

UNITED STATES DISTRICT COURT FOR THE
SOUTHERN DISTRICT OF NEW YORK

VEVEO, INC.,

Plaintiff,

v.

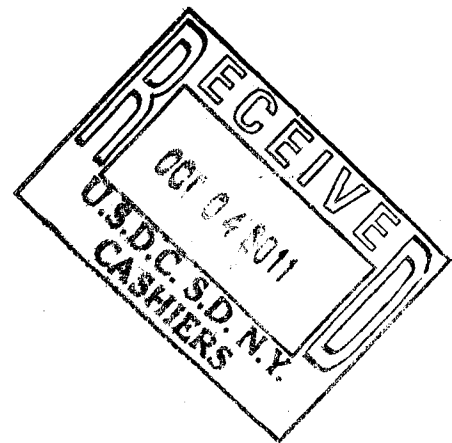
VERIZON SERVICES CORP.
VERIZON COMMUNICATIONS, INC.,
VERIZON DATA SERVICES LLC,
VERIZON ONLINE LLC,
VERIZON NEW ENGLAND, INC.,
VERIZON NEW YORK, INC.,
VERIZON WASHINGTON, DC, INC.
GTE SOUTHWEST, INC.
VERIZON CALIFORNIA, INC.
VERIZON NEW JERSEY, INC.
VERIZON PENNSYLVANIA, INC.
VERIZON VIRGINIA, INC.
VERIZON FLORIDA LLC
VERIZON MARYLAND, INC.
VERIZON DELAWARE, LLC
VERIZON SOUTH, INC.
VERIZON NORTH, LLC
VERIZON INFO. TECHNOLOGIES, LLC, and
VERIZON SERVICES ORGANIZATION, INC.,

Defendants.

Civil Action No. 10 Civ. 6709 JFK

Magistrate Judge (DCF)

JURY TRIAL DEMANDED



SECOND AMENDED COMPLAINT

Plaintiff Veveo, Inc. ("Veveo") complains of Defendants Verizon Services Corp., Verizon Communications Inc., Verizon Data Services LLC, Verizon Online, LLC, Verizon New England, Inc., Verizon New York, Inc., Verizon Washington, D.C., Inc., GTE Southwest, Inc., Verizon California, Inc., Verizon New Jersey, Inc., Verizon Pennsylvania, Inc., Verizon

Virginia, Inc., Verizon Florida LLC, Verizon Maryland, Inc., Verizon Delaware, LLC, Verizon South, Inc., Verizon North, LLC, Verizon Information Technologies, LLC, and Verizon Services Organization, Inc. as follows, and demands a jury trial of all issues. The defendants, as well as affiliates of the defendants, are collectively referred to herein as “Verizon.” The exhibits to the original Complaint are incorporated herein as if attached hereto.

THE PARTIES AND THEIR AFFILIATES

1. Veveo is a Delaware corporation with its principal place of business located at 40 Shattuck Road, Suite 303, Andover, MA 01810. Veveo is the owner of the U.S. Patent Nos. 7,536,384 (“the ‘384 Patent”), 7,779,011 (“the ‘011 Patent”), 7,788,266 (“the ‘266 Patent”), 7,895,218 (“‘218 Patent”), and 7,937,394 (“the ‘394 Patent”) (collectively, the “Asserted Patents”).
2. Defendant Verizon Communications, Inc. (“Verizon Communications”) is a Delaware corporation with a principal place of business located at 140 West Street, New York, NY 10007.
3. Defendant Verizon Services Corp. (“Verizon Services”) is a subsidiary of Verizon Communications. In the Software License and Services Agreement (“SLS Agreement”) discussed below, Verizon Services represented itself to be a New York Corporation with a place of business at 240 East 38th St., New York, NY. Verizon Services is actually a Delaware Corporation. It has a principal place of business at 1310 N. Courthouse Road, Arlington, VA.
4. Defendant Verizon Data Services LLC (“VDS LLC”) is a Delaware limited liability company. Upon information and belief, VDS LLC is an indirect, wholly owned subsidiary of Verizon Communications. Upon information and belief, VDS LLC’s principal place of business is in New York.

5. Defendant Verizon Online LLC ("Verizon Online") is a Delaware limited liability company. Upon information and belief, Verizon Online is a subsidiary or affiliate of Verizon Communications.

6. Non-defendant Verizon Data Services India Pvt. Ltd. ("VDSI") is an Indian Corporation with offices in Chennai, India. VDSI is a wholly-owned subsidiary of UUNET Singapore Pte. Ltd, a Singapore limited liability company, that is a wholly-owned subsidiary of VDS LLC. VDSI is a captive support arm of the IT division of Verizon Communications. Pursuant to a stipulation filed on or about November 17, 2010 ("the Stipulation"), the parties agreed that all of VDSI's activities relevant to the plaintiff's claims of breach of contract and misappropriation of trade secrets are attributed to VDS LLC for purposes of this case only.

7. Verizon owns and operates a system for providing customers with television and related content known as FiOS. FiOS customers have the ability to perform searches using full or partial keywords and to obtain results that identify the television content sought by the customer. Each of the defendants has a role in this process and, either individually or jointly, own and/or operate the FiOS system and components thereof, including its search capabilities. Verizon Communications is the parent company that owns and controls, directly or indirectly, the other defendants and various other affiliates, who are the operating companies. Verizon Online owns the set top boxes ("STB") provided to FiOS customers. VDS LLC owns and controls data centers that support FiOS Search. A variety of regional companies (the "Regional Verizons"), in conjunction with other Verizon entities, including VDS LLC, own and/or operate the video hub offices ("VHO") where the application and database servers supporting FiOS Search are located, and/or supply FiOS Service, including providing cable boxes. Regional Verizons include Verizon Washington DC, Inc., a New York Corporation and wholly owned subsidiary of VCI;

Verizon New England, Inc., a New York Corporation and wholly owned subsidiary of NYNEX Corporation which is, in turn, a wholly owned subsidiary of VCI; Verizon New York, Inc., a New York Corporation and wholly owned subsidiary of NYNEX Corporation; GTE Southwest, Inc., a Delaware Corporation and wholly owned subsidiary of GTE Corporation, which is a wholly owned subsidiary of VCI; Verizon California, Inc., a California corporation and wholly owned subsidiary of GTE Corporation; Verizon New Jersey, Inc., a New Jersey Corporation and wholly owned subsidiary of VCI; Verizon Pennsylvania, Inc., a Pennsylvania Corporation and a wholly owned subsidiary of VCI; Verizon Virginia, Inc., a Virginia Corporation and wholly owned subsidiary of VCI. Verizon Maryland, Inc. is a Maryland corporation. Upon information and belief, Verizon Maryland, Inc. is a subsidiary of VCI. Verizon Delaware, LLC is a Delaware limited liability company. Upon information and belief, Verizon Delaware, LLC is a subsidiary of VCI. Verizon Florida LLC is a Florida limited liability company. Upon information and belief, Verizon Florida LLC is a subsidiary of VCI. Verizon South Inc. is a Virginia corporation. Upon information and belief, Verizon South is a subsidiary of VCI. Verizon North LLC is a Delaware limited liability company. Upon information and belief, Verizon North LLC is a subsidiary of VCI.

8. Defendant Verizon Services Organization, Inc. ("Verizon Services Organization") is a Delaware corporation. Upon information and belief, Verizon Services Organization is a subsidiary or affiliate of Verizon Communications. On information and belief, Verizon Services Organization provides a variety of services for all Verizon companies, including companies that operate FiOS.

9. Defendant Verizon Information Technologies LLC ("Verizon IT") is a Delaware limited liability company. Upon information and belief, Verizon IT is a subsidiary or affiliate of

Verizon Communications. Verizon IT offers web and smart phone applications to FiOS customers, including Verizon FiOS Mobile Remote and Verizon FiOS DVR Manager.

JURISDICTION AND VENUE

10. This action for patent infringement arises under the patent laws of the United States, including 35 U.S.C. § 271. The copyright claim arises out of the copyright laws of the United States. This Court has subject matter jurisdiction over this action under 28 U.S.C. §§ 1331, 1338(a), and 1367.

11. Venue is proper in this district under 28 U.S.C. §§ 1391(c) and 1400 for the patent and copyright infringement claims. Accordingly, venue is necessarily proper over the state law claims that are appended to them under 28 U.S.C. § 1367.

12. This Court has personal jurisdiction over Verizon Communications. Verizon Communications has its principal executive office here.

13. This Court has personal jurisdiction over Verizon Services. In the SLS Agreement, Verizon Services represented itself to be a New York Corporation with a place of business at 240 East 38th St., New York, NY. Paul Pluta, who works at the above address and has an office phone number with a New York City area code, negotiated the SLS Agreement on behalf of Verizon Services and its affiliates. Further, in Section 15 of the contract, Verizon Services agreed to the jurisdiction of the courts in New York to resolve all cases or controversies arising under or related to the agreement.

14. Pursuant to the Stipulation, the parties have agreed that this Court has personal jurisdiction over VDS LLC.

15. This Court has personal jurisdiction over Verizon Online, who owns the STBs used by Verizon customers throughout New York State. It is registered to do business in New York and

lists a registered agent with the Division of Corporations as 111 Eighth Ave., New York, New York 10011.

16. This Court has personal jurisdiction over Verizon Washington D.C., Inc., Verizon New York, Inc. and Verizon New England, Inc., because they are all New York corporations.

17. This Court has personal jurisdiction over Verizon IT. It is registered to do business in New York and lists a registered agent with the Division of Corporations as 111 Eighth Ave., New York, New York 10011.

18. This Court has personal jurisdiction over Verizon Services Organization. According to Verizon New York's 2009 Annual Report Filing with the New York Public Service Commission, Verizon Services Organization provided almost \$98 million worth of services to a New York Company in 2009. On information and belief, Verizon Services Organization provides centralized finance, fleet, real estate, and supply chain services for all Verizon companies, including Verizon companies that reside in New York.

19. This Court has general personal jurisdiction over the Regional Verizons. As set forth above, some are incorporated in New York. Further, in an analogous situation where jurisdiction in Texas was contested, the Court held that Regional Verizons were subject to general personal jurisdiction because they have an ongoing business relationship to facilitate VOIP service around the country. *Centre One v. Vonage*, 6:08-CV-00467-LED (Memorandum Opinion and Order dated August 10, 2009.)

20. The Regional Verizons have numerous other contracts with New York. According to Verizon New York's 2009 Annual Report Filing with the New York Public Service Commission, in 2009, GTE Southwest provided almost \$1.5 million worth of services to a New York Company; Verizon California provided over \$0.5 million worth of services to a New York

Company; Verizon New Jersey provided almost \$3.5 million worth of services to a New York Company; Verizon Pennsylvania provided over \$4.5 million worth of services to a New York Company; Verizon Virginia provided over \$9.6 million worth of services to a New York Company; Verizon Florida provided over \$1.3 million worth of services to a New York Company; Verizon Maryland provided over \$320,000 worth of services to a New York Company; Verizon South provided over \$500,000 worth of services to a New York Company; and Verizon North provided over \$122 million worth of services to a New York Company.

21. The Regional Verizon entities work in concert with an entity in New York to provide the FiOS Search feature. The data center that supports FiOS Search is located in New York, and is owned by VDS LLC.

FACTS

22. Veveo possesses certain proprietary search technology that can be used in cable television systems. It was a pioneer in developing a system that allowed for incremental, network-based searches on STB and other devices.

23. In or around November 2005, Veveo began discussions with certain Verizon representatives about Verizon using Veveo's proprietary search technology in Verizon's FiOS television service. At that time, Verizon did not believe that incremental, network-based searches were even feasible.

24. On or around December 21, 2005, Veveo and Verizon Data Services, Inc. ("Verizon Data") signed a non-disclosure agreement ("NDA"), which was revised in July 2006. The NDA and the revision were attached to the original Complaint as Exhibits A and B, respectively. One stated goal within the NDA was to evaluate integrating Veveo's technology for potential use with Verizon's FiOS TV.

25. Veveo and Verizon Data entered into a Beta Agreement on January 12, 2006, which was attached to the original Complaint as Exhibit C. The parties amended the Beta Agreement in September 2006, to both extend the term of the original agreement, and to permit Verizon to test additional Veveo technology. Verizon Services, rather than Verizon Data, signed the amended agreement. A copy of the Amended Beta Agreement was attached to the original Complaint as Exhibit D.

26. At around the time of the execution of the original Beta Agreement, and continuing through December, 2006, the parties had a series of communications in which Veveo explained to Verizon many of its trade secrets relating to the details of its network-based incremental search system for STBs, including the proper network architecture and components thereof. It also educated Verizon about the fundamental principles and architecture of Veveo's software for performing incremental network-based searches. The communications included written documents that Veveo marked to make sure that Verizon understood that the material was subject to the contractual confidentiality restrictions, and included detailed architectural drawings.

27. In support of the Beta Agreement, in or around April 2006, Veveo began participating in daily engineering calls to assist Verizon with deployment of the Veveo-backed FiOS TV search system. Veveo's employees also helped integrate Veveo's proprietary technology into the Verizon FiOS network.

28. In December 2006, Veveo and Verizon Services entered into the previously-mentioned SLS Agreement, which outlined Verizon's permissible use of Veveo's Intellectual Property. A copy of the SLS Agreement was attached to the original Complaint as Exhibit E. The agreement replaced all prior agreements between the parties with respect to the subject matter thereof.

29. The SLS Agreement specifically stated that Veveo retained all intellectual property rights in the "Licensor Materials," which included Veveo's proprietary technology.

30. In Section 2(b), the SLS Agreement specifically provided that Verizon could not, "directly or indirectly, cause or authorize the modification, adaptation, translation, decompilation, disassembly, reverse analysis, or reverse engineering" of Veveo's software. The SLS Agreement also prohibited Verizon from creating derivative works from the licensed software.

31. Under the SLS Agreement, Verizon Services could use Veveo's confidential information only in connection with fulfilling its obligations and exercising its rights, licenses, and permissions under the agreement, was required to hold the information in strict confidence, and to not divulge it except to individuals with a need to know who had executed written confidentiality agreements, and to not duplicate any confidential information, including derivations, except in pursuit of the rights, licenses, and obligations of the agreement.

32. Under the SLS Agreement, Verizon Services was required to return or destroy all licensed software and to cease using it upon termination of the agreement.

33. After execution of the SLS Agreement, Veveo continued to assist Verizon with the integration of its incremental, network-based search system with the FiOS TV search system, and continued to educate Verizon about Veveo's proprietary technology and the network topology (and associated equipment) necessary to support the Veveo search capability.

34. In May 2007, Verizon initiated commercial deployment of the FiOS search program based on Veveo's technology, and eventually made it available to FiOS customers around the nation.

35. In May 2008, Veveo and Verizon Services amended the SLS Agreement. The amendment extended the term of the agreement to May 25, 2009.

36. Veveo met all its obligations under the SLS Agreement, as amended, and performed all conditions precedent to recovering for any breach of the agreement.

37. In February 2009, Verizon began replacing the Veveo-based FiOS search program with its own version in one geographic area at a time. In May of 2009, the SLS Agreement terminated.

38. The functionality of the replacement Verizon FiOS search system is nearly identical to the Veveo system, and it operates in nearly the same way. The Verizon group that developed the replacement FiOS system was led by one or more Verizon employees who also oversaw the integration of Veveo's search program into Verizon's FiOS system, and had access to Veveo's intellectual property, computer software and trade secrets. Given the parallels between the two systems, and the complexity of the technology, the Verizon system could only have been developed as the result of reverse analysis of the Veveo system. Further, the Verizon system qualifies as a derivative work of the Veveo system. This conduct constitutes a breach of at least Section 2(b) of the SLS Agreement.

39. Given that Verizon's engineers did not even think incremental, network-based searching was feasible before gaining access to Veveo's proprietary technology, it is clear that the defendants used the confidential information and trade secrets provided by Veveo to develop the Verizon system. Use of that information constitutes a misappropriation of trade secrets. Moreover, Verizon Services breached at least Section 13(b) of the SLS Agreement.

40. After termination of the SLS Agreement, Verizon continued to use the licensed software and failed to destroy or return it. This conduct constitutes a breach of at least Section 12(c) of the SLS Agreement.

41. On May 19, 2009, the United States Patent and Trademark Office (“U.S. PTO”) duly and legally issued the `384 patent, titled “Methods and Systems for Dynamically Rearranging Search Results into Hierarchically Organized Concept Clusters,” to Veveo. Veveo owned the patent throughout the period of the infringing acts described herein and still owns the patent. Veveo has all rights, titles, and interests in the patent, including the exclusive rights to bring suit with respect to any past, present, and future infringement thereof. A copy of the `384 patent was attached to the original Complaint as Exhibit F. On August 18, 2009, the U.S. PTO issued a Certificate of Correction that corrected certain claims. A copy of the certificate was attached to the original Complaint as Exhibit G.

42. On August 17, 2010, the U.S. PTO duly and legally issued the `011 patent, titled “Method and System for Dynamically Processing Ambiguous, Reduced Text Search Queries and Highlighting Results Thereof” to Veveo. Veveo owned the patent throughout the period of the infringing acts described herein and still owns the patent. Veveo has all rights, titles, and interests in the patent, including the exclusive rights to bring suit with respect to any past, present, and future infringement thereof. A copy of the `011 patent was attached to the original Complaint as Exhibit H. On February 15, 2011, the U.S. PTO issued a Certificate of Correction that corrected certain claims. A copy of the certificate is attached hereto as Exhibit 1.

43. On August 31, 2010, the U.S. PTO duly and legally issued the `266 patent, titled “Method and System for Processing Ambiguous, Multi-term Search Queries” to Veveo. Veveo owned the patent throughout the period of the infringing acts described herein and still owns the

patent. Veveo has all rights, titles, and interests in the patent, including the exclusive rights to bring suit with respect to any past, present, and future infringement thereof. A copy of the '266 patent was attached to the original Complaint as Exhibit I.

44. On February 22, 2011, the U.S. PTO duly and legally issued the '218 patent, titled "Method and System for Performing Searches for Television Content Using Reduced Text Input" to Veveo. Veveo owned the patent throughout the period of the infringing acts described herein and still owns the patent. Veveo has all rights, titles, and interests in the patent, including the exclusive rights to bring suit with respect to any past, present, and future infringement thereof. A copy of the '218 patent is attached hereto as Exhibit 2.

45. On May 3, 2011, the U.S. PTO duly and legally issued the '394 patent, titled "Method and System for Dynamically Processing Ambiguous, Reduced Text Search Queries and Highlighting Results Thereof" to Veveo. Veveo owned the patent throughout the period of the infringing acts described herein and still owns the patent. Veveo has all rights, titles, and interests in the patent, including the exclusive rights to bring suit with respect to any past, present, and future infringement thereof. A copy of the '394 patent is attached hereto as Exhibit 3.

46. Despite no longer having a valid license to use Veveo's intellectual property, Verizon continues to offer the search functionality described above to its FiOS customers.

47. The defendant had actual notice of the patents-in-suit and the infringement alleged herein at least upon filing of this Complaint (if not earlier). Defendants had prior notice of at least the '384 Patent no later than about October 29, 2009, when Veveo's counsel sent a letter to counsel for Verizon discussing Verizon's infringement of the '384 patent. After receiving such correspondence, Verizon continued to operate the FiOS search system in the same manner,

which was objectively reckless conduct, because there was an objectively high likelihood that its actions constituted infringement of a valid patent, and this risk was known by Verizon's counsel. Similarly, Defendant was provided with notice of the '218 and '394 patents prior to the filing of this Second Amended Complaint.

COUNT I – PATENT INFRINGEMENT - '384 PATENT

48. Plaintiff realleges and incorporates by reference the allegations of paragraphs 1-47 above.

49. The '384 Patent is valid and enforceable.

50. Defendants, acting alone and through their subsidiaries and affiliates, have directly, indirectly, contributorily, and/or by inducement infringed one or more claims of the '384 Patent, literally and/or under the doctrine of equivalents, in violation of 35 U.S.C. § 271, by making, having made, using, offering to sell, or selling with the United States, or importing into the United States, the patented invention, without authority to do so, in connection with the search functionality that is part of Verizon's FiOS system, including searches performed on STB and other devices and/or computers.

51. The above described acts of infringement committed by the Defendants have caused injury and damage to Veveo, and will cause additional severe and irreparable injury and damages in the future unless the defendants are enjoined from further infringing.

52. Upon information and belief, the Defendants' conduct is willful, wanton, and in utter disregard of Veveo's property rights in the patented invention.

53. As a consequence of Verizon's infringement, Veveo is entitled to recover damages adequate to compensate it for the injuries complained of herein, but in no event less than a reasonable royalty. Veveo is further entitled to have the Defendants enjoined from committing additional future acts of infringement which would subject Veveo to irreparable harm.

COUNT II – PATENT INFRINGEMENT - '011 PATENT

54. Plaintiff realleges and incorporates by reference the allegations of paragraphs 1-53 above.

55. The '011 Patent is valid and enforceable.

56. The Defendants, acting alone and through their subsidiaries and affiliates, have directly, indirectly, contributorily, and/or by inducement infringed one or more claims of the '011 Patent, literally and/or under the doctrine of equivalents, in violation of 35 U.S.C. § 271, by making, having made, using, offering to sell, or selling with the United States, or importing into the United States, the patented invention, without authority to do so, in connection with the search and highlight functionality that is part of Verizon's FiOS system, including searches performed on STB and other devices and/or computers.

57. The above described acts of infringement committed by the Defendants have caused injury and damage to Veveo, and will cause additional severe and irreparable injury and damages in the future unless the defendants are enjoined from further infringing.

58. Upon information and belief, the Defendants' conduct is willful, wanton, and in utter disregard of Veveo's property rights in the patented invention.

59. As a consequence of Verizon's infringement, Veveo is entitled to recover damages adequate to compensate it for the injuries complained of herein, but in no event less than a reasonable royalty. Veveo is further entitled to have the Defendants enjoined from committing additional future acts of infringement which would subject Veveo to irreparable harm.

COUNT III – PATENT INFRINGEMENT - '266 PATENT

60. Plaintiff realleges and incorporates by reference the allegations of paragraphs 1-59 above.

61. The '266 Patent is valid and enforceable.

62. The Defendants, acting alone and through their subsidiaries and affiliates, have directly, indirectly, contributorily, and/or by inducement infringed one or more claims of the '266 Patent, literally and/or under the doctrine of equivalents, in violation of 35 U.S.C. § 271, by making, having made, using, offering to sell, or selling with the United States, or importing into the United States, the patented invention, without authority to do so, in connection with the search functionality that is part of Verizon's FiOS system, including searches performed on STB and other devices and/or computers.

63. The above described acts of infringement committed by the Defendants have caused injury and damage to Veveo, and will cause additional severe and irreparable injury and damages in the future unless the defendants are enjoined from further infringing.

64. Upon information and belief, the Defendants' conduct is willful, wanton, and in utter disregard of Veveo's property rights in the patented invention.

65. As a consequence of Verizon's infringement, Veveo is entitled to recover damages adequate to compensate it for the injuries complained of herein, but in no event less than a reasonable royalty. Veveo is further entitled to have the Defendants enjoined from committing additional future acts of infringement which would subject Veveo to irreparable harm.

COUNT IV – PATENT INFRINGEMENT - '218 PATENT

66. Plaintiff realleges and incorporates by reference the allegations of paragraphs 1-65 above.

67. The '218 Patent is valid and enforceable.

68. The Defendants, acting alone and through their subsidiaries and affiliates, have directly, indirectly, contributorily, and/or by inducement infringed one or more claims of the '218 Patent, literally and/or under the doctrine of equivalents, in violation of 35 U.S.C. § 271, by making, having made, using, offering to sell, or selling with the United States, or importing into the

United States, the patented invention, without authority to do so, in connection with the search functionality that is part of Verizon's FiOS system, including searches performed on STB and other devices and/or computers.

69. The above described acts of infringement committed by the Defendants have caused injury and damage to Veveo, and will cause additional severe and irreparable injury and damages in the future unless the defendants are enjoined from further infringing.

70. Upon information and belief, the Defendants' conduct is willful, wanton, and in utter disregard of Veveo's property rights in the patented invention.

71. As a consequence of Verizon's infringement, Veveo is entitled to recover damages adequate to compensate it for the injuries complained of herein, but in no event less than a reasonable royalty. Veveo is further entitled to have the Defendants enjoined from committing additional future acts of infringement which would subject Veveo to irreparable harm.

COUNT V – PATENT INFRINGEMENT - '394 PATENT

72. Plaintiff realleges and incorporates by reference the allegations of paragraphs 1-71 above.

73. The '394 Patent is valid and enforceable.

74. The Defendants, acting alone and through their subsidiaries and affiliates, have directly, indirectly, contributorily, and/or by inducement infringed one or more claims of the '394 Patent, literally and/or under the doctrine of equivalents, in violation of 35 U.S.C. § 271, by making, having made, using, offering to sell, or selling with the United States, or importing into the United States, the patented invention, without authority to do so, in connection with the search functionality that is part of Verizon's FiOS system, including searches performed on STB and other devices and/or computers.

75. The above described acts of infringement committed by the Defendants have caused injury and damage to Veveo, and will cause additional severe and irreparable injury and damages in the future unless the defendants are enjoined from further infringing.

76. Upon information and belief, the Defendants' conduct is willful, wanton, and in utter disregard of Veveo's property rights in the patented invention.

77. As a consequence of Verizon's infringement, Veveo is entitled to recover damages adequate to compensate it for the injuries complained of herein, but in no event less than a reasonable royalty. Veveo is further entitled to have the Defendants enjoined from committing additional future acts of infringement which would subject Veveo to irreparable harm.

COUNT VI – BREACH OF CONTRACT

78. Plaintiff realleges and incorporates by reference the allegations of paragraphs 1-77.

79. The SLS Agreement was a valid contract.

80. Verizon Services breached its contractual obligations by performing the conduct described above. It breached the contract by engaging, directly or through its affiliates, in conduct prohibited by at least Sections 2(b), 12(c), and 13(b) of the SLS Agreement and by violating the covenant of good faith and fair dealing implied in every contract.

81. Such breach has injured and damaged Veveo, and continues to do so.

COUNT VII – MISAPPROPRIATION OF TRADE SECRETS

82. Plaintiff realleges and incorporates by reference the allegations of paragraphs 1-81.

83. Veveo possesses trade secrets with respect to its network-based incremental search program, including software innovations and/or information regarding network architecture necessary to support the software.

84. Veveo took reasonable steps to preserve the confidential nature of those trade secrets. It requires third parties to execute non-disclosure agreements when they are to receive trade secrets. It also takes internal measures to protect those secrets, such as confidentiality agreements with its own employees, password protections, and locks.

85. Veveo disclosed to employees in the Verizon family of companies, in confidence, various trade secrets used to design and employ Veveo's network-based incremental search program, as discussed above.

86. Verizon knew it had an obligation to maintain the confidentiality of Veveo's trade secrets with respect to Veveo's network-based incremental search program.

87. Upon information and belief, the defendants knowingly misappropriated Veveo's trade secrets by copying, using, or incorporating those secrets in its competing FiOS search program, in breach of their confidentiality obligations.

88. Verizon used the trade secrets to Veveo's detriment. The misappropriation has injured and damaged Veveo, and continues to do so.

COUNT VIII – COPYRIGHT INFRINGEMENT

89. Plaintiff realleges and incorporates by reference the allegations of paragraphs 1-88.

90. Veveo owns the copyrights for the computer program entitled "Client-Side Incremental Search Program Library" (Registration No. TX0007377870) as well as the revised version of this program entitled "Revised Client-Side Incremental Search Program Library" (Registration No. TX0007381514) (the "Copyrighted Material").

91. Veveo registered, and was granted, copyrights for the computer program entitled "Client-Side Incremental Search Program Library" as well as the revised version of this program entitled "Revised Client-Side Incremental Search Program Library" with, and by, the United States

Copyright Office. This computer program is downloaded to and used on set-top boxes to interface with, for example, servers to perform incremental, network-based searching.

92. The Copyrighted Material contains application functions (including, but not limited to, initialization and configuration functions and functions implementing network protocols and APIs), system calls and functions, and other basic facilities for the client-side that are essential to running Veveo's proprietary search system.

93. On information and belief, at all relevant times, Verizon had notice of Veveo's copyright interest in these programs.

94. Veveo provided the Copyrighted Material to Verizon under the SLS Agreement which did not allow copying of the Copyrighted Materials unless said copying was pursuant to the SLS Agreement.

95. Plaintiff has at no time granted permission to Verizon to copy, modify or distribute any of the Programs under any terms other than those of the SLS Agreement.

96. Verizon had access to the Copyrighted Material.

97. Verizon infringed Veveo's exclusive rights in the Copyrighted Materials by reproducing, preparing derivative works, distributing, copying, lending, leasing, renting, or a combination thereof, computer programs that are the same or substantially similar to the Copyrighted Material. Verizon continued to use the Copyrighted Material after termination of the SLS Agreement when it had no license, including downloading it to customers' set top boxes.

98. Plaintiff has complied in all respects with 17 U.S.C. §§ 101 et seq., and secured the exclusive rights and privileges in and to the copyrights of the above-referenced works. Plaintiff has been and still is the sole proprietor of all rights, title, and interest in and to the copyrights in their respective works as referenced above.

99. On information and belief, Plaintiff alleges that, as a direct and proximate result of their wrongful conduct, Defendants have realized and continue to realize profits and other benefits rightfully belonging to Plaintiff. Accordingly, Plaintiff seeks an award of damages pursuant to 17 U.S.C. §§ 504 and 505.

100. Defendants' conduct violates the exclusive rights belonging to Plaintiff as owner of the copyrights in their propriety search system, including without limitation Plaintiff's rights under 17 U.S.C. § 106.

101. Defendants' infringing conduct has also caused and is causing substantial and irreparable injury and damage to Plaintiff in an amount not capable of determination, and, unless restrained, will cause further irreparable injury, leaving the Plaintiff with no adequate remedy at law. Accordingly, Plaintiff seeks to enjoin Defendants infringement pursuant 17 U.S.C. § 502.

102. On information and belief, Defendants have willfully engaged in, and are willfully engaging in, the acts complained of with oppression, fraud, and malice, and in conscious disregard of the rights of Plaintiff. Plaintiff is, therefore, entitled to the maximum statutory damages allowable.

REQUEST FOR RELIEF

WHEREFORE, Veveo respectfully requests that this Court:

- A. Enter judgment that the Defendants have infringed one or more claims of the patents in suit, breached its contractual obligations, misappropriated Veveo's trade secrets and infringed its copyrights;
- B. Enter judgment that Defendants' infringement of its patents has been willful, deliberate, and intentional;

- C. Enter a permanent injunction, pursuant to 35 U.S.C. § 283, enjoining Verizon, and all of its subsidiaries, agents, servants, officers, directors, employees, and all other persons acting in concert with it, directly or indirectly, from any further acts of infringement, contributory infringement, or inducement of infringement of the patents in suit;
- D. Enter an order, pursuant to 35 U.S.C. § 284, awarding to Veveo damages adequate to compensate it for Defendants' unlawful conduct in an amount to be determined at trial, but not less than a reasonable royalty for the patent infringement;
- E. Enter an order, pursuant to 35 U.S.C. § 284, trebling all damages awarded to Veveo based upon Defendants' willful, deliberate, and intentional infringement of the patents in suit;
- F. Enter an order, pursuant to 35 U.S.C. § 285, deeming this to be an "exceptional case" and thereby awarding to Veveo its reasonable attorneys fees, costs, and expenses;
- G. Enter an order awarding damages to Veveo for the breach of contract, misappropriation of trade secrets, and copyright infringement alleged above;
- H. Enter a permanent injunction enjoining Verizon, and all of its respective subsidiaries, agents, servants, officers, directors, employees, and all other persons acting in concert with it, directly or indirectly, from any further acts of contractual breach, misappropriation of trade secrets, and copyright infringement;
- I. Enter an order awarding to Veveo pre- and post-judgment interest at the maximum rates allowable under the law;
- J. Enter an order awarding to Veveo punitive, enhanced, statutory or multiple damages, to the extent allowable under applicable law;
- K. Enter an order awarding to Veveo costs and attorneys fees pursuant to 17 U.S.C. § 505 or any other applicable statute or law; and

L. Enter an order awarding to Veveo such other and further relief, whether at law or in equity, that this Court deems just and proper, including, but not limited, to impoundment or destroying any copyrighted material.

JURY DEMAND

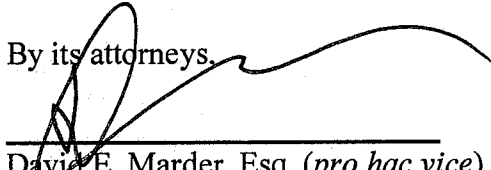
As permitted under Federal Rule of Civil Procedure 38, Plaintiff demands a jury trial on all issues so triable.

Dated: Oct. 4, 2011

Respectfully submitted,

VEVEO, INC.

By its attorneys.



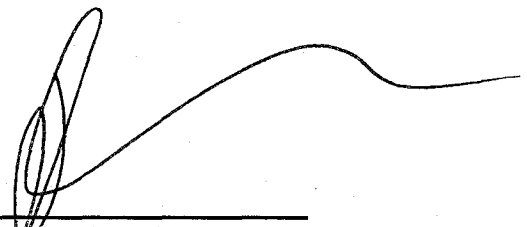
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CERTIFICATE OF SERVICE

I, David E. Marder, do hereby certify that on October 4, 2011 a copy of the foregoing document was sent via Email, with a copy by First Class Mail, to Andrew Valentine and via Email to Brian Erickson as follows:

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EXHIBIT 1

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,779,011 B2
APPLICATION NO. : 11/312908
DATED : August 17, 2010
INVENTOR(S) : Sashikumar Venkataraman et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims:

At column 8, claim 1, line 53, "which determining letters" should read --determining which letters--.

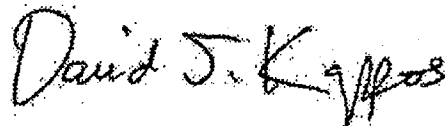
At column 9, claim 1, line 9, "mapped to said items received so" should read --mapped to said items so--.

At column 9, claim 9, line 52, "which determine letters" should read --determine which letters--.

At column 10, claim 17, line 54, "which determine letters" should read --determine which letters--.

At column 11, claim 17, line 10, "mapped to said items received so" should read --mapped to said items so--.

Signed and Sealed this
Fifteenth Day of February, 2011



David J. Kappos
Director of the United States Patent and Trademark Office

EXHIBIT 2



(12) **United States Patent**
Venkataraman et al.

(10) Patent No.: **US 7,895,218 B2**
(45) Date of Patent: **Feb. 22, 2011**

(54) **METHOD AND SYSTEM FOR PERFORMING SEARCHES FOR TELEVISION CONTENT USING REDUCED TEXT INPUT**

(75) Inventors: **Sashikumar Venkataraman, Bangalore (IN); Rakesh D. Barve, Bangalore (IN); Pranav Rajanala, Koppal (IN); Rahul Agrawal, Bhopal (IN); Murali Aravamudan, Windham, NH (US); Ajit Rajasekharan, West Windsor, NJ (US)**

(73) Assignee: **Veveo, Inc., Andover, MA (US)**

(*) Notice: **Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 938 days.**

(21) Appl. No.: **11/136,261**

(22) Filed: **May 24, 2005**

(65) **Prior Publication Data**
US 2006/0101503 A1 May 11, 2006

Related U.S. Application Data

(60) Provisional application No. 60/626,274, filed on Nov. 9, 2004, provisional application No. 60/664,879, filed on Mar. 24, 2005.

(51) Int. Cl.
G06F 7/00 (2006.01)
G06F 17/30 (2006.01)

(52) U.S. Cl. **707/754; 707/736; 707/713; 707/706**

(58) Field of Classification Search **725/51, 725/53; 707/3, 754**

See application file for complete search history.

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Primary Examiner—Apu M Mofiz

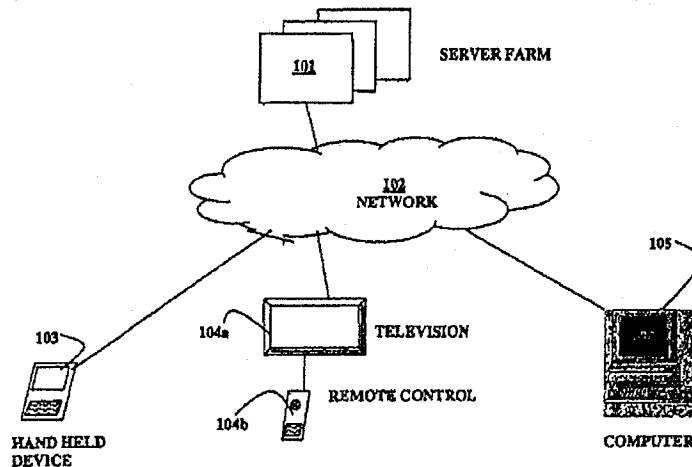
Assistant Examiner—Jared M Bibbee

(74) *Attorney, Agent, or Firm*—Wilmer Cutler Pickering Hale and Dorr LLP

(57) **ABSTRACT**

A method and system are provided for identifying a television content item desired by a television viewer from a set of television content items. Each of the television content items has one or more associated descriptors. The system receives from the television viewer a reduced text search entry directed at identifying the desired television content item. The search entry is a prefix substring of one or more words relating to the desired television content item. The system dynamically identifies a group of one or more television content items from the set of television content items having one or more descriptors matching the search entry as the television viewer enters each character of the search entry. The system then transmits the names of the one or more television content items of the identified group to be displayed on a device operated by the television viewer.

36 Claims, 8 Drawing Sheets



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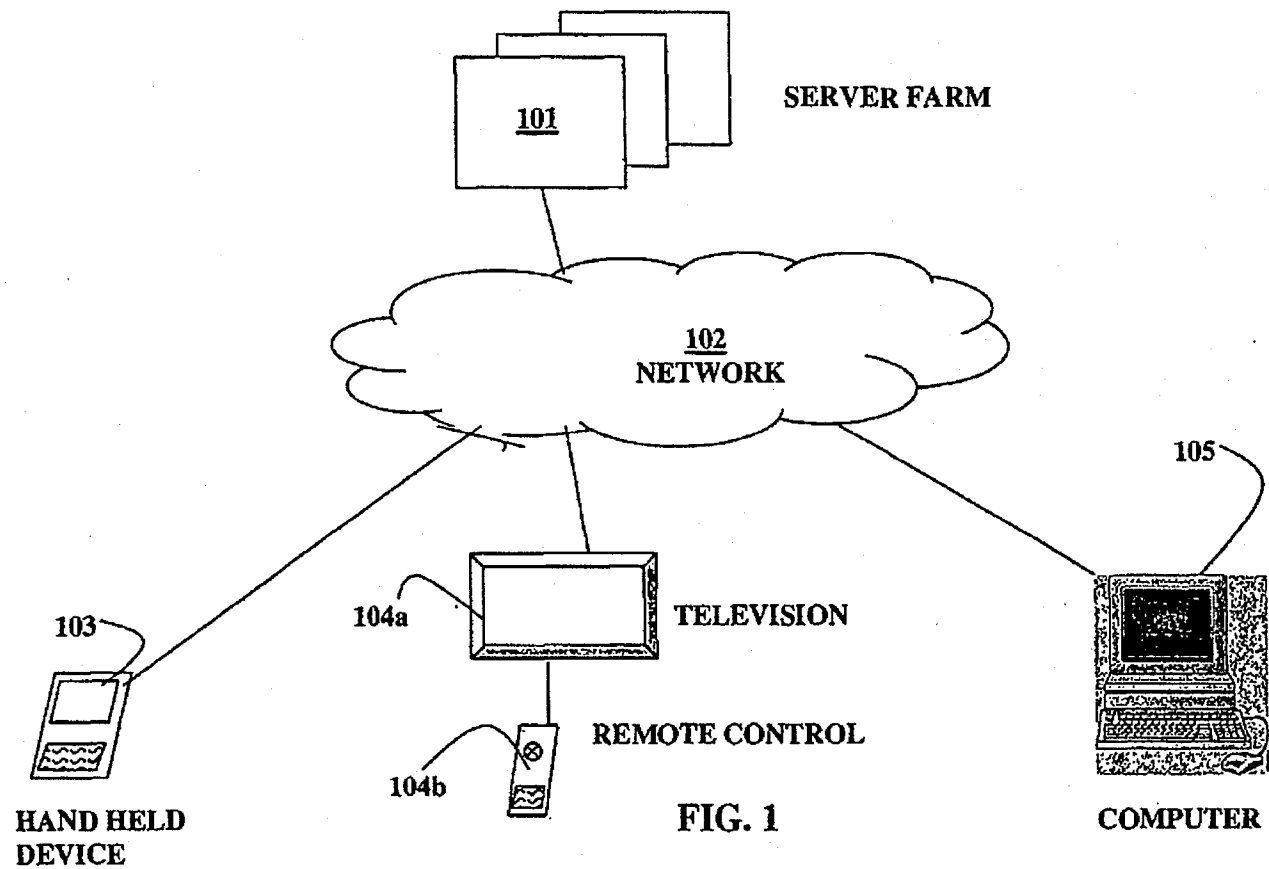
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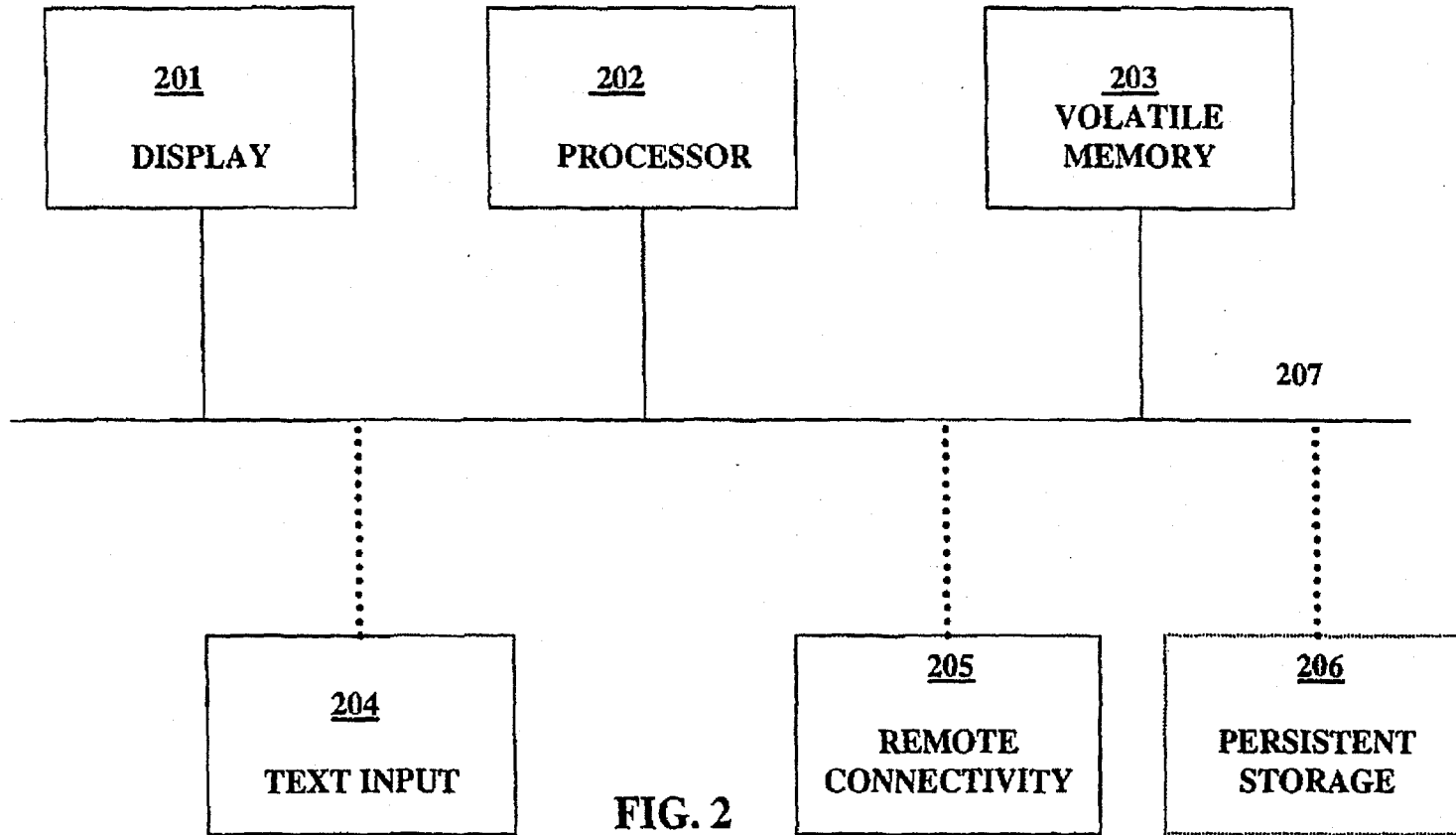
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NameSpace 301 = { Name₁, Name₂, Name₃,... Name_N};

Name 302 = { Word₁, Word₂, Word₃,... Word_N}

Examples: 303

- "Casablanca" - one-word name instance from an ordered name space (movies)
- "Malkovich" - one-word name instance from an unordered name space (cast names)
- "Guns of Navarone" - three-word name instance from an ordered name space (movie)
- "John Doe" - two-word name instance from an unordered name space (phone book)

FIG. 3

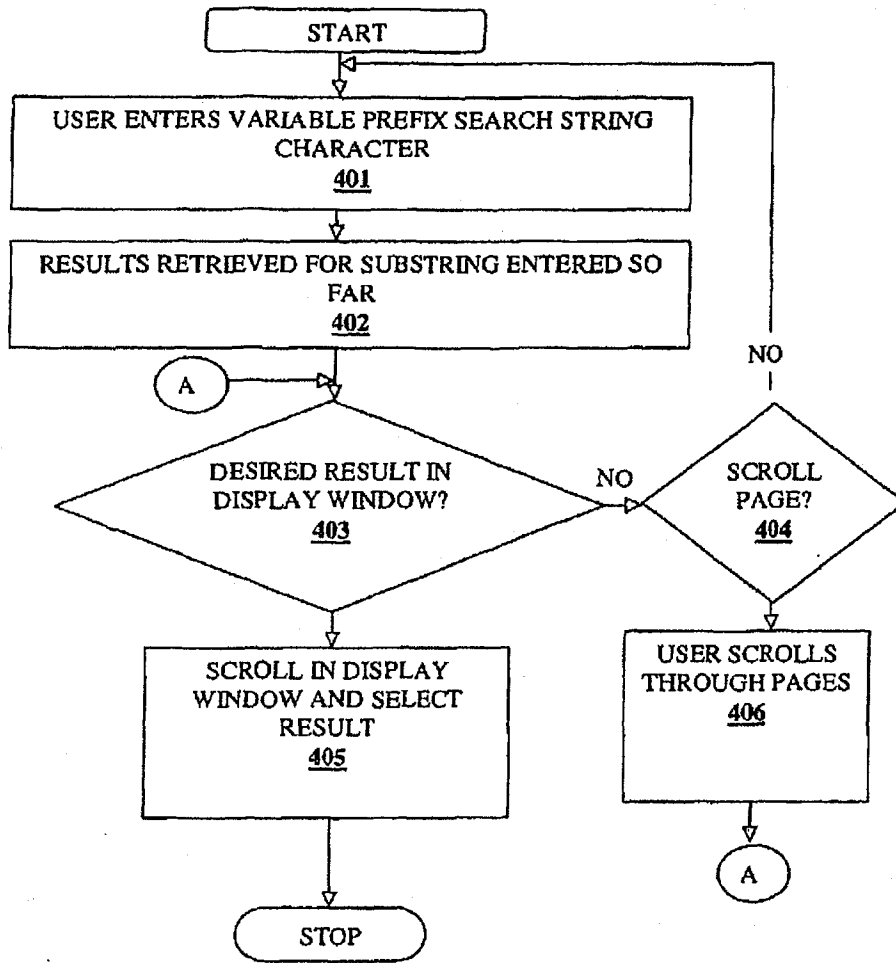


FIG. 4

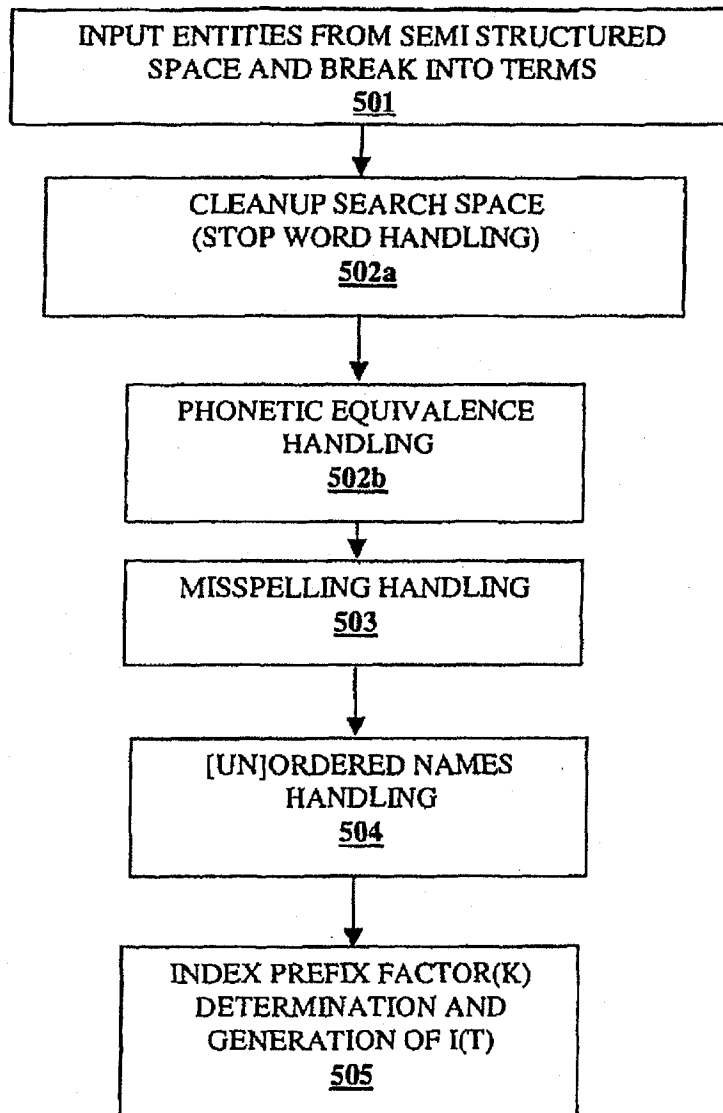


FIG. 5

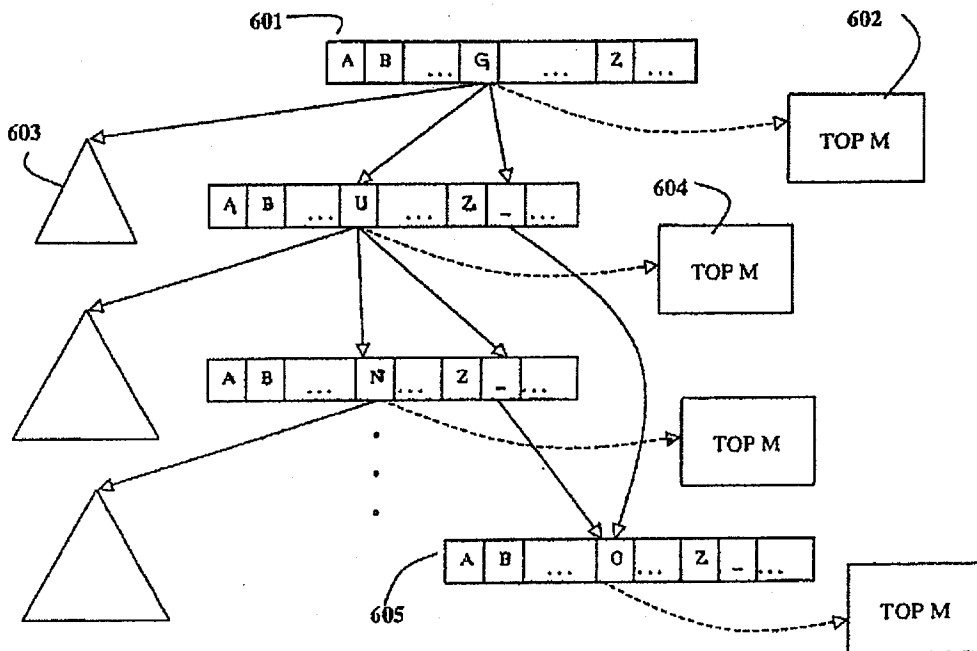


FIG. 6

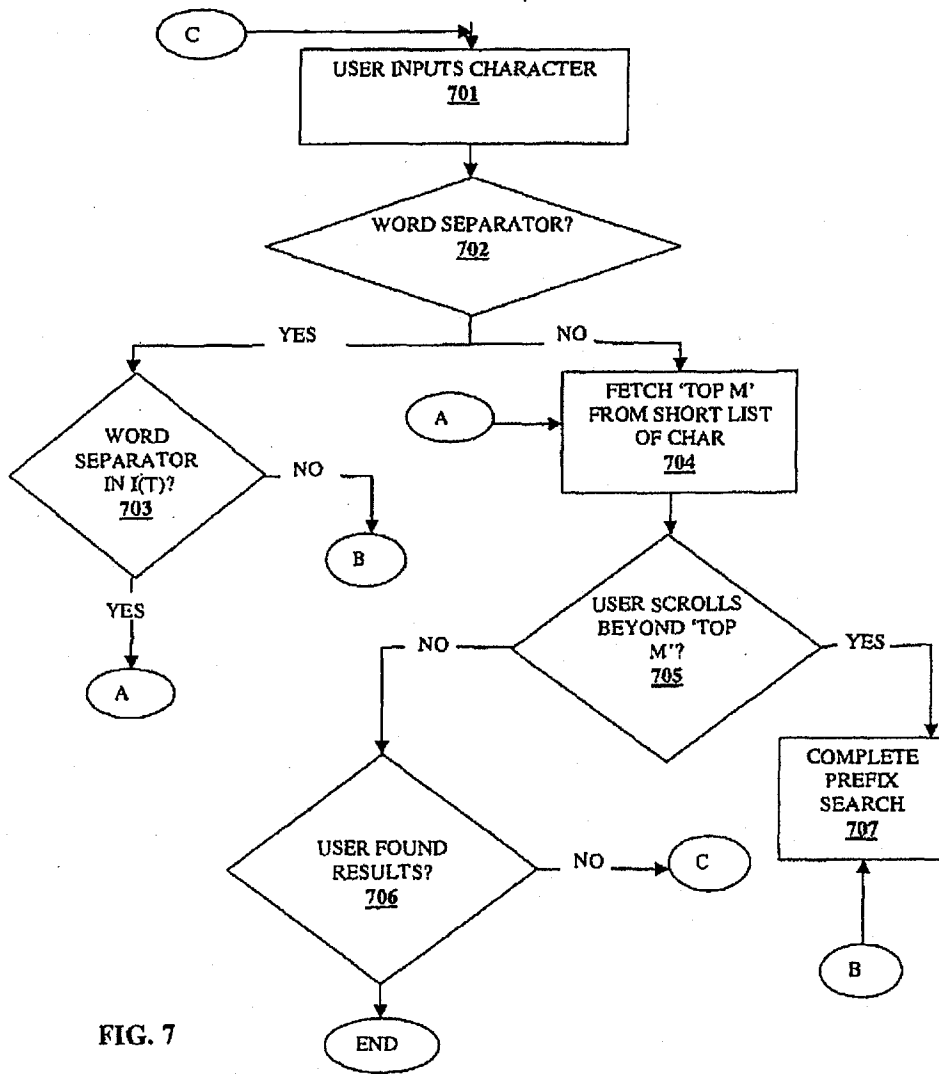


FIG. 7

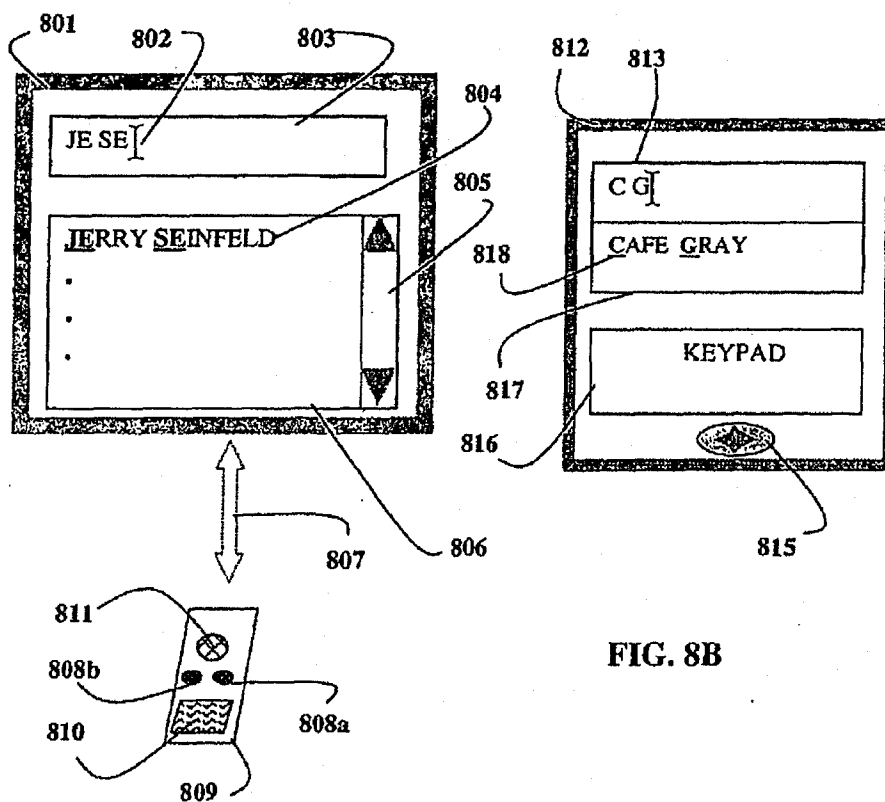


FIG. 8B

FIG. 8A

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METHOD AND SYSTEM FOR PERFORMING SEARCHES FOR TELEVISION CONTENT USING REDUCED TEXT INPUT

RELATED APPLICATIONS

The present application is based on and claims priority from the following two U.S. provisional patent applications, the specifications of which are each incorporated herein in their entirety: (1) Ser. No. 60/626,274 filed on Nov. 9, 2004 and entitled "Television Systems and Associated Methods," and (2) Ser. No. 60/664,879 filed on Mar. 24, 2005 and entitled "Method and System for Performing Searches for Television Programming Using Reduced Text Input."

BACKGROUND OF THE INVENTION

1. Field of Invention

The present invention generally relates to a method and system for performing searches for television content and, more particularly, to a method and system for performing searches with text entry by a user reduced to prefix substrings representing elements of a namespace containing a set of names composed of one or more words that are either ordered or unordered.

2. Description of Related Art

Search engines have become increasingly important for finding needed information on the Internet using Personal Computers (PCs). While performing searches is predominantly a PC based activity to date, searching has begun percolating to non-PC domains such as televisions and handheld devices, as content choices for these domains proliferate. Text input continues to be the primary input technique for search engines since speech input and other input technologies have not sufficiently matured. Though progress has been made recently for PCs with full QWERTY keyboards to reduce the amount of text input needed to arrive at a desired result, the search input process is still grossly deficient and cumbersome when it comes to searching for desired information or content on a large ten-foot interface television environment or a hand-held device. In these usage scenarios, the text input is ordinarily made using keys that are typically overloaded with multiple characters. Of the various device interactions (key stroke, scroll, selection etc.) during a search process in these non-PC systems, text input remains a dominant factor in determining the usability of search. This usability criterion typically constrains text input to a single keyword (such as a name) or a few keywords to describe the item that is being searched. Rich text input such as "natural language input" is generally precluded in the non-PC systems not by the limitations of search engines, but by the difficulty of entering text.

A useful usage scenario for searching in these limited input capability environments could be to find information on a keyword a user has in mind, where the keyword could be the name of a person, place, object, media entity etc. Examples of such a search could be finding the movie "Guns of Navarone" (which as further described below can be considered a three-word name instance from an ordered name space), and "John Doe" (a two-word name instance from an unordered name space). An interesting property of certain search domains is that the percentage of names in the search domain with two or more words is quite significant. For instance, in the case of searching for a person's name (e.g., John Doe) in a phone database, the search domain name size (number of words constituting a name—2 in the case of John Doe) is at least two. In the movie space, a random sampling of 150,000

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English movie titles revealed that 86% of the titles have name size greater than or equal to two, even with the removal of some of the most frequently occurring "article stop words" such as "a", "an", and "the."

It would be desirable for search engines for devices (with limited input capabilities in particular) to enable user to get to desired results with reduced input representing a namespace. In particular, a search method or system able to perform one or more of the following would be desirable:

- (1) Captures information from one or more words making up a name, using a reduced number of characters to represent the original name. The number of results matched for the name entry is preferably limited to a given threshold, which can, e.g., be determined by the display space for rendering the results and the ease of scrolling through the results.
- (2) Allows users to enter words in the namespace in any order. For example, a person lookup search such as "John Doe" should be possible either as "John Doe or Doe John." In this example, "John" and "Doe" is a two-word instance of a name from an unordered namespace.
- (3) Facilitates learning of an efficient usage of the reduced text entry scheme intuitively and gradually. First time users should preferably be able to even enter the full string if they choose to. The system preferably provides users with cues and assistance to help learn to key in the reduced string to get to desired results.
- (4) Works across search domains with diverse attributes such as (a) size of the search domain (b) the language used for search, (c) the clustering characteristics of names in the search domain, (d) the interface capabilities of the device used for search, and (e) computational power, memory, and bandwidth availability of the search system.

BRIEF SUMMARY OF EMBODIMENTS OF THE INVENTION

In accordance with one or more embodiments of the invention, a method and system are provided for identifying a television content item desired by a television viewer from a set of television content items. Each of the television content items has one or more associated descriptors. The system receives from the television viewer a reduced text search entry directed at identifying the desired television content item. The search entry is a prefix substring of one or more words relating to the desired television content item. The system dynamically identifies a group of one or more television content items from the set of television content items having one or more descriptors matching the search entry as the television viewer enters each character of the search entry. The system then transmits the names of the identified group of one or more television content items to be displayed on a device operated by the television viewer.

These and other features will become readily apparent from the following detailed description wherein embodiments of the invention are shown and described by way of illustration. As will be realized, the invention is capable of other and different embodiments and its several details may be capable of modifications in various respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature and not

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in a restrictive or limiting sense with the scope of the application being indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of various embodiments of the present invention, reference is now made to the following descriptions taken in connection with the accompanying drawings in which:

FIG. 1 illustrates a reduced text entry search system in accordance with one or more embodiments of the invention being used in different device and network configurations.

FIG. 2 illustrates configuration options of exemplary devices for performing searches in accordance with one or more embodiments of the invention.

FIG. 3 illustrates examples of a discrete structural composition of text input to a search system in accordance with one or more embodiments of the invention.

FIG. 4 illustrates a process of user starting a new search and entering text and arriving at a desired result in accordance with one or more embodiments of the invention.

FIG. 5 illustrates a preprocessing step on a search space prior to indexing it in accordance with one or more embodiments of the invention.

FIG. 6 illustrates an example of a data structure to enable dynamic search leveraging off pre-indexed substring prefixes in accordance with one or more embodiments of the invention.

FIG. 7 illustrates internal steps of search as each character is input in accordance with one or more embodiments of the invention.

FIGS. 8A and 8B illustrate interface characteristics of two search devices in accordance with one or more embodiments of the invention.

In the figures, like reference numerals refer to generally like elements.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Briefly, as will be described in further detail below, in accordance with more embodiments of the invention, methods and systems are provided for identifying a television content item desired by a television viewer from a set of available television content items. Such television content items can include a wide variety of video/audio content including, but not limited to, television programs, movies, music videos, video-on-demand, or any other identifiable content that can be selected by a television viewer.

The television viewer can enter into a search device having a text input interface a reduced text search entry directed at identifying the desired television content item. The text can be one or more characters, which can be any alphanumeric character, symbol, space or character separator that can be entered by the user. Each television content item has one or more associated descriptors, particularly names in a namespace relating to the desired television content item. The descriptors specify information about the content, which can include, e.g., information on titles, cast, directors, descriptions, and key words. The names are composed of one or more words that can be either ordered or unordered. The user's search entry comprises one or more prefix substrings that represent a name or names in the namespace. A prefix substring of a word in a name captures information from the word and can be a variable length string that contains fewer than all the characters making up the word.

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The system identifies a group of one or more television content items from the set of available television content items having descriptors matching the search entry. The names of the identified group of one or more television content items is then transmitted to and displayed on a device operated by the television viewer. The viewer can then select the desired content item from the group displayed, or enter further characters or edit the substring to narrow or change the results as desired.

The descriptors can include a preferably partial subset of pre-indexed prefix substring combinations. The prefix substrings entered by a user are input to an algorithm that can dynamically generate results leveraging off the pre-indexed prefix substring combinations. The size of the pre-indexed prefix substring combinations can be based on some balance between computational power, memory availability, and optionally bandwidth constraints of the system in which reduced text entry search is deployed.

The variable prefix substring search algorithm can allow multiple names to be entered, preferably without regard to the order. The results list for search is preferably dynamically culled by the text input of each character. The results are preferably ordered based on a relevance function that can be a domain specific combination of, e.g., popularity, temporal relevance, location relevance, personal preferences, and the number of words in the input search string.

One or more embodiments of the present invention also includes a system for intuitively informing and educating the user of the smallest or generally smallest substring for yielding a particular result, thereby empowering the user with a user-friendly search method particularly on platforms with limited text entry capabilities. The flexibility of entering prefix substrings of variable sizes to get to the desired result makes the reduced text entry scheme intuitive and easy to use.

FIG. 1 illustrates an overall system for performing searches with reduced text entry using a wide range of devices in accordance with one or more embodiments of the invention. A server farm 101 can serve as the source of search data and relevance updates with a network 102 functioning as the distribution framework. The distribution framework could be a combination of wired and wireless connections. Examples of possible networks include cable television networks, satellite television networks, and IP-based television networks. The search devices could have a wide range of interface capabilities such as a hand-held device 103 (e.g., a phone or PDA) with limited display size and overloaded or small QWERTY or other keypad, a television 104a coupled with a remote control device 104b having an overloaded or small QWERTY or other keypad, and a Personal Computer (PC) 105 with a full QWERTY or other keyboard and a computer display.

FIG. 2 illustrates multiple exemplary configurations for search devices in accordance with one or more embodiments of the invention. In one configuration, a search device (e.g., PC 105) can have a display 201, a processor 202, volatile memory 203, text input interface 204 (which can be on-device or through a wireless remote control 104b), remote connectivity 205 to the server 101 through the network 102, and a persistent storage 206. A device configuration for a device such as the hand-held device 103 might not include local persistent storage 206. In this case, the device 103 could have remote connectivity 205 to submit the query to the server 101 and retrieve results from it. Another configuration for the device 103 may not have remote connectivity 205. In this case, the search database may be locally resident on a local persistent storage 206. The persistent storage 206 may be, e.g., a removable storage element too such as SD, SmartMe-

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dia, CompactFlash card etc. In a configuration of the device with remote connectivity 205 and persistent storage 206 for search (e.g., television 104a), the device may use the remote connectivity for search relevance data update or for the case where the search database is distributed on the local storage 206 and on the server 101. In one or more exemplary embodiments of the invention, a television 104a may have a set-top box with a one-way link to a satellite network. In this configuration, all search data including relevance updates may be downloaded to the device through a satellite link to perform local searching.

FIG. 3 illustrates an exemplary structure of a reduced text entry query for search in accordance with one or more embodiments of the invention. Each query can be composed of one or more words preferably delimited by a separator such as, e.g., a space character or a symbol. Adjacent words of the query may constitute an ordered name, e.g., "Guns of Navarone" or an unordered name, e.g., "John Doe" as illustrated in example 303. Individual words can also be part of a set of ordered or unordered names such as "Malkovich" or "Casablanca," though the ordering attribute is irrelevant in this case. A set of names that is either ordered or unordered constitutes a namespace. An example of an unordered namespace is a phone book with names of people. An example of an ordered namespace is a database of movie titles.

FIG. 4 illustrates an exemplary process of user starting a new search, entering characters and arriving at the desired result in accordance with one or more embodiments of the invention. A user enters one or more search string characters at 401, which could be a variable size prefix of the intended query (e.g., to represent 'Brad Pitt', the user can enter B P, BR P, B PI etc.). Results are then preferably dynamically retrieved for the cumulative substring of characters entered up to that point at 402 and displayed. The user determines at 403 as to whether the desired result is shown in a display window. If the result is displayed in the display window, the user can scroll to the desired result within the display window and select the desired result at 405. If the desired result is the first entry in the display window 405, it can be selected by default obviating the need to scroll through the display window.

The ordering of results in the display window is preferably governed by a relevance function that is a domain specific combination of, e.g., popularity, temporal and location relevance. For example when a user is searching for a restaurant using a phone or Personal Digital Assistant (PDA) with GPS capabilities, then the listings could be ordered in descending order of the most popular restaurants in that area. If the user entered NBA, then the system could list the games in order of temporal relevance such as those in progress or are scheduled to begin in the near future are listed first.

If the desired result is not in the display window at step 403, the user can decide whether or not to scroll through pages of results not currently displayed in the window at 404. If the user decides to scroll through the pages, he or she can scroll down the display window linearly or page by page at 406 to reveal more results. If user does not want to scroll through pages, he or she can enter additional characters at 401 to narrow the results.

In the scenario where user does not reach the result due to misspelling or due to the case of a word whose uniqueness (e.g., Tom Brown, Todd Brown) is embedded in the suffix of a word in the query (as opposed to the prefix), the user would have to either go back to the first word and enter more characters or erase one or more of the typed characters and re-enter characters to reach the desired result. The dynamic update of results for each character entry enables the user to

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recover from an error during the text entry process itself, in contrast to discovering that no results match after typing the entire text.

FIG. 5 illustrates various steps in a pre-processing phase in accordance with one or more embodiments of the invention. As illustrated in FIG. 3, the input to this phase can be a semi-structured space of any size composed of entities or descriptors (e.g., titles, cast, directors, description, key words) with their metadata values. This semi-structured search space can have a wide range of sizes, e.g., from the size of a PDA phone book to a large subspace obtained by a focused web crawl followed by relevant text processing to derive entities. In scenarios where the search space size is large, it can be possible to organize the space into smaller sub-spaces based on a categorization scheme. The first step 501 is the breakup of entities into terms (e.g., Tom Hanks, Secret Discoveries in Ancient China). A term is a set of ordered or unordered words. In accordance with one or more embodiments of the invention, multiple permutations of the words in the entity may be considered as candidate terms (e.g., Secret Discoveries of Ancient China, Discoveries of Ancient China, Ancient China, China). This allows searching a given entity using variable prefixes of any of the candidate terms. The second step is the cleanup of the entity space at 502a. The cleanup phase involves finding the locations of stop words such as "a", "an", "the". In the next step at 502b, entity names can be duplicated for phonetic equivalence handling (e.g., Jeff and Geoff). The duplication may be either implemented by actually creating multiple variants in data, or tagging for future algorithmic equivalence determination. A misspelling handling step 503 can address typical misspellings committed while entering text. An unordered names handling step 504 can first identify all the ordered and unordered names in a namespace, and then duplicate the unordered names (e.g., John Doe, Doe John). Duplication can involve either data duplication or tagging for algorithmic determination. The steps 501 through 504 determine a set of candidate terms T for each entity. A record is any particular prefix string of a term in T. For example, for the term "guns of navarone", "g o navarone" and "gu of navarone" are two of the many possible records. The set of all possible records of the terms in T is denoted by P(T), and searching for the given item could potentially be accomplished by using any of the prefix in this set.

At step 505, the number of variable prefix strings I(T) that will be pre-computed and stored in the index is determined. In many situations, it is not practical to pre-compute and store all the possible prefixes for all the terms due to expensive memory requirements. One or more embodiments of the present invention accordingly use a flexible method to store only a subset of P(T) based on different parameters such as available memory, computational power, and in some usage scenarios—bandwidth.

While computing I(T), there are a number of terms that are meant to recall entity names. Denote any such term 'T' of length $N \geq 1$ as

$T = W_1 W_2 W_3 \dots W_N$ where W_i denotes the i^{th} word and ' ' denotes a space (which is an example of a word delimiter)

For any integer 'k', let W^k denote the k-character prefix of word W. If k is greater than length of word W, $W^k = W$. Let $W(K)$ denote the set of words W^k for $1 \leq k \leq K$, where K denotes the upper bound of the size of the prefix. For example, for the word "guns", $W(2)$ consists of prefixes "g" and "gu". For any term T, its corresponding indexed set of $I(T, K, C)$ of bounded multi-word prefix strings can be defined as follows

$$I(T, K, C) = \{X_1 X_2 X_3 X_4 X_5 \dots X_C \mid X_i \in W_i, 1 \leq i \leq C, C \leq K\}$$

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Where $X_i \in W_i(K)$ and W_i is the i^{th} word in the term T , and where C denotes the number of words for which prefixes are pre-computed. In a preferred embodiment of the invention, the set $I(T, K, C)$ (also denoted by $I(T)$) is the set of strings pre-computed on account of term T and tunable parameters K and C . The set $I(T)$ represents the pre-computed records corresponding to the terms in T and is usually a proper subset of $P(T)$. The computation method indexes only the set $I(T)$ as a part of the pre-computation, though the user could input any string in $P(T)$ (which possibly may not belong to $I(T)$) to efficiently retrieve the term T . This is done by performing some appropriate computation at runtime during the search process leveraging of the set $I(T)$.

The special case of $I(T, \infty, \infty)$ (i.e., $K=\infty$ and $C=\infty$) is the scenario where each record is pre-computed for all the terms in T . In this case $I(T)=P(T)$. It may be impractical to implement this case since the memory requirements would be high even for search spaces of modest size. The case $K=0$ and $C=0$, is the scenario where no records are pre-computed, and the search for any term is done dynamically by lookup of all possible terms matching the prefix query. In such a scenario, the runtime costs could be high due to a complete lookup during the search process especially for small prefixes that match with a large number of terms. A practical implementation would choose a value of K and C that is a balance between available memory, computational power and in some usage scenarios bandwidth. For example, a practical implementation may choose $K=2$ and $C=1$. In this case for a term "guns of navarone", the pre-computed prefix strings (or records) would be "g_ of navarone, gu_ of navarone" in addition, to the term "guns of navarone" itself. Though $I(T)$ would in most practical implementations be a proper subset of $P(T)$, the system would dynamically match terms that are not in $I(T)$ (such as gun o nav) leveraging off the set $I(T)$. It may be noted that such queries that are not in $I(T)$ contain at least K initial characters of the first word thereby reducing the potential number of matching terms significantly. These terms may then be collected and analyzed for the matching of the remaining words in the term.

FIG. 6 illustrates a data structure that enables searching using variable prefix strings. This exemplary illustration shows the case of $K=2$ and $C=1$ (although subsequent words in the term are not illustrated). The illustration uses a trie data structure 601 to index the prefix strings. Each character in the trie 604 points to a set of top M 602 records that contains the most popular terms that begin with the prefix corresponding to the path from the root to that character. The ordering could be governed, e.g., by popularity, temporal relevance, location relevance, and personal preference. Single word terms may be selectively given a boost in the ordering in order for it to be discovered quickly since it cannot leverage off the " K " factor or " C " factor. The TOP M records corresponding to every node in the trie may be placed in memory that enables quick access to them. The value of M may be determined by factors such as the display size of the devices from which search would be done and the available memory capacity of the server or client system where the search metadata is stored. Each character in the trie also points to a container 603 that holds all records following the TOP M . For the term "guns of navarone", two new prefix strings in addition to the previous term, are created for the case $K=2$, "g_ of navarone" and "gu_ of navarone". The prefix strings "g_" and "gu_" both point to node starting the next word "o" 605.

FIG. 7 illustrates a process of finding results using the variable prefix string scheme in accordance with one or more embodiments of the invention. When user inputs a character of a prefix string at 701, the system examines if it is a word

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separator at 702. If it is not a word separator, the system fetches the top M records at 704 for that character. If it is a word separator, system examines if the prefix with the word separator is in $I(T)$ at 703. If it is in $I(T)$, the system accesses the top M records for that node in the trie at 704. If the word separator is not in $I(T)$, the system does a complete search at 707 for the records beginning with that prefix string. Also, after step 704, if user scrolls through the results list beyond top M results at 705, the system would perform a complete search at 707. If the user does not scroll beyond the top M results, and the user does not arrive at the result at 706, he can go back and enter another character at 701. So by having just a proper subset $I(T)$ of the prefix strings precomputed, the system can leverage off the precomputed strings. For example, if user entered "gun_o" for the case $K=2$, $C=1$, the system would perform a complete search under strings beginning with gun and generate dynamically the top records that have the second word starting with 'o'. Accordingly, the dynamic search process rides on top of the information provided by the precomputed prefix strings.

FIGS. 8A and 8B illustrates two exemplary search devices in accordance with one or more further embodiments of the invention. In FIG. 8A, a television 801 is controlled by a remote control device 809 over a wireless connection 807. The device 809 has a keypad 810, a navigation interface 811, a 'next word' button 808a, and a 'previous' button 808b. A preferred interface layout for performing searches is illustrated on the television screen with a permanent text entry focus (which has only one text entry) and decoupled tab focus. This enables user to enter text at any time without having to explicitly switch focus to the text window 803. A results window 806 is displayed with a scroll control 805. The results window 806 can be navigated using the navigation interface 811 on the remote 809. As a user types in "JE SE" at 802, the results window content 804 is dynamically culled to show the results. The remote control 809 has a prominent and easily accessible 'next word' button 808a, that facilitates entry of a space character to delimit words. The 'next word' interface facilitates easy entry of multiple prefix strings. Additionally the remote also has the "previous word" button 808b to facilitate easy traversal to the end of the previous words. This can be used in the remote scenario where the user did not enter sufficient characters for the first 'm' prefixes of a term and has to go back to add more characters if the desired result is not reached.

The second device illustrated in FIG. 8B is a hand-held device (e.g., a phone) 812 that has a built-in keypad 816 and navigation interface 815. The display window 813 on this device is likely to be much smaller and hence hold fewer results in a results area 817. Scrolling may be cumbersome on these devices. Aggregation of words can be used wherever applicable to reduce bucket sizes and hence scrolling.

In accordance with one or more embodiments of the invention, the system provides visual cues to users to assist in educating the user on what would be a generally optimal prefix string entry. In the illustrated examples, the visual cues are in the form of underlined prefixes beneath each result 804, 818. The user may over time learn to enter a generally optimal prefix string input due to the visual cues. The optimal prefix string that can display a term within the display space of a device without scrolling can be determined in advance by the system taking into account the number of lines in the display and the relevance factor of the term.

In accordance with one or more embodiments of the invention, entity and term space complexity is considered in designing a search/disambiguating mechanism and operations, in addition to device characteristics themselves. In

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some cases, in order to apply one or more embodiments of this invention to a given entity/term space, it is useful to appropriately partition the space and have multiple distinct computing engines to serve requests. For example a movie search space could be broken down into smaller search spaces by categorizing them into genres. Similarly a phone book search space can be broken down by categorizing it into cities, and towns. The average size of the hash bucket would set a lower bound on the prefix size. Furthermore, the number of characters to be entered may have to be increased to keep the hash collision count within the tolerable limit of scrolling. For example, in a study done on the movie space, a random sampling of 150,000 English movie titles revealed that 99% of the search space can be covered by 6 characters with hash collisions below 10, while approximately 50% of the search space was covered by a 4 character scheme with a hash collision size below 10. It is interesting to note while the search space was only 150,000 items, it took 6 characters or 300 million buckets to contain the collisions within 10. A study of a restaurant namespace in Westchester, N.Y. with a listing of 1,500 restaurants showed that 98-99% of the restaurants were listed within a display list of top 5 restaurants with the entry of 4 characters, where 2 characters were taken from the first word and two from the next. A study of phone-book namespace for Connecticut State Govt. with 29,500 employees expanded to 58,000 to accommodate for unordered namespace revealed that for a bucket size of 10 and with 4 characters (first word 2 characters and 2 characters from the second word), 62% were listed in the top 10 names. When the number of characters entered increased to 6, 96.5% were listed within the top 10 names.

Methods of identifying content from reduced text input in accordance with various embodiments of the invention are preferably implemented in software, and accordingly one of the preferred implementations is as a set of instructions (program code) in a code module resident in the random access memory of a computer. Until required by the computer, the set of instructions may be stored in another computer memory, e.g., in a hard disk drive, or in a removable memory such as an optical disk (for eventual use in a CD ROM) or floppy disk (for eventual use in a floppy disk drive), or downloaded via the Internet or some other computer network. In addition, although the various methods described are conveniently implemented in a general purpose computer selectively activated or reconfigured by software, one of ordinary skill in the art would also recognize that such methods may be carried out in hardware, in firmware, or in more specialized apparatus constructed to perform the specified method steps.

Having described preferred embodiments of the present invention, it should be apparent that modifications can be made without departing from the spirit and scope of the invention.

Method claims set forth below having steps that are numbered or designated by letters should not be considered to be necessarily limited to the particular order in which the steps are recited.

The invention claimed is:

1. A method of incrementally identifying and selecting a television content item to be presented from a relatively large set of selectable television content items, the television content items being associated with descriptive terms that characterize the selectable television content items, the method comprising:

using an ordering criteria to rank and associate subsets of television content items with corresponding strings of one or more descriptor prefix strings, each descriptor prefix string being a variable length string containing a

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subset of the characters of the descriptive terms that characterize the selectable television content items, wherein each descriptor prefix string contains less than all characters of the descriptive terms;

subsequent to ranking and associating the television content items with strings of one or more descriptor prefix strings, receiving incremental text input entered by a user, the incremental text input including a first descriptor prefix of a word entered by the user for incrementally identifying at least one desired television content item of the relatively large set of television content items, wherein the first descriptor prefix contains less than all characters of the word the user is using to incrementally identify the at least one desired television content item;

selecting and presenting on a display device the subset of television content items that is associated with the first descriptor prefix string;

subsequent to receiving the first descriptor prefix, receiving subsequent incremental text input entered by the user, the subsequent incremental text input including a second descriptor prefix of a word entered by the user for incrementally identifying the at least one desired television content item and forming a string of prefixes including the first descriptor prefix and the second descriptor prefix in the order received, wherein the second descriptor prefix contains less than all characters of the word the user is using to incrementally identify the at least one desired television content item; and

selecting and presenting on the display device the subset of television content items that is associated with the string of prefixes received.

2. The method of claim 1, wherein the first and second prefixes are in an ordered format.

3. The method of claim 1, wherein the first and second prefixes are in an unordered format.

4. The method of claim 1, wherein the first and second prefixes are separated by a word separator.

5. The method of claim 1, wherein the selected and presented subset of television content item comprises two or more television content items, and wherein the selected and presented subset of television content items are ordered for presentation in accordance with a given relevance function.

6. The method of claim 5, wherein the given relevance function comprises popularity of the television content items.

7. The method of claim 5, wherein the given relevance function comprises temporal relevance of the television content items.

8. The method of claim 5, wherein the given relevance function comprises location relevance of the television content items.

9. The method of claim 1, wherein the incremental text input specifies at least a portion of a title of the at least one desired television content item.

10. The method of claim 1, wherein the method is implemented in a server system remote from the user.

11. The method of claim 1, wherein the method is implemented in a device included in or proximate to a television set for displaying the subset of television content items.

12. The method of claim 1, further comprising determining the descriptive terms prior to receiving the incremental text input from the user.

13. The method of claim 12, wherein determining the descriptive terms comprises identifying a set of candidate terms comprising ordered or unordered words.

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14. The method of claim 13, further comprising identifying the location of stop words in the descriptive terms.

15. The method of claim 12, wherein determining the descriptive terms comprises adding phonetically equivalent words to the descriptive terms.

16. The method of claim 12, wherein determining the descriptive terms comprises adding commonly misspelled words of words in the descriptive terms.

17. The method of claim 1, further comprising providing the user with visual cues to assist the viewer in entering generally optimal incremental text input for a search.

18. The method of claim 1, wherein the descriptive terms include at least one of title, cast, director, description, and keyword information relating to the television content item.

19. A system for incrementally identifying and selecting a television content item to be presented from a relatively large set of selectable television content items, the television content items being associated with descriptive terms that characterize the selectable television content items, the system comprising:

a database in an electronically readable medium for storing the relatively large set of selectable television content items and associated descriptive terms that characterize the selectable television content items;

a plurality of subsets of television content items, each subset being ranked and associated with corresponding strings of one or more descriptive prefix strings based on an ordering criteria, each descriptor prefix string being a variable length string containing a subset of the characters of the descriptive terms that characterize the selectable television content items, wherein each descriptor prefix string contains less than all characters of the descriptive terms; and

program code on a computer-readable medium, which when executed on a computer system performs functions including:

receiving incremental text input entered by a user, the incremental text input including a first descriptor prefix of a word entered by the user for incrementally identifying at least one desired television content item of the relatively large set of television content items, wherein the first descriptor prefix contains less than all characters of the word the user is using to incrementally identify the at least one desired television content item;

selecting and presenting on a display device the subset of television content items that is associated with the first descriptor prefix string;

subsequent to receiving the first descriptor prefix, receiving subsequent incremental text input entered by the user, the subsequent incremental text input including a second descriptor prefix of a word entered by the user for incrementally identifying the at least one desired television content item and forming a string of prefixes including the first descriptor prefix and the second descriptor prefix in the order received, wherein the second descriptor prefix contains less than all characters of the word the user is using to

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incrementally identify the at least one desired television content item; and

selecting and presenting on the display device the subset of television content items that is associated with the string of prefixes received.

20. The system of claim 19, wherein the first and second prefixes are in an ordered format.

21. The system of claim 19, wherein the first and second prefixes are in an unordered format.

22. The system of claim 19, wherein the first and second prefixes are separated by a word separator.

23. The system of claim 19, wherein the selected and presented subset of television content item comprises two or more television content items, and wherein the selected and presented subset of television content items are ordered for presentation in accordance with a given relevance function.

24. The system of claim 23, wherein the given relevance function comprises popularity of the television content items.

25. The system of claim 23, wherein the given relevance function comprises temporal relevance of the television content items.

26. The system of claim 23, wherein the given relevance function comprises location relevance of the television content items.

27. The system of claim 19, wherein the incremental text input specifies at least a portion of a title of the at least one desired television content item.

28. The system of claim 19, wherein the computer system is a server system remote from the user.

29. The system of claim 19, wherein the computer system is a device included in or proximate to a television set for displaying the selected subset of television content items.

30. The system of claim 19, wherein the plurality of subsets of television content items is present in the system prior to receiving the incremental text input from the user.

31. The system of claim 19, wherein the descriptive terms are determined by identifying a set of candidate terms comprising ordered or unordered words.

32. The system of claim 19, wherein the descriptive terms are determined by identifying the location of stop words in said terms.

33. The system of claim 19, wherein the descriptive terms comprise phonetically equivalent words to the descriptive terms.

34. The system of claim 19, wherein the descriptive terms comprise commonly misspelled words of words in the descriptive terms.

35. The system of claim 19, wherein the program code when executed on the computer system further performs the function of providing the user with visual cues to assist the user in entering a generally optimal incremental text input for a search.

36. The system of claim 19, wherein the descriptive terms include at least one of title, cast, director, description, or keyword information relating to the television content item.

* * * * *

EXHIBIT 3



(12) **United States Patent**
Venkataraman et al.

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(45) **Date of Patent:** *May 3, 2011

(54) **METHOD AND SYSTEM FOR DYNAMICALLY PROCESSING AMBIGUOUS, REDUCED TEXT SEARCH QUERIES AND HIGHLIGHTING RESULTS THEREOF**

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G06F 17/30 (2006.01)

(52) **U.S. Cl.** 707/741; 707/742; 707/753

(58) **Field of Classification Search** 707/741, 707/742, 753, 999.005

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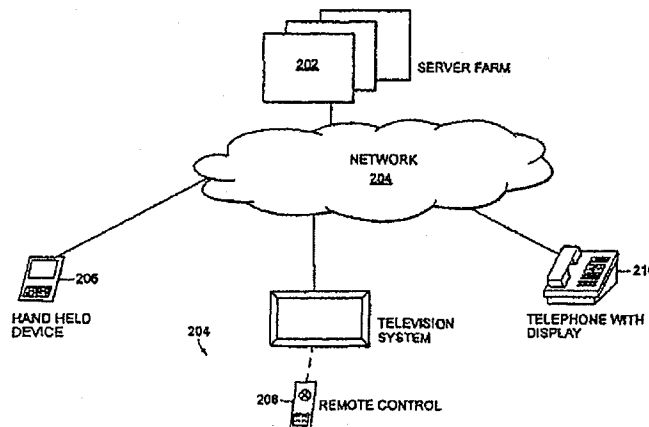
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(57) **ABSTRACT**

A method and system are provided of processing a search query entered by a user of a device having a text input interface with overloaded keys. The search query is directed at identifying an item from a set of items. Each of the items has a name including one or more words. The system receives from the user an ambiguous search query directed at identifying a desired item. The search query comprises a prefix substring of at least one word in the name of the desired item. The system dynamically identifies a group of one or more items from the set of items having one or more words in the names thereof matching the search query as the user enters each character of the search query. They system also orders the one or more items of the group in accordance with given criteria. The names of the one or more items of the identified group are output to be displayed on the device operated by the user as ordered with the characters of the one or more words in the names corresponding to the prefix substring of the search query being highlighted.

11 Claims, 7 Drawing Sheets



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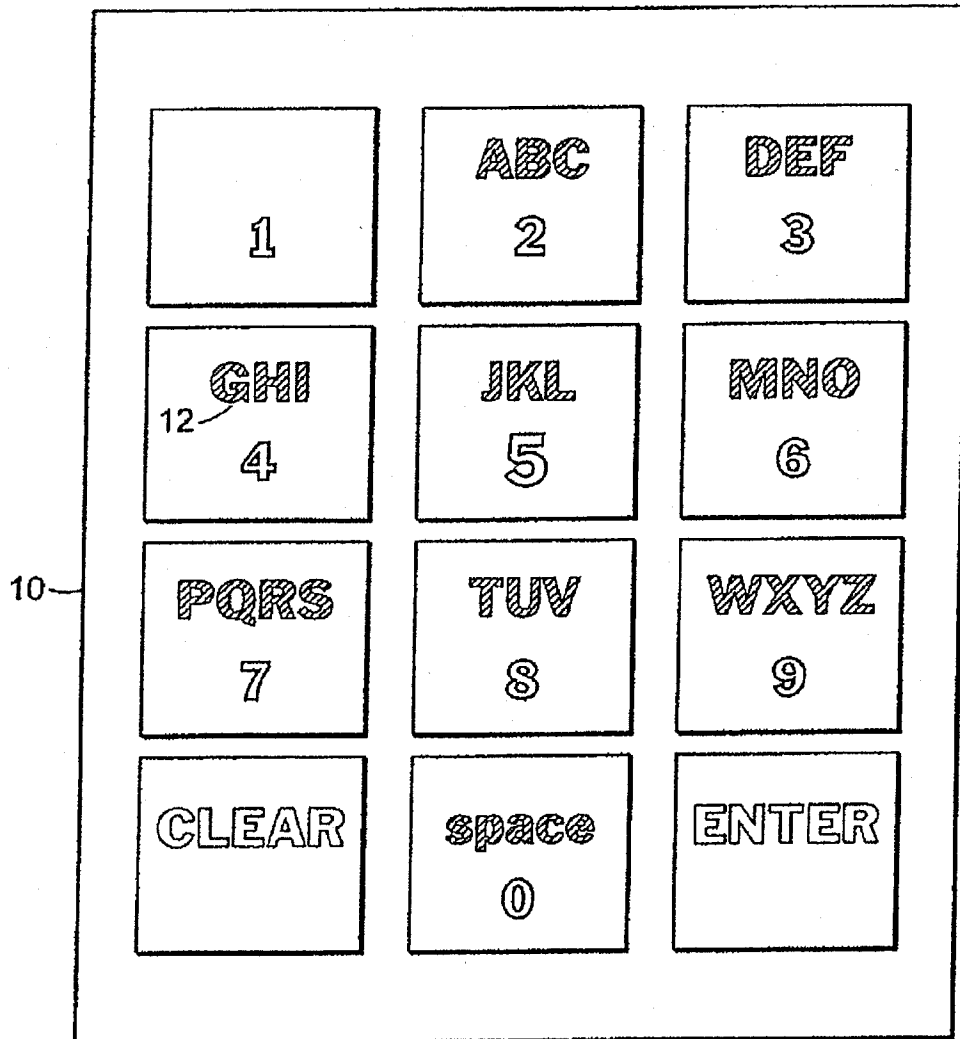
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PRIOR ART
FIG. 1

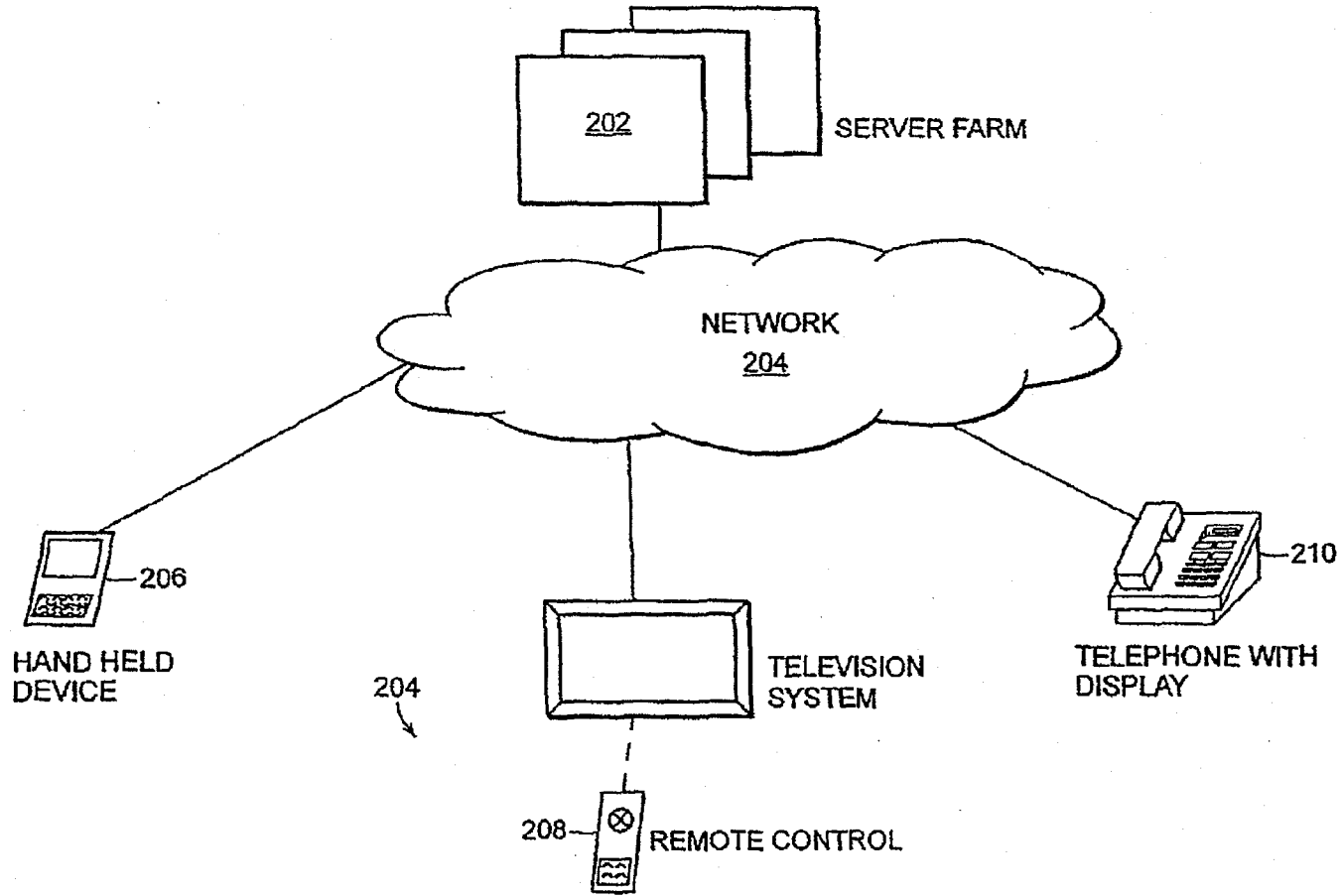


FIG. 2

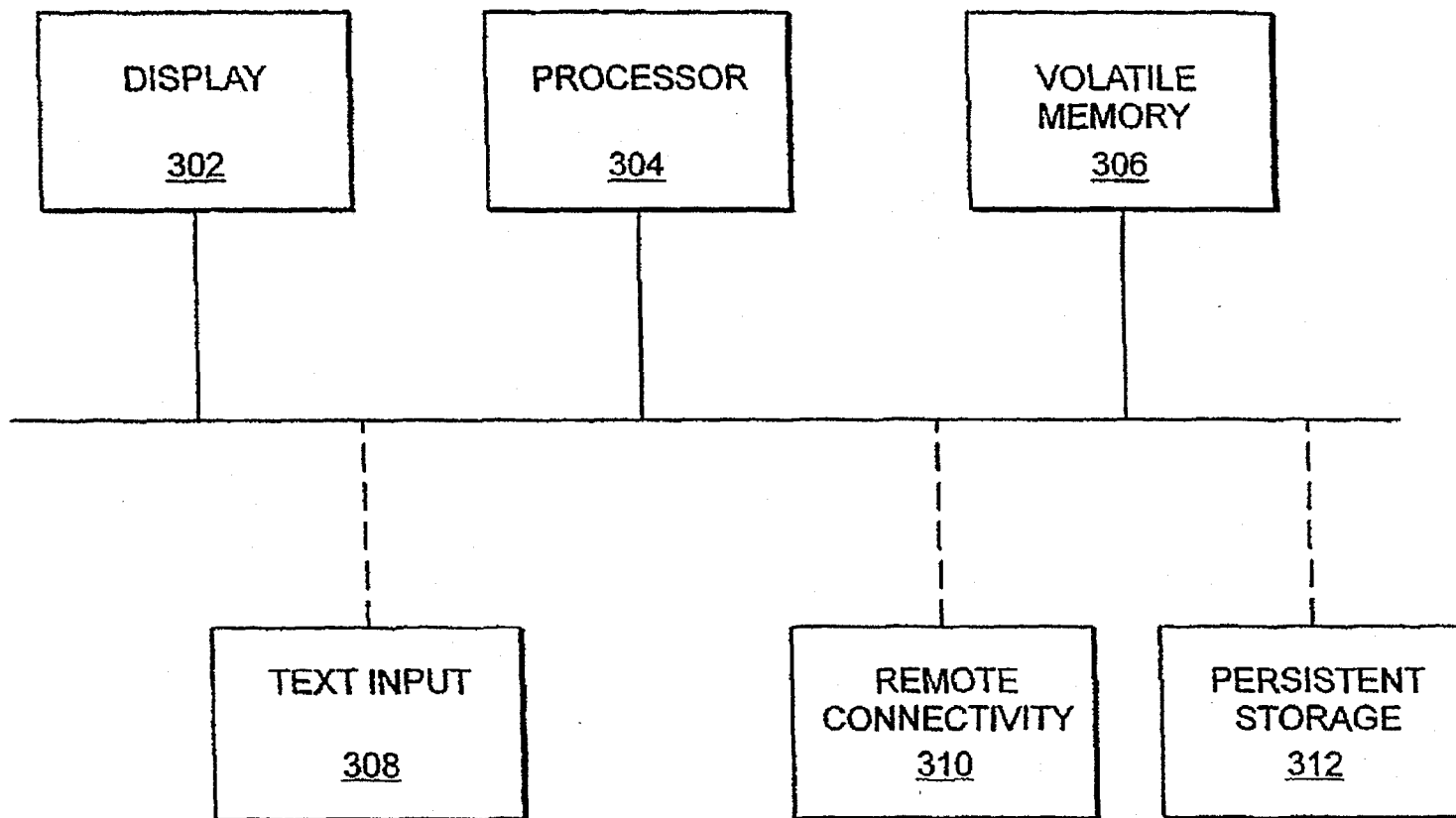


FIG. 3

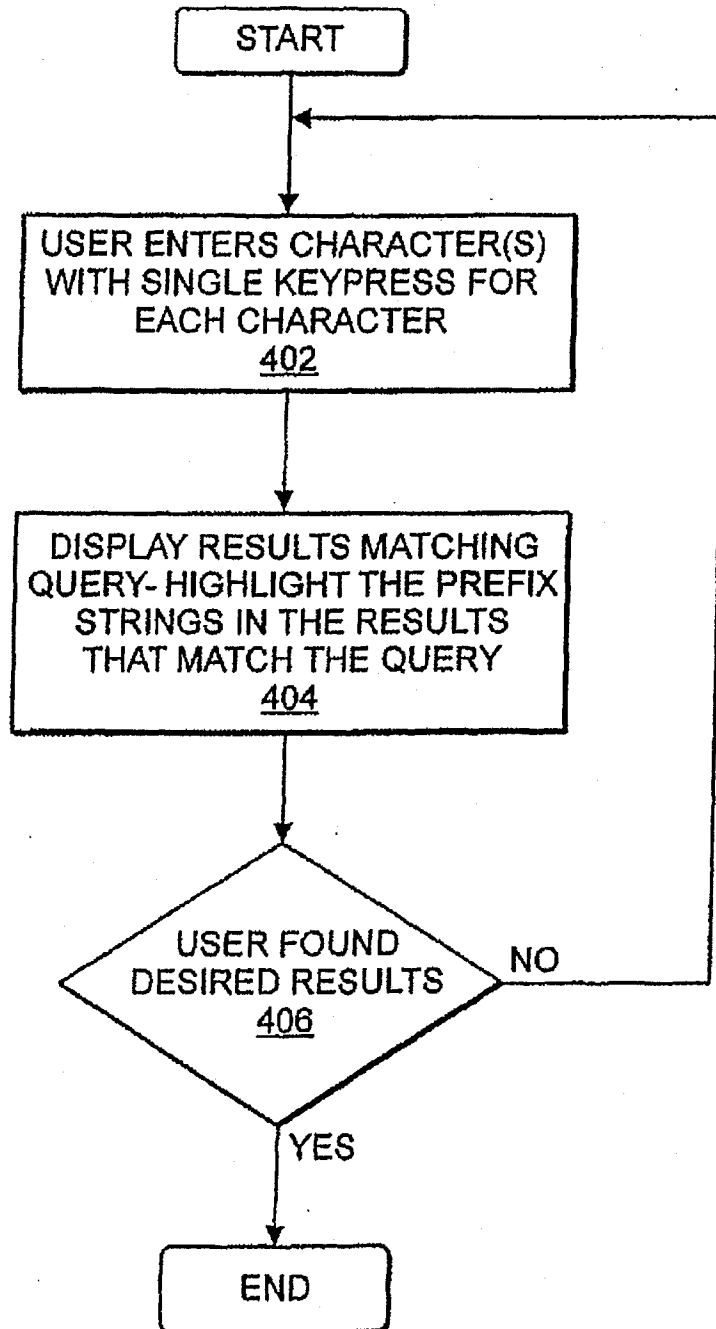


FIG. 4

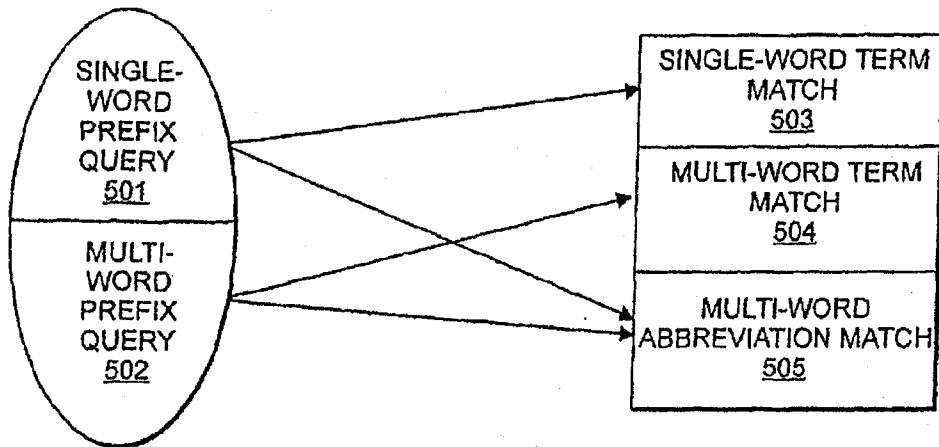


FIG. 5A

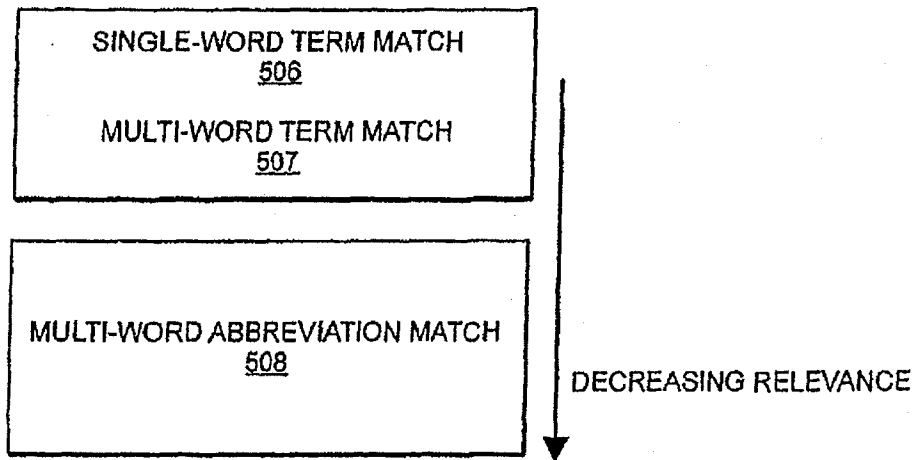
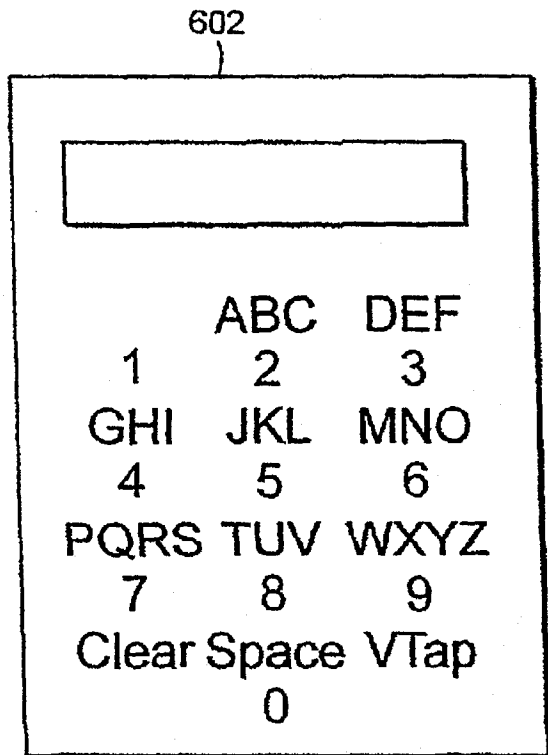


FIG. 5B



USER INPUT: 866

FIG. 6A

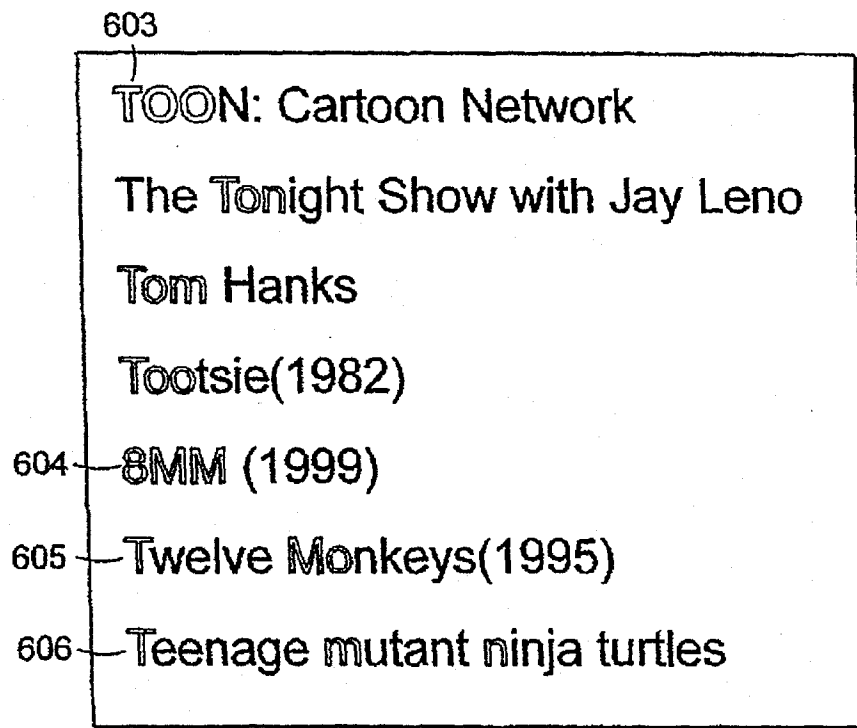
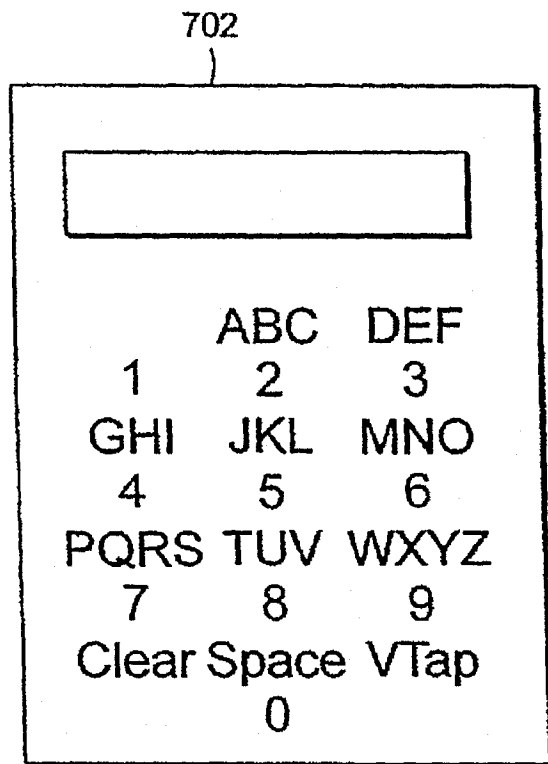


FIG. 6B



USER INPUT: 866 2

FIG. 7A

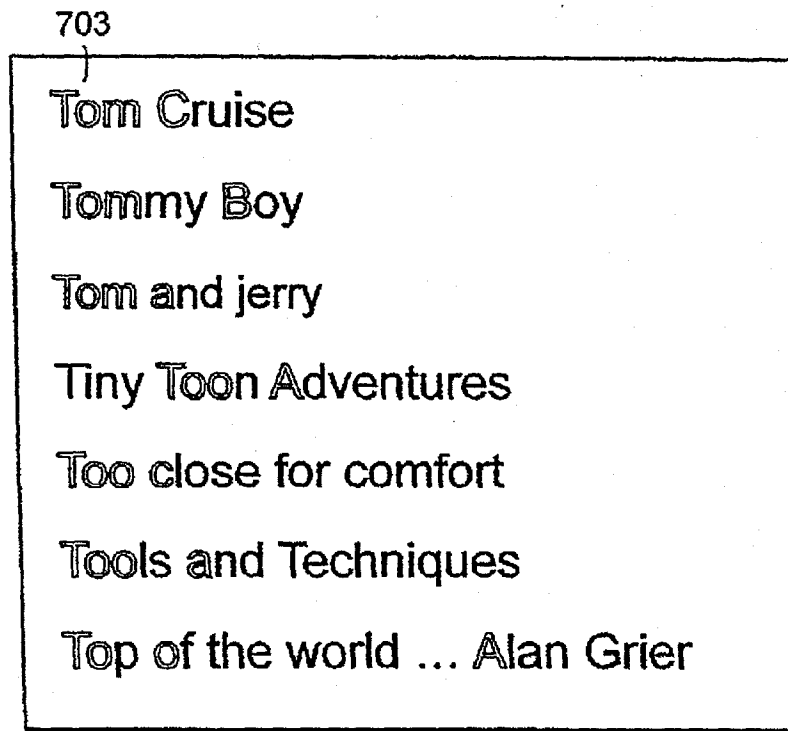


FIG. 7B

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**METHOD AND SYSTEM FOR
DYNAMICALLY PROCESSING AMBIGUOUS,
REDUCED TEXT SEARCH QUERIES AND
HIGHLIGHTING RESULTS THEREOF**

CROSS-REFERENCE TO RELATED
APPLICATIONS

The application is a continuation of U.S. patent application Ser. No. 11/312,908, entitled Method And System For Dynamically Processing Ambiguous, Reduced Text Search Queries And Highlighting Results Thereof, filed Dec. 20, 2005, now U.S. Pat. No. 7,779,011, which claims the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Patent Application No. 60/711,866 filed Aug. 26, 2005 and entitled A Dynamic Highlighting Interface of Multi Word Prefixes of Results Obtained by Incremental Search with Reduced Text Entry on Television and Mobile Devices Using a Keypad with Overloaded Keys and U.S. Provisional Patent Application No. 60/716,101 filed Sep. 12, 2005, and entitled Method and System for Incremental Search With Reduced Text Entry Using a Reduced Keypad With Overloaded Keys, all of which are incorporated herein by reference in their entirety.

BACKGROUND OF THE DISCLOSURE

1. Field of Invention

The present invention generally relates to processing search queries and, more particularly, to methods and systems for processing ambiguous, reduced text, search queries and highlighting results thereof.

2. Description of Related Art

There are many user-operated devices such as mobile phones, PDAs (personal digital assistants), and television remote control devices that have small keypads, which a user can use for text entry. In many of these devices, largely because of device size constraints, the keypad is small and has only a small number of keys, which are overloaded with alpha-numeric characters. Text input using these keypads is cumbersome.

FIG. 1 illustrates a common twelve-key keypad interface found in many cell phones and other mobile devices, and also increasingly in devices like television remote control devices. The keypad 10 includes twelve keys 12, most of which are overloaded with multiple alpha-numeric characters or functions. The same key can be pressed to enter different characters. For instance, the "2" key can be used to enter the number "2" and the letters "A", "B" and "C". Text entry using such a keypad with overloaded keys can result in an ambiguous text entry, which requires some type of a disambiguation action. For instance, with a so-called multi-press interface, a user can press a particular key multiple times in quick succession to select a desired character (e.g., to choose "B", the user would press the "2" key twice quickly, and to choose "C", the user would press the key three times quickly). Alternatively, text entry can be performed using the so-called T9 and other text input mechanisms that provide vocabulary based completion choices for each word entered. Neither of these methods is however particularly suitable for use in performing searches because of the number of steps needed to get to the result. One deficiency of the multi-press interface is that too many key strokes are needed. A drawback of applying a vocabulary based word completion interface is the need for the additional step of making a choice from a list of all possible word matches generated by the ambiguous text input. Furthermore vocabulary based word disambiguation systems are designed typically for composition applications (as opposed to search

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applications) where user explicitly disambiguates each word by performing a word completion action to resolve that word before proceeding to the next word in the composition. This deficiency is even more apparent for a multi-word search system where results could ideally be obtained by the entry of just a few characters. These methods suffer from the fact that the fewer the number of characters entered, the greater the ambiguity of the input. (The ambiguity decreases as the input character count increases.) This has the undesirable consequence of reducing the usefulness of a search engine that has the potential to retrieve results with just a few input characters.

BRIEF SUMMARY OF EMBODIMENTS OF THE
INVENTION

In accordance with one or more embodiments of the invention, a method and system are provided of processing a search query entered by a user of a device having a text input interface with overloaded keys. The search query is directed at identifying an item from a set of items. Each of the items has a name comprising one or more words. The system receives from the user an ambiguous search query directed at identifying a desired item. The search query comprises a prefix substring of at least one word in the name of the desired item. The system dynamically identifies a group of one or more items from the set of items having one or more words in the names thereof matching the search query as the user enters each character of the search query. The system also orders the one or more items of the group in accordance with given criteria. The names of the one or more items of the identified group are output to be displayed on the device operated by the user as ordered with the characters of the one or more words in the names corresponding to the prefix substring of the search query being highlighted.

These and other features will become readily apparent from the following detailed description wherein embodiments of the invention are shown and described by way of illustration. As will be realized, the invention is capable of other and different embodiments and its several details may be capable of modifications in various respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature and not in a restrictive or limiting sense with the scope of the application being indicated in the claims.

BRIEF DESCRIPTION OF THE SEVERAL VIEW
OF THE DRAWINGS

For a more complete understanding of various embodiments of the present invention, reference is now made to the following descriptions taken in connection with the accompanying drawings in which:

FIG. 1 illustrates a keypad with overloaded keys in accordance with the prior art.

FIG. 2 illustrates a search system in accordance with one or more embodiments of the invention.

FIG. 3 illustrates exemplary device configuration options for various devices for performing searches in accordance with one or more embodiments of the invention.

FIG. 4 is a flow chart illustrating a method for finding and highlighting results of a reduced text, ambiguous search query made using an overloaded keypad in accordance with one or more embodiments of the invention.

FIG. 5A illustrates the different match possibilities for a single-word and multi-word prefix query in accordance with one or more embodiments of the invention.

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FIG. 5B illustrates possible ordering criteria for search results in accordance with one or more embodiments of the invention.

FIGS. 6A and 6B illustrate an exemplary text input interface and a display interface, respectively. The display interface shows the results of a sample incremental search where the user has entered a single-word query in accordance with one or more embodiments of the invention.

FIGS. 7A and 7B illustrate an exemplary text input interface and a display interface, respectively. The display interface shows the results of a sample incremental search where the user has entered a multi-word query in accordance with one or more embodiments of the invention.

Like reference numerals generally refer to like elements in the drawings.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Briefly, methods and systems are provided in accordance with various embodiments of the invention for performing searches using ambiguous text input from devices having limited text input interfaces, and highlighting results of the searches.

As described in further detail below, in accordance with various embodiments of the invention, methods and systems are provided for processing a search query entered by a user of a device having a text input interface with overloaded keys. The search query is directed at identifying an item from a set of items. Each of the items has a name comprising one or more words.

Using the text input interface, the user can enter an ambiguous search query directed at identifying a desired item. The search query comprises a prefix substring of at least one word in the name of the desired item. A prefix substring of a word is a variable length string of characters that contains fewer than all the characters making up the word.

The system dynamically identifies a group of one or more items from the set of items having one or more words in the names thereof matching said search query as the user enters each character of said search query. The group of the one or more items is displayed on the device operated by the user with the characters of the one or more words in the names corresponding to the prefix substring of the search query being highlighted. The items are preferably displayed in an order of expected interest to the user.

The user types in the prefix input query by pressing overloaded keys of the text input interface once to form each character of an ambiguous query string. In accordance with one or more embodiments of the invention, the search space containing the searchable items is initially indexed by performing a many-to-many mapping from the alphanumeric space of terms to numeric strings corresponding to the various prefixes of each alphanumeric term constituting the query string. In a numeric string, each alphanumeric character in the string is replaced by its corresponding numeric equivalent based on the arrangement of characters on the keypad, e.g., the commonly used twelve-key reduced keypad shown in FIG. 1. This mapping scheme enables the system in accordance with one or more embodiments to incrementally retrieve results matching the ambiguous alphanumeric input query, as the user types in each character of the query. The user does not have to explicitly specify the termination of each word in the query to assist the system in disambiguating the input query; instead, the user only enters an input query that includes prefix substrings from the one or more words of the query. If multiple word prefixes are entered, the system

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can leverage off the multiple word prefixes to disambiguate it. A multiple word prefix based disambiguation method can reduce the amount of text and steps needed to enter a multiple word input query and retrieve results.

There are various possible applications for the search techniques described herein including, e.g., assisting television viewers in identifying desired television content items and channels, and assisting users of mobile devices such as cell phones and PDAs in performing searches for items in various databases (e.g., performing searches in directories of people or businesses, searching for and purchasing products/services like airline tickets, and searching for transportation schedules such as airline and train schedules, and for searching for audio and/or video content).

In the context of television systems, the term "television content items" can include a wide variety of video/audio content including, but not limited to, television shows, movies, music videos, or any other identifiable content that can be selected by a television viewer. Searching for television content items can be performed across disparate content sources including, but not limited to, broadcast television, VOD, IPTV, and PVR (local and network).

FIG. 2 schematically illustrates an overall system for performing searches with reduced text entry using various devices in accordance with one or more embodiments of the invention. The system includes a server farm or system 202, a network 204, and a variety of devices 206, 208, 210 operated by users with text input interfaces. In accordance with one or more embodiments of the invention, the server 202 processes search queries received from the user devices 206, 208, 210. In other embodiments, the search queries are processed on the devices themselves. As discussed below, the server 202 can be the source of search data and relevance updates. If part of a television system, the server 202 can also be the source of or be linked to a source of at least some of the available television content (e.g., a cable or satellite television operator) from which the user can obtain content associated with search results.

The network 204 functions as the distribution framework for transmitting data from the server 202 to the devices operated by the users. The distribution network 204 could be wired or wireless connections or some combination thereof. Examples of possible networks include computer networks, cable television networks, satellite television networks, IP-based television networks, mobile communications networks (such as, e.g., wireless CDMA and GSM networks), wired telephone networks, and IP-based wired and wireless networks.

The search devices could have a wide range of interface capabilities. A device, e.g., could be a hand-held mobile communications device 206 such as a cellular phone or PDA having a limited display size and a reduced keypad with overloaded keys. Another type of search device is a television system 204 with a remote control device 208 having an overloaded keypad. Another possible search device is a desk telephone 210 with a reduced keyboard and a small display screen.

FIG. 3 illustrates multiple exemplary configurations for search devices in accordance with various embodiments of the invention. In one configuration, a search device (e.g., devices 206, 208, 210) can have a display 302, a processor 304, volatile memory 306, text input interface 308, remote connectivity 310 to the server 202 through the network 204, and a persistent storage 312. A device configuration for a device such as the hand-held device 206 might not include local persistent storage 312. In this case, the device 206 could have remote connectivity 310 to submit the query to the server

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202 and retrieve results from it. Another configuration of the devices 206, 208, 210 may not have remote connectivity 310. In this case, the search database may be locally resident on a local persistent storage 312. The persistent storage 312 may be, e.g., a removable storage element such as SD, SmartMedia, CompactFlash card etc. In a configuration of the device with remote connectivity 310 and persistent storage 312 for performing searches (e.g., a television system 208), the device may use the remote connectivity for search relevance data update or for the case where the search database is distributed on the local storage 312 and on the server 202. A preferred configuration in a memory constrained device is the search data residing remotely on a server. Unlike composition applications where the "most frequently used or popular terms space" are small in size and can be maintained in a local vocabulary, search spaces are typically larger inherently because people instinctively use unique word "signatures" to recall an item of interest. Hence maintaining search spaces locally may not be practical in many devices that have limited local memory, making a network based search configuration preferable.

In one exemplary embodiment, a television system 208 may have a set-top box or other device with a one-way link to a satellite network. In this configuration, all search data including relevance updates may be downloaded to the device through a satellite link to perform local searching. In this case, the set-top box preferably has sufficient storage capacity to maintain search spaces locally. Local storage is preferably large in this case to circumvent the deficiency of a one-way link.

FIG. 4 illustrates a search process in accordance with one or more embodiments of the invention. At step 402, the user enters a character using an ambiguous text input interface, e.g., using a keypad with overloaded keys where a single key press is performed for each character entered. At 404, an incremental search system determines and displays at least some of the results that match the input character entered at 402. Since the input is ambiguous, the match of results would include the matches for all the ambiguous input characters represented by the single key press (including those not of interest to the user). To address this increased set of matches, an ordering scheme is preferably used to order the results to improve accessibility to results expected to be more of interest to the user. The ordering of results can be based on a variety of criteria including, e.g., temporal relevance, location relevance, popularity and personal preferences (that may have been determined implicitly or explicitly) or some combination of these criteria. (In a television application, temporal relevance can be used to favor programs whose timing may be more of interest to the viewer. For example, if the user entered NBA, then the system would list the games in order of temporal relevance such as those in progress or are scheduled to begin in the near future are listed at the higher on the list. The popularity criterion can be used to favor programs or channels that are more popular than others. The personal preference criterion can be used to favor programs or channels that the user has indicated preference for in prior user selections. For example, if a user frequently scrolls down to "CNBC" and selects it, the system would over time place CNBC higher in the list of results over a more generally popular channel such as CNN. Furthermore, identity independent time-based usage pattern learning algorithms can be applied in conjunction with personalization to apply the results ordering rules in an appropriate context. Also, e.g., when using a PDA or cell phone to search for a business, the system may use location relevance as part of the ordering criteria.)

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In addition, other ordering schemes can be used in addition to or instead of the schemes indicated above such as character count based subspace biasing. In a character count based subspace biasing scheme, items in the search space do not have a constant relevance value, but rather have a relevance value that is a function of the number of characters entered so far in the prefix substring. In such a scheme, the search space (i.e., set of items that can be searched for) can be divided into multiple subspaces. The relative relevance of a given subspace (and all the items contained therein) is dynamically boosted or suppressed as a function of the number of characters in the search query. As an example, a subspace containing television channel names might be boosted when the character count is one because television viewers might expect to find a channel with a single key press. Various examples of character count based subspace biasing are described in U.S. patent application Ser. No. 11/246,432 entitled "Method And System For Incremental Search With Reduced Text Entry Where The Relevance Of Results Is A Dynamically Computed Function Of User Input Search String Character Count" and filed on Oct. 7, 2005, which is assigned to the assignee of the present application and is incorporated by reference herein in its entirety.

The ordering criteria can also give preference to the results matching the search query based on a lexical match of the type of query input, e.g., in the following order of preference: single term prefixes, multiple term prefixes, and lastly abbreviation matches.

In accordance with various embodiments of the invention and as will be described below with reference to FIGS. 6B and 7B, the characters in the search result items that match the search prefix substring characters are highlighted to provide the user with a visual indication of the relationship between the key or keys pressed and the incremental match results. This facilitates identification by the user of the item of interest from the group of items displayed.

If the user does not find the desired results at 406, he or she can continue to enter more characters to the search query at step 402. Then at step 404, the system will perform the search based on the cumulative substring of characters of the search query entered by the user up to that point.

In the scenario where user does not reach the result due to misspelling or due to the case of a word whose uniqueness (e.g., Tom Brown, Todd Brown) is embedded in the suffix of a word in the query (as opposed to the prefix), the user would have to either go back to the first word and enter more characters or erase one or more of the typed characters and re-enter characters to reach the desired result. The dynamic highlight of the prefix strings in the results for each character entry enables the user to recover from an error during the text entry process itself, in contrast to discovering that no results match after typing the entire text.

FIG. 5A illustrates the two broad categories of input queries and the various potential matches they could have in the results space. Input queries that do not include an explicit space or other break character form a single-word prefix query. A single-word query 501 can either match a single-word term 503 or an abbreviation representing multiple words 505. Input queries that explicitly include a space character or other break character between character entries form a multi-word prefix query. A multi-word prefix query 502 can match a multi-word term 504 or an abbreviation presenting multiple words. In an exemplary search of a movie database, the matches could be a direct match on terms representing a title (e.g., for the search query "go mu", a match could be the movie title Gods Must Be Crazy) or it could be matches on terms representing different types of information (e.g., if a

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user is searching for a movie starring Tom Hanks that features volleyball, he or she may enter the search query "to vo" to get the result: Tom Hanks Volleyball). As described earlier, these matches are then ordered in decreasing relevance, and in one or more embodiments, in the following order: single-word term matches 506 and multi-word term matches 507 followed by multi-word abbreviation matches 508 as illustrated in FIG. 5B.

FIGS. 6A and 6B illustrate an example of highlighted search results in accordance with one or more embodiments of the invention. FIG. 6A illustrates an overloaded keypad interface 602, which can in a television application, be an on-screen interface. In this example, the user has entered a single-word text input query "866" using the keypad 602. The results of the search input are shown in FIG. 6B, which shows single-word term matches 603 and 604 ordered before abbreviation matches 605 and 606. Because each key pressed by the user is overloaded and represents multiple possible search prefixes, simply displaying the text input "866" with the results will not provide the user sufficient information to associate his or her input with the match results. The "8" character entered initially by the user matches all items in the search database containing any word which begins with any of the alphanumeric characters "8", "T", "U" or "V". Examples of matches to the first character would be "8MM" 604 and "Star Trek" (not shown here since what is shown is the result of the query 866, not 8). The "6" character next entered by the user limits these search results only to items containing words that begin with the alphanumeric characters "8", "T", "U" or "V" and whose second character is one of the alphanumeric characters "6", "M", "N" or "O" or to items containing words that begin with the alphanumeric characters "8", "T", "U" or "V" and that also contain subsequent words that begin with the alphanumeric characters "6", "M", "N" or "O". The earlier match, "Star Trek", would drop out of the match results when the user pressed the overloaded "6" key because the "r" following the "T" matched by the "8" character does not match "6", "M", "N" or "O" and there are no words following "Trek" to match the "6", "M", "N" or "O".

The next "6" character entered by the user as the third overloaded character further limits the search result to only those matches that also contain the alphanumeric characters "6", "M", "N" or "O" immediately following one of the matched characters for the first "6" previously entered or that contain subsequent words that begin with the alphanumeric characters "6", "M", "N" or "O". This relationship between the overloaded characters entered by the user and the match results is complicated and not necessarily intuitive to the user. In various embodiments of the invention, the characters in the search result that match the overloaded single-word search prefix characters are highlighted, providing the user with a visual indication of the relationship between the key pressed and the incremental match results. This facilitates identification by the user of the item of interest from the group of items displayed.

The term "highlighting" as used herein refers to making more prominent or otherwise making more distinct characters of interest in the search results relative to other characters. Non-limiting examples of highlighting include bolding, italicizing, coloring, underlining, or changing font of (or some combination thereof) the characters of interest relative to the others.

In another example, FIG. 7B illustrates the results for a multi-word text input "866 2" using a 12-key keypad 702 shown in FIG. 7A. As discussed earlier, the multi-word term matches 703 are preferably ordered ahead of multi-word abbreviation matches. The difference between the single-

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word search illustrated in FIG. 6B and the multi-word search illustrated in FIG. 7B is that the use of an explicit word separator in the user input (in this case a space character) before the "2" entry, further limits results of the search. Only the results of the search illustrated in FIG. 6B for prefix substring "866" that also contain at least two words and in which a subsequent word begins with "2", "A", "B", or "C" are included in the results displayed to the user. A title such as "Tomb Raider" would not match the multi-word search even though the word "Tomb" matches the overloaded keys "8", "6", "6", "2" because the "2" must match the first letter in a subsequent word. As in the FIG. 6B example, the characters in the ordered result that match the multi-word overloaded search prefix characters are highlighted to provide the user with immediate feedback relating the key pressed to the incremental match results.

Methods of processing ambiguous search query inputs from users and highlighting results in accordance with various embodiments of the invention are preferably implemented in software, and accordingly one of the preferred implementations is as a set of instructions (program code) in a code module resident in the random access memory of a computer. Until required by the computer, the set of instructions may be stored in another computer memory, e.g., in a hard disk drive, or in a removable memory such as an optical disk (for eventual use in a CD ROM) or floppy disk (for eventual use in a floppy disk drive), or downloaded via the Internet or some other computer network. In addition, although the various methods described are conveniently implemented in a general purpose computer selectively activated or reconfigured by software, one of ordinary skill in the art would also recognize that such methods may be carried out in hardware, in firmware, or in more specialized apparatus constructed to perform the specified method steps.

Having described preferred embodiments of the present invention, it should be apparent that modifications can be made without departing from the spirit and scope of the invention.

Method claims set forth below having steps that are numbered or designated by letters should not be considered to be necessarily limited to the particular order in which the steps are recited.

What is claimed is:

1. A method of processing unresolved keystroke entries by a user from a keypad with overloaded keys in which a given key is in fixed association with a number and at least one alphabetic character, the unresolved keystroke entries being directed at identifying an item from a set of items, each of the items being associated with information describing the item comprising one or more words, the method comprising:

providing access to an index of the items, the index having an association between subsets of the items and corresponding strings of one or more unresolved keystrokes for overloaded keys so that the subsets of items are directly mapped to the corresponding strings of unresolved keystrokes for various search query prefix substrings;

for at least one subset of items, determining which letters and numbers present in the information associated with and describing the indexed items of the subset caused the items to be associated with the strings of one or more unresolved keystrokes that directly mapped to the subset;

receiving from a user a search query for desired items composed of unresolved keystrokes, the search query comprising a prefix substring for at least one word in information associated with the desired item;

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in response to each unresolved keystroke, identifying and displaying the subsets of items, and information associated therewith, that are associated with the strings of one or more unresolved keystrokes received from the user based on the direct mapping of strings of unresolved keystrokes to subsets of items; and

in response to each unresolved keystroke, as the identified items are displayed, highlighting the letters and numbers present in the one or more words in the information describing the identified items that were determined to have caused the displayed items to be associated with the strings of unresolved keystrokes that are directly mapped to the items so as to illustrate to the user how the unresolved keystrokes entered match the information associated with the displayed items.

2. The method of claim 1, wherein highlighting the letters and numbers comprises highlighting by coloring, bolding, italicizing, underlining, or changing to a different font, or some combination thereof.

3. The method of claim 1, wherein the items of the subsets of items displayed are ordered when displayed such that items having single-word or multi-word term matches between the

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information associated with and describing those items and the unresolved keystrokes of the search query received from the user are displayed before items having single-word or multi-word abbreviation matches.

4. The method of claim 1, wherein the search query is processed by a server system remote from said user.

5. The method of claim 1, wherein the search query is processed by a device operated by said user.

6. The method of claim 5, wherein the device is a cell phone.

7. The method of claim 5, wherein the device is a desk phone.

8. The method of claim 5, wherein the device is a remote control device for a television.

9. The method of claim 1, wherein at least some items of the set of items are television content items.

10. The method of claim 1, wherein at least some items of the set of items are product items.

11. The method of claim 1, wherein identifying and displaying the subsets of items comprises identifying the subsets of items by reference to the index of the items.

* * * * *