

- 1 -

**A SYSTEM AND METHOD FOR AUTOMATED ORDERING OF
COMMODITIES**

5 The present invention relates to an automated
ordering system for commodities, in particular for
medical drugs. More particularly there is provided a
system for the ordering of medicinal drugs from
multiple suppliers in an efficient manner.
Information regarding the commodities on sale is held
10 on a database accessible over a public telephone
network and the system is operable by means of
recognition of the user's speech.

15 Medical professionals, including nurses,
pharmacists and doctors, regularly need to order
medicinal drugs from multiple suppliers.

Presently, whenever fresh stocks of drugs are
required the medical personnel must either complete
and despatch substantial documentation to their
suppliers or, more usually, telephone a large number
20 of different suppliers which involves locating many
telephone numbers and speaking to many individual
people. Where the medical facility is small, e.g. a
lone doctor and one nurse, time and resources are
wasted ordering the drugs rather than being spent on
25 tending to patients. Also, where the medical facility
is large, a host of different drugs will be required.
In certain markets, each drug may be distributed by a
different supplier. In order to keep all required
drugs in stock, significant effort must be expended
30 either directing the aforesaid paperwork to the
relevant supplier and to ensure that the paperwork is
in the correct form acceptable to each supplier or in
telephoning the many different suppliers.

35 According to the present invention there is
provided a system for ordering commodities over a
public telephone network, the system comprising a
database, transmission means, voice recognition means,

and means for connecting the system, in use, to the public telephone network to receive user commands for commodity orders from the user made via a telephony device connected to the telephone network, further
5 comprising computer control means programmed to control the voice recognition means, database and transmission means such that after recognition by the voice recognition means of one or more user commands relating to one or more commodity orders, one or more
10 order requests for said commodities are automatically transmitted by the transmission means to one or more suppliers of said commodities via the telephone network.

There is also provided a method of ordering
15 commodities over a public telephone network comprising the steps of detecting one or more user commands for one or more commodities communicated via the telephone network, processing the user commands, accessing a consolidated commodity list stored in a database, and
20 automatically transmitting orders for said commodities to one or more suppliers of said commodities via the telephone network.

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

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

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

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

Figure 4 is a flow chart of a typical drug ordering sequence according to the present invention;

35 Figure 5 is a flow chart of a typical data capture operation according to the present invention; and

Figure 6 is a flow chart of a typical fax-out sequence according to the present invention.

SUMMARY OF THE INVENTION

5 One aspect of the invention is an automated telephony-based system and apparatus allowing users to place orders for drugs by speaking their requests. In particular, it allows, in one call, a user to place
10 orders for multiple drug types sold by different suppliers. An order subsystem processes and dispatches the orders to the relevant suppliers by a suitable means such as email or facsimile transmission.

15 A server hosts a database containing the information concerning the drugs, drug suppliers, etc and the order subsystem at a remote location. A voice recognition unit (VRU) is connected to the database and also to the telephone network, for example, a
20 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 including the order subsystem.

25 An email system may be connected to the PSTN, which is used to transmit information to the user and suppliers in the form of an email messages. Alternatively, a facsimile unit may be used for this function.

DETAILED DESCRIPTION OF THE INVENTION

System Architecture

35 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
5 (cell) phone which transmits via 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 suitable voice
10 recognition software, such as the 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
15 the VRU 100 allowing 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 voice recognition software.

The VRU 100 is preferably PC server configured
20 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.

The VRU 100 exchanges information with a database
25 200. The database 200 contains a consolidated product list containing information on the drugs which may be ordered by the user 1. The consolidated product list includes drugs from multiple, unconnected suppliers. The information preferably includes not only drug
30 names (generic and brand), but also drug price information, a list of new drugs etc. The database 200 also contains information required by the order subsystem. For example, the information preferably includes not only the suppliers' postal addresses, but
35 also email addresses and facsimile numbers. The information in the consolidated product list is

updated in database 200 regularly as product updates are received from the suppliers.

5 The contents of the consolidated product list are provided to the user 1 by any suitable means, such as by hard-copy mail-shot, or in electronic form on a storage media such as a diskette, or over the Internet or via email systems. The information may be provided as plan listing or in the form of a searchable, relational database file, for example a Microsoft
10 Access (RTM) formatted file. The user 1 is then free to browse through the consolidated list at leisure and compare, amongst other variables, prices from different suppliers.

15 The VRU 100 and database 200 are connected using open database connectivity (ODBC) compatible connections over a local area network 201, such as an Ethernet Local Area Network (Ethernet LAN).

20 The database 200 is, in turn, connected to a transmittal unit 300 which operates to transmit the order information as required to the user and suppliers via the PSTN 400 in any acceptable format. The information may be sent by the transmittal unit 300 over the Internet using email using, for example, ".txt" formatted files. Other file formats may of
25 course be used. Preferably the email system, database and order subsystem functionality are provided by a single server 250.

30 Alternatively, a facsimile unit may be used utilizing ".tiff" formatted files. Other file formats which may be used include ".jpg", ".gif", ".pdf", ".txt" and ".rtf".

35 In the following description the transmittal unit 300 will be described, by way of example only, as an email system. However, it is to be understood that an facsimile unit may equally be used.

The email system 300 further comprises an email-logger which records details of successful and failed

transmission attempts in the database 200. The email-logger is controlled by suitable software, such as SpeechWorks Service Level Execution Environment application software.

5 The database 200 is preferably a relational database in which the drug and supplier information is stored as ".txt" formatted files, which is one of the standard formats used by email systems.

10 The database information, which includes information which may be sent to the user 1 and suppliers as well as information used internally by the system, such as user and account details, is stored in a directory structure containing the information in a number of records. Figure 2 shows a
15 typical structure for the database 200. The database 200 comprises an Account record 211; an EmailToSend record 212, a Drug record 213, three records used by the Email-logger, namely EmailSuccess 214, EmailRetry 215 and EmailFail 216, and three records used by the
20 order subsystem; namely OrderDetails, OrderSuccess and Orderfail. Other records may be used as required.

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

25 X(7) or 9(4,2)

 for example, where X represents any alphanumeric character. In the first example above the field is a string of 7 alphanumeric characters, e.g. 1234567. In
30 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.

 The Account record 211 contains fields for the
35 user's or supplier's account number, email address and personal identification number (PIN). The account number may be a fax number.

The EmailToSend record 212 contains fields for the date and time of sending the email message, the user's or supplier's account number and email address and the drug order summary.

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

10 The EmailSuccess 214, EmailRetry 215 and EmailFail 216 records all contain the same field types as the EmailToSend record 212.

The OrderDetails record 217 contains fields for the drug name, supplier reference, quantity ordered and any applicable bonus as well as other fields as desired.

15 The OrderFail record 218 contains fields for the date and time of transmission, supplier reference, user account number and reasons for the transmission failure.

20 The OrderSuccess record 219 contains fields for date and time of transmission, supplier reference, user account number, payment mode, urgency status as well as a number of other fields as desired.

MODE OF OPERATION

25 As described above, the VRU 100 is connected to the PSTN 400 by multiple channels. The VRU 100 administers each telephony channel as a dedicated "call-flow" thread. Creation and initialisation of
30 each thread occurs at start-up of the VRU 100 application. This differs from other arrangements 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
35 any initialisation latency when answering users' calls. Once initialised each call-flow thread is 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.

The system operation includes the steps of login,
5 drug ordering and data transmittal.

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 drug ordering sequence which begins after user login is completed. In the specific embodiment described the drug ordering sequence includes the stages of specifying drug name, dosage, quantity, required bonus and audio order confirmation.

In the first step 410 the VRU 100 requests the user 1 to say the drug name.

Following identification of the required drug name the VRU 100 requests at step 411 the user 1 to say the desired dosage, for example, tablet, liquid or other.

In the next step 412 the VRU 100 requests the user 1 to say the required quantity, for example two boxes, three bottles, one carton etc.

In the next step 413 the VRU 100 requests the user 1 to say whether any bonus applies to the specific order, for example 10% discount, buy two get one free etc.

In the next step 414 the VRU 100 plays back the order summary to the user 1 and requests them to confirm that the order is correct. If the order is not correct the VRU 100 moves back to step 410.

Checking routines as described above are used for each of the above steps.

After the user 1 has confirmed that the first order is correct the VRU 100 sends an instruction to the database 200 over the LAN 201 to insert a record OrderDetails 217 in database 200. The VRU 100 then checks at step 415 to see if the user requires any other drugs. If the answer is yes then the system repeats the drug ordering sequence from step 410 as described above.

When the final order has been placed the a drug order summary record (not illustrated) in the form of a ".txt" formatted file is created in database 200 containing a summary of all OrderDetail records 217.

The VRU 100 contains routines for checking that the words spoken by the user 1 are understood and match known words in the database 200. A typical data capture operation during the drug ordering sequence will now be illustrated in more detail, with reference to Figure 5, which illustrates the step of identifying the drug to be ordered and the checking routines employed by the system.

At step 510 a variable DrugRetry is set to equal one. In the next step 511 the VRU 100 requests the user 1 to say the name of the first drug that they wish to order. 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.

At step 512 the VRU 100 checks to see that variable DrugName is recognised. If DrugName is not recognised then 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 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 yes, then the VRU 100 moves to step 522 below. 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 back to step 518 and again asks for the user to spell the drug name. If the answer is yes, then the call is may be terminated at step 521, or an audio prompt is played indicating that the requested drug is not available, or the call may

be transferred to an operator. The number of allowed attempts at specifying the drug name may, of course, be varied as desired.

5 The VRU 100 sends an instruction at step 522 to the database 200 over the Ethernet LAN 201 to set field DrugName in record EmailToSend 212 to equal the variable DrugName provided by the user 1.

Similar checking routines are used for the other steps of the drug ordering sequence described above.

10 Once the drug ordering sequence is completed the VRU 100 checks that the email containing the drug order summary should be sent to the user's default email address. If the answer is yes, then the EmailNumber field in record EmailToSend 212 is set to
15 equal the field EmailNumber in record Account 211. An audio confirmatory message may be given to the user. If the answer is no, then the VRU 100 requests the user 1 to specify a different email address and this address is recorded as field EmailNumber in record
20 EmailToSend 212. Again, an audio confirmatory message may be given.

Figure 6 shows a typical transmittal sequence including the email transmission of the drug order summary to user 1. However similar routines are used
25 for the email transmission of the separate drug orders to the necessary suppliers.

The database 200 triggers the email system 300 to send the summary of the drug orders to the user 1 as a ".txt" formatted file from the database 200. The
30 email system 300 may contain self-checking routines to monitor the transmission outcome. These routines will now be described with reference to the transmission of the order summary to the user 1 but apply equally to the transmissions to the separate suppliers.

35 Database 200 sends record EmailToSend 212 to the email system 300. A counter variable EmailRetry is set to equal one at step 528. Subsequently, the email

system 300 accesses database 200 and acquires the relevant ".txt" formatted file for the drug order summary. The email system 300 then sends this ".txt" file at step 529 to the email address specified in
5 field EmailNumber of record EmailToSend 212. At step 530 the email system 300 checks to see if the message has been sent successfully. There may be a delay whilst receipt or fail messages are bounced back to the email system. If the answer is yes, then the
10 details of record EmailToSend 212 are entered in record EmailSuccess 214 of the email-logger at step 531. If the answer is no, then the variable EmailRetry is incremented by one at step 533, the details of record EmailToSend 212 are temporarily
15 stored in record EmailRetry 215 in the email-logger and at step 534 the email system 300 checks to see if variable EmailRetry is greater than three. If the answer is no, then the email system 300 retries to send the email message at step 529. If the answer is
20 yes, then the message is not sent and the details of record EmailToSend 212 are entered in record EmailFail 216 of the email-logger at step 535. The number of transmission attempts may, of course, be varied as desired.

25 Consequently, the email-logger may be used to analyse the proportion of email transmissions which are successfully completed. Also a system administrator may see if, for example, email transmissions are failing in particular to any
30 individual user or supplier.

The order subsystem divides the user's order into separate supplier components and inserts the appropriate OrderDetails record 217 for each supplier in the database which then triggers the email system
35 300 to send a each drug order to the relevant supplier as a ".txt" formatted file. The transmission and logging procedure is as described above except that

the records OrderDetails 217, OrderSuccess 219 and OrderFail 218 are used rather than EmailToSend 212, EmailSuccess 214 and EmailFail 213.

5 The system can incorporate an acknowledgement service wherein each supplier, on receipt of their respective order, sends an acknowledgement via facsimile, email, pager, short messaging service (SMS) or equivalent to the database 200 and/or directly to the user 1.

10

Asynchronous Events

15 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.

20 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.

25 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.

30 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.

35 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.

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 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 of, for example, additional and/or more explicit prompts.

A "goodbye" function may be provided wherein the user may say "goodbye" or similar at any point in the call-flow in order to terminate the call.

A "usual order" function may be provided wherein the user may say "usual order" or similar to place an order for a consignment of drugs which has previously been ordered by the same user. This is beneficial in speeding up the ordering of routinely required drugs, especially for large volume users such as clinics and hospitals.

Advantageously, the system of the present invention is able to recognise a large variety of words, phrases and sentences spoken by the user 1. 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 drugs they 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 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 is not restricted to use with a PSTN 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 400.

Whilst the operation of the system has been described in detail with reference to the ordering of medical drugs, it is to be understood that the system may be used to order other commodities 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. A system for ordering commodities over a public telephone network, the system comprising a database,
5 transmission means, voice recognition software, and means for enabling the system to be connected, in use, to the public telephone network to receive user commands for commodity orders from the user made via a telephony device connected to the telephone network,
10 the system further comprising computer control means programmed to control the voice recognition software, database and transmission means such that after recognition by the voice recognition software of at least one commodity order made by a user relating to
15 at least one commodity, at least one order request for said at least one commodity is automatically transmitted by the transmission means to a supplier of said commodity via the telephone network.
- 20 2. A system as claimed in claim 1 wherein the computer control means comprises an ordering subsystem to group commodity orders for commodities supplied by each supplier in a single order request.
- 25 3. A system as claimed in claim 1 or claim 2 wherein means are provided for transmitting a commodity order summary to the user.
- 30 4. A system as claimed in any previous claim wherein the voice recognition software is provided with means for connecting it to multiple telephone lines of a public telephone network.
- 35 5. A system as claimed in any previous claim wherein the voice recognition software and database are connected via a local area network.



- 5 6. A system as claimed in any previous claim wherein the computer control means comprises at least one server on which the database and transmission means are hosted.
- 10 7. A system as claimed in any previous claim wherein the voice recognition software comprises speech recognition hardware and/or software for the detection of verbal user commands.
- 15 8. A system as claimed in any previous claim wherein the voice recognition software comprises means for detection of user commands utilising dual tone multiple frequency (DTMF) signals or other non-verbal signals.
- 20 9. A system as claimed in any previous claim wherein the connection between the database and voice recognition means is an open database connectivity (ODBC) compatible connection.
- 25 10. A system as claimed in any previous claim wherein the database is a relational database.
- 30 11. A system as claimed in claim 10 wherein the relational database stores information in one or more of the file formats ".tiff", ".gif", ".jpg", ".pdf", ".txt" and ".rtf".
- 35 12. A system as claimed in any previous claim further comprising logging means for recording information on the outcomes of attempted transmissions.
13. A system as claimed in any previous claim wherein the transmission means is a facsimile machine.



14. A system as claimed in any of claims 1 to 12 wherein the transmission means is an email system.

5 15. A method of ordering commodities over a public telephone network comprising the steps of detecting at least one user command for at least one commodity communicated via the telephone network, processing the at least one user command, accessing a consolidated commodity list stored in a database, and automatically
10 transmitting orders for said commodities to one or more suppliers of said commodities via the telephone network.

15 16. A method as claimed in claim 15 wherein the user commands are spoken as words, phrases or sentences.

17. A method as claimed in claim 15 wherein the user commands are spoken letter by letter.

20 18. A method as claimed in claim 15 wherein the user commands as provided by dual tone multiple frequency (DTMF) signals or other non-verbal signals.

25 19. A method as claimed in any of claims 15 to 18 wherein the user commands comprise record name, variable name or file name parameters utilised by the database.

30 20. A method as claimed in any of claims 15 to 19 wherein the user commands are processed after validation of at least one of a user account name, a personal identification number and a password.

35 21. A method as claimed in any of claims 15 to 20 wherein context-sensitive voice prompts are provided to the user.



- 19 -

22. A method as claimed in claim 21 wherein user barge-ins are permitted.

23. A method as claimed in claim 21 or claim 22
5 wherein a user input of "help" or similar may be used at any time to obtain additional and/or more explicit voice prompts.

24. A method as claimed in any of claims 21 to 23
10 wherein a user input of "usual order" or similar may be used at any time to place a repeat order for commodities previously ordered by the same user.

25. A method as claimed in any of claims 15 to 24
15 wherein a commodity order summary is transmitted to a default facsimile number stored in the database for a particular user.

26. A method as claimed in any of claims 15 to 25
20 wherein the user may specify a facsimile number to which a commodity order summary is transmitted.

27. A method as claimed in any of claims 15 to 26
25 wherein logging means records information on the outcomes of attempted transmissions.

28. A method as claimed in any of claims 15 to 27 wherein the commodities are medicinal drugs.