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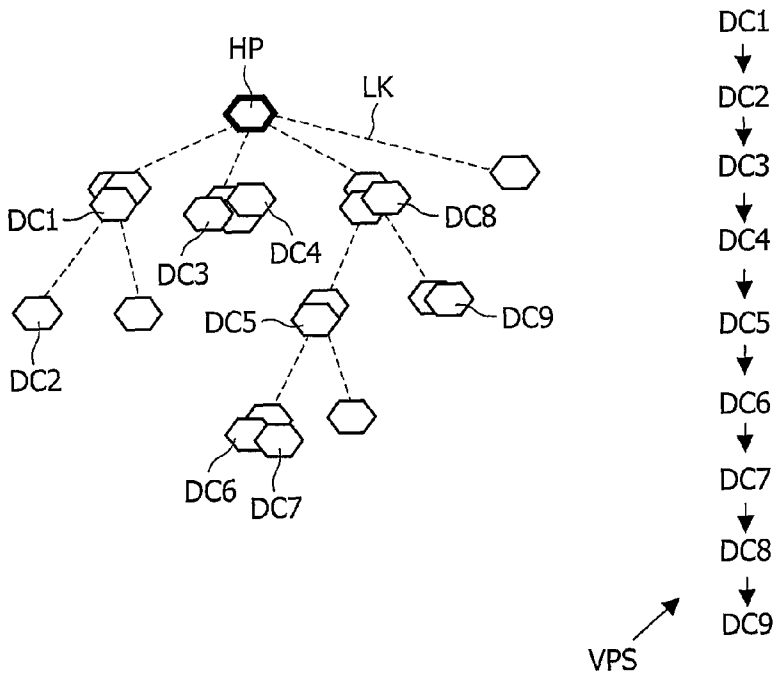
(54) Title: METHOD, DEVICE AND SYSTEM FOR PROVIDING SEARCH RESULTS



(57) Abstract: A method, a device and a system for providing a search result in response to a user request. The method includes the steps of entering one or more keywords to a search engine. The search engine may be an Internet search engine or a local search facility to search on a local hard disc. At least one information link is received in response to the search, e.g. a website homepage or a directory on a hard disc. The method includes scanning through documents arranged in connection with the information link in order to find documents that are relevant with respect to the user request. The documents arranged in connection with the information link may be scanned through using a width-before-depth or depth-before-width strategy or a combination thereof. A path is generated through the documents that are found relevant, and a video presentation based on this path through the documents is finally generated. Preferably, the video presentation includes a video part as well as an audio part. In preferred embodiments, selected parts of text documents are translated into a synthesized voice signal before included into the video presentation. As a result, a user can enjoy a video show of the search result in a lean-back mode, e.g. on a TV set, instead of clicking through all parts of an Internet website in order to find relevant documents. A device with user input means, network connecting means and processing means adapted to perform the mentioned method may be formed by a computer, a video recorder, a hard disc recorder, a video camera or a digital TV set.

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METHOD, DEVICE AND SYSTEM FOR PROVIDING SEARCH RESULTS

The invention relates to the field of searching for digital information and for providing results thereof. More specifically, the invention provides a method, a device and a system for providing a search result in response to a user request.

Comprehensive amounts of information on all kinds of topics are available to many people, either locally on their computer hard disc, via local networks, or via the Internet. People can easily find lists of links to sources of information by using search engines, e.g. www.google.com, www.yahoo.com, and www.a9.com. However, there is no easy way to have a comprehensive overview of the large amount of information available.

Normally, an Internet search engine generates in response to a search a list of a large number of links to websites and links to single relevant documents. Each website can include hundreds of single elements, pages or documents of information, and many of such may not even be relevant for the user. Thus, the user is confronted with a large amount of manual work if he/she wants to get an overview of relevant information present – even on one single website.

US patent application 2002/0023084 A1 describes a method of rendering search results from an Internet search engine and providing a user with a slideshow presentation of the search results.

WO 01/96978 A2 describes a robot agent for extracting web document information and layout images of web documents on the Internet. Embodiments are described that display scaled-down versions of the web images one by one in a slideshow.

It is preferred to provide a user with an easily accessible overview of relevant information arranged in connection with an information link.

In a first aspect, the invention provides a method for providing a search result in response to a user request, the method comprising the steps of:

1) entering, based on the user request, one or more keywords to a search engine,

2) receiving in response at least one information link,

3) scanning through documents arranged in connection with the information link,

4) generating a path through documents that are found relevant based on the user request, and

5) generating a video presentation based on the path through the documents.

The method provides the possibility of automatically presenting a search result, e.g. a search result from an Internet search engine. Such search engines will typically produce a list of links to single documents and information links, such as website links that can have a large amount of different documents, elements or pages, arranged in connection thereto. A website typically has documents arranged in a hierarchical structure according to content - documents with broad content are arranged at a higher level than documents with more detailed content. By 'document' is understood a file of any modality such as text, image, audio clip, video clip etc.

By scanning through documents arranged in connection with the information link, e.g. a website, content of each single document arranged in connection with the information link can be evaluated to be relevant or not relevant based on the user request. Documents that are found relevant are then included into a path of the document structure of the information link, i.e. a list of relevant documents associated with the information link. Thus, using the method, it is possible to provide the user with relevant documents only rather than presenting the entire amount of documents arranged in connection to the information link. Thereby, the user can view a video presentation without any irrelevant information and thus save time watching and/or clicking through documents on a website that are irrelevant to the user.

The path generated through the relevant documents may be in form of a list of hyperlinks to such relevant documents. Finally, a video presentation is generated based on the path through the relevant documents. The video presentation may be a video film of the path through the relevant document, i.e. such as experienced if the user manually entered hyperlinks to these documents arranged under the information link. The video preferably includes relevant documents of all types of modalities present, i.e. both still picture documents as text and images or photos as well as non-still documents such as video and audio documents. A number of still picture documents may be displayed in a slideshow manner, and video documents may be played. In case relevant audio documents are found, such audio documents may be played along with still picture documents and/or video documents.

The method is suited to be performed in connection with a search engine such as an Internet search engine, e.g. Google etc. Alternatively, the search engine may be a search facility installed on a local device, e.g. a computer, such as a personal computer (PC). The

method may be performed on the local device, e.g. in storage means of the local device, e.g. on a hard disc installed in the device. The method may be provided as an integrated functionality provided by an operating system of the device or as a desktop search functionality. Thus, the method may equally well be performed in connection with information searches on a type of network or on a local information device without any network connections.

In case of an Internet search the information link may be a website with several documents associated therewith. In case of a local search the information may in such case be a link to a directory of the hard disc.

The method is advantageous since relevant information for a user contained in connection with an information link is presented in a video instead of e.g. a link to a homepage on the Internet. Thus, the user is presented in a compressed form with the relevant information from the information link in "lean-back" mode e.g. by watching the video presentation on a TV screen. Often, an information link received as a result of a search using a search engine may contain a large amount of relevant documents that are arranged in a complicated structure. Therefore, it can be time consuming for a user to click through all documents of such link in order to find relevant information. By watching a video presentation of relevant documents, the user saves time, and the method may include a possibility for the user to mark or indicated documents during the video presentation that he finds especially interesting and therefore wants to store or keep as "favorites". The video presentation may include, e.g. in a corner, an index that allows the user to identify the current document being presented.

The video presentation may either be an executable file that contains hyperlinks to documents to execute and timing associated therewith, i.e. a very compact form since image and video clips are not directly included in the file. Alternatively, the video may be a complete video file according to a video file format that contains all video and audio information with a given resolution, so the file can be played without access to the information link and the documents arranged in connection thereto. In yet another alternative, the video may be presented on-line on a multimedia computer or on a TV set.

The one or more keywords to enter are extracted from the user request. The user request, i.e. user query, may be in form of only one or more keywords. Alternatively, the user request may comprise the step of the user filling out a questionnaire, e.g. interactively, so as to obtain additional information relevant for the user to the search to be performed, thus

enabling a more selective search and the possibility to extract information that is most likely relevant for the user.

In preferred embodiments, different strategies may be applied for searching through documents arranged in connection with the information link, and thus for generating the path through documents found to be relevant. In case documents of the information link are arranged in a hierarchical structure, the hierarchical structure may be searched through by predominantly searching for:

a) documents on an equal level of the hierarchical level before searching for documents on another level of the hierarchical structure, e.g. a width-before-depth search strategy, or alternatively

b) documents on another level of the hierarchical level before searching for documents on an equal level of the hierarchical structure, e.g. a depth-before-width search strategy.

More alternatively, the strategy may be based on a combination of a) and b).

The path through documents, i.e. the order in which the documents are presented in the video presentation, is then preferably chosen to reflect the search strategy.

The information link may be a link to a website on the Internet, a link to a site on a local network, a link to a directory on a local device, e.g. a local hard disc.

The method may further include the steps of converting text parts of a document into a synthesized voice signal, and then include this synthesized voice signal in the video presentation. Optionally, such synthesized voice signal may be used as a narrative of the video presentation. Thus, the audio-visual presentation can be guided, i.e. outlined, based on spoken text documents. The additional modalities, images, video clips, audio clips etc. are then arranged in accordance therewith to support a structured audio-visual presentation. Preferably, the synthesized narrative voice is aligned with the additional presentations so that e.g. when the narrative voice explains about Mount Everest then images or video clips from Mount Everest are displayed along therewith.

It may be preferred that all text documents that are found relevant are converted into a synthesized voice signal. By eliminating or at least reducing text to be displayed in the video presentation, the information in the video presentation is easier for the user to absorb, and thus the video presentation can be compressed in time. The synthesized voice signal can be presented along with documents of other modalities such as images or video clips, and synthesized speech may even be combined with other audio clips, that support the message in the speech, e.g. birds singing in order to support an image from a forest etc. to form a

complete audio-visual presentation. Thus, the user can be presented with the result of the search in a TV program like presentation. The voice synthesis of text may be performed in various ways such as known to the skilled person. The voice synthesis may be such as dictionary based (unit selection) voice synthesis, diphone based voice synthesis or voice synthesis based on simulating human voice sounds using a mathematical model of the human speech organs (articulatory synthesis).

In order to further compress the video presentation, the method may include the step of summarizing two or more documents that are found relevant into one document before inclusion into the video presentation. Summarization can be performed with the purpose of reducing redundancy, especially if a very brief video presentation is the goal. Various methods exist for automatic summarization for various modalities. Text summarization may be performed with one of the methods described in "Advances in Automatic Text Summarization I", Mani and M.T. Maybury, editors, MIT Press, 1999. Speech Summarization may be performed as described in "Automatic speech summarization based on word significance and linguistic likelihood", C Hori, S Furui - ICASSP IEEE INT CONF ACOUST SPEECH SIGNAL PROCESS PROC, 2000. Video summarization may be performed according to "Summarization of video programs based on closed captioning", L. Agnihotri, K. Devara, T. McGee, and N. Dimitrova, In Proc. SPIE Conference on Storage and Retrieval in Media Databases, pages 599-607, 2001, or according to one of the methods reported in "Video summarization: Methods and landscape", M. Barbieri, L. Agnihotri, and N. Dimitrova. In SPIE ITCOM Conference on Internet Multimedia Management Systems, 2003.

A duration of the video presentation may be selected by a user input. Thus, the user may in advance, e.g. as a part of the user request, indicated that the video presentation should have a duration of 2 minutes. Preferably, summarization, as described above, can be applied in order to reduce a duration of a video presentation if the information link contains a large amount of relevant documents. For example a summary of a single text document may be performed prior to conversion to synthesized speech. This is especially advantageous in case a user selects a very short video presentation, e.g. a duration of 30 seconds. In such case, a summarization may be performed for all of the documents found to be relevant, and it may even be preferred to summarize a larger number of the relevant documents in order to reduce a number of documents to be included in the video presentation.

The method may further comprise a step of evaluating relevance of the documents connected to the information link, based on additional information provided by the user, e.g.

additional information provided in the user request. For example, the additional information may include a list of priority provided by the user. Such additional list of priority may be information provided by the user related to a priority of source of documents.

Other types of additional information provided by the user may be such as, in the example of a search related to planning a vacation on a specific travel site, information from the user if he/she has already visited the travel site before or if it is first time to visit the site. Such additional information from the user can then be taken into account by omitting documents describing the most basic information about the travel site if the user has already visited the site, as it can be assumed that such basic information is already known by the user.

The method is advantageous for use in providing results of information searches that include a number of information links. The method may then include automatically switching to a second information link and perform the same steps and thus generate a second video presentation based thereon and so forth. The user may be able to interact during watching a video presentation. The user may be able to indicating that he wants to skip the present presentation and instead go to a video presentation of the next information link in case the user works through a large search result list including many information links.

The method according to the first aspect may be applied within various devices and systems together with video on demand services and systems, web services etc.

In a second aspect, the invention provides a device adapted to provide a search result in response to a user request, the device comprising

- receiving means for receiving the user request,
    - searching means adapted to entering one or more keywords, based on the user request, to a search engine, and adapted to receive in response at least one information link, and
- processing means adapted to
        - scan through documents arranged in connection with the information link,
        - generate a path through documents that are found relevant based on the user request, and
        - generate a video presentation based on the path through the documents.

The device according to the second aspect provides the same advantages as mentioned in connection with the first aspect. In addition, the same embodiments related to the processing means exist as mentioned in connection with the first embodiment.

The device may be selected from the group consisting of: personal video recorders, stationary consumer electronics, portable consumer electronics, personal infotainment companions, media servers, digital cameras, DVD recorders, hard disc recorders, TV sets etc. The device may also be implemented using a computer, e.g. a Personal Computer (PC).

The receiving means may include a keyboard where the user can enter search words etc. The receiving means may additionally or alternatively include a remote control, and/or a mouse, or a combination of the mentioned means for user interaction. The receiving means may include a microphone and a speech recognition system to accept vocal commands.

The network connection means may include any type of electronic means, either wired or wireless, that is capable of providing a connection to an information network such as the Internet or a locally accessible network.

The device preferably includes storage means, e.g. RAM/ROM based or disc based, adapted to store the generated video presentation in a file so a user can view the presentation at any convenient time. The device does not necessarily include itself display and loudspeaker means to present the presentation to the user. Thus, a generated audio-visual presentation file may be played back using e.g. a TV set by connection via any known audio-visual analog or digital connection. The device may also be able to store a presentation file on a portable memory medium, such as a memory stick, a memory card etc. This will enable the user to carry the generated presentation to another device with audio-visual capabilities. The device may also stream or transmit the presentation to another device, e.g. a mobile phone or a personal computer – either for immediate presentation or for storage purposes.

In a third aspect, the invention provides a system adapted to provide a search result on a user request, the system comprising

- receiving means for receiving the user request,
    - searching means adapted to entering one or more keywords, based on the user request, to a search engine, and adapted to receive in response at least one information link, and
- processing means adapted to
        - scan through documents arranged in connection with the information link,
        - generate a path through documents that are found relevant based on the user request, and
        - generate a video presentation based on the path through the documents, and

- video display means adapted to present a visual part of the video presentation.

The advantages and embodiments described for the first and second aspect apply for third aspect as well.

The system may be integrated into a single apparatus or the system may comprise a number of separate interconnected apparatuses. For example, the system may comprise a hard disc recorder connected to a TV set. The hard disc recorder may then comprise receiving means, network connecting means and processing means adapted to generate the video presentation, whereas the TV has loudspeaker means and video display means to present the video presentation provided by the hard disc recorder.

In a fourth aspect, the invention provides a computer readable program code adapted, i.e. software, comprising algorithms implementing the method as described in the first aspect. Accordingly, the advantages and embodiments described for the first aspect apply for the fourth aspect as well.

The computer executable program code may be adapted to run on a specific computer or processor, alternatively the program code may be a generic program code adapted to be translated into a processor dependent code for execution. The program code may be stored on a storage medium. The storage medium may be a memory, e.g. RAM/ROM, a memory stick, a memory card etc. Alternatively, the storage medium may be a disc such as a CD, a DVD or a hard disc.

In the following the invention is described in more details with reference to the accompanying figures, of which

Fig. 1 illustrates an example of a document structure of an information link and a video presentation based on relevant documents of the information link, and

Fig. 2 illustrates in schematic form a preferred device according to the invention.

While the invention is susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. It should be understood, however, that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

Fig. 1 illustrates a document structure of an information link, e.g. a website, with a website homepage HP and with links LK indicated by dashed lines. Documents, i.e. various types of webpages or files of different modalities arranged in connection with the information link HP, are shown as polygons. According to a preferred method one or more keywords based on a user request are entered to an Internet search engine and a link to the homepage HP, among others, is received in response. All single documents arranged in connection with the homepage HP, i.e. the illustrated polygons, are then scanned with the purpose of determining whether each single document is relevant to the user request or not. The documents found to be relevant are indicated as DC1-DC9. A path is then generated through the documents that are found to be relevant DC1-DC9. This path is then preferably used as a sequence, illustrated as VPS, for a video presentation through the relevant documents and thus serves as a form of providing the search result.

In the illustrated example, the video presentation sequence VPS is based on the sequence in which the documents are scanned, namely following the numbers from DC1 to DC9. With the hierarchical structure of the documents of the illustrated homepage HP, it appears that a depth-before-width strategy has been used since it is seen that document DC2 has been found after DC1, and DC2 is at a lower level than DC1. The same is seen e.g. for DC5 and DC6. With a depth-before-width strategy, documents related to one subject and details related hereto are then typically presented before documents related to other subjects. Still, of course, all documents that are included in the video presentation are relevant with respect to user request since only such documents are included in the path through the documents.

In case some of the documents DC1-DC9 are of different modality, it may be possible to simultaneously present them in the video presentation, e.g. an image and an audio clip or an image and a text document presented as a synthesized voice.

The method may be part of a vacation planning system or vacation planning program for a computer with Internet connection. Thus, with the strategy presented, a user may in a user request include the keyword “Rome”. E.g. search engine Google finds a personal homepage including different documents from the owner’s visits to Rome. E.g. DC1 may then be a text document explaining about Colloseum, and DC2 may be an image showing Colloseum. Instead of presenting a text page for 30 seconds and then present the image for another 30 seconds, it is advantageous to convert the text document DC1 to synthesized voice and then present it along with the image DC2. Following the example, DC3 may be a video clip showing a goal made by Football Club Roma and DC4 may be an image of a autograph

of Club's key players. The method is advantageous since, e.g. in case of a personal home page, a lot of irrelevant documents may be present in a quite unstructured order – e.g. an archive of personal photos that are not related to Rome. An automated video presentation through relevant documents then saves a lot of manual work clicking through numerous irrelevant documents. By converting text documents to a synthesized voice signal, it is possible to further compress the video presentation in order to save time for the user watching it. The text document may even further be summarized prior to the synthesized voice conversion so as to further reduce the duration of the video presentation.

Fig. 2 shows a device DEV embodiment according to the invention. The device DEV includes receiving means RM for receiving a user request UR. Depending on the application of the device DEV, the receiving means RM may be a keyboard on which the user can enter the user request UR such that keywords and optionally other information that enables a more precise search. The receiving means RM may also include buttons with pre-selected functions etc. Furthermore, the receiving means RM may include wireless communication means to that the user can enter the user request UR from a wireless terminal or device, e.g. using a mobile phone or a remote control. The receiving means RM may also include interface means that allow the device DEV to communicate with a computer, e.g. using a communication port of a PC, and thus the user can enter the user request UR on a computer and then send it to the device DEV via the interface means. The receiving means may include a microphone and a speech recognition system to accept vocal commands.

One or more keywords from the user request UR are transferred from the receiving means RM to searching means SM. The searching means SM can be adapted to a network NW, e.g. a local network or the Internet, the searching means SM may then be adapted to enter the one or more keywords to a search engine on the network NW, e.g. Google on the Internet, that sends at least one information link in response to the entered keyword(s). As illustrated, the searching means SM can also be adapted to other information storage means, such as a hard disc HD, e.g. a locally installed hard disc in a hard disc recorder or a computer, and the searching means SM may then use a locally installed search facility or program as a search engine on the hard disc HD to provide an information link in response to the entered keyword(s). The information link may be a website in case of searching on the Internet, while the information link may be a directory in case of a search on a local hard disc or a local network.

The search result in form of the at least one information link is then processed by processing means PM that is adapted to operate in accordance with the method of the first

aspect of the invention. The processing means includes scanning means SC adapted to scan through documents arranged in connection with the information link with the purpose of finding or identifying documents that are relevant, taking into account the user request UR. The scanning means SC may be adapted to scan through the documents according to a predefined scanning strategy such as depth-before-width or width-before-depth in case of a hierarchical arrangement of documents connected to the information link. After having identified the relevant documents, path generating means PG generate a path through the relevant, e.g. an ordered list of links to the relevant documents.

Finally, video generating means VG generates a video presentation based on the path through the relevant documents. Preferably, the video presentation includes a video part V as well as an audio part A as illustrated. The video part V may include video documents, image documents, photo document, and text document, and the audio part A may include speech, music or other sound files, either directly connected to documents presented in the video part V.

Depending on the relevant documents found in the scanning process, the video presentation may include all relevant documents, or only a part thereof, for example if a user has input a desired duration of the video presentation to 1 minute and a large amount of relevant documents have been identified during the scanning.

Optionally, as illustrated in Fig. 2, the processing means PM includes additional features that may be found advantageous to compress the video presentation, e.g. in case a large number and/or comprehensive documents are found to be relevant for presentation and/or if the user requests a very short video presentation. All of or at least part of the relevant documents found in the scanning SC, may be further processed prior to inclusion in the video presentation. Such further processing means may be a voice synthesizer VSYN which is relevant for conversion of text documents to a voice signal. By such conversion, it is possible to simultaneously include in the video presentation a spoken version of a text document along with e.g. an image or a video clip and possibly additional audio effects. Another optional processing illustrated in Fig. 2 is a summarizer SMM that is adapted to convert two or more documents of the same modality to one document being a summary of the two or more input documents. Known summarizing algorithms exist for summarizing in different modalities.

Preferably, the processing means PM is implemented as an algorithm to be executed on a computer or a signal processor. Nonetheless, the processing means PM can also be implemented as an ASIC or a combination of integrated circuits.

The audio part A and visual part V of the presentation may be presented using one or more loudspeakers LSPK and a video display VDSP, e.g. using a TV set or similar that includes means for presenting both the audio A and visual V parts of the presentation.

The device DEV illustrated in Fig. 2 may be included in a hard disc recorder, optionally with an Internet connection. The user input UIP used to receive the user request may be buttons on a front panel of the hard disc recorder or a remote control, alternatively via a connected keyboard. The device DEV may also be included in a system such as a digital TV that also includes stereo loudspeakers LSPK and a display VDSP to present the video presentation.

It will be appreciated that the present invention may be applied within a wide range of different searches related to different topics. The method may be used in itself or it may be part of a more dedicated system such as the mentioned example of a vacation planning system that has been used for illustration purpose only.

In the claims reference signs to the figures are included for clarity reasons only. These references to exemplary embodiments in the figures should not in any way be construed as limiting the scope of the claims.

CLAIMS

1. A method for providing a search result in response to a user request, the method comprising the steps of:

1) entering, based on the user request, one or more keywords to a search engine,

2) receiving in response at least one information link (HP),

3) scanning through documents arranged in connection with the information link (HP),

4) generating a path (VPS) through documents (DC1-DC9) that are found relevant based on the user request, and

5) generating a video presentation based on the path (VPS) through the documents (DC1-DC9).

2. A method according to claim 1, wherein documents of the information link (HP) are arranged in a hierarchical structure, and wherein the hierarchical structure is searched through by predominantly searching for documents on an equal level of the hierarchical level before searching for documents on another level of the hierarchical structure.

3. A method according to claim 1, wherein documents of the information link (HP) are arranged in a hierarchical structure, and wherein the hierarchical structure is searched through by predominantly searching for documents on another level of the hierarchical level before searching for documents on an equal level of the hierarchical structure.

4. A method according to claim 1, wherein the at least one information link (HP) is selected from the group consisting of: a link to a website on the Internet, a link to a site on a local network, a link to a directory on a local device.

5. A method according to claim 1, further comprising the steps of converting text parts of a document into a synthesized voice signal, and including this synthesized voice signal in the video presentation.

6. A method according to claim 5, wherein the synthesized voice signal is used as a narrative of the video presentation.

7. A method according to claim 1, further including the step of summarizing two or more documents into one document before inclusion into the video presentation.

8. A method according to claim 1, wherein a duration of the video presentation can be selected by a user input.

9. A device (DEV) adapted to provide a search result in response to a user request (UR), the device comprising

- receiving means (RM) for receiving the user request (UR),

- searching means (SM) adapted to entering one or more keywords, based on the user request (UR), to a search engine, and adapted to receive in response at least one information link, and

- processing means (PM) adapted to

- scan through documents arranged in connection with the information link,

- generate a path through documents that are found relevant based on the user request (UR), and

- generate a video presentation (A, V) based on the path through the documents.

10. A system adapted to provide a search result on a user request (UR), the system comprising

- receiving means (RM) for receiving the user request (UR),

- searching means (SM) adapted to entering one or more keywords, based on the user request (UR), to a search engine, and adapted to receive in response at least one information link, and

- processing means (PM) adapted to

- scan through documents arranged in connection with the information link,

- generate a path through documents that are found relevant based on the user request (UR), and

- generate a video presentation (A, V) based on the path through the documents, and

- video display means (VDSP) adapted to present a visual part (V) of the video presentation (A, V).

11. Computer executable program code adapted to perform a method for providing a search result in response to a user request, the method comprising the steps of:

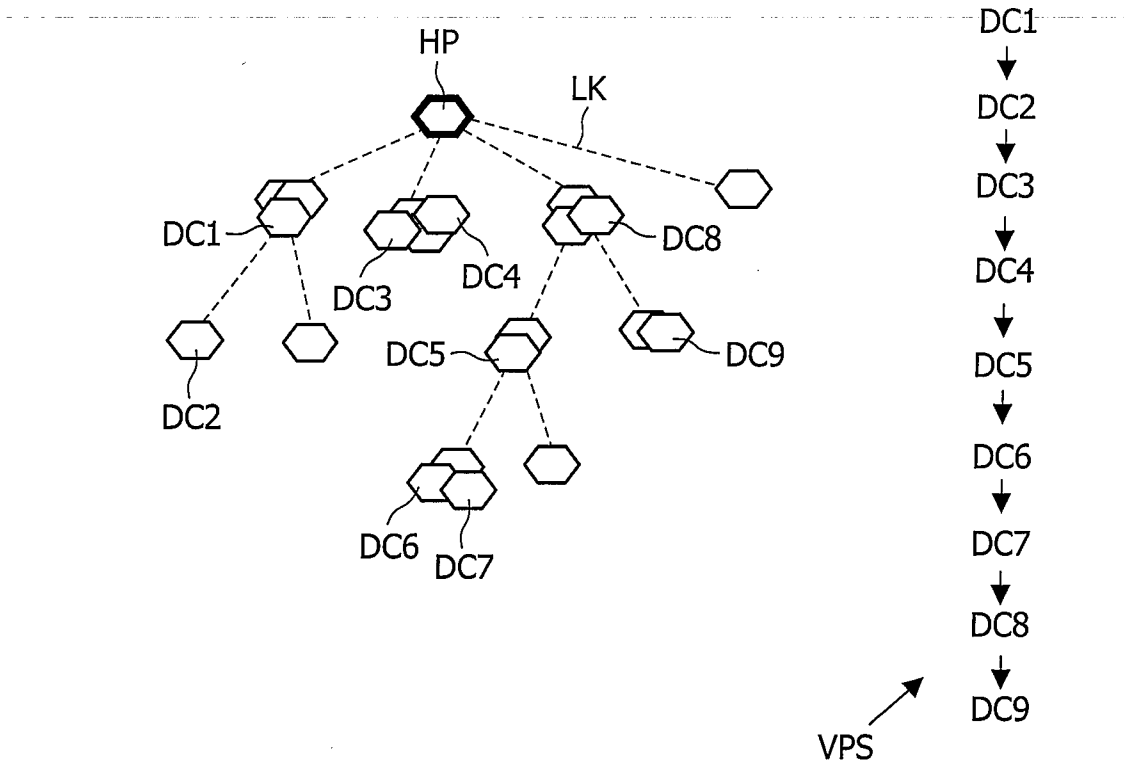
1) entering, based on the user request, one or more keywords to a search engine,

2) receiving in response at least one information link,

3) scanning through documents arranged in connection with the information link,

4) generating a path through documents that are found relevant based on the user request, and

5) generating a video presentation based on the path through the documents.


HP
LK
DC1
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VPS

FIG. 1

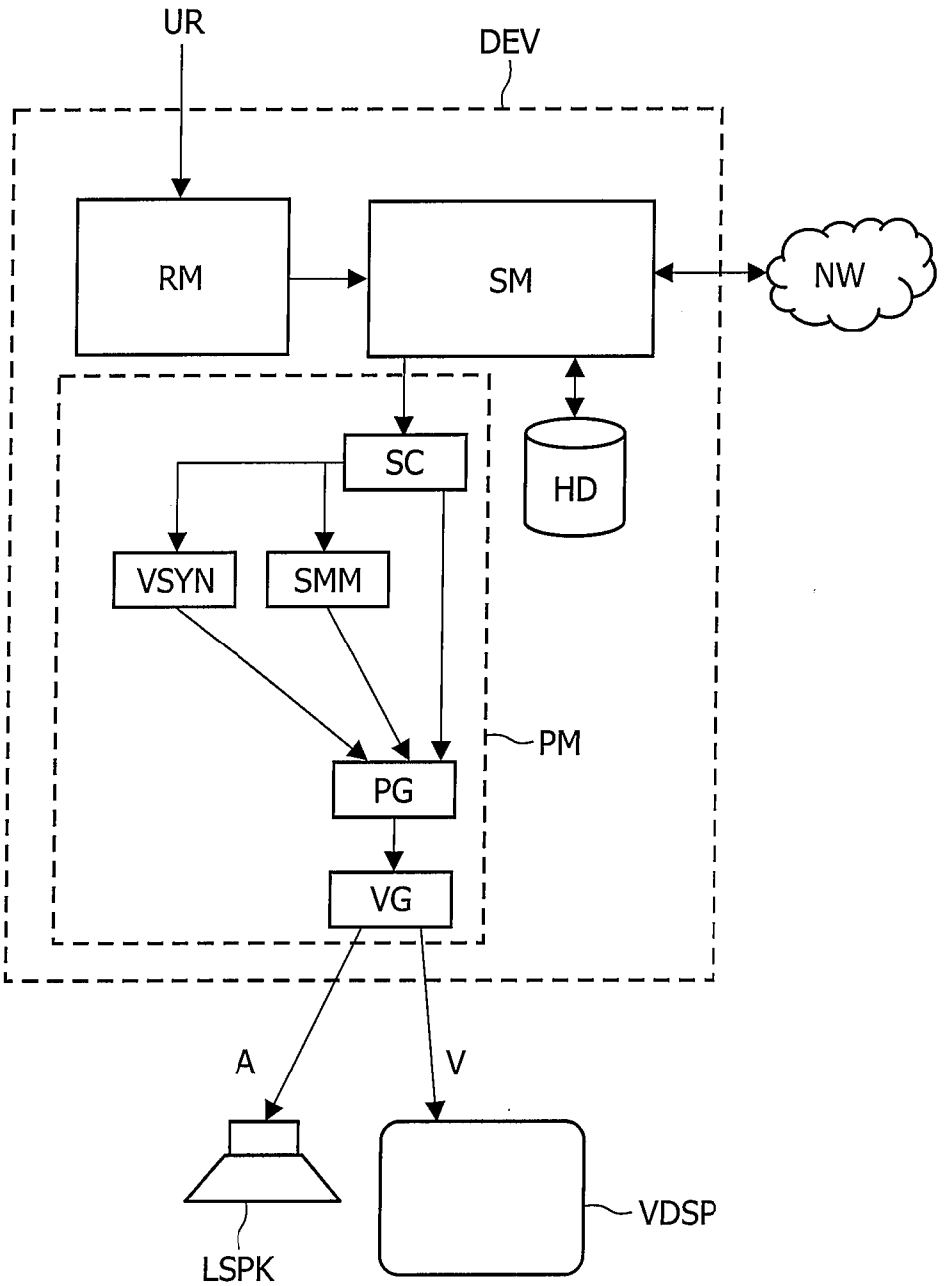

FIG. 2