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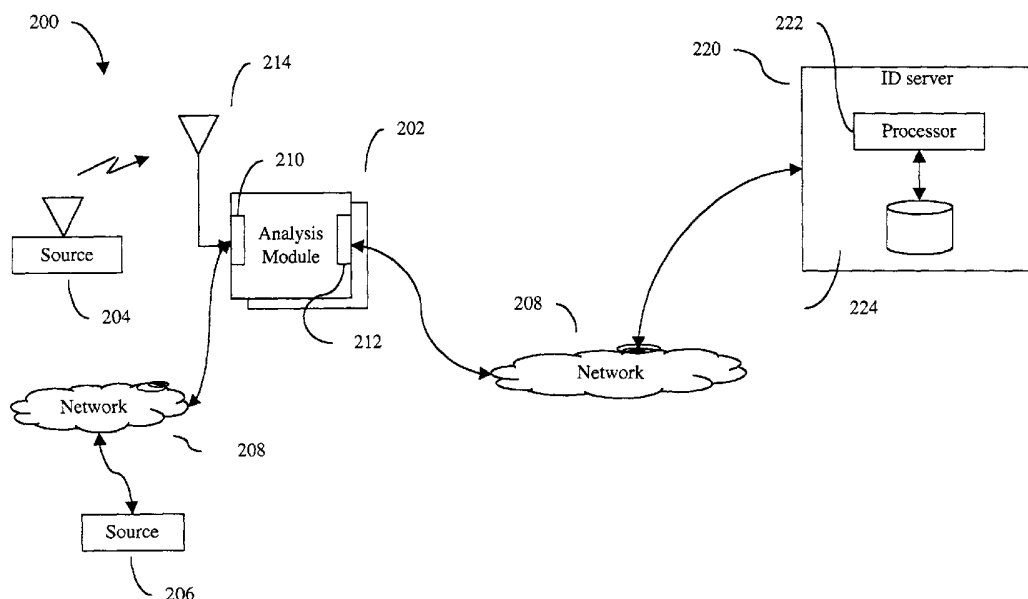
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(54) Title: PLAYLIST GENERATION METHOD AND APPARATUS



(57) Abstract: A method and system for playlist generation is disclosed. In one aspect, the system may include at least one analysis module (202) for receiving and analyzing an unknown work and generating a corresponding representation thereof, and at least one identification (ID) server (220) for receiving the representation from the analysis modules (202) and determining the identity of the unknown work.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## PLAYLIST GENERATION METHOD AND APPARATUS

### RELATED APPLICATIONS

This application claims the benefit of U.S. Patent Application Serial No. 09/910,680, filed 20 July 2001.

### BACKGROUND

#### Field of the Disclosure

The present disclosure relates to data communications, and, in particular, to a novel system and apparatus for the automatic generation of media playlists.

#### The Prior Art

##### Background

One application of the Internet that has received considerable attention is the ability to transmit or stream media content over the Internet. Once an audio or video work has been digitally encoded it may be both downloaded by users for play, or broadcast ("streamed") over the Internet. When works are streamed, they may be listened to or viewed by Internet users in a manner much like traditional radio and television stations.

Given the widespread use of digital media, audio works, or video works may need to be identified. The need for identification of works may arise in a variety of situations. For example, an artist may wish to verify royalty payments or generate their own Arbitron®-like ratings by identifying how often their works are being streamed or downloaded. Thus, playlists of media may need to be generated. The prior art has made efforts to create methods for identifying digital works and generating playlists.

As is known by those skilled in the art, a playlist is the documentation of the performance of one or more works at a particular time over a particular media.

Figure 1 shows a playlist generation system 100 of the prior art. The system 100 may include one or more remote detection modules 102 deployed at various locations throughout a broadcast area. Each detection module 102 may include an antenna 104 for receiving broadcast signals and providing the signals to an analysis and lookup module 106. The module 106 is typically configured to identify the content of the received signal by comparing its audio content against a database 108 of known reference signatures.

If a match is made, typically the module 102 will keep a record of all matches made during a predetermined period of time on the database 108. For example, the module 102 may keep a record of song titles detected during a 24-hour period.

The system 100 may further include a playlist server 110 having a processor 112 and database 114. The server 110 is typically configured to receive information such as the titles of identified songs from the one or more detection modules 102 through a network such as the Internet 109 and generate a playlist which may be stored on database 114.

The system 100 of the prior art in operation typically requires the identity of an unknown work to be determined by the individual detection modules. The playlist server 110 is typically only configured to receive and compile identities of works from the modules 102 into a playlist.

### SUMMARY

A playlist generation system is disclosed. In one aspect, the system may include at least one analysis module for receiving and analyzing an unknown work and generating a corresponding representation thereof, and at least one identification (ID) server for receiving the representation from the at least one analysis modules and determining the identity of the unknown work.

The system may receive unknown works from networked sources or broadcast sources, or directly from the source prior to the work being provided to a network or broadcast source. The analysis modules and ID servers may be coupled over a network, such as the Internet.

The representations and identification may be based upon feature vectors, a spectral representation of the unknown work, the text output of a speech recognition system, musical score produced by a music transcription system, or a bit calculated key method, such as MD5 hash, as are known in the art.

The system analysis modules may receive a plurality of streaming sources for analysis at a single location, or from a plurality of streaming sources for analysis at a plurality of access points of the network.

The system provides representations in approximately real time, and the system may generate a playlist of identified works. The ID server may generate a playlist of identified works received from different access points of the network in approximately real time.

Various methods for generating a playlist are also disclosed.

### BRIEF DESCRIPTION OF THE DRAWING FIGURES

Figure 1 is a prior art diagram of a system.

Figure 2 is a block diagram of one aspect of a disclosed system including one or more analysis modules and ID servers.

Figure 3 is a block diagram of one aspect of an analysis module.

Figure 4 is a flowchart of one aspect of a disclosed system.

Figure 5 is a flowchart of one aspect of a disclosed system.

### DETAILED DESCRIPTION

Persons of ordinary skill in the art will realize that the following description is illustrative only and not in any way limiting. Other modifications and improvements will readily suggest themselves to such skilled persons having the benefit of this disclosure.

This disclosure may relate to data communications. Various disclosed aspects may be embodied in various computer and machine-readable data structures. Furthermore, it is contemplated that data structures embodying the teachings of the disclosure may be transmitted across computer and machine-readable media, and through communications systems by use of standard protocols such as those used to enable the Internet and other computer networking standards.

The disclosure may relate to machine-readable media on which are stored various aspects of the disclosure. It is contemplated that any media suitable for retrieving instructions is within the scope of the present disclosure. By way of example, such media may take the form of magnetic, optical, or semiconductor media.

Various aspects of the disclosure may be described through the use of flowcharts. Often, a single instance of an aspect of the present disclosure may be shown. As is appreciated by those of ordinary skill in the art, however, the protocols, processes, and procedures described herein may be repeated continuously or as often as necessary to satisfy the needs described herein. Accordingly, the representation of various aspects of the present disclosure through the use of flowcharts should not be used to limit the scope of the present disclosure.

#### Exemplary structure

Figure 2 is a schematic diagram of one aspect of a disclosed playlist generation system 200. The system 200 may include at least one analysis module 202 for receiving an unknown work from a broadcast source 204 as is known in the art. The analysis module

may include one or more conventional antennae 214 coupled to the analysis module 202 through an input port 210. The input port 210 may include a conventional receiver for the reception of desired broadcast signals. The input port 210 may also be configured to provide remote control functionality for allowing the remote control and configuration of the receiver, such as providing for remote tuning. The input port 210 may be further configured to digitize received signals in digital formats using protocols known in the art, such as PCM.

The analysis module 202 may also be configured to receive an unknown work from one or more networked sources 206. In one aspect of a disclosed system, the input port 210 of the analysis module 202 may be configured to monitor sources providing content in standard formats such as Real®, QuickTime®, Windows Media®, MP3®, and similar formats, using hardware and software as is known in the art.

In another aspect of a disclosed system, the input port 210 may be configured to directly receive audio or video through any of the various means known in the art, such as a microphone or video acquisition system. These unknown works may also be provided in standard formats such as MP3, Windows Media, and similar formats. Thus, the analysis module 202 may be configured to receive an unknown work prior to the unknown work being presented to the broadcast system or network source. It is envisioned that this presentation could occur almost simultaneously.

The input port 210 may be operatively coupled to a network 208 through which the source 206 may be accessed. The network 208 may comprise any packet- or frame-based network known in the art, such as the Internet. The input port 210 may also be configured to access the network 208 through any means known in the art, such as through traditional copper connections. Furthermore, the input port 210 may also be configured to access the network 208 using wireless connectivity methods as known in the art, including low-power broadband methods such as Bluetooth®, or cellular-based access methods such as those used to provide wireless connectivity to cellular phones and personal digital assistants (PDAs).

The analysis module 202 may also include an output port 212 for providing connectivity to the network 208. The output port 212 may comprise a separate unit within the analysis module 202 and may include hardware and software to provide the same functionality as the input port 210. Additionally, it is contemplated that the output port 212 may comprise substantially the same circuitry as the input port 210 in order to save space and cost.

Referring now to Figure 3, a conceptual block diagram of one aspect of a disclosed

analysis module 202 is shown. The analysis module 202 may include a processor 302 for operating various aspects of the present disclosure. The processor 302 may be operatively disposed between the input port 210 and output port 212.

It is contemplated that any processor known in the art may be employed in the module 202, and the choice of a processor may depend on the application. For example, if the module 202 is embodied in a personal computer, the processor 202 may comprise a microprocessor capable of running conventional operating systems such as Microsoft Windows®, while if the module 202 is deployed in a mobile unit such as a PDA, the processor 202 may need only be capable of running an operating system such as Palm OS®, or other embedded systems such as may be present in a cell phone or other consumer device.

The module 202 may include ancillary hardware and software, such as conventional memory 304 and a conventional database 306 for the storage and retrieval of various aspects of the disclosed system and data.

The module 202 may be configured to generate a representation of an unknown work which may then be used by the system to identify the unknown work. It is contemplated that a wide variety of methods may be used by the analysis module 202 to generate the representation. The analysis module may be configured to generate a representation of the unknown work using the psychoacoustic properties of the audio content of the unknown work. Such methods are known in the art. For example, the analysis module may generate feature vectors as disclosed in US Patent #5,918,223 to Blum, et al., which is assigned to the same assignee of the present disclosure and incorporated by reference as though fully set forth herein.

Additionally, the module 202 may use audio or video spectral or wavelet representation techniques as are known in the art. For example, other representation forms may comprise the text output of a speech recognition system, text output of a close captioned transmission, or a musical score produced by a music transcription system. In another embodiment, the representation may comprise a bit calculated key using any of the techniques as are known in the art such as MD5 hash and CRC. It is contemplated that a wide variety of analysis methods may be employed singly or in combination advantageously in the present disclosure.

Referring back to FIG. 2, the system 200 may further include at least one identification (ID) server 220 for identifying an unknown work. The ID server 220 may identify an unknown work using a representation received from the analysis module 202

through network 208. Though FIG. 2 shows the ID server 220 coupled to the same network 208 as the analysis module 202, it is to be understood that the various components of the present disclosure may be coupled to different networks at different times.

The ID server 220 may comprise a computer suitable for running an operating system such as Microsoft Windows®, UNIX®, LINUX®, MAC OS®, and the like. The ID server 220 may include a conventional processor 222 for operation of the server. The ID server may further include associated hardware and software known in the art such as a conventional database 224 for storing embodiments of the disclosure or data.

It is contemplated that the ID server 220 may be configured to identify the unknown work using a variety of methods known in the art. The method for identification may correspond to the method(s) used to generate the representation within the analysis module. For example, the ID server 220 may be configured to perform identification using the methods disclosed in US Patent #5,918,223 to Blum, et al, if the representation were generated using corresponding methods.

Another example would be the pure spectral representations as are known in the art. It is envisioned that other representations such as wavelets may be used. The invention could also identify the unknown work from the speech recognized text compared against a database of song lyrics using any of a variety of methods known to those skilled in the art.

Yet another example would be any of a number of search techniques as are known in the art when the representation is a bit calculated key.

The system may also identify the unknown work by searching a collection of musical works for musical note sequences that correspond to the musical score in the representation.

In another configuration the system may use a combination of identification techniques, each of which correspond to a representation of the unknown work. By using several identification techniques, the chance of a mis-identification may be greatly reduced.

Though the analysis module and ID server are shown as being located separately, it is contemplated that they also may be co-located in a single server. For example, it is contemplated that the analysis module and ID server may each be embodied in a single board computer wherein the analysis module and ID server are housed in a single unit and operatively coupled through a common backplane.

#### Exemplary operation

Figure 4 is a flowchart of one aspect of a disclosed method for automatically generating a playlist. The process begins in act 400, where at least one unknown is received



by an analysis module. The analysis module may comprise hardware and software substantially as shown and described above.

Additionally, one or more of the analysis modules may be configured to receive a plurality of streaming sources simultaneously for analysis. It is contemplated that the analysis modules may be located and configured to receive and analyze a wide variety of content, including analog radio or video, digital streaming audio or video, or any other media.

In act 402, the analysis module then creates a representation of the received unknown work as shown and described above. The representation may be created by the analysis module by extracting psychoacoustic properties from the received unknown work as described above.

In act 404, the representations created by the one or more analysis modules may be provided to an ID server. The ID server may comprise hardware and software as described above. It is contemplated that the ID server may comprise a single server, multiple servers networked at a single location, or multiple servers located at different locations.

It is contemplated that the various analysis modules may provide representations to one or more ID servers in a wide variety of manners. For example, all of the analysis modules present in a system may provide representations in real-time. Or, different analysis modules may be configured to provide representations at different intervals depending on the needs of the end user. The analysis modules may transmit representations every sixty seconds, hourly, or as often as is needed.

In some cases where network connectivity is challenging, the representations may be batched up and sent to the ID server(s) once a day or less. In particularly harsh or secretive conditions, the representations may be stored within the analysis modules until the modules could be physically retrieved and operatively coupled to an ID server at another physical location.

It is contemplated that an out-of-band event may be used to trigger the transmission of representations. For example, such a trigger may comprise the initialization of a connection to a network, or the activation of media playing software or hardware.

Figure 5 is a flowchart of a further disclosed aspect of a disclosed method. The process begins with act 500, where an ID server receives at least one representation of an unknown work. The representations may be received from analysis modules as described above.

In act 502, the ID server identifies the unknown work based upon the representation. This identification may be performed using the methods as described above. The identification may include such information as the song title, artist, label, or any other information as is known in the art that may be associated with the work. The identification information might contain information such as the name of the advertiser or a descriptive notation of an FCC broadcaster identification segment.

Once an identification of the unknown work is made, it is contemplated that a wide variety of further acts may be performed. For example, the identifications made by the ID server may be used to construct or maintain a playlist database. Such a playlist may be stored on the ID server, or on a distant server. As will be appreciated by those skilled in the art, if representations are provided to the ID server in real-time (or near real-time depending on the equipment or network used), a playlist may be generated in corresponding real-time. Thus, a playlist may be generated in real-time from inputs provided from distant geographic locations or multiple sources that contains a comprehensive playlist of every identified media segment.

Additionally, the identification may be transmitted back to the analysis module which generated the representation. This may be advantageous where it is desired to generate a playlist for the particular analysis module's location or user. Thus, the ID server may be configured to provide an identification back to the source analysis module.

The identity of the received work may also be used for the maintenance of the system. Typically, copies of received works are stored on local drives for audit purposes. Since the intermediate representation files may be larger in size than the identities, it may be desirable to configure the analysis module to purge intermediate files for identified works to recover drive space. It is contemplated that the ID server may be configured to transmit the identity of received works back to the generating analysis module, and the corresponding representation files may then be deleted from local drives by the analysis module, thereby recovering valuable capacity.

Furthermore, it is contemplated that the ID server or analysis module may be configured to send information regarding identified works to third parties, such as third-party servers. Additionally, the ID server or analysis module may be configured to provide an electronic notification to third parties of identifications made by the ID server. Examples of electronic notifications may include email, HTTP POST transactions, or other electronic communication as is known in the art. As is known by those skilled in the art, these

electronic notifications may be used to initiate an action based on their content. For example, such notifications may allow the playlist to be accessed in real-time or as desired.

It is contemplated that the ID server may be configured to provide customized playlists containing information tailored to a customer's individual needs. For example, a customer may wish to be notified whenever a certain work is broadcast, or whether a particular work is broadcast on a particular media outlet. Customers may wish to have complete playlists provided to them periodically at desired intervals that may include statistics known in the art. By using the system as disclosed herein, such requests may be satisfied automatically in real-time, or at whatever interval may be desired. It is to be understood that any of the aspects of the present disclosure may be performed in real time or as often as desired.

It is contemplated that the ID server may examine the representations of all segments that were not identified in the process described above, and determine that some sub-segments were actually performances of a single work. Furthermore, this examination may extract a plurality of other characteristics of the original broadcast such as the amount of musical content, amount of speech content, a transcription based on speech recognition, the beat of any music present, etc. These characteristics of the un-identified segments can then be used to classify the un-identified unknown representations. For instance, a sub-segment that has been performed many times may be correlated with a high amount of musical content and a certain minimum length of playtime to indicate that a new song has been detected. Correlating other values and characteristics could indicate that a new advertisement has been detected. In some cases a corresponding segment of the original broadcast signal could be retrieved and played for a human to perform an identification.

While embodiments and applications have been shown and described, it would be apparent to those skilled in the art that many more modifications and improvements than mentioned above are possible without departing from the inventive concepts herein. The disclosure, therefore, is not to be restricted except in the spirit of the appended claims.

What is claimed is:

1. A playlist generation system comprising:
  - at least one analysis module for receiving and analyzing an unknown work and generating a corresponding representation thereof;
  - at least one identification (ID) server for receiving said representation from said at least one analysis module and determining the identity of said unknown work.
2. The system of claim 1, wherein said at least one analysis module further includes an input port configured to receive said unknown work from a networked source.
3. The system of claim 1, wherein said at least one analysis module further includes an input port configured to receive said unknown work from a broadcast source.
4. The system of claim 1, wherein said at least one analysis module further includes an input port configured to receive said unknown work in the form of a pre-broadcast digital form.
5. The system of claim 1, wherein said at least one analysis module and said at least one ID server may be coupled over a network.
6. The system of claim 5, wherein said network comprises the Internet.
7. The system of claim 1, wherein said corresponding representation comprises feature vectors.
8. The system of claim 1, wherein said corresponding representation comprises a spectral representation of said unknown work.
9. The system of claim 1, wherein said corresponding representation comprises the text output of a speech recognition system.
10. The system of claim 1, wherein said corresponding representation comprises the musical score output of a music transcription system.
11. The system of claim 1, wherein said corresponding representation comprises a bit calculated key.
12. The system of claim 1, wherein said ID server is configured to identify said unknown work using feature vectors.
13. The system of claim 1, wherein said ID server is configured to identify said unknown work using a spectral representation of said unknown work.
14. The system of claim 1, wherein said ID server is configured to identify said unknown work using the text output of a speech recognition system.

15. The system of claim 1, wherein said ID server is configured to identify said unknown work using the musical score output of a music transcription system.
16. The system of claim 1, wherein said ID server is configured to identify said unknown work using a bit calculated key.
17. The system of claim 1, wherein said at least one analysis modules are further configured to receive a plurality of streaming sources for analysis at a single location.
18. The system of claim 1, wherein said at least one analysis modules are further configured to receive a plurality of streaming sources for analysis at a plurality of different access points of the network.
19. The system of claim 1, wherein said at least one analysis module is configured to provide said representations to said at least one ID server at a predetermined time interval.
20. The system of claim 19, wherein said predetermined time interval comprises at least once a day.
21. The system of claim 19, wherein said predetermined time interval comprises approximately once an hour.
22. The system of claim 19, wherein said at least one analysis module is configured to provide said representations to said at least one ID server in approximately real time.
23. The system of claim 19, wherein said at least one analysis module is configured to provide said representations to said at least one ID server based on an out-of-band event.
24. The system of claim 1, wherein said ID server is further configured to generate a playlist of identified works.
25. The system of claim 1, wherein said ID server is further configured to generate a playlist of identified works received from said different access points of the network in approximately real time.
26. The system of claim 1, wherein said at least one ID server is further configured to provide an identification of said unknown work back to the corresponding source analysis module.
27. The system of claim 18, wherein said ID server is further configured to generate a playlist of identified works in approximately real time.

28. The system of claim 27, wherein said at least one ID server is further configured to provide an identification of said unknown work back to the corresponding source analysis module in approximately real time.
29. The system of claim 27, wherein said at least one analysis module is further configured to purge a corresponding representation once an identification is received.
30. The system of claim 29, wherein said at least one analysis module is further configured to purge a corresponding representation in approximately real time once an identification is received.
31. A method for automatically generating a playlist comprising:
  - receiving, by at least one analysis module, an unknown work;
  - generating, by said at least one analysis module, a representation of said unknown work; and
  - sending, by said at least one analysis module, said representation to at least one identification server.
32. The method of claim 31, further comprising the act of identifying, by said identification server, said unknown work based upon said representation.
33. The method of claim 32, further comprising the act of storing said identification in a playlist database.
34. The method of claim 32, further comprising the act of sending, by said identification server, said identification to said at least one analysis module.
35. The method of claim 34, further comprising the act of purging, by said at least one analysis module, at least one file corresponding stored to said identification.
36. The method of claim 31, wherein said acts of receiving and sending are performed over a network.
37. The method of claim 36, wherein said acts of receiving and sending are performed over the Internet.
38. The method of claim 31, wherein said representation comprises feature vectors.
39. The method of claim 31, wherein said representation comprises a spectral representation of said unknown work.
40. The method of claim 31, wherein said representation comprises the text output of a speech recognition system.
41. The method of claim 31, wherein said representation comprises musical score output of a music transcription system.

42. The method of claim 31, wherein said representation comprises a bit calculated key of the digital signal.
43. The method of claim 32, wherein said act of identifying is performed using feature vectors.
44. The method of claim 32, wherein said act of identifying is performed using a spectral representation of said unknown work.
45. The method of claim 32, wherein said act of identifying is performed using the text output of a speech recognition system.
46. The method of claim 32, wherein said act of identifying is performed using the musical score output of a music transcription system.
47. The method of claim 31, wherein said act of identifying is performed using a bit calculated key of the digital signal.
48. The method of claim 31, wherein said act of receiving, by at least one analysis module, an unknown work includes receiving a plurality of streaming sources for analysis at a single location.
49. The method of claim 31, wherein said act of receiving, by at least one analysis module, an unknown work includes receiving a plurality of streaming sources for analysis at different access points of the network.
50. The method of claim 31, wherein said act of sending, by said at least one analysis module, said representation to at least one identification server is performed in approximately real time.
51. A method for automatically generating a playlist comprising:
  - receiving a representation of an unknown work;
  - identifying said unknown work using said representation; and
  - generating a playlist.
52. A playlist generation system comprising:
  - means for receiving an unknown work;
  - means for generating a representation of said unknown work; and
  - means for sending said representation to at least one identification server.
53. The system of claim 52, further including means for identifying said unknown work based upon said representation.

54. The system of claim 53, further including means for storing said identification in a playlist database.
55. The system of claim 54, further including means for sending said identification to said at least one analysis module.
56. The system of claim 52, further including means for generate a playlist of identified works received from different access points of the network in approximately real time.
57. The system of claim 52, further including means for generating a playlist of identified works in approximately real time.
58. The system of claim 52, further including means for providing an identification of said unknown work back to the corresponding source analysis module in approximately real time.
59. A playlist generation system comprising:
  - means for receiving an unknown work;
  - means for generating a representation of said unknown work;
  - means for sending said representation to at least one identification server; and
  - means for sending an identification of said representation to at least one other computer system.



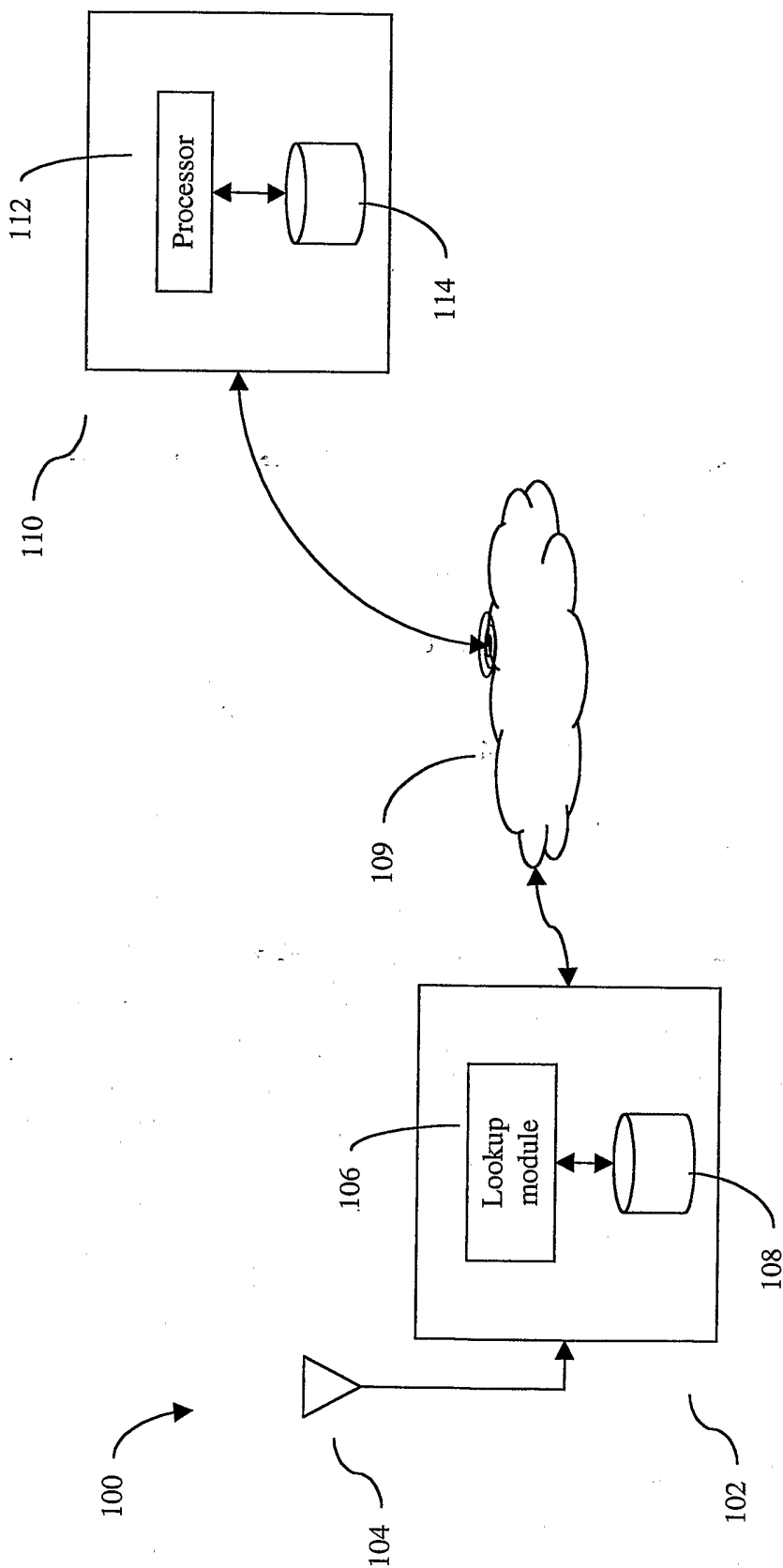


FIG. 1  
Prior Art

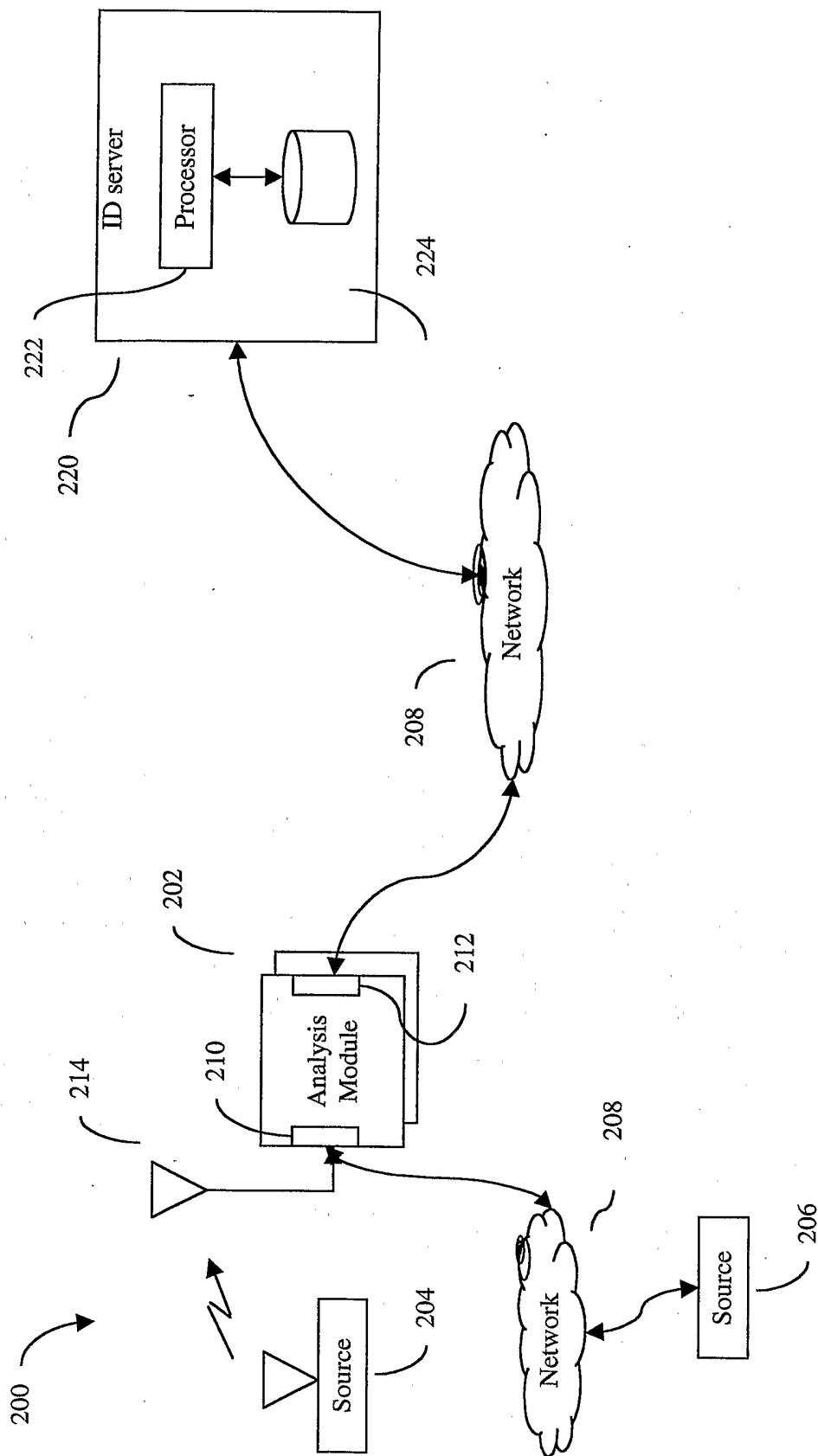


FIG. 2

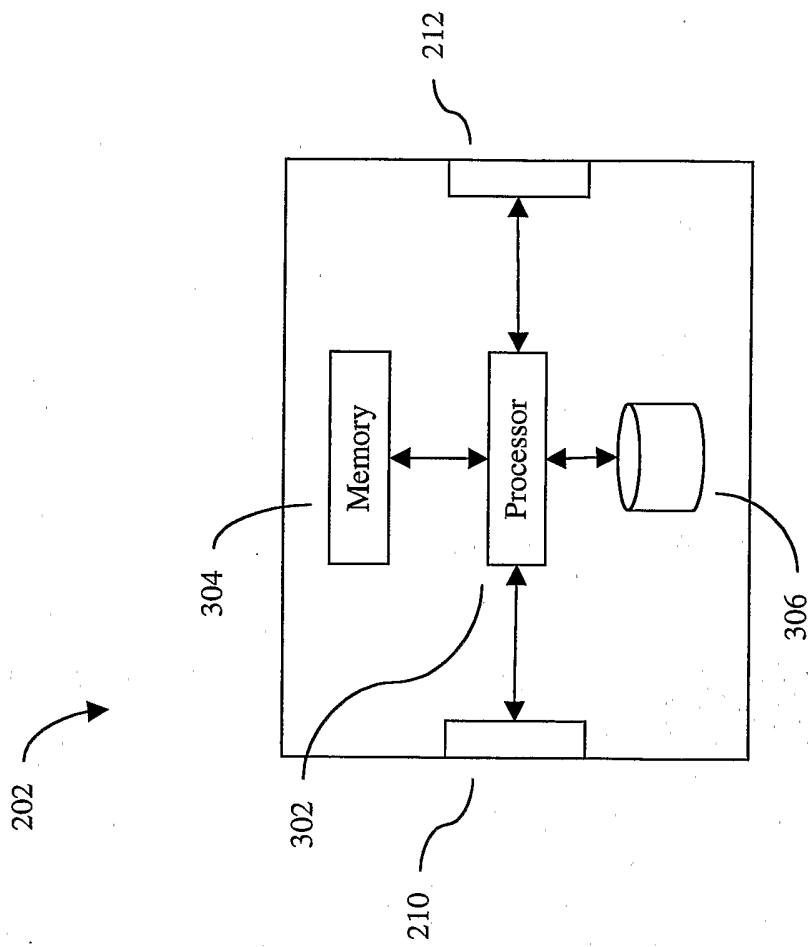


FIG. 3

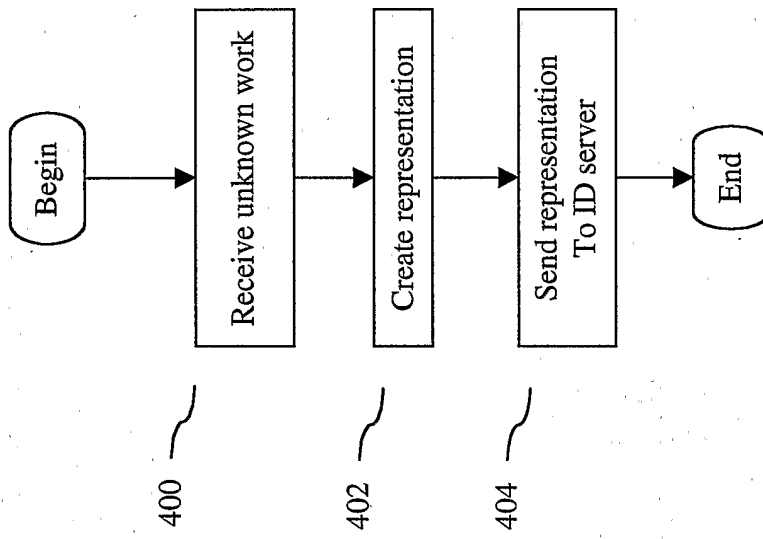


FIG. 4

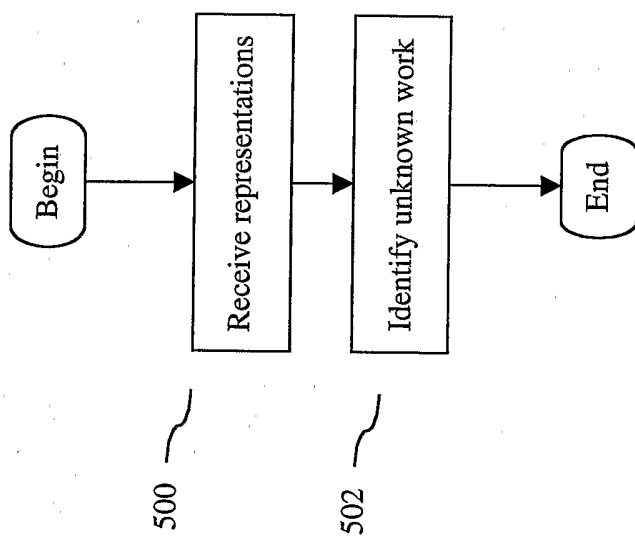


FIG. 5

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/22931

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(7) : G06F 13/00; H04N 7/10; G11B 17/22; G06F 3/00; G10L 11/00 US CL : 709/223, 217; 707/104; 345/349; 704/270 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) U.S. : 709/223, 217; 707/104; 345/349; 704/270 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched None Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) East		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,026,439 A (CHOWDHURY et al) 15 February 2000 (15.02.2000), column 5, lines 15-56.	1-59
Y	US 6,006,256 A (ZDEPSKI et al) 21 December 1999 (21.12.1999), column 6, lines 55-67; column 7, lines 1-49.	1-59
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Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Donaghue, Larry <i>7m</i> <i>James R. Matthews</i> Telephone No. (703)305-9669	