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(56) Documents Cited:
WO 2016/154121 A1
US 20170116785 A1
US 20130293582 A1
US 20200090224 A1
US 20150178257 A1
US 20020196202 A1

(58) Field of Search:
INT CL **G06T**

(54) Title of the Invention: **Augmented reality messaging system**
Abstract Title: **Displaying Content (e.g. Messages) in Augmented Reality**

(57) Displaying (e.g. on a transparent display) content in augmented reality (AR) comprises obtaining augmented image data of an environment (e.g. via an operating system API or device native layer), the data comprising image data augmented with depth information. A display surface and its orientation is identified within the augmented image data. Content data representing the content is configured (e.g. scaling, focussing, setting a viewing perspective) using the identified surface and its orientation to align and orient the content with the surface, and the configured content data and the image data is displayed such that the content appears to be present on the display surface. The augmented image data is captured from the environment using camera(s) and LiDAR scanner(s) which may be aligned using motion sensors. The content may be a received, downloaded or generated message, or may be text, picture or video. Identifying the display surface may involve determining a display surface from received or stored data and searching the augmented image data for that display surface.

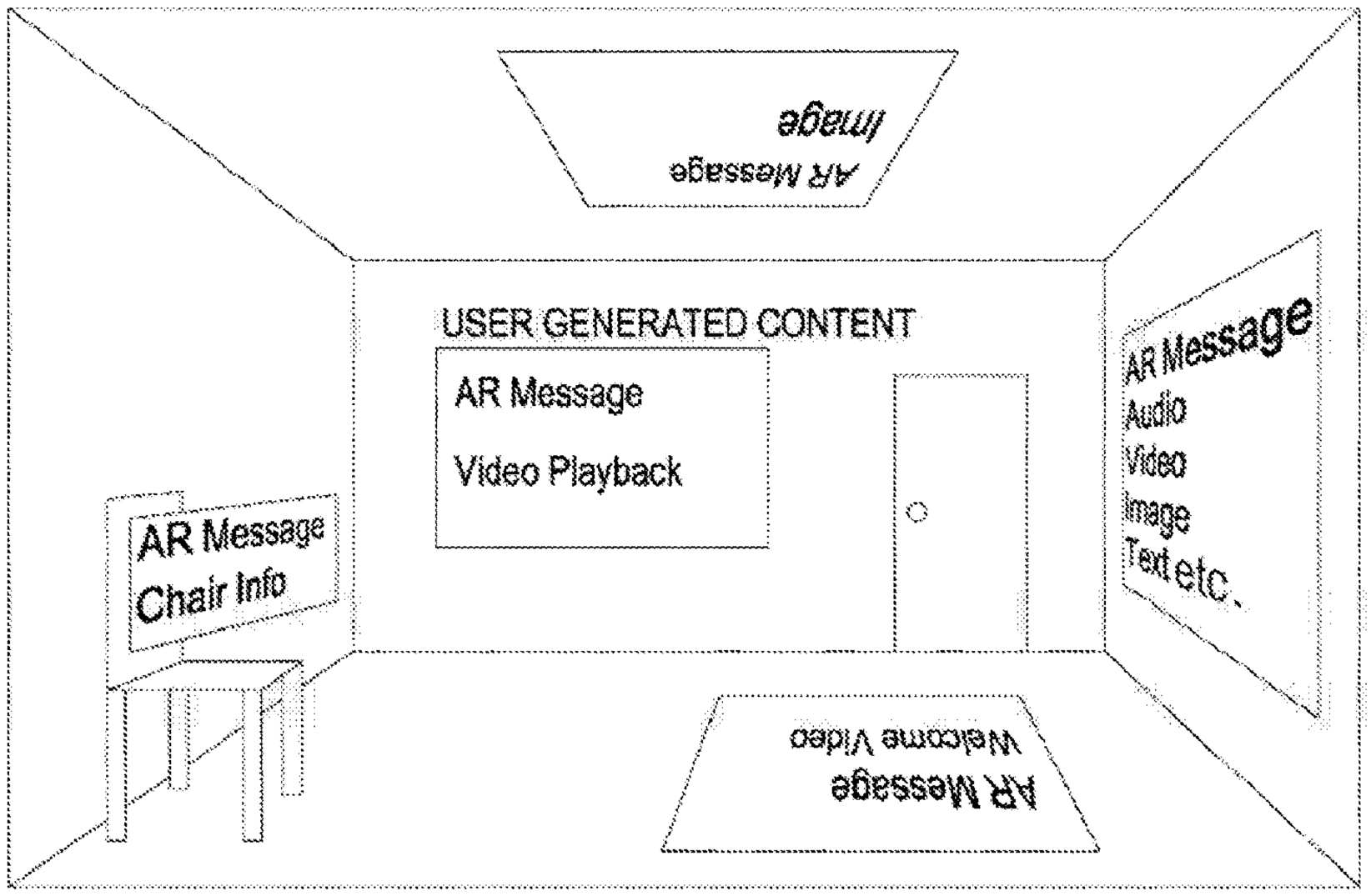

Figure 3

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2588838 A

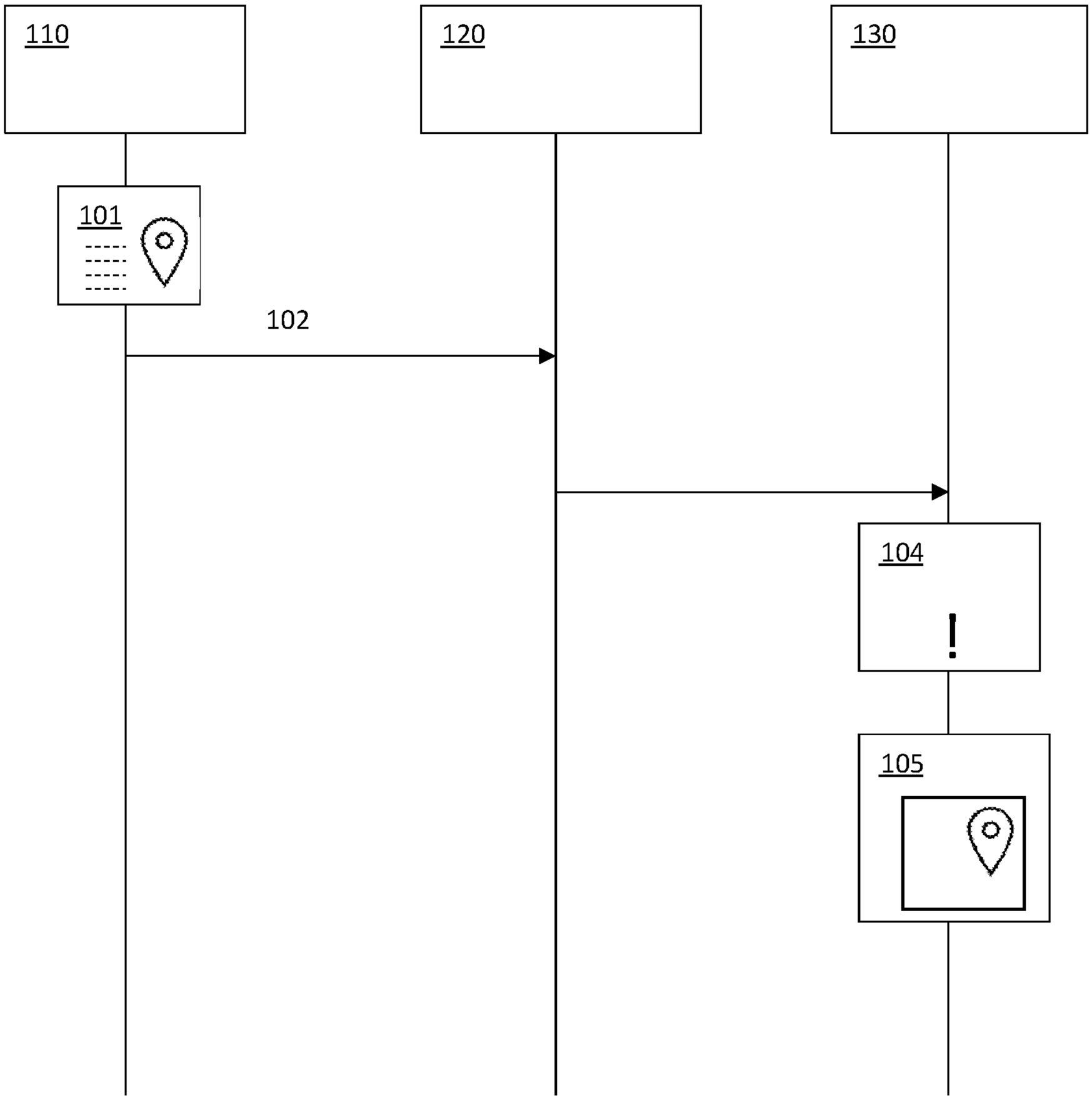

Figure 1

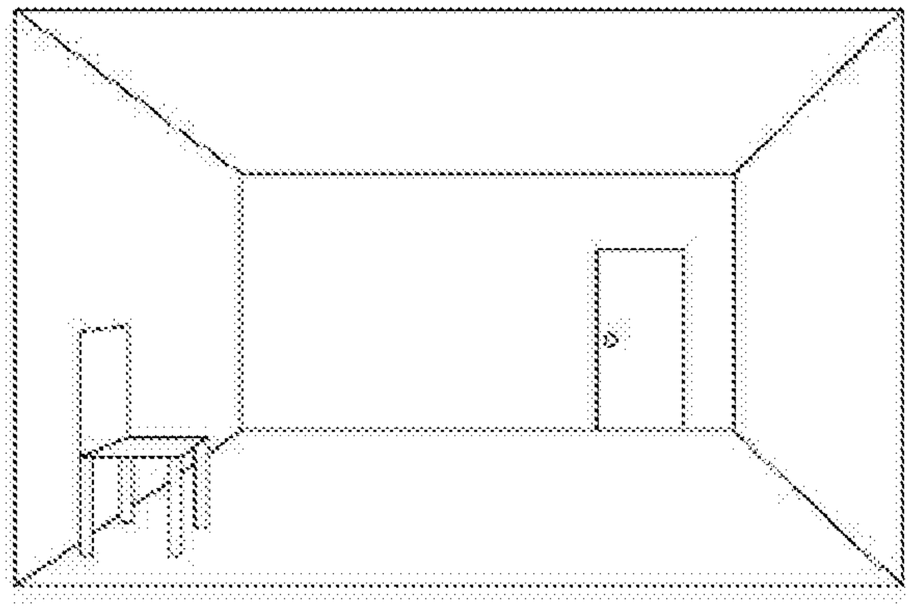

Figure 2A

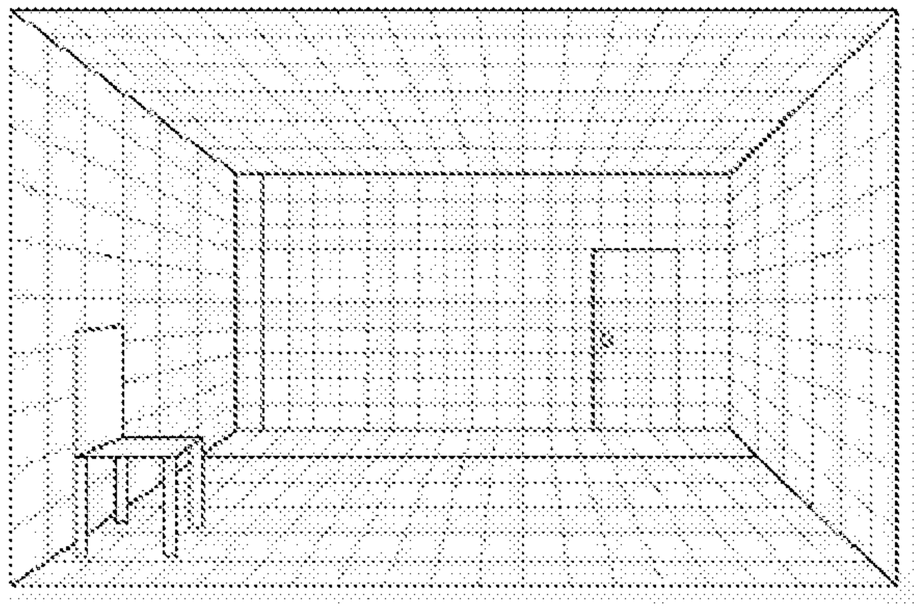

Figure 2B

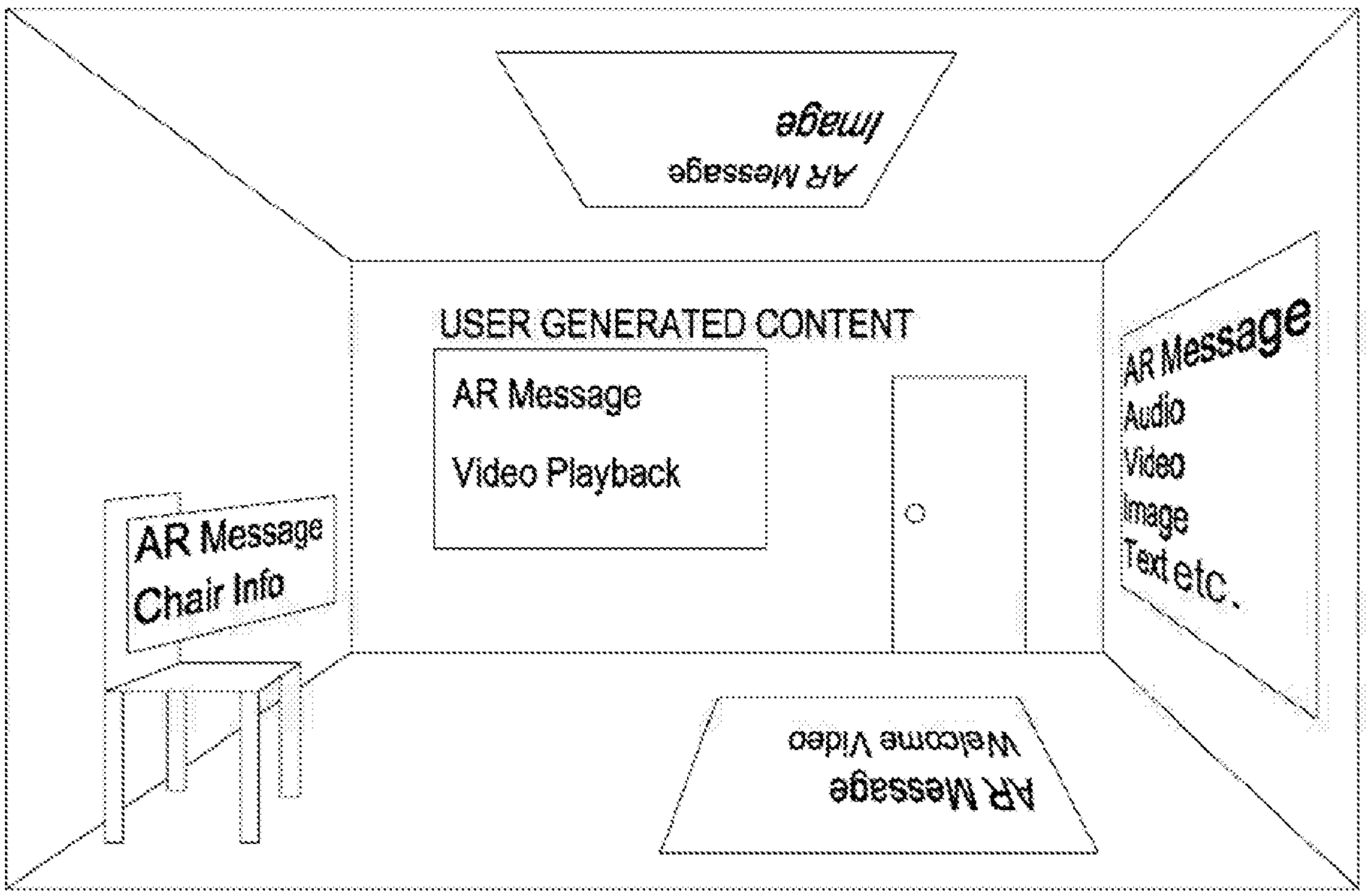

Figure 3

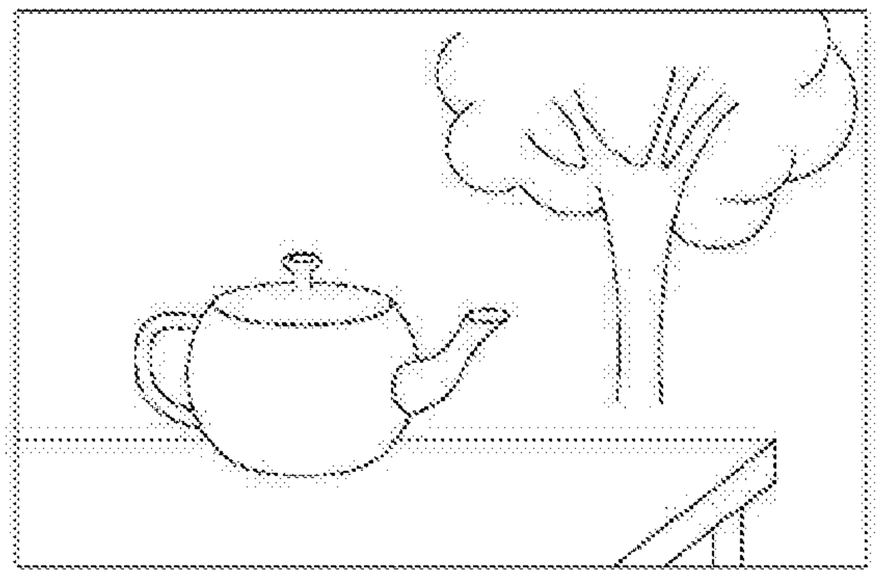

Figure 4A

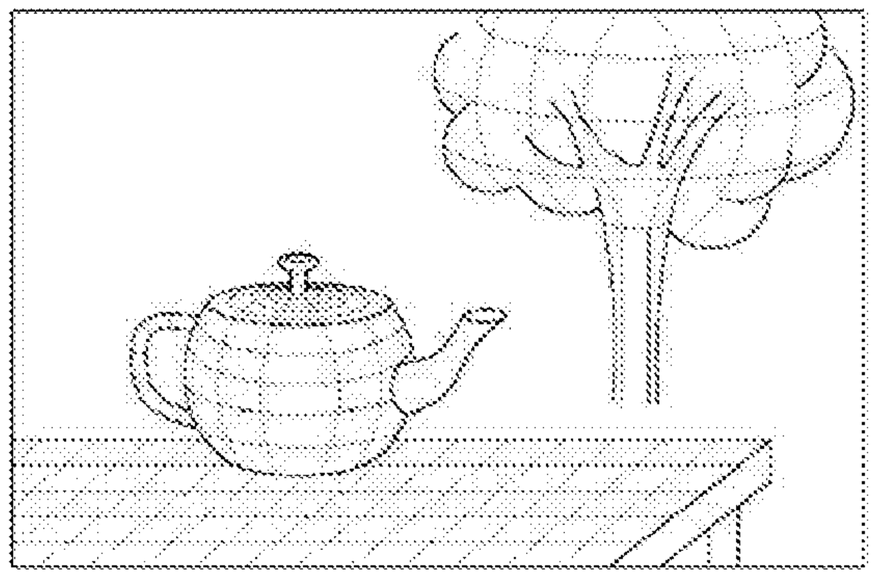

Figure 4B

21
26 03

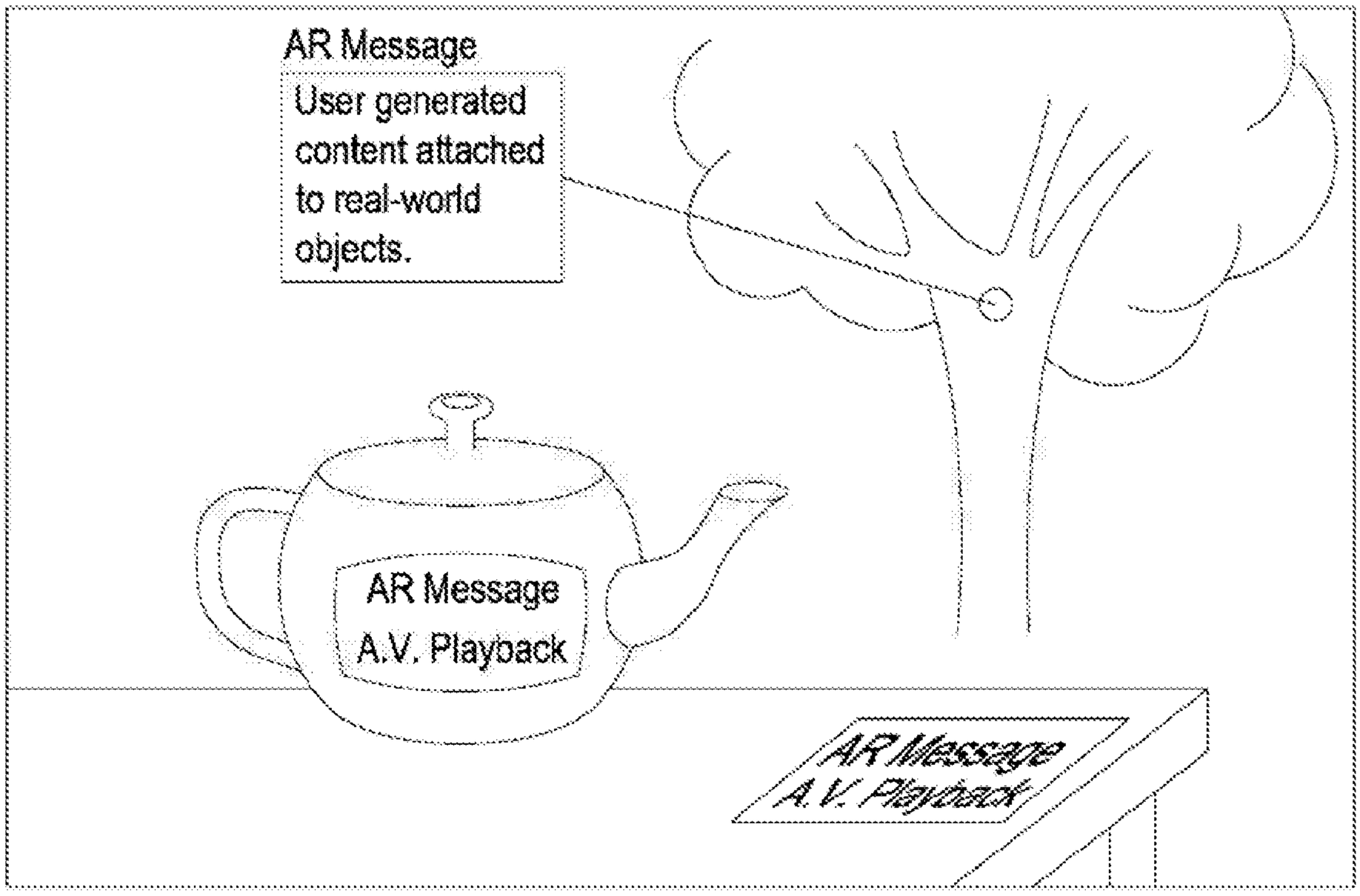

Figure4C

Intellectual Property Office

The following terms are registered trade marks and should be read as such wherever they occur in this document:

Android
Apple
iPad
Google Play
Zome

Augmented Reality Messaging System

Field of the Invention

The present invention relates to an augmented reality messaging system. The system may provide a location-based message distribution service for distributing messages to a multiplicity of end-user devices.

Background

The majority of messaging applications provided for end-user mobile devices such as smartphones are essentially agnostic in a geographical sense. A user will receive a message sent to him or her regardless of their location. However, users of messaging services are often using devices with access to additional data, such as location. Messaging services have begun to take advantage of this, offering features such as location tagged messages (i.e. messages associated with a particular location).

An example message flow for a single message in such an app is shown in Figure 1. The message flow involves a sending client 110, a server 120, and a receiving client 130. In step 101, the sending client 110 creates a message, which includes details of a particular location. In step 102, the sending client 110 sends this message to the server 120. In step 103, the server 120 forwards this message to the receiving client 130, which notifies the user in step 104. The receiving client displays the message in step 105 in some kind of location-identifying view. The message may only be available for viewing (i.e. the message content delivered to the client) when the receiving client 120 is present at or in the vicinity of the associated location.

For the purpose of displaying a received message, a number of interesting Augmented Reality (AR) approaches have been considered. AR involves overlaying the message on some real-world image. This can be achieved using, for example a display and a camera, with the message being overlaid on the displayed image, or a transparent display such as smart glasses or a vehicle windscreen. Such applications tend to be quite limited in the positioning of the message on the display or screen, and typically display the message at a fixed location on the display or screen, e.g. top left or bottom

right. In order to make a messaging service more relevant and interesting to users, more flexible display solutions are desirable.

Summary

According to a first aspect of the present invention there is provided a computer-implemented method of displaying content on a display of an electronic device. The method comprises obtaining real-time augmented image data of an environment of the device, the data comprising image data augmented with depth information, identifying within the augmented image data a display surface of the environment and an orientation of that surface, and configuring content data representing said content using the identified display surface and it's orientation to align and orient the content with the identified display surface. The configured content data and the image data are then displayed on the display such that the content appears to be present on said display surface.

The invention may be implemented as an app, for example adapted to run on a smartphone such as a smartphone using the Android™ or Apple iOS™ operating systems. The app may receive image and depth data separately from respective operating system interfaces and combine the data itself to obtain the augmented image data. In other cases the already augmented image data may be obtained via a single operating system interface. He app may receive motion sensor data from the operating system interface.

Aspects of the present invention are set out in the appended claims.

Brief Description of the Drawings

Figure 1 is a diagram of message flow according to an exemplary prior art method;

Figure 2A illustrates schematically image data representing an environment;

Figure 2B illustrates augmented image data comprising the image data of Figure 2A augmented with depth data;

Figure 3 illustrates an image on a device display generated using the image data of Figure 2A and content data representing content;

Figures 4A and 4B illustrate image data and augmented image data representing an outdoor environment; and

Figure 4C illustrates an image on a device display generated using the image data of Figure 4A and content data representing content.

Detailed Description

The following disclosure is concerned with a messaging application or "app" in which messages may be associated with location data, and where users can view messages in a geographic region (e.g. close to the user) via an interface. An example of such an application is the ZOME™ app available on the Apple App Store™ and GooglePlay™. It will however be appreciated that this represents only an exemplary use of the described novel system and other uses are clearly within the scope of the invention.

The recently launched Apple iPad Pro is provided with a Light Detection and Ranging (LiDAR) scanner that is capable of measuring distances to surrounding objects up to 5m away at nano-second speeds. The device's processor is able to tightly integrate data generated by the LiDAR scanner with data collected by the devices cameras and motion sensors. It is expected that other devices including smartphones will in the near future be provided with LiDAR or other scanners (such as ultrasonic scanners) to enable the capture of 3D aspects of an environment. Systems may alternatively or additionally utilise multiple spaced apart cameras to capture images with depth information. It can also be expected that the range at which scanners operate will increase over time from the iPad's current 5m range.

In order to make use of LiDAR and other data, e.g. camera data etc, Apple provides app developers with a software development kit (SDK) that consists of tools used for developing applications for the Apple iOS. In common with other vendors, the Apple SDK includes an application programming interface (API) which serves as a link between software applications and the platform they run on. APIs can be built in many ways and include helpful programming libraries and other tools.

The introduction and development of this new technology makes possible a new message display paradigm. Figure 2A illustrates by way of example a view of a room captured by a camera or cameras of a device such as a smartphone. This does not contain depth information. However, such depth information can be captured by a LiDAR scanner of the device. Using motion sensors of the device, the captured depth information can be aligned with the image data. The combined data is illustrated

schematically in Figure 2B. It will be appreciated that the image data of Figure 2B may be captured in essentially real time and is dynamically adjusted as the device and camera(s) move. Of course, the device's display may display only the captured image data with the depth information being essentially hidden. It is of course possible to display the view of Figure 2B or some other AR view if desired.

In the case of Apple iOS, it is understood that the SDK allows a developer to create an app that obtains from the system image data that is a composite of data provided by a device's camera and depth data provided by the LiDAR scanner. The two are aligned using motion sensor data. Thus, for example, image data may be obtained that has, for each pixel of an image, a depth or distance value.

Returning to the location-based messaging service discussed above, e.g. ZOME, a user of the device may be sent a message having as its location the location of the room. Whilst not in the room, the user will not be able to view the message content although might be provided with in indication that a message is available in the room. In the present context, the message location may be further specified as being on a particular surface of the room. This might be for example a whiteboard or wall mounted screen within the room. In that case of course, the sender of the message may be required to identify the display location. Alternatively, the recipient may specify a display location for his or her incoming messages. For example, a received message may at first float in the environment when viewed on a display, with the user being able to pin that message to a surface by dragging the message onto the surface.

When the user enters the room and views the room on the device display, an appropriate algorithm running on the device's processor analyses the image data to identify the specified display location, e.g. the whiteboard. This may also utilise the data obtained by the LiDAR scanner and motion sensors. In any case, using all of this data, the device configures the message content for display on the device display so that, when presented, it appears as if it is actually on the whiteboard surface. Moreover, as the camera moves, the message content remains fixed in position relative to the whiteboard. Even where the display surface is at an angle to the device, e.g. see the whiteboard on the right hand wall of Figure 3, the message content appears in the correct orientation. The content is also stationary in the sense that, as the camera moves, the content remains fixed relative to the display surface. Considering for example the content fixed to the floor and ceiling of the room of Figure

3, the appears upside down from the current position of the device, but as the user walks around the messages towards the door, with the camera still pointed at the messages, the user will see the messages turning until they are the right way up.

Referring now to Figure 4A, this illustrates an outdoor image captured by a camera or cameras of a device. Figure 4B illustrates schematically the combination of the image data of Figure 4A with data obtained using a LiDAR scanner of the device and using data provided by motion sensors.

Figure 4C illustrates message content that appears to be pinned or tagged to a tree, as well as a message pinned to a teapot. The algorithm running on the device may allow the user to move a message to another location in this environment, e.g. by dragging it from one location to another. In doing so, the algorithm re-calculates the content data so that its size and orientation is appropriate for the new surface. Figure 4C illustrates a message dragged from the teapot to the table surface from which this change is apparent (one might assume that the message on the teapot will not appear after it has been moved). It will also be appreciated that if the object providing the display surface is moved within the environment, the message will move with the object and will be dynamically reconfigured accordingly.

Whilst the message content might be simple text, e.g. “remember to buy milk”, it can also be images, video (with accompanying audio) etc. It may also be content that is configured to interact with the display surface. One could image for example, the case where the display surface is a painting, and the message content is an image overlaid on the painting, e.g. the content is a bird flying back and forth over a landscape within the painting.

Whilst the proposal above relates to a device having a camera and a display, the proposal can also be applied to transparent displays such as spectacles. In this case, a camera is still likely required to recognise a display location, but the content is presented as AR content over the transparent display. Other devices that might be used include smart windows such as vehicle windscreens. The proposal is also applicable, by way of example, to smart watches.

It will be further appreciated that the proposal is not restricted to messaging services but is applicable to many other services and applications. Such an application might be

a note keeping or memo application where a user creates a memo using an app on his or her phone and pins this to a surface in the environment using the devices camera and display. When the user views that environment in the future, the memo will appear on the display surface. The memo (or indeed message) may be associated with a display time such that it appears and / or disappears at set times or after set time periods.

CLAIMS:

1. A computer-implemented method of displaying content on a display of an electronic device, the method comprising:

obtaining real-time augmented image data of an environment of the device, the data comprising image data augmented with depth information;

identifying within the augmented image data a display surface of the environment and an orientation of that surface;

configuring content data representing said content using the identified display surface and it's orientation to align and orient the content with the identified display surface; and

displaying the configured content data and the image data on the display such that the content appears to be present on said display surface.

2. A method according to claim 1, wherein said real-time augmented image data is obtained via an operating system API or native layer of the device.

3. A method according to claim 1 or 2, wherein said augmented real-time image data is captured from the environment using one or more cameras and one or more LiDAR scanners of the electronic device.

4. A method according to claim 3, wherein data obtained from the camera or cameras and the LiDAR scanner are aligned using one or more motion sensors of the device.

5. A method according to any one of the preceding claims, wherein said step of configuring content data representing said content comprises scaling and setting a viewing perspective of the data.

6. A method according to any one of the preceding claims wherein the display is a transparent display.

7. A method according to claim 6, wherein said step of configuring content data representing said content comprises configuring the content so that it is in focus on said display surface.

8. A method according to anyone of the preceding claims, wherein said content is content of a message received by the electronic device, or content downloaded to the device, or content generated at the device.

9. A method according to any one of the preceding claims, wherein said step of identifying within the augmented image data a display surface comprises determining a display surface from received or stored data and searching the augmented image data for that display surface.

10. A method according to any one of the preceding claims, wherein said content is one or a combination of text data, picture data, video data.

11. A computer program stored on a non-transitory computer storage medium, the program being configured to cause a computer device to:

obtain real-time augmented image data of an environment of the computer device, the data comprising image data augmented with depth information;

identify within the augmented image data a display surface of the environment and an orientation of that surface;

configure content data representing said content using the identified display surface and it's orientation to align and orient the content with the identified display surface; and

display the configured content data and the image data on a display of the computer device such that the content appears to be present on said display surface.

Amendments to claims are filed as follows

CLAIMS:

1. A computer-implemented method of displaying message content on a display of a smartphone, the method comprising:

receiving a message comprising message content and a message display location;

determining that the smartphone is in an environment corresponding to said message display location;

using one or more cameras and one or more LiDAR scanners of the smartphone to capture real-time augmented image data of said environment, the data comprising image data augmented with depth information;

obtaining the real-time augmented image data via an operating system API or native layer of the smartphone;

identifying within the obtained augmented image data a display surface of the environment and an orientation of that surface;

configuring content data representing said message content using the identified display surface and it's orientation to align and orient the message content with the identified display surface; and

displaying the configured content data and the image data on the display such that the message content appears to be present on said display surface.

2. A method according to claim 1, wherein data obtained from the camera or cameras and the LiDAR scanner are aligned using one or more motion sensors of the device.

3. A method according to any one of the preceding claims, wherein said step of configuring content data representing said content comprises scaling and setting a viewing perspective of the data.

4. A method according to any one of the preceding claims, wherein said step of identifying within the augmented image data a display surface comprises determining a display surface from said message location data and searching the augmented image data for that display surface.

5. A method according to any one of the preceding claims, wherein said content is one or a combination of text data, picture data, video data.

6. A smartphone comprising a non-transitory computer storage medium having stored thereon a computer program configured to cause the smartphone to:

receive a message comprising message content and a message display location;

determine that the smartphone is in an environment corresponding to said message display location;

using one or more cameras and one or more LiDAR scanners of the smartphone to capture real-time augmented image data of said environment, the data comprising image data augmented with depth information;

identify within the obtained augmented image data a display surface of the environment and an orientation of that surface;

configure content data representing said message content using the identified display surface and it's orientation to align and orient the message content with the identified display surface; and

display the configured content data and the image data on a display of the computer device such that the message content appears to be present on said display surface.

Intellectual Property Office

Application No:	GB2010399.0	**Examiner:**	Mr Iwan Thomas
Claims searched:	1-11 (truncated)	**Date of search:**	9 December 2020

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-11	US 2020/0090224 A1 (FALCONER) See e.g. abstract, figs. 5A&B and paragraphs [0022], [0030] & [0042]
X	1-11	US 2017/0116785 A1 (JARVIS) See e.g. paragraphs [0054] & [0057]-[0059] and fig. 7
X	1-11	US 2015/0178257 A1 (JONES) See e.g. abstract, fig. 3 and paragraphs [0025], [0034] & [0063]
X	1-11	US 2013/0293582 A1 (NG-THOW-HING) See e.g. abstract, fig. 6 and paragraphs [0076]-[0080]
X	1-11	US 2002/0196202 A1 (BASTIAN) See e.g. abstract, figs. 6&7 and paragraphs [0010] and [0049] - [0053]
X	1-11	WO 2016/154121 A1 (UNIVERSITY OF MARYLAND) See e.g. figs. 3, 4A & 4B and paragraphs [0005] & [0048] - [0060]

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

G06T

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

Intellectual Property Office

International Classification:

Subclass	Subgroup	Valid From
G06T	0019/00	01/01/2011