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H04N 21/845 (2011.01)   *H04N 21/8547* (2011.01)

(56) Documents Cited:
EP 1483911 A2   **EP 0891675 A1**

(58) Field of Search:
INT CL **G06F, H04N**
Other: **WPI, EPODOC, INSPEC**

(54) Title of the Invention: **Online video distribution**
Abstract Title: **Synchronising hyperlink and associated object positions using frame numbers encoded as pixel data**

(57) A video data file comprises: a video sequence comprising plural frames, and associated hyperlink data comprising link address information and position data defining a plurality of positions within the respective video frames, wherein at least some frames include a unique frame number indicia encoded as pixel data within the frame (e.g. adjacent corner or edge pixels, below a flyout icon 26, in a rectangular or linear array); an associated video player and video encoder for encoding and decoding such a link and frame number data file are also claimed. Thus, the issue that online video players tend not to report an accurate frame number, with the resulting poor synchronization of the movement of a hyperlink 20 and object 16, is overcome by a subset of the pixels in the frame being used to encode a numeric frame identifier. Hyperlink (internet link) position data and video data may be delivered as separate streams, the hyperlink data including a frame number associated with defined (link, object) positions; position or location data may include hyperlink size information.

Fig 1

GB 2504270 A

Fig 1

Fig 2
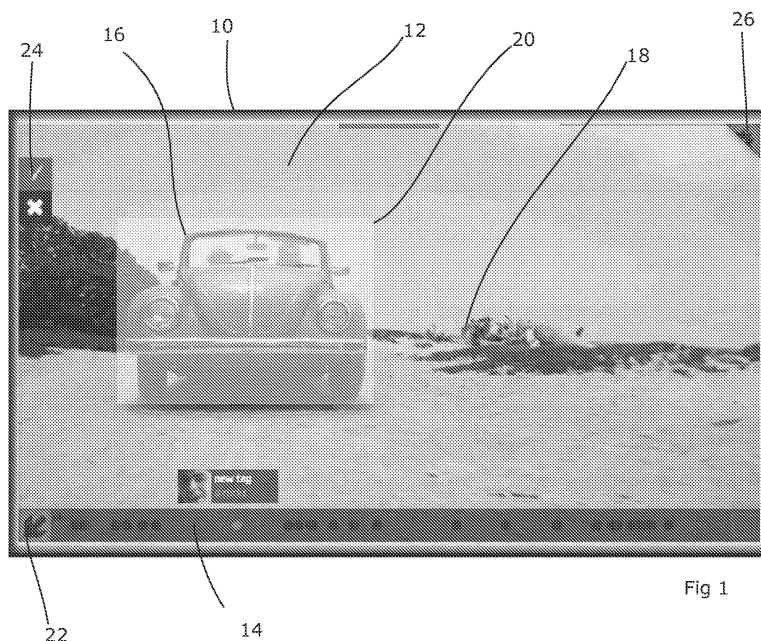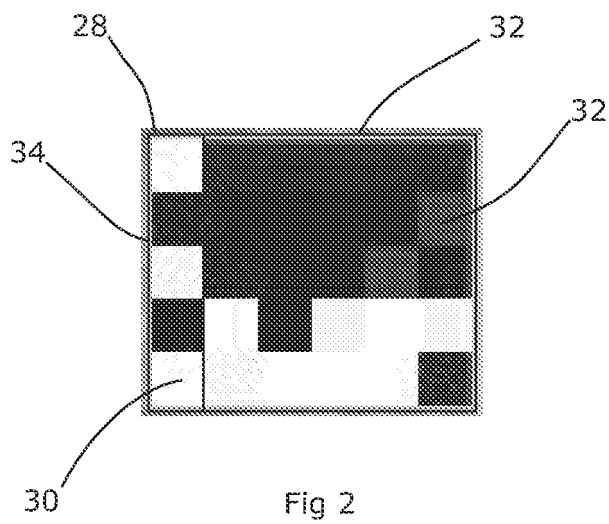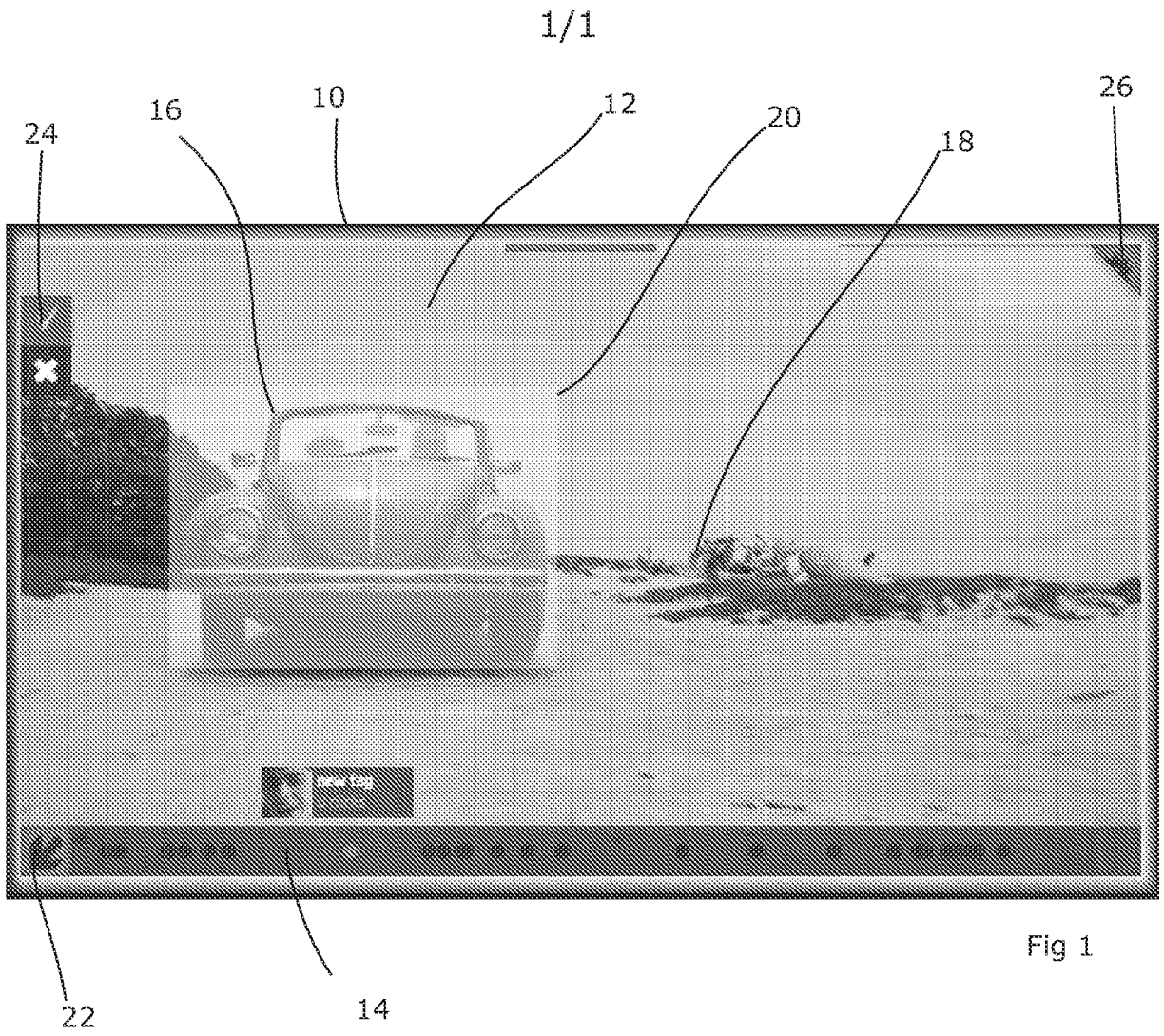
Fig 3

5   Online video distribution

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FIELD OF THE INVENTION

The present invention relates to online video distribution.

BACKGROUND ART

Online video is now an established communication tool, being used for social purposes and for commercial marketing and other purposes. Indeed, the success of online video is such that content-enabled video services are being developed, allowing functionality to be co-delivered with the video such as clickable hyperlinks within the video frame, such as external links that lead the viewer to a specific website or other internet address, or popouts to display text or images, or play video or audio alongside or instead of the video previously being played.

US 7620914 discloses the incorporation of clickable hyperlinks into a viewable video, sending the hyperlink data in a separate stream alongside the video data. The two are then re-united in the video player and the hyperlinks are displayed over the video data, allowing a user to click the hyperlink as and when desired.

US 7817822 discloses a motion tracking system for such hyperlinks. This allows a user to associate the hyperlink with a specific feature in a frame of the video, following which the motion tracking system detects movement of that feature in subsequent frames and adjusts the position of the hyperlink accordingly. As a result, the hyperlink appears to "float" over the feature and follow it as it moves in the video. The hyperlink can therefore be associated with the feature, such as a link offering more information on or an opportunity to purchase the item forming that feature. Multiple hyperlinks can then be safely added to a video or video segment, with the meaning of each hyperlink remaining clear to a viewer at all times.

SUMMARY OF THE INVENTION

As US 7620914 sends the hyperlink and the video data in separate streams, when the two streams are united a correlation needs to be made between the two so that they can be properly synchronised. If this cannot be done then a system based on US 7620914 will not be able to display the video in correct synchronisation.

Most systems use the frame number of the video as a time code to identify current playback point of the video and hence identify the hyperlinks and other objects that should be displayed. However, we have found that most online video players do not in fact provide an accurate record of the frame number and thus the returned frame number information is likewise inaccurate. This inaccuracy is typically of the order of a few frames, such as up to about 5 frames, and is insignificant for most online purposes. It is significant in this context, however, and can lead to a distinct "lag" in the movement of hyperlinks over the displayed video.

We therefore propose a video data format comprising viewable video, associated hyperlink data comprising both link data and position data (which may include a location within or relative to the frame, and a size of any bounding box or other object) defining a position within the video frame that may change from frame to frame, and frame count information encoded as pixel data within the video stream. This enables the player to determine precisely where to position the hyperlink or tag, to ensure that the display of hyperlinks is correlated correctly with the video playback.

Thus, in a first aspect the present invention provides a video data file comprising a viewable video sequence comprising a plurality of frames, associated hyperlink data comprising at least link address information, and position data defining a plurality of positions within a plurality of respective video frames, wherein at least a plurality of the frames include a unique frame number indicia encoded as pixel data within the frame.

The hyperlink data and the viewable video can be delivered as separate streams, in which case the hyperlink data can include a frame number associated with each of the defined position data sets.

We prefer that the unique frame number is encoded in a plurality of pixels in the video frame. These can be a group of adjacent pixels, such as a rectangular area which can be located at a corner of the video frame, for example. Alternatively, a group of adjacent pixels arranged in a linear array can be used, such as a group located at an edge of the video frame.

The unique frame number indicia is ideally included in substantially all the frames of the viewable video. They can, if desired, be located in a non-viewable area of the video frame such as an area concealed by a menu item or icon.

In second aspect, the present invention provides a video player for online video, including a video decoder for interpreting and displaying a received viewable video stream comprising a sequence of frames, a hyperlink decoder able to receive and display over the displayed video stream hyperlink data comprising link address information and position data defining a plurality of positions within a plurality of respective video frames, wherein the player is further arranged to inspect a subset of the pixels of a frame to be displayed time to determine a unique frame number indicia encoded in the subset and use the thus determined frame number to select a hyperlink for display over the frame.

In a third aspect, the present invention provides a system for encoding online video arranged to receive a viewable video stream comprising a sequence of frames, receive hyperlink data comprising link address information and position data defining a plurality of positions within a plurality of respective video frames, encode a unique frame number indicia into at least the plurality of respective video frames by writing non-image data to a subset of

the pixels of the frame, and combine the thus encoded video stream and the hyperlink data for download.

The thus encoded video stream and the hyperlink data can be combined to form a single downloadable stream, or sent as two correlated downloadable streams.

Finally, in its fourth aspect the present invention provides a video data format comprising a data stream including viewable video comprising a sequence of frames, associated hyperlink data comprising at least link address information, and position data defining a plurality of positions within a plurality of respective video frames, wherein at least a plurality of the frames include a unique frame number indicia encoded as pixel data within the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the present invention will now be described by way of example, with reference to the accompanying figures in which;

Figure 1 shows an example of an online player window according to the present invention;

Figure 2 shows a group of pixels encoding a frame number; and

Figure 3 shows the manner in which the frame number is encoded into the pixels of figure 2.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Referring to figure 1, a video player window 10 comprises a video display 12 above a timeline 14 showing the progress of the current playback position through the length of the video. Within the video display, a video is currently running and depicts a vehicle 16 on a beach 18.

A highlight area 20 is shown over the vehicle. This denotes a clickable hyperlink, which (as discussed above) may result in any of a variety of actions taking place when a user clicks within the highlight area. For example, there could be a pop-up box or window giving further details of the type of car and further information as to its provenance, or

further photographs of the car, or one or more links to sites where cars of that type can be purchased.

The video display 12 also includes a number of operating icons. For example, a "full screen" icon 22 is shown adjacent the timeline 14 to allow a user to expand the video display to occupy the entirety of the screen of whatever device is being used for playback. After a preset period of inactivity, the timeline is made to disappear automatically, returning if the mouse pointer or other GUI input becomes active again. Figure 1 also shows operating icons 24 which help the viewer navigate the tags . In addition, there is a flyout icon 26 in the upper right corner of the video display 12 which allows a user access to a wider range of control functions; clicking the flyout icon 26 causes additional icons for these control functions to be displayed. If present permanently, these icons could be distracting and would obscure part of the video, so they are normally hidden and only the flyout icon 26 is displayed permanently. This does obscure a part of the video, but only a small part and only in one corner; it is unusual for a corner location to contain crucial information.

The part of the video stream that lies underneath this flyout icon 26 is therefore never seen. According to the present invention, the pixels beneath this icon are employed to store a time code instead of video data. An image of a typical time code is shown in figure 2, and is in the form of a 6x5 rectangular block 28 of pixels 30. Of this block, a 5x5 square group of pixels 32 are allowed to adopt an on (white) or off (black) state, and can thus encode a binary number according to the pattern shown in figure 3. This shows a least-significant-bit (LSB) on the bottom right hand corner of the rectangle with the bit values increasing to the left and upwards. This yields a single number encoded by the pixel values and which can be unique to each frame of a video. Thus, it can be used to indicate a time associated with the frame, or a frame number. Thus uniquely identifies the frame concerned without ambiguity or approximation, and can therefore be used as a reference by which the correct hyperlink placement is identified.

In addition, a vertical strip of pixels 34 to the left of the 5x5 group 32 appear white, black, white, black, white from top to bottom. These pixels retain this pattern throughout the video and indicate to the player that the pixel time code exists. The chances of a chequered column of that arrangement appearing as part of the actual video frame is very unlikely, so the player first looks for this pattern in order to confirm that a pixel time code is

present. Of course, a different pattern could be adopted, for example using a different pattern of light and dark pixels and/or a different size or shape; all that necessary for such a marker pattern is that it be known in advance and unlikely to appear in the actual video by chance.

5   If desired, the individual squares 32 which form the bit values of the time code could each be defined by a plurality of pixels in the video itself, rather than as individual pixels. In other words, the 6x5 and/or the 5x5 groups of squares could cover substantially more than a 6x5 block of pixels in the raw video data. This and the use of on/off black/white encoding could help the frame data to be resilient to typical video compression algorithms; while

10   these algorithms may distort the squares slightly, they are unlikely to turn a square completely black (or white) when it was previously white (or black). Figure 2 shows some squares such as square 32 which are slightly paler than others, but which are clearly intended to be black and are above a mid-grey threshold and can therefore be interpreted as black by a decoding algorithm.

15   A 5x5 block of pixels allows for 25 bits of data. This allows a unique frame number of up to about $3x10^7$ which is more than adequate for even the longest video at the highest frame rate, corresponding to about 186 hours of video at 50 frames per second. If desired, a smaller block of squares could be used, which would take up less space and could be concealed by a smaller icon. Alternatively, a non-rectangular block could be used, such as a

20   linear strip of squares which could be aligned along an edge of the video such as the top, bottom, or sides of the video. These could be cropped prior to display and hence remain invisible to the viewer.

Alternatively, a larger block of squares could be defined, providing more than 5x5 squares and hence allowing more data to be stored. This will probably be unnecessary for

25   frame identification but would allow other data to be encoded such as (perhaps) the hyperlink data. This latter step might require the bit depth to be increased by allowing colour variation of the squares, but care would need to be taken to ensure this data survived video compression techniques.

This frame number reference can be incorporated into the video file during

30   compression or other processing. The algorithm performing the processing can maintain a simple frame count and can be programmed to convert this into the appropriate pattern of

squares. These can then be written onto the frame over whatever pixel values were there originally to create the necessary video data file which can then be stored together with (or in combination with) the hyperlink data.

When the video data is received for display, the code can be retrieved by the video player by interpreting the pixel data appropriately, returning a reliable frame number and allowing proper synchronisation of the hyperlink information.

It will of course be understood that many variations may be made to the above-described embodiment without departing from the scope of the present invention.

CLAIMS

1.   A video data file comprising;

     a viewable video sequence comprising a plurality of frames,

     associated hyperlink data comprising at least

          i.   link address information, and

          ii. position data defining a plurality of positions within a plurality of respective video frames,

     wherein at least a plurality of the frames include a unique frame number indicia encoded as pixel data within the frame.

2.   A video data file according to claim 1 in which the hyperlink data and viewable video are delivered as separate streams and the hyperlink data includes a frame number associated with each of the defined positions.

3.   A video data file according to claim 1 or claim 2 in which the unique frame number is encoded in a plurality of pixels in the video frame.

4.   A video data file according to claim 3 in which the plurality of pixels comprise a group of adjacent pixels defining a rectangular area.

5.   A video data file according to claim 4 in which the rectangular area is located at a corner of the video frame.

6.   A video data file according to claim 3 in which the plurality of pixels comprise a group of adjacent pixels arranged in a linear array.

7.   A video data file according to claim 6 in which the linear array is located at an edge of the video frame.

8.   A video data file according to any one of the preceding claims in which the position data includes a location relative to the video frame.

9.   A video data file according to claim 8 in which the position data includes size information relating to the hyperlink.

10.   A video data file according to any one of the preceding claims in which the unique frame number indicia is included in substantially all the frames.

11.   A video data file according to any one of the preceding claims in which the plurality of pixels are located in a non-viewable area of the video frame.

12.   A video player for online video, including:

a video decoder for interpreting and displaying a received viewable video stream comprising a sequence of frames,

a hyperlink decoder able to receive and display over the displayed video stream hyperlink data comprising link address information and position data defining a plurality of positions within a plurality of respective video frames,

wherein the player is further arranged to inspect a subset of the pixels of a frame to be displayed time to determine a unique frame number indicia encoded in the subset and use the thus determined frame number to select a hyperlink for display over the frame.

13.   A system for encoding online video arranged to:

receive a viewable video stream comprising a sequence of frames,

receive hyperlink data comprising link address information and position data defining a plurality of positions within a plurality of respective video frames,

encode a unique frame number indicia into at least the plurality of respective video frames by writing non-image data to a subset of the pixels of the frame, and

combine the thus encoded video stream and the hyperlink data for download.

14.   A system for encoding online video according to claim 12 in which the thus encoded video stream and the hyperlink data are combined to form a single downloadable stream.

15.   A system for encoding online video according to claim 12 in which the thus encoded video stream and the hyperlink data are combined as at least two correlated downloadable streams.

16.   A video data format comprising a data stream including;

viewable video comprising a sequence of frames,

associated hyperlink data comprising at least

  i.   link address information, and

  ii.   position data defining a plurality of positions within a plurality of
        respective video frames,

wherein at least a plurality of the frames include a unique frame number indicia
encoded as pixel data within the frame.

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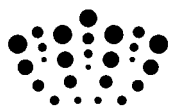
Application No:	GB1213015.9	**Examiner:**	Matthew Males
Claims searched:	1-16	**Date of search:**	26 November 2012

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, 12, 13, 16 at least	EP 1483911 A2 INTELLOCITY USA - see Abstract; page 13, lines 1-20, etc; Fig 3A-C.
A	-	EP 0891675 A1 BRITISH TELECOM PLC - see Abstract.

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

G06F; H04N

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

WPI, EPODOC, INSPEC

International Classification:

Subclass	Subgroup	Valid From
H04N	0021/858	01/01/2011
G06F	0017/30	01/01/2006
H04N	0021/4725	01/01/2011
H04N	0021/4782	01/01/2011
H04N	0021/845	01/01/2011
H04N	0021/8547	01/01/2011