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(54) **DATA TRANSMISSION CAPTURE IN SUPPORT OF MEDICATION PREPARATION**

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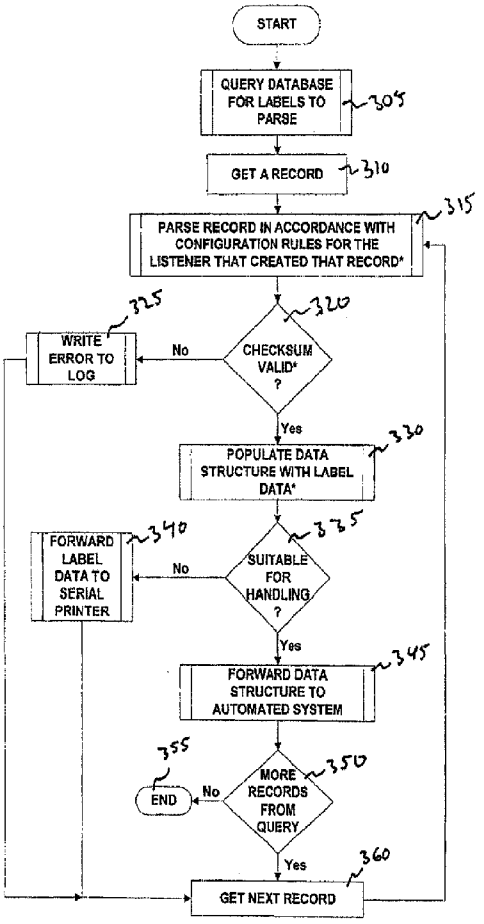
(57) **ABSTRACT**

A method and software interface enables selective processing of data transmissions containing one or more medication orders intended for a pharmacy. Data transmissions are monitored and parsed for prescribed information which is utilized to populate a prescribed data structure, The data structure and parsing rules can be associated with a specific source that can be determined from the data transmission. The parsed data is tested against an order database to determine suitability for automated handling. If suitable, the medication preparation system prepares the medications identified by the data. Those portions of the data that are not suited for automated handling are released (e.g., from the parser). Further verification can be performed by determining the source of the data transmission and verifying it as a valid source, Data transmissions can be monitored over a network, within a network component, or in cooperation with another software program.



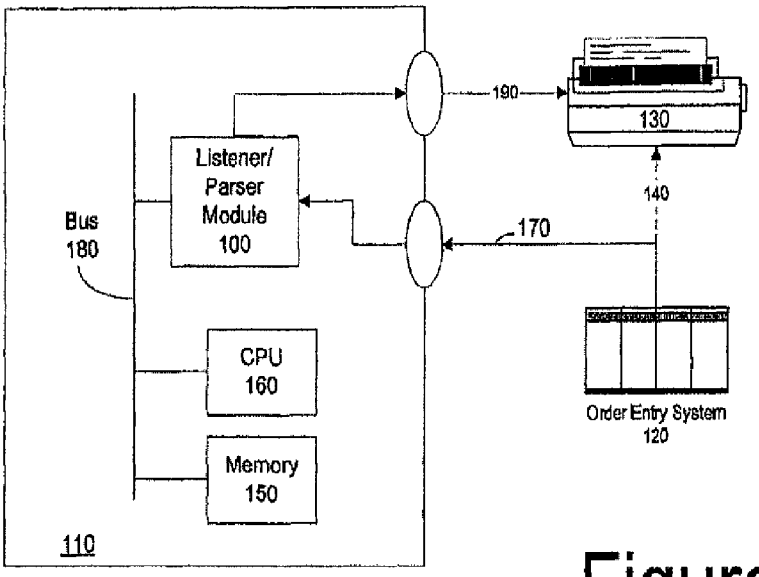


Figure 1

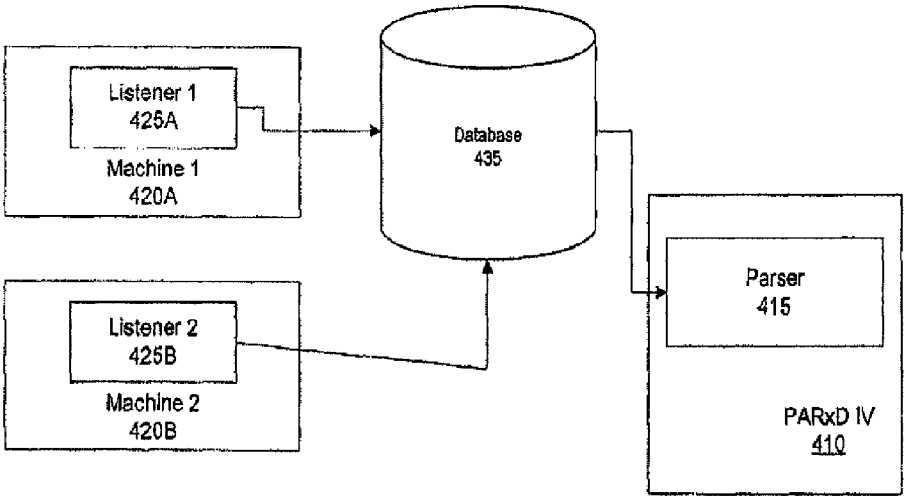


Figure 4

FIG. 2

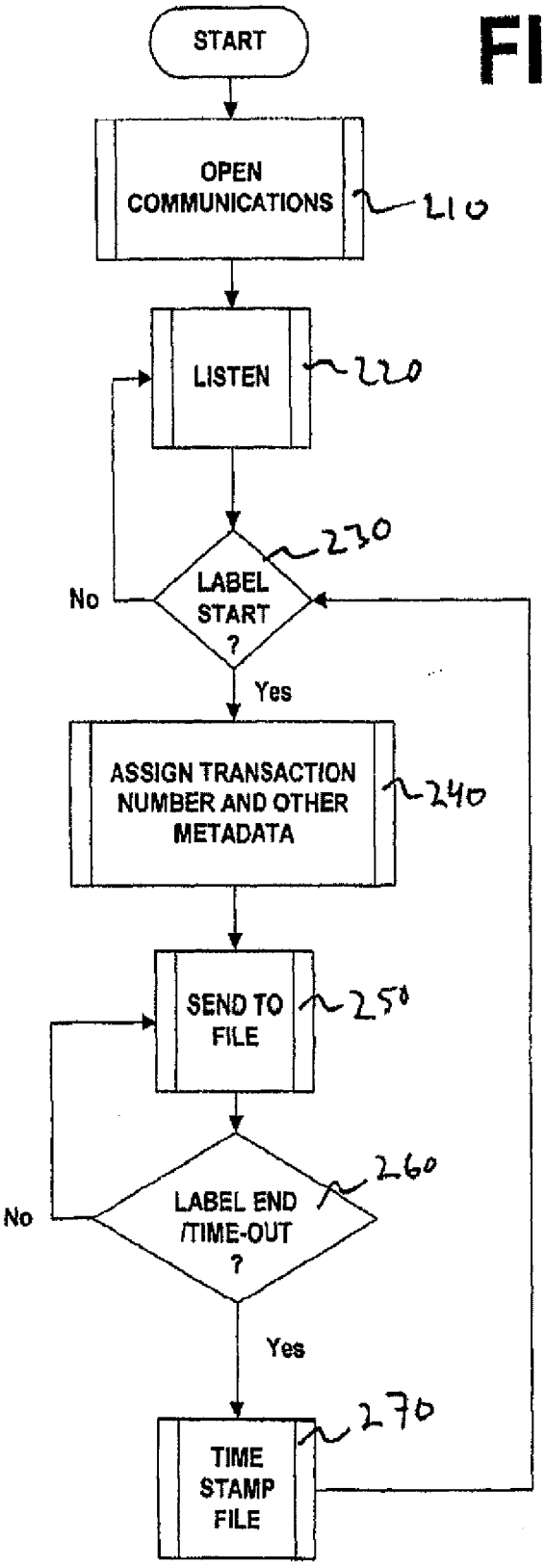
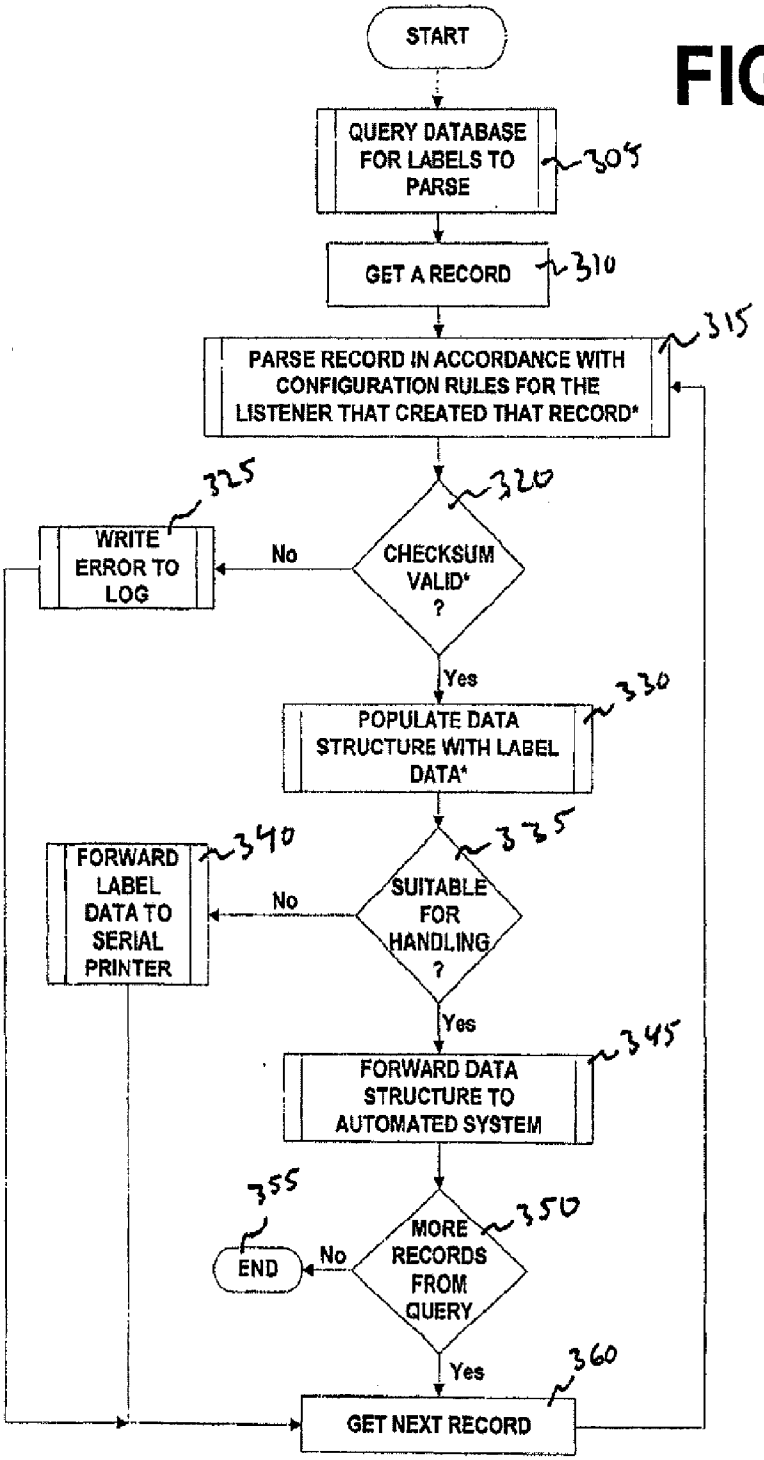

START
OPEN COMMUNICATIONS
210
LISTEN
220
230
LABEL START ?
No
Yes
ASSIGN TRANSACTION NUMBER AND OTHER METADATA
240
SEND TO FILE
250
LABEL END /TIME-OUT ?
260
No
Yes
TIME STAMP FILE
270

FIG. 3


START
QUERY DATABASE FOR LABELS TO PARSE
305
GET A RECORD
310
PARSE RECORD IN ACCORDANCE WITH CONFIGURATION RULES FOR THE LISTENER THAT CREATED THAT RECORD*
315
CHECKSUM VALID* ?
320
No
WRITE ERROR TO LOG
325
Yes
POPULATE DATA STRUCTURE WITH LABEL DATA*
330
SUITABLE FOR HANDLING ?
335
No
FORWARD LABEL DATA TO SERIAL PRINTER
340
Yes
FORWARD DATA STRUCTURE TO AUTOMATED SYSTEM
345
MORE RECORDS FROM QUERY
350
No
END
355
Yes
GET NEXT RECORD
360

DATA TRANSMISSION CAPTURE IN SUPPORT OF MEDICATION PREPARATION

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 09/991,048 entitled "Serial Data Capture Processing," U.S. Pat. No. 7,096,212, which is hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to monitoring of data interfaces and network components and, more specifically, to data transmission capture that permits data configuration in support of medication preparation.

BACKGROUND OF THE INVENTION

[0003] The task of integrating multiple systems into a computer network is often associated with custom programming and delays. This is particularly true when dealing with proprietary network components such as may often be found in hospital environments. For example, hospital information systems are conventionally employed to manage patient data and input medications that are to be administered to a patent. An electronic hospital information system typically must interact with an electronic pharmacy system within an automated facility, the interface between these two systems requires that the software communicate and process the data appropriately. When integrating a new network component into an existing system, the software providers of each system must meet and agree upon specifications prior to even establishing a project timetable, in order to ensure that the necessary communications and processing needs are met. This is attendant with great expense and difficulty.

[0004] On the other hand, most hospital information systems and pharmacy systems send data to label printers that identify a patient, a medication to be administered, the time of administration, contra-indications, and other data. It makes no difference whether the label printer is a local or network device. Thus, one way of obtaining a reliable data stream from one system for importing into another is to capture the data that is intended to be printed to a label. However, in order to operate on this data, subsequent processing is required. The electronic transmission of data through hospitals has resulted in the integration on various messaging systems, data storage, and order processing. In some environments, a printed label may not be generated from an order. Rather, the order can remain in an electronic format.

[0005] The invention can provide improvements in device interaction by initiating tasks in response to the receipt of data at a serial port that parse and manage the information in that data stream for handling by other network devices. In further aspects, the invention can identify label data in a serial data stream and divide the label data into a first stream that launches automated medication preparation processes and a second stream that is redirected to a conventional printer. According to yet a further aspect of the invention, data transmission between network components or locally to a network device can be monitored and processed regardless of format.

SUMMARY OF THE INVENTION

[0006] In accordance with one aspect of the invention, a method for selectively trapping data streams intended for a pharmacy comprises the steps of: trapping a printer output stream of an order entry system; parsing the output stream for prescribed information; testing the parsed output stream against an order database to determine suitability for automated handling by a medication preparation system associated with the pharmacy; and releasing only those portions of the output stream that are not suitable, the released output stream being printed for manual handling.

[0007] In a particular embodiment of the invention, the foregoing method includes additional steps of populating a data structure with data parsed from the printer output stream in accordance with a set of configuration rules. In another embodiment, the printer output stream can identify its source so that the parsing step can parse the printer output stream in accordance with a set of configuration rules for that source. In a particularly preferred embodiment, the printer output stream is saved as a record or logged in a database. In this preferred method, metadata can be associated with the output stream to assist in further processing. Thus, for example, the metadata can identify the source of the printer output stream and include that source data for each record for use in parsing the printer output stream. The metadata can also include a marker indicative of whether a given record has been parsed, with the marker being used in database queries to locate a subset of records that have been marked as not yet having been parsed. The data in the record can be used to populate the data structure, as described above. It should be understood, however, that printer output streams and, more generally, serial data streams, can be managed by the methods of the present invention whether saved in a database or operated upon on the fly.

[0008] In accordance with another aspect of the present invention, a serial data interface is provided which comprises: at least one listener software module ("LSM") executing on a first machine, the LSM receiving serial data streams from a port of the first machine; a parser software module ("PSM") communicatively connectable to the LSM and executing on a second machine, the PSM processing the serial data streams received from the LSM to extract data therefrom and populate a data structure therewith; and a set of configuration rules accessible by the PSM, the set of configuration rules defining the manner of processing by the PSM on the serial data streams from a prescribed LSM, wherein the data structure enables data handling by an automated medication preparation system.

[0009] Depending on the complexity or needs of a given implementation, the PSM and LSM can execute on the same machine. In a preferred embodiment, the serial data stream identifies a particular LSM and the set of configuration rules used for processing the serial data stream is selected for the identified LSM. As in the method above, embodiments can save the received serial data streams as records in a database or operate on the data as it comes in over a port of the machine, and preferably utilize metadata of the type mentioned above and described more fully hereinbelow.

[0010] In accordance with yet a further aspect of the present invention, data transmissions of an order entry system for a pharmacy can be monitored and selectively processed. Each data transmission can have an identifiable source. The data transmissions are parsed in accordance with a set of configuration rules that can be associated with a particular source. The parsed data is used to populate a data structure in further accordance with the configuration rules. Suitability for automated handling by a pharmacy's medication preparation system is determined by comparing the parsed data stream against and order database. If the data stream is suitable for

automated handling, the medication preparation system prepares one or more medications according to the data contained within the stream. If a portion of the data stream is not suitable for automated handling, that portion is released for manual handling.

[0011] In accordance with further features of the present invention, the source of the data transmission can be determined and verified as a trusted or valid data source. If the source of the transmission is verified, then the data stream is processed to determine suitability for automated handling.

[0012] These and other aspects, features, steps and advantages can be appreciated further from the accompanying Drawing Figures and Detailed Description of Certain Embodiments.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0013] FIG. **1** is a functional block diagram of a software listener and parser module in accordance with an exemplary embodiment, and further illustrating its functional connections to a computer network.

[0014] FIG. **2** is a flow diagram illustrating the operation of an exemplary embodiment of a listener software module (LSM).

[0015] FIG. **3** is a flow diagram illustrating the operation of an exemplary embodiment of a parser software module (PSM).

[0016] FIG. **4** is a distributed hardware arrangement in which the PSM is responsive to multiple LSMs.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

[0017] By way of overview and introduction, the present invention provides a software interface that enables a network device to emulate a printer that is attached to a network serial port in order to trap and filter serial data for automated handling by downstream equipment. Externally, the interface exposes itself as a printer device that receives serial print strings, traps the data into a buffer or data store, parses the print string to extract data, and outputs the extracted data into a format usable by the network device. Preferably, the parsing routine is configurable to handle a variety of different data streams thereby permitting the interface to be used with standard networks and network devices without programming their respective output and input streams.

[0018] In a preferred implementation, the serial interface is used to bridge a hospital information system to an automated medication preparation station. The hospital information system, in response to operator input or a program resident in that system, generates a stream of output data pre-configured to print onto labels. Ordinarily, this output stream is directed to a printer in a local or on-premises pharmacy and is used to prepare medications. The label is thereafter applied to the preparation. The preferred embodiment of the invention provides a configuration routine that permits an installer to configure a set of rules by which a parser software module (described below) locates the start and end of the data for each label, as well as discrete data elements within the label data. The configuration routine thereby allows a user to configure messages that pass through the interface to be properly parsed for a given pharmacy system. Because users ordinarily can format labels for pharmacy systems as desired, both the structure of the incoming message to the pharmacy system and the rules for parsing these messages are field configurable, thereby providing great flexibility to the interface of the present invention.

[0019] In the preferred implementation, both the listener and the parser are included on the same machine within an automated medication operation system to provide an interface to an order entry system ("OES"). An exemplary automated medication operation is the PARxD IV medication preparation system of For Health Technologies, Inc., Oklahoma City, Okla., which prepares syringes for intravenous introduction. An exemplary OES is the PharmNet Millennium hospital information system of Cerner Corporation, of Kansas City, Mo. The PARxD IV is a software-controlled medical device that receives and manufactures orders for syringes for future (batch) or current (new order) production. The PARxD IV device contains knowledge about how the syringes are to be prepared (final dose volume, diluents, etc.) and so the incoming order from the OES need only specify the drug and dose to be delivered, the patient name, the location of the patient, and other administrative information that may be of use to have on the syringe label.

[0020] With reference now to FIG. **1**, a functional block diagram of a software listener and parser module **100** is shown within an automated medication preparation system **110** that may be used within a pharmacy or other formulary. In conventional pharmacies in which the automated system **110** is not present, an OES **120** located somewhere in the building sends new and batch orders for drugs to a label printer **130** over a serial data communication connection **140**. For example, the OES **120** has an RS-**232** serial port for one-way data communication over the link **140** to a standard printer **130** fitted with paper or, more typically, adhesive labels. However, in accordance with the present invention, the automated system **110** is fitted with listener software, described below, that is preferably running resident in the automated system **110**, for example by being loaded into a memory **150** and executed by a central processing unit ("CPU) **160**. The automated system **110** is connected directly or through a computer network to the serial port of the OES **120** through a one-way communication connection **170**. The listener module manages data received across the connection **170**, for example, through a data bus **180** within the automated system **110**. The serial data on connection **170**, the CPU **160**, the memory **150** and the listener module **100** are preferably all communicatively coupled to the data bus **180**.

[0021] The arrangement of FIG. **1** provides a listener module and a parser module together at the automated system **110**, but these modules can be resident in different machines, as described below in connection with the arrangement of FIG. **4**. The parser module operates on the data received from the OES **120** to selectively cause the automated system **110** to manufacture drug dosages for administration to patients or to reject the data as not suitable for handling. Thus, depending on the configuration of the automated system **110**, the parser can cause the automated system to prepare intravenous doses, oral doses, or doses suitable for specific therapies such as chemotherapy. Typically, the automated system **110** is configured to prepare only one of these dosages types and so any dosage form outside the system's configuration (e.g., tablets) is rejected as not being suitable for handling. Those drug orders that are not suitable are sent to the label printer **130** as a serial data output stream **190**. Consequently, the listener/parser module **100** enables drug orders to be better managed, with those susceptible to automated preparation being pre-

pared without user intervention and with only those drug orders that are not suitable for the automated system **110** being sent to the label printer. This arrangement thereby reduces the number of drug orders that require manual handling, determines which orders require manual handling, and provides a filtered output stream **190** at the label printer **130** consisting of only those jobs that require manual handling.

[0022] The operation of the listener software module and the parser software module are described with reference to FIGS. **2** and **3**, respectively.

[0023] The listener software module opens a serial communications channel on a serial port of the automated system **110** at step **210**. For example, the listener module can be communicatively connected with the port making the connection **170** to the OES **120**. Once communications have been opened, the listener software module (LSM) listens to that serial port for any data, at step **220**. Preferably, drug orders are preceded by a character or character string that marks the beginning of a serial data stream. The LSM continuously tests to see whether a beginning-of-string character is detected at step **230**, because such character or string denotes the start of label data. If a beginning character is not detected, then the LSM loops back to the listening step **220**. On the other hand, if the start of a label is detected, then the serial data is written to a database together with (e.g., by appending) metadata.

[0024] As soon as the output stream is written to the database, the database assigns a unique transaction number, at step **240**, to a newly opened log entry or record that will contain the incoming serial data. The LSM generates other data that is written to each log entry including the date and time of the transaction, the name assigned to the particular LSM that is writing the new database record, the serial data itself (sometimes referred to as "transaction text"), a marker to indicate whether the record requires parsing, a reference pointer that permits one database record to refer to another (e.g., for error checking purposes), and error condition information concerning errors that were observed on the communications line **170** during data transfer. This information is assigned to the transaction at step **240** as well. All of this information can be reviewed, if desired, using a viewer that displays each log entry together with any error messages that might have been generated or associated with a particular database record.

[0025] At step **250**, the serial data itself is written to the record that was opened at step **240**. The serial data continues to be written to that record until a label with an end-of-string character is detected or until a time-out event (e.g., end-of-message reached if no activity for X milliseconds) is detected, at step **260**. Depending on the format of the data of received from the OES **120**, there may or may not be an end of data stream character delimiting the end of a particular drug order. In the absence on the specific end-of-string delimiter, one drug order can be distinguished from the next either by detecting a beginning-of-string character or by permitting a prescribed time period to pass since the last data came in. Until an end-of-string condition is determined, the serial data continues to be sent to the database at step **250** and the end-of-string test at step **260** is repeated. When the end-of-string condition is determined, the record is time stamped at step **270** and the process flow loops back to step **230** to determine if a beginning-of-string character has been detected. As a result of the foregoing steps, records are created in the database by the LSM.

[0026] With reference now to FIG. **3**, the operation of the parser software module (PSM) is described. At step **305**, the PSM queries the database for any data that is to be parsed (i.e., data records that are marked as requiring parsing). As noted above, the LSM engrafts metadata to the serial stream coming into the automated system **110** over the connection **170**. Part of the metadata includes a marker that tracks whether a given record has been parsed already (Parse="True") or not (Parse="False"). The marker can also be set to ensure that an error log entry is not parsed (by setting Parse to be "True" for that entry). The database query except **305** can take on a variety of forms, but generally selects all fields from the transaction log in which Parse="False." An index can be used to speed query processing, as understood by those of skill in the art. Essentially, the PSM uses the marker to determine which records have not been parsed, and returns a list of the labels that still must be parsed in order to fill all the drug orders (whether new or batch).

[0027] Using the returned list, a record is retrieved at step **310** and parsed by the PSM at step **315**. Parsing is conducted in accordance with configuration rules that have previously been established for that LSM. The configuration rules can accommodate a variety of data formats including fixed formats, name-value pairs, and XML formats. For example, if the serial data is in a fixed format, then the drug order data will have prescribed positions within the serial data stream such as a patient name occupying character positions 15-45 on the fourth line of the label or positions 15-45 on the same line of the label as the word "patient." As another example, if the serial data is in the name—value pair format, the data may be located between a variable delimiter ("<Patient>") and an end-of-line character (e.g., CR, LF or both). Also, because the particular LSM is preferably identified in the data record, multiple data formats can be accommodated by the PSM and properly parsed by selecting a suitable set of configuration rules. A set of configuration rules, therefore, enables proper parsing of the data from the printer output stream into the data structure used by the PSM to determine suitability for handling and handling of drug orders by the automated medication preparation system.

[0028] With brief reference to FIG. **4**, a distributed system **400** is illustrated in which the automated system **410** comprises the PARxD IV drug preparation system of For Health Technologies, Inc. The system **410** has a parser software module **415** executing as a resident software application on one machine. In this arrangement, there are two order entry systems, denoted **420**A and **42013**, comprising physically different machines than the one executing the PSM **415**. The OESes **420**A, **420**B also comprise physically distinct systems, such as an in-patient system and an outpatient system configured to service different patient sets. Each OES has its own LSM **425**A, **425**B, respectively, which writes data records having uniquely assigned transaction numbers to a database **435**. OES **425**A and **425**B can have different data formats, yet because each new data record identifies the source of the record (L1 or L2), the parser **415** can properly parse records as they are retrieved at step **315**.

[0029] Continuing the discussion of FIG. **3**, a test is made at step **320** to determine whether the data received from the OES was received correctly. For example, the test can ensure that the checksum was valid and check its type (Mod 43, 16-bit cycle redundancy check ("CRC"), 32 bit CRC, etc.). If the data entered into the data record did not write correctly, the error is written to the database at step **325**, for example as a

new log entry, and the next database record in the list is retrieved at step **360**. The new log entry preferably includes a reference pointer back to the log entry that had the error.

[0030] On the other hand, if the checksum were valid, then the transaction data is populated into a data structure at step **330**. The data structure is selected to be compatible with the automated system **110**, **410** and serves to assign each of the required data values with a variable. The variables that are included in the data structure can include, but are not limited to: the patient's name, location within the hospital or other institution, a drug code (e.g., the national drug code ("NDC"), the drug named in the drug order, the dose, the units, the administration date, the administration time, the order date, the order time, the checksum, any label comments, the order type (e.g. batch or new), and order frequency (e.g. "q6h6," for every six hours starting at 6 A.M.).

[0031] With the serial data now contained in the data structure of the automated system **110**, **410**, the drug order is tested at step **335** by the parser to see whether it is suitable for handling by the automated system. A given drug order is generally suitable for handling unless one of the following limited circumstances exists:

[0032] 1. The automated medication preparation system cannot recognize the drug code included in the drug order.

[0033] 2. The automated medication preparation system recognizes the drug code but does not handle the drug in the drug order and therefore cannot fill the drug order.

[0034] 3. The automated medication preparation system understands the drug code and ordinarily can fill the drug order, but does not have the required drug in stock at the present time.

[0035] 4. The parser encounters an error while parsing of the data.

[0036] Apart from these three circumstances, the test at step **335** should result in a determination that the drug order can be handled by the automated system. Preferably, the test for suitability for handling is made with reference to an order database that maintains tables of data concerning drug names and drug codes associated with those names in various dosages. In the event of the drug cannot be handled by the automated system, the next step **340** the drug order is forwarded to the label printer **130** for printing (e.g., onto an adhesive label) and manual handling by staff. If, however, the test that step **335** resulted in the determination that the drug order can be handled by the automated system, then the populated data structure is forwarded to the automated system for handling at step **345**. In sophisticated applications, the data structure can first be routed to a scheduler for queue handling in accordance with a prescribed priority. For example, a new order can be processed ahead of a batch order if the prescribed priority is "whether time permits" such routing. It should be understood that the step of determining whether the drug order is suitable for handling results in the drug order being automatically processed or, if not automatically processed, a label being generated for only those drug orders that cannot be automatically processed. This results in proactive and dynamic filtering of drug orders as they come in over serial data lines from order entry systems, in view of the capabilities of the automated systems and their current stock of medications.

[0037] At step **350**, a test is made to determine whether there are any more listed records to retrieve in response to the database query at step **305**. If there are no more records to retrieve, the process ends at step **355**. Otherwise, if there are more records, the next record is retrieved at step **360** and the process flow loops back to step **315** where the newly retrieved record is parsed in accordance with the configuration rules for the listener that created that record.

[0038] In operation, the PSM may return several different errors, each of which is preferably recorded as a log entry in the database. In the process flow of FIG. **3**, steps **315**, **320**, and **330** are marked with an asterisk ("*") to indicate the steps at which errors might be returned. In particular, if data is missing that was expected to be included in the transaction data or that was to be provided by the LSM, an error code could result at step **315**. If the checksum test at step **320** determines that the checksum is missing or does not match, an error code results and is written to the error log at step **325**. Also, if required data is missing, the parser will determine this when populating the data structure with the transaction data, at step **330**. Other errors can result which are not specifically noted above concerning interactions between the parser and one or more automated systems. A reference pointer to the problematic data record is preferably included whenever appropriate. A reference pointer is not appropriate, for example, when the error concerns a failure of the serial port or other hardware error.

[0039] It should be understood that the one-way serial listener interface lacks hand-shaking to permit confirmation that all information has been received intact from the OES. A more robust protocol such as HL7 over TCP/IP using a minimal lower layer protocol can be used, if necessary, to provide such confirmations.

[0040] The LSM is designed to trap a serial output stream of the type that is ordinarily sent to a label printer. This output stream is in the clear, that is, is non-proprietary, and includes critical information for preparing a medication. Thus, by trapping the output stream ordinarily intended for a label printer, the automated system can ensures compatibility with any hospital information system.

[0041] While the above discussion has focused on the capture and processing of serial data streams intended for printer devices in a hospital pharmacy, the present invention also can be used to monitor or listen to many varying types of network data transmissions between and among network components or to monitor data transmissions stored locally within a networked component regardless of whether the data is transmitted as serial data or to a serial port. As such, the invention can be adapted to capture, process, and automate the handling and preparation of medications using systems that are at least partially paperless or do not rely on printers for order management and fulfillment. Also, the invention can be adapted for use within an OES **120** that is not directed specifically to the printing of medication labels, but which more broadly is configured to manage the transmission and processing of medication orders, such as within or to a pharmacy. Data transmissions can be monitored between and among devices in communication over a network. Monitoring can be performed by the LSM between various network devices including similar devices (e.g., between computers) or between a dissimilar devices (e.g., computer and a networked printer). Thus, for example, data transmission can be monitored by a standalone network LSM positioned within a network to intercept or "sniff" (e.g., receive without affecting the data being transmitted) network communications. If a standalone component is used, it can be configured to relay suitable medication orders to a separate automated system **110**. Alter-

natively, the LSM can include software executing on one of the networked devices (e.g., the automated system **110**). For example, monitoring software can be programmed into the network protocol stack of a network device so as to intercept data transmissions when received, or after being received, by the device. Data transmissions can be intercepted covertly such that the application intended to receive the communication is unaware of the interception, or, alternatively, the data transmission interception can be known or publicized to other components in the system.

[0042] Alternatively, data transmissions can be monitored within a networked device in cooperation with another software application. For example, the LSM can include an email filter configured to monitor incoming email or monitor email contained in a specific set of folders. Monitored email messages can be parsed by the PSM to extract the data necessary to fulfill medication orders. In one particular configuration, an email program monitors email messages when or after they are received. The email message is parsed by the PSM and tested to determine if it is suitable for handling by the automated medication preparation system **110**. If the data contained within the message cannot be handled by the automated medication preparation system **110**, it is released to be handled by the email program in the ordinary manner in which such messages are handled (e.g., forwarded to a specific email address for manual processing).

[0043] In a further example of monitoring data transmissions between networked components, the LSM can include a software program configured to receive instant messages (e.g., AIM, Jabber, Yahoo Messenger, and ICQ) and/or monitor instant messages sent to a specific user for processing at a pharmacy. Monitoring can be performed in a manner similar to the monitoring of email as discussed above, with messages received by the IM software being parsed when or after they are received. Alternatively, an automated instant messaging software program ("bot") can be configured to act as the destination of messages containing medication order information. The bot can act as the destination (e.g., the interface to the automated system **110**), or alternatively can act as an intermediary that receives and distributes messages suitable for automated handling to the automated medication preparation system **110** and forwards messages that are not suitable for automated handling to a manual handling destination.

[0044] Data transmissions that are stored on a computer, for example files on a networked disk drive or File Transfer Protocol ("FTP") server, can be actively monitored by a software process. The process can poll a specific directory for new messages that contain data concerning medication orders. If a new file is present, the file can be processed in the above described manner thereby causing those portions of orders suitable for automated handling to be fulfilled by an automated medication preparation system and relaying the portions of orders not suitable for automated handling to a specified destination for manual fulfillment.

[0045] An order that is not suitable for automated handling can be forwarded to a specified destination for manual order fulfillment. In a particular implementation, the portions of a data transmissions that are unsuitable for automated processing are forwarded to a printer. In an alternative implementation, those portions of orders can be relayed in their original format, or transformed into a new format. For example, medication orders contained in a file on a networked disk drive that are unsuitable for automated handling can be converted into an email and sent to the appropriate address for manual fulfillment within the pharmacy.

[0046] Monitoring and processing of data transmission can be performed in a distributed environment, such as an environment having multiple order entry systems **120** and multiple automated medication preparation systems **110** or manual medication preparation stations. Thus, LSMs can exist at a variety of locations throughout the system. A particular LSM can listen to all data transmissions it receives, or it can be associated with a particular source or destination. Thus, the LSM can process all information it receives or filter the received data transmissions for its associated source or destination. Similarly, multiple PSMs can coexist within the environment. Each PSM can be associated with a particular medication preparation station (e.g., I.V. station or syringe station), and receive data transmissions designated for that station from one or more LSMs. Alternatively, PSMs can receive data transmissions from one or more LSMs and determine the designated medication preparation station after parsing the information. Thus, the invention can capture data transmissions in a variety of formats from a variety of sources, and distribute the information contained within the data transmissions to multiple machines configured to perform different tasks.

[0047] Regardless of how the data transmission is monitored, each transmission can be associated with the particular source from which it was sent. Each source can identify itself during data transmission or include its identity in the transmission. Alternatively, the system monitoring the information can record the source of the message. For example, if the messages are transmitted using a TCP/IP packet, the IP address of the source can be logged and associated with the transmission.

[0048] Other methods of source identification can be used alone or in combination. For example, email messages and instant messages identify the sender of the transmission. Further source identification can be accomplished by signing the data transmissions. In a particular implementation, cryptographic keys can be associated with the machines sending messages. These keys can be used sign outgoing messages such that the sender can be authenticated without further human action to authenticate the message.

[0049] Preferably, the source of the data transmission identified is authenticated by the automated system **110** as a valid source. Valid source ID's can be stored in the database **435** and compared with the source of the transmission. Alternatively, data transmissions that are signed can be authenticated through the user of a secure key server (not shown). The further processing of the data transmission can be predicated on the successful authentication of the source as a valid source. Thus, if the source is identified as invalid, the transmission can be logged, for example in the database **435**, and stored with the determined source for future analysis or processing.

[0050] Moreover, each data transmission can be logged whether the source is determined valid or invalid. The transmission can be logged in the database **435**, flat file, or by any other standard method known in the art. Various metadata and derivative data determined from analyzing the data transmission can be also be logged and associated with the logged data transmission. For example, the determined data source, parsed data, or any errors encountered while authenticating the source or parsing the data can be logged. Entries in the log

that include errors can be flagged for analysis manually or by secondary systems. The log, or portions of the log, can also be displayed to a user or printed for review. Additionally, the log can be filtered and searched to generate reports based on various criteria or to enable a user to find a specific set of entries.

[0051] While the invention has been described in detail with particular reference to certain embodiments thereof, the invention is capable of other and different embodiments, and its details are capable of modifications in various obvious respects. As would be readily apparent to those skilled in the art, variations and modifications can be affected while remaining within the spirit and scope of the invention. Accordingly, the foregoing disclosure, description, and Drawing Figures are for illustrative purposes only, and do not in any way limit the invention, which is defined only by the claims.

1-28. (canceled)

29. A method for processing data of an order entry system, the data comprising medication data and specifying at least one dose order of medication suitable to be delivered to a patient, comprising:

parsing, using a central processing unit, the data for prescribed information in accordance with a set of configuration rules;

determining, using the central processing unit with reference to an order database, suitability of the medication data in the parsed data for automated handling by an automated medication preparation system;

dividing the parsed data, using the central processing unit, into two mutually exclusive data comprising a first medication data that has been determined as being suitable for automatic handling by the automated medication preparation system and a second medication data that has been determined as not being suitable for automatic handling;

initiating a launch, using the central processing unit, of one or more automated medication preparation processes based on the first medication data to manufacture one or more doses that are suitable for delivery and administration to the patient, wherein each manufactured dose corresponds to the one or more medication data from the first medication data that was determined suitable for automated handling; and

directing, using the central processing unit, the second medication data, which was determined not suitable for automatic handling, to a printer as a filtered output consisting of only those jobs that require manual handling.

30. The method of claim **29**, further comprising:

monitoring the data of the order entry system comprising the medication data using the central processing unit.

31. The method of claim **30**, wherein the monitoring step comprises monitoring incoming messages associated with the data of the order entry system as a transmission from the order entry system.

32. The method of claim **31**, wherein the data has an identifiable source.

33. The method of claim **32**, wherein the set of configuration rules are associated with the identifiable source.

34. The method of claim **29**, wherein the second medication data directed to the printer specifies at least a drug and a dose.

35. The method of claim **34**, wherein the second medication data specifies a patient name corresponding to the dose order in the medication data included in the second medication data.

36. The method of claim **29**, further comprising:

determining whether the parsed data was received from the order entry system correctly;

writing an error to a database for parsed data that is in error; and

populating a data structure with a remainder of the parsed data, whereby parsed data not received correctly from the order entry system are not among the data in the populated data structure.

37. The method of claim **36**, wherein the data structure is compatible with the automated medication preparation system.

38. The method of claim **37**, wherein the data structure includes a plurality of data values assigned with a corresponding variable, wherein the plurality of data values comprise at least one of a patient name, a location, a drug code, a drug name, a dose, units, an administration date, an administration time, an order date, an order time, a checksum, label comments, an order type, and an order frequency.

39. The method of claim **38**, wherein the plurality of data values comprise each of a patient name, a location, a drug code, a drug name, a dose, units, an administration date, an administration time, an order date, an order time, a checksum, label comments, an order type, and an order frequency.

40. The method of claim **36**, wherein the first medication data and the second medication data include all of the data in the populated data structure.

41. The method of claim **36**, wherein the step of determining whether parsed data was received correctly includes reviewing data parsed from the order entry system in accordance with configuration rules associated with the data,

42. The method of claim **29**, wherein the one or more manufactured doses have a label applied to the dose in order to be suitable for delivery and administration to the patient.

43. The method of claim **29**, wherein none of the first medication data is included in the second medication data sent to the printer as part of the directing step.

44. The method of claim **29**, wherein the automated medication preparation system is configured to prepare one of intravenous doses, oral doses, or doses suitable for a specific therapy.

45. The method of claim **29**, further comprising saving the second medication data as a record in a database.

46. The method of claim **29**, wherein the data comprises medication data concerning a plurality of respective patients and specifies a corresponding plurality of dose orders of medication to be delivered to respective ones of the plurality of patients.

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