [35] zum Detektieren von Reflexionsstrahlungen [34] und eine Abtasteinrichtung [36] zum Verändern der Emissionsrichtungen der Signalstrahlen [32] der Emissionseinheiten [31]. Des Weiteren weist die mobile Vorrichtung [1] eine Auswerteeinrichtung [28] auf, die ausgebildet ist, zumindest aus den von dem Empfänger [35] detektierten Reflexionsstrahlungen [34] in Echtzeit eine graphische Darstellung derjenigen Bereiche des Objektraums zu erzeugen und auszugeben, durch die die mobile Vorrichtung [1] bewegt werden kann und/oder bewegt wurde. Schließlich weist die mobile Vorrichtung [1] eine Datenschnittstelle [29] auf, die ausgebildet ist, Daten an eine Speichereinrichtung [30] zur Nachverarbeitung auszugeben. Ferner betrifft die Erfindung ein entsprechendes Verfahren zum Erfassen eines Objektraums. embedded image

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16.   **2913796**   METHOD OF GENERATING PANORAMA VIEWS ON A MOBILE MAPPING SYSTEM   EP - 02.09.2015

Int.Class G06T 7/00   **Appl.No** 14156863   **Applicant** NAVVIS GMBH   **Inventor** REINSHAGEN FELIX

The ability to precisely and thoroughly map, measure and survey indoor environments has become a major requirement for a variety of applications in industries like civil engineering, architecture, security, movie productions, asset management, and many more. Most of these applications do not only expect precise information about the 3D geometry of the mapped environment but also require high resolution imagery. To this end, state-of-the-art mobile mapping system are equipped with 360 degree panoramic cameras. These mapping systems, however, are typically operated by a person, which consequently occludes part of the field of view of the panoramic camera. A novel design of a panoramic camera rig is proposed consisting of multiple individual cameras, arranged in a way such that the operator is hidden in the blind angle of the individual cameras. The resulting parallax effect is corrected by exploiting information about the 3D geometry of the surrounding environment.

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17.   **3550513**   METHOD OF GENERATING PANORAMA VIEWS ON A MOBILE MAPPING SYSTEM   EP - 09.10.2019

Int.Class G06T 7/55   **Appl.No** 19164909   **Applicant** NAVVIS GMBH   **Inventor** REINSHAGEN FELIX

The ability to precisely and thoroughly map, measure and survey indoor environments has become a major requirement for a variety of applications in industries like civil engineering, architecture, security, movie productions, asset management, and many more. Most of these applications do not only expect precise information about the 3D geometry of the mapped environment but also require high resolution imagery. To this end, state-of-the-art mobile mapping system are equipped with 360 degree panoramic cameras. These mapping systems, however, are typically operated by a person, which consequently occludes part of the field of view of the panoramic camera. A novel design of a panoramic camera rig is proposed consisting of multiple individual cameras, arranged in a way such that the operator is hidden in the blind angle of the individual cameras. The resulting parallax effect is corrected by exploiting information about the 3D geometry of the surrounding environment.

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18.   **3958214**   METHOD OF GENERATING PANORAMA VIEWS ON A MOBILE MAPPING SYSTEM   EP - 23.02.2022

Int.Class G06T 7/55   **Appl.No** 21202258   **Applicant** NAVVIS GMBH   **Inventor** REINSHAGEN FELIX

The ability to precisely and thoroughly map, measure and survey indoor environments has become a major requirement for a variety of applications in industries like civil engineering, architecture, security, movie productions, asset management, and many more. Most of these applications do not only expect precise information about the 3D geometry of the mapped environment but also require high resolution imagery. To this end, state-of-the-art mobile mapping system are equipped with 360 degree panoramic cameras. These mapping systems, however, are typically operated by a person, which consequently occludes part of the field of view of the panoramic camera. A novel design of a panoramic camera rig is proposed consisting of multiple individual cameras, arranged in a way such that the operator is hidden in the blind angle of the individual cameras. The resulting parallax effect is corrected by exploiting information about the 3D geometry of the surrounding environment.

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19.   **WO/2021/180932**   METHOD AND DEVICE FOR PRECISELY SELECTING A SPATIAL COORDINATE BY MEANS OF A DIGITAL IMAGE   WO - 16.09.2021

Int.Class G06T 19/00   **Appl.No** PCT/EP2021/056352   **Applicant** NAVVIS GMBH   **Inventor** MANSOOR, Fahad

The present invention relates to a computer-implemented method for precisely selecting a spatial coordinate by means of a digital image. In the method, a digital image of surface elements [8, 9] in a three-dimensional space and a scatter plot are provided, wherein the points which form the scatter plot are assigned spatial coordinates, and the points are assigned surface elements [8, 9] in the three-dimensional space. The surface elements [8, 9] in the three-dimensional space are visualised by a first representation [15] of the digital image. A pixel of the digital image is marked, and approximated spatial coordinates for the marked pixel are determined, which correspond to the surface element [9], visualised by the marked pixel, in the three-dimensional space. A supplementary view [16] is then displayed, which shows the points of the scatter plot [18] lying within a limited three-dimensional environment of the approximated spatial coordinates, determined for the marked pixel, in a second representation [17]. Finally, a point [18] of the scatter plot shown in the supplementary view [16] is selected. The invention also relates to a corresponding device for precisely selecting a spatial coordinate by means of a digital image.

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20.   **102020107010**   VERFAHREN UND VORRICHTUNG ZUM PRÄZISEN AUSWÄHLEN EINER RAUMKOORDINATE MITTELS EINES DIGITALEN BILDES   DE - 16.09.2021

Int.Class G06F 3/048   **Appl.No** 102020107010   **Applicant** NavVis GmbH   **Inventor** Mansoor Fahad

Die vorliegende Erfindung betrifft ein computer-implementiertes Verfahren zum präzisen Auswählen einer Raumkoordinate mittels eines digitalen Bildes. Bei dem Verfahren wird ein digitales Bild von Oberflächenelementen [8, 9] in einem dreidimensionalen Raum und eine Punktwolke bereitgestellt, wobei den Punkten, welche die Punktwolke bilden, Raumkoordinaten zugeordnet sind und den Punkten Oberflächenelemente [8, 9] in dem dreidimensionalen Raum zugeordnet sind. Die Oberflächenelemente [8, 9] im dreidimensionalen Raum werden durch eine erste Darstellung [15] des digitalen Bildes visualisiert. Ein Pixel des digitalen Bildes wird markiert und approximierte Raumkoordinaten zum markierten Pixel werden ermittelt, die dem durch das markierte Pixel visualisierten Oberflächenelement [9] im dreidimensionalen Raum entsprechen. Anschließend wird eine Ergänzungsansicht [16] eingeblendet, welche die in einer begrenzten dreidimensionalen Umgebung der zum markierten Pixel ermittelten approximierten Raumkoordinaten liegenden Punkte der Punktwolke [18] in einer zweiten Darstellung [17] darstellt. Schließlich wird ein in der Ergänzungsansicht [16] dargestellter Punkt [18] der Punktwolke ausgewählt. Ferner betrifft die Erfindung eine entsprechende Vorrichtung zum präzisen Auswählen einer Raumkoordinaten mittels eines digitalen Bildes. embedded image

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21.   **20210132195**   MOBILE APPARATUS AND METHOD FOR CAPTURING AN OBJECT SPACE   US - 06.05.2021

Int.Class G01S 7/481   **Appl.No** 17045259   **Applicant** NavVis GmbH   **Inventor** Mandolin MAIDT

A mobile apparatus for capturing an object space includes a frame and at least one single scanner mounted on the frame and a multiple scanner mounted on the frame above the single scanner. This multiple scanner has a plurality of emission units integrated in one component, a receiver for detecting reflected rays, and a scanning device for changing the emission directions of the signal beams of the emission units. Furthermore, the mobile apparatus has an evaluation device which is designed to generate and output in real time, at least from the reflected rays detected by the receiver, a graphical representation of those areas of the object space through which the mobile apparatus can be moved and/or has been moved. Finally, the mobile apparatus has a data interface designed to output data to a memory device for post-processing. A corresponding method for capturing an object space is also disclosed.

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22. 3775993 MOBILE APPARATUS AND METHOD FOR DETECTING AN OBJECT SPACE   EP - 17.02.2021

Int.Class G01S 17/42   **Appl.No** 19720395   **Applicant** NAVVIS GMBH   **Inventor** MAIDT MANDOLIN

The present invention relates to a mobile apparatus [1] for detecting an object space, and to a corresponding method. The apparatus [1] has a frame and at least one single-sampling scanner [13] mounted on the frame [single-plane laser scanner] and a multi-sampling scanner [16] mounted on the frame above the single-sampling scanner [13]. Said multi-sampling scanner comprises a plurality of emission units integrated into one component, a receiver for detecting reflection radiation, and a scanning device for modifying the emission directions of the signal beams from the emission units. The apparatus [1] further has an evaluation device, which is designed to generate and to output, at least from the reflection radiation detected by the receiver and in real time, a graphical representation of those areas of the object space through which the apparatus [1] can be moved and/or was moved. The apparatus [1] finally has a data interface, which is designed to output data to a memory device for post-processing. The first plane [40] defined by the signal beams of the single-sampling scanner [13] is tilted forward from the vertical by an angle of preferably 15° with respect to the forward movement direction A. A first camera [17] pointing forwards is optionally provided. The signal beams from the multi-sampling scanner [16] generate an emission fan [42]. Said emission fan [42] is symmetrical with respect to a centre axis [43], which is perpendicular to the rotation axis [44] of the multi-sampling scanner [16] and is inclined downward with respect to a horizontal plane D. The mobile apparatus [1] can detect and output in real time the position of the apparatus [1] in the object space during the detection process, including in buildings, using the multi-sampling scanner [16] and the accompanying evaluation device. The object space can be detected very precisely using a high-accuracy single-sampling scanner [13], generation of a three-dimensional model of the detected object space not being possible until post-processing. A second or a third single-sampling scanner can be arranged on the top of the frame.

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23. WO/2019/193207 MOBILE APPARATUS AND METHOD FOR DETECTING AN OBJECT SPACE   WO - 10.10.2019

Int.Class G01S 17/42   **Appl.No** PCT/EP2019/058843   **Applicant** NAVVIS GMBH   **Inventor** MAIDT, Mandolin

The present invention relates to a mobile apparatus [1] for detecting an object space, and to a corresponding method. The apparatus [1] has a frame and at least one single-sampling scanner [13] mounted on the frame [single-plane laser scanner] and a multi-sampling scanner [16] mounted on the frame above the single-sampling scanner [13]. Said multi-sampling scanner comprises a plurality of emission units integrated into one component, a receiver for detecting reflection radiation, and a scanning device for modifying the emission directions of the signal beams from the emission units. The apparatus [1] further has an evaluation device, which is designed to generate and to output, at least from the reflection radiation detected by the receiver and in real time, a graphical representation of those areas of the object space through which the apparatus [1] can be moved and/or was moved. The apparatus [1] finally has a data interface, which is designed to output data to a memory device for post-processing. The first plane [40] defined by the signal beams of the single-sampling scanner [13] is tilted forward from the vertical by an angle of preferably 15° with respect to the forward movement direction A. A first camera [17] pointing forwards is optionally provided. The signal beams from the multi-sampling scanner [16] generate an emission fan [42]. Said emission fan [42] is symmetrical with respect to a centre axis [43], which is perpendicular to the rotation axis [44] of the multi-sampling scanner [16] and is inclined downward with respect to a horizontal plane D. The mobile apparatus [1] can detect and output in real time the position of the apparatus [1] in the object space during the detection process, including in buildings, using the multi-sampling scanner [16] and the accompanying evaluation device. The object space can be detected very precisely using a high-accuracy single-sampling scanner [13], generation of a three-dimensional model of the detected object space not being possible until post-processing. A second or a third single-sampling scanner can be arranged on the top of the frame.

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24. 102016116572 AUSRICHTUNG VON PUNKTWOLKEN ZUR MODELLIERUNG VON INNENRÄUMEN   DE - 08.03.2018

Int.Class G06T 19/00   **Appl.No** 102016116572   **Applicant** NavVis GmbH   **Inventor** Al-Nuaimi Anas

Die vorliegende Erfindung betrifft ein Verfahren zum Ermitteln einer Ausrichtung einer Sourcepunktwolke im Verhältnis zu einer Targetpunktwolke, wobei die Source- und die Targetpunktwolke jeweils Teilmodelle von Innenräumen einer Baustruktur darstellen und jeweils bezüglich einer Gravitationsachse ausgerichtet sind und zumindest eine kleine Überlappung bezüglich der tatsächlichen Gebäudegeometrie aufweisen. In einem ersten Schritt wird ein Sourcesignaturhistogramm der Sourcepunktwolke mit einem Targetsignaturhistogramm der Targetpunktwolke kreuzkorreliert, um eine Rotation der Sourcepunktwolke zu ermitteln. In einem zweiten Schritt wird anhand von Punktpaaren ein Translationshistogramm berechnet, wobei jedes Punktpaar einen Sourcepunkt aus der Sourcepunktwolke und einen Targetpunkt aus der Targetpunktwolke umfasst, um eine Verschiebung der Sourcepunktwolke zu ermitteln.

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25. 20130288702 VISUAL LOCALIZATION METHOD   US - 02.05.2017

Int.Class G06F 17/30   **Appl.No** 13816093   **Applicant** Eckehard Steinbach   **Inventor** Eckehard Steinbach

There is provided a visual localization method comprising: [a] transmitting data representative of one or more detected visual features from a mobile device to a server; [b] estimating the location of the mobile device at the server based on the visual features 5 received from the mobile device; [c] transmitting reference data associated with the estimated location from the server to the mobile device; and [d] the mobile device determining its location based on the reference data received from the server.