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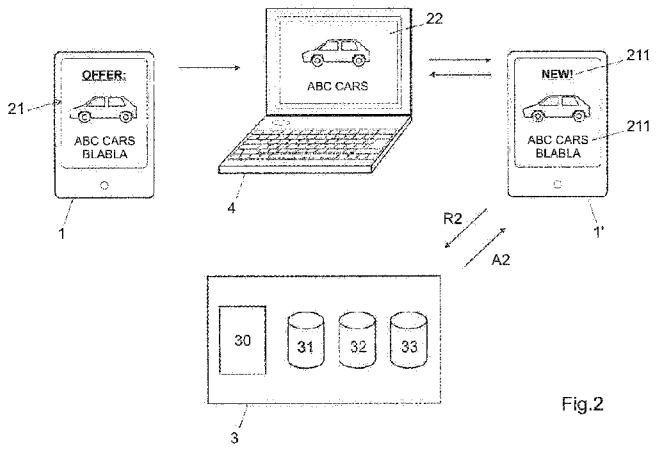

Fig.2

(57) Abstract: A method comprising: (a) an originating user captures an original image (2) with a mobile equipment (1); (b) the image (21) is displayed on the originating user's mobile equipment (1) with first annotations (210); (c) first data information (R1) including the time and the location of said mobile equipment together with an information that said first annotations has been displayed is sent to a server (3); (d) the originating user transmits the image to a second equipment (4) of at least one second user; (e) the image (22) is displayed on said second equipment; (f) second annotations (211) are displayed to said second user in combination with said image; (g) second data information (R2) including the time and the location of a equipment (1') of said second user together with an information that said second annotations (211) has been displayed is sent to the server (3); (h) said server (3) determines from said location and/or time whether said image is an original image captured by the originating user, or a transmitted image displayed to a second user.

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Image annotation method and system

[0001] The present invention relates to a method used in relation with display of reality augmented information on image.

[0002] WO2008032203 concerns a method where a user with a mobile equipment captures an image, for example the image of a point of interest. Features of the image are compared with source image to attempt recognition; the image is then tagged. Those tags are displayed to the user who can click or select a tag to get more information related to the keyword. The application further suggests sending the tags to a "visual search server". This document is thus related to automatic classification of images, but not to augmented reality where annotations are superimposed over recognized features of an image.

[0003] Tarumi H et al., in "Communication through virtual active objects overlaid onto the real world", Proceedings of the 3rd international conference on collaborative virtual environments, CVE2000, San Francisco, Sept 10-12, 2000, describe a system for creating and displaying virtual objects, called SpaceTags, that can be accessed only within a limited area and a limited time period. SpaceTags can be created by end-users and transmitted to the server. They can be associated with real-world objects and displayed as augmented reality annotations.

[0004] EP1246080 discloses a method of displaying augmented reality augmented information on static or video images. In one embodiment, names of mountains or other cartographic features are superimposed on a landscape view. In another embodiment, visitors in a painting exhibition can have additional information related to a selected painting displayed over a view of this painting captured with a mobile device. The augmented reality features of a view can comprise additional annotations, highlights, etc.

[0005] Augmented reality is also proposed by various companies for annotating advertisings, such as billboards or newspaper ads, and providing customers with additional contents related to this ad.

[0006] It is an aim of the present invention to provide a new method based on augmented reality.

[0007] The invention is based on the finding that more and more images are associated with an augmented reality content, i.e., annotations. It is likely that some of those images will be transmitted over various electronic channels, for example over emails, MMS, blogs, social networks and so on, to other recipients. For example, some users might want to transmit an image of a mountain, painting or advertising to other users.

[0008] If augmented reality becomes more ubiquitous, it is likely that at least some of those recipients will check if those images they receive are associated with augmented reality annotations. For example, some users will capture an image received in an email or otherwise, and associate this image with augmented reality content. The sender might even invite the recipient to do so when the augmented reality content is of particular interest.

[0009] In addition, more and more users will create augmented reality models for matching with subsequently captured images. Some of those augmented reality models will be private, others will be public and available to everyone and many will be shared or transmitted, for example over social networks, for allowing friends or related users to access additional content when they capture an image matching this model.

[0010] It has been found that for providers of augmented reality content it could be important to know whether the annotated view is an original view captured by the originating user, or a transmitted image of this view received by a recipient. It might also be important to know how and to whom an augmented reality model is shared.

[0011] A value-added content provider might have different reasons to need this information. For example, some providers might want to provide different annotations to the first originating user than to later viewers, who might even be prevented from accessing those annotations. If the annotated image corresponds to an advertising, the advertising company might charge a different fee for the first view than for subsequent ones, and/or want to prepare reports for showing the viral distribution of the image. In some situations, one might want to inform a user who captured and distributed an image that this image has been displayed and annotated by some recipients.

[0012] In the prior art, there is no easy and robust way for knowing whether the annotated view is an original view captured by the originating user, or a transmitted image of this view received by a recipient. In addition, there is no easy way for knowing whether an augmented reality model has been shared.

[0013] Therefore, according to one aspect of the invention, this information is made available with a method comprising:

(a) an originating user captures an original image with a mobile equipment;

(c) first data information including the time and the location of said mobile equipment is stored;

(d) the originating user shares said image with a second equipment of a second user, either as an image to annotate or as a model for annotating other images;

(e) an annotated image is displayed on said second equipment;

(g) second data information including the time and the location of said second equipment is stored.

[0014] Those various steps might be carried out in the alphabetical order of the above lettered list. Alternatively, those various steps might be carried out in a different, non-alphabetical order. Similar and identical steps are designated with the same letters throughout the document, where they are described with various levels of details.

[0015] The first and second data information might be stored centrally in a server, for example in a central database accessed by the equipments of all users. Alternatively, in a distributed system, the first and second data information might be stored in the user's equipments.

[0016] In one embodiment, users share images to annotate, using an otherwise available augmented reality model. The first and the second data information include time and location of the corresponding user's equipment when those transmitted images are displayed. Alternatively, the first and second data information include time and location of the corresponding user's equipment when those images are transmitted.

[0017] The method of this embodiment may also include:

(b) the original image is displayed on the originating user's mobile equipment with first annotations superimposed on the image and in relation with recognized features of the image;

(c) said first data information further includes an information that said first annotations has been displayed on the originating user's mobile equipment,

(d) the originating user shares said image as an image to annotate by transmitting said image to said second equipment;

(e) the image is displayed on said second equipment;

(f) second annotations are displayed to said second user in combination with said image;

(g) said second data information further include an information that said second annotations has been displayed to said second user, said second information being further sent to the server ;

(h) said server determines from the received location and/or time whether said image is an original image captured by the originating user, or a transmitted image displayed to a second user.

[0018] Time and location might not be sufficient to determine in all situations whether an image is an original or a transmitted image. Nevertheless, in many applications such as statistical analysis of campaigns, etc, a perfect accuracy is not required, and even a not always reliable

determination might be extremely useful. Other parameters, including for example embedded watermarks, could be used in addition to time and location when a higher reliability is needed.

[0019] In a further embodiment, users share augmented reality models that are later used by the recipients for annotating other images. The first and the second data information include time and location of user's equipments at the instant when the augmented reality models are shared. Accordingly, the method of this embodiment may include:

(b) said first data information include said time and location of said first mobile equipment when said image used as a model is shared by the originating user;

(f) second annotations are displayed to said second user, based on said model and superimposed on a further image;

(f') the second user shares said model with a third user;

(g) said second data information include said time and location of said second mobile equipment when said image used as a model is shared by the second user.

[0020] The present invention thus provides a method and system to keep track of shared images or shared augmented reality model, notably in an augmented reality social network. It then becomes possible to determine information about the distribution of a given shared augmented reality content as well as its modification.

[0021] In the present application, the expression "augmented reality model", or sometimes simply "model", designates a set of data required to recognize an image and play back the augmented reality content. An augmented reality model may comprise a 2D or 3D or plenoptic model of a scene, or a list of features identifying a scene and which can be matched with corresponding features in a captured image, as well as one or a plurality of annotations associated with one or several elements in this model.

[0022] According to an aspect of the present invention, there is provided a method for determining if an annotated view is an original view captured by an originating user, or a transmitted image of said view, received by a recipient, the method comprising the steps of:

(a) capturing an image of an element with a first mobile equipment;

(b) displaying the image on the first mobile equipment;

(c) annotating the image displayed on the firstmobile equipment with first annotations, wherein the first annotations are displayed on the image;

(d) sending first data information to a server,wherein the first data information includes the current time and the location of said firstmobile equipment together with an information that saidimage displayed on thefirst mobile equipment has been annotated with the first annotations;

(e) transmitting saidimage, from thefirst mobile equipment, to at least one other equipment;

(f) receiving the image at least in one other equipment and displaying said imageat least in one other equipment;

(g) annotating the image displayed at least in one other equipment with second annotations, wherein the second annotations are added to the image;

(h) sending second data information to a server, wherein the second data information includes the current time and the location of at least one other equipment,together with an information that the image displayed on said at least in one other equipment has been annotated with said second annotations;

(i) operating the server to determine from said current time and/or location of a respective equipment whether said image displayed on therespective equipment is an original image captured by said respective equipment or is an image transmitted to said respective equipment from another equipment.

[0023] According to an aspect of the present invention, a method is provided for retrieving from a database a time period and/or a location

associated with an augmented reality model, such as a reference image, and using this time period and/or location for determining whether an image matching said augmented reality model is an original image or a copy. The annotation of the image might depend on the result of this test.

[0024] According to one aspect, the possible location and/or time where an image can possibly be takenis known, for example in a server. In one example, the server could know a geographic area and time periods from which a day view of the north face of the Matterhorn can be taken. In the case of advertising billboards, the server could access a database to retrieve the location and/or planning of distribution of each image. In those situations, each originating image can be associated with a location, such as a punctual position or geographic area, from where the image can be captured. Each originating image could also be associated with a time, or series of time periods, during which the image can be taken. An image associated with a different location and/or time period is considered to be a copy of an originating initial view.

[0025] The invention will be better understood with a description of some possible embodiments illustrated with the following features:

Fig.1 schematically illustrates an access to augmented reality content by the originating user;

Fig. 2 schematically shows a second access to augmented reality content by a second user to which the initial image has been transmitted;

Fig. 3 schematically point ups a system for preparing and distributing value-added content for augmented reality application, in the exemplary case of an advertising application;

Fig. 4 schematically illustrates an augmented reality social network graph showing the viral distribution of an image or augmented reality model associated with augmented reality content;

Fig. 5 shows a table illustrating the information stored in a centralized database.

Fig. 6-8 showvarious tables illustrating the local information that might be stored in different user devices in a distributed system.

Fig. 9 shows a table illustrating the parent/child relation between two augmented reality models.

[0026] In this document, a "mobile device" or "mobile equipment" means a personal, portable device like a mobile phone, a mobile station, a PDA, a tablet, a smartphone equipped with or connected to a camera capable of communication over a network.

[0027] Figure 1 illustrates an access to augmented reality content by a first user. An originating user uses a mobile device to capture an initial image of a scene comprising at least one element 2 with one or more features to annotate. In this example, the element is anadvertising poster 2, for example a paper advertising poster, or an electronic advertising poster, or a billboardor digital signagesfor displaying static or animated adverting images. A digital signage includes a display and a local controller, the last having access to a server over a communications network or to a local data storage (such as a hard disk, a USB stick etc) for displaying visual content. The poster 2 may comprise one or more features 20 which can be annotated independently from each other, for example one or several elements of the image, one barcode or datamatrix, one logo, and so on.The user initiates a display of annotations (augmented reality content) on his mobile equipment 1, using for example a suitable software application executed in user's mobile equipment. In one embodiment, the application could be the PixLive application available on the iOS operating system. In one embodiment, the software application includes an imaging tool which enables a user to capture an image; in this case the image is captured directly using the tool in the application. The image could be a still picture or an animated figure.

[0028] In one embodiment, the application in the mobile equipment 1 sends a request R1 for annotation (additional content) to a remote server 3. The remote server 3 could be a single server connected to the Internet, a park of different interconnected machines, a virtual server in a cloud system, for example. The request R1 could be sent over the Internet. The request R1 preferably contains the static or video image to annotate, or at least some features allowing the remote server to identify a matching augmented reality model and determines a set of possible annotations.

[0029] In one embodiment, some parts of the remote server 3 can be located and operated directly on the mobile equipment 1. Especially the annotating module 30 and the model database 32 can be implemented on a smartphone in order to speed up the process of recognizing a reference image and augmentingits content.

[0030] In one embodiment, the remote server 3 comprises an augmented reality module using computer vision methods to analyse the content of the received image, to match it with a model such as a reference image 32 previously stored or otherwise made available to the server 3. The server further registers the captured image with the matching model, and uses an annotating module 30 to prepare an annotated image 21 to be send over message A1 and displayed by the mobile equipment,in which additional content, i.e., annotations (augmented reality elements), 210from a database 31 is added on or is in relation with the recognized features of the image. The annotations210 could comprise text, images, highlights, hyperlinks, audio, video, etc. The superimposed annotations could comprise text, images, highlights, hyperlinks, video, etc., displayed on top of a captured or received image.

[0031] In another embodiment, the matching of features of the captured image with reference features of the model, the registration, and/or the combination of the retrieved annotation with the image, is carried out at least in part by an augmented reality module in the user's mobile equipment 1 The augmented reality models maybe stored in a distributed way in the user's equipments, and shared between users for

instance by transmitting the models directly from one equipment to the next, or by downloading the models from a central storage in the server 3. In this case, the request R1 for annotation will be executed locally in the user's equipment.

[0032] The request R1 sent by the mobile equipment 1, or any subsequent request for annotation, includes the location of the mobile equipment 1 as determined by the mobile equipment itself, using for example a satellite geopositioning system such as a GPS module, and/or network location information previously transmitted by a cellular network, and/or the relative position of one or more beacons. This request R1 also, or alternatively, comprises the time at which the image has been captured and/or the time at which the model or the image to annotate has been sent or received by the user's mobile equipment. In one embodiment, time is not transmitted, and the server or software module in the user's equipment assumes that the request R1 was transmitted in real time after the capture of the image; in this case, the transmission of time is implicit.

[0033] The annotation on the image 21 can depend on said time and/or location. For example, the language of the annotations 210 could depend on the main language of the region where the recipient is currently located. Optionally, the mobile equipment 1 or remote server 3 may provide a means which enables a user to select in which language the annotations 210 should be displayed.

[0034] The server 3 preferably also contains a user right storing database 33 for determining which user or group of users can access to a particular annotation associated with a feature of an augmented reality model. Some content may depend on a previous subscription, or on a token, as will be described. Therefore, availability of annotations (annotating content) 31 depends on user rights in database 33.

[0035] On Figure 2, the user of the mobile equipment 1 uses a software module for sharing with a second equipment the original image, or for sharing with this second equipment an augmented reality model

corresponding to the original image. Using this module, the user of the mobile equipment distributes the initially captured image, or an augmented reality reference model to match with subsequent images, to a second equipment 4. In this particular example the second equipment is a laptop 4; however it will be understood that the second equipment may take any suitable form, for example it could be a PC or another mobile device such as a mobile phone or asmartphone. It will also be understood that themobile equipment 1 could distribute the initially captured image and/or the augmented reality model, to a plurality of other second equipments 4, either sequentially or simultaneously. The first user takes an initial image of an element (in this case the advertising poster 2) using the mobile equipment; the initial image is annotated in the manner described and illustrated in Figure 1, to provide an annotated view 20. The first user will be referred as the originating user, the recipient of an image previously captured or a model will be called the second user. In the example, the originating user sends the captured image (preferably without the annotations) from themobile equipment 1 to a second equipment i.e. a personal computer or laptop 4, of a second user, using for example e-mails, MMS, a blog, or an augmented reality social network such as Facebook, LinkedIn, Twitter, Google+, etc. An augmented reality social network is a network of augmented reality users sharing augmented reality models or captured images. As it will be seen, this augmented reality network could be represented by an augmented reality social network graph.

[0036] In one embodiment, the originating equipment captures the initial image andshares the initial image as captured, without any annotations. The not yet annotated transmitted image 22 is received by the second user and then displayed on the second user's equipment (i.e. laptop 4). Sharing the transmission of already annotated images could also be considered.

[0037] The second user can then capture an image of the image displayed on the laptop 4, using for example a secondmobile equipment 1' with a camera such as a mobile phone, a PDA, a tablet, a smartphone, etc. Alternatively, the laptop 4 may transmit the transmitted image 22 to the

second mobile equipment 1' e.g. over the internet. The image captured using the second mobile equipment 1', or sent to the second mobile equipment 1' from the laptop 4, canthen be annotated by a suitable application on the mobile equipment 1' of the receiving user, e.g. in a similar way to that described and illustrated in Figure 1.

[0038] In another embodiment, the laptop 4 of the receiving user can directly annotate the transmitted image 22 it receives. The annotation of the image is carried out by a suitable application in the laptop 4; in this case annotation is achieved without requiring a secondmobile equipment 1' to capture an image. The laptop 4 may capture or form a second image which is to be annotated from the transmitted image 22 it receives; in this case the second image is identical to the transmitted image 22 exceptthat the second image is in a form which is suitable to be annotated by a suitable program on the laptop 4.The second user can also forward or otherwise share the unannotated image, from the laptop 4, with at least one further friend.

[0039] If the second user uses the second mobile equipment 1' to annotate the image captured by the second mobile equipment 1', then the second mobile equipment 1' sends a second request R2 including second data information, from the second mobile equipment 1' to the server 3, in the same way that the first user sent the request R1 previously (as discussed with reference to Figure 1). The second request R2 contains the location of the second mobile equipment 1' and/or time at which the second mobile equipment captured an image of theimage displayed on the laptop 4. In a distributed system, this second request R2 might also be sent to any device in which the augmented reality model is available, including the second mobile equipment 1'.

[0040] The remote server 3, or a suitable application in the second mobile equipment 1', or in the laptop 4, prepares from the information received in request R2 an annotated image A2 to be displayed by the second mobile equipment 1', or provides information needed by this second mobile equipment 1' to prepare an annotated image.

[0041] In both scenarios, the remote server 3 verifies the information about location of the mobile equipments 1,1' and/or time received in request R1 and R2, and uses this information to determine whether the received imagesR1 and R2 respectively is an original image sent by the originating user, or a copy received from another user. For example, the remote server 3 could contain or have access to a database indicating the location from which each reference model 32 has been captured; so for example, if an image to be annotated by a first mobile equipment includes the Eifel Tower as a feature, and the location of the first mobile equipment is Switzerland, then the remote server 3 can conclude that the image is not an original image i.e. the image has been sent to the first mobile equipment from another equipment. If on the other hand the location of thefirst mobile equipment is Champ de Mars in Paris, France, then the remote server 3 can determine that the image is an original image.

[0042] As it has been already mentioned, the sharing of augmented reality models for matching with subsequently captured images could also be considered. In this case, an originating user of a mobile equipment 1 creates, retrieves or edits an augmented reality model, and shares it with other users, for example by transmitting this model directly to another user or by making this model stored in a database 32 in the server 3 available to other users.

[0043] In one embodiment, at least some augmented reality models in the database 32 are associated with a location. This location could be indicated as coordinates of a geographical point. In another embodiment, at least some locations correspond to a larger surface, for example a region indicated by a center and radius, or a cell or group of cells in a territory logically divided into cells, etc. The location could also correspond to a 3D volume. Any image of a particular feature taken from a location not associated with this feature will then be supposed to be a transmitted copy, and not an original from the originating user.

[0044] Some augmented reality models could also be associated with particular time periods. For example, advertising postersare usually only

displayed during limited time periods, and any image of a feature from this poster transmitted after this period is supposed to be a copy. Other features might be associated with time of the day (such as a day or a night view), periods of the year (such as a snowy mountain),or other periods or sets of periods where it is possible or not possible to capture them.A feature transmitted outside of a possible period (for example an image of snowy mountains in summer, or an image of an advertising poster during a period where theadvertising campaignfor the particular advertised product is no longer running) will then be supposed to be a copy.

[0045] Other information received by the server 3 could be used to distinguish between an initial image and a view from a copy. For example, the server 3 could analyse the quality of the image, its colour, the size of pixels, possible deformations (maybe caused by reproduction on a monitor), the luminosity, and so on, to determine that the image is not an original but more likely a copy such as a screen copy. Furthermore, as it will be described, the server could analyse watermarks or any hidden mark added between the original display of the image and a later display of the image by a different equipment, in order to distinguish an original image from a copy.

[0046] Fig. 3 schematically illustrates a system for preparing and distributing value-added content for augmented reality use cases, in the case of an advertising application. Elements which are identical or have a similar function tocorresponding elementsare shown in Figure 1, theyhave the same reference numbers. The system illustrated on Figure 3 comprises a product or a service provider 7 who wants to promote a product or a service; for example it is a marketing agency responsible for preparing a marketing campaign using a poster advertising company 9 for preparing a poster campaign resulting in the display of advertising posters 2 at some predefined locations and during a predefined time of period. The locations and time periods associated with each poster is stored in a database 90 administrated and/or operated by the poster advertising company 9.For example, the database 90 could store a data record indicating an exact location, or a 2D area such as a cell, or a 3D volume, from which each

particular feature could be seen and captured, as well as a time period, or a set of time periods, or repetitive time periods, during which a particular feature can be seen. In the example of poster advertising, the database 90 can for example indicate the location of each individual poster 2, and the schedule of thetime period of which each individual poster 2 will be presented at a location. In one embodiment, one or a plurality of locations is associated with one feature, for example when one poster is simultaneously displayed at a plurality of locations on a plurality of digital signages. In one embodiment, the location of a poster is not geographically fixed but is associated with the trajectory of a vehicle like a bus, a train, etc.

[0047] Annotations and other added-value content for annotating the images are stored by the poster advertising company 9 and/or by the marketing agency 8 in an annotationdatabase 31 accessible by the server 3. Regular users of mobile equipments1, 1' can also add annotations to the database 31.

[0048] Augmented reality models are stored by the poster advertising company 9 and/or by the marketing agency 8 and/or by other users in a database 32. These reference features are matched by the server 3 with later captured images in order to annotate those images.

[0049] Figure 4 shows an example of an augmented reality social network graph illustrating a possible viral distribution of an image associated with annotations. The illustrated graph comprises nodes A to F corresponding to augmented reality users, and arcs between those nodes corresponding to various possible channels used to share an augmented reality model or an image to annotate between users. The node A is a root, i.e., a node of the network which first generates a new augmented reality model either by creating it or modifying it.

[0050] This graph may be described by and reconstructed with the following information:

- Augmented reality model ID
  Identification of the shared model.

- Augmented reality image ID
  Identification of the shared image to annotate.

- Sender ID
  Device unique identification of the augmented reality user sending a model or an image to annotate.

- Recipient ID
  Device unique identification of the augmented reality user receiving a model or an image to annotate.

- Time stamp
  Date and time at which the augmented reality model or image to annotate is sent.

- Location
  User location, ad determined with a GPS; cellular localization system etc, at the moment of sharing or receiving an augmented reality model or an image to annotate.

- Sharing channel
  Channel used to share the augmented reality model or image to annotate between two users. Example of channels could include e-mail, SMS, MMS, Facebook, Twitter, blogs, etc.

- Comments or feedbacks
  Users comments or feedbacks attached to a shared model or to an image to annotate.

[0051] An initial image 2 having features 20 associated with annotations is captured by a mobile equipment 1 of the user at the root A of the network, and then virally distributed to other users over various channels, such as e-mails, blogs, social networks such as Facebook, Twitter, etc. This image may be an original image, or a copy from another source. Each user can further distribute the image to other users, who can annotate the received image with their mobile equipment. Since the central server 3 (Figs. 1 – 3) is informed on each time a request R1, R2 for annotations is received, it can follow the distribution of the image between users, and for example calculate how many users see and annotate each image initially captured by the originating user 1. This information can be used for example for invoicing this annotation to the advertising company 7 or the marketing agency 8, or for controlling the distribution of the image. A report can be prepared by the reporting module 34 and displayed in order to show how an image (either an original or already a copy) associated with augmented reality annotations is virally widespread, making use of a multiplication effect.

[0052] In one embodiment, the image is transmitted from one equipment to the next using a variety of channels and various type of messages, such as MMS, e-mails, contributions to blogs or social networks, etc. In this case, an applicationexecuted in the user's mobile equipment may be configured to inform the central server 3 about the channel used for further distribution of the image (e.g. whether the image was forwarded using and SMS,MMS or e-mail etc.); this will enable an even more detailed report to be prepared, showing the channel/application used by each user for sending image, as well as the transmission time and date.

[0053] In one embodiment, the application used for transmitting the image from one equipment to the next one also modifies the image, for example by adding or modifying a code such as a barcode, a datamatrix or a watermark. This additional information could be used as a further indication that the transmitted image is not an original one from the view, but was transmitted by another user. It can also be used for tracking the distribution of image from one user to the next, and contain additional

information about the viral distribution which can be transmitted and used by the central server 3. Furthermore, the annotation and augmented reality content might depend on this additional information or watermark, so that different users will receive different annotations depending on the watermark or other code associated with their image.

[0054] Certain features may have a token associated with them; for example a poster may have a token associated with it. Each time a user forwards an image which illustrates the poster, the user will be awarded with a token. The token may be part of the token scheme, whereby the user is awarded when they have collected a predetermined number of tokens. This feature is particularly advantageous for adverting as it enables advertising to reach otherwise unreachable markets; for example if a poster advertising campaign for a particular productis limited to the USA, each posterhaving a token associated with it;then a user located in New York may capture an image of one of the posters and send the image to any many other users as possible. The user is motivated to distribute the image to as many users as possible as each time the user sends the image they gain a token. The user may send the image to users which are located outside the USA thus reaching markets which the poster advertising campaign would otherwise not reach. The users who received the image may in turn forward the image they received to other users, and doing this they are also awarded with a token. Once the users have gained a predetermined number of tokens they may cash-in the tokens to receive an award e.g. a new application for their mobile equipment. The reward can be based on the level of the user in the sharing network; a user at the root, or close to the root, may for instance receive a greater reward than another user deeper in the hierarchy or less close to the root.

[0055] Additionally or alternatively, eachfeature may have a code such as a verification token associated with them, which is used by said server to verify whether an annotation of that feature can be displayed or not. For example, if the feature is a painting in an art gallery whichhas a token associated with it, the token allows the server to provide annotations for an original image of the painting, but prevents the server from providing

annotations for images of the paintings which are not original images i.e. images received from another user. This will ensure that only those who have paid an entry to the gallery will be entitled to an annotated image of the painting. Token may be distributed for example as part of a fidelity program, or to friends or fans of a particular page or user of a social network. In this way, a user can dynamically distribute tokens to his friends in a social network, and use this token to control and limit the access to annotating content. In another embodiment, a token, or user rights, can be sold and bought in order to make the access of annotations (additional content) subject to a fee. The code or verification is thus available to a closed group of users. The code or token can also be transmitted by the first user to the second user and to subsequent users.

[0056] As it is already mentioned, users might share augmented reality models, instead or in addition to the sharing of images to annotate. In this case, a graph similar to the one illustrated on Figure 4 might be used for tracking the propagation of an augmented reality modelbetween the users. This might give information on how successful a marketing campaign is.By having a closer look at the different paths of the graph, we can precisely determine the history of the AR model throughout the network and extract useful insights such as whether the model has been modified or from where and using which channels people were sharing it.

[0057] The time associated with a branch of the graph, might be for example the time (and date) at which the model was shared. Alternatively, the graph might indicate the time (and date) at which the shared model is actually used by the recipient.

[0058] The obtained graph information is particularly relevant to augmented reality content providers regarding different market such as Media, Advertisement or Technical Documentation. This information can indeed be used to choose the augmented reality content to be sent for a certain user. The provided augmented reality content might be tailored differently for distinct users. This selection can for instance be based on the augmented reality model history in the graph: for example, users looking

at an advertisement may get more and more discounts the more they share an augmented reality model which is in turn further shared. It becomes a powerful and controllable marketing tool to create viral advertisement. Similar examples may use location, time, sharing channel or other available information to create the viral marketing.

[0059] Another application concerns community sharing. For instance, tourists visiting a new city might use augmented reality as an interactive guide. While capturing images of historical buildings with their mobile equipments, the visitors obtain additional information as augmented reality annotations superimposed on the image. Visitors wanting to shareinformation about particular parts of the building could add it directly in the augmented reality model of the building. In this way, when subsequent visitorscapture an image of the same building, they would be able to access this additional content as annotations superimposed on the image.

[0060] For all embodiments (sharing of images to annotate, or sharing of augmented reality models), two architectures designs might be considered: centralized or distributed. In a centralized system, the augmented reality model database 32 and the annotation database 31 are centrally stored in a central server 3 and common to all users of the system. It therefore ensures a complete database representation for all users. A distributed system on the other hand stores augmented reality models and annotationsin the user's equipments 1, 1'; a centralized server might be available or not.

[0061] Figure 5 is an example of table corresponding to the graph of Figure 4 and showing how a description of the graph might be stored in a centralized database, and updated for example every time an augmented reality model or an image to annotate is shared or displayed. From the database information, it is possible to reconstruct the corresponding complete network graph.

[0062] In this case, in a centralized architecture, each time a model is shared witha recipient, a notification to download the model data from the centralized server 3 might be sent to this recipient. This way, we avoid sending the model each time the model is shared.

[0063] Figures 6-8 shows examples of tables corresponding to the graph of Figure 4 and showing how a description of the graph might be stored in a distributed system.In a distributed system, the database containing the graph information is stored on the user's equipments, without the need of a centralized server. A typical distributed architecture might be based on a peer-to-peer network, in which each node acts as a client or a server for the other nodes in order to transfer data. It implies that each time an augmented reality model or image is shared between two users, a direct connection is established between them for the augmented reality model to be transfered. A version of the database is stored on different user's equipments and updated every time a connection is set up with that user. The updated database of the two connected users is composed of the union of the entries stored in their local database.

[0064] A distributed system ensures that each user is aware of the history of the relevant augmented reality models or images he received. Figure 6, 7 and 8, respectively, depict the local information stored for user A, B and F, respectively, in the network of Figure 4. From the distributed databases, it is possible for a user to determine the history of each received augmented reality model.

[0065] A user who receives a model can choose to further forward it to other users or edit it. The augmented reality model edition can imply changing the annotations or modifying the reference image. It leads to the attribution of a new augmented reality model ID.

[0066] In a similar way, a user who receives an image to annotate can choose to further forward it to other users or edit it. The augmented realityimage edition can imply modifying the reference image. It leads to the attribution of a new augmented reality image ID.

[0067] The modification of a model, respectively image,is similar to the creation of a new augmented reality model, respectively image. The main difference resides in the fact that the original augmented reality model ID,respectively augmented reality image ID (i.e. before edition), is saved. It then becomes possible to reconstruct the parent/child relation between augmented reality models/images. This relation is stored in another table of the database (either centralized or distributed), as represented in Figure 9, which contains a parent model ID and its child model ID. Except from that new entry, all other information generated upon edition of an augmented reality model, respectively image, is the same as if the model/image were newly created.

[0068] A mechanism can also be implemented in the system to notify users about an updated model. Users can then update their model and see the modifications. It opens doors to community sharing and feedback loops between users. It means that a group of users can keep sharing and editing a same augmented reality model while being able to keep track of updated and old versions. Options to notify or filter out some users only may be available for confidentiality or privacy purposes. In this way, the idea of source control systems, which is known in other fields, is applied to augmented reality models.

[0069] The various operations of methods described above may be performed by any suitable means capable of performing the operations, such as various hardware and/or software component(s), circuits, and/or module(s). Generally, any operations described in the application may be performed by corresponding functional means capable of performing the operations. The various means, logical blocks, and modules may include various hardware and/or software component(s) and/or module(s), including, but not limited to a circuit, an application specific integrated circuit (ASIC), or a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array signal (FPGA) or other programmable logic device (PLD), discrete gate or transistor logic, discrete hardware components or any combination thereof designed to perform the functions

described herein. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any commercially available processor, controller, microcontroller or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration. A server may be implemented as a single machine, as a set of machine, as a virtual server, or as a cloud server.

[0070] As used herein, the term "annotation" encompasses a wide variety of possible elements, including for example text, still images, video images, logos, image layers, sounds and/or other elements that could be superimposed or otherwise added to an image.

[0071] As used herein, the term "determining" encompasses a wide variety of actions. For example, "determining" may include calculating, computing, processing, deriving, investigating, looking up (e.g., looking up in a table, a database or another data structure), ascertaining, estimating and the like. Also, "determining" may include receiving (e.g., receiving information), accessing (e.g., accessing data in a memory) and the like. Also, "determining" may include resolving, selecting, choosing, establishing and the like.

[0072] The steps of a method or algorithm described in connection with the present disclosure may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in any form of storage medium that is known in the art. Some examples of storage media that may be used include random access memory (RAM), read only memory (ROM), flash memory, EPROM memory, EEPROM memory, registers, a hard disk, a removable disk, a CD-ROM and so forth. A software module may comprise a single instruction, or many instructions, and may be distributed over several different code segments, among different programs, and across multiple storage media. A software module may consist of an executable program, a portion or routine or library used in a complete program, a plurality of

interconnected programs, an "apps" executed by many smartphones, tablets or computers, a widget, a Flash application, a portion of HTML code, etc. A storage medium may be coupled to a processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. A database may be implemented as any structured collection of data, including a SQL database, a set of XML documents, a semantic database, or a set of information available over an IP network, or any other suitable structure.

[0073] Thus, certain aspects may comprise a computer program product for performing the operations presented herein. For example, such a computer program product may comprise a computer readable medium having instructions stored (and/or encoded) thereon, the instructions being executable by one or more processors to perform the operations described herein. For certain aspects, the computer program product may include packaging material.

[0074] It is to be understood that the claims are not limited to the precise configuration and components illustrated above. Various modifications, changes and variations may be made in the arrangement, operation and details of the methods and apparatus described above without departing from the scope of the claims.

Claims

1. A method comprising:

(a) an originating user captures an original image (21) with a first mobile equipment (1);

(c) first data information (R1) including the time and the location of said first mobile equipment (1) is stored;

(d) the originating user shares said image, or an augmented reality model corresponding to said image, with the user of a second equipment (4);

(e) an annotated image is displayed on said second equipment (1');

(g) second data information (R2) including the time and the location of said second equipment (1') is stored.

2. The method of claim 1, wherein:

(b) the original image (21) is displayed on the originating user's mobile equipment (1) with first annotations (210) superimposed on the image and in relation with recognized features of the image;

(c) said first data information (R1) further include an information that said first annotations has been displayed, said first data information (R1) being sent to a server (3) where it is stored;

(d) the originating user shares said image as an image to annotate by transmitting said image to said second equipment (4);

(e) said transmitted image (22) is displayed on said second equipment;

(f) second annotations (211) are displayed to said second user in combination with said transmitted image;

(g) said second data information (R2) further includes an information that said second annotations has been displayed, said second information being further sent to the server (3);

(h) said server (3) determines from said location and/or time whether said image is an original image captured by the originating user, or a transmitted image displayed to a second user.

3. The method of claim 2, wherein said second user captures said image displayed on a second equipment with a second mobile equipment (1') comprising a camera, and wherein said display of second annotations (211) initiated by said second user is carried out by said second mobile equipment.

4. The method of one of the claim 1 to 3, wherein the first annotations (210) which are associated with the original, initially captured image are different from the second annotations (211) which are associated with any subsequent transmitted image.

5. The method of claim 1, whereinthe originating user shares an augmented reality model corresponding to said image, with the user of a second equipment, and wherein:

(b) said first data information (R1) include said time and location of said first mobile equipment (1) when said image used as a model is shared by the originating user;

(f) second annotations (211) are displayed to said second user, based on said model and superimposed on a further image;

(f') the second user shares said model with a third user;

(g) said second data information (R2) include said time and location of said second mobile equipment when said image used as a model is shared by the second user.

6. The method of one of the claims 1 to 5, wherein said first and second data information is stored in a central server (3) and made accessible to said first mobile equipment (1) and to said second equipment (1', 4).

7. The method of one of the claims 1 to 6, wherein said first and second data information is stored in a distributed way in said user's equipments.

8. The method of one of the claims 1 to 7, wherein said annotations (210, 211) depend on said location in said data information so,

that different annotationsare superimposed onto a same image if said location is different.

9. The method of one of the claims 1 to 8, wherein said annotations (210, 211) depend on said time in said data information, so that different annotation are superimposed onto a same image if said time is different.

10. The method of one of the claims 1 to 9, further comprising:
a code which is associated with said image;
said annotations (210, 211) are only displayed if said code is available to said first respectively second user.

11. The method of claim 10, wherein said code is only made available to a closed group of users.

12. The method of one of the claims 10or 11, wherein said code is transmitted by said first user to said second user.

13. The method of one of the claims 10to 12, wherein said code is transmitted by a user over a social network.

14. The method of one of the claims 10to 13, wherein said code is made available to all fans of a particular page of a social network.

15. The method of one of the claims 1 to 14, further comprising:
embedding a watermark in said image;
including in said data information sent to said server (3) information depending on said watermark.

16. The method of claim 15, further comprising:
modifying said watermark for transmission of said image to a different user.

17. The method of claim 16, wherein said server determines from said information depending on said watermark whether said image is an original image captured by the originating user, or a transmitted image displayed to a second user.

18. The method of one of the claims 1 to 17, wherein said image is an image of an advertising (2), wherein said server (3) compares said time and/or location with known time and/or location of presentation of said advertising to determine whether said annotations have been associated with an original image captured by the originating user, or with a transmitted image displayed to a second user.

19. The method of one of the claims 1 to 18, further comprising associating each said image with a geographic area, and determining that said image is a transmitted image if said location of said second equipment (1') is outside of said geographic area.

20. The method of claim 5, further comprising a step where a user edits a received augmented reality model, resulting into a new augmented reality model, and storing the relationship between the received augmented reality model and the edited augmented reality model.

21. A method carried out by a server (3) and comprising:

(i) receiving in said server first data information (R1) including the time and the location of a mobile equipment (1) together with an information where first annotations(210) have been displayed or that an augmented reality model has been shared;

(ii) receiving in said server (3) second data information (R2) including the time and the location of a second equipment together with an information where second annotations(211) have been displayed by said second equipment or that the augmented reality model has been made available to said second equipment.

22. The method of claim 21, further comprising a step of determining from said location and/or time whether said annotations (210,

211) have been associated with an original image captured by the originating user, or with a transmitted image displayed to a second user.

23. The method of claim 22, wherein said image is an image of an advertising (2), wherein said server (3) compares said time and/or location with known time and/or location of presentation of said advertising to determine whether saidannotations (210, 211) have been associated with an original image captured by the originating user, or with a transmitted image displayed to a second user.

24. The method of one of the claims 21 to 23, wherein said server (3) determines from a watermark embedded in said image whether said image is an original image captured by the originating user, or a transmitted image displayed to a second user.

25. The method of one of the claims 21 to 24, wherein said server verifies a token and determine from said token whether said annotationscan be displayed or not.

26. A computer program product, stored on a non-transitory media support and comprising instructions causing at least one data processor to execute the steps of the method according to one of the claims 1 to 25.

27. A system, comprising:

- a first mobile equipment (1) comprising a camera suitable for capturing an original image, and a display for displaying said image;
- an augmented reality module for retrieving and superimposing annotations on top of said image;
- a second equipment (4) comprising a display;
- a software module arranged for sharing with said second equipment said original image, or for sharing with said second equipment an augmented reality model corresponding to said original image;
- a store storing first data information (R1) including the time and the location of said first mobile equipment (1) and the time and

location of said second mobile equipment when said image is displayed or when said image or said model is shared.

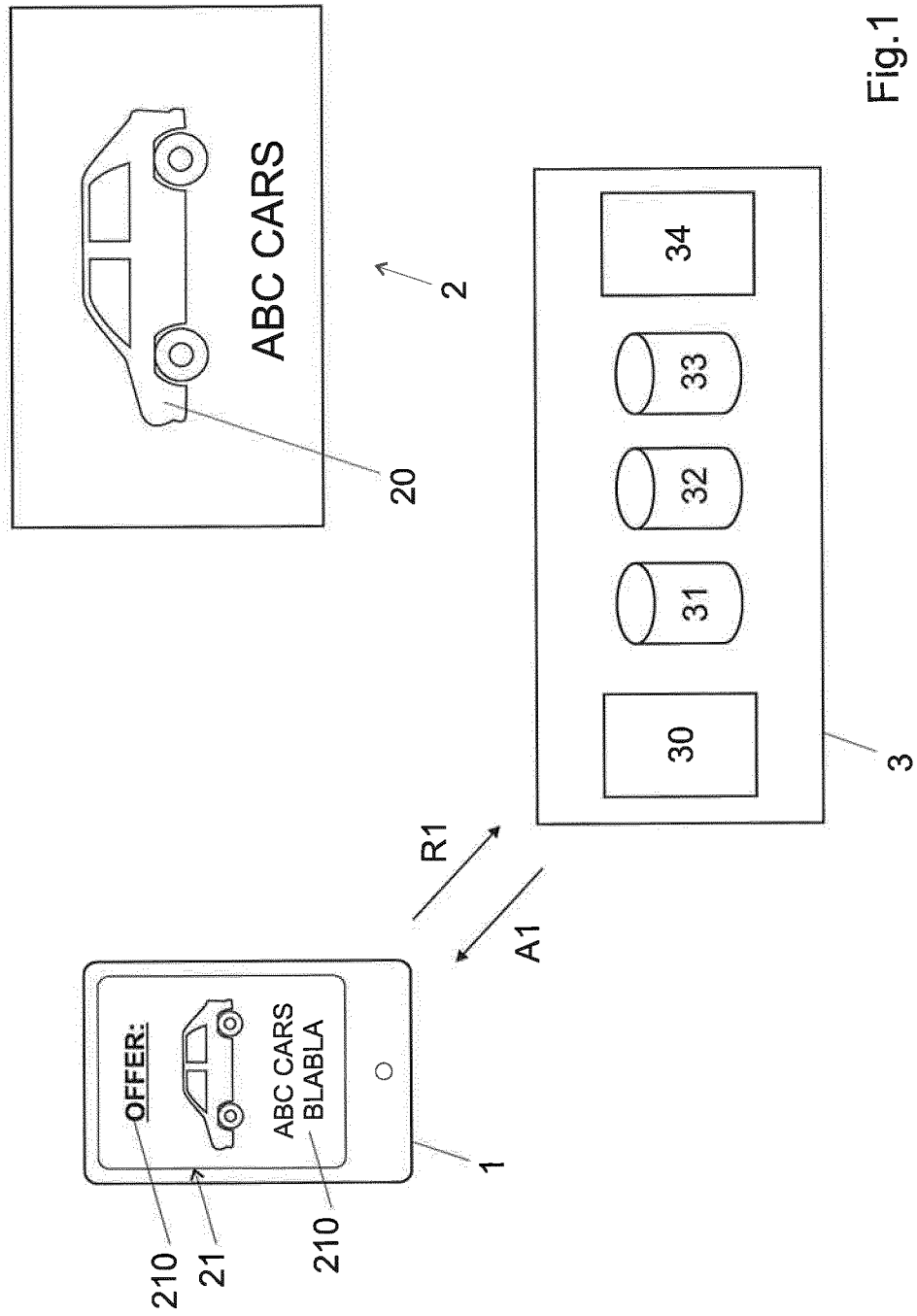
ABC CARS
20
2
34
33
32
31
30
3
R1
A1
OFFER:
ABC CARS
BLABLA
1
210
21
210

Fig.1

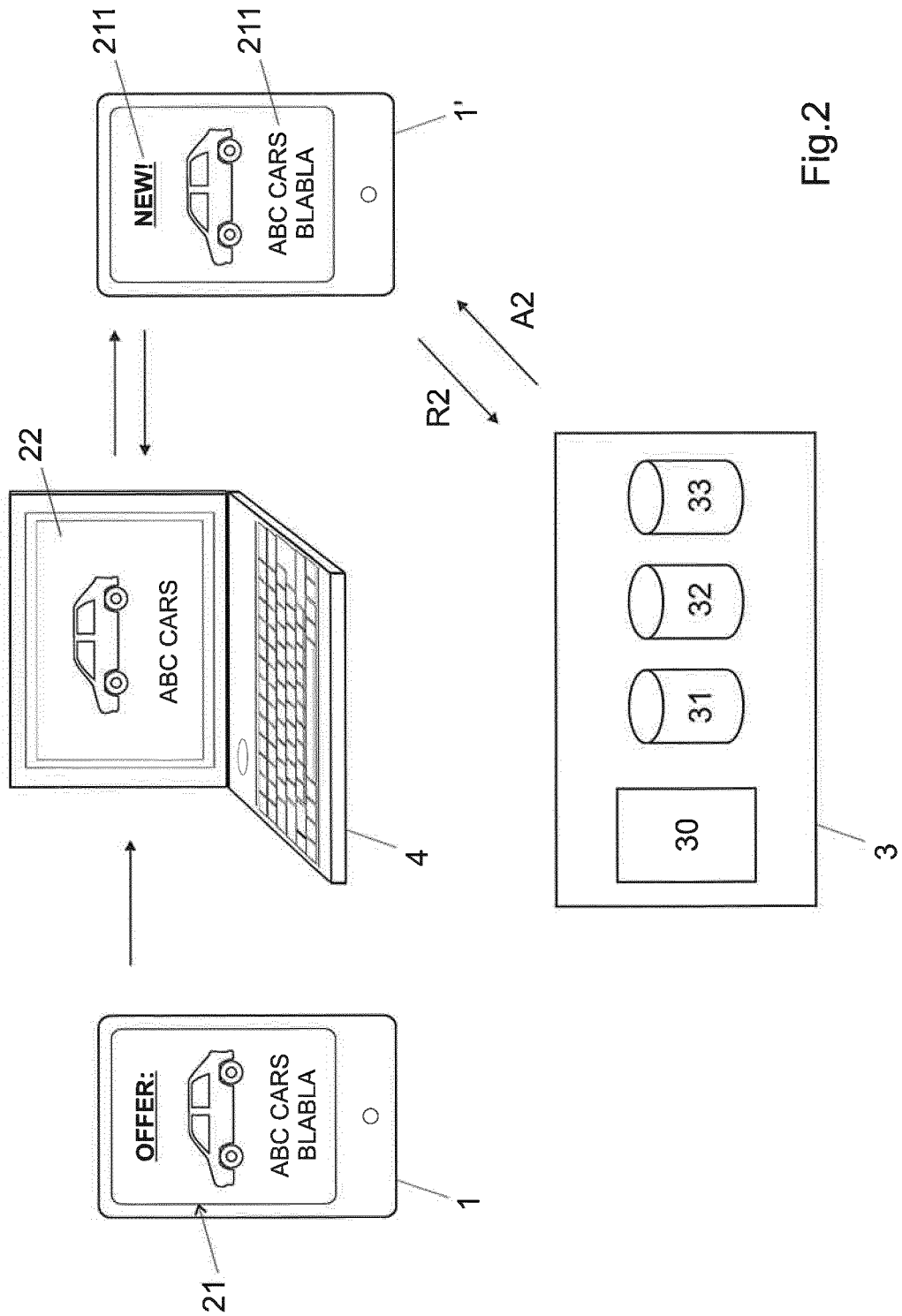
211
211
NEW!
ABC CARS
BLABLA
1'
A2
R2
22
ABC CARS
4
33
32
31
30
3
OFFER:
ABC CARS
BLABLA
1
21

Fig.2

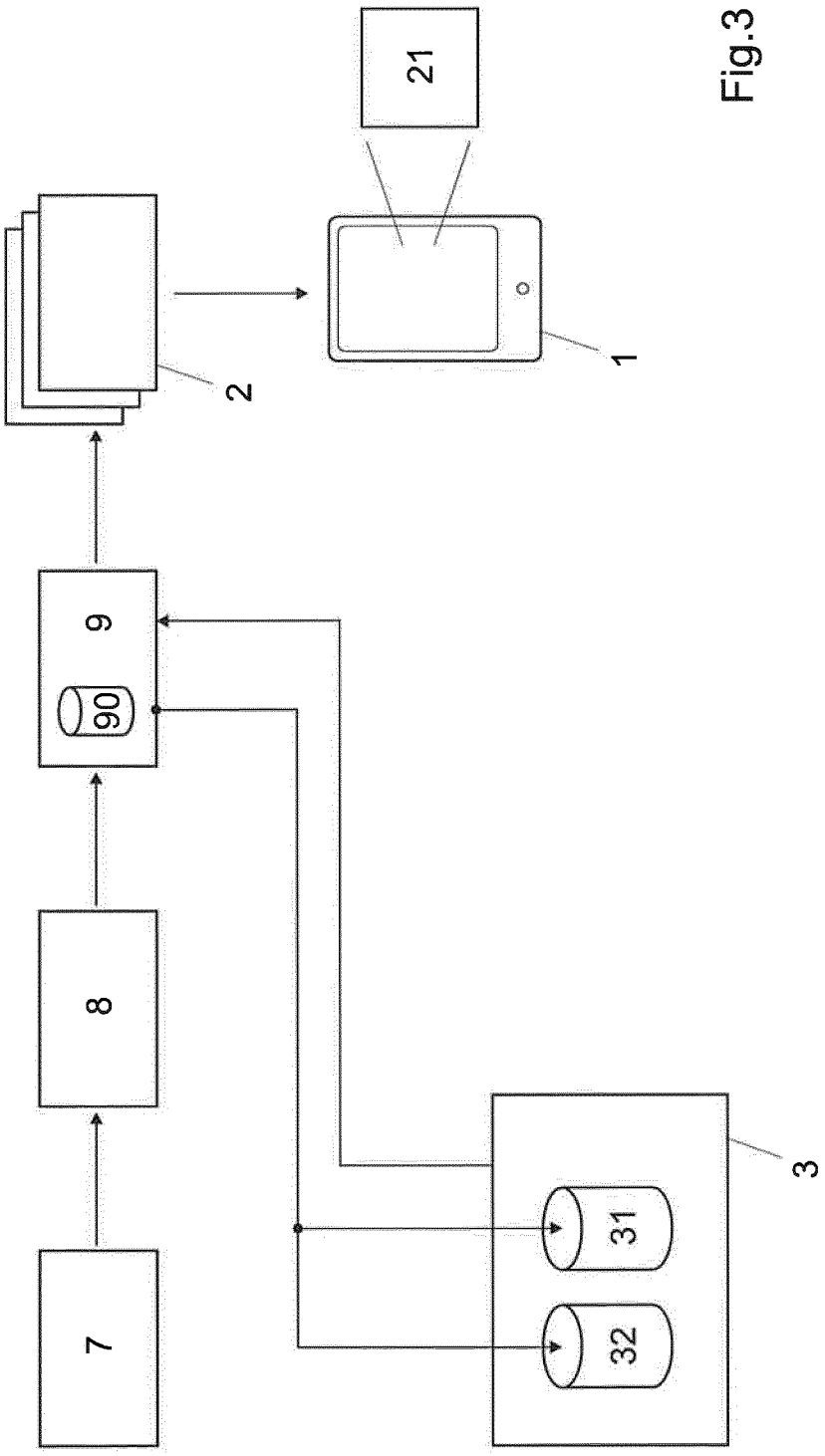

Fig.3

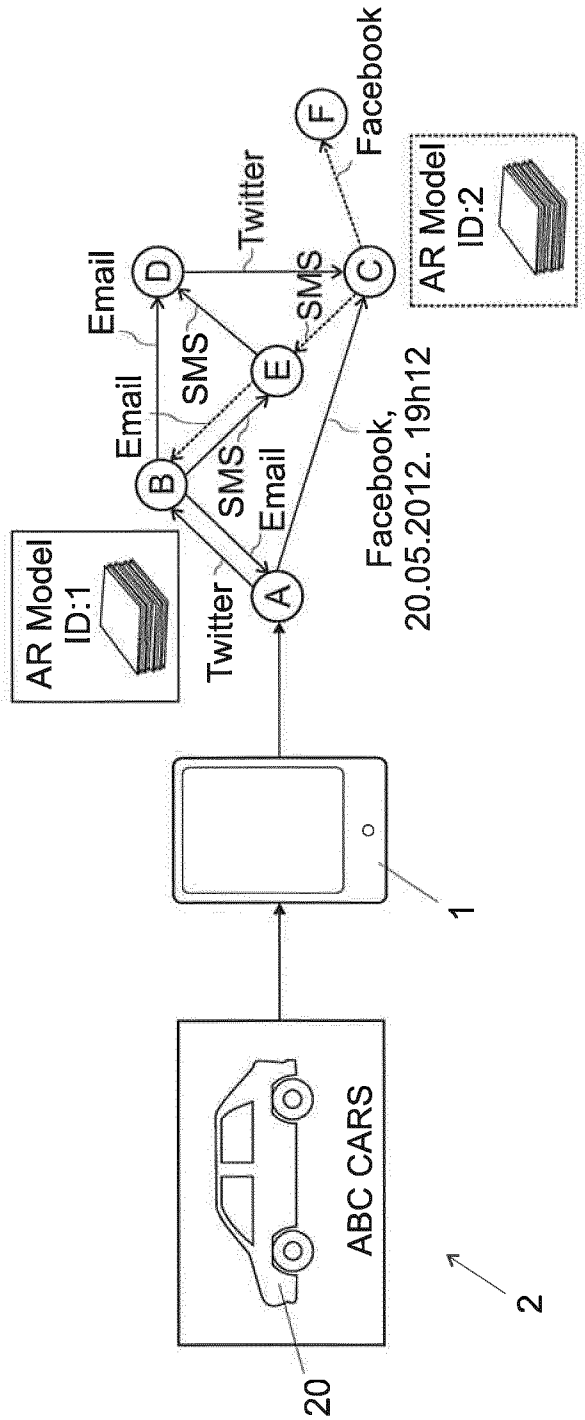
ABC CARS
20
2
1
AR Model ID:1
AR Model ID:2
A
B
C
D
E
F
Email
SMS
Twitter
Facebook
Facebook, 20.05.2012. 19h12

Fig.4

Model ID	Sender ID	Recipient ID	Channel	Date	Time	...
1	A	B	Twitter	19.05.12	03h56	...
1	A	C	Facebook	20.05.12	19h21	...
1	B	D	Email	21.05.12	23h03	...
1	B	E	Sms	23.05.12	9h17	...
1	B	A	Email	25.05.12	15h10	...
1	D	E	Sms	25.05.12	16h18	...
2	C	E	Sms	26.05.12	01h45	...
1	D	C	Twitter	26.05.12	9h20	...
2	C	F	Facebook	28.05.12	22h49	...
2	E	B	Email	29.05.12	13h37	...

Fig.5

Model ID	Sender ID	Recipient ID	Channel	Date	Time	...
1	A	B	Twitter	19.05.12	03h56	...
1	A	C	Facebook	20.05.12	19h21	...
1	B	D	Email	21.05.12	23h03	...
1	B	E	Sms	23.05.12	9h17	...
1	B	A	Email	25.05.12	15h10	...

Fig.6

Model ID	Sender ID	Recipient ID	Channel	Date	Time	...
1	A	B	Twitter	19.05.12	03h56	...
1	A	C	Facebook	20.05.12	19h21	...
1	B	D	Email	21.05.12	23h03	...
1	B	E	Sms	23.05.12	9h17	...
1	B	A	Email	25.05.12	15h10	...
1	D	E	Sms	25.05.12	16h18	...
2	C	E	Sms	26.05.12	01h45	...
2	E	B	Email	29.05.12	13h37	...

Fig.7

Model ID	Sender ID	Recipient ID	Channel	Date	Time	...
1	A	B	Twitter	19.05.12	03h56	...
1	A	C	Facebook	20.05.12	19h21	...
1	B	D	Email	21.05.12	23h03	...
1	B	E	Sms	23.05.12	9h17	...
1	D	E	Sms	25.05.12	16h18	...
2	C	E	Sms	26.05.12	01h45	...
1	D	C	Twitter	26.05.12	9h20	...
2	C	F	Facebook	28.05.12	22h49	...

Fig.8

Parent model ID	Child model ID	Date	Time	...
1	2	25.05.12	03h06	...

Fig.9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/072072

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F17/30
ADD.

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)
G06F

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008/032203 A2 (NOKIA CORP [FI]; SCHLOTER C PHILIPP [US]) 20 March 2008 (2008-03-20) abstract page 6, line 27 - page 11, line 2 page 13, line 31 - page 16, line 6 figures 3-4 ----- -/--	1-27

[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

"E" earlier application or patent but published on or after the international filing date

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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
14 December 2012	21/12/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Konak, Eyüp

1

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	TARUMI H ET AL: "COMMUNICATION THROUGH VIRTUAL ACTIVE OBJECTS OVERLAID ONTO THE REAL WORLD", PROCEEDINGS OF THE 3RD. INTERNATIONAL CONFERENCE ON COLLABORATIVE VIRTUAL ENVIRONMENTS. CVE 2000. SAN FRANCISCO, CA, SEPT. 10 - 12, 2000; [PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON COLLABORATIVE VIRTUAL ENVIRONMENTS], NEW YORK, NY : ACM, US, vol. CONF. 3, 10 September 2000 (2000-09-10), pages 155-164, XP001075676, DOI: 10.1145/351006.351034 ISBN: 978-1-58113-303-5 abstract page 155, right-hand column, paragraph 1 - page 158, right-hand column, last paragraph page 160, left-hand column, paragraph 2 -----	1-27

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/072072

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008032203 A2	20-03-2008	AU 2007297253 A1	20-03-2008
		CA 2662630 A1	20-03-2008
		CN 101535997 A	16-09-2009
		EP 2064636 A2	03-06-2009
		KR 20090054471 A	29-05-2009
		US 2008071749 A1	20-03-2008
		WO 2008032203 A2	20-03-2008