US 20030046083A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2003/0046083 A1

DEVINNEY, JR. et al. (43) Pub. Date: Mar. 6, 2003

(54) USER VALIDATION FOR INFORMATION SYSTEM ACCESS AND TRANSACTION PROCESSING

(76) Inventors: EDWARD J. DEVINNEY JR., DELANCO, NJ (US); MANISH SHARMA, SOMERSET, NJ (US); CHRIS KEYSER, ROEBLING, NJ (US); RAINER ROTHACKER, CLIFFWOOD BEACH, NJ (US); RICHARD J. MAMMONE, BRIDGEWATER, NJ (US)

Correspondence Address:
Thomas H. Young, Esq.
Merchant & Gould, P.C.
3200 IDS Center
80 South Eighth Street
Minneapolis, MN 55402-2215 (US)

(*) Notice: This is a publication of a continued prosecution application (CPA) filed under 37 CFR 1.53(d).

(21) Appl. No.: **08/976,279**

(22) Filed: **Nov. 21, 1997**

Related U.S. Application Data

(60) Provisional application No. 60/031,638, filed on Nov. 22, 1996.

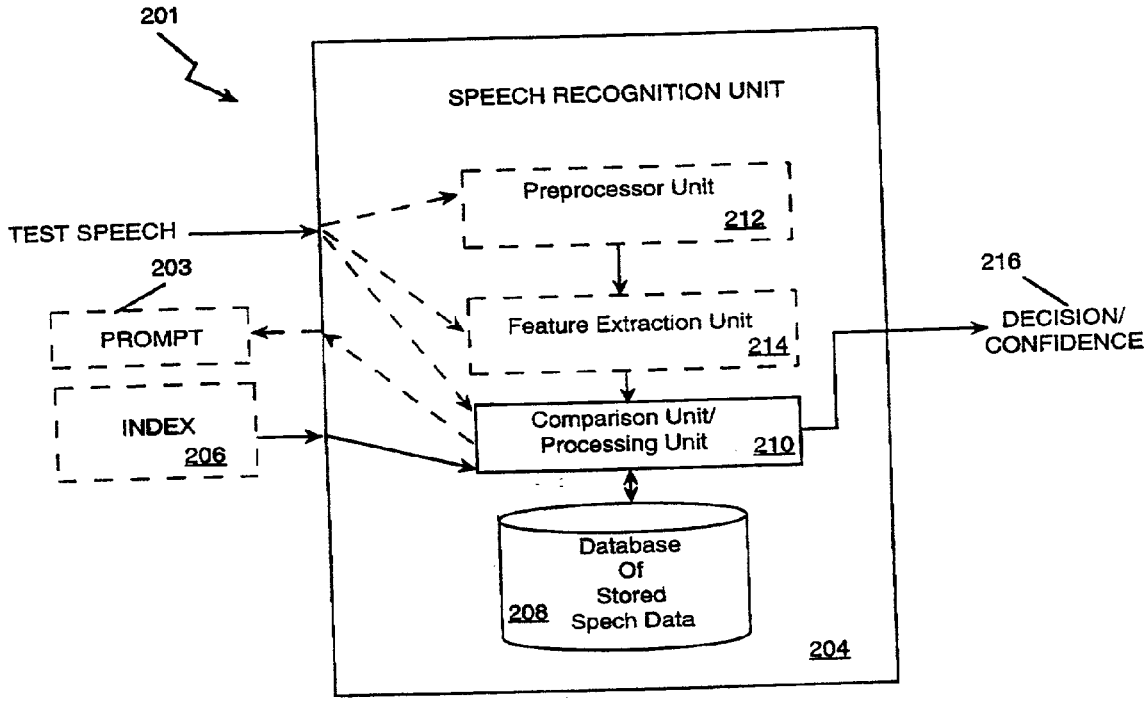
Publication Classification

(51) **Int. Cl.**[7] **G10L 21/00**

(52) **U.S. Cl.** **704/273**

(57) **ABSTRACT**

The present invention applies speech recognition technology to remote access, verification, and identification applications. Speech recognition is used to raise the security level of many types of transaction systems which previously had serious safety drawbacks, including: point of sale systems, home authorization systems, systems for establishing a call to a called party (including prison telephone systems), internet access systems, web site access systems, systems for obtaining access to protected computer networks, systems for accessing a restricted hyperlink, desktop computer security systems, and systems for gaining access to a networked server. A general speech recognition system using communication is also presented. Further, different types of speech recognition methodologies are useful with the present invention, such as "simple" security methods and systems, multi-tiered security methods and systems, conditional multi-tiered security methods and systems, and randomly prompted voice token methods and systems.



BANK OF AMERICA ET AL. EXHIBIT 1024

FIG. 1

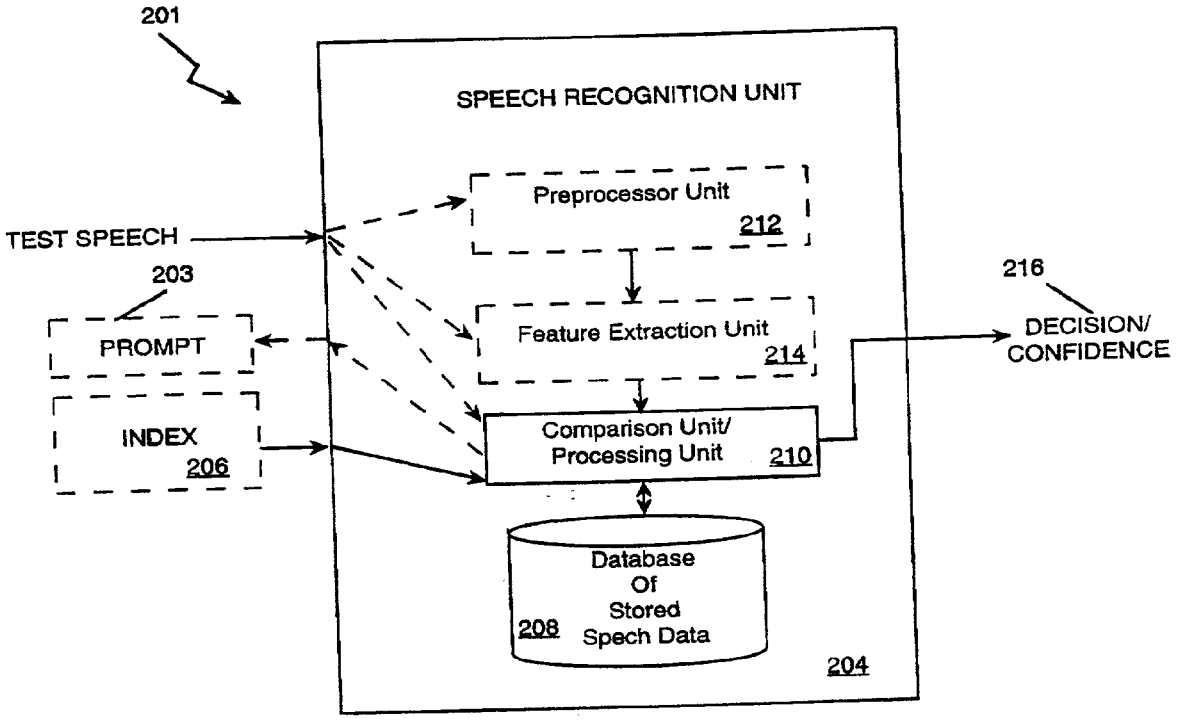

201
SPEECH RECOGNITION UNIT
Preprocessor Unit
212
TEST SPEECH
203
PROMPT
INDEX
206
Feature Extraction Unit
214
Comparison Unit/
Processing Unit
210
216
DECISION/
CONFIDENCE
Database
Of
Stored
Spech Data
208
204

FIG. 2

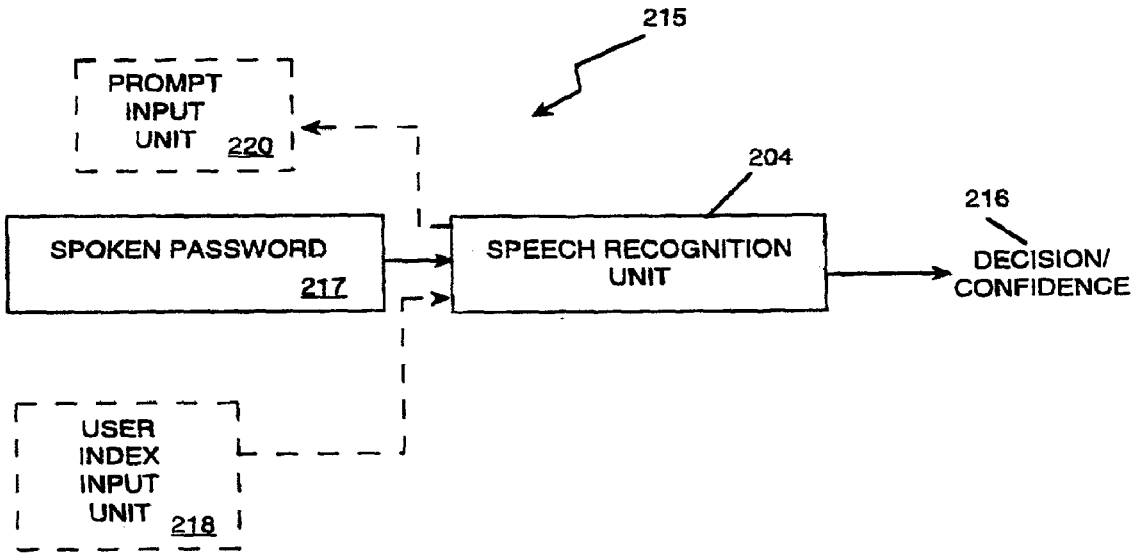

215
PROMPT INPUT UNIT 220
204
216
SPOKEN PASSWORD 217
SPEECH RECOGNITION UNIT
DECISION/ CONFIDENCE
USER INDEX INPUT UNIT 218

FIG. 3

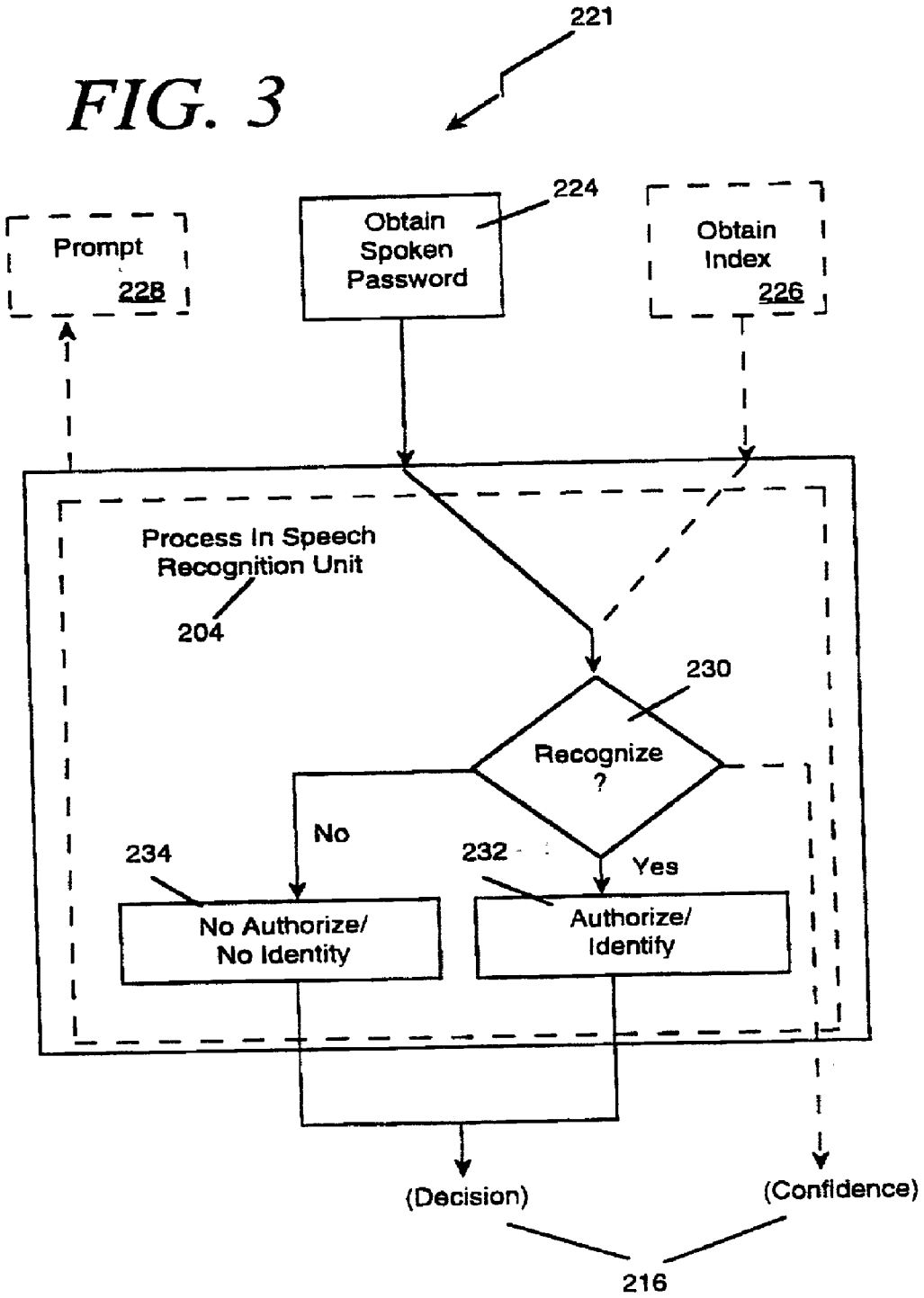

221
224
Obtain Spoken Password
Prompt
228
Obtain Index
226
Process In Speech Recognition Unit
204
230
Recognize ?
No
Yes
234
232
No Authorize/ No Identity
Authorize/ Identify
(Decision)
(Confidence)
216

FIG. 4A

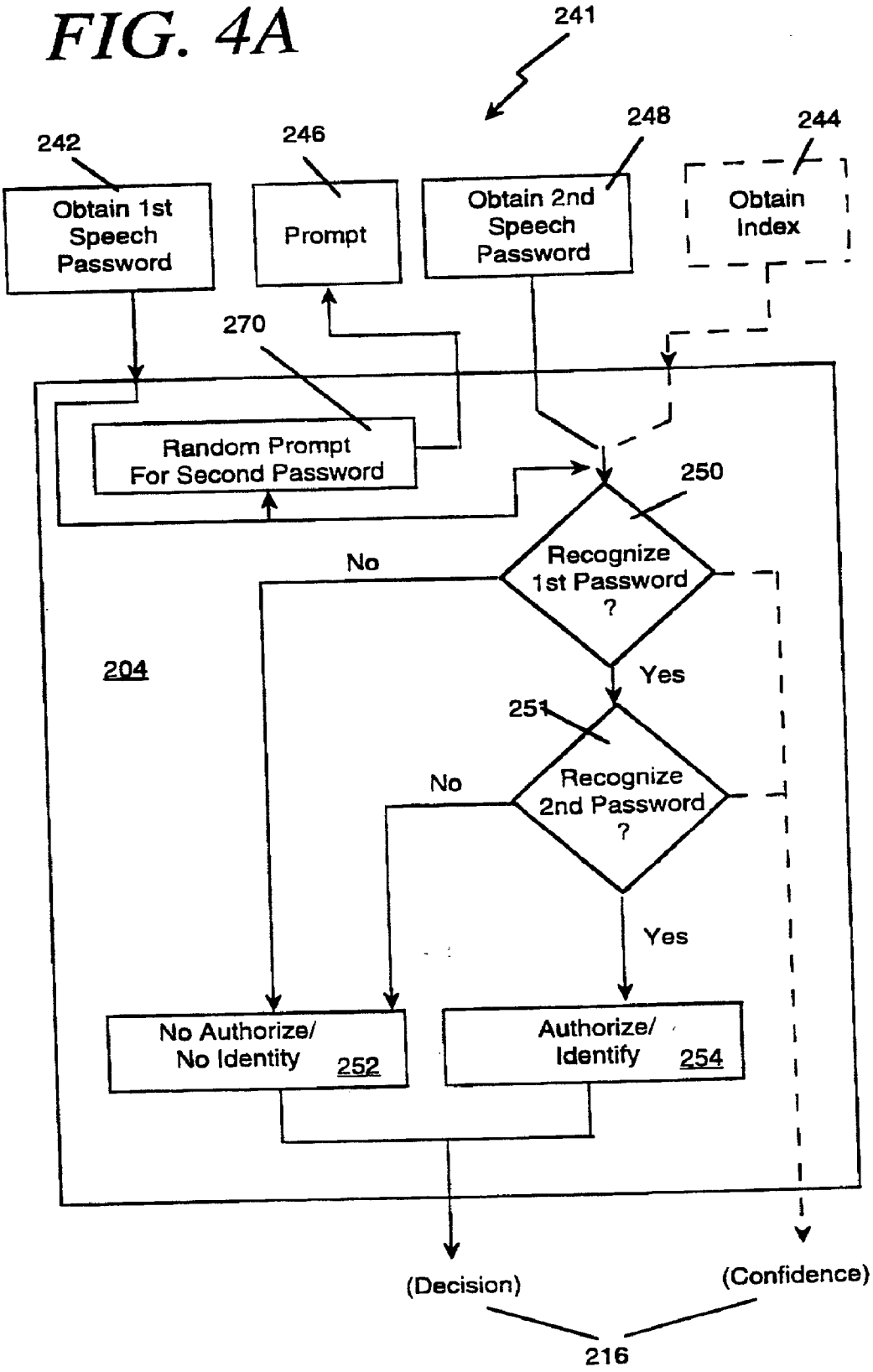

241
242
246
248
244
Obtain 1st Speech Password
Prompt
Obtain 2nd Speech Password
Obtain Index
270
Random Prompt For Second Password
250
Recognize 1st Password ?
No
Yes
204
251
Recognize 2nd Password ?
No
Yes
No Authorize/ No Identity 252
Authorize/ Identify 254
(Decision)
(Confidence)
216

FIG. 4B

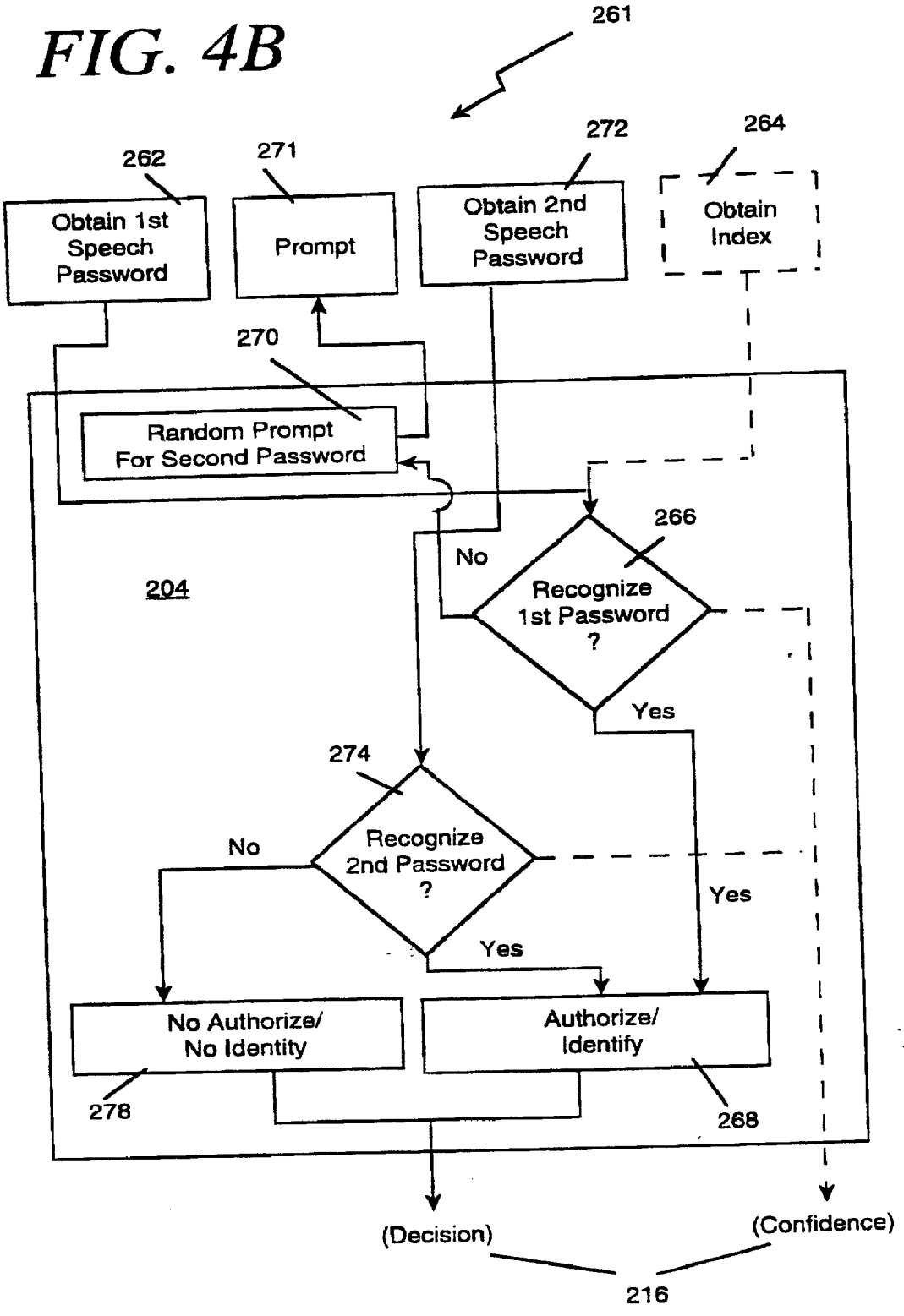
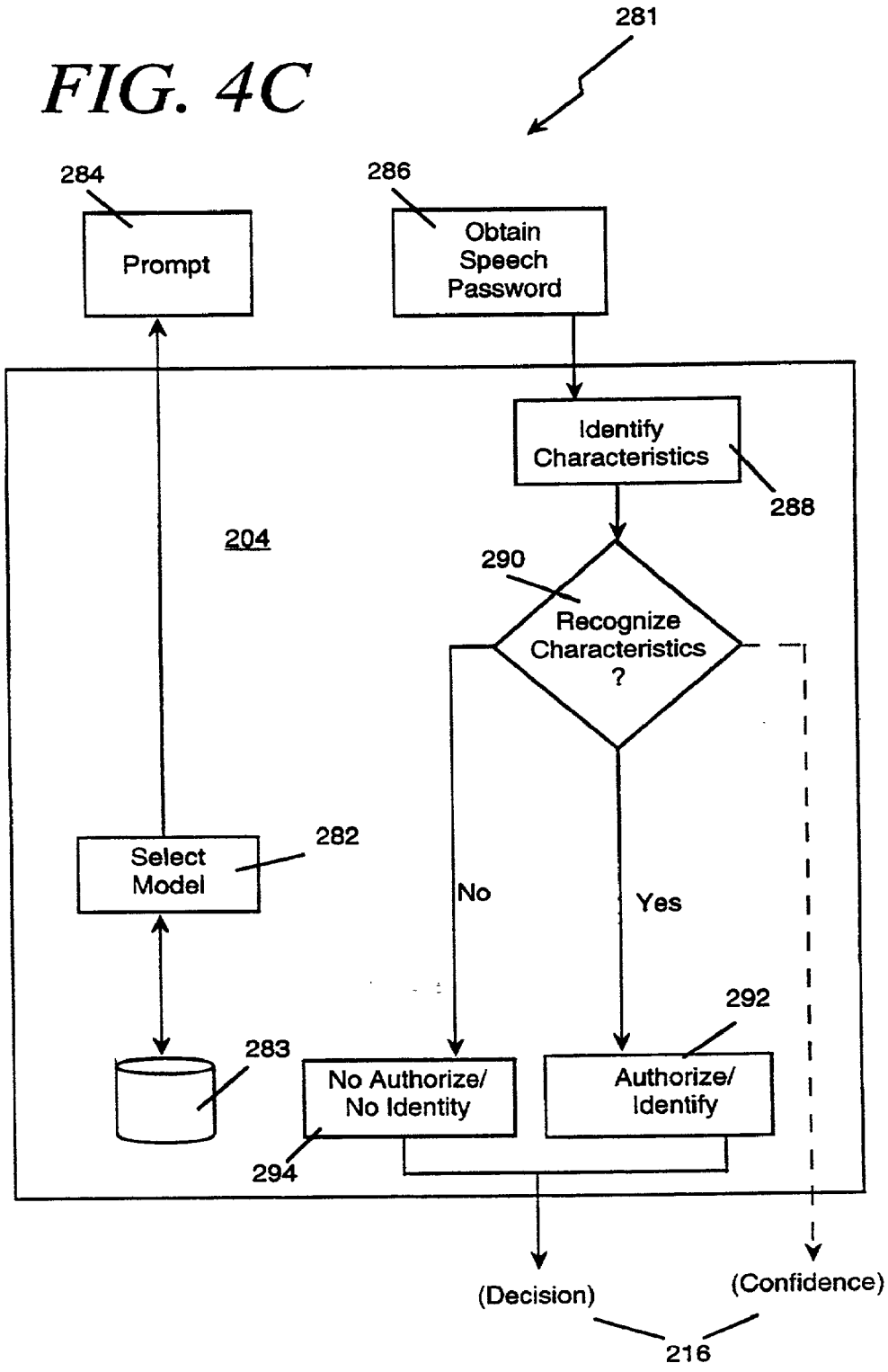

261
262
271
272
264
Obtain 1st Speech Password
Prompt
Obtain 2nd Speech Password
Obtain Index
270
Random Prompt For Second Password
204
266
No
Recognize 1st Password ?
Yes
274
No
Recognize 2nd Password ?
Yes
Yes
No Authorize/ No Identity
Authorize/ Identify
278
268
(Decision)
(Confidence)
216

FIG. 4C


281
284
Prompt
286
Obtain Speech Password
Identify Characteristics
288
204
290
Recognize Characteristics ?
Select Model
282
No
Yes
283
292
No Authorize/ No Identity
Authorize/ Identify
294
(Decision)
(Confidence)
216

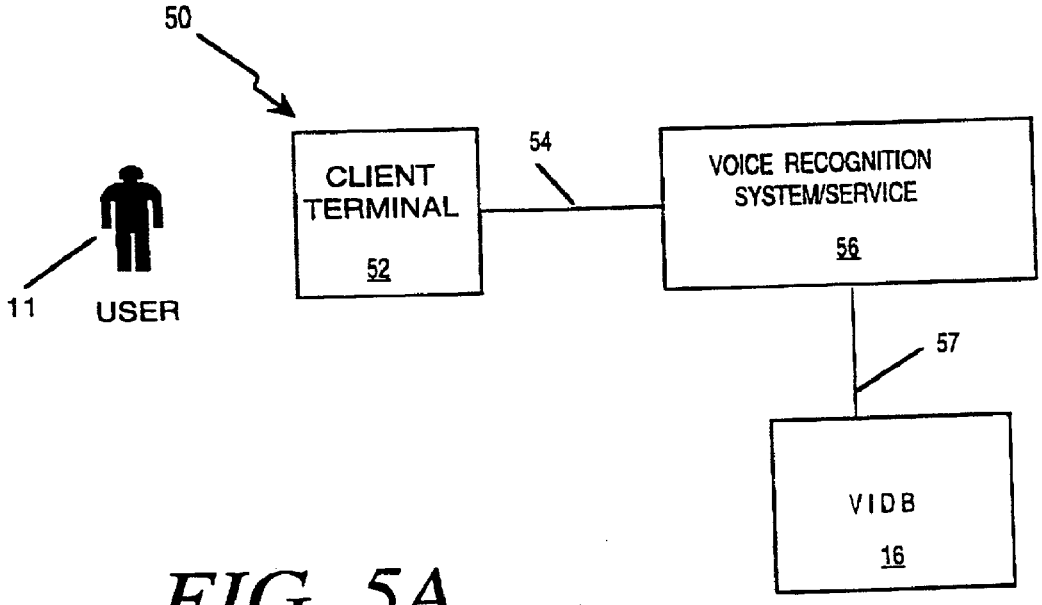

50
CLIENT TERMINAL
52
54
VOICE RECOGNITION SYSTEM/SERVICE
56
57
VIDB
16
11
USER

FIG. 5A

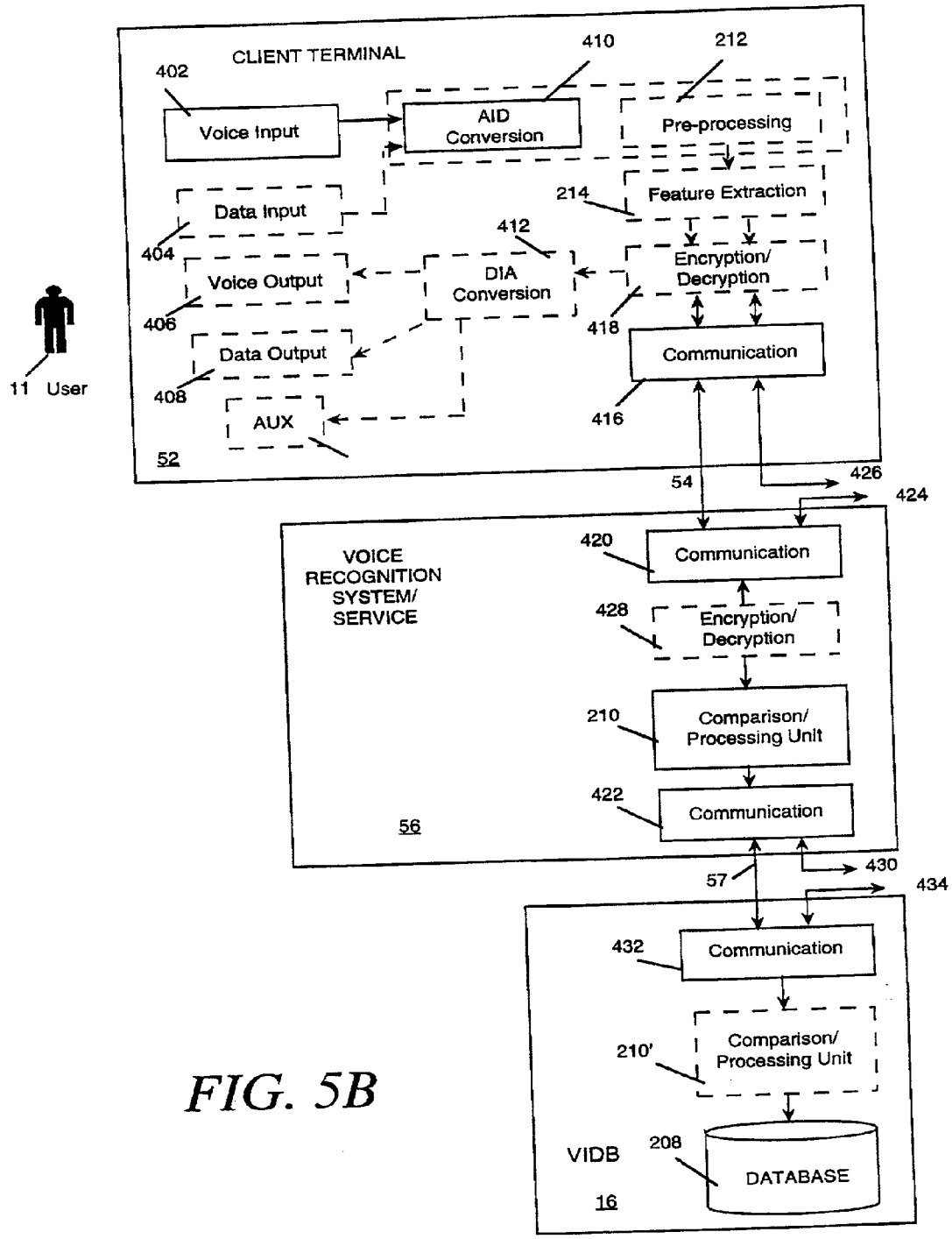

CLIENT TERMINAL
402
410
212
Voice Input
AID Conversion
Pre-processing
Data Input
214
Feature Extraction
412
404
Voice Output
DIA Conversion
Encryption/ Decryption
406
418
Data Output
Communication
408
AUX
416
52
11 User
54
426
424
VOICE RECOGNITION SYSTEM/ SERVICE
420
Communication
428
Encryption/ Decryption
210
Comparison/ Processing Unit
422
Communication
56
57
430
434
432
Communication
210'
Comparison/ Processing Unit
VIDB
208
DATABASE
16

FIG. 5B

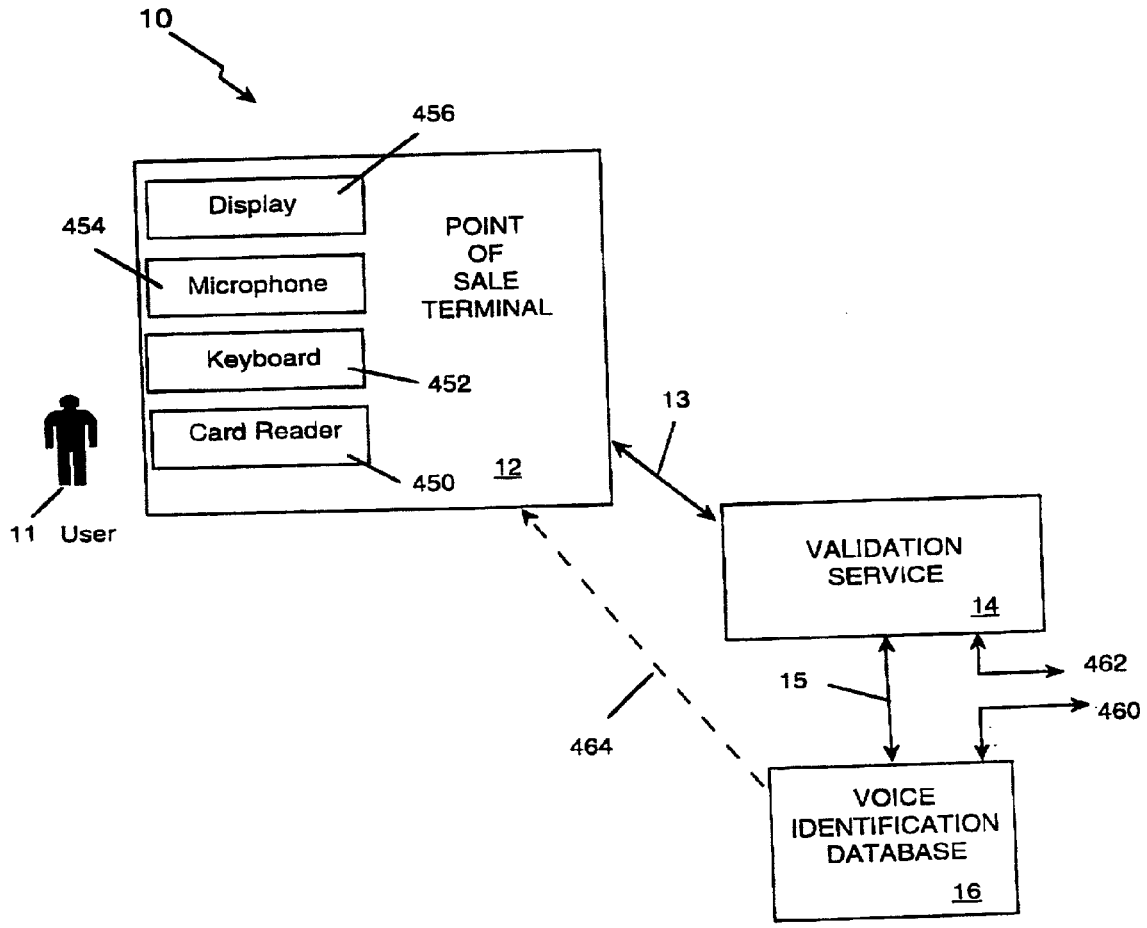

10
456
Display
454
Microphone
Keyboard
452
Card Reader
450
12
POINT
OF
SALE
TERMINAL
13
11 User
VALIDATION
SERVICE
14
462
15
460
464
VOICE
IDENTIFICATION
DATABASE
16

FIG. 6

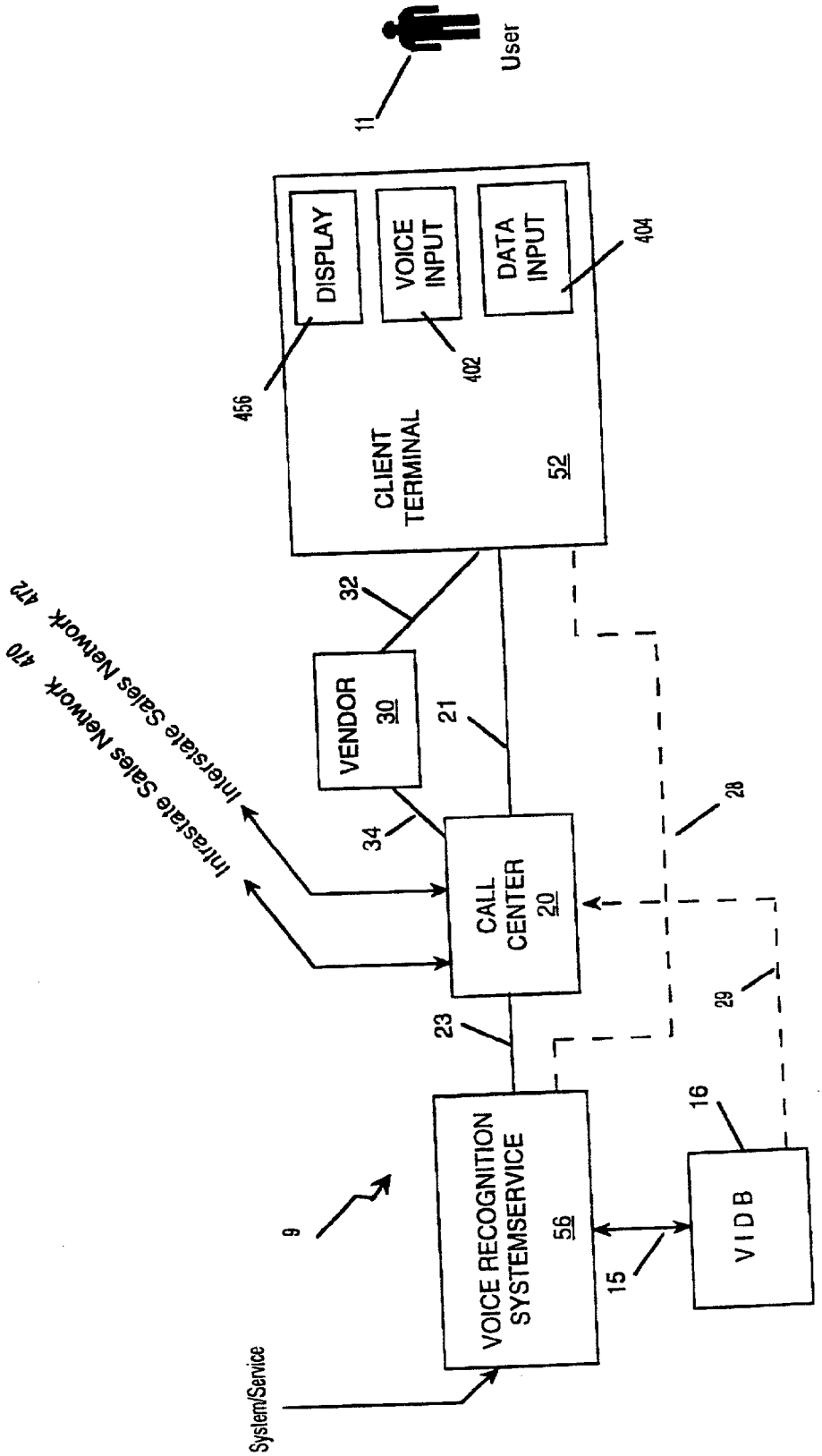

User
11
DISPLAY
VOICE INPUT
DATA INPUT
404
456
402
CLIENT TERMINAL
52
32
VENDOR
30
21
Interstate Sales Network
470
Interstate Sales Network
472
34
CALL CENTER
20
28
29
23
16
VOICE RECOGNITION SYSTEMSERVICE
56
VIDB
15
9
System/Service

FIG. 7

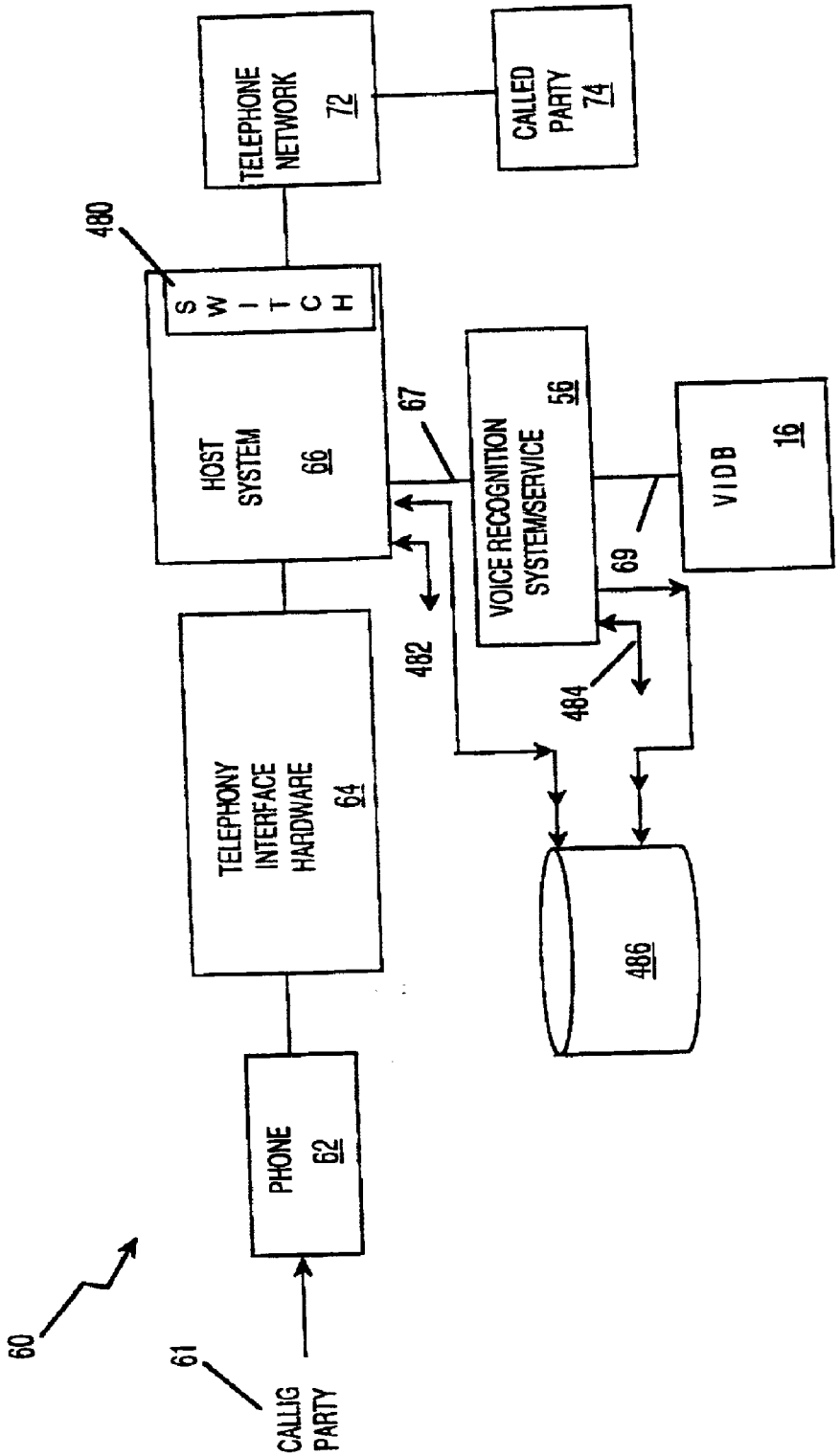

TELEPHONE NETWORK 72
CALLED PARTY 74
480
SWITCH
HOST SYSTEM 66
67
VOICE RECOGNITION SYSTEM/SERVICE 56
VIDB 16
69
482
484
TELEPHONY INTERFACE HARDWARE 64
486
PHONE 62
60
61
CALLG PARTY

FIG. 8

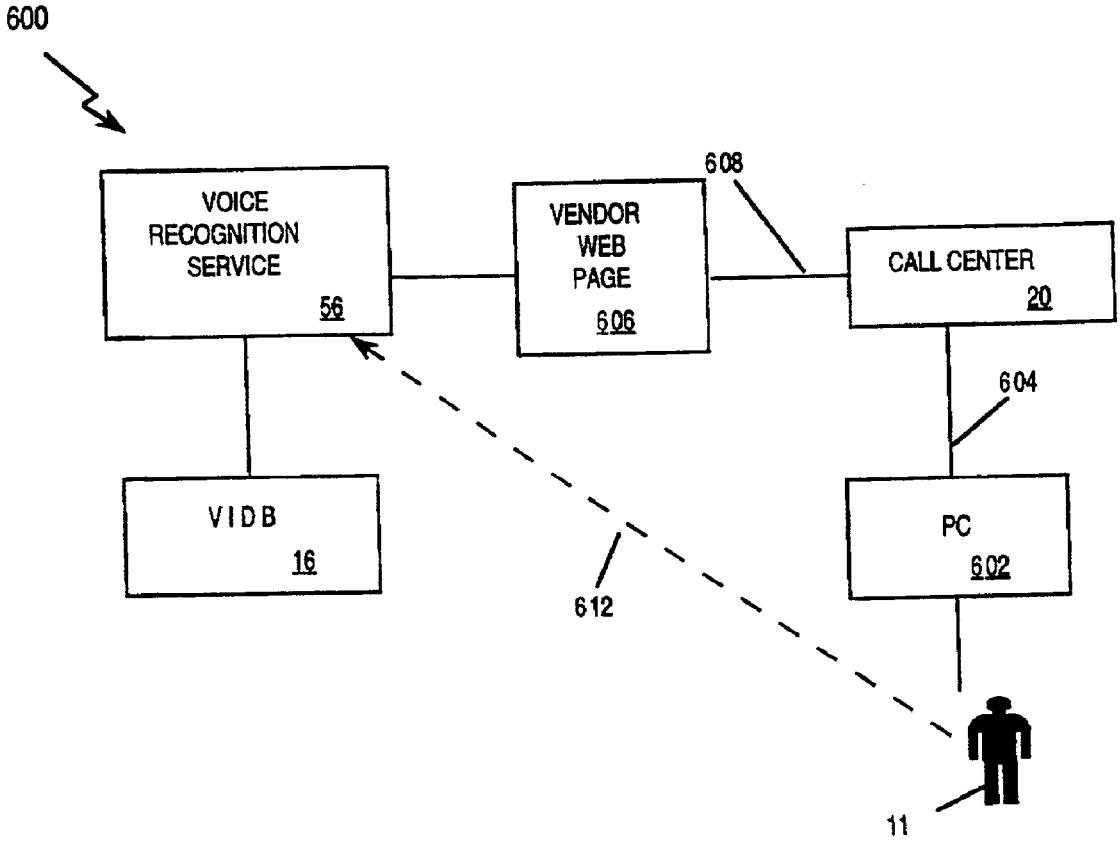

600
VOICE RECOGNITION SERVICE
56
VENDOR WEB PAGE
606
608
CALL CENTER
20
604
VIDB
16
612
PC
602
11

FIG. 9

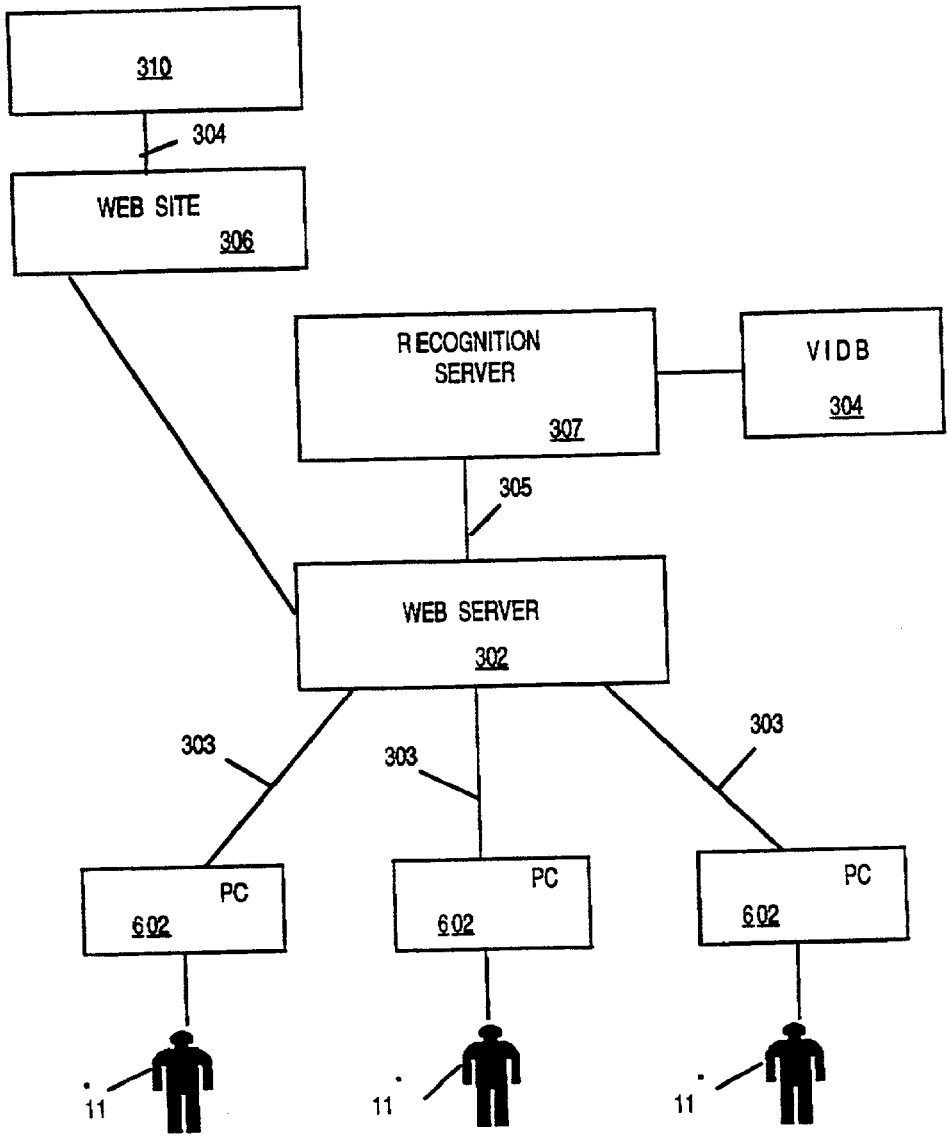

310
304
WEB SITE
306
RECOGNITION SERVER
307
VIDB
304
305
WEB SERVER
302
303
303
303
PC
602
PC
602
PC
602
11
11
11

FIG. 10A

FIG. 10B

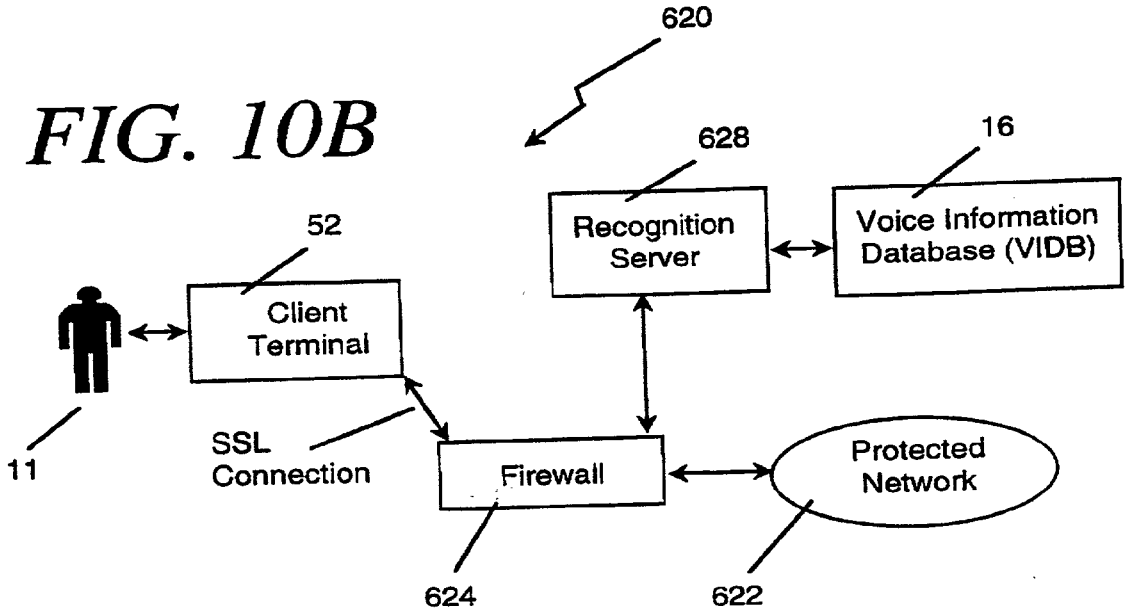

620
628
16
52
Recognition Server
Voice Information Database (VIDB)
Client Terminal
11
SSL Connection
Firewall
Protected Network
624
622

FIG. 10C

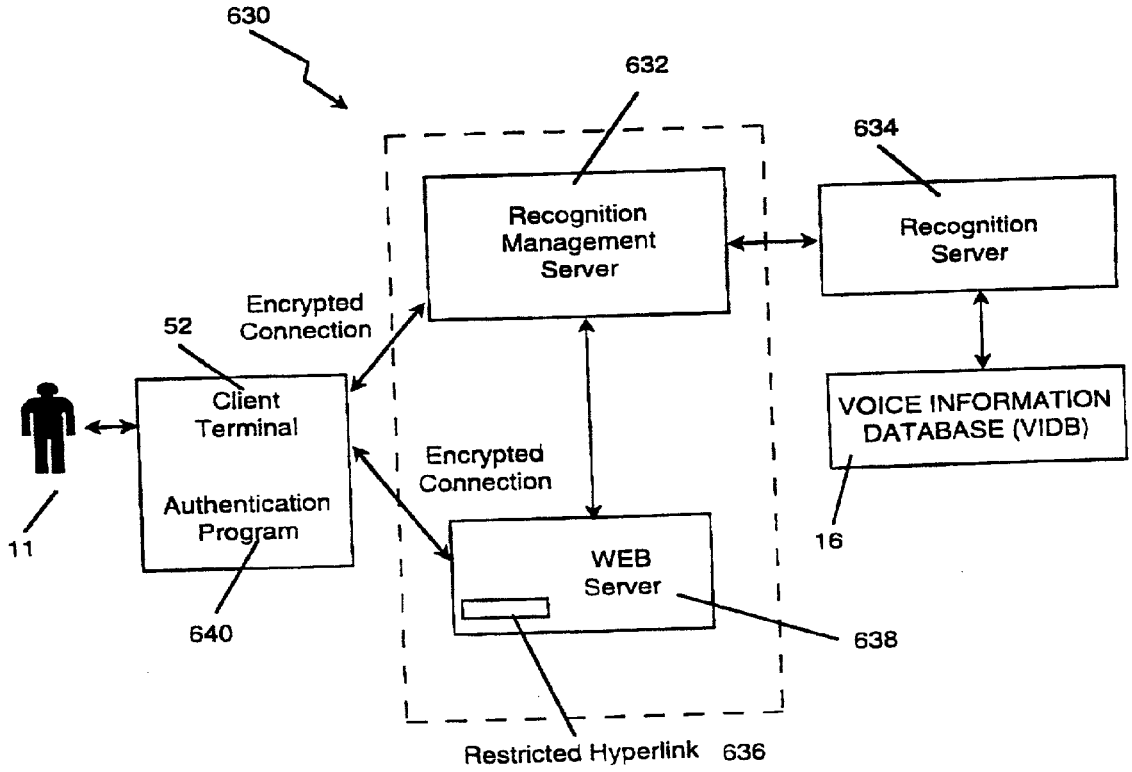

630
632
634
Recognition Management Server
Recognition Server
Encrypted Connection
52
Client Terminal
Authentication Program
11
640
Encrypted Connection
VOICE INFORMATION DATABASE (VIDB)
16
WEB Server
638
Restricted Hyperlink
636

FIG. 11

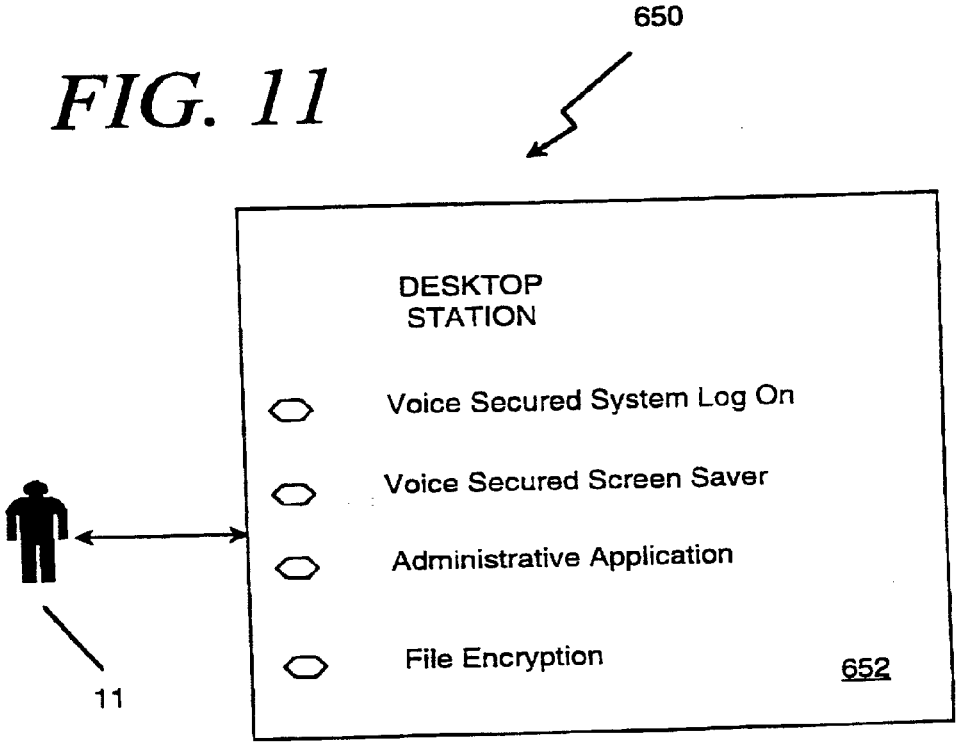

650
DESKTOP
STATION
Voice Secured System Log On
Voice Secured Screen Saver
Administrative Application
File Encryption
652
11

FIG. 12A

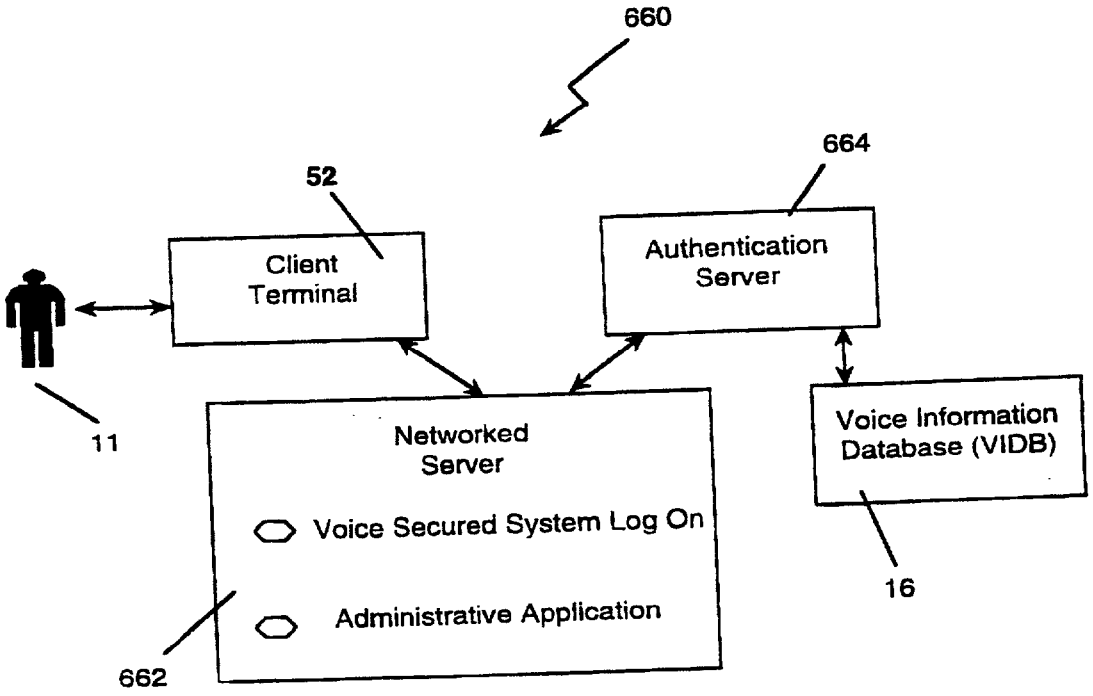
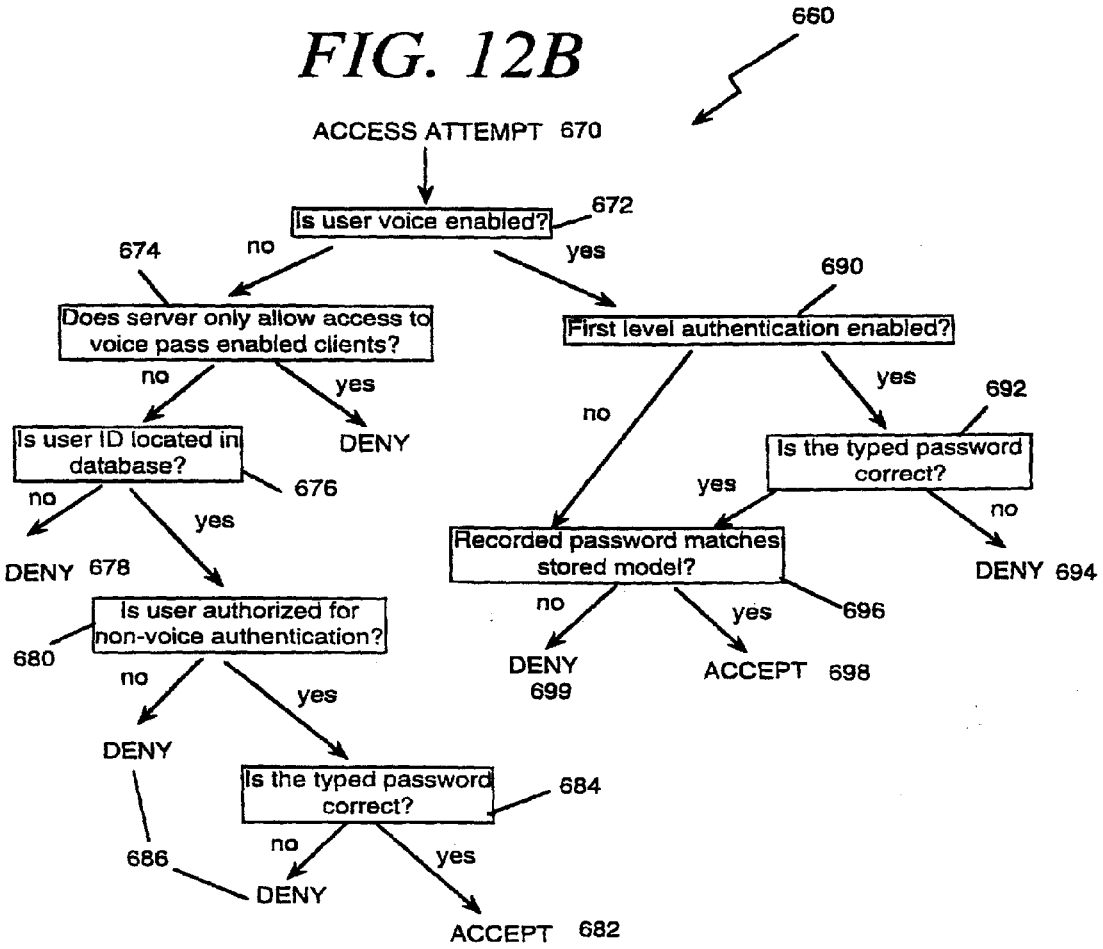

660
664
52
Client Terminal
Authentication Server
11
Networked Server
Voice Secured System Log On
Administrative Application
662
Voice Information Database (VIDB)
16

FIG. 12B


660
ACCESS ATTEMPT 670
Is user voice enabled?
672
674
no
yes
690
Does server only allow access to voice pass enabled clients?
First level authentication enabled?
no
yes
yes
692
DENY
Is user ID located in database?
676
Is the typed password correct?
no
yes
no
yes
DENY 678
Recorded password matches stored model?
DENY 694
Is user authorized for non-voice authentication?
696
680
no
yes
no
yes
DENY
699
ACCEPT 698
DENY
Is the typed password correct?
684
686
no
yes
DENY
ACCEPT 682

USER VALIDATION FOR INFORMATION SYSTEM ACCESS AND TRANSACTION PROCESSING

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from U.S. Provisional Application Ser. No. 60/031,638, Filed Nov. 22, 1996, entitled "User Validation For Information System Access And Transaction Processing."

BACKGROUND OF THE INVENTION

[0002] The invention is a verification system for ensuring that transactions are completed securely. The invention uses the principle of speaker recognition to allow a user to complete a transaction.

[0003] 1. Field of the Invention

[0004] The invention relates to the fields of signal processing, communications, speaker recognition and security, and secure transactions.

[0005] 2. Description of Related Art

[0006] With the increased use of credit card and computer related transactions security of the transactions is a reoccurring problem of increasing concern. Conventional approaches for credit card validation have included reading a magnetic strip of the credit card at a point of sale. Information stored on the credit card, such as account information, is forwarded over a telephone connection to a credit verification service at the credit card company. For example, an X.25 connection to the credit verification system has been used. A response from the credit verification service indicates to the salesperson whether the customer's credit card is valid and whether the customer has sufficient credit. An example of the above-described system is manufactured by VeriFone® of Redwood City, Calif., U.S.A.. These prior art systems, however, have the disadvantage that the credit card may be verified as valid and as having sufficient credit even if it is used by someone who is not authorized to use the credit card.

[0007] The identity of the consumer who presents a credit card is manually verified by a merchant. The back of the credit card contains a signature strip, which the consumer signs upon credit card issuance. The actual signature of the consumer at the time of sale is compared to the signature on the back of the credit card by the merchant. If in the merchant's judgement, the signatures match, the transaction is allowed to proceed.

[0008] Other systems of the prior art include placing photographs of authorized users on the credit card. At the time of the transaction, the merchant compares the photograph on the card with the face of the person presenting the card. If there appears to be a match, the transaction is allowed to proceed.

[0009] While signatures and photographs are personal characteristics of the user, they have not been very effective. Signatures are relatively easy to forge and differences between signatures and photographs may go unnoticed by inattentive merchants. These systems are manual and consequently prone to human error. Further, these systems cannot be used with credit card transactions which do not occur in person, i.e., which occur via telephone.

[0010] Computer related applications, such as accessing systems, local area networks, databases and computer network (such as "Internet") systems, have conventionally used passwords (known as personal identification numbers—"PINs") entered from a keyboard as a security method for accessing information. Computer passwords have the shortcoming of being capable of being stolen, intercepted or re-created by third parties. Computer programs exist for guessing ("hacking") passwords. Additionally, computer passwords/PINs are not personal characteristics, which means that they are less complex and easier to generate by a third party with no knowledge of the authorized individual's personal characteristics.

[0011] With the advent of electronic commerce on the internet, goods and services are increasingly being purchased by consumers, who submit credit card or other "secure" information to merchants over the internet. Transactions initiated from users connected to the internet currently have limited security provisions. For example, a retail provider receiving a user's credit card number from the internet has no idea whether the person providing the number is authorized to use the credit card, or has obtained a credit card number from an illegal source.

[0012] As computers play a greater and more critical role in everyday life, security has emerged as a significant concern. Whether it's restricting children from playing with their parent's tax return (local access), protecting against an employee stealing trade secrets (network access), or limiting access to a value added WEB site (remote network access), the ability to determine that the claimed user is the real user is absolutely necessary.

[0013] Additional areas in which a need for heightened security exists are cellular telephone systems and prison telephone systems. In cellular systems, fraud from unauthorized calling is a recurring problem. In prison systems, the identity of inmates must be closely monitored, for purpose of authorizing certain transactions, such as telephone calls.

[0014] What is needed are local and remote secure access systems and methods using personal characteristics of users for identifying and/or verifying the users.

SUMMARY OF THE INVENTION

[0015] The present invention is an improved method and system for increasing the security of credit card transactions, prison inmate transactions, database access requests, internet transactions, and other transaction processing applications in which high security is necessary. According to the present invention, voice print and speaker recognition technology are used to validate a transaction or identify a user.

[0016] Within speaker recognition (also referred to as voice recognition herein), there exists two main areas: speaker identification and speaker verification. A speaker identification system attempts to determine the identity of a person within a known group of people using a sample of his or her voice. Speaker identification can be accomplished by comparing a voice sample of the user in question to a database of voice data, and selecting the closest match in the database. In contrast, a speaker verification system attempts to determine if a person's claimed identity (whom the person claims to be) is valid using a sample of his or her voice. Speaker verification systems are informed of the person's

claimed identity by index information, such as the person's claimed name, credit card number, or social security number. Therefore, speaker verification systems typically compare the voice of the user in question to one set of voice data stored in a database, the set of voice data identified by the index information.

[0017] Speaker recognition provides an advantage over other security measures such as passwords (including personal identification numbers) and personal information, because a person's voice is a personal characteristic uniquely tied to his or her identity. Speaker verification therefore provides a robust method for security enhancement.

[0018] Speaker verification consists of determining whether or not a speech sample provides a sufficient match to a claimed identity. The speech sample can be text dependent or text independent. Text dependent speaker verification systems identify the speaker after the utterance of a password phrase. The password phrase is chosen during enrollment and the same password is used in subsequent verification. Typically, the password phrase is constrained within a specific vocabulary (i.e. number of digits). A text independent speaker verification system does not use any pre-defined password phrases. However, the computational complexity of text-independent speaker verification is much higher than that of text dependent speaker verification systems, because of the unlimited vocabulary.

[0019] The present invention uses speech biometrics as a natural interface to authenticate users in today's multi-media networked environment, rather than a password that can be easily compromised.

[0020] In accordance with the present invention, security can be incorporated in at least three access levels: at the desktop, on corporate network servers (NT, NOVELL, or UNIX), and at a WEB server (internets/intranets/extranet). The security mechanisms may control access to a work station, to network file servers, to a web site, or may secure a specific transaction. Nesting of these security levels can provide additional security; for instance, a company could choose to have it's work stations secured locally by a desktop security mechanism, as well as protect corporate data on a file server with a NT, NOVELL or FTP server security mechanism.

[0021] Use of speaker recognition, and therefore voice biometric data, is able to provide varying levels of security based upon customer requirements. A biometric confirms the actual identity of the user; other prevalent high security methods, such as token cards, can still be compromised if the token card is stolen from the owner. A system can employ any of these methods at any access level. In all cases of the inventive methods described herein, the user must know an additional identifying piece of information. The security system is not compromised whether this information is publicly obtainable information, such as their name, or a private piece of information, such as a PIN, a social security number, or an account number.

[0022] In accordance with the present invention, "simple" security systems and methods (single spoken password), multi-tiered security systems (multiple tiers of spoken passwords) and randomly prompted voice tokens (prompting of words obtained through a random look-up) are provided for improved security. These security systems and methods may be used to increase the security of point of sale systems, home authorization systems, systems for establishing a call to a called party (including prison telephone systems), internet access systems, web site access systems, systems for obtaining access to protected computer networks, systems for accessing a restricted hyperlink, desktop computer security systems, and systems for gaining access to a networked server.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] **FIG. 1** is a diagram of a speech recognition unit.

[0024] **FIG. 2** is a high level representation of the unit shown in **FIG. 1**.

[0025] **FIG. 3** shows a "simple" security method and system.

[0026] **FIG. 4A** shows a diagram of a multi-tiered security method and system.

[0027] **FIG. 4B** shows a diagram of a multi-tiered security method and system with conditional tiers.

[0028] **FIG. 4C** shows a diagram of a randomly prompted voice token method and system.

[0029] **FIG. 5A** shows a schematic diagram of the general configuration of a speaker verification method and system.

[0030] **FIG. 5B** shows a more specific schematic of the **FIG. 5A** method and system.

[0031] **FIG. 6** is a schematic diagram of a speaker recognition method and system for a point of sale system.

[0032] **FIG. 7** is a schematic diagram of an embodiment where home authorization is obtained through a call center.

[0033] **FIG. 8** is a schematic diagram of an embodiment for establishing a call to a called party using speaker recognition.

[0034] **FIG. 9** is a schematic diagram of an embodiment for use in establishing an internet connection using speaker recognition.

[0035] **FIG. 10A** is a schematic diagram of an embodiment for use in establishing a connection to a web site using speaker recognition.

[0036] **FIG. 10B** is a schematic diagram of an embodiment for use in establishing a connection to a protected network using speaker recognition.

[0037] **FIG. 10C** is a schematic diagram of an embodiment for use in establishing a connection to a restricted hyperlink on a web server using speaker recognition.

[0038] **FIG. 11** shows an embodiment for use in securing a desktop computer using speaker recognition.

[0039] **FIG. 12A** shows a system for use in gaining access to a networked server using speaker recognition.

[0040] **FIG. 12B** shows a method for use in gaining access to a networked server using speaker recognition.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0041] The present invention uses speech recognition in combination with various security and communications sys-

tems and methods. As a result, an inventive, remotely accessible and fully automatic speech verification and/or identification system results.

[0042] 1. Speech Recognition Unit.

[0043] **FIG. 1** illustrates a speech recognition system **201**. Test speech **202** from a user is input into a speech recognition unit **204**, which contains a database of stored speech data. A prompt **203** may be presented to the user to inform the user to speak a password or enter index information. In a speaker verification system, an index **206** is normally supplied, which informs the speech recognition unit **204** as to which data in the database **208** is to be matched up with the user. In a speaker identification system, an index **206** is normally not input, and the speech recognition unit **204** cycles through all of the stored speech data in the database to find the best match, and identifies the user as the person corresponding to the match. Alternatively, if a certain threshold is not met, the speech identification system **204** may decide that no match exists.

[0044] In either case, the speech recognition unit **204** utilizes a comparison processing unit **210** to compare the test speech **202** with stored speech data in a database **208**. The stored speech data may be extracted features of the speech, a model, a recording, speech characteristics, analog or digital speech samples, or any information concerning speech or derived from speech. The speech recognition unit **204** then outputs a decision **216**, either verifying (or not) the user, or identifying (or not) the user. Alternatively, the "decision"**216** from the speech recognition unit includes a confidence level, with or without the verification/identification decision. The confidence level may be data indicating how close the speech recognition match is, or other information relating to how successful the speech recognition unit was in obtaining a match. The "decision"**216**, which may be a identification, verification, and/or confidence level, is then used to "recognize" the user, meaning to identify or verify the user, or perform some other type of recognition. Either verification or identification may be performed with the system **201** shown in **FIG. 1**. Should identification be preferred, the database **208** is cycled through in order to obtain the closest match.

[0045] Systems which may be used to implement the speech recognition system of **FIG. 1** are disclosed in U.S. Pat. No. 5,522,012, entitled "Speaker Identification and Verification System," issued on May 28, 1996, patent application Ser. No. 08/479,012 entitled "Speaker Verification System," U.S. patent application Ser. No. 08/_____, entitled "Model Adaption System And Method For Speaker Verification," filed on Nov. 3, 1997 by Kevin Farrell and William Mistretta, U.S. patent application Ser. No. 08/_____, filed on Nov. 21, 1997, entitled "Voice Print System and Method," by Richard J. Mammone, Xiaoyu Zhang, and Manish Sharma, each of which is incorporated herein by reference in its entirety.

[0046] Referring to **FIG. 1**, the speech recognition unit **204** may contain a preprocessor unit **212** for preprocessing the speech prior to making any comparisons. Preprocessing may include analog to digital conversion of the speech signal. The analog to digital conversion can be performed with standard telephony boards such as those manufactured by Dialogic. A speech encoding method such as ITU G711 standard μ and A law can be used to encode the speech samples. Preferably, a sampling rate of 8000 Hz is used.

[0047] The preprocessor unit may perform any number of noise removal or silence removal techniques on the test speech, including the following techniques which are known in the art:

[0048] Digital filtering to remove pre-emphasis. In this case, a digital filter $H(z)=1-\alpha z^{-1}$ is used, where α is set between 0.9 and 1.0.

[0049] Silence removal using energy and zero-crossing statistics. The success of this technique is primarily based on finding a short interval which is guaranteed to be background silence (generally found a few milliseconds at the beginning of the utterance, before the speaker actually starts recording).

[0050] Silence removal based on an energy histogram. In this method, a histogram of frame energies is generated. A threshold energy value is determined based on the assumption that the biggest peak in the histogram at the lower energy region shall correspond to the background silence frame energies. This threshold energy value is used to perform speech versus silence discrimination.

[0051] Additionally, the speech recognition unit may optionally contain a microprocessor-based feature extraction unit **214** to extract features of the voice prior to making a comparison. Spectral speech features may be represented by speech feature vectors determined within each frame of the processed speech signal. In the feature extraction unit **214**, spectral feature vectors can be obtained with conventional methods such as linear predictive (LP) analysis to determine LP cepstral coefficients, Fourier Transform Analysis and filter bank analysis. One type of feature extraction is disclosed in previously mentioned U.S. Pat. No. 5,522,012, entitled "Speaker Identification and Verification System," issued on May 28, 1996 and incorporated herein by reference in its entirety.

[0052] The speech recognition unit **204** may be implemented using an Intel Pentium platform general purpose computer processing unit (CPU) of at least 100 MHz having about 10 MB associated RAM memory and a hard or fixed drive as storage. Alternatively, an additional embodiment could be the Dialogic Antares card.

[0053] While the speech recognition systems previously incorporated by reference are preferred, other speech recognition systems may be employed with the present invention. The type of speech recognition system is not critical to the invention, any known speech recognition system may be used. The present invention applies these speech recognition systems in the field of security to increase the level of security of prior, ineffective, systems.

[0054] 2. Security Methodology and Systems.

[0055] According to the present invention, speaker recognition can provide varying levels of security based upon customer requirements. A biometric, such as voice verification, confirms the actual identity of the user. Other prevalent high security methods, such as token cards, can still be compromised if the token card is stolen from the owner. With speaker recognition, the user need know only a single piece of information, what to speak, and the voice itself supplies another identifying piece of information. The

present invention contemplates at least three levels of security, "simple" security, multi-tiered security, and randomly prompted voice tokens.

[0056] A more general depiction of a speaker recognition system **215** is shown in **FIG. 2**. As shown in **FIG. 2**, the user supplies a spoken password **217** to the speech recognition unit **204**. The spoken password is preferably input into a microphone at the user's location (not shown) or in the speech recognition unit **204** (not shown). The password may also be obtained from a telephone or other voice communications device (not shown). In response to the spoken password, or subsequent data, the speech recognition unit **204** outputs a decision **216**, which may be or include a confidence level. To increase the level of security, an optional user index input unit **218** may be included to obtain index information, such as a credit card number, social security number, or PIN. The user index input unit **218** may be a keyboard, card reader, joystick, mouse, or other input device. The index may be confidential or public, depending on the level of security desired. An optional prompt input unit **220** may be included to prompt the user for a speech password or index information. The prompt input unit may be a display, speaker, or other audio/visual device.

[0057] A "simple" security method **221** is shown in **FIG. 3**. This method may be implemented in the system of **FIG. 1** or **2**. The "simple" security system requires only the password and the voice biometric. This type of authentication provides a security level typical of today's token based systems. Thus, in **FIG. 3, a** spoken password **224** is obtained as well as optional index information **226**. The password and index may be obtained from prompting **228** the user. This information is then processed in the speech recognition unit **204**. The speech recognition unit **204** attempts to recognize **230** the speaker of the password (as belonging to the person identified by the index information, if entered). If the speaker is recognized, authorization is granted or the person is identified **232**. If the speaker is not recognized, authorization is denied (i.e. not granted or a "no identity" result occurs **234**). Optionally, the speech recognition unit's decision **216** is or includes a confidence level.

[0058] A Multi-tiered security flow diagram is shown in **FIG. 4A**. The **FIG. 4A** method may be implemented in the systems of **FIG. 1** or **2**. The method **241** shown in **FIG. 4A** employs multiple tiers of spoken passwords to enhance security even further. For instance, a user is required to speak their selected password as well as additional randomly prompted information that is currently used for authentication today, such as mother's maiden name, birth date, home town, or SSN. A multi-tier system adds randomness to the system to deter attacks through mechanisms such as digital recordings, as well as offers enhanced biometric validation. For example, if system performance typically authenticates with a 99.5% accuracy, a two tier system will authenticate at 99.9975%, and a three tier system at 99.999988%. Additionally, a multi-tier system checks both multiple pieces of knowledge and multiple biometric samples. Because speech is an easy to use, natural interface, the burden placed on the user for a multi-tier system will still be less then that of a token based system. This system can be language dependent or language independent.

[0059] As shown in **FIG. 4A, a** first speech password is obtained **242** from the user. Index information may also, optionally, be obtained **244** from the user. After receiving the first speech password and optional index information, the voice recognition unit **204** prompts **246** for a second (random) password **246**. The prompt may be displayed by the prompt input unit **220** of **FIG. 2**. Next, the second speech password is obtained **248**. The voice recognition unit **204** then determines whether it recognizes the first password **250**. If the first password is not recognized, there is no authorization or identification **252**. If the first password is recognized, the voice recognition unit determines whether it recognizes the second password **251**. If the second password is not recognized there will be no authorization or identification **252**. If the second password is recognized, authorization and/or identification will occur **254**. Optionally, a confidence level is output as, or included in, the decision **216**.

[0060] A two-tier system may be made conditional on rejection of a first password. **FIG. 4B** shows a conditional two-tier system **261**. As shown in **FIG. 4B, a** first speech password is obtained **262**. Optionally, index information is also obtained **264**. The speech recognition unit **204** then determines whether it recognizes the first password **266**. If the first password is recognized, authorization and identification will occur **268**.

[0061] If the speech recognition unit does not recognize the first password, it generates a second (random) password **270**. The second password is randomly generated by the speech recognition unit **204**. A prompt for this password may be displayed **271** on a prompt input unit **220** (**FIG. 2**). The second speech password is obtained **272**, and if the second password **270** is recognized **274**, authorization or identification occurs **278**. If the second password is not recognized, no authorization or identification takes place **268**. Optionally, the decision **216** may comprise, or include a confidence level.

[0062] A randomly prompted voice token method **281** is shown in **FIG. 4C**. In a randomly prompted voice tokens system, the system models specific, discrete characteristics of particular spoken sounds, such as vowels. The system then randomly selects a word or phrase from a large database **283** of hundreds, or even thousands of words, and prompts the user to speak that word. The system then separates the particular characteristics of interest from that word and verifies against those characteristics. This gives a completely random word selection to achieve a high level of immunity against digital recordings and does not require the user to remember a password.

[0063] As shown in **FIG. 4**C, the speech recognition unit **204** selects a model **282** of specific discrete characteristics of particular spoken sounds from the database **283**. The user is then prompted to speak a word or phrase containing information relating to the model, which may be prompted **284** by the prompt input unit **220** (**FIG. 2**). The speech password is then obtained **286**. In this case, the speech password relates to the prompted speech characteristics.

[0064] After receiving the speech password **286**, the voice recognition unit **204** identifies characteristics of the speech password **288**. The voice recognition unit **204** then determines whether it recognizes these characteristics as consistent with those in the selected model of characteristics **290**. If the characteristics are recognized, authorization and/or identification occur **292**. If the characteristics are not rec-

ognized, no authorization or identification occurs **294**. Optionally, a confidence level may be included in the decision **216**.

[**0065**] The "simple" system, multi-tiered system and randomly prompted voice token system may be combined with each other in alternative embodiments. For example, a speech password and a randomly prompted voice token could be used together, in either single or multiple levels. Other types of current security systems of methodologies, either voice or non-voice, may be employed with the present invention, such as smartcard systems or password systems. The present invention adds the advantages of voice-recognition to known systems and methodologies.

[**0066**] 3. Additional Embodiments

[**0067**] The present invention is useful in a number of embodiments, described in more detail below. The "simple" system, multi-tiered system, randomly prompted voice token system, and/or other systems may be used in combination with the embodiments presented below.

[**0068**] 3.1 Speaker Recognition System/Service—General.

[**0069**] **FIG. 5A** illustrates a schematic diagram of a general configuration of a voice verification method and system **50**. As shown in **FIG. 5**A, client terminal **52** is connected **54** to a voice recognition system/service **56**. The connection **54** can be a voice connection (such a telephone connection), a data connection (such as a modem connection) or a combination of a voice connection and a data connection (such as an ISDN connection). The voice recognition system/service **56** establishes a link **57** with a voice identification database unit (VIDB) **16**. The VIDB **16** stores information such as voice identities or voice prints.

[**0070**] If the connection **54** is a voice connection, the voice verification system **56** matches a voice sample from the client terminal **52** to a voice sample stored in the VIDB **16**. If a data connection is established, a voice sample of the client is converted by client terminal **52** to data features at the client terminal **52**'s site. The data features sent over connection **54** are optionally encrypted. The voice recognition system/service **56** matches the data from user **52** with data stored in VIDB **16**, to perform voice recognition on the user's voice.

[**0071**] **FIG. 5B** shows a more detailed description of the client terminal **52**, voice recognition system/service **56**, and VIDB **16**, shown in **FIG. 5A**. The preprocessor unit **212** of **FIG. 1** and the feature extraction unit **214** of **FIG. 1** are included in the client terminal **52** of **FIG. 5B**. The comparison processing unit **210** of **FIG. 1** is preferably included in the voice recognition system/service **56** of **FIG. 5**B, but alternatively may be provided in the VIDB **16** of **FIG. 5B210'**. The database **208** of **FIG. 1** is also preferably located in the VIDB **16**.

[**0072**] The system of **FIG. 5B** further clarifies where the location of additional components are preferably installed. The client terminal **52** normally contains a voice input unit **402**, data input unit **404**, voice output unit **406** and data output unit **408**. The voice input unit may be a microphone, which is used to provide analog voice signals to an A to D conversion unit **410**. The data input unit **404** may be a keyboard or mouse, or card reader, which enables users to input data. The data may or may not require A to D conversion, the data input unit **404** is shown connected to the A to D convertor unit for purposes of clarity.

[**0073**] The voice output unit **406** is used to provide prompts and other information to the user. The voice output unit **406** may be a speaker or headphones. The data output unit **408** is used to provide data and/or prompts to the user. The data output unit **408** may be a cathode ray tube, LCD display, LED display or other visual indicator. Many types of data outputs require analog information, thus, a digital to analog convertor **412** is connected to the inputs of the voice output unit **406** and data output unit **408**. An AUX unit **414** is also provided. The AUX unit **414** may be a switch or other device which is instructed to function upon the occurrence of a successful or unsuccessful verification or identification, or upon a certain confidence level. The AUX unit **414** may or may not require digital to analog conversion prior to operation.

[**0074**] The client terminal **52** is used to obtain voice input information and/or data input (such as index) information. This information may be directly provided to a communication unit **416** for transfer to the voice recognition system/service **56**. However, preferably, the voice/data information is A to D converted (if necessary) and undergoes other preprocessing in the preprocessing unit **212**. The preprocessing may occur as previously described with respect to **FIG. 1**. Also, following preprocessing, feature extraction occurs in a feature extraction unit **214**. Feature extraction is used to extract digitized features of interest from the voice information and occurs as previously described with respect to **FIG. 1**. These extracted features are unintelligible and, therefore, the voice data cannot be compromised once the data leaves the client terminal.

[**0075**] After feature extraction, the information, preferably, is passed to an encryption/decryption unit **418**. The encryption/decryption unit **418** digitally encrypts the information and allows for a secure transmission to the voice recognition system/service **56**.

[**0076**] The communication unit **416** in the client terminal may be a telephonic communication device, modem, internet access line, cellular telephone, digital PCS transmitter or any known local or remote voice/data interface, including as known busses and interfaces.

[**0077**] The voice recognition system/service **56** contains a first communication unit **420**, comparison processing unit **210** and second communication unit **422**. The first communication unit **420** receives transmissions from the client terminal **52** or other sources. Communications transmissions are received from the client terminal **52** on line **54** and from other sources on line **424**. The communication unit in the client terminal communicates to the voice recognition system/service on line **54** and to other sources on line **426**.

[**0078**] The comparison/processing unit **210** performs the task of voice recognition by obtaining voice information from the database **208** in the VIDB **16**. The comparison/processing unit **210** formulates a recognition decision **216** based on a comparison of the voice features of the user and the stored voice data from the database **208**. Both speaker verification and speaker identification may be performed.

[**0079**] If the client terminal does not contain an A to D converter **410**, preprocessor **212** or feature extraction unit

214, the voice recognition system/service **56** contains these components (not shown). The voice recognition system/service **56** also, preferably, contains an encryption/decryption unit **428**. The encryption/decryption unit **428** is used to encrypt or decrypt information from the client terminal **52**. The voice recognition system/service **56** communicates to the VIDB **16** through the second communication unit **422**. The communication unit may also communicate to any other destination, including the client terminal **52** on line **430**.

[**0080**] The VIDB **16** contains a communication unit **432** and database **208**. Optionally, the VIDB contains a comparison/processing unit **210'**. The comparison/processing unit **210'** is present in the VIDB only in the event that the voice recognition system/service **56** is utilized as a switching network to forward all incoming information to VIDB **16**. The VIDB **16** may also contain a encryption/decryption unit (not shown), if the voice recognition system/service **56** communicates encrypted information to VIDB **16**. However, it is assumed that communication line **57** between the voice recognition service and VIDB is secure, or that the VIDB **16** and voice recognition/service **56** are co-located. In this event, a secure transmission on line **57** would not be required.

[**0081**] The systems of **FIG. 5**A and **FIG. 5B** are useful for obtaining a voice and/or data input from a user, performing remote or local voice recognition, and communicating the success or failure of the recognition to the user. Voice recognition is performed at the voice recognition system/service **52**, and the decision **216** of the recognition communicated to the user on the user's voice output **406** or data output. Alternatively, as shown in **FIG. 5**B, the decision of recognition **216** may be communicated by the voice recognition system/service **52** to a third party on line **430**. As a further alternative, also shown in **FIG. 5**B, if the user is attempting entry to a system requiring recognition, the user's communication equipment may directly communicate the success or failure of recognition to the third party on line **426**. As an even further alternative, shown in **FIG. 5**B, the VIDB may contain a comparison/processing unit and therefore directly communicate the recognition decision **216** to the client terminal **52** on line **434**, voice recognition system/service **56** on line **57**, or third party on line **434**.

[**0082**] Other types of information may also be communicated between client terminal **52**, voice recognition system/service **56**, and VIDB **16**. For example, information may be supplied by client terminal **52** to voice recognition system/service **56**, and/or VIDB **16** as to where the recognition decision **216** should be communicated, and by which part of the system.

[**0083**] As one example, if a user **11** wishes to access a database (not shown), the user **11** provides a spoken password which is matched against a voice identity stored in VIDB **16**. The voice recognition system/service **56** provides a decision to the user **11** as to whether or not his password was accepted or rejected as matching the stored voice identity in VIDB **16**. This decision is then automatically communicated to the database provider via line **426**. Alternately, the decision may be communicated on line **424** directly to the database provider if so indicated by client terminal **52**. The database provider may be a service as for example provided by ORACLE or the like.

[**0084**] The security methods described previously, i.e. the "simple" system **221** of **FIG. 3**, the multi-tiered system **241**, **261** of **FIGS. 4A & 4B**, and the randomly prompted voice token system **281** of **FIG. 4C** may be implemented in the voice recognition system/service. The spoken passwords are obtained via the voice input **402**, the index information obtained via the data input **404** (if necessary) and the prompts communicated to the user via the voice output **406** or data output **408**. Thus, for a general system, the embodiments of **FIG. 5**A and **FIG. 5B** are able to provide very high level of security.

[**0085**] 3.2. Credit Card Validation.

[**0086**] **FIG. 6** illustrates a schematic diagram of the voice recognition method and system of the present invention for a credit card validation system **10**. In the credit card validation system **10**, a user **11** is validated at point of sale terminal **12**, located at a point of sale. The point of sale terminal **12** may be constructed as shown in **FIG. 5B** with respect to the client terminal **52**. In this case, the credit card number is read by a card reader **450**. Other information, such as the price of the item(s) the user seeks to purchase may be entered by a keyboard **452**. A spoken password is entered by the user into a microphone **454**. The card reader **450** and keyboard **452** correspond to the data input **404** of **FIG. 5**B, and the microphone **454** corresponds to the voice input **402**. The credit card number, other related information (if present), and spoken password are transmitted to the validation service **14** over a conventional link **13**, such as a telephone line. The validation service **14** may be constructed as shown in **FIG. 5B** with respect to the voice recognition system/service **56**.

[**0087**] The validation service **14** establishes a conventional link **15** with a voice identification database (VIDB) **16**. The voice identification database (VIDB) **16** may be constructed as shown in **FIG. 5B**. The VIDB **16** receives account information from validation service **14** in order to index a stored voice identity or voiceprint corresponding to the account information. Additionally, the VIDB **16** may contain account data in its database (not shown) to verify that the user's account is valid and will not be exceeded by the requested purchase. Alternatively, the VIDB **16** or validation service **14** may communicate to an external credit bureau over lines **460**, **462**, respectively, to confirm that the user's account is valid and is not going to be exceeded by the requested purchase.

[**0088**] The validation service **14** performs speaker recognition on the spoken password to determine whether the spoken password matches the speech data stored in the database for the person identified by the index information. The validation service **14** may also obtain credit bureau results, as previously discussed.

[**0089**] The validation decision **216** and credit bureau results (if present) are forwarded via link **13** back to the point of sale terminal **12**. Alternatively, the decision is forwarded via a direct connection **464** between VIDB **16** and point of sale terminal **12**, if the comparison/processing unit **210'** is located in VIDB **16**. The point of sale terminal has a display **456** corresponding to the data output **408** of **FIG. 5B**. The display **456** informs the merchant as to whether the user is authorized, whether the user has exceeded the maximum on the credit card account, and/or whether the credit card is valid.

[**0090**] Preferably, a preprocessor unit, a feature extractor unit, and a encryption/decryption unit (not shown) are used

in the point of sale terminal **12** in the credit validation system **10**. These components function as previously described with respect to **FIG. 5B**.

[**0091**] The security methods described previously, i.e. the "simple" system **221** of **FIG. 3**, the multi-tiered system **241**, **261** of **FIGS. 4A & 4B**, and the randomly prompted voice token system of **FIG. 4C** may be implemented in the credit validation system **10**. The spoken passwords are obtained via the microphone **454**, the index information obtained via keyboard **452** and the prompts communicated to the user via the display **456**. Thus, the present invention is able to significantly improve the security provided over prior art credit card validation systems.

[**0092**] 3.3. Home Authorization to Call Center.

[**0093**] In another embodiment, shown in **FIG. 7, a** user **11** can establish a connection **21** between a client terminal **52** and a call center **20** to provide home validation of credit card transactions. In system **9** shown in **FIG. 7**, the client terminal **52** is constructed as previously shown and described in **FIGS. 5A and 5B**.

[**0094**] Referring back to **FIG. 7**, the client terminal **52** can connect from the home via telephone line **21** to a call center **20**, which is connected to intra-state sales networks **470** and inter-state sales **472** networks. The user **11** provides account information (which may be used as index information) via a data input unit device, for example a keyboard, and a voice identity password via a voice input unit **402**, for example a microphone, to the client terminal **52**. A display **456** is used for showing decisions or prompts. The client terminal **52** connects to call center **20** via telephone line **21**, or another standard link. The call center **20** passes the voice and index information (if present) to the voice recognition system/service **56** over a standard link **23**, which may be a telephone line.

[**0095**] The voice recognition system/service **56** may be constructed as previously described with respect to **FIGS. 5A and 5B**. After receiving the voice and index information (if present), the voice authorization service **56** requests voice data from the voice information database unit **16** (VIDB). The VIDB may be constructed as shown and described with respect to **FIGS. 5A and 5B**.

[**0096**] An optional connection **28** may be established between the voice recognition system/service **56** and the user's terminal **52** for providing results on the display as to whether or not the user **11** is accepted or rejected by the voice recognition system/service **56**. Another alternative connection **29** may be established between the VIDB **16** and the call center **20**, should the VIDB contain the comparison processing unit **210'** shown in **FIG. 5B**.

[**0097**] From a marketing standpoint, profiling of users **11** for buying preferences and the like can be provided either at voice recognition system/service **56** or at VIDB **16**.

[**0098**] In another alternative embodiment, a the client terminal **52** may connect to call center **20** via a vendor retail service bridge **30**. The client terminal **52** can establish connection **32** with vendor retail bridge **30** either as a telephone connection or a modem connection to a vendor retailer computer in vendor retail service bridge **30**. The vendor retail service bridge **30** connects to the call center **56** over a link **34** for receiving the decision **216** of whether or not to accept or reject the user **11**. The decision **216** from the voice recognition system/service **56** is forwarded via link **23** to the call center **20**, and may subsequently be forwarded via link **21** to the client terminal **52** or may be forwarded via link **30** to the vendor retail service bridge **30**.

[**0099**] Preferably, a preprocessor, a feature extractor, and an encryptor (not shown) are used in the client terminal **52** of the home call center embodiment. These components function as previously described with respect to **FIG. 5B**.

[**0100**] The security methods described previously, i.e. the "simple" system **221** of **FIG. 3**, the multi-tiered system **241**/**261** of **FIGS. 4A & 4B**, and the randomly prompted voice token system **281** of **FIG. 4C** may be implemented in the call center embodiment **9**. The spoken passwords are obtained via the voice input **402**, the index information obtained via the data input **404**, the prompts communicated to the user via the display **456**. Thus, call centers may be provided with heightened security using the principles of the present invention.

[**0101**] 3.4. Telephone Call Verification/Identification.

[**0102**] **FIG. 8** illustrates the voice recognition method and system **60** of the present invention for establishing a call to a called party using a telephone network **12**. This application is particularly advantageous for establishing security for calls from prison inmates to parties outside the prison system. Certain prison inmates may be denied telephone privileges, and the present system ensures that these inmates cannot make telephone calls to a called party.

[**0103**] In the embodiment of **FIG. 8**, the calling party **61**, who may be a prison inmate, uses a phone instrument **62** to access telephony interface hardware **64**. The telephony interface hardware **64** connects to a host system **66**. The host system **66** establishes a connection **67** with the voice recognition system **56**.

[**0104**] A voice sample of calling party **61** is passed from the telephone **62** to the telephony interface hardware **64** through host system **66** to voice recognition system/service **56**. The voice sample can be either voice or data of the voice sample created at host system **66**.

[**0105**] In this embodiment, the host system **66** contains the elements of the client terminal **52** shown in **FIG. 5**B, using a switch **480** as the AUX unit **414**. The host system **66** establishes a link **67** with the voice recognition system/service **56**. The voice recognition system/service **56** is preferably constructed as shown in **FIG. 5B**. The voice recognition system/service **56** establishes link **69** with VIDB **16** to index (if index data is present) a stored voice identity or voice print of calling party **61**. The index data may be manually entered by the prisoner or calling party **61** via touch-tones at the onset of the telephone call.

[**0106**] The voice recognition system/service **56** makes a decision **216** whether or not to accept or reject calling party **61**. This decision **216** is communicated to the host system **66**, which establishes a connection **70** to the telephone network **72** via the switch **480** if the decision is positive. Thereafter, telephone network **72** establishes a connection to the called party **74** to enable communications with the calling party **61**.

[**0107**] Either the host system **66** or the voice recognition system **56** may be connected to a credit bureau via lines **482**,

484 to ensure that the calling party has sufficient credit to complete the call. Further, the host system **66** or the voice recognition system **56** may be connected to a prison database **486** to determine whether the identified/authorized caller has calling privileges generally, or is blocked from the specific dialed number. The prison database **486** could alternatively be included within the VIDB unit **16**.

[**0108**] The security methods described previously, i.e. the "simple" system **221** of **FIG. 3**, the multi-tiered system **241**, **261** of **FIGS. 4A & 4B**, and the randomly prompted voice token system **281** of **FIG. 4C** may be implemented in the called party system **60**. The spoken passwords are obtained via the telephone **62**, the index information obtained via touch-tone or rotary dialing, and the prompts communicated to the user via a voice output **406** using speech or audible tones.

[**0109**] Therefore, in order for a prisoner to make a call, index (if desired) and a voice password must be communicated to the host system **66**. If voice recognition does not occur, and if the proper access criteria are not present, the switch will not be opened and the call will not be allowed to proceed. Thus, by updating a database **486**, prison officials can control the ability of prisoners to make telephone calls.

[**0110**] 3.5. Internet Access.

[**0111**] **FIG. 9** is a schematic diagram of the voice recognition method and system **600** of the present invention for use in establishing an internet connection. The user **11** provides a voice sample to a PC **602**, configured as shown in **FIG. 5B** with respect to client terminal **52**. Alternatively PC **602** may be web television configured as shown in **FIG. 5B** with respect to client terminal **52**.

[**0112**] The PC **602** communicates via internet access link **604** to a call center **20**. The vendor call center **20** establishes connection **608** to vendor web page **606** which provides access to the voice recognition system/service **56**. The voice recognition system/service **56** is configured as shown in **FIG. 5B**.

[**0113**] In operation, the user **11** provides a spoken password to PC **602**. Preferably, PC **602** includes a voice input (i.e. microphone), preprocessor, feature extractor and encryption (not shown). Additionally, the user may provide a digital identification for use as index information. The digital identification may be a secret key assigned to the internet user. For example, a digital identification that can be used in the present invention is the "Digital ID" manufactured by VeriSign of Mountain View Calif., U.S.A.

[**0114**] The voice and index information is communicated to call center **20**, and forwarded via line **608** to the vendor web page **606**, and then to the voice recognition system/service **56**. The recognition decision **216** is then forwarded by the voice recognition system/service **56** to the vendor web page **606**, and over link **608** to the call center **20**. Thus, the vendor web page is informed as to whether the user is verified or identified. The call center **20** may notify the PC **602** as to the decision **216**.

[**0115**] Alternatively, the user **11** provides a spoken password over a separate connection **612** to voice recognition system/service **56**. In such a case, the voice recognition system/service contains the voice input (i.e. microphone), preprocessor and feature extractor shown in **FIG. 5B**. The recognition decision **216** is still forwarded by the voice recognition system/service **56** to the call center **20**, and over link **608** to the vendor web page.

[**0116**] Other alternative links of communication may occur. For example, if the comparison processing unit of **FIG. 5B** is located in VIDB **16**, a link (not shown) may be established between VIDB **16** and PC **602**, call center **20**, or vendor web page **606**.

[**0117**] The security methods described previously, i.e. the "simple" system of **FIG. 3**, the multi-tiered system **241**, **261** of **FIGS. 4A & 4B**, and the randomly prompted voice token system **281** of **FIG. 4C** may be implemented in the internet access embodiment **200**. The spoken passwords and index information are obtained via the PC **602**. The PC **602** also displays the prompts shown in **FIGS. 3, 4A**, 4B, and 4C.

[**0118**] Therefore, internet access can be made very secure in order to increase the faith of internet providers that only authorized users are using their access systems.

[**0119**] 3.6. Electronic Commerce.

[**0120**] **FIGS. 10A, 10B**, and 10C illustrate a schematic diagram of a verification method and system **300** of the present invention for application in a world-wide-web environment. Speaker verification technology can be implemented in several different ways to secure access and transactions in the internet environment, and at several different levels. These include:

[**0121**] Securing transactions by enabling an existing standard such as Secure Electronic Transactions (SET) or Certificate of Authority (CA) to support voice biometrics. This is done through embedding the voice model or a reference to the voice model within the certificate or message.

[**0122**] Add support for voice biometrics to firewall products, which can then restrict access at periphery of the protected network to voice authenticated users. Add support to WEB server security features to support voice passwords in addition to typed passwords to restrict access to a WEB site.

[**0123**] A voice protected hyperlink that restricts access to certain areas of a WEB site to voice password enabled users. This could be done through a control, such as a JAVA applet or ActiveX control, that acts as the hyperlink after verifying a user.

[**0124**] Create a proprietary transaction interface to secure a transaction such as making a purchase on a WEB site.

[**0125**] With respect to **FIG. 10A**, users **11** operate PC's **602**. PC's **602** are configured as the client terminals shown in **FIG. 5B**. The users provide a spoken password to PC's **602**. The PC's **602** can include a series of distinctive tones to prompt a user to perform specified actions, such as prompting the user to speak his password. The distinctive tones can be used to replace conventional prompts of PC's **602**.

[**0126**] The PC's **602** preferably include a preprocessor, feature extractor, and encryptor (not shown). The encrypted speech features **303** are then communicated to web server **302**. The encrypted speech features **303** are decrypted by the web server **302** with a key stored in the web server **302**. The

web server **302** communicates over connection **305** with a recognition server **307**. The recognition server **307** is constructed as shown in **FIG. 5B** with respect to the voice recognition system/service **56**.

[**0127**] The recognition server **307** establishes a link with VIDB **304** and obtains a decision **216** as to whether or not user **11** is accepted or rejected. The decision is communicated on link **305** to the web server **302**. If a user **11** is accepted, the web server allows access to the web site **306**. Alternatively, the web server may establish a connection and access to another (protected) web server to host a protected site (not shown). The access allows a user **11** to have obtain to stored information or to establish a transaction. For example, the user can establish access to: a database used for storing information related to a user's 401 (k) account; to an investment application for placing orders to buy or sell mutual funds or stocks, or to an information service to access a mail order application for purchasing retail items and the like.

[**0128**] As shown in **FIG. 10B, a** firewall system **620** can be modified to function in accordance with the present invention. When a user at a client terminal **52** attempts to access a protected network **622** across the Internet, the connection first must pass through a firewall **624**. The firewall **624** performs checking at various levels to ensure the validity of the attached users, both at initial access and during operation, to ensure the integrity of the connection is maintained an not used maliciously. Typical authentication methods at initial access are a log ID/password or a challenge/response token based system.

[**0129**] Speaker verification is a more robust mechanism to ensure the authenticity of the actual accessing user, and is not a piece of knowledge that can be easily compromised, or a token generating card that can be stolen. The client terminal **52** of **FIG. 10B** is preferably configured as the client terminal **52** shown in **FIG. 5B**. A recognition server **628** is preferably configured as the voice recognition system/service **56** of **FIG. 5**B, and the VIDB **16** is preferably configured as in **FIG. 5B**.

[**0130**] With reference to **FIG. 10**B, at initial access from the client terminal the user is prompted to say their password. This may be done through an Active X control or an applet if the user is accessing through a browser using the HTTP protocol. At the client terminal the speech data is optionally reduced to a feature set and then sent across an encrypted connection, such as a Secure Socket Layer (SSL) connection, to the firewall.

[**0131**] The firewall passes the data to the recognition server **628**, along with the user's log ID. The recognition server **628** retrieves the model from the VIDB for that user and compare the speech data to the stored model. If the user is recognized, the firewall **624** permits the connection to be established, otherwise the user is denied access.

[**0132**] The firewall **624** also protects against internal users bringing in malicious data or programs from locations outside the protected network. Speaker verification may also be used to restrict external network access to authorized users.

[**0133**] **FIG. 10C** shows a voice protected hyperlink system **630**. As shown in **FIG. 10C, a** client terminal **52**, recognition management server **632**, recognition server, and VIDB **16** are the key components to the system for granting access to a restricted hyperlink **636** at a web server **638**. The client terminal **52** is preferably configured as shown in **FIG. 5**B, and is running an authentication program **640**. The recognition server **634** is preferably configured as the voice recognition system/service **56** of **FIG. 5**B, and the VIDB **16** is preferably configured as in **FIG. 5B**.

[**0134**] With continued reference to **FIG. 10C, a** client at a client terminal browsing a web site selects a hyperlink **636** that is voice protected. Rather than going immediately to the hyperlinked location, an authentication program **640**, such as a JAVA applet or ActiveX control, is launched at the client terminal through the client's browser. The authentication program **640** requests the user to enter an identifier, such as their name or account number. The identifier is used as index information for verification.

[**0135**] The authentication program **640** at the client terminal **52** then requests the recognition management server **632** to validate the user identifier, and if the identifier is valid requests the user to speak their pass phrase. The authentication program **640** then records the user speaking their pass phrase. An optional feature extraction may be performed by the program to reduce the data set requiring transfer and to make the speech unintelligible. The speech information is then passed from the authentication program **640** to the recognition management server **632**, which passes it to the recognition server **634** for processing, with an optional security level.

[**0136**] The recognition server **634** compares the speech data to the retrieved voiceprint model for the user, and passes a decision or the results of the comparison back to the recognition management server **632**. If the user is authenticated, then the server **632** passes the name of the protected hyperlink back to the authentication program **640** on the client terminal **52**. The authentication program **640** then instructs the browser to access the restricted hyperlink **636** at the web site **638**.

[**0137**] The security methods described previously, i.e. the "simple" system **221** of **FIG. 3**, the multi-tiered system **241**. **261** of **FIGS. 4A & 4B**, and the randomly prompted voice token system **281** of **FIG. 4C** may be implemented in the internet security embodiments of **FIGS. 10A, 10B**, and **10**C. The spoken passwords and index information are obtained via the PCs **602** or client terminals **52**. The PCs **602** or client terminals **52** also display or indicate via audio means, the prompts shown in **FIGS. 3, 4A**, 4B, and 4C.

[**0138**] Therefore, the security of electronic commerce can be greatly increased to improve the ability of users to obtain information, products and services via the internet.

[**0139**] 3.7. PC Security.

[**0140**] **FIG. 11** shows a desktop security system **650**. The desktop security system **650** is locally stored in a desktop station **652**. In this embodiment, all the elements of **FIG. 5B** are included in the desktop station, and the communication units are all local interfaces.

[**0141**] Several components may be included in a desktop station to provide voice biometric protection, including:

[**0142**] Voice secured system login. A login prompt replaces the existing security, if any, on a desktop

station. This login requires a voice biometric authentication before allowing access to the system.

[0143] A voice secured screen saver de-activation. This ensures that the station is locked after idling for an extended period and can only be accessed by a valid user. A hot-key activation could also immediately activate voice password protection without waiting for screen saver activation. This logic invokes the voice login when deactivating the screen saver. It only permits de-activation once a valid spoken password is received.

[0144] An administrative application for configuring user profiles and enrolling users in the system.

[0145] File Encryption (optional). This system encrypts files that can only be accessed through a spoken passphrase. The key for the file encryption could be derived from the spoken password, which adds a particular high level of security for documents accessed by a single person but prohibits sharing of encrypted document. Alternatively after an authentication the key could be looked up in an encrypted database for that file, or derived from information about the file, and then used for decryption.

[0146] The security methods described previously, i.e. the "simple" system **221** of **FIG. 3**, the multi-tiered system **241**, **261** of **FIGS. 4A & 4B**, and the randomly prompted voice token system **281** of **FIG. 4C** may be implemented in the desktop station embodiment. The spoken passwords and index information are obtained via the desktop station. The desktop stations also display or indicate via audio means, the prompts shown in **FIGS. 3, 4A**, 4B, and 4C.

[0147] These security precautions help ensure that only the authorized user of a desktop station gains access to the desktop station and/or its files.

[0148] 3.8. Network Security.

[0149] **FIGS. 12A and 12B** show a network security embodiment **660**. **FIG. 12A** shows a network installation, including a user, client terminal **52** (such as a PC), networked server **662**, authentication server **662** and VIDB **16**. The client terminal is preferably configured as shown in **FIG. 5B**. The authentication server **664** is preferably configured as the voice recognition system/service **52** shown in **FIG. 5B**. The VIDB is preferably configured as shown in **FIG. 5B**.

[0150] Major predominant network servers have built in security mechanisms, typically through a login name/password, to limit access to server resources. These servers include Windows NT, NOVELL, and UNIX based systems. As strategies to attack these systems are becoming more sophisticated, the need for an alternative approach becomes evident. Voice biometrics provides a sophisticated mechanism much more difficult to compromise then typical server authentication methods.

[0151] The following features may be integrated into the network server security system and method:

[0152] Voice secured server login. A login prompt replaces the existing security, if any, for server access. Typically servers require a login name/password in order to access server resources. The server also typically assigns a set of privileges and access rights to a given user. The biometric login replaces the password login The underlying security model is still relied upon to provide access control to system resources once a user has logged on.

[0153] An administrative application for configuring user profiles and enrolling users in the system. Typically the administration will integrate into the existing server tools, unless the particular operating system of the server disallows tool modification.

[0154] As shown in **FIG. 12B**, the server security system **660** can operate in a mode where only users with voice passphrases are allowed to access a server, or a mixed mode where some users logging in through conventional password means can also gain access at reduced or equal security levels. User and security administration integrates as seamlessly as possible into the standard operating system management features; for instance, under Windows NT, the look and feel of the domain user and server manager programs are maintained.

[0155] With reference to **FIG. 12B**, when the user attempts to access the networked server **670**, they are prompted for a conventional login name/password prompt to gather the user identification information at the client terminal. The client terminal sends the user information to the networked server. The network server makes a determination based upon the user identification whether the user is voice password enabled **672**.

[0156] If the user is not voice password enabled and the server is configured to only allow access to voice pass enabled clients, or if the user ID is not located in the user database **676**, then the login is denied **678**. If the server is not configured to only allow access to voice pass enabled clients, and if this user's ID is located in the database **676**, then the user's authorization is examined **680**.

[0157] If this user is authorized for non-voice authorization **680**, then the server allows the user access **682** if the typed password matches **684** the password stored in the user database for that user ID. If one of these first two conditions are not met, then the server will deny authentication.

[0158] Referring back to the access attempt **640** of **FIG. 12B**, if the user is voice enabled, the system may optionally use a conventional password to provide first level authentication **690**. If first level authentication is enabled, the system performs first level authentication to check the user's password **692**. If the password is not correct, access is denied **694**, and if the password is correct, matching between the stored model and the recorded password is performed **696**.

[0159] Matching between the stored model and the recorded password is also performed if first level authentication **690** is not enabled. Upon deciding to proceed with the matching **696**, the client terminal prompts the user to say their spoken password. At this point feature extraction may optionally take place at the client on the speech data to reduce the data size and to put it into a format that is not intelligible to external applications. The speech data or features may then be encrypted and time stamped, then conveyed to the networked server **662**. The networked server passes this information to the authentication server with an optional security level specified to indicating the severity of threshold to apply when making the biometric authentication.

[0160] The authentication server **664** retrieves a model of the spoken password from the VIDB **16** and compares data from the spoken pass phrase with the model, providing a binary result and optionally a confidence level.

[0161] The network server **662** then uses this authentication level to decide whether the recorded password matches the stored model to an acceptable degree. If the degree of matching is acceptable, access is allowed **698**, otherwise access is denied **699**. A configurable number of re-attempts will be permitted. If the number of allowed re-attempts is exceeded, then the server disables the account.

We claim:

1. A system for recognizing a user through speech recognition, comprising:

a client terminal, comprising:

a voice input, which obtains speech data; and

a first communication unit, connected to the voice input, which transmits information concerning the speech data;

a voice recognition system, operably connected to receive user information from a voice information database, comprising:

a second communication unit for receiving the information concerning the speech data from the first communication unit; and

a processing unit for providing output information concerning voice recognition between the input speech data and the user information from the voice information database.

2. The system of claim 1, wherein the client terminal further comprises:

a preprocessor connected to the voice input;

a feature extraction unit, connected to the preprocessor and to the first communication unit, wherein the feature extraction unit extracts the information concerning the speech data, and

wherein the processing unit utilizes the extracted information concerning the speech data.

3. The system of claim 1, wherein the first communication unit can receive output information, wherein the voice recognition system transmits output information to the client terminal, and the client terminal contains an output unit for indicating the output information.

4. The system of claim 1, wherein the output unit is a display and wherein the input unit is a microphone.

5. The system of claim 2, wherein the client terminal is a point of sale terminal, and wherein the first and second communication units are connected by a telephone line.

6. The system of claim 2, wherein the first and second communication units are connected by a call center.

7. The system of claim 2, wherein the call center is connected to the first communication unit by a vendor retail service bridge.

8. The system of claim 1, wherein the voice input is a telephone input, the first communication unit can receive output information, the voice recognition system transmits output information to the client terminal, and wherein the client terminal contains a switch which connects a telephone network to the telephone input upon successful voice recognition.

9. The system of claim 8, wherein the telephone input is connected to a telephone set located in a prison.

10. The system of claim 2, wherein the client terminal is a personal computer, wherein the first and second communication units are connected through a vendor web page and a call center, and wherein the vendor web page provides the personal computer with internet access in the event of successful voice recognition.

11. The system of claim 2, wherein the first and second communication units are connected through a firewall, and wherein the firewall provides the client terminal with access to a protected network in the event of successful voice recognition.

12. The system of claim 2, wherein the first and second communication units are connected through a web server and recognition management server, and wherein the recognition management server provides the client terminal with access to a restricted hyperlink in the event of successful voice recognition.

13. The system of claim 1, wherein the first and second communication units are interfaces on a desktop computer, and wherein the entire system is located on the desktop computer.

14. The system of claim 2, wherein the client terminal is a client terminal, wherein the first and second communication units are connected through a networked server, and wherein the network server provides the client terminal with access to a protected network in the event of successful voice recognition.

15. The system of claim 14, wherein successful voice recognition includes first level authentication.

* * * * *