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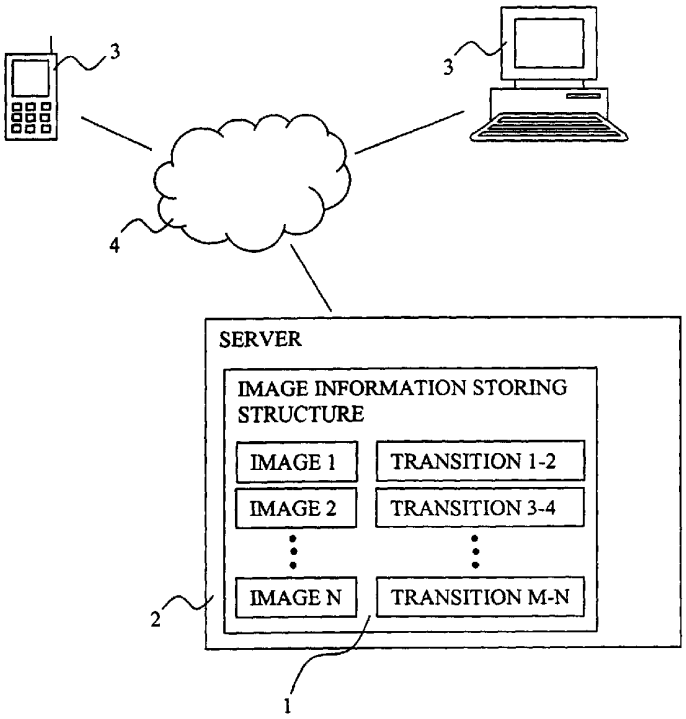
(54) Title: AN IMAGE-BASED DIGITAL REPRESENTATION OF A SCENERY



(57) Abstract: An image-based digital representation of a scenery for visually presenting the scenery is stored in an image information storing structure, which comprises vertices, each representing a digital image, and edges binding together a first vertex with a second vertex. Each edge represents information of a transition between a first image in the first vertex and a second image in the second vertex, the first and the second image depicting different views of the scenery, the first image having a first area and the second image having a second area, wherein the depictions of the first area substantially correspond to the depictions of the second area. The transition information defines a manipulation of at least one of the first and the second images, said manipulation comprising a computation of at least one transition image, the transition image depicting a new view of the scenery depicted in the first and second images. Also, a method for presentation of a navigation in a scenery, a method for presentation of images, and a device, a method, and a computer program for creating an image information storing structure is disclosed.

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AN IMAGE-BASED DIGITAL REPRESENTATION OF A SCENERY

Technical Field of the Invention

The present invention relates to an image-based digital representation of a scenery, and an image information storing structure for use in presentation of digital images. The invention also relates to a method for presentation of a navigation in a scenery represented by digital images, and a method for presentation of digital images. The invention further relates to a device, a method and a computer program for creating an image-based digital representation of a scenery.

Background of the Invention

Today, the interest in presenting information on computer networks, such as the Internet, is quickly increasing. There is a desire to present information taking up large memory space, such as images. At the same time, connections to the Internet are now being made through mobile phones with slower connections and thus longer downloading times. Therefore, as small data packages as possible should be downloaded while as much information as possible is desired to be presented. These two features are very hard to combine.

The problem is especially noticeable when images are to be downloaded, and even more if the image depicts complex objects such as in a scenery. If a company would like to present a product on its home page, a simple picture of the product might not be satisfying. All details of the product might not be evident from a picture of reasonable storing size. Then, a first picture in low resolution could be presented and a larger picture in high resolution could be downloaded only when a user requests it. However, if the high resolution is to be

presented the large size picture still has to be downloaded with its associated long downloading time.

If a landscape is to be presented, the presentation is even more impeded by a slow connection. A landscape may contain lots of details, requiring very large images, or even a great number of images of different viewing angles. Currently, there are methods for creating a computer representation of 3D sceneries. Then, all objects in the scenery need to be modelled in the computer. These methods require large memory capacities for storing the generated model, and the creation of the computer representation of the scenery is very complicated and time consuming.

If several images of different viewing angles are obtained, these images may be stitched together to create a very large image for enabling panning in the scenery. Such a method is shown in US 5,963,664. However, these very large images are not practical to download through a slow connection. Further, US 6,198,852 discloses a method for creating a new view of a scenery from a different viewing angle out of two views of the scenery from different viewing angles. However, this only provides a method for creating a new view of the scenery. It will not allow a user to navigate in the scenery. Further, it will create more views which would require longer downloading times, since more images are to be downloaded.

It may also be convenient to create an animation for showing a transition between different viewing angles. However, an animation has an even larger size than a single picture. There will therefore be no desire to download such an animation through a slow connection since it will take too much time.

Some methods are known for generation of image data which is to be shown in an animation between two images. Such methods are disclosed e.g. in "Navigating Through Sparse Views" by S. Fleishman, B. Chen, A. Kaufman, and

D. Cohen-Or, VRST (Symposium on Virtual Reality Software and Technology) '99, and in "Feature-Based Image Metamorphosis", T. Beier and S. Neely, SIGGRAPH '92.

Summary of the Invention

It is an object of the invention to provide improved presentation of information. The presentation should require short downloading times and still be able to present a lot of information. Further, a scenery should be easily represented digitally for enabling navigation between different views of the scenery.

These and other objects are achieved by an image-based digital representation of a scenery according to claim 1, a method for presentation of a navigation in a scenery according to claim 22, an image information storing structure according to claims 30 and 31, a method for presentation according to claim 32, and a device, method and computer program for creating an image information storing structure according to claims 33, 42, and 49.

Thus, according to one aspect of the invention, there is provided an image-based digital representation of a scenery for visually presenting the scenery. The representation being stored in an image information storing structure, which comprises vertices, each representing a digital image, and edges binding together a first vertex with a second vertex. Each edge represents information of a transition between a first image in the first vertex and a second image in the second vertex, wherein the first and the second image depict different views of the scenery. The first image has a first area and the second image has a second area, wherein the depictions of the first area substantially correspond to the depictions of the second area. The transition information defines a manipulation of at least one of the first and the second images, said manipulation comprising a computation of at least one transition image, the

transition image depicting a new view of the scenery depicted in the first and second images.

The image-based representation of the scenery implies that a complex scenery may be easily modelled. Then, through the manipulation defined by the transition, images of the scenery may be computed. The storing of the images and information of transitions in an image information storing structure arranges the different images in a logical way so that navigation between the images through transition images may easily be performed. Furthermore, only the images and the transition information need to be loaded, e.g. downloaded, in order to view such a navigation, since they hold all information needed. This implies that a lot of information may be presented while requiring only small data amounts to be downloaded. Transition images may be computed at a presentation device using the defined manipulation, which has been received through the download. Thus, the presentation may be performed over slow connections to the image-based representation without requiring extensive downloading of information over the connection. Further, since the transition images may be computed at the presentation device, the presentation device may control what images are to be shown. This enables free navigation between the first and the second image, i.e. if the first image is presented depicting a first view of the scenery and a transition is activated towards a second view of the scenery depicted in the second image, the transition may be halted or reversed at any time.

Furthermore, if the image information storing structure comprises several vertices and thus several images with connecting edges a dynamic presentation is enabled. Several transitions back and forth between different images could be performed, and a sequence in which the transitions are to be made is not stipulated. Thus, there is provided a possibility to vary the

presentation and in which order images should be presented.

It is an advantage of the invention that images, which have not been stored and need not be downloaded, may be presented. This enables a presentation of a scene by means of a limited number of images. Navigation in the scene is still enabled, i.e. an observer could be guided from a presentation of a first view to a presentation of a second view by transition images being shown. Thereby, the observer will get an impression of how the first and the second views are interrelated. Further, the observer will not experience any annoying waiting times between the presentations of the first and the second images. Further, a transition from a first image to a second image may be halted. A user may then reverse the direction of the transition back to show the first image or start a transition in another direction towards a third image. Thus, the user has large possibilities to control what image is presented.

In a specific application of the invention, the second image could be completely comprised in the first image, and the transition between the first image and the second image would then constitute zooming in the first image. In this particular application, the manipulation could be performed using only the first image. Thus, only the first image needs to be downloaded in order to enable the transition. Then, during the transition, the second image could be downloaded, and the downloading time will not be noticed.

In the context of this application, the term "scenery" should be interpreted broadly as a 3D-environment, including not only a landscape or a room, but also a 3D-object. Further, the "scenery" may be a real, existing environment or a virtual, drawn or computer generated environment. Within the art other common denominations used to describe such a scenery are scene or 3D-world. The term "view" should be interpreted

as the appearance of the whole or a part of the scenery from a certain position (viewing point) and angle (viewing angle). The viewing angle defines an angle between an optical axis of the depiction plane and the coordinate axes of the 3D-scenery. In the context of this application, a first image showing a part of a second image in greater scale is regarded as depicting a different view than the second image. In this case, the first and the second image have different viewing points but the same viewing angle.

A transition image will only depict parts of the scenery that are depicted in any of the first and second images. The transition image may depict the scenery from a different viewing point and/or viewing angle than the viewing points and viewing angles of the first and second images. Since the transition image is created through manipulation of at least one other image, the transition image will not present a perfect depiction of the scenery, but the depiction of the transition image may be so good that no faults or only small faults in the transition image are visible to the human eye. A transition implies a change of viewing point and/or viewing angle of the presented image in accordance with the transition information. The transition information describes how the presented image should be altered for changing the viewing point and/or viewing angle.

In the context of this application, the term "area" of an image should be interpreted as a portion or section of the two-dimensional image surface depicting a 3D-scenery, not a region of an object or scenery that is depicted in the image. However, the portion or section of the image surface forming the "area" will of course hold information of part of the depictions in the image.

Depictions of two areas "substantially corresponding" should be interpreted as the two areas depicting or showing the same or mainly the same part of the same or at least almost identical objects or

sceneries. For example, a first area depicting a front view of a painting substantially corresponds to a second area depicting the painting from a side angle. The second area will show more of the frame of the painting, but the information in the first and the second area will still be corresponding.

Images depicting the view may be obtained in several different ways, such as by taking photographs with a camera, drawing views of the scenery, computer generating views of the scenery, etc. The images may also be obtained by video cameras, which continuously monitor a landscape or a room. Then, the images in the image information storing structure will be continuously replaced or updated. This will enable real time navigation in a scenery that is monitored by video cameras.

Further, the image information storing structure describes the structure of how the images and transitions are interrelated, it should not be interpreted as a description of how the structure is implemented.

According to another aspect of the present invention, there is provided an image information storing structure for altering a presentation of a first image so that a transition is made to a presentation of a second image. The image information storing structure is accessible by a presentation device and comprises vertices, each representing an image, and edges binding together a first vertex with a second vertex. Each edge represents information of a transition from a first image in the first vertex to a second image in the second vertex, wherein the first image has a first area and the second image has a second area, information in the first area substantially corresponding to information in the second area. The transition information defines a manipulation of at least one of the first and the second images, wherein the manipulation forms a function for altering a presentation of the first image so that a

transfer is made to a presentation of the second image via a presentation of at least one transition image.

According to yet another aspect of the invention, there is provided an image information storing structure, which is accessible to a presentation device and comprises a first image and a second image. The first image has a first area and the second image has a second area, wherein information in the first area substantially corresponds to information in the second area. The image information storing structure further comprises information of a transition from a first image to a second image. The transition information defines a manipulation of at least one of the first and the second images, the manipulation forming a function for altering a presentation of the first image so that a transfer is made to a presentation of the second image via a presentation of at least one transition image.

The image information storing structure according to the invention enables a transition from a first image to a second image to be calculated when the transition is to be made. Thus, there is no need of downloading a file containing a recorded animation, but instead only a start image and an end image need to be downloaded together with a definition on how a manipulation is to be made. This implies that a small amount of data could be downloaded for presentation of a lot of information. Part of the presented information could then be created during the presentation by means of the defined manipulation.

The needed information is conveniently stored in the image information storing structure and accessible to a presentation device. The manipulation could then be used for calculating and creating a transition from the start image to the end image in the presentation device or in a computer connected to it. Thus, the transition is calculated when it is to be performed and only information that is absolutely needed is downloaded.

Information created by the transition is not downloaded, which shortens the downloading times.

According to yet another aspect of the invention, there is provided a method for presentation of a navigation in a scenery represented by digital images. The method comprises the steps of accessing a first and a second digital image, the first and the second image depicting different views of the scenery. The first image has a first area and the second image has a second area, wherein the depictions of the first area substantially correspond to the depictions of the second area. The method further comprises the steps of accessing information of a transition between the first image and the second image, said transition information defining a manipulation of at least one of the first and the second images, and determining at least one transition image using the defined manipulation. The transition image depicts a new view of the scenery depicted in the first and second images. The method further comprises the step of performing a visual navigation in the scenery by replacing a presentation of an image depicting a view of the scenery by a presentation of another image depicting a different view of the scenery.

This implies that an observer may be guided through a scenery. Different parts of the scenery may be shown and the observer will get a sense of how the parts of the scenery are interrelated. Further, this navigation will be achieved by downloading only small amounts of data, which enables complex presentations over a slow connection. It is not necessary that the first and the second images are presented during the navigation. It may be sufficient to present a navigation in transition images only. Then the first and second images are used only for the computation of transition images. Further, if only the first image is used for the manipulation, it is not necessary to access the second image until the second image is to be presented.

According to yet another aspect of the invention, there is provided a method for presentation of digital images. The method comprises the step of accessing a first and a second stored digital image. The first image has a first area and the second image has a second area, wherein information in the first area substantially corresponds to information in the second region. The method further comprises the steps of accessing information of a defined transition from the first to the second image, presenting the first image on a presentation device, performing the transition from the first image to the second image by calculating a manipulation of at least one of the first and the second images, and presenting at least one transition image on the presentation device. The transition image is created by the manipulation. The method further comprises the step of presenting the second image on the presentation device to complete the transition of presentation of the first image to presentation of the second image.

The method according to the invention allows a transition to be made from a first image to a second image on a presentation device without demanding extensive downloading of information.

According to still another aspect of the invention, there is provided a device for creating an image-based digital representation of a scenery for virtually presenting the scenery. The device comprises means for obtaining a first and a second digital image, the first and the second image depicting different views of the scenery, and means for defining a first area of the first image and a second area of the second image, wherein the depictions of the first area substantially correspond to the depictions of the second area. The device further comprises means for defining information of a transition between the first image and the second image, wherein the transition information defines a manipulation of at least one of the first and the second images. The manipulation

comprises a computation of at least one transition image, the transition image depicting a new view of the scenery depicted in the first and second images. The device further comprises means for storing the first and the second images as two vertices in a graph of an image information storing structure and the defined transition information from the first to the second image as an edge binding together said two vertices in the graph of the image information storing structure.

This device provides a possibility to easily create a new image information storing structure, which could be used for the new method of transforming a presentation of a first image to a presentation of a second image.

Preferred embodiments according to the different aspects of the invention will now be described. It is possible to combine embodiments presented for one aspect of the invention with other aspects of the invention.

According to the image-based digital representation of the invention, the manipulation preferably comprises a computation of several transition images depicting different views of the scenery. This gives larger freedom for navigation in the scenery, since there are more images available for presentation.

In a preferred embodiment of the image-based digital representation of the invention, the transition defines a manipulation for altering a presentation of a first image, the depictions of which comprising a planar surface from a first viewing point, to a presentation of a second image, the depictions of which comprising said planar surface from a second viewing point.

Since the first image and the second image both depict the same planar surface, a navigation between different viewing points and viewing angles is easily enabled. An observer will then be guided by transition images through a change of viewing angle of the scenery to show the scenery from the other angle.

Thus, there is no need to download a recorded animation of transforming a presentation of the scenery from one position to a presentation of the scenery from another position. Only the start and end images together with the transition to be performed is needed. Further, the navigation may be halted at any transition image. Then, the user may freely choose to continue to perform a transition to a presentation of the second image or in stead to initiate a transition towards the presentation of the first image or towards a third image depicting the scenery from yet another viewing point or viewing angle.

In another preferred embodiment, the transition defines a manipulation for altering a presentation of a first image depicting a scenery from a viewing point in a first viewing angle to a presentation of a second image depicting the scenery from said viewing point in a second viewing angle.

This would correspond to a rotation of a camera depicting the scenery. This may preferably be combined with a transition between different viewing points for allowing even more freedom of changing the presentation of the scenery.

In yet another preferred embodiment, the transition defines a manipulation for altering a presentation of a first image depicting a scenery from a first viewing point in a viewing angle to a presentation of a second image depicting the scenery from a second viewing point in said viewing angle.

Thus, if a first image representing a product is presented, details on the product may be presented by performing a transition towards a presentation of a second image in higher resolution, i.e. depicting the scenery from a closer viewing point with the same viewing angle. Thus, the second image represents only the detail. When the presentation of the first image is transformed into the presentation of the second image according to the invention, a user is guided by transition images to

the detail and will get an impression of where the detail is situated in the product.Thus, if a detail is to be shown, the first image does not have to be replaced by a large size image in high resolution, which would require a long downloading time, but instead only a small size image of the particular detail in high resolution may be presented. This is a great advantage by comparison with other representations of a scenery, such as a generated 3D computer model of the scenery. If it should be possible to present several details, several separate images each representing one or a few details may be used. Thus, information that is not of interest will not be downloaded or stored in high resolution, since no high resolution image will be available depicting uninteresting details.

Preferably, the manipulation is based on the information in the first and second areas. Thus, the manipulation will use information that is common to the two images. Thereby, the interrelationship between the images could be determined and manipulations, such as translations or rotations, needed for converting the first image to the second image is known.

Further, the manipulation preferably uses information of correspondence points in the first and the second areas. Use of four correspondence points is sufficient for relating the images to each other according to a projective transformation, which will transform the image plane of the first image to the image plane of the second image. This transformation may also be used for transforming the image planes of the first and second images to an image plane of a transition image for computing the transition image.

The manipulation may comprise a projective transformation. By means of a projective transformation the first image is transformed so that the four points of the first image are placed in a position, which could be chosen arbitrarily. The position is determined by a

function, which calculates intermediate points between the four correspondence points of the two images. The projective transformation will alter the conceived viewing point and/or viewing angle of the first image and during the transition the viewing point and/or viewing angle will be continuously altered from the viewing point and viewing angle of the first image to the viewing point and viewing angle of the second image. Further, using the projective transformation, the transition may be calculated very quickly. However, this limits the transitions which are possible to perform to transitions between images depicting the same plane, images depicting a scenery from the same point of view but in different viewing angles, and images having different zoom levels, which could be approximated as depicting the scenery from different viewing points but in the same viewing angle. Further, transitions constituting combinations of the previously mentioned cases may still be performed.

Preferably, the transition information defines a function of the progress of the transition for the movement of the correspondence points from a position in the first image to another position in the second image. The movement of the correspondence points is dependent on the progress of the transition, i.e. how much the viewing point and viewing angle have changed. The movement of the correspondence points may then be used for computing where all other points of the images should be placed in the transition images.

In a preferred embodiment, the transition further comprises a point set, which define the positions of the correspondence points in a specific transition image. Thus, the transition may be forced through presenting a transition image with a specific viewing point and viewing angle. The definition of the point set may be achieved by using an additional image, depicting a view of the scene, said view being different from the views depicted in the first and the second images. The point

set may then be defined as the positions of the correspondence points in the additional image. The transition between the first and the second image may thus be forced through the view of the additional image. However, the additional image need not be stored in the image information storing structure. The view depicted in the additional image may be computed through the manipulation of the first and/or the second image.

In another preferred embodiment, a point in the transition image is computable by blending a mapping of a point in the first image onto said point in the transition image with a mapping of a point in the second image onto said point in the transition image. The blending ensures that information of both images may be used. The blending may be calculated pixelwise by computing the influence from the first and second images on one point of the transition image at a time. As an alternative, all points of the first and second images may be mapped onto the image plane of the transition image before blending the mapped images.

The transition information preferably defines weights for the blending. These weights define the influence of each point in the first and second images for calculation of the transition image.

The transition information preferably defines different weights for the intermediate images. These weights define the influence of the intermediate images for calculation of the transition image. Thus, the influence on the transition image from the first image could differ from the influence from the second image. If a transition image in the beginning of the transition is calculated, the intermediate image calculated from the first image could have greater influence than the intermediate image calculated from the second image. This might be advantageous since this transition image will be most resembling or closest to the first image. The influence or weights for the intermediate images could be

varied throughout the transition to take into consideration that the transition images in the beginning of the transition will be most resembling to the first image and in the end of the transition will be most resembling to the second image. Preferably, the weights of the first and the second images vary as a function of the progress of the transition for calculation of different transition images.

If e.g. the brightness differ substantially between the first and the second images, edge effects may occur in the transition image. This means that the mapping of an edge of one of the first and second images onto the transition image will appear in the transition image as an edge between a darker and a brighter region in the image. Preferably, the weights differ within the first and second image in accordance with a predefined function. By e.g. smoothly decreasing the weight of the points towards the edges of the first and second image, the mapping of the edges of the first and the second images will not appear sharply in the transition image.

The manipulation may also preferably use at least one additional image for computation of the transition image, the first, the second and the additional images depicting different views of the scenery, the first image having a first area, the second image having a second area, and the additional image having a third area, wherein the depictions of the first area substantially correspond to the depictions of the second area and the third area. This will enable even more freedom of navigation in a scenery, since the presented view may be altered between at least three different views simultaneously. It may also improve the quality of the presented transition images, since more information is present in the images used for computing the transition images.

Preferably, the transition defines a function for altering a presentation of at least a part of the first

image to a presentation of at least a part of the second image via a presentation of the at least one transition image. Then, an animation may be shown for continuously changing the viewing point and viewing angle. When only a part of the first and the second image is presented, the presentation of areas in the transition image receiving no information from either the first image or the second image may be avoided. If no point of the projections of the first image and the second image is projected onto a point of the transition image, this would be the case.

Advantageously, the transition is reversible, whereby the transition is usable for altering a presentation of at least a part of the second image to a presentation of at least a part of the first image. Thus, the same transition may be used for the reversed transition, which implies that only one transition between the images needs to be defined.

The vertex representing the first image may further comprise a link to another vertex via at least one specified edge for transition of a presentation of the first image to a presentation of the image represented by the other vertex. As a result, a navigation through several images depicting different views of the scenery may be predefined. Upon activation of the link, the navigation will be presented.

The link may be coupled to a hotspot or other means of navigation, such as mouse movement. Then, a user may activate the navigation by clicking in the hotspot or by moving the mouse. This could illustrate in what direction the viewing point and viewing angle will be changed during the navigation. However, the link may also be coupled to any graphical object presented to the user. For example, the link may be coupled to a button or a text.

Preferably, the first and second areas are predefined. Then, the image information storing structure holds information of which areas of the images that

should be used for the manipulation before the manipulation is actually performed.

The transition is preferably initiatable by input from a user. The user may initiate the transition in a lot of different ways, such as by pushing a button with a pointing means, e.g. a mouse, and/or moving the pointing means.

According to a preferred embodiment of the method of presentation of a navigation, a user controls what image is to be presented. This implies that a user will freely control how the viewing point and viewing angle will be altered when changing the image which is being presented.

According to another embodiment, an animation is presented, said animation forming a specified path for altering the presentation of an image to the presentation of another image. Then a specified succession of images will be shown. The path of the animation defines which transitions that should be used, i.e. showing a transition from a first image to a second image and then, possibly, further transitions to additional images.

According to a preferred embodiment of the method of the invention, the method further comprises the step of downloading the first and the second images to the presentation device.

The downloading of the first image will be performed before the transition is started. If the manipulation only manipulates the first image in creating the transition images, the second image need not be downloaded before the transition is started. In stead, the second image may be downloaded during the transition and manipulation of the first image. In this way, the downloading time of the second image will not be noticed, since a transition from a presentation of the first image is presented during the download. This is particularly useful when the transition constitutes a zooming in the first image, since then the second image is completely incorporated in the first image. This may also be used

for a transition where the viewing angle and the viewing position are changed, if all of the depiction of the second image is within the depiction of the first image.

The method may further comprise the step of enabling a transition from a first image to a second image, when both images have been downloaded to the presentation device. Thus, a transition may be activated when the images needed for performing the manipulation have been downloaded. The calculations of the manipulation is preferably performed at the presentation device. Then, data created in the manipulation need not be downloaded through a slow connection, but is created where it is needed.

The steps of accessing the first and the second images and the transition information comprise the step of accessing a computer program, which reads a parameter file comprising a description of the image information storing structure. The computer program will then be able to find the needed or desired images that are to be accessed or downloaded from the storing structure or from a location pointed out by the structure. The computer program preferably reads a description of the image information storing structure. This description could for example be in XML (eXtensive Markup Language). However, a description in any other suitable language may be read.

According to a preferred embodiment of the device for creating an image information storing structure of the invention, the device further comprises means for presenting an overview of the graph of the image information storing structure. This enables an operator who creates an image information storing structure to easily embrace the structure that has been created.

Preferably, the device further comprises means for defining correspondence points of the first and the second images for use in the manipulation. Then, suitable points that will give a transition with good quality of the transition images may be defined.

The device may also comprise means for presenting guiding lines for the definition of corresponding points. These guiding lines may help the user to correctly define the points and to better see how the points are related to each other.

Preferably, the device further comprises means for presenting a magnified view of a part of an image, in which a corresponding point is to be defined. This makes it even easier for the operator to correctly define the correspondence points. Preferably, the device further comprises means for scaling down the obtained images in resolution. This enables the images that are to be stored into the image structure to be packed to a small format. Also the means for presenting a magnified view may then use the obtained image, which is in high resolution.

The device may further comprise means for presenting the defined transition. This enables the operator to instantly check the quality of the defined transition.

Preferably, the device further comprises means for halting a presentation of the defined transition at an arbitrary point. Then, the operator can check the quality of each part of the transition. Since the transition is freezed, the operator may study each part of the transition thoroughly.

Brief Description of the Drawings

The invention will now be described in more detail by way of example referring to the appended drawings.

Fig. 1 is a schematic view of an image information storing structure according to the invention and its accessibility.

Fig. 2 is a view over images of an image information storing structure.

Fig. 3 is a schematic view of a mapping of a plane in a first image to a plane in a second image.

Fig. 4 is a schematic illustration of a path of transition.

Fig. 5 is a schematic view of a blending between a mapping of the first image and a mapping of the second image.

Fig. 6 is a flow chart illustrating a method of presenting images according to the invention.

Fig. 7 is a schematic view of areas in an image for activating transitions.

Fig. 8 is a schematic view of a first mode of a device for creating an image information storing structure according to the invention.

Fig. 9 is a schematic view of a second mode of a device for creating an image information storing structure according to the invention.

Detailed Description of Preferred Embodiments

Referring to Fig. 1, access to a presentation of images is described. An image information storing structure 1 is stored in such a way that it is accessible for a presentation device 3. Thus, the image information storing structure may be stored on a server 2, or locally on a storing unit. It may also be embedded in the presentation device or in a viewer software. The access could be achieved over a computer network 4, such as the Internet, or over a file system if the image information storing structure is stored locally. The computer network 4 could also be wireless, such that the presentation device 3 could be constituted of a mobile phone.

The server 2, which may be accessed through a home page, comprises the image information storing structure 1. This image information storing structure 1 may comprise pointers or references to different images and transitions between these images. Thus, the actual images and transitions need not be stored on the server 2. The image information storing structure 1 may alternatively comprise the actual images and transitions. In the following, the image information storing structure 1 will

be described as comprising the actual images and transitions.

Referring to Fig. 2, the image information storing structure 1 according to the invention is described in more detail. The image information storing structure 1 comprises at least a first 6 and a second 7 image and information of a defined transition 8 for transforming a presentation of the first image 6 to a presentation of the second image 7. However, the image information storing structure 1 preferably comprises several images and information of transitions between these images. The construction of the structure could be described as a graph, i.e. vertices connected by edges. Each vertex comprises one image, and each edge comprises information of a transition between the two images, which are connected by the edge.

The first 6 and the second images 7 comprise areas 9, 10, the information of which substantially corresponds. These areas 9, 10 having corresponding information are used for determining a transformation of a presentation of the first image 6 to a presentation of the second image 7. The corresponding information may constitute an object or surface, which is depicted in both images. It may also constitute depictions of corresponding objects in the first 6 and second images 7. All or only a part of the corresponding information is used for the transition. In the preferred embodiment, only four correspondence points are used for the transition. The corresponding information preferably comprises a plane, i.e. a planar surface defined in the depiction of the images. Through this plane, the relation between the first 6 and the second images 7 may be determined by means of the plane defining a projective mapping from the first image 6 to the second image 7. This relation could then be used for the transition 8. It is sufficient that the common planar surface constitute only a small part of the images 6, 7. Transitions 8 may

also be defined between images that depict a scenery from the same viewing point but in different viewing angles, or for zooming between images, where one of the images shows a detail of the other image in higher resolution.

A transition from the first image 6 to the second image 7 constitutes a defined manipulation of at least one of the images for smoothly transforming a presentation of the first image 6 to a presentation of the second image 7. The manipulation being defined implies that the intended path of the transition is known. However, the actual calculation will not be performed until the transition from the presentation of the first image 6 to the presentation of the second image 7 is actually made. The manipulation will use corresponding information of the images. The corresponding information could be four correspondence points defining a plane that is depicted in the images.

Links to other images may be coupled to each image. These links constitute pointers to a path through the graph, following specific edges for transforming the presentation. Thus, the link could activate a transition 8 from the first image 6 to the second image 7 via the transition 8. However, it could also activate a transition from the first image to the third image via a first transition to the second image and a second transition to the third image. The link specifies a certain path to be taken between the images, i.e. what edges should be followed. The links could be coupled to a hotspot or other means of navigation, such as mouse movement. Thus, a user could activate the transition by activating the area to which the link is coupled. Alternatively, the link could be coupled to a specific part of the image, such as an arrow 11 in the image or an area of the image, which may be depicting the same parts of the scenery as the image to which the transition is made. A link could also be created by requesting a graph search for a certain vertex from another vertex, for

example from the vertex that is presented at the time of the search.

Referring to Fig. 3, a manipulation will be described. A projected plane 12 is determined in a first 6 and a second image 7. The plane 12 is defined by four points 13-16. These points 13-16 are corresponding in the two images 6, 7. The correspondence points 13-16 are used to compute a homography. Homographies are described in more detail in Paul Heckbert; *"Projective Mappings for Image Warping"*; Rendering, 15-862; 26 Sept 1995. The correspondence points 13-16 are named u_i, v_i in the first image and x_i, y_i in the second image for i=0,1,2,3. A homography matrix *H* is computed by solving the following 8x8 equation system.

$$\begin{bmatrix} u_i & v_i & 1 & 0 & 0 & 0 & -u_i x_i & -v_i x_i \\ 0 & 0 & 0 & u_i & v_i & 1 & -u_i y_i & -v_i y_i \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \\ e \\ f \\ g \\ h \end{bmatrix} = \begin{bmatrix} x_i \\ y_i \end{bmatrix}$$

$$H = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & 1 \end{bmatrix}$$

The homography matrix is used to transform points in the first image 6 to points in the second image 7. In a preferred embodiment, the transform is passed through a [0,0,1,1] plane 12. This gives simpler calculations. In Fig. 3, the mapping of a plane 12 in the first image 6 onto the [0,0,1,1] plane 12 and then onto a plane 12 in the second image 7 is illustrated. There are several other methods for transforming the images. The transform

may be based on information other than the correspondence points, such as the image contents in the areas of the images comprising corresponding information.

In order to create a smooth transform from the first image 6 to the second image 7, an interpolation is performed in conjunction with the projective transformation. Each correspondence point 13-16 follows a path from the position in the first image 6 to the position in the second image 7. The path may be specified using key point sets. The key point sets define positions which the correspondence points 13-16 should have for a specific transition image. Thus, the first image 6 and the second image 7 are the first and the last key point sets in the transform. More key point sets can be inserted between the first and last key point sets to control the path of the correspondence points 13-16. Certain positions of an interpolation of the correspondence points 13-16 between the key point sets are used to calculate transition images, which are presented during the transform. These transition images are presented in succession to create the smooth transform.

The transform preferably describes a circular or arcuate path for the correspondence points 13-16, when a transition corresponding to a rotation of a camera is performed. This is advantageous, since an object which is rotated between the two images will not appear to be distorted during the transform. If a linear path would be used, the object will be smaller during the transform. Thus, this will not result in a rigid transform. Further, the key point sets may be defined in such manner that the transition will not create transition images, which require information that is not present in any of the first and the second images. This may otherwise be at risk, if a linear interpolation is made between the first 6 and the second images 7, as shown in Fig. 4, indicated by arrows A. If a key point set is used instead, the

alternative path indicated by arrows B may be defined, and the transition images will not include any information which is not present in the first 6 and the second images 7. In other cases of transitions, it may be suitable to use a linear path.

Further, if only a part of the first 6 and second images 7 are shown during the transition the risk of showing information which is not present in any of the first 6 and the second images 7 may be avoided. This would correspond to a zooming in the first 6 and the second images 7. Then, the mappings of the first 6 and the second images 7 hold more information than presented when the first 6 and the second images 7 are presented. As a result, it may be assured that at least one pixel of the first 6 and the second images 7 is mapped onto each pixel of each transition image.

The position of the parameters, i.e. the correspondence points 13-16, in a transition image is a function of the progress of the transition. The positions may be calculated by means of an interpolation equation, for example a spline equation.

The interpolation process results in three point sets, i.e. the point set of the first image 6, the point set of the second image 7, and the point set of the transition image to be generated. Using these point sets two homographies can be computed, one from the first image 6 to the transition image, and one from the second image 7 to the transition image. By applying these homographies to the first 6 and the second images 7, respectively, each pixel of the first 6 and second images 7 may be projected onto the image plane of the transition image to be generated. These projections are combined to a final transition image by blending the projections from the first and the second images in each pixel of the transition image.

Referring to Fig. 5, a blending of the first 6 and second images 7 into a transition image is described.

Each pixel, i.e. a discrete point in a two-dimensional coordinate system, of the first 6 and the second images 7 is transformed by multiplication of the corresponding homography matrix. Then, a combination or blending of the projections of the first 6 and the second images 7 is used for calculating the transition image. Each pixel of the original images (the untransformed first and second images) is assigned a weight value. In a preferred embodiment of the invention, a linear combination of the pixels from the first 6 and second images 7 is used for determining the values of pixels in the transition image. Then, the blending could be described as:

$$P = \frac{\alpha}{\alpha+\beta}P_1 + \frac{\beta}{\alpha+\beta}P_2,$$

where P is the value of the pixel in the transition image, P_1 is the value of the pixel in the first image 6, which is mapped onto the pixel P in the transition image, and P_2 is the value of the pixel in the second image 7, which is mapped onto the pixel P in the transition image. The weights of the pixels from the first 6 and the second images 7 are determined by the parameters α and β. In a preferred embodiment, these weights differ depending on the progress of the transition. Thus, the parameter α should be large if the transition is close to the first image 6 and the parameter β should be large if the transition is close to the second image 7. This could be described as:

$$\alpha = f(u,v,1-t),$$
$$\beta = f(u,v,t),$$

where $t=[0,1]$ is a parameter describing the progress of the transition. As seen, the parameters α and β also depend on a function f. This depends on the position of the pixel in the first and the second images. Thus, the

weight of a pixel is dependent on where it is situated in the image. Preferably, the function *f* is a two-dimensional bell-curve, which would give large weights to pixels in the middle of an image and small weights to pixels in the edge of an image. Thereby, edge effects as described earlier may be avoided. Thus, the function *f* could be described as:

$$f(u,v) = 1-(x^2(3-2x))^2,$$
$$x = \sqrt{(u-0{,}5)^2+(v-0{,}5)^2},$$

where u, v =[0,1] is the coordinates of the pixel in the image to be transformed.

The correspondence points 13-16 need not be used for the whole transition from a first image 6 to a second image 7. Instead, at a certain stage of the transition, another set of correspondence points may replace the first set used. Alternatively, more than one set of correspondence points 13-16 may be used for the calculation of each transition image. Then, the different sets of correspondence points are used for computing intermediate transition images according to the above, and the final transition image is computed by blending the intermediate transition images.

The images may relate to each other as showing a scenery in different viewing angles from the same point of view. The transition will then constitute a rotation of the viewing angle. The images may also be related by showing the same plane from different viewing points. This plane may be a small planar part of a curved surface. The different viewing points may show the plane from different angles or from different distances. The images may also be related by having different focuses on a scenery showed from the same point of view and the same viewing angle, for example the first image may depict the scene focussing on an object close to the viewing point

whereas the second image depicts the scene focussing on an object farther away from the viewing point. For all these alternatives, both images are needed for the manipulation. The images may also be related by the second image showing only a part of the first image, but in greater resolution. In this case, the transition may be performed by only manipulating the first image. Then, a zooming is made in the first image towards the part of the first image shown in the second image. In this case, the transition may be started even before both images have been downloaded. The above described transitions may be combined for transforming between images related in other ways.

Referring to Fig. 6, a method for presenting a transition between images is described. The presentation is performed on a presentation device. The presentation device accesses an image information storing structure through a computer network, step 20, or through a local file structure. The images and transitions of the image information storing structure are downloaded to the presentation device, step 22. A part or the whole of a first image is then presented on the presentation device, step 24. When a second image and a transition from the first image to the second image has been downloaded, the transition is enabled. If a user requests a transition, step 26, the manipulation is calculated, step 28, at the presentation device by means of the downloaded transition. The transition presents transition images, step 30, which guide the user from the first image to the second image. When the transition is complete, a part or the whole second image is presented, step 32. When the second image is presented, a new transition may be initiated to a third image or back to the first image. Then, transitions may be made in arbitrary order between the images of the image information storing structure. Also, a transition may be halted when presenting a transition image. Then, the transition may reversed

towards presenting the first image again, continued towards presenting the second image, or a new transition may be started towards presenting a third image.

Referring to Fig. 7, an image 40 could be divided into several areas 41-43, which will lead to the transition to different images. When a pointer is moved into an area the transition is started. Preferably, the user will also have to click the pointer to start the transition. However, the transition may be stopped by moving the pointer out of the area. Then, the initiated transition is reversed from a presentation of the last presented transition image to a presentation of the origin image 40. In a preferred embodiment, the transition may only be stopped up to a certain point. Then, if the transition has reached too far away from the origin image 40 it will be completed irrespective of movements of the pointer. This point may be specified by the parameter *t*. When the transition is within the limits of still being able to be reversed, the transition may also be altered to a transition from the origin image 40 to another image. As shown in Fig. 7, the origin image 40 is divided into three areas 41-43 leading to three different transitions from the origin image 40. A transition to move to the left from the origin image 40, as indicated by arrow C, may then be altered into a transition upwards, as indicated by arrow D, when the parameter *t* of the transition to the left is below a critical value.

If several images are overlapping each other, an almost free movement in the images is enabled. This is possible if the transitions are held below the critical value of *t*.

Referring to Figs. 8 and 9, an editor for creating an image information storing structure will now be described. However, before the image information storing structure may be created, images having areas with corresponding information need to be captured in digital

form. These images may then be used to create the image information storing structure.

The editor comprises two modes. In a first mode, shown in Fig. 8, the images may be schematically related to each other. Here, the images which are to be used in the image information storing structure are logically related to each other, i.e. the connections between the images are shown. In this mode, an operator creating the image information storing structure may get an overview of the structure. The images to be used are shown as thumbnail images 50 and connected by lines 51 illustrating the possible transitions.

By activating an image or a transition, e.g. by clicking with a mouse pointer on any of these, the operator is transferred to a second mode of the editor, as shown in Fig. 9. In this mode, the operator may study the transition and create new or improve existing transitions. The presented information in the second mode is divided in four parts 52-55. In the two upper parts 52, 53, the two images involved in the transition of current interest are presented. The operator may define correspondence points 13-16 by clicking in these two images. To help the operator to correctly define the correspondence points, guiding lines 56 may be shown in the images, so that the area defined by the points is illustrated.

To further help the operator to correctly define the correspondence points 13-16, a zoom of the active image is shown in the right hand lower part 54 of the second mode. This zoom may be enabled by the image being obtained in higher resolution than the image that is stored into the image information storing structure. Then, the high resolution obtained image is scaled down for the storage of the image into the image information storing structure. The definition of the correspondence points may also be corrected in the zoomed-in image.

Also, an additional image may be used for defining a key point set, i.e. a set of positions of the correspondence points 13-16 in a certain transition image. The operator may define the positions of the correspondence points 13-16 as the key point set. Then, during the transition between a first and a second image, a transition image will show the view depicted in the additional image. The additional image need not be stored in the image information storing structure, but could be used only for the purpose of defining the key point set.

Further, in the left hand lower part 55 of the second mode, the transition resulting from the defined correspondence points may be viewed. This transition may be viewed as an animation. A free navigation through the transition is also allowed. As a result, the operator may calmly examine all parts of the transition to identify any unsatisfactory parts of the transition.

The operator may shift between the two modes of the editor to relate the images to each other in a logical way and to create all transitions that are needed. When the structure is complete, the editor will store the images and transitions with the desired relations between images and transitions maintained.

It should be emphasized that the preferred embodiments described herein is in no way limiting and that many alternative embodiments are possible within the scope of protection defined by the appended claims. For example, the presentation of the images may be performed on a presentation device which is directly connected to the computer on which the image information storing structure is stored.

Further, the images may be captured from live cameras which are filming a scenery from different point of views. Still pictures captured from the cameras could be used for the navigation in the scenery. The cameras could then continuously replace the still picture used for the navigation. Then, the areas of the images

comprising corresponding information may not be predefined. However, if the scenery has an easily defined plane, such as a wall or a door or the like, the areas may be defined automatically when the transition is to be performed. Also, if the same scenery is being continuously monitored, the same correspondence points may always be used among objects that are constantly depicted, such as a door.

Moreover, other manipulations of the images may be performed simultaneously with the manipulations for computing the transition images. Thus, the brightness or coloration of an image may be manipulated during a transition.

Also, the order for downloading images of an image information storing structure may be controlled by keeping statistics of the probability that an image is viewed by a user. Thus, if an image information storing structure contains a large amount of images, the most popular images are downloaded first.

CLAIMS

1. An image-based digital representation of a scenery for visually presenting the scenery, the representation being stored in an image information storing structure comprising

vertices, each representing a digital image, and

edges binding together a first vertex with a second vertex, each edge representing information of a transition between a first image in the first vertex and a second image in the second vertex, the first and the second image depicting different views of the scenery, the first image having a first area and the second image having a second area, wherein the depictions of the first area substantially correspond to the depictions of the second area,

said transition information defining a manipulation of at least one of the first and the second images, said manipulation comprising a computation of at least one transition image, the transition image depicting a new view of the scenery depicted in the first and second images.

2. The image-based digital representation according to claim 1, wherein the manipulation comprise a computation of several transition images depicting different views of the scenery.

3. The image-based digital representation according to claim 1 or 2, wherein the transition information defines a manipulation for altering a presentation of a first image, the depictions of which comprising a planar surface from a first viewing point, to a presentation of a second image, the depictions of which comprising said planar surface from a second viewing point.

4. The image-based digital representation according to claim 1 or 2, wherein the transition information defines a manipulation for altering a presentation of a

first image depicting a scenery from a viewing point in a first viewing angle to a presentation of a second image depicting the scenery from said viewing point in a second viewing angle.

5. The image-based digital representation according to claim 1 or 2, wherein the transition information defines a manipulation for altering a presentation of a first image depicting a scenery from a first viewing point in a viewing angle to a presentation of a second image depicting the scenery from a second viewing point in said viewing angle.

6. The image-based digital representation according to any one of the preceding claims, wherein the manipulation comprises a projective transformation.

7. The image-based digital representation according to any one of the preceding claims, wherein said manipulation is based on the information in the first and second areas.

8. The image-based digital representation according to any one of the preceding claims, wherein said manipulation uses information of correspondence points in the first and the second areas.

9. The image-based digital representation according to claim 8, wherein the transition information defines a function of the progress of the transition for the movement of the correspondence points from a position in the first image to another position in the second image.

10. The image-based digital representation according to claim 8 or 9, wherein the transition information further comprises a point set, which define the positions of the correspondence points in a specific transition image.

11. The image-based digital representation according to any one of the preceding claims, wherein a point in the transition image is computable by blending a mapping of a point in the first image onto said point in the transition image with a mapping of a point in the second image onto said point in the transition image.

12. The image-based digital representation according to claim 11, wherein the transition information defines weights for the blending, said weights defining the influence of each point in the first and second images for calculation of the transition image.

13. The image-based digital representation according to claim 12, wherein the weights differ within the first and second image in accordance with a predefined function.

14. The image-based digital representation according to claim 12 or 13, wherein the weights of the first and the second images varies as a function of the progress of the transition for calculation of different transition images.

15. The image-based digital representation according to any one of the preceding claims, wherein the manipulation uses at least one additional image for computation of the transition image, the first, the second and the additional images depicting different views of the scenery, the first image having a first area, the second image having a second area, and the additional image having a third area, wherein the depictions of the first area substantially correspond to the depictions of the second area and the third area.

16. The image-based digital representation according to any one of the preceding claims, wherein the transition information defines a function for altering a

presentation of at least a part of the first image to a presentation of at least a part of the second image via a presentation of the at least one transition image.

17. The image-based digital representation according to claim 16, wherein the transition is reversible, whereby the transition is usable for altering a presentation of at least a part of the second image to a presentation of at least a part of the first image.

18. The image-based digital representation according to any one of the preceding claims, wherein the vertex representing the first image further comprises a link to another vertex via at least one specified edge for transition of a presentation of the first image to a presentation of the image represented by the other vertex.

19. The image-based digital representation according to claim 18, wherein the link is coupled to the first area.

20. The image-based digital representation according to any one of the preceding claims, wherein the first and second areas are predefined.

21. The image-based digital representation according to any one of the preceding claims, wherein the transition is controllable by input from a user.

22. A method for presentation of a navigation in a scenery represented by digital images, said method comprising the steps of:

accessing a first and a second digital image, the first and the second image depicting different views of the scenery, the first image having a first area and the second image having a second area, wherein the depictions

of the first area substantially correspond to the depictions of the second area,

accessing information of a transition between the first image and the second image, said transition defining a manipulation of at least one of the first and the second images,

determining at least one transition image using the defined manipulation, said transition image depicting a new view of the scenery depicted in the first and second images,

performing a visual navigation in the scenery by replacing a presentation of an image depicting a view of the scenery by a presentation of another image depicting a different view of the scenery.

23. The method according to claim 22, wherein a user controls what image is to be presented.

24. The method according to claim 22 or 23, wherein an animation is presented, said animation forming a specified path for altering the presentation of an image to the presentation of another image.

25. The method according to any one of claims 24, wherein the presentation of the animation is controllable by a user.

26. The method according to any one of the claims 22-25, further comprising the step of downloading the first and the second images to a presentation device.

27. The method according to any one of claims 26, wherein calculations of the manipulation is performed at the presentation device.

28. The method according to claim 26 or 27, further comprising the step of enabling a transition from a first

image to a second image, when both images have been downloaded to the presentation device.

29. The method according to any one of claims 22-28, wherein the steps of accessing the first and the second images and the transition comprise the step of accessing a computer program, which accesses the image information storing structure.

30. An image information storing structure for altering a presentation of a first image so that a transition is made to a presentation of a second image, said image information storing structure being accessible by a presentation device and comprising:

vertices, each representing an image, and

edges binding together a first vertex with a second vertex, each edge representing information of a transition from a first image in the first vertex to a second image in the second vertex, the first image having a first area and the second image having a second area, information in the first area substantially corresponding to information in the second area,

said transition information defining a manipulation of at least one of the first and the second images, said manipulation forming a function for altering a presentation of the first image so that a transfer is made to a presentation of the second image via a presentation of at least one transition image.

31. An image information storing structure for altering a presentation of a first image so that a transition is made to a presentation of a second image, said image information storing structure being accessible by a presentation device and comprising:

a first image and a second image, the first image having a first area and the second image having a second

area, information in the first area substantially corresponding to information in the second area,

information of a transition from a first image to a second image, said transition information defining a manipulation of at least one of the first and the second images, said manipulation forming a function for altering a presentation of the first image so that a transfer is made to a presentation of the second image via a presentation of at least one transition image.

32. A method for presentation of digital images, said method comprising the steps of:

accessing a first and a second stored digital image, said first image having a first area and said second image having a second area, information in the first area substantially corresponding to information in the second area,

accessing information of a defined transition from the first to the second image,

presenting the first image on a presentation device,

performing the transition from the first image to the second image by calculating a manipulation of at least one of the first and the second images,

presenting at least one transition image on the presentation device, said transition image being created by the manipulation,

presenting the second image on the presentation device to complete the transition of presentation of the first image to presentation of the second image.

33. A device for creating an image-based digital representation of a scenery for visually presenting the scenery, said device comprising

means for obtaining a first and a second digital image, the first and the second image depicting different views of the scenery,

means for defining a first area of the first image and a second area of the second image, wherein the depictions of the first area substantially correspond to the depictions of the second area,

means for defining information of a transition between the first image and the second image, said transition information defining a manipulation of at least one of the first and the second images, said manipulation comprising a computation of at least one transition image, the transition image depicting a new view of the scenery depicted in the first and second images,

means for storing the first and the second images as two vertices in a graph of an image information storing structure and the defined transition information between the first and the second image as an edge binding together said two vertices in the graph of the image information storing structure.

34. The device according to claim 33, further comprising means for presenting an overview of the graph of the image information storing structure.

35. The device according to claim 33 or 34, further comprising means for defining correspondence points of the first and the second images for use in the manipulation.

36. The device according to claim 35, further comprising means for presenting guiding lines for the definition of correspondence points.

37. The device according to claim 35 or 36, further comprising means for presenting a magnified view of a part of an image, in which a correspondence point is to be defined.

38. The device according to claim 37, further comprising means for scaling down the obtained images in resolution.

39. The device according to claim 37, wherein the means for presenting a magnified view uses the obtained image, which is in high resolution.

40. The device according to any one of claims 33-39, further comprising means for presenting the defined transition.

41. The device according to claim 40, further comprising means for halting a presentation of the defined transition at an arbitrary point.

42. A method for creating an image-based digital representation of a scenery for visually presenting the scenery, said method comprising the steps of:

obtaining a first and a second digital image, the first and the second image depicting different views of the scenery,

defining a first area of the first image and a second area of the second image, wherein the depictions of the first area substantially correspond to the depictions of the second area,

defining information of a transition between the first image and the second image, said transition information defining a manipulation of at least one of the first and the second images, said manipulation comprising a computation of at least one transition image, the transition image depicting a new view of the scenery depicted in the first and second images,

storing the first and the second images as two vertices in a graph of an image information storing structure and the defined transition information between the first and the second image as an edge binding

together said two vertices in the graph of the image information storing structure.

43. The method according to claim 42, further comprising the step of presenting an overview of the graph of the image information storing structure.

44. The method according to claim 42 or 43, further comprising the step of defining correspondence points of the first and the second images for use in the manipulation.

45. The method according to claim 44, further comprising the step of presenting guiding lines for the definition of correspondence points.

46. The method according to claim 43 or 44, further comprising the step of presenting a magnified view of a part of an image, in which a correspondence point is to be defined.

47. The method according to any one of claims 42-46, further comprising the step of presenting the defined transition.

48. The method according to claim 47, further comprising the step of halting a presentation of the defined transition at an arbitrary point.

49. A computer program for creating an image-based digital representation of a scenery for visually presenting the scenery, said computer program comprising

code for obtaining a first and a second digital image, the first and the second image depicting different views of the scenery,

code for defining a first area of the first image and a second area of the second image, wherein the

depictions of the first area substantially correspond to the depictions of the second area,

code for defining information of a transition between the first image and the second image, said transition information defining a manipulation of at least one of the first and the second images, said manipulation comprising a computation of at least one transition image, the transition image depicting a new view of the scenery depicted in the first and second images,

code for storing the first and the second images as two vertices in a graph of an image information storing structure and the defined transition information between the first and the second image as an edge binding together said two vertices in the graph of the image information storing structure.

50. The computer program according to claim 49, further comprising code for presenting an overview of the graph of the image information storing structure.

51. The computer program according to claim 49 or 50, further comprising code for defining correspondence points of the first and the second images for use in the manipulation.

52. The computer program according to claim 51, further comprising code for presenting guiding lines for the definition of correspondence points.

53. The computer program according to claim 51 or 52, further comprising code for presenting a magnified view of a part of an image, in which a correspondence point is to be defined.

54. The computer program according to any one of claims 49-53, further comprising code for presenting the defined transition.

55. The computer program according to claim 54, further comprising code for halting a presentation of the defined transition at an arbitrary point.

FIG 1

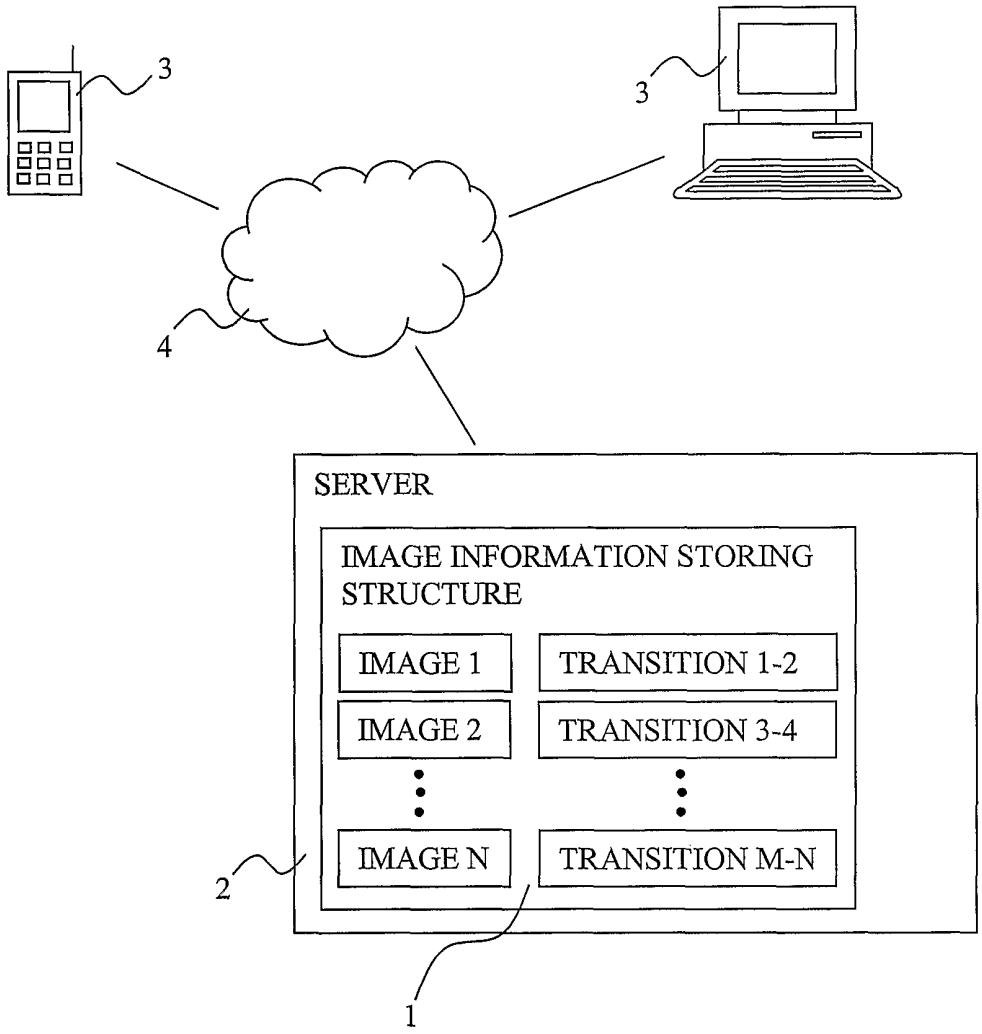

3
3
4
SERVER
IMAGE INFORMATION STORING STRUCTURE
IMAGE 1
TRANSITION 1-2
IMAGE 2
TRANSITION 3-4
IMAGE N
TRANSITION M-N
2
1

Fig 2

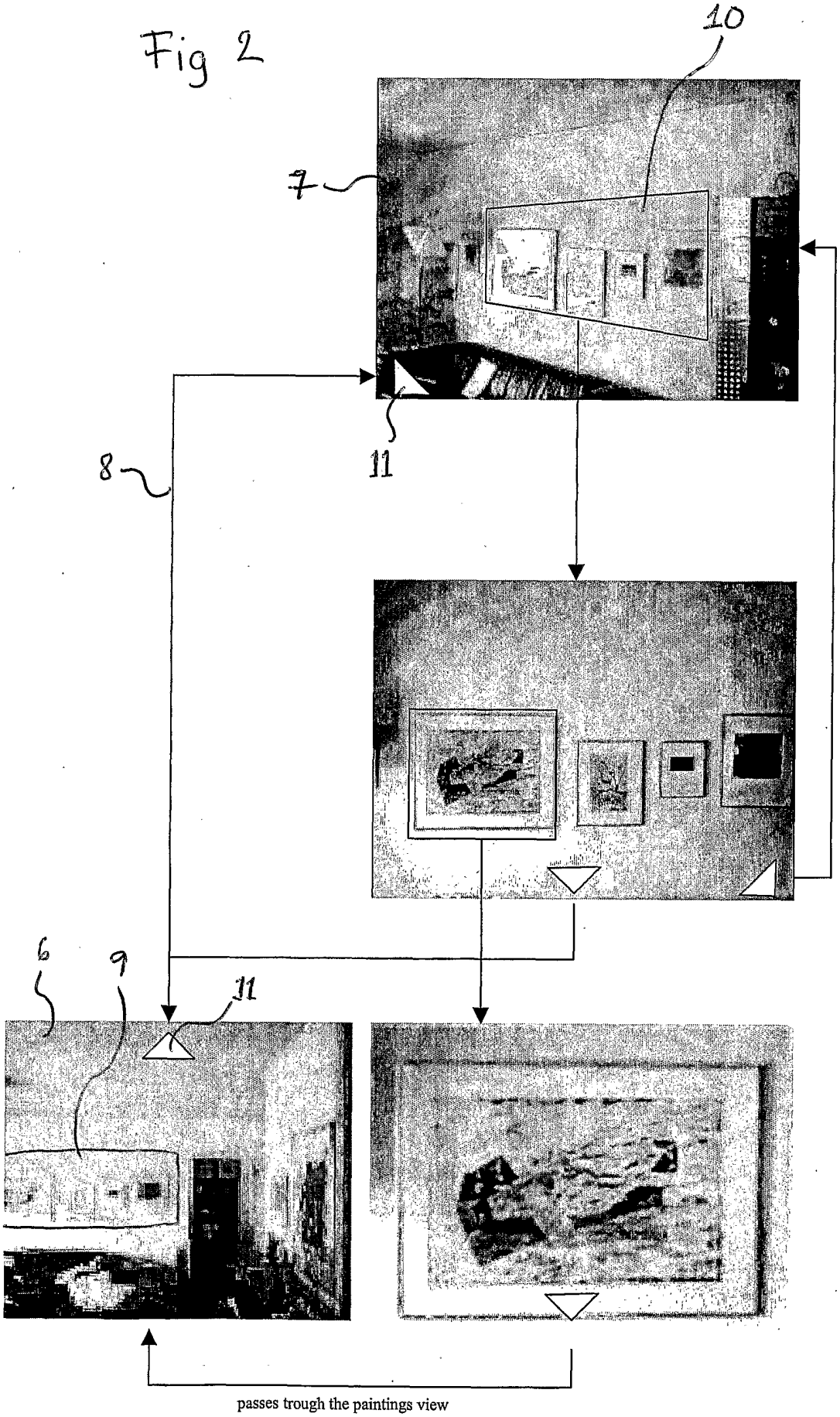


FIG 3

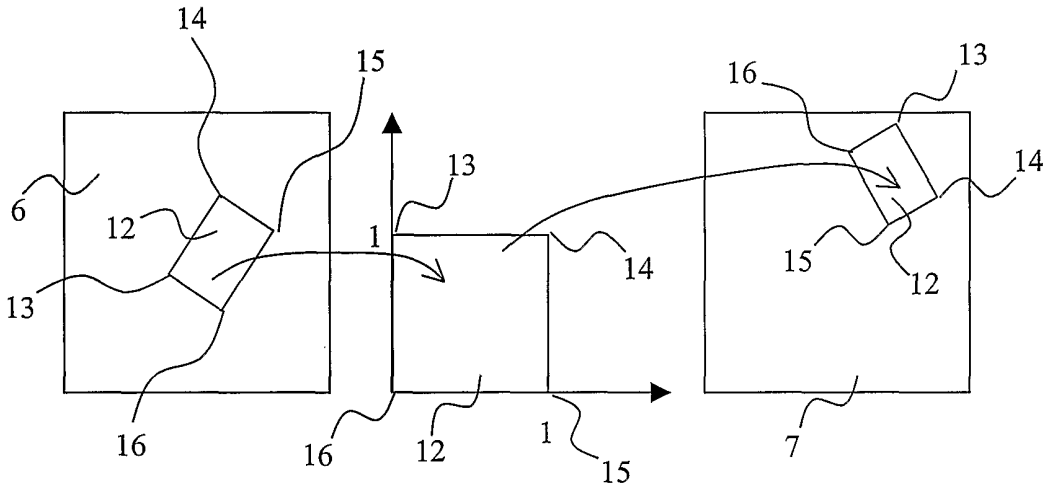


FIG 4

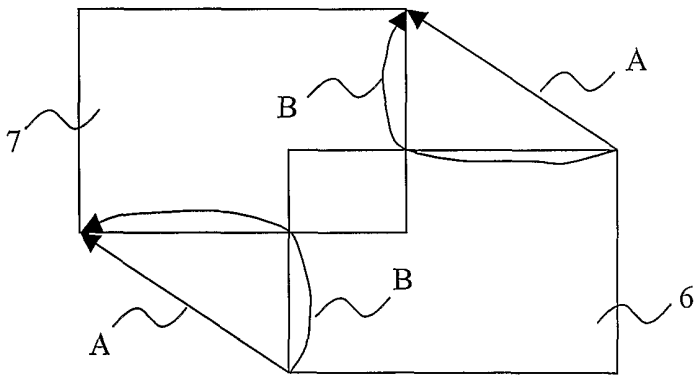


FIG 5

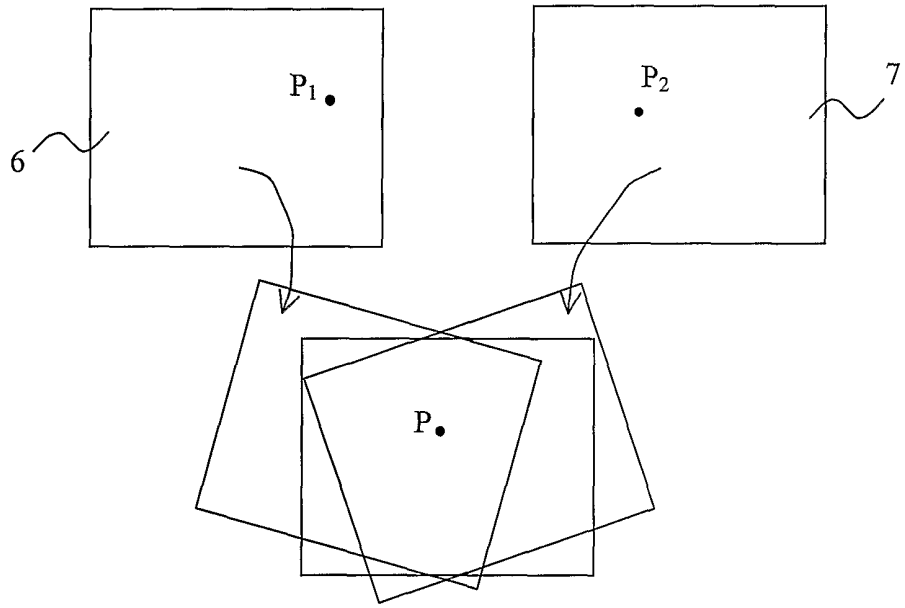


FIG 6

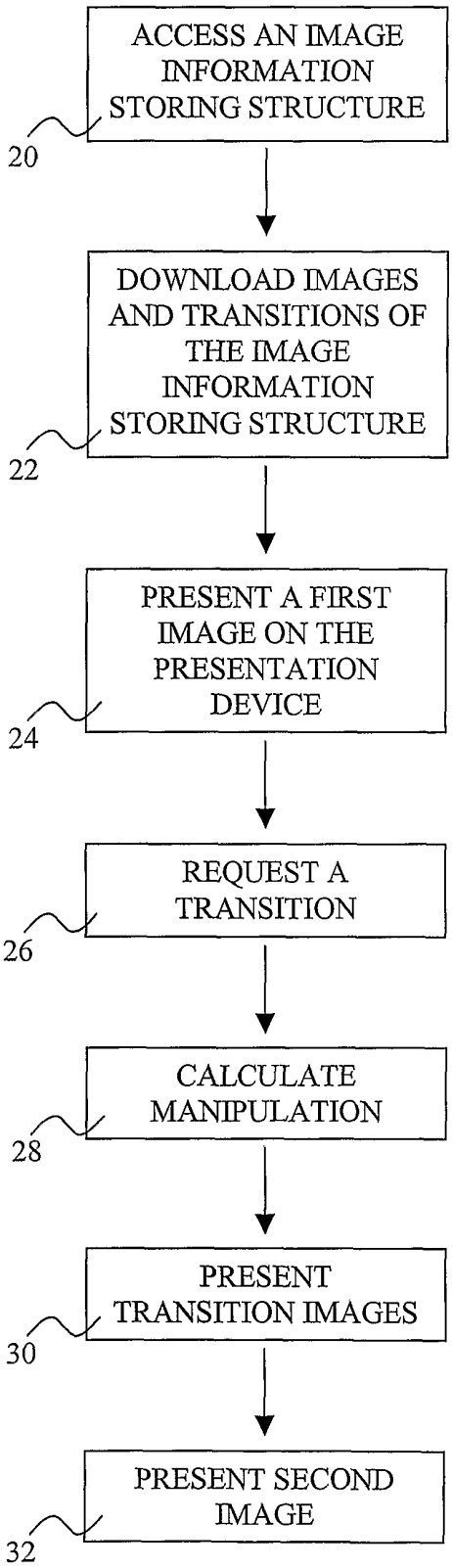

ACCESS AN IMAGE INFORMATION STORING STRUCTURE
20
DOWNLOAD IMAGES AND TRANSITIONS OF THE IMAGE INFORMATION STORING STRUCTURE
22
PRESENT A FIRST IMAGE ON THE PRESENTATION DEVICE
24
REQUEST A TRANSITION
26
CALCULATE MANIPULATION
28
PRESENT TRANSITION IMAGES
30
PRESENT SECOND IMAGE
32

FIG 7

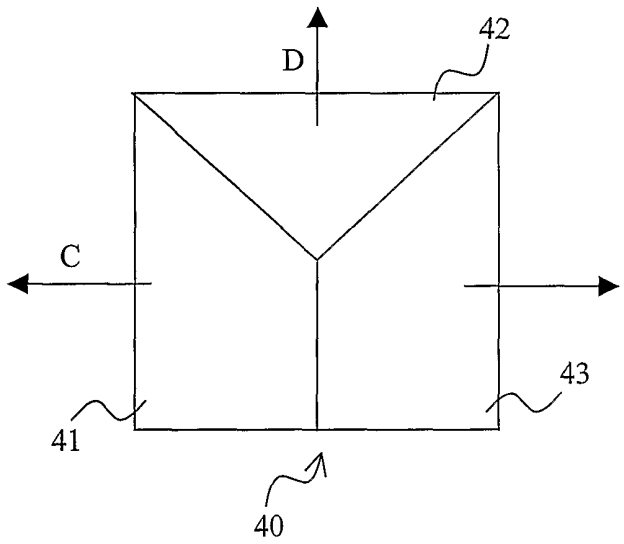


FIG 8

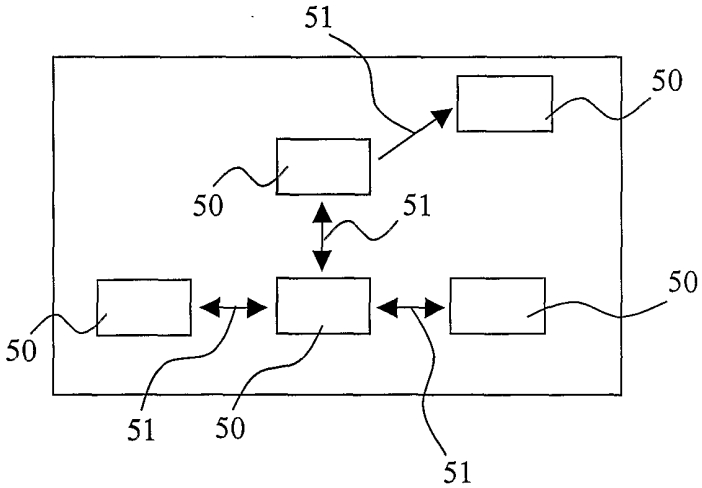
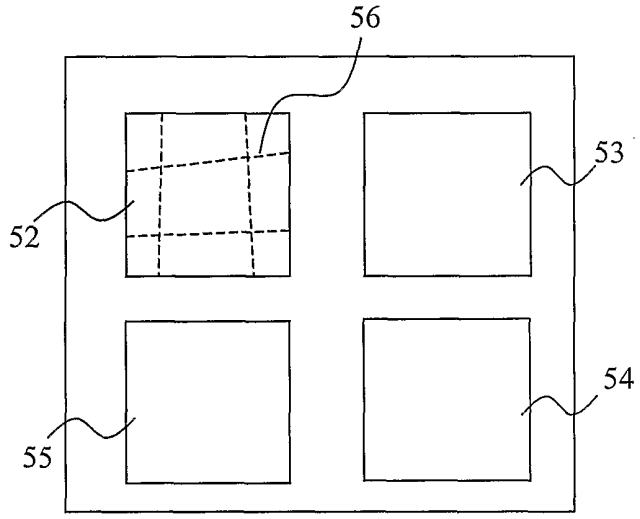


FIG 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/00097

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06T 3/20, G06T 13/00 // H 04 N 5/262, G 06 T 3/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06T, H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI DATA, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP11073522 A ((ERAK-I)ERA K)1999-03-16 (abstract). World Patent Index (online). London, U.K.:Derwent Publications, Ltd. (retrieved on 2002-06-17). Retrieved from: EPO WPI Database. DW199921, Accession No. 1999-250146 --	1-55
A	15th International Conference on Pattern Recognition, 2000., vol. 3, 2000, pages 139-142, Hang-Shin Cho et al: "An Efficient Walktrough from Two images using View Morphing and Spidery Mesh Interface", abstrat, figure 1 --	1-55
A	US 5917495 A (M. DOI ET AL.), 29 June 1999 (29.06.99), figure 1, abstract --	1-55

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 June 2002	24 -06- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Patrik Blidefalk/AE Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/00097

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Interlending & Document Supply, Volume 29, No 4, 2001, Graham P. Cornich, "The third dimension in documnet supply", page 158 - page 164, abstract ---	1-55
A	EP 0867690 A1 (NIPPON TELEGRAPH AND TELEPHONE CORPORATION), 30 Sept 1998 (30.09.98), figure 1, abstract ---	1-55
A	Computer, N. Talagala et al: "The Art of Massive Storage: A Web Image Archive", 11-11-2000, pages 22-28, see especially page 23, figure 1 --- --------	1-55

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 02/00097

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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EP 0867690 A1	30/09/98	CN 1203369 A	30/12/98
		JP 3225882 B	05/11/01
		JP 10267671 A	09/10/98
		US 6222583 B	24/04/01
		JP 3053172 B	19/06/00
		JP 11086035 A	30/03/99
		JP 3053169 B	19/06/00
		JP 11053583 A	26/02/99