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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
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(54) **Title:** ASYNCHRONOUS SPEECH ACT DETECTION IN TEXT-BASED MESSAGES

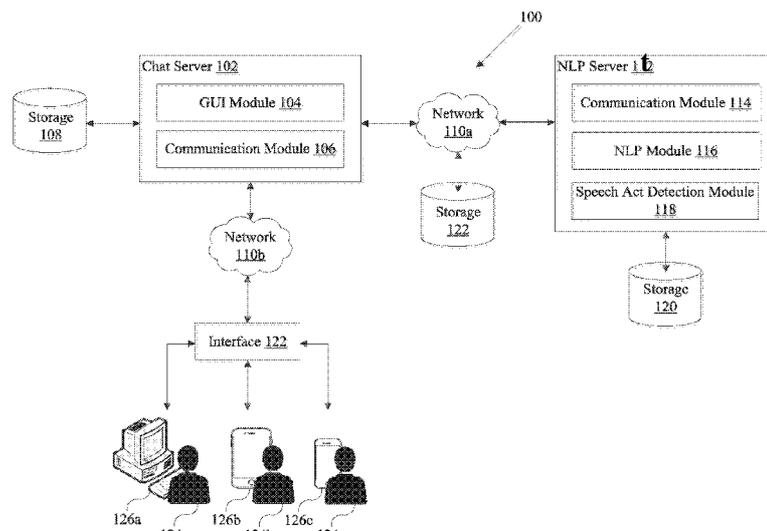


FIG. 1

(57) **Abstract:** Various embodiments are described herein that relate to communication systems that employ Natural Language Processing (NLP). More specifically, various embodiments relate to systems, methods, and interfaces for performing asynchronous speech act detection on text-based messages transmitted between used of a communication platform. Asynchronous speech act detection allows the content of the messages to be analyzed without interrupting the flow of communication. That is, the messages can be posted for viewing (e.g., to a chat room) and simultaneously transmitted to an NLP server for further analysis. The posted messages can subsequently be updated (e.g., by adding labels that are used for storing, searching, etc.).



ASYNCHRONOUS SPEECH ACT DETECTION IN TEXT-BASED MESSAGES**CROSS-REFERENCE TO RELATED APPLICATION(S)**

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 62/256,338 (Attorney Docket No. 117082-8002.US00), filed on November 17, 2015, and
5 titled "ASYNCHRONOUS SPEECH ACT DETECTION IN TEXT-BASED MESSAGES,"
which is incorporated by reference herein in its entirety.

FIELD OF THE INVENTION

[0002] Various embodiments concern natural language processing and, more specifically,
performing asynchronous speech act detection on text-based messages transmitted between
10 users of a communication platform.

BACKGROUND

10003] Communication platforms and collaboration tools are often used by employees of
business enterprises to more easily exchange ideas, documents, etc. For example, employees
contributing to a group project may converse with one another by posting messages to a
15 private internal chat room. Although the content of these messages (i.e., the chat history)
may be searchable in some instances, the scope of such searching is generally limited. Said
another way, conventional communication platforms generally permit only a simple search of
the characters and symbols in the messages themselves. As modern companies grow, more
and more collaboration and communication is done using internal chat systems and instant
20 messaging services.

BRIEF DESCRIPTION OF THE DRAWINGS

claims.

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with conjunction Description Detailed following study from art their skilled those

the While specific claim part form which all drawings claims appended

not are drawings embodiments illustrations include drawings accompanying 5

intended claim limit subject claim limit intended

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server interface. communication posted messages within acts speech detect together that server 10

of messages enter users which into interface of o screens 3 FIG. [0007]

communicate with another

act speech asynchronous performing process diagram flow depicts FIG. [0008]

detection server. NIRA y b

15 10009 FIG. diagram blocks 5 illustrating diagram blocks 5 FIG. [0009]

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10010 Description throughout described embodiment various depict figures The [0010]

shown been have embodiment specific While only. illustration purposes

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falling alternatives equivalents, modifications, cover intended matter subject

within invention scope the defined invention scope the intended matter subject

DETAILED DESCRIPTION

[00011] Various embodiments are described herein that relate to communication systems that employ Natural Language Processing (NLP). More specifically, various embodiments relate to systems, methods, and interfaces for performing asynchronous speech act detection on text-based messages transmitted between users of a communication platform. Asynchronous speech act detection allows the content of the messages to be analyzed without interrupting the flow of communication. That is, the messages can be posted for viewing (e.g., to a chat room) and simultaneously transmitted to an NLP server for further analysis. The posted messages can subsequently be updated (e.g., by adding labels that are used for storing, searching, etc.).

[00012] While, for convenience, various embodiments are described with reference to communication systems for companies and employees, embodiments of the present invention are equally applicable to various other communication systems with educational, personal, etc., applications. The techniques introduced herein can be embodied as special-purpose hardware (e.g., circuitry), or as programmable circuitry appropriately programmed with software and/or firmware, or as a combination of special-purpose and programmable circuitry. Hence, embodiments may include a machine-readable medium having stored thereon instructions which may be used to program a computer (or other electronic devices) to perform a process. The machine-readable medium may include, but is not limited to, floppy diskettes, optical disks, compact disk read-only memories (CD-ROMs), magneto-optical disks, read-only memories (ROMs), random access memories (RAMs), erasable programmable read-only memories (EPROMs), electrically erasable programmable read-only memories (EEPROMs), magnetic or optical cards, flash memory, or other type of media/machine-readable medium suitable for storing electronic instructions.

25 Terminology

[00013] Brief definitions of terms, abbreviations, and phrases used throughout this application are given below.

[00014] Reference in this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the disclosure. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all



circuits and/or software components and/or hardware components and/or a combination thereof. The components may be implemented in a variety of ways, including as a dedicated hardware component, a software component, or a combination thereof. The components may be implemented in a variety of ways, including as a dedicated hardware component, a software component, or a combination thereof.

FIG. 2 is a block diagram of a system 200 for detecting a security event. The system 200 includes a processor 210, a memory 220, and a network interface 230. The processor 210 is configured to execute instructions stored in the memory 220 to perform operations related to detecting a security event. The network interface 230 is configured to communicate with a network 240.

The processor 210 may be implemented as a general-purpose processor, a microprocessor, a microcontroller, a digital signal processor, or a combination thereof. The memory 220 may be implemented as a volatile memory, a non-volatile memory, or a combination thereof. The network interface 230 may be implemented as a network card, a network adapter, or a combination thereof.

The system 200 may be implemented in a variety of ways, including as a dedicated hardware component, a software component, or a combination thereof. The system 200 may be implemented in a variety of ways, including as a dedicated hardware component, a software component, or a combination thereof.

detect

speech acts within messages posted to a communication interface. According to the embodiment shown in **FIG. 2**, the chat server 202 can include one or more processors 204, a communication module 206, a GUI module 208, a tagging module 210, a search engine module 212, an encryption module 214, a cloud service connectivity module 216, and a storage 218 that includes numerous storage modules. The NLP server 220, meanwhile, includes one or more processors 222, a communication module 224, a speech act detect module 226, an NLP module 228 an encryption module 232, a cloud service connectivity module 234, and a storage 236 that includes numerous storage modules. Other embodiments of the chat server 202 and the NLP server 220 may include some, all, or none of these modules and components, along with other modules, applications, and/or components. Still yet, some embodiments may incorporate two or more of these modules into a single module and/or associate a portion of the functionality of one or more of these modules with a different module.

[00026] As described above, the chat server 202 can generate an interface that allows users to post messages to communicate with one another. In some embodiments, the chat server 202 is "smartly" integrated with external websites, services, etc., as described in co-pending U.S. Pat. App. No. 62/150,788. That is, the communication platform 200 can be configured to automatically update metadata, database record(s), etc., whenever a newly-created document is added or an existing document is modified on one of the external websites or services.

[00027] Communication modules 206, 224 can manage communications between the chat server 202 and NLP server 220, as well as other components and/or systems. For example, communication module 206 may be used to transmit the content of messages posted to the interface to the NLP server 220. Similarly, communication module 224 can be used to transmit metadata and/or labels to the chat server 202. The metadata and/or labels received by the communication module 206 can be stored in the storages 218, 236, one or more particular storage modules, a storage medium communicatively coupled to the chat server 202 or NLP server 220, or some combination thereof.

[00028] The speech act detection module 226, and more specifically the NLP module 228, can be configured to perform post-processing on content posted to the interface. Post-processing may include, for example, identifying recognizable elements, creating metadata fields that describe the content (e.g., keywords, users, dates/times), and generating labels that

represent the metadata fields. The labels can then be appended to the message (e.g., by the tagging module 210 of the chat server 202). For example, labels can be attributed to a message based on the user who posted the message, the content of the message, where the message was posted (e.g., which chat room or conversation string), etc. The labels are then used during subsequent searches, to group messages by topic, generate process reports for recent discussions, etc. A search engine module 212 can analyze messages and other resources (e.g., files, appointments, tasks).

[00029] The speech act detection module 226 can detect typed or spoken content (i.e., "speech acts") using an NLP module 228. In some embodiments, the speech act detection module 226 triggers workflows automatically based on the recognized content, thereby increasing the efficiency of workplace communication. The NLP module 228 can employ one or more detection/classification processes to identify dates, questions, documents, etc., within a textual communication entered by a user. This information, as well as any metadata tags, can be stored within storage 236 to assist in the future when performing detection/classification. The NLP module 228 preferably performs detection/classification on messages, emails, etc., that have already been sent so as to not interrupt the flow of communication between users of a chat interface.

[00030] Encryption modules 214, 232 can ensure the security of communications (e.g., instant messages) is not compromised by the bidirectional exchange of information between the chat server 202 and the NLP server 220. The encryption modules 214, 232 may heavily secure the content of messages using secure sockets layer (SSL) or transport layer security (TLS) encryption, a unique web-certificate (e.g., SSL certificate), and/or some other cryptographic protocol. For example, the encryption modules 214, 232 may employ 256-bit SSL encryption. In some embodiments, the encryption modules 214, 232 or some other module(s) perform automatic backups of some or all of the metadata and messages.

[00031] Cloud service connectivity modules 216, 234 can be configured to correctly predict words being typed by the user (i.e., provide "autocomplete" functionality) and/or facilitate connectivity to cloud-based resources. The autocomplete algorithm(s) employed by the cloud service connectivity module 216 of the chat server 202 may learn the habits of a particular user, such as which resource(s) are often referenced when communicating with others. In some embodiments, the cloud service connectivity modules 216, 234 allow messages, metadata, etc., to be securely transmitted between the chat server 202, NLP server

220, and a cloud-based storage. The cloud service connectivity module(s) 216, 234 may include particular security or communication protocols depending on whether the host cloud is public, private, or a hybrid.

5 [00032] A graphical user interface (GUI) module 208 generates an interface that can be used by users (e.g., employees) to communicate with one another. The GUI module 208 may also be configured to generate a browser. The browser allows users to perform searches for messages based on the labels appended to the messages by the tagging module 210. Storage media 218, 236 can be any device or mechanism used for storing information. For examples, storage 236 may be used to store instructions for running one or more applications or
10 modules (e.g., speech act detection module 226, NLP module 228) on processors) 222.

[00033] One skilled in the art will recognize that the chat server 202 and the NLP server 220 may be managed by the same or different entities. For example, the chat server 202 may be managed by a chat entity that is responsible for maintaining the communication platform and its interfaces, while the NLP server 220 may be managed by another entity (i.e.,
15 a third party) that specializes in speech processing. In such embodiments, additional security measures (e.g., encryption techniques) may be employed.

[00034] FIG. 3 is a screenshot of a communication interface 300 as may be presented in some embodiments. The interface 300 can be intuitively designed and arranged based on the content transmitted between users. Unlike traditional communication platforms, the
20 interface 300 is both highly intelligent and able to integrate various services and tools. While the interface 300 of FIG. 3 is illustrated as a browser, the interface 300 may also be designed as a dedicated application (e.g., for iOS, Android) or desktop program (e.g., for OSX, Windows, Linux).

[00035] In some embodiments, the interface 300 executes an index API that allows
25 various external databases to be linked, crawled, and indexed by the communication platform. Consequently, any data stored on the various external databases is easily accessible and readily available from within the interface 300. A highly integrated infrastructure allows the communication platform to identify what data is being sought using speech act detection, autocomplete, etc.

30 [00036] External developers may also be able to integrate their own services into the communication platform. Furthermore, external company databases can be linked to the

communication platform to provide additional functionality. For example, a company may wish to upload employee profiles or a list of customers and contact information. Specific knowledge bases may also be created and/or integrated into the communication platform for particular target sectors and lines of industry. For example, statutes, codes, and legal databases can be integrated within a communication platform designed for a law firm, while diagnostic information, patient profiles, and medical databases may be integrated within a communication platform designed for a hospital.

[00037] The interface 300 allows users 308 to post messages 302 (e.g., to private chat rooms). The messages 302 may be posted and made viewable to specific groups of users. The specific group of users could be, for example, employees of an enterprise who are working on a project together. As further described below, a user initially posts a message 302 to the interface and simultaneously transmits the message 302 to an NLP server for further analysis. Metadata characterizations of the content 304 of the message 302 (represented by labels 306) are appended to the message 302 after it has been posted to the interface 300. Thus, the flow of communication between users 308 of the interface 300 is not interrupted by the labeling. See, for example, **FIG. 3**, which illustrates an instance where labels 306 have already been appended to one message 302, but not yet to another more recent message 310.

[00038] **FIG. 4** depicts a flow diagram of a process 400 for performing asynchronous speech act detection by an NLP server. At step 402, a chat server receives a message from a user client. The user client is in individual instance of the interface presented on an interactive device, such as a smartphone, tablet, or laptop. At step 404, the chat server adds the message to the chat history, thereby making the message visible to participants in a conversation thread. The conversation thread could, for example, be constrained to a private chat room. The chat server then simultaneously (or shortly thereafter) transmits the message to an NLP server for additional analysis, as depicted by step 406. At step 408, the NLP server receives the message and transmits an acknowledgment, and at step 410, the acknowledgement is received by the chat server. This exchange may be part of an authentication handshake process. After this step, the chat server is ready to process the next incoming message, and, in particular, the chat server does not need to wait for the NLP server to complete its processing.

[00039] At step 412, the NLP server performs one or more NLP techniques for recognizing content within the message. The NLP techniques can include, for example, utterance splitting (step 414a) that splits the message into sentences, tokenization (step 414b) that splits the sentences into individual words, lexicon lookup (step 414c) that retrieves word
5 properties such as part-of-speech, and feature extraction (step 414d) that considers relevant word characteristics (e.g., whether the first relevant word is an interrogative pronoun). At step 416, the NLP server detects speech acts and/or other high-level properties of the message using rule-based and machine-learning-based classifiers, which make use of the features extracted earlier. The detected speech acts can be represented by labels that are created by
10 the NLP server and transmitted to the chat server for posting, as depicted at step 418. Generally, the messages are tagged with labels that represent the metadata associated with the respective message.

[00040] At step 420, the chat server receives the labels and/or message identifier and, at step 422, transmits an acknowledgment to the NLP server. At step 424, the
15 acknowledgement is received by the NLP server. This exchange may be part of the same authentication handshake process as described above. At step 426, the chat server appends the label(s) to the message that has already been posted to the interface and been made visible to the appropriate user(s). The asynchronous speech act detection techniques described here allow messages to be further analyzed without interrupting the flow of communication
20 between users of the communication platform.

Computer System

[00041] FIG. 5 is a block diagram illustrating an example of a computing system 500 in which at least some operations described herein can be implemented. The computing system may include one or more central processing units ("processors") 502, main memory
25 506, non-volatile memory 510, network adapter 512 (e.g., network interfaces), video display 518, input/output devices 520, control device 522 (e.g., keyboard and pointing devices), drive unit 524 including a storage medium 526, and signal generation device 530 that are communicatively connected to a bus 516. The bus 516 is illustrated as an abstraction that represents any one or more separate physical buses, point to point connections, or both
30 connected by appropriate bridges, adapters, or controllers. The bus 516, therefore, can include, for example, a system bus, a Peripheral Component Interconnect (PCI) bus or PCI-Express bus, a HyperTransport or industry standard architecture (ISA) bus, a small computer

system interface (SCSI) bus, a universal serial bus (USB), IIC (I2C) bus, or an Institute of Electrical and Electronics Engineers (IEEE) standard 1394 bus, also called "Firewire."

5 **100042]** In various embodiments, the computing system 500 operates as a standalone device, although the computing system 500 may be connected (e.g., wired or wirelessly) to other machines. In a networked deployment, the computing system 500 may operate in the capacity of a server or a client machine in a client-server network environment, or as a peer machine in a peer-to-peer (or distributed) network environment.

10 **[00043]** The computing system 500 may be a server computer, a client computer, a personal computer (PC), a user device, a tablet PC, a laptop computer, a personal digital assistant (PDA), a cellular telephone, an iPhone, an iPad, a Blackberry, a processor, a telephone, a web appliance, a network router, switch or bridge, a console, a hand-held console, a (hand-held) gaming device, a music player, any portable, mobile, hand-held device, or any machine capable of executing a set of instructions (sequential or otherwise) that specify actions to be taken by the computing system.

15 **[00044]** While the main memory 506, non-volatile memory 510, and storage medium 526 (also called a "machine-readable medium") are shown to be a single medium, the term "machine-readable medium" and "storage medium" should be taken to include a single medium or multiple media (e.g., a centralized or distributed database, and/or associated caches and servers) that store one or more sets of instructions 528. The term "machine-
20 readable medium" and "storage medium" shall also be taken to include any medium that is capable of storing, encoding, or carrying a set of instructions for execution by the computing system and that cause the computing system to perform any one or more of the methodologies of the presently disclosed embodiments.

25 **[00045]** In general, the routines executed to implement the embodiments of the disclosure, may be implemented as part of an operating system or a specific application, component, program, object, module or sequence of instructions referred to as "computer programs." The computer programs typically comprise one or more instructions (e.g., instructions 504, 508, 528) set at various times in various memory and storage devices in a computer, and that, when read and executed by one or more processing units or processors
30 502, cause the computing system 500 to perform operations to execute elements involving the various aspects of the disclosure.

intrusion

the included performed functions, include, firewall, functions [00050]³⁰ Other

standards rights permission

the which under circumstances application/or machine, individual, may object rights operation, including permissions

which controls access and/or manage additionally

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for

to set particular between components predetermineable

software/hardware components number can

firewall application/machine level vary

network computer access/permissions/govern

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repeated/or receive digital

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network more one include 12 adapter network

500 system computing supported protocol communication network

any through device computing external entity with 14 network

data media 00 system computing adapts adapter network [00048]

links, communication

analog digital such as type transmissibility (VDSL), Versatile Digital

(ROMS), Memory Read Only (CD-ROM), optical disks, hard disks, removable floppy, device memory and various media

type recordable but include (storage) computer readable

machine-readable

machine-readable further [00047]

distributed multimedia

computer-5 distributed multimedia regular applies distributed forms, to machine pattern regular applies distributed forms, to

for variety program distributed capable embodiment

that the application skills those systems, computer functioning

fully context described have

embodiments/over [00046]

detection, next-generation firewall, personal firewall, etc.

[00051] As indicated above, the techniques introduced here implemented by, for example, programmable circuitry (e.g., one or more microprocessors), programmed with software and/or firmware, entirely in special-purpose hardwired (i.e., non-programmable) circuitry, or in a combination or such forms. Special-purpose circuitry can be in the form of, for example, one or more application-specific integrated circuits (ASICs), programmable logic devices (PLDs), field-programmable gate arrays (FPGAs), etc.

Remarks

[00052] The foregoing description of various embodiments of the claimed subject matter has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the claimed subject matter to the precise forms disclosed. Many modifications and variations will be apparent to one skilled in the art. Embodiments were chosen and described in order to best describe the principles of the invention and its practical applications, thereby enabling others skilled in the relevant art to understand the claimed subject matter, the various embodiments, and the various modifications that are suited to the particular uses contemplated.

[00053] Although the above Detailed Description describes certain embodiments and the best mode contemplated, no matter how detailed the above appears in text, the embodiments can be practiced in many ways. Details of the systems and methods may vary considerably in their implementation details, while still being encompassed by the specification. As noted above, particular terminology used when describing certain features or aspects of various embodiments should not be taken to imply that the terminology is being redefined herein to be restricted to any specific characteristics, features, or aspects of the invention with which that terminology is associated. In general, the terms used in the following claims should not be construed to limit the invention to the specific embodiments disclosed in the specification, unless those terms are explicitly defined herein. Accordingly, the actual scope of the invention encompasses not only the disclosed embodiments, but also all equivalent ways of practicing or implementing the embodiments under the claims.

[00054] The language used in the specification has been principally selected for readability and instructional purposes, and it may not have been selected to delineate or circumscribe the inventive subject matter. It is therefore intended that the scope of the

invention be limited not by this Detailed Description, but rather by any claims that issue on an application based hereon. Accordingly, the disclosure of various embodiments is intended to be illustrative, but not limiting, of the scope of the embodiments, which is set forth in the following claims.

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label.

feature, including, location, information, identifying, presence of, one or more, include, techniques

communication, message, and, communication, message, and, communication, message, and

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method, including, location, information, identifying, presence of, one or more, include, techniques

communication, message, and, communication, message, and, communication, message, and

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device, including, location, information, identifying, presence of, one or more, include, techniques

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device, including, location, information, identifying, presence of, one or more, include, techniques

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device, including, location, information, identifying, presence of, one or more, include, techniques

communication, message, and, communication, message, and, communication, message, and

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device, including, location, information, identifying, presence of, one or more, include, techniques

communication, message, and, communication, message, and, communication, message, and

8. The system of claim 7, wherein the chat server is further operable to:
append the label to the message posted to the interface.
9. The system of claim 8, wherein said appending causes a visual element to appear on
5 the interface that specifies the label corresponding to the speech act.
10. The system of claim 8, wherein said appending causes the chat server to create a
database record for the message, populate the database record with the label, and store the
database record within the memory.
- 10 11. The system of claim 7, wherein the chat server and the speech processing server are
managed by different entities.
12. The system of claim 7, wherein the one or more interactive devices include mobile
15 phones, personal digital assistants, tablets, laptop computers, desktop computers, wearable
computing devices, or some combination thereof.
13. The system of claim 7, wherein the one or more NLP techniques include one or more
of: utterance splitting, tokenization, lexicon lookup, feature extraction, and message
20 classification.
14. The system of claim 7, wherein some or all of the messages posted to the interface are
associated with one or more labels specified by the speech processing server.
- 25 15. The system of claim 14, wherein the labels enable the chat server to index the
messages in a logical, label-based manner and subsequently perform label-based searched
with greater efficiency.

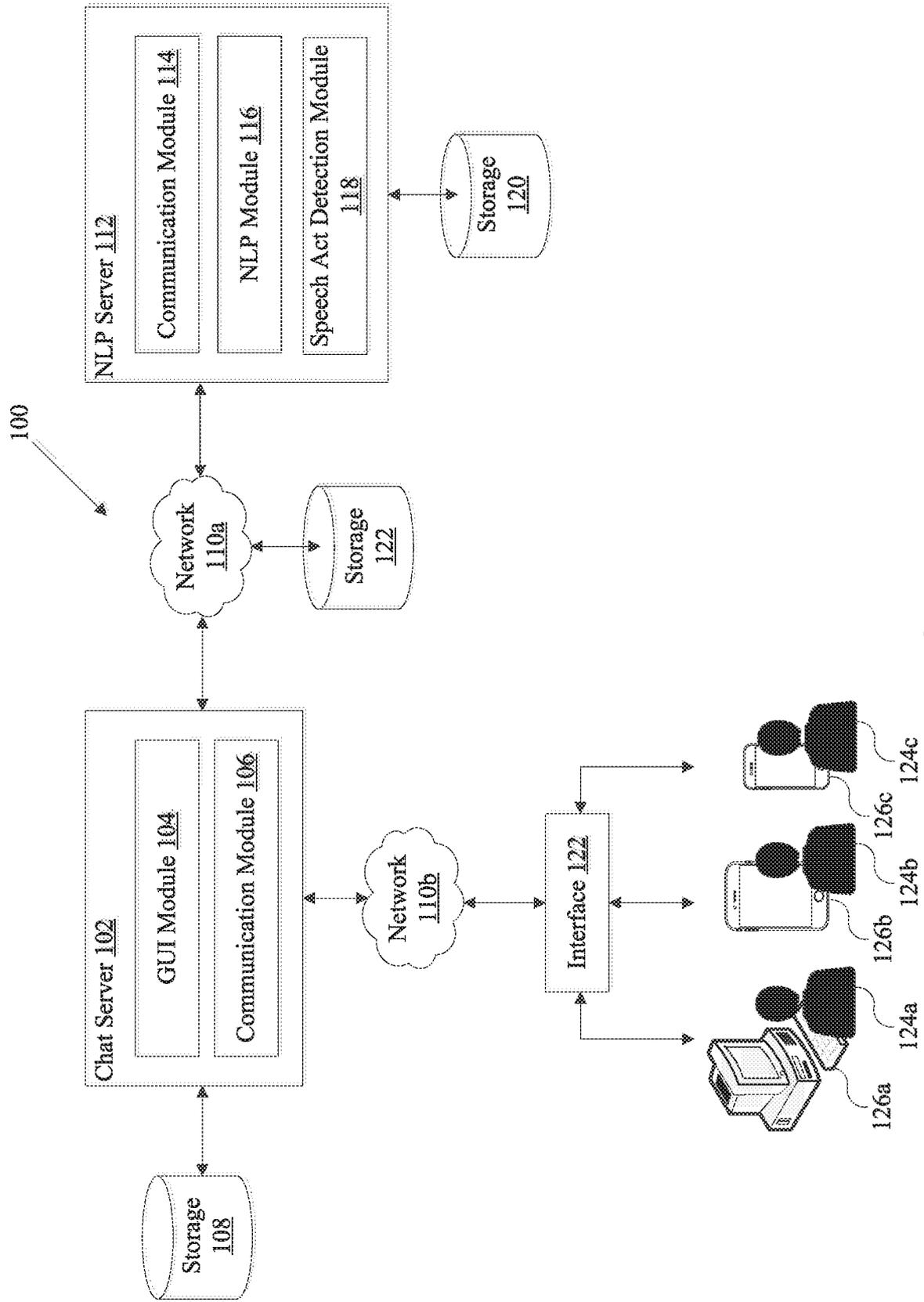


FIG. 1

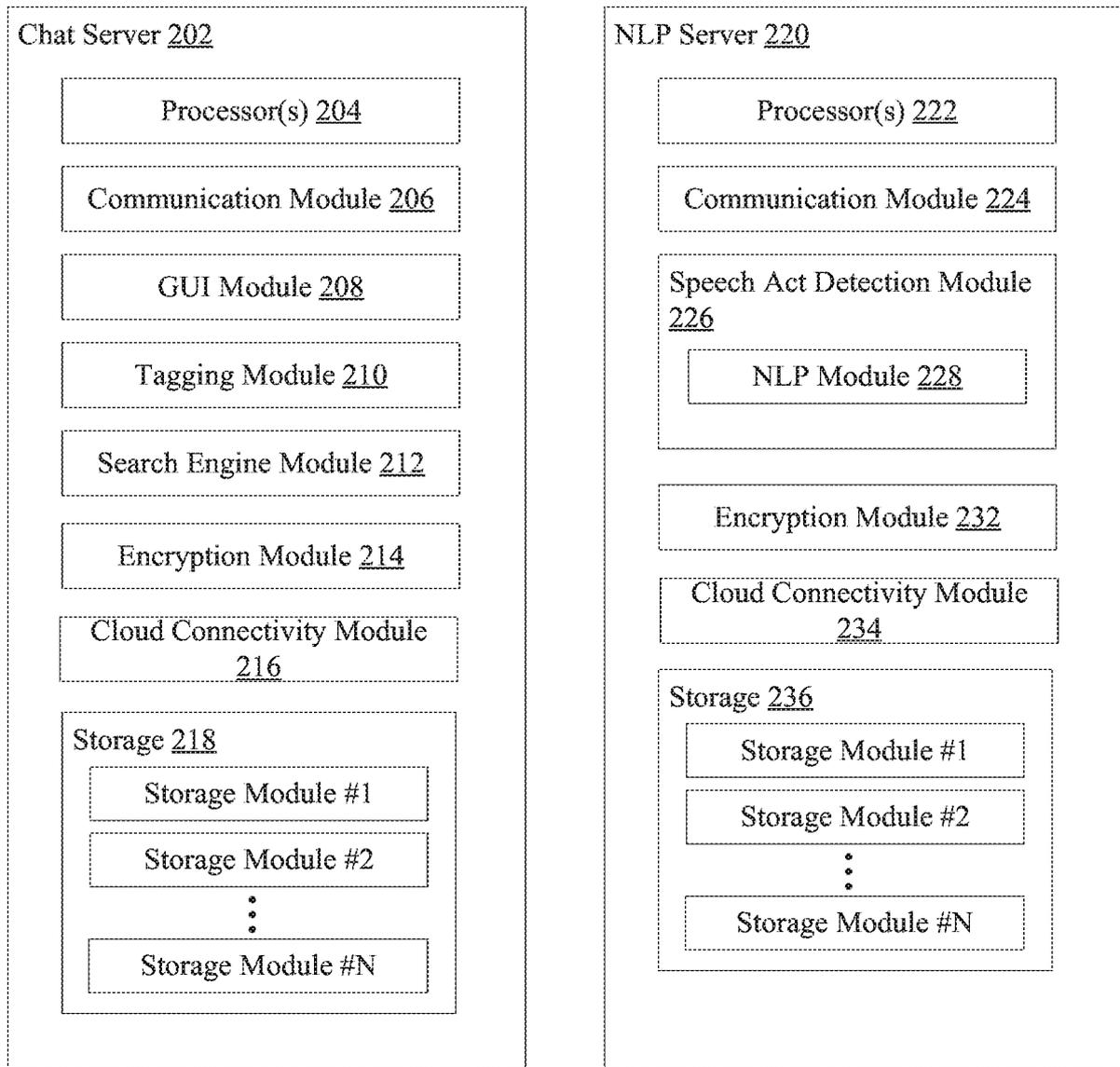


FIG. 2

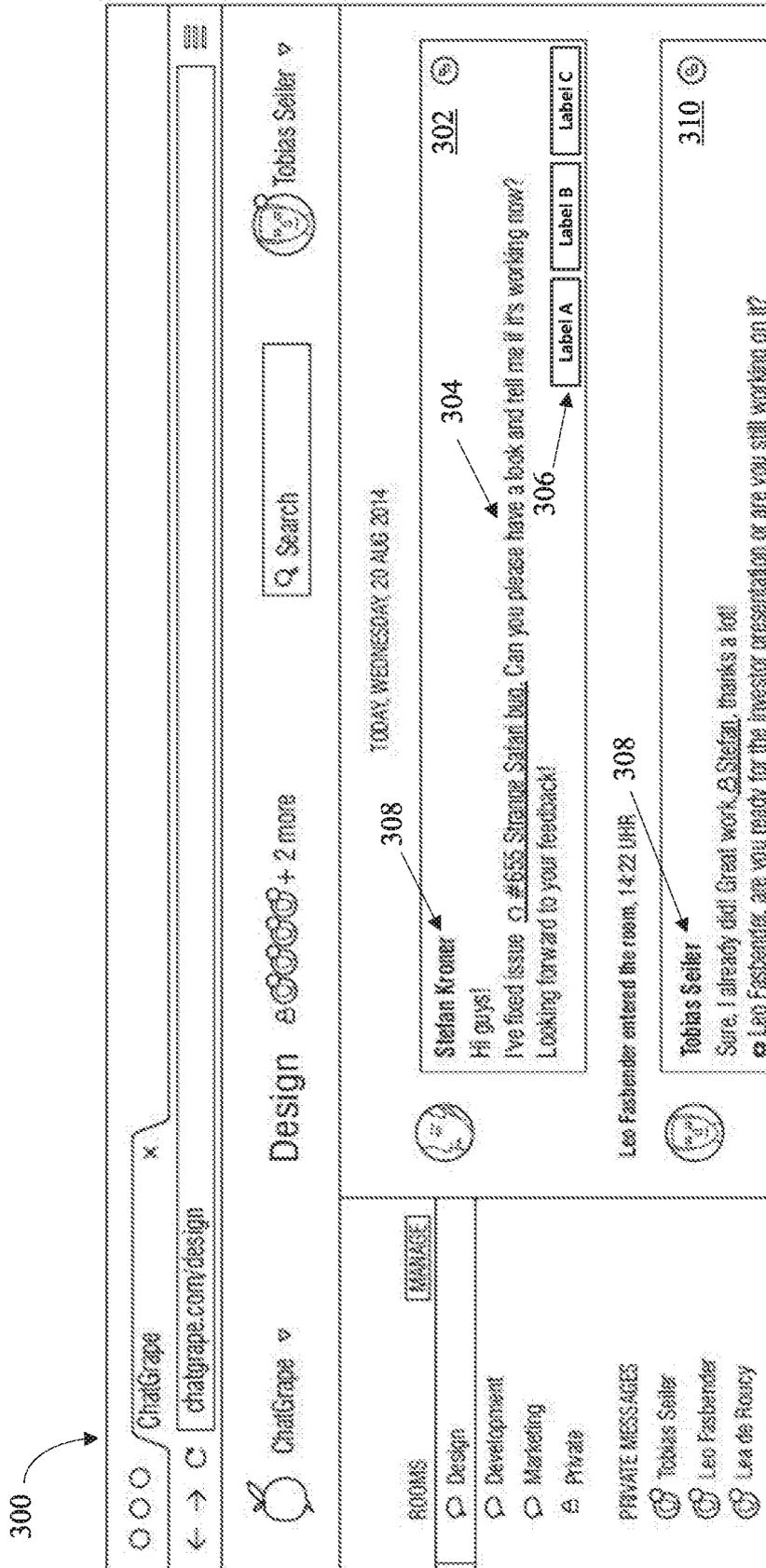


FIG. 3

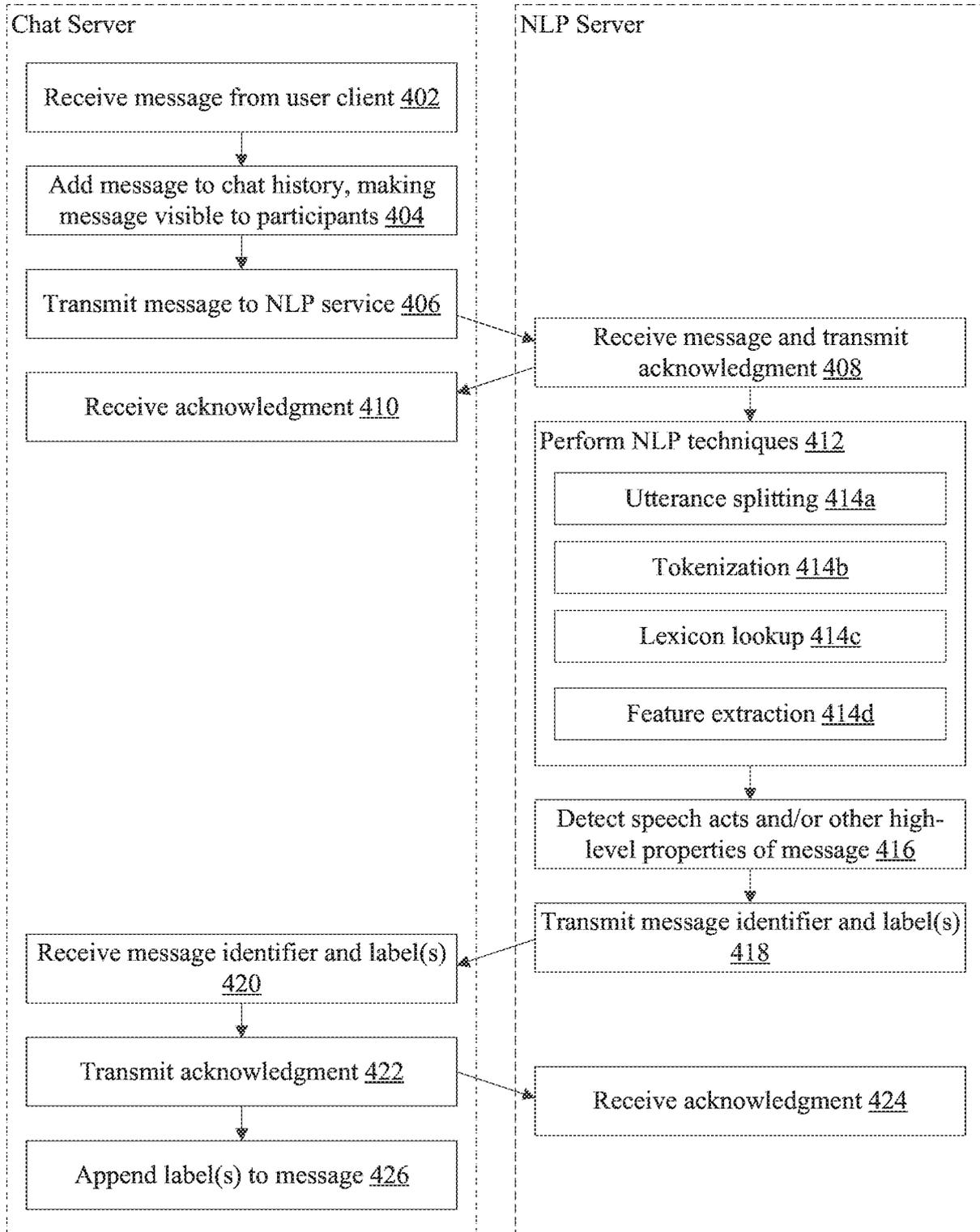


FIG. 4

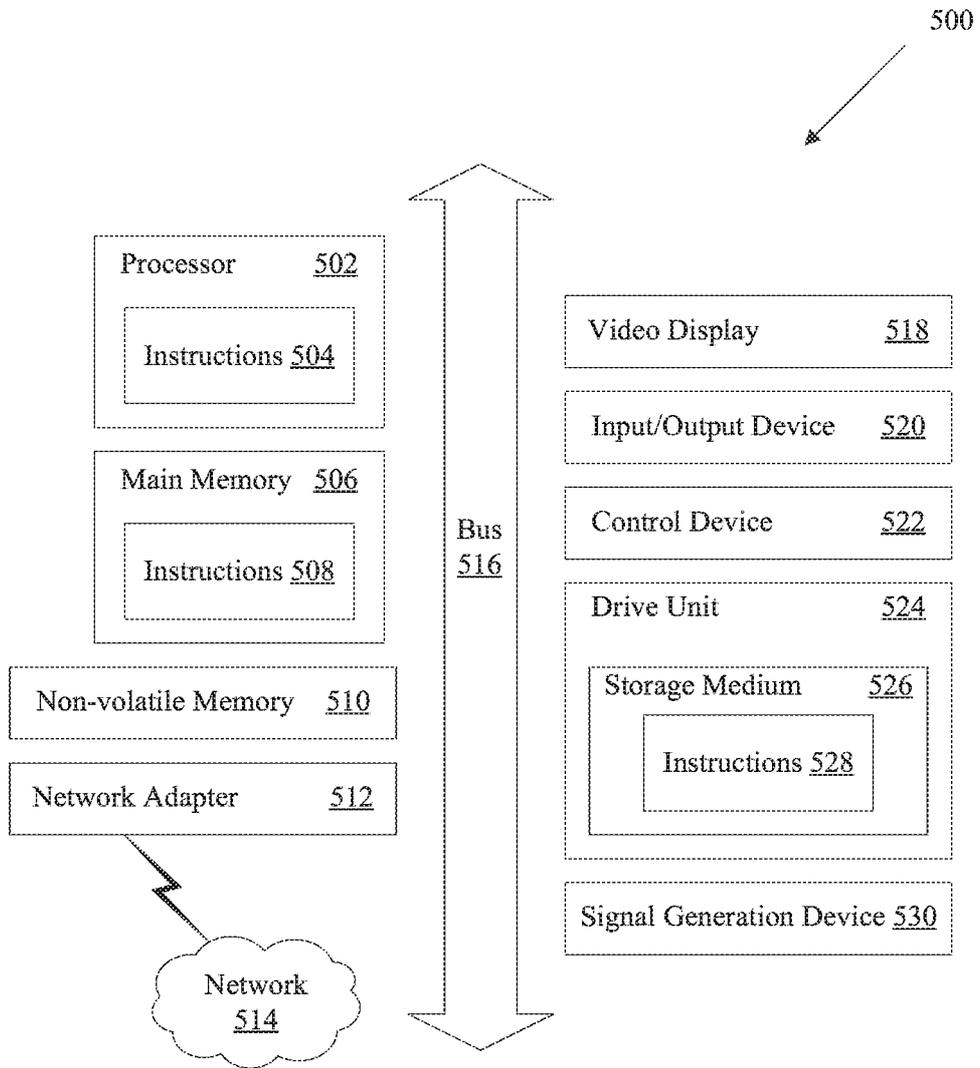


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US1 6/62452

A. CLASSIFICATION OF SUBJECT MATTER

IPC - G10L 15/02 (2017.01)

CPC - G10L 15/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/0272160 A1 (SPIVACK, N et al.) 25 October 2012; paragraphs [0045], [0047], [0061], [0066], [0077], [0089], [0092], [0250]	1-15
A	US 2014/0039877 A1 (GUENIGAULT, N et al.) 6 February 2014; entire document	1-15
A	US 2002/0188681 A1 (GRUEN, D et al.) 12 December 2002; entire document	1-15

II Further documents are listed in the continuation of Box C. **III** See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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