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A SYSTEM AND METHOD FOR AUTOMATED INFORMATION STORAGE
AND RETRIEVAL

5 The present invention relates to the automated,
remote retrieval of information, in particular medical
information. More particularly there is provided a
system for the storage of information on drugs,
medical conditions and treatment options on a remote
10 database wherein the information is accessed by
recognition of the user's speech and retrieved by
automated facsimile transmission to the user's
facsimile machine.

Medical professionals, including nurses,
pharmacists and doctors, continually require access to
15 information concerning drugs, medical conditions and
treatments.

Presently, this requirement is fulfilled through
the use of publications which are compiled by
organisations in this field. Examples include the
20 MIMS by MediMedia and DDS by Synapseworld publications
in Singapore.

A shortcoming of all such paper-based
publications is that a practitioner must have the
publication to hand, i.e. on the premises. This
25 requires storage space in the premises which may be,
for example, surgeries, hospitals and clinics, where
space is at a premium. Also, a practitioner who is
attending to a patient off the premises will not have
access to the information. Also, the publications
30 quickly become outdated and/or incomplete. As a
result, either a new edition or else manual updating
of the old edition is required. This is expensive and
time consuming. There is also the risk, that due to
human error, the publications will not be updated
35 correctly.

Another aspect of the prior art is the
availability of information over the Internet.
However, Internet access requires a suitably
configured personal computer with Internet capability.
40 Furthermore, the retrieval of information over the

Internet may involve searching for suitable websites and requires manual input of drug name, medical condition, treatment type, etc. This can be complicated, requiring specialised training, and time consuming. Thus, this method is unsuitable where a quick response is required, for example in emergency situations or during busy periods in clinics.

The prior art also includes US 5,910,107, which describes a system and method directed towards a medical knowledge-based system designed to give medical advice to the general public over the telephone network. The system incorporates interactive voice response and speech recognition technology, but is limited to dialogue which consists of simple yes/no and multiple choice questions. As a result the use of the system is slow since the system must provide detailed user prompts at each stage. Use of the system can also be frustrating, especially to experienced users, as it is inflexible and does not allow the use of natural language by the user. Also, the intended purpose is only to provide medical advice based on inputs received about the patient's condition.

Outside the medical field there are also businesses that have automated information-on-demand services. These businesses include banks, stockbroking firms and telephone companies. Services offered by such businesses include speech recognition to process a user's request but are limited to giving aural answers over the telephone using pre-recorded voice messages. Such systems are unsuitable for the transmission of complicated or technical information.

According to the present invention there is provided a system for providing information on request to a user over a public telephone network, the system comprising an information database, facsimile transmission means, voice recognition means, and means for connecting the system, in use, to the public telephone network to receive user requests for specified information from the user made via a

telephony device connected to the telephone network, further comprising computer control means programmed to control the voice recognition means, information database and facsimile transmission means such that on
5 recognition by the voice recognition means of a user request for specified information, said specified information from at least one data file stored in the information database corresponding to the user request is transmitted by the facsimile transmission means to
10 the user via the telephone network.

There is also provided a method of providing information on request to a user over a public telephone network comprising the steps of detecting a user request for specified information communicated
15 via the telephone network, processing the user request, accessing at least one data file stored in an information database corresponding to the requested information, and sending a facsimile transmission of the specified information from the at least one data
20 file to the user via the telephone network.

An embodiment of the present invention will now be described, by way of example only, with reference to the attached drawings, in which:

Figure 1 is a schematic diagram of the system
25 architecture of the present invention;

Figure 2 shows a typical structure of a database of the present invention;

Figure 3 is a flow chart of a typical login sequence according to the present invention;

30 Figure 4 is a flow chart of a typical data request sequence according to the present invention; and

Figure 5 is a flow chart of a typical fax-out sequence according to the present invention.

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SUMMARY OF THE INVENTION

One aspect of the invention is an automated telephony-based system and apparatus allowing users to obtain medical information by speaking their requests
40 and receiving the required information by facsimile.

A server hosts a database containing the information concerning the drugs, medical conditions, treatments, etc at a remote location. A voice recognition unit (VRU) is connected to the database and also to the telephone network, for example, a Public Switched Telephone Network (PSTN). The VRU has speech recognition capability and acts to capture information supplied by the user over the telephone and transmits the request to the database and fax subsystem.

A facsimile unit is connected to the PSTN, which is used to transmit the requested information to the user in the form of a facsimile message.

DETAILED DESCRIPTION OF THE INVENTION

SYSTEM ARCHITECTURE

Figure 1 shows in schematic form the architecture of the system of the present invention.

A user 1 interacts with the system via a telephone 11 connected to a Public Switched Telephone Network (PSTN) 400. The telephone 11 may be a land line connected by conventional wiring 14 or a mobile (cell) phone connected by radio waves 13, microwaves, etc.

The PSTN 400 relays the call from the user 1 to the system front-end, which comprises a voice recognition unit (VRU) 100 running Dialogic and SpeechWorks Recognition Engine application software. Preferably a number of separate telephone lines 17 are provided between the PSTN 400 and the VRU 100. Preferably, twenty-four lines connect the PSTN 400 to the VRU 100 allows the system to handle simultaneous enquiries from up to twenty-four users 1. The interface between the VRU 100 and the PSTN 400 is handled by the Dialogic and SpeechWorks application software.

The VRU 100 is preferably PC server configured and provided with phone line cards for connection to the PSTN 400 and digital signal processing cards, such

as the Antares card, for use in capturing and analysing the user's spoken requests.

5 The VRU 100 exchanges information with a database 200 which contains the information which the user 1 is requesting, for example drug information in the form of drug names (generic and brand), manufacturer's details, price information, a list of new drugs etc.

10 The VRU 100 and database 200 are connected using Open Database Connectivity (ODBC) compatible connections over an Ethernet Local Area Network (Ethernet LAN) 201.

15 The database 200 is, in turn, connected to a facsimile unit 300 which operates to transmit the requested information to the user's facsimile machine 12 via the PSTN 400 in any acceptable format, for example as ".tiff" formatted files. Other file formats which may be used include ".jpg", ".gif", ".pdf", ".txt" and ".rtf". Preferably the facsimile and database functionality are provided by a single
20 database-facsimile server 250.

The facsimile unit 300 further comprises a fax-logger which records details of successful and failed transmission attempts in the database 200. The fax-logger is controlled by SpeechWorks Service Level
25 Execution Environment application software.

The database 200 is preferably a relational database in which the drug information which is to be sent to the user 1 is stored as ".tiff" formatted files, which is the standard format used by facsimile
30 machines.

The database information, which includes both the information which may be sent to the user 1 as well as information used internally by the system, such as user and account details, is stored in a directory
35 structure containing the information in a number of records. Figure 2 shows a typical structure for the database 200. The database 200 comprises an Account record 211, a FaxToSend record 212, a Drug record 213 and also three records used by the fax-logger:

FaxSuccess 214, FaxRetry 215 and FaxFail 216. Other records may be used as required.

In Figure 2 the fields of the records are shown using the format:

5

X(7) or X(4,2)

for example, where X represents any alphanumeric character. In the first example above the field is a
10 string of 7 alphanumeric characters, e.g. 1234567. In the second example above the field is a string of 4 alphanumeric characters, followed by a decimal point, followed by another 2 alphanumeric characters, e.g. 1234.56..

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The Account record 211 contains fields for the user's account number, fax number and personal identification number (PIN). The user's account number may be their fax number.

20

The FaxToSend record 212 contains fields for the date and time of sending the facsimile message, the user's account number and fax number, the drug code and an alternative drug code or codes.

25

The Drug record 213 contains fields for the drug name, manufacturer, price, as well as a number of other items as desired.

MODE OF OPERATION

As described above, the VRU 100 is connected to
30 the PSTN 400 by multiple channels. The VRU 100 administers each telephony channel as a dedicated "call-flow" thread. Creation and initialisation of each thread occurs at start-up of the VRU 100 application. This differs from other arrangements
35 where the thread creation and initialisation occurs at the point when a call is received over the PSTN 400. In this way the system of the present invention avoids any initialisation latency when answering users' calls. Once initialised each call-flow thread is
40 executed independently from one another.

Consequently, blocking operations in one thread, such as blocking reads performed during back-end transactions, will not overtly affect other threads.

5 The system operation includes the steps of login, data request and fax-out.

Figure 3 shows a typical login sequence for the system. Login is initiated by the user 1 ringing a centralised number for the VRU 100. A hunt-group service will connect the call to one of the different
10 lines 17 for the VRU 100. Preferably, the hunt-group service is provided by the PSTN operator. The VRU 100 welcomes the user 1 with a voice message 501 and sets an internal counter variable, LoginRetry, to equal one at step 502. In the next step 503, the VRU 100
15 requests the user 1 to provide his (or her) account number. The user's answer is recorded as the variable AccountNumber.

Then, at step 504, the VRU 100 requests the user 1 to provide their personal identification number
20 (which may be the user's pre-registered default fax number) and their answer is recorded as variable PIN. A numeric password may also be requested as further confirmation of the user's right of access.

At step 505 the VRU 100 interrogates the database
25 200 over the Ethernet LAN 201 to determine whether the AccountName and PIN variables match an accepted account. If yes, then in the next step 506 the user 1 is passed to the main menu. If no, then variable LoginRetry is incremented by one at step 507 and a
30 check is made at step 508 to determine whether variable LoginRetry is greater than three. If the answer is no, then the VRU 100 moves back to step 503 and again requests the user's account number. If the answer at step 508 is yes, then the call is terminated
35 at step 509. The number of allowed login attempts may, of course, be varied as desired.

Figure 4 shows a typical data request sequence which begins at the main menu 506. At step 510 a variable DrugRetry is set to equal one. In the next
40 step 511 the VRU 100 requests the user 1 to say the

name of the drug that they require information about. The user's answer is recorded as variable DrugName. The drug may be requested using either a specific name, trade name or the generic name.

5 At step 512 the VRU 100 checks to see that variable DrugName is recognised. If DrugName is recognised then the user is asked at step 513 if they require information on alternative drugs to the one specified. If DrugName is not recognised then
10 DrugRetry is incremented by one at step 514 and at step 515 the VRU 100 checks to see if DrugRetry is greater than two. If the answer is no, then the VRU 100 moves back to step 511 and again asks for the user to speak the drug name. If the answer is yes, then
15 the VRU 100 sets a new variable, DrugSpellRetry to equal one at step 517 and asks the user to spell, rather than say, the drug name at step 518 and the answer is recorded as DrugName. At step 518 the VRU 100 checks to see if DrugName is now recognised. If
20 yes, then the VRU 100 moves to step 513 as above. If DrugName is still not recognised then at step 519 DrugSpellRetry is incremented by one and at step 520 the VRU 100 checks to see if DrugSpellRetry is greater than two. If the answer is no, then the VRU 100 moves
25 back to step 518 and again asks for the user to spell the drug name. If the answer is yes, then the call is terminated at step 521. The number of allowed attempts at specifying the drug name may, of course, be varied as desired.

30 If the answer to step 513 is no, i.e. the user does not require any information on alternative drugs, then the VRU 100 sends an instruction at step 522 to the database 200 over the Ethernet LAN 201 to set field DrugName in record FaxToSend 212 to equal the
35 variable DrugName provided by the user 1.

 The VRU 100 then checks at step 523 that the fax containing the information on the drug selected should be sent to the user's default fax number. If the answer is yes, then the FaxNumber field in record
40 FaxToSend 212 is set to equal the field FaxNumber in

record Account 211. (This operation is omitted from Figure 4 for clarity). A confirmatory message may be given at step 524. If the answer is no, then the VRU 100 at step 525 requests the user 1 to specify a
5 different fax number and this number is recorded as field FaxNumber in record FaxToSend 212. (This operation is omitted from Figure 4 for clarity). A confirmatory message may be given at step 526.

If, at step 513, the user requests information on
10 alternative drugs then the VRU 100 at step 527 sends instructions to the database 200 to set field DrugName in record FaxToSend 212 to equal the variable DrugName provided by the user 1 and the field Alternative in record FaxToSend 212 to indicate that the information
15 on the alternative drugs is required. VRU 100 then moves to step 522 as described above.

Figure 5 shows a typical fax-out sequence wherein the database 200 triggers the facsimile unit 300 to send a ".tiff" formatted file from the database 200.
20 Database 200 sends record FaxToSend 212 to the facsimile unit 300. A counter variable FaxRetry is set to equal one at step 528. Subsequently, the facsimile unit 300 accesses database 200 and acquires the relevant ".tiff" formatted files for the drugs
25 specified in field DrugName and optionally field Alternative or record Drug 213. The facsimile unit 300 then sends these ".tiff" files at step 529 to the facsimile number specified in field FaxNumber of record FaxToSend 212. At step 530 the facsimile unit
30 300 checks to see if the message has been sent successfully. If the answer is yes, then the details of record FaxToSend 212 are entered in record FaxSuccess 214 of the fax-logger at step 531. If the answer is no, then the variable FaxRetry is
35 incremented by one at step 533, the details of record FaxToSend 212 are temporarily stored in record FaxRetry 215 in the fax-logger and at step 534 the facsimile unit 300 checks to see if variable FaxRetry is greater than three. If the answer is no, then the
40 facsimile unit 300 retries to send the facsimile

message at step 529. If the answer is yes, then the message is not sent and the details of record FaxToSend 212 are entered in record FaxFail 216 of the fax-logger at step 535. The number of transmission attempts may, of course, be varied as desired.

Consequently, the fax-logger may be used to analyse the proportion of facsimile transmissions which are successfully completed. Also a system administrator may see if, for example, facsimile transmissions are failing in particular to any individual account.

ASYNCHRONOUS EVENTS

The system of the present invention has the ability to handle a number of asynchronous events. Specific management of these events is context specific and may be enabled or disabled depending on the state of the system.

Dual Tone Multiple Frequency (DTMF) entry will be enabled in some parts of the system to allow a user 1 to enter information via the telephone keypad rather than by speech. For example during the data request sequence if the user 1 is prompted to spell the drug name because the spoken drug name has not been understood then the system may be enabled to allow the user 1 to spell the drug name by inputting key strokes on the telephone handset.

Speaker timeouts, where no speech is detected during a specified time-frame, are handled by issuing time-out specific prompts. For example, the VRU 100 may repeat the last given instruction, or the system may terminate the call whilst at the same time clearing all necessary variables and reinitialising the thread ready for the next call.

The system may allow for user barge-in where a user 1 may answer a specific prompt before completion of the prompt message by the VRU 100. This is particularly useful for experienced users who know the call-flow sequence and can pre-empt the prompts. Detection of user barge-in will result in any active

or pending prompts being cancelled as well as commencement of speech recognition to detect the user's response during the barge-in.

5 Detection of user hang-up will result in the system properly logging out, independent of the current state of the call-flow. An exception to this would be hang-up detection prior to completion of the account/validation operation at the beginning of the call-flow. Should hang-up occur prior to account
10 logon, the given thread will simply return to an idle state to await another call.

A "help" function may be provided wherein the user may call "help" at any point during the call-flow for the provision of automated assistance in the form
15 of, for example, additional and/or more explicit prompts.

Advantageously, the system of the present invention is able to recognise a large variety of words, phrases and sentences spoken by the user 1.
20 There is therefore no need to use extensive prompts in which all possible options must be listed, to each of which the user 1 must give an answer such as "yes", "no", or enter a number on the telephone keypad. Instead the user 1 may specify the information they
25 require or provide information to the system using words and phrases which directly correspond to record names, variable names or file names stored in the database 200. For example, the drug name may be specified directly by the user 1 using its proper
30 name, which equates to field DrugName in record Drug 213, rather than using a serial or other identification number or waiting for the system to list all possible drug names.

It is to be understood that the present invention
35 is not restricted to use with a PSTN network but may equally be used with other types of public telephony system.

The system may have more or less than twenty-four telephone lines linking it to the PSTN
40 400.

Whilst the operation of the system has been described in detail with reference to requests for information on medical drugs, it is to be understood that the system may be used to provide textual,
5 graphic or any other form of data or information on any topic, medical or non-medical, where it is preferable for the user 1 to provide more information than simple yes-no answers, or answers to multiple-choice questions.

Claims:

1. System for providing information on request to a
5 user over a public telephone network, the system
comprising an information database, facsimile
transmission means, voice recognition means, and means
for connecting the system, in use, to the public
telephone network to receive user requests for
10 specified information from the user made via a
telephony device connected to the telephone network,
further comprising computer control means programmed
to control the voice recognition means, information
database and facsimile transmission means such that on
15 recognition by the voice recognition means of a user
request for specified information, said specified
information from at least one data file stored in the
information database corresponding to the user request
is transmitted by the facsimile transmission means to
20 the user via the telephone network.

2. System as claimed in claim 1 wherein the voice
recognition means is provided with means for
connecting it to multiple telephone lines of a public
25 telephone network.

3. System as claimed in claim 1 or claim 2 wherein
the voice recognition means and information database
are connected via an Ethernet local area network.
30

4. System as claimed in any previous claim wherein
the computer control means comprises at least one
server on which the information database and facsimile
transmission means are hosted.



5. System as claimed in any previous claim wherein the voice recognition means comprises speech recognition hardware and/or software for the detection
5 of verbal user requests.

6. System as claimed in any previous claim wherein the voice recognition means comprises means for detection of user requests utilising dual tone
10 multiple frequency (DTMF) signals or other non-verbal signals.

7. System as claimed in any preceding claim wherein the connection between the information database and
15 voice recognition means is an open database connectivity (ODBC) compatible connection.

8. System as claimed in any preceding claim wherein the information database is a relational database.
20

9. System as claimed in claim 8 wherein the relational database stores information in one or more of the file formats ".tiff", ".gif", ".jpg", ".pdf", ".txt" and ".rtf".
25

10. System as claimed in any preceding claim further comprising fax-logger means for recording information on the outcomes of attempted facsimile transmissions.



11. A method of providing information on request to a user over a public telephone network comprising the steps of detecting a user request for specified
5 information communicated via the telephone network, processing the user request, accessing at least one data file stored in an information database corresponding to the requested information, and
10 sending a facsimile transmission of the specified information from the at least one data file to the user via the telephone network.

12. A method as claimed in claim 11 wherein the user requests are spoken as words, phrases or sentences.

15 13. A method as claimed in claim 11 wherein the user requests are spoken letter by letter.

14. A method as claimed in claim 11 wherein the user requests utilise dual tone multiple frequency (DTMF)
20 signals or other non-verbal signals.

15. A method as claimed in any of claims 11 to 14 wherein the user requests comprise record name,
25 variable name or file name parameters utilised by the database.

16. A method as claimed in any of claims 11 to 15 wherein the user request is processed after validation
30 of at least one of a user account name, a personal identification number and a password.



17. A method as claimed in any of claims 11 to 16 wherein context-sensitive voice prompts are provided to the user.

5 18. A method as claimed in claim 17 wherein the user is prompted to indicate whether any alternative data files are required.

10 19. A method as claimed in claim 17 or claim 18 wherein user barge-ins are permitted.

15 20. A method as claimed in any of claims 17 to 19 wherein a user input of "help" or similar may be used at any time to obtain additional and/or more explicit voice prompts.

20 21. A method as claimed in any of claims 11 to 20 wherein the at least one data file is transmitted to a default facsimile number stored in the database for a particular user.

25 22. A method as claimed in any of claims 11 to 21 wherein the user may specify a facsimile number to which the at least one data file is transmitted.

23. A method as claimed in any of claims 11 to 22 wherein a fax-logger records information on the outcomes of attempted facsimile transmissions.

30 24. A method as claimed in any of claims 11 to 23 wherein the database contains information relating to medicinal drugs, treatments or conditions.

