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(54) INFORMATION ENTRY MECHANISM FOR SMALL KEYPADS

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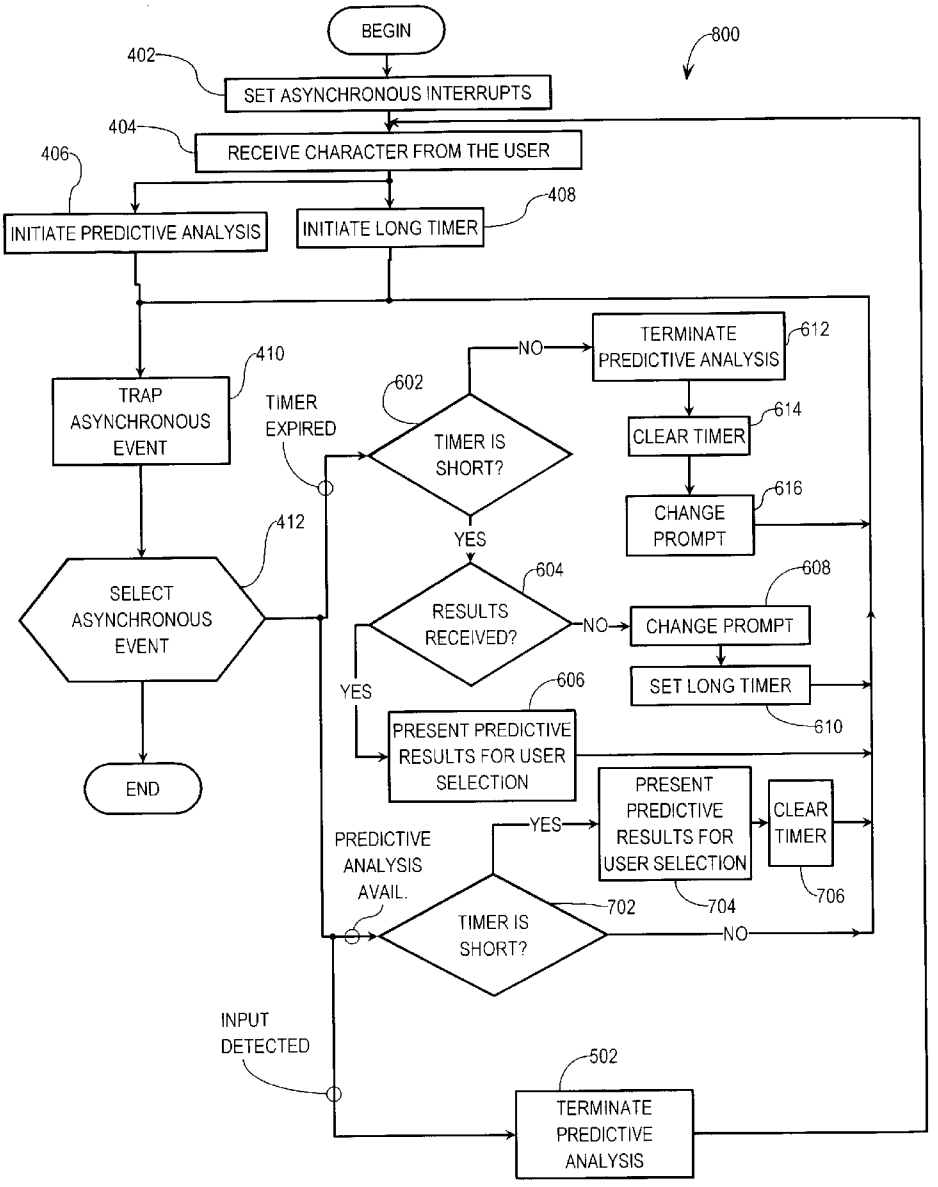
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(57) **ABSTRACT**

Presentation of results of a predictive analysis of text is delayed until entry of the text by a user is paused by a particular amount of time. The results are available for selection by the user for another particular amount of time. After the other particular amount of time is expired, the results are no longer available to for selection. If a particular result is selected, the selected result either replaces or supplements the entered text.



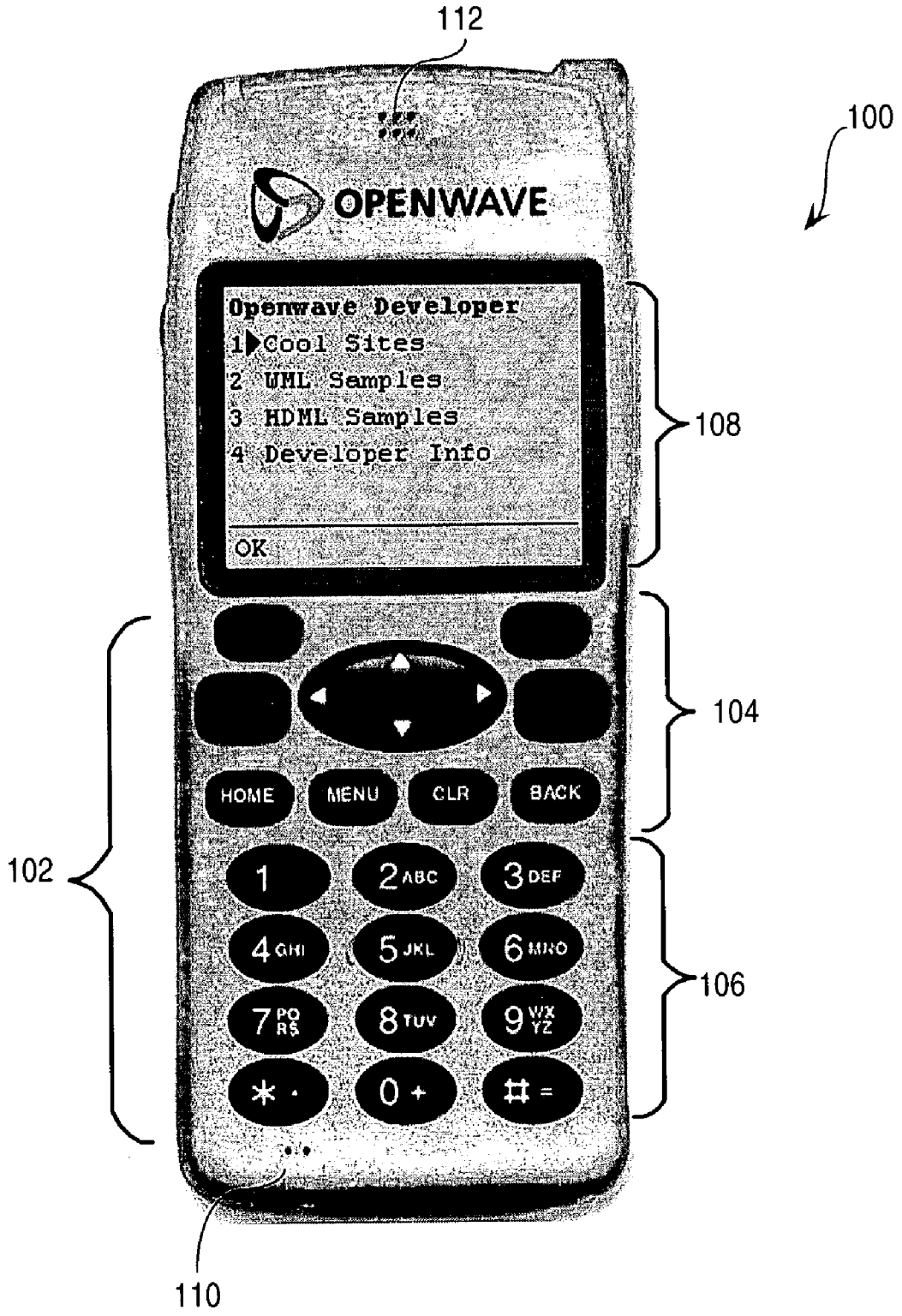

112
100
OPENWAVE
Openwave Developer
1 Cool Sites
2 WML Samples
3 HDML Samples
4 Developer Info
OK
108
104
HOME
MENU
CLR
BACK
102
1
2 ABC
3 DEF
4 GHI
5 JKL
6 MNO
7 PQ RS
8 TUV
9 WX YZ
* .
0 +
=
106
110

FIGURE 1

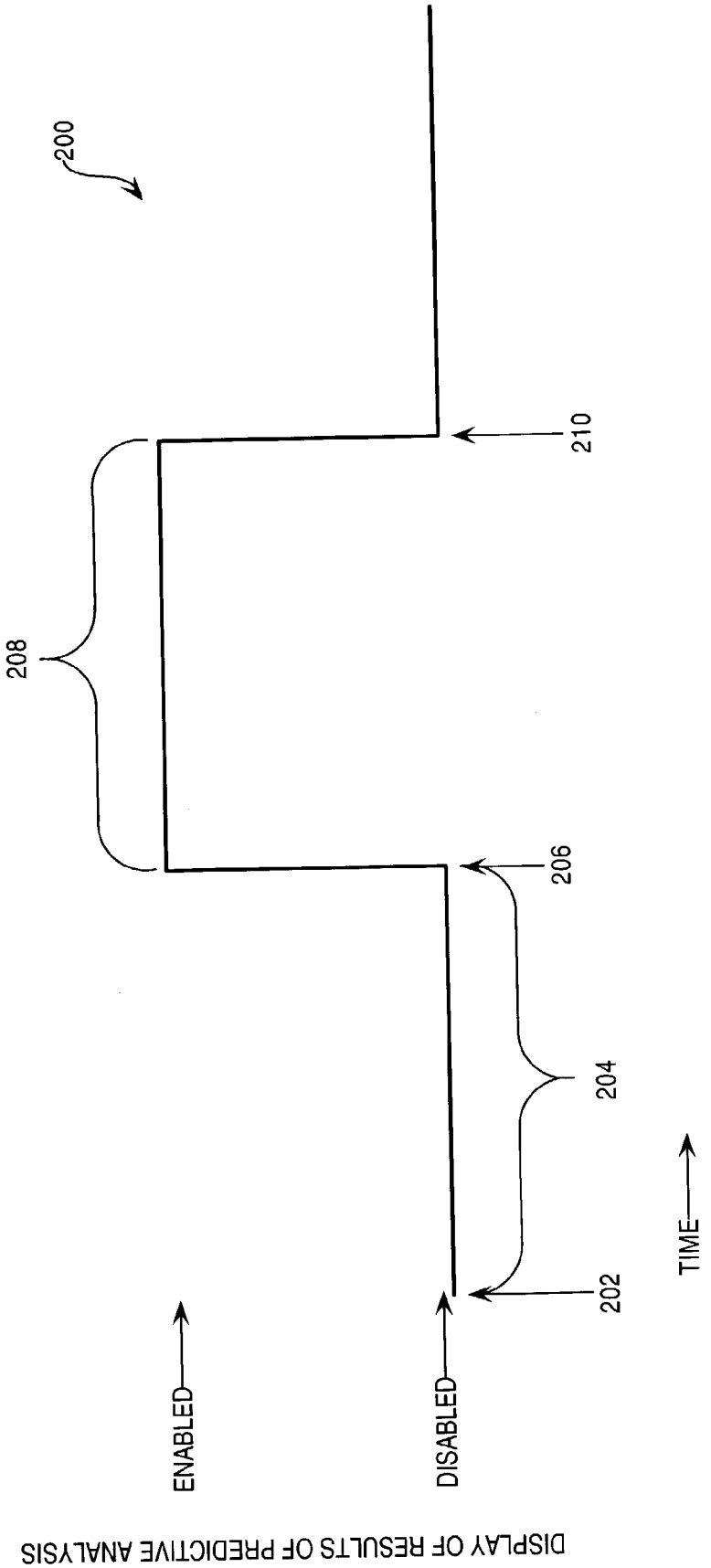

200
210
208
206
204
202
TIME
ENABLED
DISABLED
DISPLAY OF RESULTS OF PREDICTIVE ANALYSIS

FIGURE 2

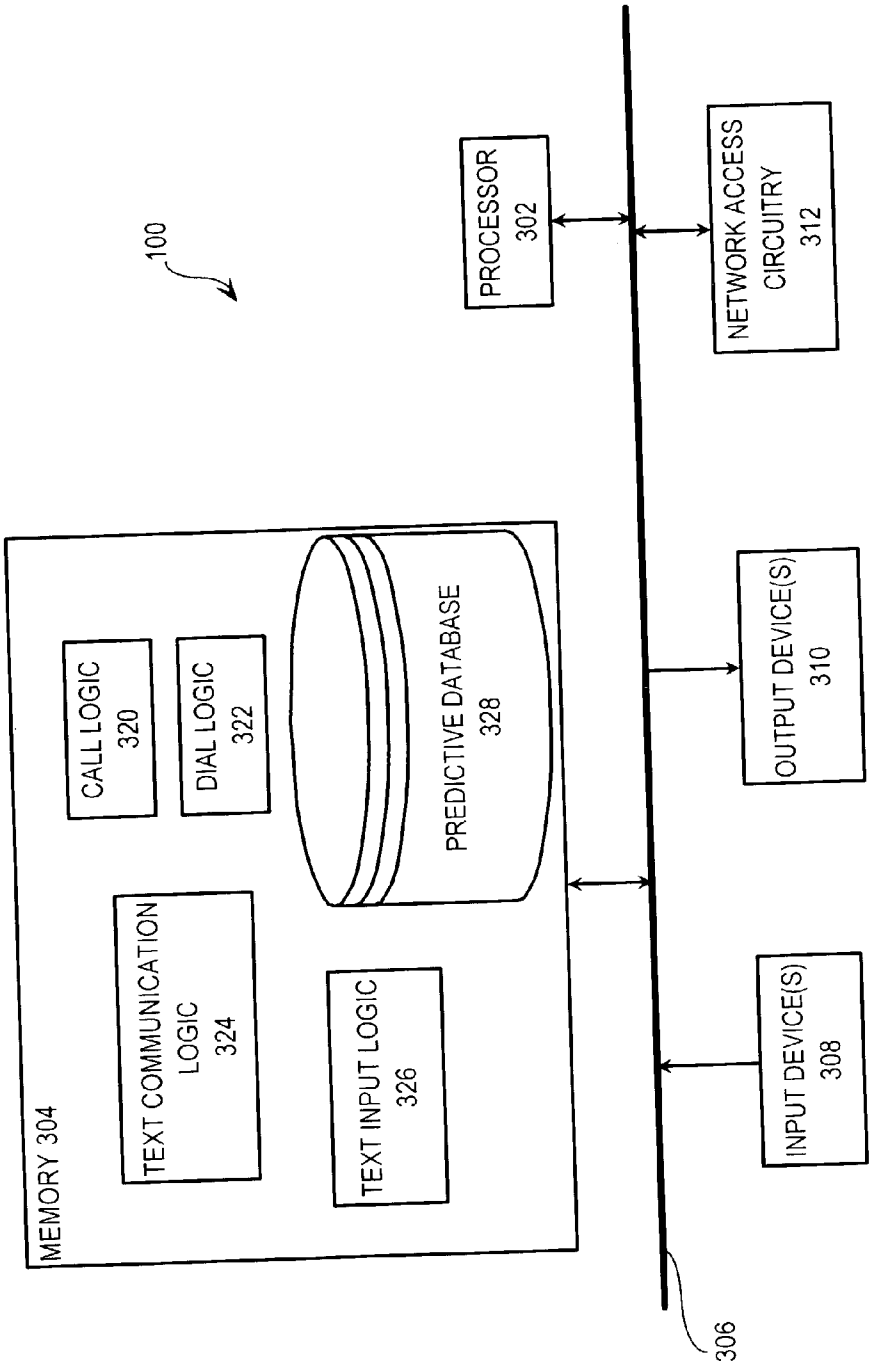

100
PROCESSOR 302
NETWORK ACCESS CIRCUITRY 312
MEMORY 304
CALL LOGIC 320
DIAL LOGIC 322
PREDICTIVE DATABASE 328
TEXT COMMUNICATION LOGIC 324
TEXT INPUT LOGIC 326
OUTPUT DEVICE(S) 310
INPUT DEVICE(S) 308
306

FIGURE 3

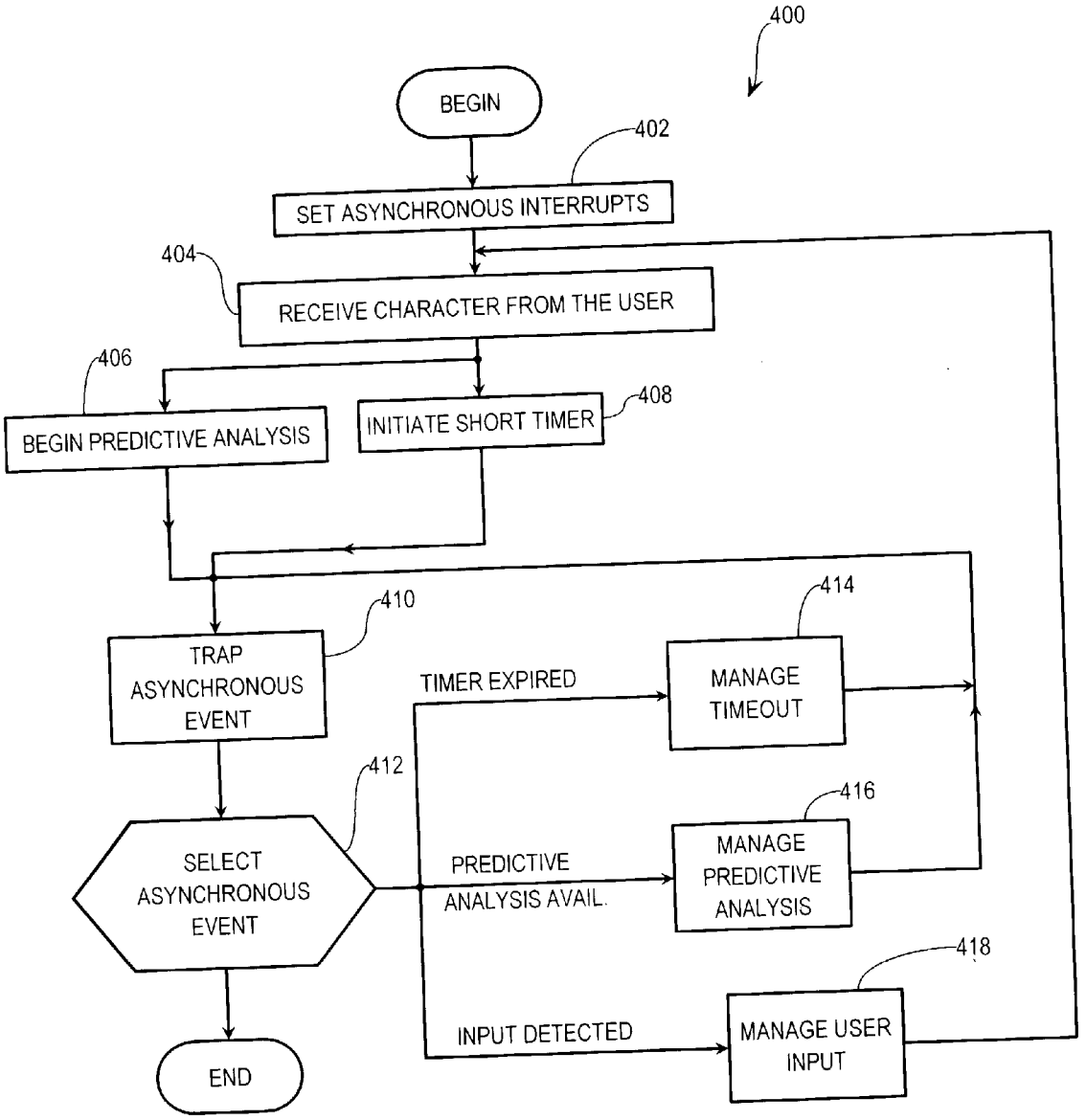

400
BEGIN
402
SET ASYNCHRONOUS INTERRUPTS
404
RECEIVE CHARACTER FROM THE USER
406
BEGIN PREDICTIVE ANALYSIS
INITIATE SHORT TIMER
408
410
TRAP ASYNCHRONOUS EVENT
414
TIMER EXPIRED
MANAGE TIMEOUT
412
416
SELECT ASYNCHRONOUS EVENT
PREDICTIVE ANALYSIS AVAIL.
MANAGE PREDICTIVE ANALYSIS
418
INPUT DETECTED
MANAGE USER INPUT
END

FIGURE 4

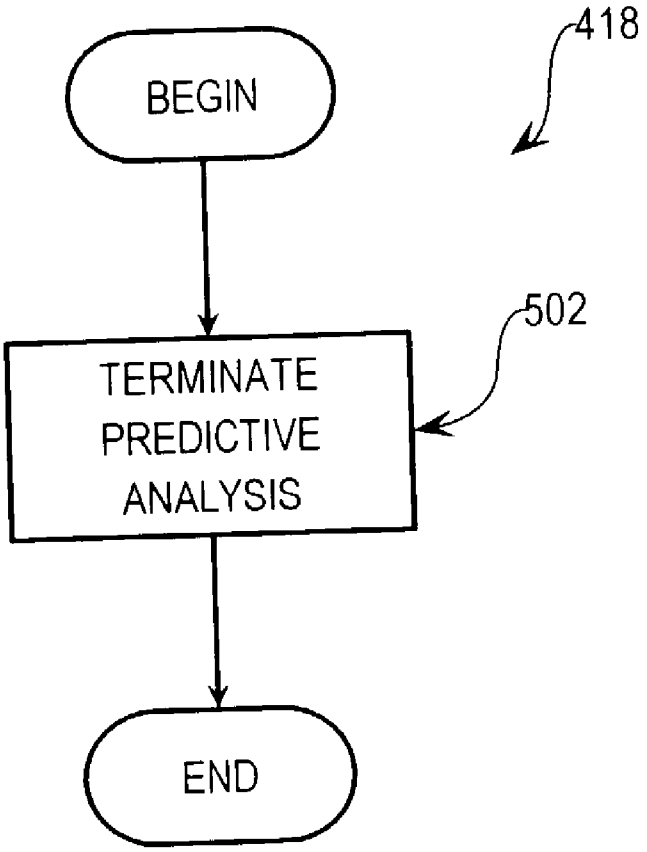


FIGURE 5

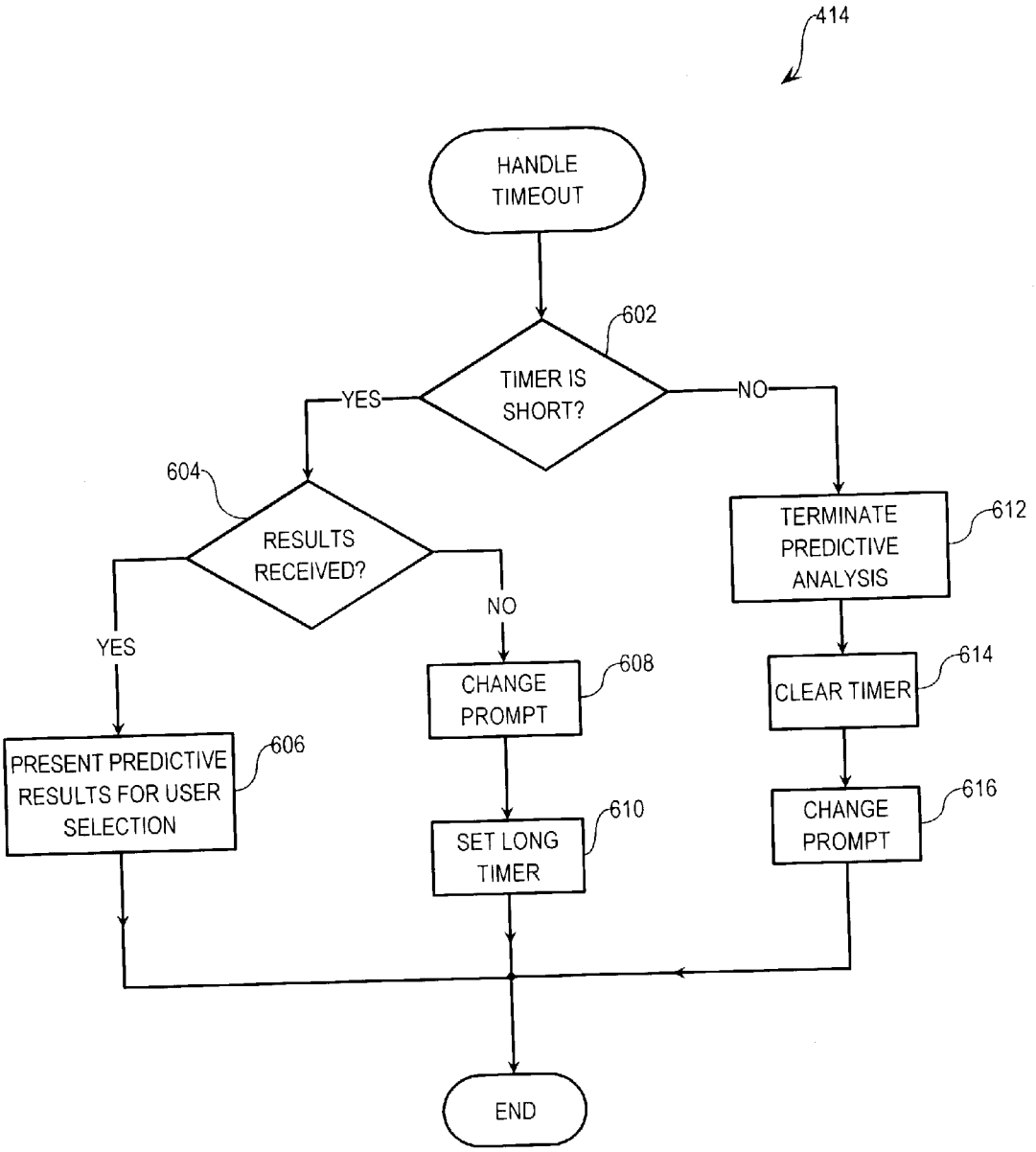

414
HANDLE TIMEOUT
602
TIMER IS SHORT?
YES
NO
604
RESULTS RECEIVED?
YES
NO
PRESENT PREDICTIVE RESULTS FOR USER SELECTION
606
CHANGE PROMPT
608
SET LONG TIMER
610
TERMINATE PREDICTIVE ANALYSIS
612
CLEAR TIMER
614
CHANGE PROMPT
616
END

FIGURE 6

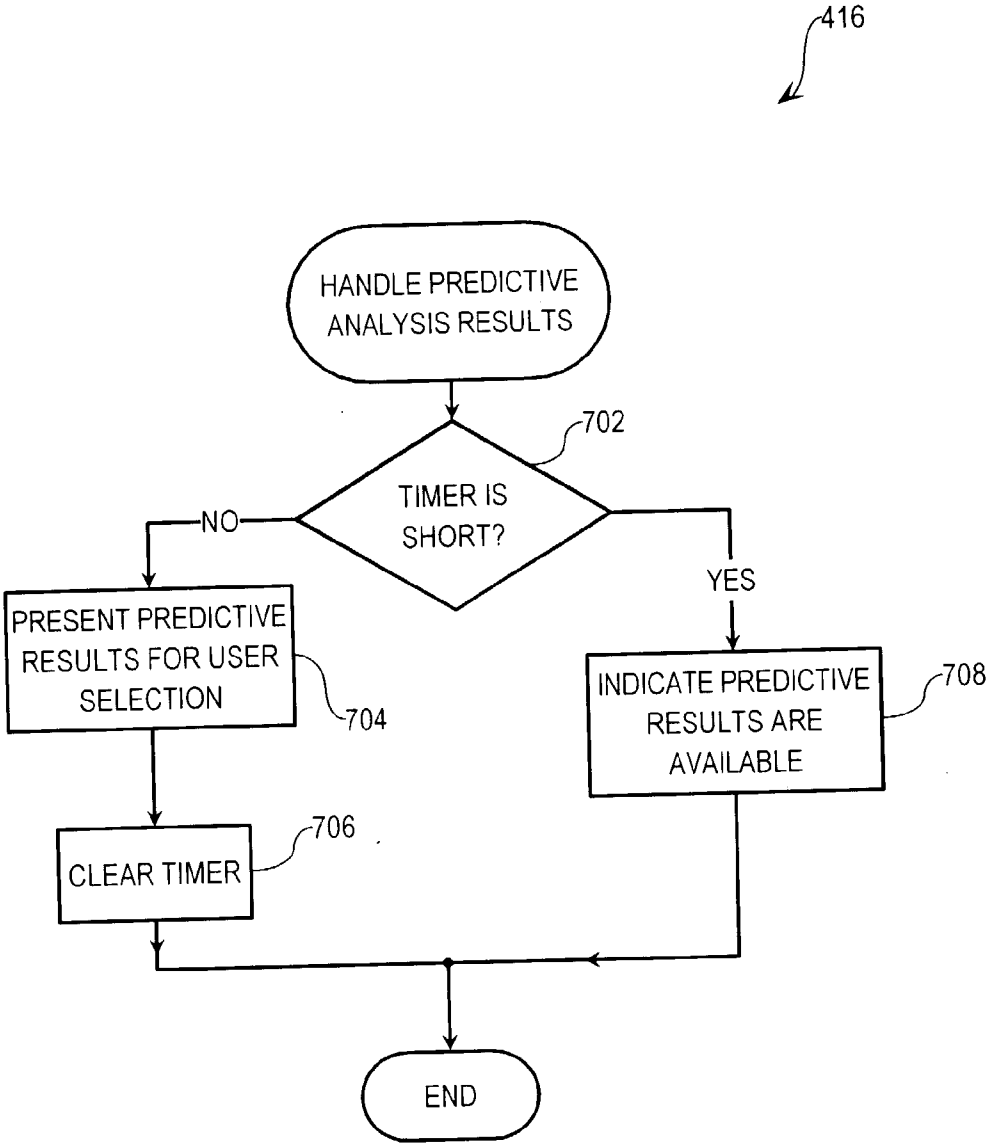

416
HANDLE PREDICTIVE ANALYSIS RESULTS
702
TIMER IS SHORT?
NO
YES
PRESENT PREDICTIVE RESULTS FOR USER SELECTION
704
CLEAR TIMER
706
INDICATE PREDICTIVE RESULTS ARE AVAILABLE
708
END

FIGURE 7

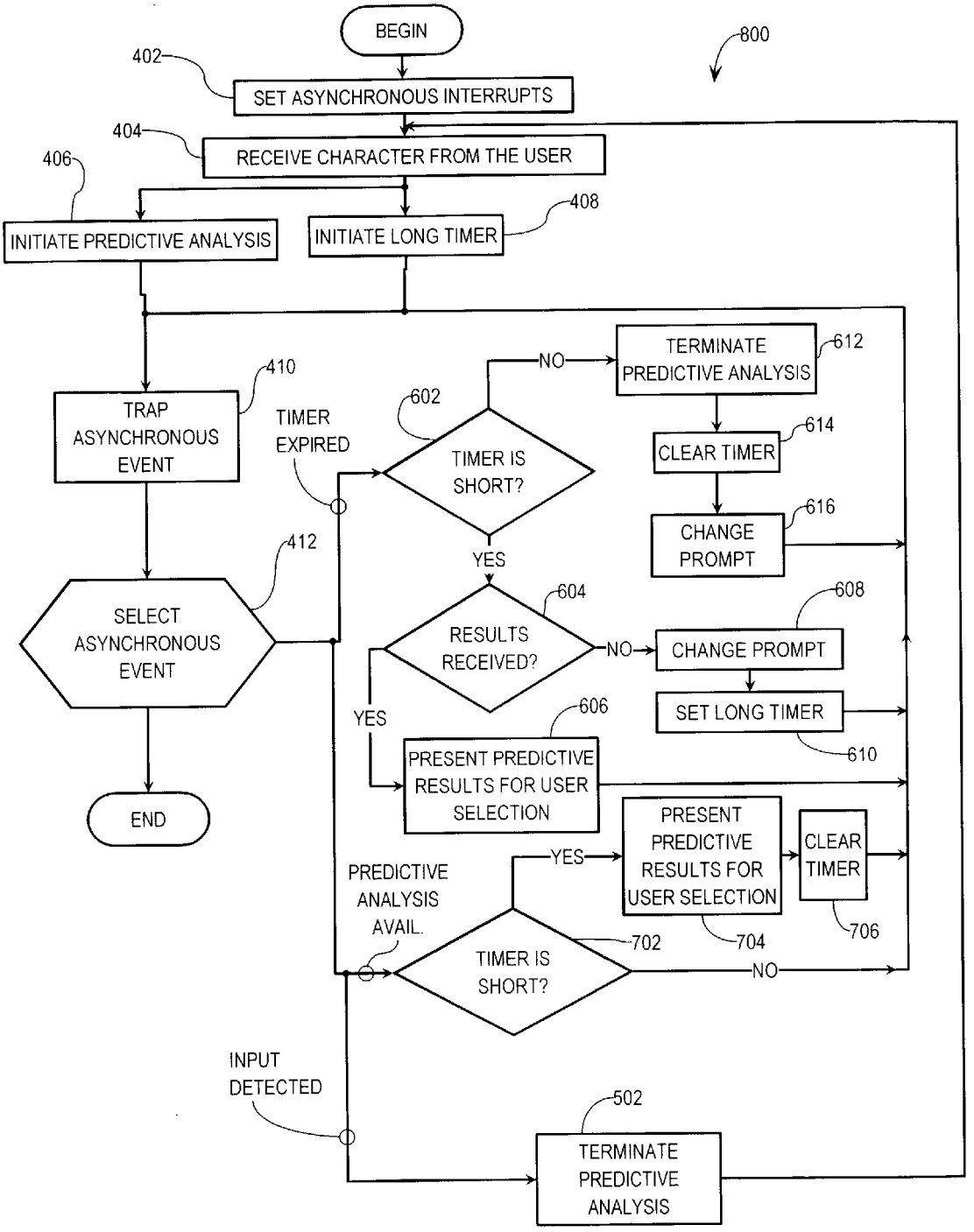

BEGIN
800
402
SET ASYNCHRONOUS INTERRUPTS
404
RECEIVE CHARACTER FROM THE USER
406
INITIATE PREDICTIVE ANALYSIS
INITIATE LONG TIMER
408
TRAP ASYNCHRONOUS EVENT
410
TIMER EXPIRED
602
TIMER IS SHORT?
NO
TERMINATE PREDICTIVE ANALYSIS
612
CLEAR TIMER
614
CHANGE PROMPT
616
YES
SELECT ASYNCHRONOUS EVENT
412
604
RESULTS RECEIVED?
NO
608
CHANGE PROMPT
SET LONG TIMER
610
YES
606
PRESENT PREDICTIVE RESULTS FOR USER SELECTION
END
PRESENT PREDICTIVE RESULTS FOR USER SELECTION
704
CLEAR TIMER
706
YES
PREDICTIVE ANALYSIS AVAIL.
TIMER IS SHORT?
702
NO
INPUT DETECTED
502
TERMINATE PREDICTIVE ANALYSIS

FIGURE 8

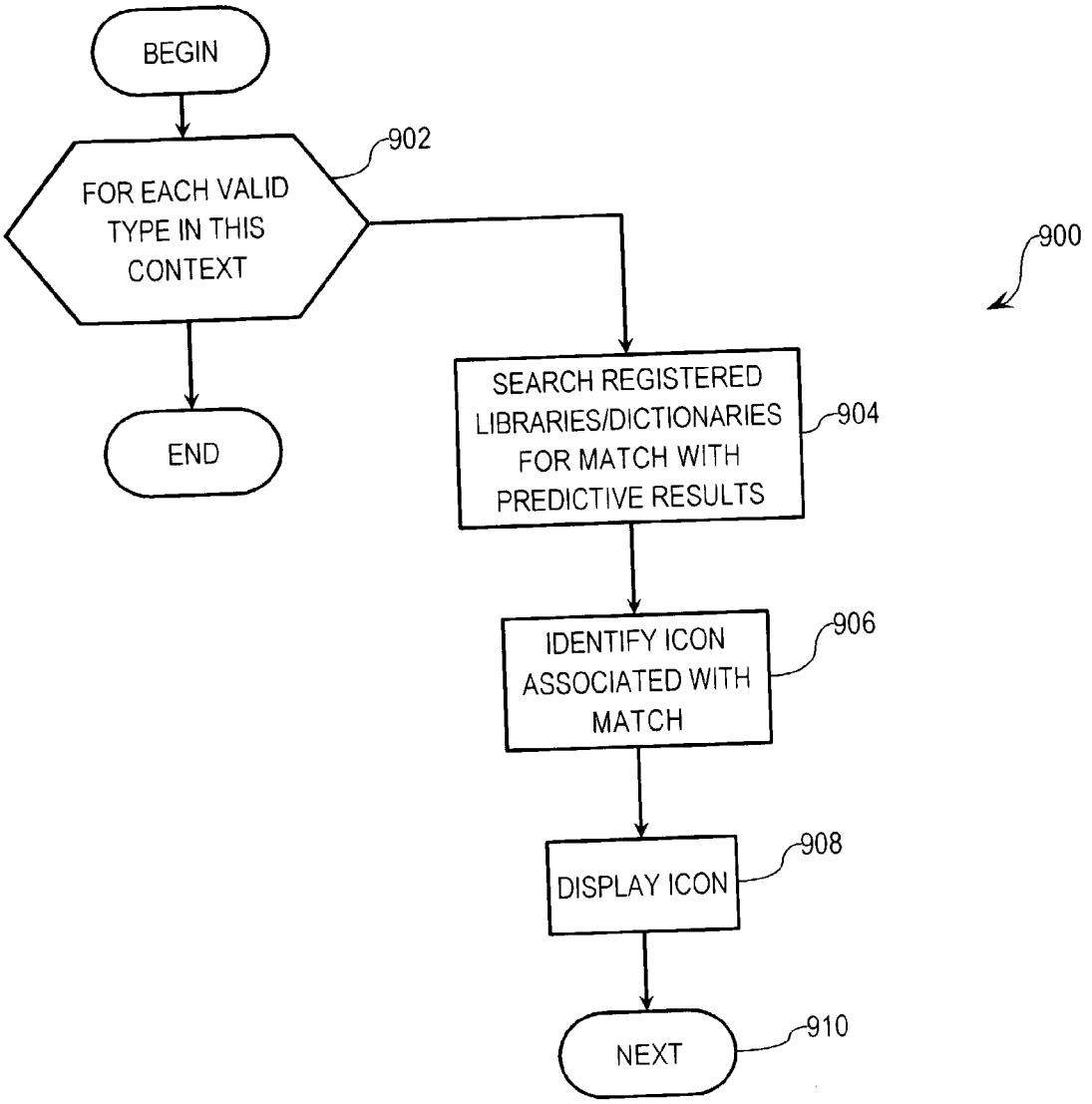

BEGIN
902
FOR EACH VALID TYPE IN THIS CONTEXT
900
END
SEARCH REGISTERED LIBRARIES/DICTIONARIES FOR MATCH WITH PREDICTIVE RESULTS
904
IDENTIFY ICON ASSOCIATED WITH MATCH
906
DISPLAY ICON
908
NEXT
910

FIGURE 9

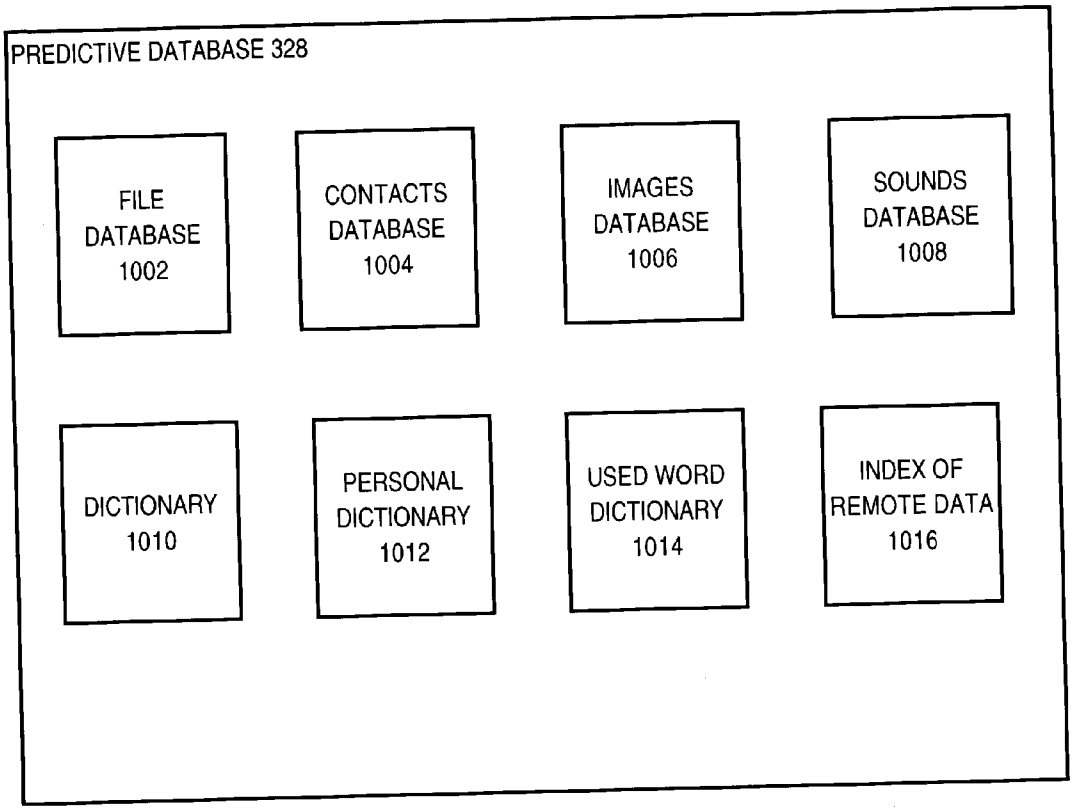

PREDICTIVE DATABASE 328
FILE DATABASE 1002
CONTACTS DATABASE 1004
IMAGES DATABASE 1006
SOUNDS DATABASE 1008
DICTIONARY 1010
PERSONAL DICTIONARY 1012
USED WORD DICTIONARY 1014
INDEX OF REMOTE DATA 1016

FIGURE 10

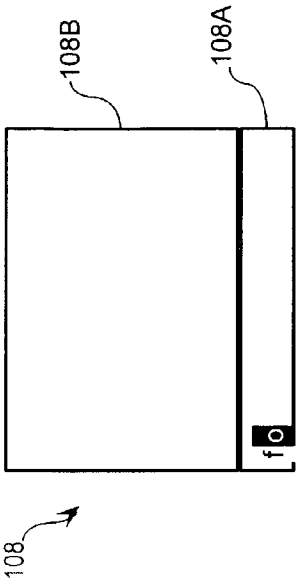


FIGURE 12

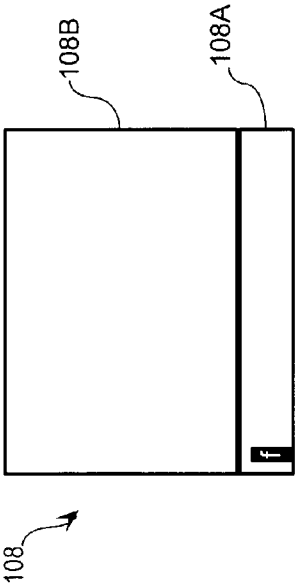


FIGURE 11

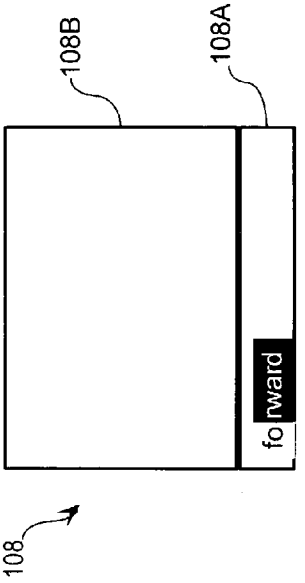


FIGURE 14

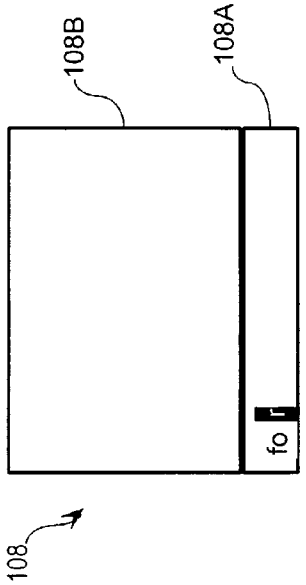


FIGURE 13

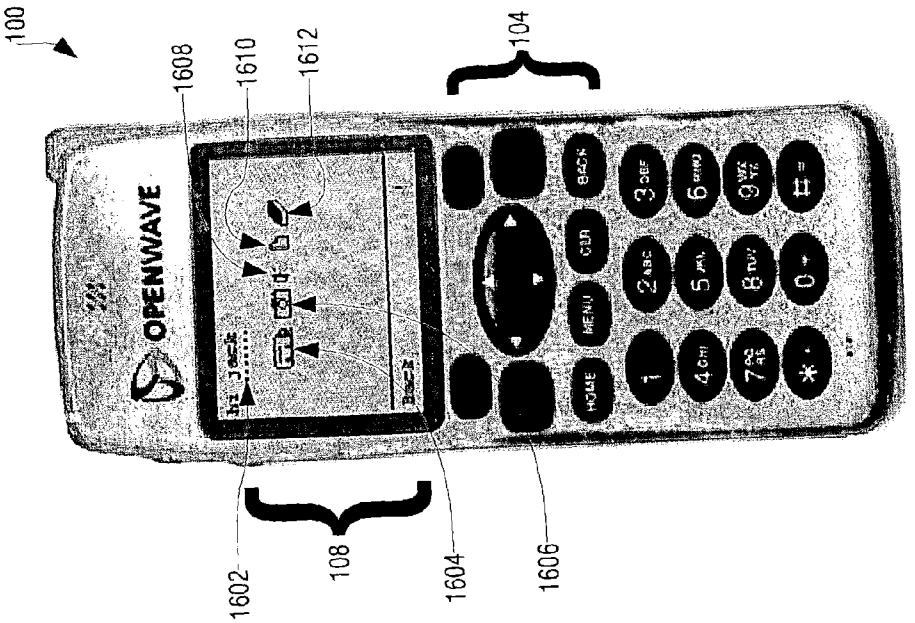


Figure 16

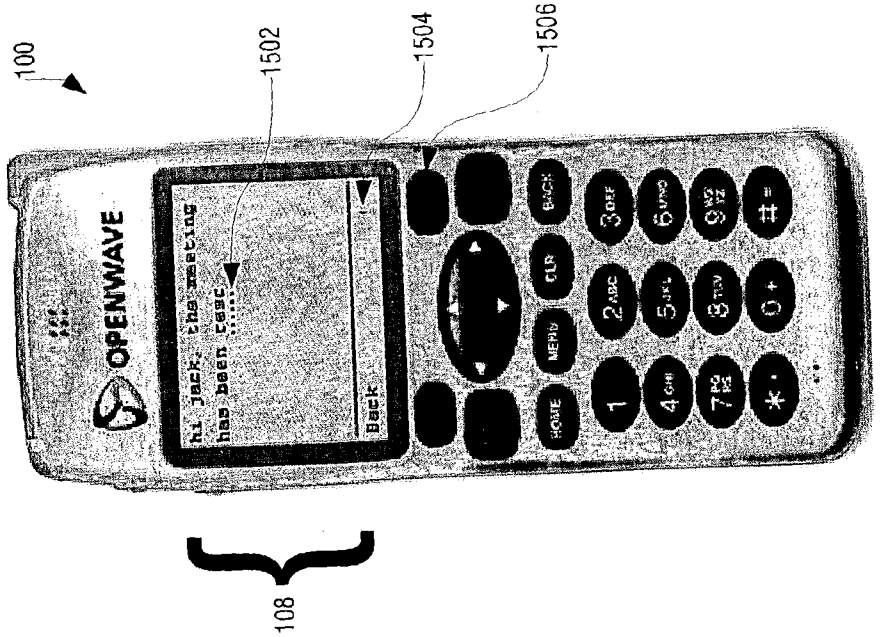


Figure 15

INFORMATION ENTRY MECHANISM FOR SMALL KEYPADS

FIELD OF THE INVENTION

[0001] This invention relates to the field of information entry in electronic devices, and more specifically to a mechanism which is both efficient and intuitive to the user for entering information in a reduced keypad.

BACKGROUND OF THE INVENTION

[0002] The dramatic increase of popularity of the Internet has led to a corresponding dramatic rise in the popularity of textual communications such as e-mail and instant messaging. Increasingly, browsing of the World Wide Web of the Internet and textual communications are being performing using reduced keypads such as those found on mobile telephones.

[0003] Multi-tap systems provide usable but less than convenient text entry functionality for users of the Roman or similar alphabet. Briefly, multi-tap systems determine a number of repeated presses of a key to disambiguate multiple letters associated with a single key. For example, pressing the "2" key once represents the letter "a;" pressing the "2" key twice represents the letter "b;" pressing the "2" key thrice represents the letter "c;" and pressing the "2" key four (4) times represents the numeral "2." The number of presses of a particular key is typically delimited with a brief pause. While feasible, entering textual data of the Roman alphabet using multi-tap is cumbersome and time-consuming.

[0004] Some attempts have been made to use predictive interpretation of key presses to disambiguate multiple written symbols associated with individual keys. Such predictive interpretation is described by Zi Corporation on the World Wide Web and in U.S. Pat. No. 5,109,352 to Robert B. O'Dell (hereinafter the O'Dell Patent). Predictive interpretation is generally effective and greatly simplifies text input using reduced keypads with very large collections of written symbols. However, predictive interpretation has difficulty with words used in proper nouns, slang, and neology as such words might not be represented in a predictive database.

[0005] Despite its great efficiency, predictive interpretation of key presses for disambiguation provides a somewhat less than intuitive user experience. In particular, predictive interpretation lacks accuracy until a few characters have been specified. The following example is illustrative.

[0006] Consider that a user is specifying the word "forest" using a numeric telephone keypad. In predictive interpretation, the user presses the following sequence of keys: 3-6-7-3-7-8. It should be appreciated that entering "forest" using multi-tap is significantly more cumbersome, pressing 3-3-3-6-6-6-7-7-7-3-3-7-7-7-7-8. Entry of text in which two or more consecutive letters are presented by the same key is exacerbated by the need to pause for a period of time between specifying each such letter to delimit the respective letter. In predictive interpretation, pressing "3" by the user does not necessarily interpret and display "f" as the indicated letter. Instead, an "e" or a "d" could be displayed to the user as the interpretation of the pressing of the "3" key. In some predictive interpretation implementations, the entire predicted word is displayed to the user. Since numerous words begin with any of the letters d, e, or f, it is rather common that the predicted word is not what the user intends to enter. Thus, as the user presses the "3" key to begin spelling "forest," an entirely different word such as "don't" can be displayed as a predicted word.

[0007] As the user presses the second key in spelling "forest," namely, the "6" key, some word other than "forest" can continue to be displayed as the predicted word. What can be even more confusing to the user is that the predict word can change suddenly and dramatically. For example, pressing the "6" key can change the predicted word from "don't" to "eminently"—both of which are spelled beginning with the "3" key followed immediately by the "6" key—depending upon frequency of usage of those respective words. To obtain full efficiency of predictive interpretation systems, the user continues with the remainder of the sequence—finishing with 7-3-7-8. Once the full sequence is entered, only one word—or just a few words—match the entered sequence. However, until that point is reached, the user is required to place faith and trust that the predictive interpretation will eventually arrive at the correct interpretation notwithstanding the various displayed incorrect interpretations early in the spelling of the desired word.

[0008] What is needed is an improved mechanism for efficiently disambiguating among multiple symbols associated with individual keys of a reduced keypad while continuing to provide accurate and reassuring feedback to the user.

SUMMARY OF THE INVENTION

[0009] In accordance with the present invention, display of results of predictive interpretation of key presses is postponed for a period of time such that a user entering multiple characters is not interrupted with repeated guesses as to what the user is intending to enter. Specifically, predictive analysis begins immediately following pressing of a key by the user, but results of such analysis are not displayed until at least a predetermined amount of time, e.g., 0.5 seconds, has elapsed since the last key press by the user. Accordingly, the user's experience in entering data is substantially enhanced.

[0010] It is helpful to consider the illustrative example of specifying "deforestation" using a reduced keypad. In accordance with the present invention, the user specifies "defo" unambiguously. During the entry of these first four characters, the user does not pause longer than the predetermined period of time. Accordingly, the user does not see any predicted candidates for the intended data. While predictive analysis was performed immediately following specification of each character, no results of such analysis were ever displayed to interrupt or confuse the user.

[0011] After specifying "defo," the user pauses for at least the predetermined period of time. The user is most likely to pause if the user becomes somewhat confused as to which key to press next or if the user has determined that a sufficient number of characters have been specified that predictive analysis can produce accurate results. In either case, presentation of predicted candidates of the user's intended data is a welcome event. Since the user has paused for at least the predetermined amount of time, results of predictive analysis are presented to the user.

[0012] It is also advantageous that the user does not wait indefinitely for results of predictive analysis. Therefore, if results of predictive analysis are not available by no less than a second predetermined amount of time from the last key press, e.g., 2.0 seconds, no predicted candidates of the user's intended data are presented to the user. It is preferred that some characteristic of the display is changed to indicate to the user that predicted candidates are not forthcoming. For example, a blinking cursor can indicate that predictive analysis is under way while a transition from a blinking cursor to a solid cursor indicates that predictive candidates are not available.

[0013] In addition, the availability of predictive candidates can be indicated to the user, either immediately or upon elapsing of the predetermined amount of time. The user can request display of any available predicted candidates by making a user input gesture so indicating. For example, a word being entered by the user can be highlighted, e.g., with a dotted underline, to indicate that predicted candidates for completion of the word are available and a soft key can be labeled to indicate that pressing the soft key causes display of available predicted candidates. Thus, display of results of predictive analysis of user input data can be explicitly requested by the user.

[0014] To ensure that results of predictive analysis are thorough and complete prior to presentation to the user, such results can be considered available only when resources for predicted candidates have been thoroughly and completely processed. Alternatively, partial results of predictive analysis can be considered available while predictive analysis continues and adds to the already available partial results until processing is terminated at the elapsing of the second predetermined amount of time from the last key press.

[0015] In addition, the same advantages can be realized on full-size keyboards. Some word processors—such as StarOffice from Sun Microsystems of Palo Alto, Calif., and OpenOffice from the OpenOffice.org community of which Sun Microsystems is a member—include a word completion feature which can present predictive candidates to the user as the user types a partial word. By only displaying predicted candidates to the user when the user has paused for a predetermined amount of time, such word processors would not quickly flash predicted candidates to the user as the user continues to type, thereby avoiding a somewhat annoying experience for the user.

[0016] These advantages are also applicable to non-textual data. For example, predicted candidates of contact records, images, sounds, and data files can be presented to the user without interrupting the user by waiting for a predetermined amount of time from the last user input gesture, e.g., key press, before presenting such candidates. In some contexts, multiple data types can be active and it is possible that the user partially specifies a number of data records of more than one of the active data types. In this case, the user is presented with representations of each data type, e.g., icons, from which the user selects an intended data type. Then, predicted candidates of the selected data type are presented to the user for selection.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] **FIG. 1** shows a mobile telephone which is used for textual communication.

[0018] **FIG. 2** shows a diagram of a timeline of information entry in a mobile telephone.

[0019] **FIG. 3** shows a block diagram of the mobile telephone which is used for textual communication.

[0020] **FIG. 4** shows a logic flow diagram of predictive analysis of input text.

[0021] **FIG. 5** shows a logic flow diagram of managing user input in predictive analysis of input text.

[0022] **FIG. 6** shows a logic flow diagram of managing time-outs in predictive analysis of input text.

[0023] **FIG. 7** shows a logic flow diagram of managing a predictive analysis result in predictive analysis of input text.

[0024] **FIG. 8** shows a logic flow diagram of predictive analysis of input text.

[0025] **FIG. 9** shows a logic flow diagram of presenting predictive results for selection by a user.

[0026] **FIG. 10** shows a block diagram of a predictive database.

[0027] FIGS. **11-14** show a display of mobile telephone presenting predictive results and selection by a user.

[0028] **FIG. 15** shows a mobile telephone displaying a message in which a word is highlighted with a dotted underline to indicate the predicted candidates are available to the user in accordance with the present invention.

[0029] **FIG. 16** shows a mobile telephone displaying a message in which predicted candidates for multiple data types are available to the user in accordance with the present invention.

DETAILED DESCRIPTION

[0030] In accordance with the present invention, display of results of predictive interpretation of user input gestures is postponed for an interval of time. The user is permitted to continue entry of data without interruption during the interval of time. The user is therefore not distracted while entering such data. Predicted candidates are only displayed to the user after a pause in user input gestures of at least a predetermined minimum duration. Such a pause is presumed to indicate that the user is either puzzled or intentionally awaiting predicted candidates.

[0031] **FIG. 1** shows a mobile telephone **100** which is used for textual communication. For example, mobile telephone **100** can be used to send and receive textual messages and/or can be used to browse the ubiquitous World Wide Web according to the known and standard Wireless Application Protocol (WAP). Mobile telephone **100** can also be used, in this illustrative embodiment, to send text messages according to the currently available and known Short Message Service (SMS). Of course, other types of devices with reduced keypads are used to enter data for purposes other than communications. Text entry in mobile telephone **100** is merely an illustrative embodiment. Mobile telephone **100** includes a keypad **102** which includes both command keys **104** and data input keys **106**. In addition, mobile telephone **100** includes a display screen **108** for display of text and/or graphical information. Mobile telephone **100** also includes a microphone **110** for receiving audio signals and a speaker **112** for presenting audio signals to a user.

[0032] Data input keys **106**, which are sometimes referred to herein collectively as numeric keypad **106**, are arranged in the typical telephone keypad arrangement as shown. While numeric keypad **106** is described herein as an illustrative example of a reduced keypad, it should be appreciated that the principles of the present invention are applicable to other reduced keypads. As used herein, a reduced keypad is a keypad in which one or more keys can each be used to enter one of a group of two of more symbols. For example, the letters "a," "b," and "c" are associated with, and specified by a user pressing, the "2" key of numeric keypad **106**.

[0033] **FIG. 2** shows a timing diagram **200** which illustrates the display of predicted candidates resulting from predictive analysis in accordance with the present invention. Time **202** represents a time at which the user has most recently pressed any of data input keys **106**. Until time **206**, i.e., during time interval **204**, display of any predicted candidates for text intended to be entered by the user is suppressed. If the user presses any of data input keys **106** during time interval **204**, the user sees no predicted results, and timing diagram **200** is reset to time **202**. Accordingly, the user can continue entering text in a conventional manner, e.g., using an unambiguous text entry mechanism such as multi-tap, without interruption as long as the user does not pause for the entire duration of time interval **204**.

[0034] However, if the user has paused for the duration of time interval **204**, i.e., no key press is detected at time **206** relative to the most recent key press, display of predicted candidates resulting from predictive analysis is enabled at time **206**. A few things are worth noting at this point. First, predictive analysis begins immediately upon pressing of any of data input keys **106**, i.e., at time **202**. Second, it is possible that predictive analysis completes prior to time **206**. If so, presentation of the resulting predicted candidates to the user is suppressed during time interval **206**. However, availability of predicted candidates can be indicated to the user in a preferably subtle and non-disruptive manner. Third, it is also possible that predictive analysis does not complete by time **206**. In this case, predictive analysis continues. In this illustrative embodiment, display **108** is modified at time **206** if predictive analysis continues. For example, the cursor can change from a steady state to a blinking state. Such notifies the user that mobile telephone **100** is analyzing data entered by the user thus far to predict a larger portion of data intended by the user. For example, given a few letters entered by the user, a blinking cursor can indicate to the user that mobile telephone **100** is processing those letters to predict an intended word or phrase.

[0035] Predicted candidates can also be made available to the user prior to completion of predictive analysis. For example, such partial results can be indicated to the user as available prior to time **206** and can be presented to the user while predictive analysis continues during time interval **208**.

[0036] If predictive analysis produces one or more predicted candidates for the data intended by the user, those predicted candidates are presented to the user for browsing and selection. In this illustrative embodiment, the user uses command keys **104** to browse among two or more predicted candidates displayed in display **108** and to select as predicted candidate as the intended data. For example, if the predicted candidates represent words and/or phrases of a text message, selecting a candidate causes the predicted word or phrase to be included in a message which is currently being composed by the user. The user is also permitted to ignore the displayed predicted candidates and to continue using data input keys **106** to enter data. Pressing any of data input keys **106** during time interval **208**, regardless of whether predicted candidates are displayed in display **108**, causes timing diagram to reset at time **202**.

[0037] Since all good things must come to an end, predictive analysis is only permitted to continue for a limited amount of time in this illustrative embodiment. Accordingly, predictive analysis terminates at time **210**, i.e., at the end of time interval **208**. If predictive analysis has not produced predicted candidates by time **210**, no predicted candidates are presented to the user. In this illustrative embodiment, display **108** is again modified to indicate to the user that predictive analysis terminated without producing useful predicted candidates, e.g., by changing the cursor from a blinking state back to a steady state. The user therefore does not wait endlessly for predictive analysis if no results are forthcoming. In this illustrative embodiment, time **210** is two (2) seconds from time **202**. In another embodiment, time **210** does not exist or is set to such a large amount of time that predictive analysis doesn't terminate during data entry by the user. The user can always terminate predictive analysis, even if such analysis goes on for a considerable amount of time, by continuing to enter data by pressing any of data input keys **106**.

[0038] After time **210**, the user continues to enter data normally, i.e., without the assistance of predictive analysis. Such can include pressing any of data input keys **106** to continue specifying a character or pressing one or more of control keys **104** to indicate that a complete unit, e.g., a word or phrase, has been successfully specified. In the former case, pressing any of data input keys **106** restarts the behavior of mobile telephone **100** represented in timing diagram **200**. In particular, pressing any of data input keys **106** subsequent to time **210** resets at time **202** such that predictive candidates are presented to the user after a subsequent occurrence of time **206**, i.e., in a subsequent instance of timing diagram **200**.

[0039] The result of displaying predicted candidates in the manner described in conjunction with timing diagram **200** is that predictive analysis of data entry in reduced keypads is much more comfortable and palatable to the user. Specifically, the user continues to enter data at a reasonable pace without interruption so long as the user does not pause for the duration of time-interval **204**. At some point in time, the user may be confused as to which key to press next or may believe that sufficient data has been entered such that predictive analysis can make a very accurate guess as to the entire word, phrase, or data element intended by the user. Accordingly, the user pauses for the duration of time-interval **204** and predicted candidates are displayed after time **206** to the user for browsing and selection. If the user was confused, the predicted candidates can be very helpful. If the user was hoping to see predicted candidates, then mobile telephone **100** behaves exactly as the user intends. In either case, presentation of the predicted candidates is a positive experience for the user and not at all annoying.

[0040] Some elements of mobile telephone **100** are shown in diagrammatic form in **FIG. 3**. Mobile telephone **100**

includes a microprocessor **302** which retrieves data and/or instructions from memory **304** and executes retrieved instructions in a conventional manner.

[**0041**] Microprocessor **302** and memory **304** are connected to one another through an interconnect **306** which is a bus in this illustrative embodiment. Interconnect **306** is also connected to one or more input devices **308**, one or more output devices **310**, and network access circuitry **312**. Input devices **308** include, for example, keypad **102** (**FIG. 1**) and microphone **110**. In alternative embodiments, input devices **308** (**FIG. 3**) can include other types of user input devices such as touch-sensitive screens, for example. Output devices **310** include display **108** (**FIG. 1**), which is a liquid crystal display (LCD) in this illustrative embodiment, and speaker **112** for playing audio received by mobile telephone **100** and a second speaker for playing ring signals. Input devices **308** and output devices **310** can also collectively include a conventional headset jack for supporting voice communication through a convention headset. Network access circuitry **312** includes a transceiver and an antenna for conducting data and/or voice communication through a network.

[**0042**] Call logic **320** includes a collection of instructions and data which define the behavior of mobile telephone **100** in communicating through network access circuitry **312** in a conventional manner. Dial logic **322** includes a collection of instructions and data which define the behavior of mobile telephone **100** in establishing communication through network access circuitry **312** in a conventional manner. Text communication logic **324** includes a collection of instructions and data which define the behavior of mobile telephone **100** in sending and receiving text messages through network access circuitry **312** in a conventional manner.

[**0043**] Text input logic **326** includes a collection of instructions and data which define the behavior of mobile telephone **100** in accepting textual data from a user. Such text entered by the user can be sent to another through text communication logic **324** or can be stored as a name of the owner of mobile telephone **100** or as a textual name to be associated with a stored telephone number. As described above, text input logic **326** can be used for a wide variety of applications other than text messaging between wireless devices. Predictive database **328** stores data which is used to predict text intended by the user according to pressed keys of input devices **308** in a manner described more completely below. Predictive database **328** is shown in greater detail as block diagram **328** (**FIG. 10**).

[**0044**] Logic flow diagram **400** (**FIG. 4**) illustrates behavior of the mobile telephone **100** (**FIG. 3**) according to text input logic **326** of this illustrative embodiment. In step **402**, the text input logic sets asynchronous interrupt traps for a number of events such as receiving user input, receiving predictive analysis results, and expiration of a timer.

[**0045**] In step **404**, text input logic **326** (**FIG. 3**) receives a character entered by the user by use of data input keys **106** (**FIG. 1**). In this illustrative embodiment, the user enters characters using conventional multi-tap techniques. Receipt of a character in step **404** corresponds to the beginning time **202** of the timeline **200** (**FIG. 2**).

[**0046**] In step **406**, text input logic **326** (**FIG. 3**) begins predictive analysis. Once begun, text input logic **326** performs predictive analysis concurrently with the steps of logic flow diagram **400**. In predictive analysis, text input logic **326** collects data previously entered by the user and predicts therefrom one or more additional characters, whole or partial words, and/or phrases intended by the user.

[**0047**] Text input logic **326** performs predictive analysis for the Chinese language in generally the manner described in the O'Dell Patent and that description is incorporated herein by reference. Predictive analysis can be performed in any of a number of ways for various languages. Generally, a dictionary stores a large collection of words and/or phrases representing the most likely things the user is expected to enter. As the user enters data, those words and/or phrases stored in the dictionary which match the entered data become fewer and fewer in number. Any such matching words and/or phrases are ranked accordingly to frequency of use such that the first element of the list of matching words and phrases is the most frequently used word or phrase of the list. In this illustrative embodiment, text input logic **326** expects words of the English language, and predictive data **328** stores words of the English language. In one embodiment, predictive analysis includes using relative frequency of appearance of bigrams, tri-grams, etc. to respectively predict second, third, etc. characters in the manner described in copending U.S. patent application Ser. No. 10, by Roland Williams and Robert O'Dell entitled "Text Entry Mechanism for Small Keypads" dated October _____, 2002 and that description is incorporated herein by reference.

[**0048**] In one embodiment, predicted candidates resulting from predictive analysis are only made available when predictive analysis completes. In an alternative embodiment, predictive analysis can make partial results available, generating one or more events to convey one or more corresponding parts of the complete set of results.

[**0049**] In step **408** (**FIG. 4**), text input logic **326** (**FIG. 3**) sets a timer to expire at time **206** (**FIG. 2**). Accordingly, text input logic **326** (**FIG. 3**) is initially set to trap expiration of time interval **204**. As shown, the relative order of steps **406** and **408** is unimportant and, in fact, can be performed concurrently.

[**0050**] In step **410**, text input logic **326** traps an asynchronous event. Asynchronous event traps are well-known and are not described further herein. In step **412**, text input logic **326** (**FIG. 3**) determines the type of asynchronous event trapped in step **410**. As described above, three types of asynchronous events are trapped in this illustrative embodiment: receiving user input, receiving predictive analysis results, and expiration of a timer. If the trapped asynchronous event is receipt of user input, i.e., detected pressing of any of data input keys **106**, processing transfers to step **418**. If the trapped asynchronous event is completion of predictive analysis as started in step **406**, processing transfers to step **416**. If the trapped asynchronous event is expiration of a timer, processing transfers to step **414**.

[**0051**] Logic flow diagram **418** (**FIG. 5**) shows step **418** in greater detail. In step **502**, text input logic **326** (**FIG. 3**) terminates predictive analysis that began in step **406** (**FIG. 4**). After step **502**, processing according to logic flow diagram **418**, and therefore step **418** (**FIG. 4**) completes. After step **418**, processing by text input logic **418** transfers to step **404** in which the character entered by the user is received and thus to step **408** in which timers are reset such that timing diagram **200** (**FIG. 2**) is reset at time **202**.

[0052] Step **416** (**FIG. 4**), in which text input logic **326** processes a trapped asynchronous timeout event, is shown in greater detail as logic flow diagram **416** (**FIG. 7**). Operations of timers and trapping asynchronous timeouts thereof are well known and are not described further herein.

[0053] In step **702**, text input logic **326** (**FIG. 3**) determines if the timer is currently set to expire at time **206** (**FIG. 2**). If so, time **206** has not yet been reached and presentation of predictive analysis results is premature. However, if time **206** has already been reached, the timer is set to expire at time **210** as described more completely below. Therefore, if the timer is not set to expire at time **206**, text input logic **326** (**FIG. 3**) determines that presentation of results of predictive analysis is now permitted and presents such results in step **704**.

[0054] The results of predictive analysis can be presented to the user in various ways. In one embodiment, a list of predicted candidates, which are sorted in descending order of frequency of usage, is presented to the user and the user is free to select from the list, e.g., by using control keys **104**, rather than continuing to specify individual characters, e.g., by using data input keys **106**. In an alternative embodiment, the most frequently used predicted candidate is superimposed over text currently entered by the user. Pressing a selected one of control keys **104**, the user can accept the superimposed predicted candidate. By pressing selected others of control keys **104**, the user can scroll up and/or down a list of predicted candidates sorted by frequency of usage to switch which of the predicted candidates is superimposed over the text entered so far by user.

[0055] In step **706** (**FIG. 7**), text input logic **326** (**FIG. 3**) clears the timer such that termination of time-interval **208** is not trapped since termination of predictive analysis is no longer necessary. In an alternative embodiment in which partial results of predictive analysis are made available to the user, step **706** is skipped such that time **210** is recognized to enable termination of predictive analysis at time **210**. In this alternative embodiment, text input logic **326** presents predicted candidates to the user in step **704** while predictive analysis continues if it has not yet completed. More results of predictive analysis can be made available to the user in subsequent performances of logic flow diagram **416** as such results become available during time-interval **208**.

[0056] Through test step **702**, text input logic **326** (**FIG. 3**) ensures that time **206** has been reached prior to presentation of predicted candidates to the user. In particular, if the timer is set to expire at time **206**, time **206** has not yet been reached and step **704** is skipped. Thus, according to logic flow diagram **416**, if time **206** has been reached when results of predictive analysis are available, such results are displayed for the user; and such results are not displayed if time **206** has not yet been reached.

[0057] In the embodiment shown in **FIG. 7**, the availability of predicted candidates is indicated to the use in step **708** despite the fact that time **206** has not yet been reached. It is preferred that such indication be relatively subtle so as to not disrupt data entry by the user. An illustrative example of a relatively subtle indication is shown in **FIG. 15**. A dotted underline **1502** for the partial word, "resc," subtly indicates to the user that mobile telephone **100** has predicted candidates for completion of that partial word. Exclamation point **1504** is associated with soft button **1506** to suggest to the user that pressing soft button **1506** will allow the user to review and select from the predicted candidates. A soft button is a button whose function is dynamic. A soft button is typically associated with a dynamic function indicator such as the adjacent portion of display **108** in which exclamation point **1504** is displayed.

[0058] Step **414** (**FIG. 4**), in which text input logic **326** (**FIG. 3**) handles asynchronous timer expiration, is shown in greater detail as logic flow diagram **414** (**FIG. 6**). In test step **602**, text input logic **326** (**FIG. 3**) determines whether the timer is set to expire at time **206** (**FIG. 2**) in the manner described above with respect to test step **702** (**FIG. 7**). If the timer is set to expire at time **206**, processing transfers to test step **604**. Conversely, if the time is set to expire at another time, e.g., time **210**, processing transfers to step **612**.

[0059] Initially, the timer is set to expire at time **206**, so processing transfers to test step **604** in which text input logic **326** (**FIG. 3**) determines whether results of predictive analysis have been received. If so, processing transfers to step **606** in which the results are presented to the user in the manner described above. Conversely, if results of predictive analysis are not yet available, processing transfers from test step **604** to step **608**.

[0060] In step **608**, text input logic **326** (**FIG. 3**) changes a prompt or another aspect of display **108**. Such informs the user that mobile telephone **100** is actively processing an implicit request to predict the data intended by the user. In this illustrative embodiment, text input logic **236** changes a cursor within display **108** from a static state to a blinking state in step **608**. From the user's perspective, mobile telephone **100** has been awaiting data input during time interval **204** as indicated by a static cursor or similar aspect of information displayed in display **108**. Unbeknownst to the user, mobile telephone **100** has been actively working at predicting intended data as begun in step **406**. At time **206**, a timer interrupt is handled in step **414** and, if no predictive analysis results are available at that time, a change in a passive state to an active state is indicated in display **108**, e.g., by a blinking cursor. Thus, at time **206**, the user perceives that mobile telephone **100** is actively processing data entered so far. This perception is reassuring to a user who has paused for the duration of time interval **204** either as a result of uncertainty as to how to continue data entry or as a result of intentionally triggering predictive analysis.

[0061] In step **610** (**FIG. 6**), text input logic **326** (**FIG. 3**) sets the timer to expire at time **210** (**FIG. 2**) since the next time to trap after time **206** is time **210**.

[0062] If text input logic **326** (**FIG. 3**) determines in test step **602** that the timer is set to expire at time **210**, e.g., by a previous performance of step **610**, processing transfers to step **612**. In step **612**, text input logic **326** (**FIG. 3**) terminates predictive analysis. It should be noted that step **612** is only reached at time **210** when no results of predictive analysis are available or, alternatively, if predictive analysis has not completed by time **210** after presentation of partial predictive analysis results. In step **614**, text input logic **326** (**FIG. 3**) clears the timer so no further timeout events will occur. In step **616**, text input logic **326** (**FIG. 3**) changes the prompt, or another aspect of display **108**, to indicate to the user a transition from an active state back to a passive state. Such communicates to the user that no predicted candidates of intended text are forthcoming.

[0063] After any of steps **606**, **610**, or **616**, processing according to logic flow diagram **414**, and therefore step **414** (**FIG. 4**), completes. After either of steps **414-416**, processing according to logic flow diagram **400** transfers to step **410** in which the next asynchronous interrupt is trapped.

[0064] Text input logic **326** (**FIG. 3**) handles an asynchronous interrupt trap of receiving user input by managing user input in step **418**. Step **418** is shown more completely as logic flow diagram **418** (**FIG. 5**). In step **502**, text input logic **326** (**FIG. 3**) terminates predictive analysis started in step **406** (**FIG. 4**). After step **502**, processing according to step **418** completes and processing transfers to step **404**. Unlike steps **414-416**, after which processing transfers to step **410** in which another asynchronous event is trapped, processing transfers from step **418** to step **404** to interpret the received data as a character of text input and the overall processing of logic flow diagram **400**, as represented in timing diagram **200**, restarts.

[0065] Logic flow diagrams of FIGS. **4-7** are shown collectively for the reader's convenience in **FIG. 8**. FIGS. **11-14** illustrate an example of usage of mobile telephone **100** in accordance with the present invention. **FIG. 11** shows display **108** of mobile telephone **100** (**FIG. 1**). User specification of text according to the present invention is described in the context of an illustrative example of the user specifying the word, "forward."

[0066] Display **108** is divided logically, i.e., by text input logic **326** (**FIG. 3**), into an upper portion—window **108**B (**FIG. 11**)—and a lower portion—window **108**A. Window **108**A displays a current word, i.e., the word currently being specified by the user. Window **108**B displays previously specified words which have been confirmed by the user and therefore appended to a current message which can include multiple words during the first time-interval **204** (**FIG. 2**). In an alternative embodiment, display **108** is not divided in this matter and individual characters specified by the user are displayed in the context of a message as entered by the user.

[0067] In this illustrative example, the user specifies the letter "f" using multi-tap user interface techniques, e.g., by pressing the "3" key three (3) times and pausing to confirm the specification of the letter "f." The results are shown in **FIG. 11** in which the letter "f" is displayed in window **108**A. In this illustrative example, the user has not previously specified any words so window **108**B is empty.

[0068] In logic flow diagram **400** as shown in **FIG. 8**, text input logic **326** (**FIG. 3**) receives signals representing the letter "f" as entered by the user in step **404** and displays the letter "f" in window **108**A (**FIG. 11**). In steps **406** and **408**, text input logic **326** respectively begins predictive analysis and sets a timer to expire at time **206**. In step **410**, text input logic **326** traps the next asynchronous event. In this illustrative example, the user presses the "6" key of numeric keypad **106** prior to time **206** (**FIG. 2**). However, it is possible that predictive analysis completes prior to pressing of the "6" key by the user.

[0069] If predictive analysis does not complete prior to pressing of the "6" key by the user, the first asynchronous event trapped by text input logic **326** is detected input and processing accordingly transfers to step **502** in which any predictive analysis is terminated. From step **502**, processing transfers to step **404** in which the input signals are interpreted as specification of one of the letters associated with the "6" key, namely, "m,""n," or "o." Once any of data input keys **106** is pressed by the user, multi-tap techniques are employed to determine which letter is intended by the user. Thus, in this illustrative embodiment, the user presses the "6" key thrice without a significant pause to indicate the letter "o" is intended.

[0070] Suppose, however, for illustration purposes that predictive analysis completes prior to pressing the "6" key by the user. In this scenario, the first trapped asynchronous event is the completion of predictive analysis by text input logic **326**. Accordingly, processing transfers to step test step **702** (**FIG. 8**). Since time **206** has not yet been reached, the timer is set to expire at time **206** and processing transfers from test step **702** to step **410**, bypassing step **704** such that results of predictive analysis are not displayed in window **108**A (**FIG. 12**). In step **410**, the next asynchronous event is trapped.

[0071] In this illustrative example, the next asynchronous event is detection of input signals prior to time **206**. Thus, processing transfers to step **502** in which the data input signals are processed in the manner described above. As a result, no predictive results are presented despite completion of predictive analysis. Whether predictive analysis completes prior to user input or subsequently, results of predictive analysis are not shown prior to time **206**.

[0072] Continuing in this illustrative embodiment, the user enters another character resulting in the view shown in **FIG. 13**. Subsequent to receipt of the letter "r" as shown, the user does not press any keys of mobile telephone **100** prior to time **206**. Therefore, a number of possible sequences of events are possible. In one sequence, predictive analysis results are available prior to time **206**. In another sequence of events, predictive analysis results become available after time **206** and prior to time **210**. In a third sequence of events, predictive analysis results are not available at time **210**.

[0073] In the first sequence of events, predictive analysis results are available prior to time **206**. The first event trapped is completion of predictive analysis and, since time **206** has not yet been reached, processing transfers through test step **702** to step **410** in the manner described above. The second event trapped is a timeout event at time **206** and processing transfers from step **410** to test step **602**. In test step **602**, text input logic **326** determines whether the timer is set to expire at time **206** or at time **210**. Since the timer is set to expired at time **206**, processing transfers to test step **604** and therefrom to step **606** since predictive analysis results are available. In step **606**, test input logic **326** presents predicted candidates for selection by the user in the manner described above. Such is shown in **FIG. 14** in which text input logic **326** has predicted that the user intends to enter the word "forward." The user is free to select this predicted word and add it to text in window **108**B in the manner described above. If the user does so, the next event trapped in step **410** is user input and processing transfers to step **404**.

[0074] In the second sequence of events, predictive analysis results become available after time **206**. Accordingly, the first event trapped is a timeout at time **206**. Processing transfers from step **410** to test step **602**. Since the timer is set to expire at time **206**, processing transfers to test step **604**. Since no predictive analysis results are available, i.e., predictive analysis continues, processing transfers to step **608**

in which text input logic **326** changes the prompt or another aspect of display **108** to indicate a transition from a passive state to an active state. In step **610**, text input logic **326** sets the timer to expire at time **210** such that the next timer-related event to be trapped is expiration of time interval **208**.

[**0075**] The next event to be trapped in step **410** in this illustrative example is completion of predictive analysis. Accordingly, processing transfers to test step **702** and therethrough to step **704** since the timer is now set to expire at time **210**. In step **704**, text input logic **326** presents results of predictive analysis to the user for selection and the timer is cleared in step **706**. Accordingly, the user can select from among the predicted candidates and the timer will no longer generate an asynchronous event which could interrupt browsing and selection of predicted candidates by the user.

[**0076**] In the third sequence of events, predictive analysis results are not available at time **210**. In the manner described above, the first event trapped is a timeout which causes processing to include steps **602**, **604**, **608**, and **610**. In step **610**, the timer is set to expire at time **210**. Since results of predictive analysis are not available at time **210** in this illustrative sequence of events, the next event trapped at step **410** is another timeout event. From test step **602**, processing transfers to step **612** since the timer is set to expire at time **210**.

[**0077**] In step **612**, text input logic **326** terminates predictive analysis. In step **614**, text input logic **326** clears the timer so no further timeout events occur until user input is detected, thereby causing another performance of step **408**. In step **616**, text input logic **326** changes the prompt or another aspect of display **108** to indicate to the user a change from an active state to a passive state such that the user understands that predictive analysis results are not forthcoming.

[**0078**] The benefits of the system described above with respect to text entry are also applicable to specification of other types of data. For example, a user can enter data representing a file stored within mobile telephone **100**, a contact stored within a contacts database within mobile telephone **100**, an image, or a sound. In some embodiments, the type of data which can be specified by the user is clear and unambiguous. In another embodiment, various contexts of data input are implemented and each context can have two or more valid data types. For example, in the context of composing a text message, valid types can include all those listed above, namely, filenames, contacts, images, and sounds. In the body of a text message, the user can identify a contact to (i) address the message to the contact or (ii) to attach a v-card representing identified contact information to the message. Similarly, specifying an image, a sound, or any other file stored in mobile telephone **100** in the body of a message enables attachment of the corresponding file to the message. In addition, the user can enter ordinary words in the manner described above.

[**0079**] To support various types of data specified by a user, predictive database **328** includes various databases **1002-1012 (FIG. 10)**. File database **1002** includes data specifying files stored within mobile telephone **100**. Contacts database **1004** includes data specifying contact information, e.g., telephone numbers, addresses, e-mail addresses, and various message service addresses, of individuals whom the user may wish to contact. Images database **1006** includes data specifying information about various images stored within mobile telephone **100**. Sounds database **1008** includes data specifying information about various sounds stored within mobile telephone **100**, including ring tones, for example.

[**0080**] In addition, predictive database **328** includes a dictionary **1010** of the English language such that text input logic **326 (FIG. 3)** can accurately predict words of the English language intended by the user during text input in the manner described above. Predictive database **328** also includes (i) a personal dictionary **1012** which includes words specific to the user, i.e., proper nouns and slang frequently used by the user or stored in a contacts database used by the user and (ii) a used words dictionary **1014** which specifies words previously entered by the user such that words entered by the user which are not represented within dictionary **1010**. Accordingly, text input logic **326 (FIG. 3)** can accurately predict non-standard words entered by the user, including slang terms, neologies, and proper nouns for example. Used words dictionary **1014** is used in conjunction with databases **1002-1012** to order predicted candidates according to frequency and/or recency of use by the user. Thus, predictive behavior adapts to the specific data entry habits of the specific user.

[**0081**] Index of remote data **1014** includes references to data similar to data stored in databases **1002-1012** and which is accessible through a network. For example, contact data can be retrieved from known and conventional LDAP WAP or web servers. Similarly, sounds such as ring tones and music in the known and ubiquitous MP3 format and be made available through wireless Internet servers and cataloged and referenced within index of remote data **1014**.

[**0082**] Text input logic **326** predicts data intended by the user when implementing multiple data types in the manner shown in logic flow diagram **900 (FIG. 9)**. Loop step **902** and next step **910** define a loop in which each of the databases **1002-1014** which are valid in the current context. The context is determined by the type of task currently being performed by mobile telephone **100**. If the user is specifying the intended recipient of a text message, only contacts database **1004** is valid. During composition of the body of a text message, all databases **1002-1014** are valid. During each iteration of the loop of steps **902-910**, the particular database processed according to steps **904-908** is referred to as the subject database.

[**0083**] In step **904**, text input logic **326** identifies entries in the subject database which match one or more characters recently specified by the user. In step **906**, text input logic **326** identifies a graphical icon that is associated with the subject database. For example, a file can be associated with a file icon; an image can be associated with an image icon or a thumbnail of the image itself; a sound can be associated with a musical note icon; and a contact can be associated with an index card icon. In step **906**, text input logic **326** associates the graphical icon with a textual representation of each of the entries. Accordingly, subsequent presentation of any of the entries as results of predictive analysis, e.g., in steps **606** or **704**, can cause the associate icon to be displayed in conjunction with the textual description. Thus, the user can readily determine the type of data item predicted by text input logic **326**. For example, an associated icon can indicate to the user whether a predicted candidate whose textual description is "jack" is a contact, an image, a sound, or a word.

[0084] The result of processing according to logic flow diagram **900** is shown in **FIG. 16**. In display **108**, the word, "jack," is highlighted with a dotted underline **1602** to indicate that predicted candidates are available for that word. Display **108** also includes icons **1604-1612**, displayed in respective performances of step **908** (**FIG. 9**), to indicate the various types of predicted candidates which are available for "jack" in the context shown in **FIG. 16**. Specifically, (i) icon **1604** is a Rolodex® style card to represent contact information associated with "jack," (ii) icon **1606** is a camera to represent one or more graphical images associated with "jack," (iii) icon **1608** is a speaker to represent one or more sounds associated with "jack," (iv) icon **1610** is document icon to represent one or more data files associated with "jack," and (v) icon **1612** is a book to indicate one or more words which begin with "jack." Thus, by using control keys **104**, the user can select from the various data types represented by icons **1604-1620** to select the type of data indicated by the entered text, "jack."

[0085] For example, the user can highlight and select icon **1604** to indicate that "jack" refers to contact information, e.g., of a person. Upon such selection, mobile telephone **100** allows the user to select from one or more contact records associated with "jack."

[0086] Once such a record is selected, actions can be associated with contacts and can be initiated by the user. One such action can be to address the current message currently being composed and shown in display **108** to the entity represented by the selected contact record. Another such action is to associate a v-card data item representing the selected contact record for attachment to the current message.

[0087] Other actions can be associated with other data types. Sounds in a message can be embedded in the message such that the sound plays when the message is displayed or can be attached as a sound data file. Images can be embedded in the message such that the image is a displayed component of the message itself or can be attached as an image data file. A data file can be attached to the message or the contents of the data file can be imported into the body of the message.

[0088] The above description is illustrative only and is not limiting. For example, while text messaging using a wireless telephone is described as an illustrative embodiment, it is appreciated that text entry in the manner described above is equally applicable to many other types of text entry. Wireless telephones use text entry for purposes other than messaging such as storing a name of the wireless telephone's owner and associating textual names or descriptions with stored telephone numbers. In addition, devices other than wireless telephones can be used for text messaging, such as two-way pagers and personal wireless e-mail devices. Personal Digital Assistants (PDAs) and compact personal information managers (PIMs) can utilize text entry in the manner described here to enter contact information and generally any type of data. Entertainment equipment such as DVD players, VCRs, etc. can use text entry in the manner described above for on-screen programming or in video games to enter names of high scoring players. Video cameras with little more than a remote control with a numeric keypad can be used to enter text for textual overlays over recorded video. Text entry in the manner described above can even be used for word processing or any data entry in a full-sized, fully-functional computer system.

[0089] Therefore, this description is merely illustrative, and the present invention is defined solely by the claims which follow and their full range of equivalents.

What is claimed is:

1. A method for generating information in response to signals generated by a user, the method comprising:

generating a predictive interpretation of data intended by the user by the signals; and

postponing presentation of the predictive interpretation during a first interval of time.

2. The method of claim 1, wherein the method includes:

presenting the predictive interpretation to the user after the first interval of time;

receiving an indication of a selection of the predictive interpretation from the user; and

accepting the selected predictive interpretation as accurately representing the data intended by the user.

3. The method of claim 2, wherein the step of presenting includes:

displaying the selected predictive interpretation.

4. The method of claim 2, wherein the step of presenting includes:

generating a voice synthesis of the selected predictive interpretation; and

outputting the voice synthesis through a speaker.

5. The method of claim 1, wherein the method includes:

determining that a second predetermined time interval has expired; and

changing a display characteristic to indicate that the predictive interpretation is not available.

6. The method of claim 1, wherein the step of generating includes:

searching a predictive database for data corresponding to the one or more signals.

7. A method for generating information in response to signals generated by a user, the method comprising:

determining that the signals from the user represent entered data;

predicting supplemental data from the entered data;

determining that the user has paused during generation of the signals for a first time interval of a predetermined length; and

presenting the supplemental data to the user.

8. The method of claim 7, wherein the predicting includes:

searching a predictive database for the data.

9. The method of claim 7, wherein the method includes:

receiving an indication of selection of the predicted supplemental data from the user; and

modifying the entered data in accordance with the supplemental data.

10. The method of claim 7, wherein the method includes:

determining that a second predetermined time period has expired; and

changing a display characteristic to indicate that the supplemental data is not available.

11. A method for generating information in response to signals generated by a user, the method comprising:

receiving data from a user;

predicting at least one character from the data;

determining that a first time-interval has expired since the receiving;

presenting the at least one character for selection by the user after the first time-interval;

receiving an indication of selection of the at least one character from the user; and

modifying the data in accordance with the selected character.

12. The method of claim 11, wherein the predicting includes:

searching a predictive database for the data.

13. The method of claim 11, wherein the method includes:

changing a characteristic of a display to indicate that the selection is not available, after expiration of a second predetermined time interval.

14. A computer readable medium useful in association with a computer which includes a processor and a memory, the computer readable medium including computer instructions which are configured to cause the computer to provide predictive interpretation of a plurality of user input signals by performing the steps of:

generating in the memory a predictive interpretation of data intended by the user by the signals; and

postponing presentation of the predictive interpretation to an output device during a first interval of time.

15. The computer readable medium of claim 14, wherein execution of the computer instructions cause the computer to also perform the steps of:

presenting the predictive interpretation to the user through the output device after the first interval of time;

receiving an indication of a selection of the predictive interpretation from the user through an input device; and

accepting the selected predictive interpretation as data specified by the one or more user input gestures.

16. The computer readable medium of claim 15, wherein the step of presenting includes:

displaying the selected predictive interpretation.

17. The computer readable medium of claim 15, wherein the step of presenting includes:

generating a voice synthesis of the selected predictive interpretation; and

outputting the voice synthesis through a speaker.

18. The computer readable medium of claim 14, wherein the computer instructions are configured to cause the computer to perform the following additional steps:

determining that a second predetermined time interval has expired; and

changing a display characteristic to indicate that the predictive interpretation is not available.

19. The computer readable medium of claim 14, wherein the step of generating includes:

searching a predictive database for data corresponding to the one or more signals.

20. A computer readable medium useful in association with a computer which includes a processor and a memory, the computer readable medium including computer instructions which are configured to cause the computer to provide predictive interpretation of one or more user input signals by performing the steps of:

generating in a memory a predictive interpretation during a first time interval of signals of one or more user input gestures; and

postponing presentation of the predictive interpretation to an output device during the first interval of time.

21. The computer readable medium of claim 20, wherein the computer instructions are configured to cause the computer to perform the following additional steps:

presenting the predictive interpretation to the user through the output device after the first interval of time;

receiving an indication of a selection of the predictive interpretation from the user through an input device; and

accepting the selected predictive interpretation as data specified by the one or more user input gestures.

22. The computer readable medium of claim 21, wherein the step of presenting includes:

displaying the selected predictive interpretation.

23. The computer readable medium of claim 20, wherein the step of presenting includes:

generating a voice synthesis of the selected predictive interpretation; and

outputting the voice synthesis through a speaker.

24. The computer readable medium of claim 20, wherein the computer instructions are configured to cause the computer to perform the following additional steps:

determining that a second predetermined time interval has expired; and

changing a display characteristic to indicate that the predictive interpretation is not available.

25. The computer readable medium of claim 20, wherein the step of generating includes:

searching a predictive database for data corresponding to the one or more signals.

26. A computer readable medium useful in association with a computer which includes a processor and a memory, the computer readable medium including computer instructions which are configured to cause the computer to provide predictive interpretation of user input signals, by performing the steps of:

determining that the signals from the user represent entered data;

predicting supplemental data from the received data;

determining that the user has paused during entry of the data for a first predetermined time interval; and

presenting the supplemental data to the user.

27. The computer readable medium of claim 26, wherein the predicting includes:

searching a predictive database for the data.

28. The computer readable medium of claim 26, wherein the computer instructions are configured to cause the computer to perform the following additional steps:

receiving an indication of selection of the predicted supplemental data from the user; and

modifying the data in accordance with the supplemental data.

29. The computer readable medium of claim 26, wherein the computer instructions are configured to cause the computer to perform the following additional steps:

determining that a second predetermined time period has expired; and

changing a display characteristic to indicate that the supplemental data is not available.

30. A computer readable medium useful in association with a computer which includes a processor and a memory, the computer readable medium including computer instructions which are configured to cause the computer to provide predictive interpretation of a plurality of user input signals, by performing the steps of:

receiving data from a user;

predicting at least one character from the data;

determining that a first time-interval has expired since the receiving;

presenting the predicted character for selection by the user after the first time-interval;

receiving an indication of selection of the predicted character from the user; and

modifying the data in accordance with the selected character.

31. The computer readable medium of claim 30, wherein the predicting includes:

searching a predictive database for the data.

32. The computer readable medium of claim 30, wherein the computer instructions are configured to cause the computer to perform the following additional steps:

changing a characteristic of the display to indicate that the selection is not available, after expiration of a second predetermined time interval.

33. A computer system comprising:

a processor;

a memory operatively coupled to the processor; and

a predictive interpreter which executes in the processor from the memory and which, when executed by the processor, causes the computer to provide predictive interpretation of a plurality of user input signals, by performing the steps of:

generating a predictive interpretation of data intended by the user by the signals; and

postponing presentation of the predictive interpretation during a first interval of time.

34. The computer system of claim 33, wherein the predictive interpreter, when executed, performs the following additional step:

presenting the predictive interpretation to the user after the first interval of time;

receiving an indication of a selection of the predictive interpretation from the user; and

accepting the selected predictive interpretation as accurately representing the data intended by the user.

35. The computer system of claim 34, wherein the step of presenting includes:

displaying the selected predictive interpretation.

36. The computer system of claim 34, wherein the step of presenting includes:

generating a voice synthesis of the selected predictive interpretation; and

outputting the voice synthesis through a speaker.

37. The computer system of claim 33, wherein the predictive interpreter, when executed, performs the following additional steps:

determining that a second predetermined time interval has expired; and

changing a display characteristic to indicate that the predictive interpretation is not available.

38. The computer system of claim 33, wherein the step of generating includes:

searching a predictive database for data corresponding to the one or more signals.

39. A computer system comprising:

a processor;

a memory operatively coupled to the processor; and

a predictive interpreter which executes in the processor from the memory and which, when executed by the processor, causes the computer to provide predictive interpretation of a plurality of user input signals, by performing the steps of:

determining that the signals from the user represent entered data;

predicting supplemental data from the received text;

determining that the user has paused during entry of the data for a first predetermined time interval; and

presenting the supplemental data to the user.

40. The computer system of claim 39, wherein the predicting includes:

searching a predictive database for the data.

41. The computer system of claim 39, wherein the predictive interpreter, when executed, performs the following additional steps:

receiving an indication of selection of the predicted supplemental data from the user; and

modifying the data in accordance with the supplemental data.

42. The computer system of claim 39, wherein the predictive interpreter, when executed, performs the following additional steps:

determining that a second predetermined time period has expired; and

changing a display characteristic to indicate that the supplemental data is not available.

43. A computer system comprising:

a processor;

a memory operatively coupled to the processor; and

a predictive interpreter which executes in the processor from the memory and which, when executed by the processor, causes the computer to provide predictive interpretation of a plurality of user input signals, by performing the steps of:

receiving data from a user;

predicting at least one character from the data;

determining that a first time-interval has expired since the receiving;

presenting the predicted character for selection by the user after the first time-interval;

receiving an indication of selection of the predicted character from the user; and

modifying the data in accordance with the selected character.

44. The computer system of claim 43, wherein the predicting includes:

searching a predictive database for the data.

45. The computer system of claim 43, wherein the predictive interpreter, when executed, performs the following additional step:

changing a characteristic of a display to indicate that the selection is not available, after expiration of a second predetermined time interval.

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