



- (51) **International Patent Classification:**
G06F 3/041 (2006.01)
- (21) **International Application Number:**
PCT/CN2013/077169
- (22) **International Filing Date:**
13 June 2013 (13.06.2013)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (71) **Applicant:** NOKIA CORPORATION [FI/FI]; Keilalahdentie 4, FI-02150 Espoo (FI).
- (71) **Applicant (for LC only):** NOKIA (CHINA) INVESTMENT CO., LTD. [CN/CN]; Nokia China Campus, No.5 Donghuan Zhonglu, Beijing Economic and Technological Development Area, Daxing District, Beijing 100176 (CN).
- (72) **Inventor:** ZHANG, Liang; Room 7A1, #1 Building, Yard 2, Shenghejiayuan, Anhuidongli, Chaoyang District, Beijing 100101 (CN).
- (74) **Agent:** KING & WOOD MALLESONS; 20th Floor, East Tower, World Financial Center, No.1 Dongsanhuan Zhonglu, Chaoyang District, Beijing 100020 (CN).
- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

- (54) **Title:** A METHOD AND APPARATUS FOR DISTINGUISHING PARTIAL AND COMPLETE HANDWRITTEN SYMBOLS

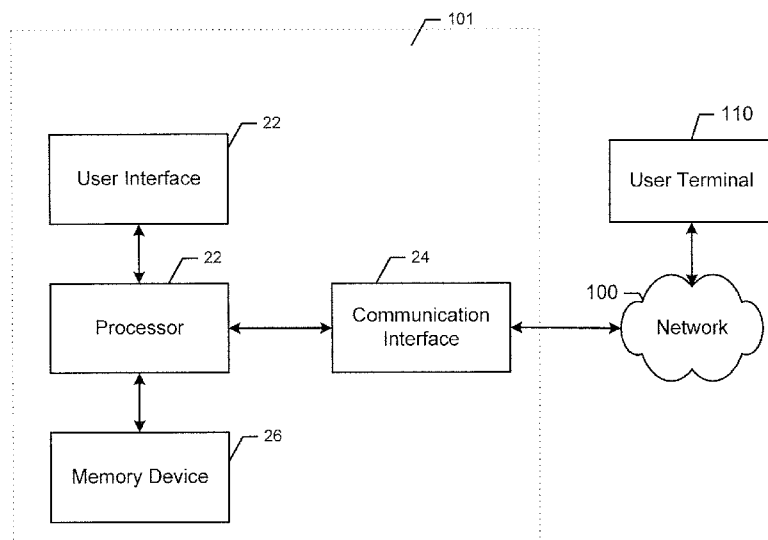


Figure 1

- (57) **Abstract:** A method, apparatus, and computer program product are provided for distinguishing partial and complete symbols during handwriting recognition. The technique includes determining that an input may be both a potential complete symbol and a partial symbol, and altering a timeout period used to identify the completion of one symbol and the start of a next symbol. The technique may be valuable in Chinese script, in which a symbol may represent both a complete symbol, and a radical that is a portion of another complete symbol. Altering the timeout period may give a user an opportunity to complete a symbol without a system falsely identifying a partial symbol as a complete symbol.

A METHOD AND APPARATUS FOR DISTINGUISHING PARTIAL AND COMPLETE HANDWRITTEN SYMBOLS

5 TECHNOLOGICAL FIELD

An example embodiment of the present invention relates generally to handwriting recognition, and more particularly, to a method, apparatus and computer program product for distinguishing partial and complete handwritten symbols.

10 BACKGROUND

Handwriting recognition systems are used in various computing devices including personal computers, mobile devices, and the like. In some natural languages, such as Chinese, individual characters, referred to as radicals, may have both a meaning on their own, and may be combined with other radicals to form a
15 complete symbol with a different meaning from that of one radical alone. Any number of radicals may be written on top of one another, above, below and/or side by side, and may be adjacent and/or adjoined to form a complete symbol.

BRIEF SUMMARY

20 A method, apparatus, and computer program product are therefore provided for distinguishing partial and complete handwritten symbols. In an example embodiment, a method is provided that includes receiving a first handwritten input, determining that the first handwritten input is both a) a potential complete symbol, and b) a portion of a complete symbol, and altering a timeout period. The identification of
25 at least one complete symbol candidate occurs upon expiration of the timeout period.

In some embodiments, the method further includes receiving at least a second handwritten input, and determining that the first handwritten input and the at least second handwritten input form a complete symbol that is not likely extendable. Altering the timeout period may include extending the timeout period, and the method
30 may further include determining, after receipt of the first handwritten input, that the extended timeout period is expired without receipt of an additional handwritten input, and identifying at least one complete symbol candidate based on the first handwritten input. In some embodiments, altering the timeout period may include overriding the timeout period, and the method may further include receiving an indication that the
35 first handwritten input is a complete symbol.

In some embodiments, the first handwritten input is a Chinese radical. Altering a timeout period may include determining a partial symbol timeout period and a

complete symbol timeout period. The method may further include causing display of the at least one complete symbol candidate for selection.

In another embodiment, an apparatus is provided that includes at least one processor and at least one memory including computer program code with the at least one memory and the computer program code configured to, with the processor, cause the apparatus to at least receive a first handwritten input, determine that the first handwritten input is both a) a potential complete symbol, and b) a portion of a complete symbol, and alter a timeout period. The identification of at least one complete symbol candidate occurs upon expiration of the timeout period.

In some embodiments, the at least one memory and the computer program code are further configured to, with the processor receive at least a second handwritten input, and determine that the first handwritten input and the at least second handwritten input form a complete symbol that is not likely extendable. In some embodiments, the at least one memory and the computer program code are further configured to, with the processor, determine, after receipt of the first handwritten input, that the extended timeout period is expired without receipt of an additional handwritten input, and identify at least one complete symbol candidate based on the first handwritten input. Altering the timeout period may include overriding the timeout period, and the at least one memory and the computer program code may be further configured to, with the processor receive an indication that the first handwritten input is a complete symbol.

In a further embodiment, a computer program product is provided that includes at least one non-transitory computer-readable storage medium having computer-executable program code instructions stored therein with the computer-executable program code instructions including program code instructions to receive a first handwritten input, determine that the first handwritten input is both a) a potential complete symbol, and b) a portion of a complete symbol, and alter a timeout period. The identification of at least one complete symbol candidate occurs upon expiration of the timeout period.

The computer-executable program code instructions may further include program code instructions to receive at least a second handwritten input, and determine that the first handwritten input and the at least second handwritten input form a complete symbol that is not likely extendable.

In some embodiments the computer-executable program code instructions further include program code instructions to determine, after receipt of the first handwritten input, that the extended timeout period is expired without receipt of an

additional handwritten input, and identify at least one complete symbol candidate based on the first handwritten input.

Altering the timeout period may include overriding the timeout period, and the program code instructions may be further configured to receive an indication that the first handwritten input is a complete symbol.

In yet another embodiment, an apparatus is provided that includes means for receiving a first handwritten input, means for determining that the first handwritten input is both a) a potential complete symbol, and b) a portion of a complete symbol, and means for altering a timeout period. The identification of at least one complete symbol candidate occurs upon expiration of the timeout period.

BRIEF DESCRIPTION OF THE DRAWINGS

Having thus described certain example embodiments of the present invention in general terms, reference will hereinafter be made to the accompanying drawings which are not necessarily drawn to scale, and wherein:

Figure 1 is a block diagram of an apparatus that may be configured to implement example embodiments of the present invention;

Figure 2 is a flowchart illustrating operations to distinguish partial and complete symbols, according to an example embodiment; and

Figures 3A-3D are displays according to an example embodiment.

DETAILED DESCRIPTION

Some example embodiments of the present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all, embodiments of the invention are shown. Indeed, various embodiments of the invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout. As used herein, the terms “data,” “content,” “information,” and similar terms may be used interchangeably to refer to data capable of being transmitted, received and/or stored in accordance with embodiments of the present invention. Thus, use of any such terms should not be taken to limit the spirit and scope of embodiments of the present invention.

Additionally, as used herein, the term ‘circuitry’ refers to (a) hardware-only circuit implementations (e.g., implementations in analog circuitry and/or digital circuitry); (b) combinations of circuits and computer program product(s) comprising software and/or firmware instructions stored on one or more computer readable

memories that work together to cause an apparatus to perform one or more functions described herein; and (c) circuits, such as, for example, a microprocessor(s) or a portion of a microprocessor(s), that require software or firmware for operation even if the software or firmware is not physically present. This definition of 'circuitry' applies to all uses of this term herein, including in any claims. As a further example, as used herein, the term 'circuitry' also includes an implementation comprising one or more processors and/or portion(s) thereof and accompanying software and/or firmware. As another example, the term 'circuitry' as used herein also includes, for example, a baseband integrated circuit or applications processor integrated circuit for a mobile phone or a similar integrated circuit in a server, a cellular network device, other network device, and/or other computing device.

As defined herein, a "computer-readable storage medium," which refers to a physical storage medium (e.g., volatile or non-volatile memory device), may be differentiated from a "computer-readable transmission medium," which refers to an electromagnetic signal.

As described below, a method, apparatus and computer program product are provided to distinguish partial and complete symbols in handwriting recognition systems. As described above, many symbols in the Chinese language can stand alone as a complete symbol, and/or may represent a radical, or partial symbol.

Because of the complex nature of the radicals and complete symbols comprising multiple radicals, it is common for a user to pause between the writing of symbols. Therefore, a timeout period is often used to determine when a user has completed writing one symbol. In other words, after a pause of one second, for example, a system may identify a previously written symbol as a complete symbol, and subsequent writing as an additional symbol.

However, because many users may also pause between the writing of radicals wherein multiple radicals make up on complete symbol, Chinese radicals are often misinterpreted as complete symbols, prior to the user's completion of remaining radicals. For example, the symbol for "bright" comprises two radicals, individually meaning "sun" and "moon." Handwriting recognition systems may erroneously identify the symbol for "sun" prior to completion of the symbol for "bright" while a user pauses to consider how to write the radical for "moon."

Example embodiments may improve the detection of partial and complete symbols by determining whether a user intends for an input to be a complete symbol, or intends to provide additional radical(s) with which to combine an input. Chinese symbols are used throughout merely as an example and it will be appreciated that

embodiments may be applied to other written languages and/or other types of character input.

Referring now to Figure 1, apparatus 101 for distinguishing partial and complete symbols may include or otherwise be in communication with a processor 20, user interface 22, communication interface 24, and memory device 26. Apparatus 101 may be embodied by a wide variety of devices including mobile terminals, such as personal digital assistants (PDAs), pagers, mobile televisions, mobile telephones, gaming devices, laptop computers, tablet computers, cameras, camera phones, video recorders, audio/video players, radios, global positioning system (GPS) devices, navigation devices, or any combination of the aforementioned, and other types of voice and text communications systems. The apparatus 101 need not necessarily be embodied by a mobile device and, instead, may be embodied in a fixed device, such as a computer or workstation.

In some embodiments, the processor 20 (and/or co-processors or any other processing circuitry assisting or otherwise associated with the processor 20) may be in communication with the memory device 26 via a bus for passing information among components of the apparatus 101. The memory device 26 may include, for example, one or more volatile and/or non-volatile memories. In other words, for example, the memory device 26 may be an electronic storage device (e.g., a computer readable storage medium) comprising gates configured to store data (e.g., bits) that may be retrievable by a machine (e.g., a computing device like the processor 20). The memory device 26 may be configured to store information, data, content, applications, instructions, or the like for enabling the apparatus to carry out various functions in accordance with an example embodiment of the present invention. For example, the memory device 26 could be configured to buffer input data for processing by the processor 20. Additionally or alternatively, the memory device 26 could be configured to store instructions for execution by the processor 20, and/or a dictionary of Chinese symbols to be referenced according to example embodiments described herein.

The apparatus 101 may, in some embodiments, be embodied in various devices as described above. However, in some embodiments, the apparatus 101 may be embodied as a chip or chip set. In other words, the apparatus 101 may comprise one or more physical packages (e.g., chips) including materials, components and/or wires on a structural assembly (e.g., a baseboard). The structural assembly may provide physical strength, conservation of size, and/or limitation of electrical interaction for component circuitry included thereon. The apparatus 101 may therefore, in some cases, be configured to implement an embodiment of the present invention on a single chip or as a single "system on a chip." As such, in some

cases, a chip or chipset may constitute means for performing one or more operations for providing the functionalities described herein.

The processor 20 may be embodied in a number of different ways. For example, the processor 20 may be embodied as one or more of various hardware processing means such as a coprocessor, a microprocessor, a controller, a digital signal processor (DSP), a processing element with or without an accompanying DSP, or various other processing circuitry including integrated circuits such as, for example, an ASIC (application specific integrated circuit), an FPGA (field programmable gate array), a microcontroller unit (MCU), a hardware accelerator, a special-purpose computer chip, or the like. As such, in some embodiments, the processor 20 may include one or more processing cores configured to perform independently. A multi-core processor may enable multiprocessing within a single physical package. Additionally or alternatively, the processor 20 may include one or more processors configured in tandem via the bus to enable independent execution of instructions, pipelining and/or multithreading.

In an example embodiment, the processor 20 may be configured to execute instructions stored in the memory device 26 or otherwise accessible to the processor 20. Alternatively or additionally, the processor 20 may be configured to execute hard coded functionality. As such, whether configured by hardware or software methods, or by a combination thereof, the processor 20 may represent an entity (e.g., physically embodied in circuitry) capable of performing operations according to an embodiment of the present invention while configured accordingly. Thus, for example, when the processor 20 is embodied as an ASIC, FPGA or the like, the processor 20 may be specifically configured hardware for conducting the operations described herein.

Alternatively, as another example, when the processor 20 is embodied as an executor of software instructions, the instructions may specifically configure the processor 20 to perform the algorithms and/or operations described herein when the instructions are executed. However, in some cases, the processor 20 may be a processor of a specific device (e.g., a mobile terminal or network entity) configured to employ an embodiment of the present invention by further configuration of the processor 20 by instructions for performing the algorithms and/or operations described herein. The processor 20 may include, among other things, a clock, an arithmetic logic unit (ALU) and logic gates configured to support operation of the processor 20.

Meanwhile, the communication interface 24 may be any means such as a device or circuitry embodied in either hardware or a combination of hardware and software that is configured to receive and/or transmit data from/to a network and/or any other device or module in communication with the apparatus 101. In this regard,

the communication interface 24 may include, for example, an antenna (or multiple antennas) and supporting hardware and/or software for enabling communications with a wireless communication network. Additionally or alternatively, the communication interface 24 may include the circuitry for interacting with the antenna(s) to cause
5 transmission of signals via the antenna(s) or to handle receipt of signals received via the antenna(s). In some environments, the communication interface 24 may alternatively or also support wired communication. As such, for example, the communication interface 24 may include a communication modem and/or other hardware/software for supporting communication via cable, digital subscriber line
10 (DSL), universal serial bus (USB) or other mechanisms.

In some embodiments, such as instances in which the apparatus 101 is embodied by a user device, the apparatus 101 may include a user interface 22 that may, in turn, be in communication with the processor 20 to receive an indication of a user input and/or to cause provision of an audible, visual, mechanical or other output
15 to the user. For example, user interface 22 may be any means by which a user may provide a handwritten input, among other things. As such, the user interface 22 may include, for example, a stylus, a keyboard, a mouse, a joystick, a display, a touch screen(s), touch areas, soft keys, a microphone, a speaker, or other input/output mechanisms. Alternatively or additionally, the processor 20 may comprise user
20 interface circuitry configured to control at least some functions of one or more user interface elements such as, for example, a speaker, ringer, microphone, display, and/or the like. The processor 20 and/or user interface circuitry comprising the processor 20 may be configured to control one or more functions of one or more user interface elements through computer program instructions (e.g., software and/or
25 firmware) stored on a memory accessible to the processor 20 (e.g., memory device 26, and/or the like).

The apparatus 101 may receive the handwritten input. Additionally or alternatively, a user terminal 110 may receive the handwritten input that is provided to and analyzed by the apparatus 101. In this embodiment, any number of user
30 terminal(s) 110 may connect to apparatus 101 via a network 100. User terminal 110 may be embodied as a mobile terminal, such as personal digital assistants (PDAs), pagers, mobile televisions, mobile telephones, gaming devices, laptop computers, tablet computers, cameras, camera phones, video recorders, audio/video players, radios, global positioning system (GPS) devices, navigation devices, or any
35 combination of the aforementioned, and other types of voice and text communications systems. The user terminal 110 need not necessarily be embodied by a mobile device and, instead, may be embodied in a fixed device, such as a computer or

workstation. The user terminal 110 may include a user interface, similar to the user interface 22, to enable a user in an example embodiment to provide handwritten input, to ultimately be processed by the apparatus 101.

Network 100 may be embodied in a local area network, a wide area network, e.g., the Internet, any other form of a network, or in any combination thereof, including proprietary private and semi-private networks and public networks. The network 100 may comprise a wire line network, wireless network (e.g., a cellular network, wireless local area network, wireless wide area network, some combination thereof, or the like), or a combination thereof, and in some example embodiments comprises at least a portion of the Internet. As another example, a user terminal 110 may be directly coupled to an apparatus 101. In some embodiments, the apparatus 101 may be embodied as or otherwise associated with a user terminal 110, the user terminal 110 receiving handwritten input, and providing the handwriting recognition operations described herein.

Figure 2 is a flowchart of example operations apparatus 101 may perform to distinguish partial and complete handwritten symbols. At operation 200, the apparatus 101 may include means, such as processor 20, user interface 22, communication interface 24, and/or the like, for receiving a first handwritten input. The input, and other handwritten inputs described herein may be provided by a stylus, finger, and/or other pointing device. The first handwritten input may comprise any number of strokes. In some embodiments, the apparatus 101 may process each individual stroke of the user handwriting as a first handwritten input. In some embodiments, the input may be communicated from a device over network 100, to the apparatus 101, such as by the communication interface 24.

As shown by operation 202, the apparatus 101 may include means, such as processor 20, and memory device 26, for example, for determining that the first handwritten input is a potential complete symbol and a portion of a complete symbol. For example, the apparatus 101, such as the processor 20, may process, as a first handwritten input, a series of strokes representing the Chinese symbol for “sun.” The apparatus 101, with processor 20, may determine that the symbol is a potential complete symbol, e.g., the user intended to input, “sun.” The apparatus 101, such as the processor 20, may also determine that the symbol is a portion of a complete symbol, such as the symbol for “bright,” which comprises two radicals, “sun,” and “moon.” The apparatus 101 may make this determination, for example, by accessing a symbol dictionary or repository on memory device 26. The symbol for “sun,” may be identified as a complete symbol, and/or a partial symbol, that when combined with

another partial symbol, forms a symbol with a different meaning than if the partial symbol were interpreted individually as a complete symbol.

In some embodiments, the apparatus 101 may include means, such as the processor 20, the user interface 22 the communication interface 24 or the like, for providing an indication of a number of potential complete symbols that incorporate the input as a radical. In some embodiments, popularity and/or usage of symbols may be tracked or otherwise accessed by the processor 20 to determine probabilities or likelihoods that an input is provided is intended as a complete symbol or a partial symbol. In some embodiments, potential complete symbol candidates may be displayed to the user, and may be selectable.

Continuing to operation 206, the apparatus 101 may include means, such as processor 20, and/or memory device 26, to alter a timeout period, wherein identification of at least one complete symbol candidate occurs upon expiration of the timeout period. An apparatus 101, and/or a handwriting recognition system may utilize a timeout period to identify the end of one complete symbol and the start of a subsequent symbol. If a user provides an input, and pauses for one second, for example, before providing an additional input, the apparatus 101 and/or handwriting recognition system may consider the pause to signal of completion of one symbol and the start of another.

As such, in some embodiments, the apparatus 101, such as the processor 20, may alter a timeout period by overriding it altogether, allowing a user to signal by some other means, such as via input provided via the user interface 22, when a complete symbol has been entered. In some embodiments, this may be accomplished by the apparatus 101, such as the processor 20, providing a list of complete candidate symbols. Selection of a complete candidate symbol by the user may signal to the apparatus 101 the intended symbol, and may allow the user to begin providing a handwritten input for the next symbol.

In some embodiments, a timeout may be extended by the processor 20, such as by adding, e.g., a predefined amount, to the timeout or by resetting the timeout to a new, larger value, e.g., a predetermined longer timeout period. Implementing a longer timeout, such as two seconds, would require the user to wait two seconds following providing the symbol for "sun," where "sun" is the intended complete symbol. This may be considered a minor inconvenience because many Chinese symbols include multiple radicals and it may be an unlikely scenario that a user has to pause for two seconds.

In some embodiments, altering a timeout period may include extending a timeout period for a complete symbol to two seconds, while maintaining a partial

symbol timeout of one second, for example. Using the example timeout periods, a user may provide the symbol for “sun,” pause for a length of time between 1-2 seconds, provide the symbol for “bright,” and pause for at least 2 seconds. The apparatus 101 may then interpret the complete symbol for “moon.” Alternatively, a user may provide the symbol for “sun,” and pause for at least 2 seconds, indicating the intent to provide a complete symbol for “sun.” Utilizing two distinct timeout periods, a partial symbol timeout period and complete symbol time period, may therefore allow a user to pause between the writing of radicals, as is often needed for a user to think of the next radical to write, without falsely and/or prematurely triggering recognition of a partial symbol as a complete symbol.

Continuing to operation 210, as described in the above example, the apparatus 101 may include means, such as the processor 20 or the user interface 22, communication interface 24, to receive at least a second handwritten input. As described in the above example, a second handwritten input, may be a symbol for “moon.”

At operation 214, the apparatus 101 may include means, such as processor 22, for determining that the first handwritten input and the at least second handwritten input form a complete symbol that is not likely extendable. The apparatus 101, upon identifying the radicals for “sun,” and “moon,” may determine that the only possible complete symbol containing the two radicals for “sun” and “moon” is the symbol for “bright.” Therefore, in some embodiments, the apparatus 101 may determine that the first and second inputs are not likely to be further extended, and may not require an expiration of a timeout period in order to identify a complete symbol. As such, a timeout period may be altered and/or reverted by the processor 20 to a previous value.

Figures 3A-3D illustrate displays according to example embodiments. Figure 3A depicts an editor 300 provided by the processor 20 based on the execution of instructions stored in the memory device 26 for display via the user interface 22, which may reflect an interpretation of a user’s input, or symbols identified by apparatus 101, such as the processor 20, as matching the user’s input. Area 306 reflects the handwritten input as it is provided by a user. For example, a user may provide the input of area 306 with a pointing device such as a stylus or finger by use of a touch screen, for example.

In Figure 3A, a user may provide a first handwritten input. The user may then pause to consider how to write the next symbol and/or radical. The handwritten input may be identified by the processor 20 as being a potential complete symbol, the symbol for “water.” However, the processor 20 may also determine that the handwritten input may be a partial symbol, or radical, which is a portion of another

complete symbol. The apparatus 101, such as the processor 20, may therefore alter a timeout period so as not to yet enter the symbol for “water” in the editor 300.

As shown in Figure 3B, the apparatus 101 has not yet caused the symbol for “water” to appear in the editor 300. Rather, an area 310 of the display may provide suggested complete symbols a user may be intending to provide. In some embodiments, a user may select a symbol from area 310. In some embodiments, a user may continue to provide handwritten input, such as that in area 320 of Figure 3C. In an example embodiment, apparatus 101, such as the processor 20, may recognize that the first handwritten input of area 306 and second handwritten input of area 320 may be combined to form a complete symbol. As shown in Figure 3D, the editor 300 may then be updated by the processor 20 to display the complete symbol.

As described above, altering a timeout period used in handwriting recognition may provide for more accurate or more efficient interpretation of handwritten inputs. More specifically, the altering of a timeout period may prevent apparatus 101, or any handwriting recognition system from falsely identifying a complete symbol, when a user is actually pausing to think of the next radical to provide in order to complete a symbol. The altering of the timeout period may be achieved in various ways, such as overriding a timeout period, extending a timeout period, and/or establishing a partial symbol timeout period and complete symbol timeout period, where the two timeout periods are different from one another.

As described above, Figure 2 is a flowchart of operations performed by an apparatus 101. It will be understood that each block of the flowchart, and combinations of blocks in the flowchart, may be implemented by various means, such as hardware, firmware, processor, circuitry, and/or other devices associated with execution of software including one or more computer program instructions. For example, one or more of the procedures described above may be embodied by computer program instructions. In this regard, the computer program instructions which embody the procedures described above may be stored by a memory device 26 of an apparatus 101 employing an embodiment of the present invention and executed by a processor 20 of the apparatus 101. As will be appreciated, any such computer program instructions may be loaded onto a computer or other programmable apparatus (e.g., hardware) to produce a machine, such that the resulting computer or other programmable apparatus implements the functions specified in the flowchart blocks. These computer program instructions may also be stored in a computer-readable memory that may direct a computer or other programmable apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture the

execution of which implements the function specified in the flowchart blocks. The computer program instructions may also be loaded onto a computer or other programmable apparatus to cause a series of operations to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions which execute on the computer or other programmable apparatus provide operations for implementing the functions specified in the flowchart blocks.

Accordingly, blocks of the flowchart support combinations of means for performing the specified functions and combinations of operations for performing the specified functions for performing the specified functions. It will also be understood that one or more blocks of the flowchart, and combinations of blocks in the flowchart, may be implemented by special purpose hardware-based computer systems which perform the specified functions, or combinations of special purpose hardware and computer instructions.

In some embodiments, certain ones of the operations above may be modified or further amplified. Furthermore, in some embodiments, additional optional operations may be included. Modifications, additions, or amplifications to the operations above may be performed in any order and in any combination.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although the foregoing descriptions and the associated drawings describe example embodiments in the context of certain example combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the appended claims. In this regard, for example, different combinations of elements and/or functions than those explicitly described above are also contemplated as may be set forth in some of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

WHAT IS CLAIMED IS:

1. A method comprising:
receiving a first handwritten input;
5 determining that the first handwritten input is both a) a potential complete symbol, and b) a portion of a complete symbol; and
altering a timeout period, wherein identification of at least one complete symbol candidate occurs upon expiration of the timeout period.
- 10 2. The method according to claim 1, further comprising:
receiving at least a second handwritten input following receipt of the first handwritten input; and
determining that the first handwritten input and the at least second handwritten input form a complete symbol that is not likely extendable.
- 15 3. The method according to any of claims 1 and 2, wherein altering the timeout period comprises extending the timeout period, and the method further comprises:
determining, after receipt of the first handwritten input, that the extended
20 timeout period is expired without receipt of an additional handwritten input; and
identifying at least one complete symbol candidate based on the first handwritten input.
- 25 4. The method according to any of claims 1 and 2, wherein altering the timeout period comprises overriding the timeout period, and the method further comprises:
receiving an indication that the first handwritten input is a complete symbol.
- 30 5. The method according to any of claims 1-4, wherein the first handwritten input is a Chinese radical.
6. The method according to any of claims 1-5, wherein altering a timeout period comprises determining a partial symbol timeout period and a complete symbol timeout period.

35

7. The method according to any of claims 1-6, further comprising:
causing display of the at least one complete symbol candidate for selection.

8. An apparatus comprising at least one processor and at least one
5 memory including computer program code, the at least one memory and the computer
program code configured to, with the processor, cause the apparatus to at least:
receive a first handwritten input;
determine that the first handwritten input is both a) a potential complete
symbol, and b) a portion of a complete symbol; and
10 alter a timeout period, wherein identification of at least one complete symbol
candidate occurs upon expiration of the timeout period.

9. An apparatus according to claim 8, wherein the at least one memory
and the computer program code are further configured to, with the processor:
15 receive at least a second handwritten input following receipt of the first
handwritten input; and
determine that the first handwritten input and the at least second handwritten
input form a complete symbol that is not likely extendable.

20 10. An apparatus according to any of claim 8 and 9, wherein the at least
one memory and the computer program code are further configured to, with the
processor:
determine, after receipt of the first handwritten input, that the extended timeout
period is expired without receipt of an additional handwritten input; and
25 identify at least one complete symbol candidate based on the first handwritten
input.

11. The apparatus according to any of claims 8 and 9, wherein altering the
timeout period comprises overriding the timeout period, and the at least one memory
30 and the computer program code are further configured to, with the processor:
receive an indication that the first handwritten input is a complete symbol.

12. The apparatus according to any of claims 8-11, wherein the first
handwritten input is a Chinese radical.

13. The apparatus according to any of claims 8-12, wherein altering a timeout period comprises determining a partial symbol timeout period and a complete symbol timeout period.

5 14. The apparatus according to any of claims 8-13, wherein the at least one memory and the computer program code are further configured to, with the processor:

cause display of the at least one complete symbol candidate for selection.

10 15. A computer program product comprising at least one non-transitory computer-readable storage medium having computer-executable program code instructions stored therein, the computer-executable program code instructions comprising program code instructions to:

receive a first handwritten input;

15 determine that the first handwritten input is both a) a potential complete symbol, and b) a portion of a complete symbol; and

alter a timeout period, wherein identification of at least one complete symbol candidate occurs upon expiration of the timeout period.

20 16. A computer program product according to claim 15, the computer-executable program code instructions further comprising program code instructions to:

receive at least a second handwritten input following receipt of the first handwritten input; and

25 determine that the first handwritten input and the at least second handwritten input form a complete symbol that is not likely extendable.

17. The computer program product according to any of claim 15 and 16, the computer-executable program code instructions further comprising program code instructions to:

30 determine, after receipt of the first handwritten input, that the extended timeout period is expired without receipt of an additional handwritten input; and

identify at least one complete symbol candidate based on the first handwritten input.

35 18. The computer program product according to any of claims 15 and 16, wherein altering the timeout period comprises overriding the timeout period, and the computer-executable program code instructions further comprise program code

instructions to:

receive an indication that the first handwritten input is a complete symbol.

19. The computer program product according to any of claims 15-18,
5 wherein the first handwritten input is a Chinese radical.

20. The computer program product according to any of claims 15-19,
wherein altering a timeout period comprises determining a partial symbol timeout
period and a complete symbol timeout period.

10

21. The computer program product according to any of claims 15-20, the
computer-executable program code instructions further comprising program code
instructions to:

cause display of the at least one complete symbol candidate for selection.

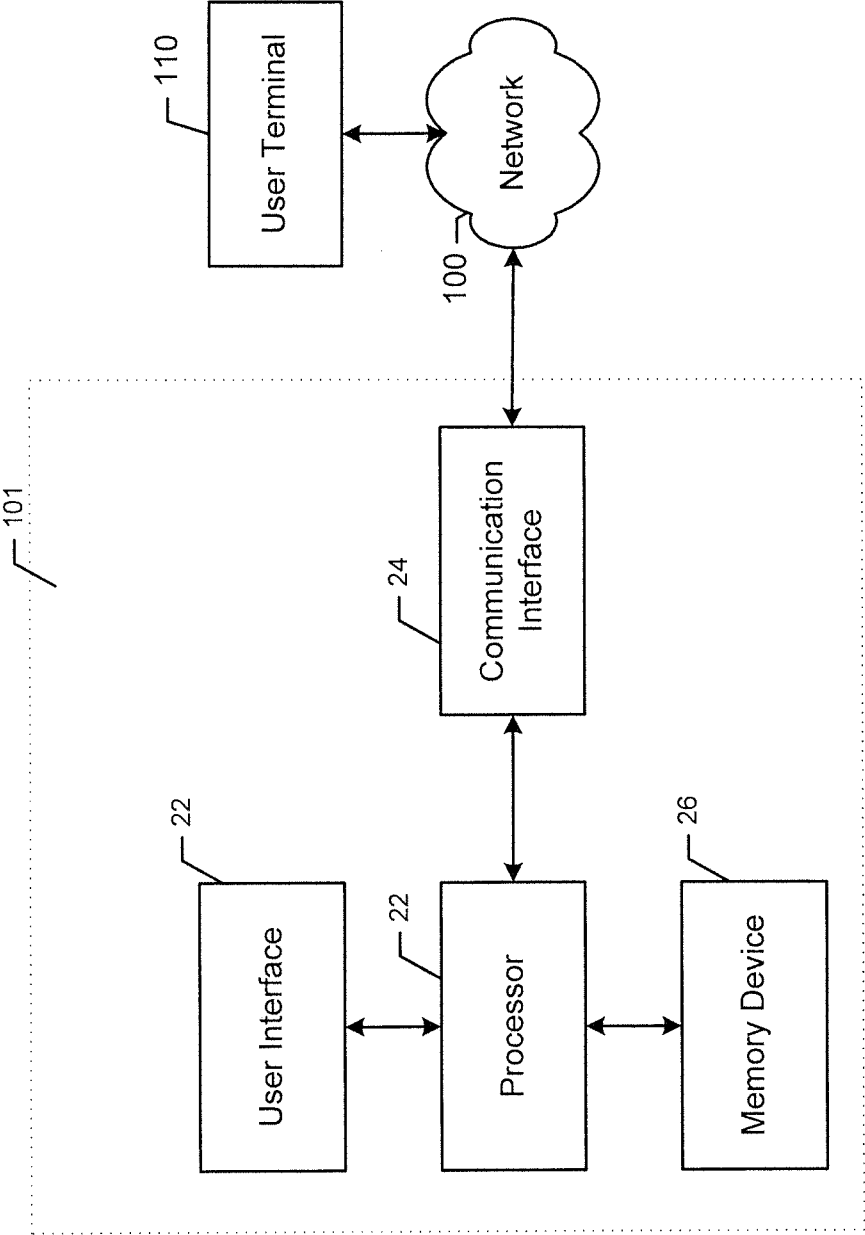


Figure 1

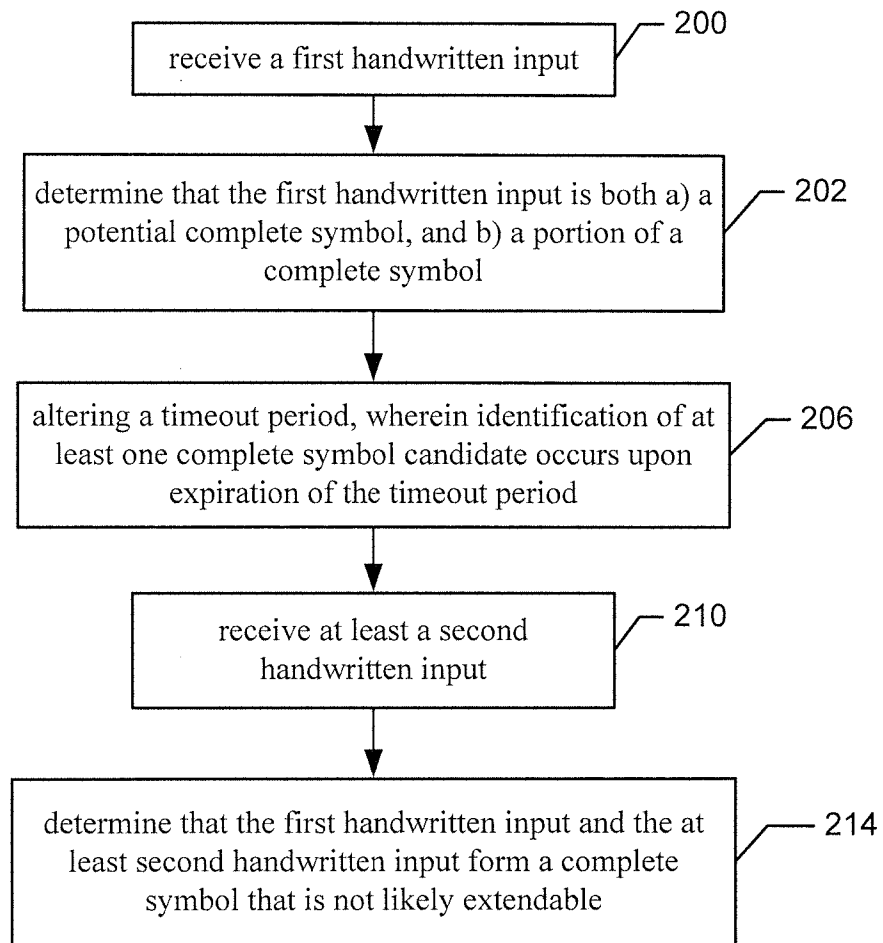


Figure 2

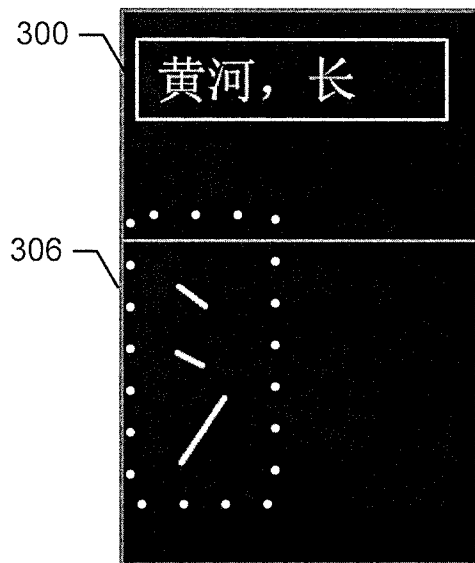


Figure 3A

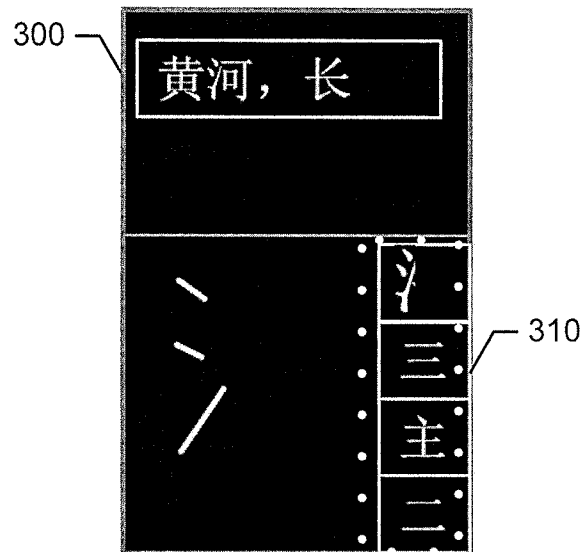


Figure 3B

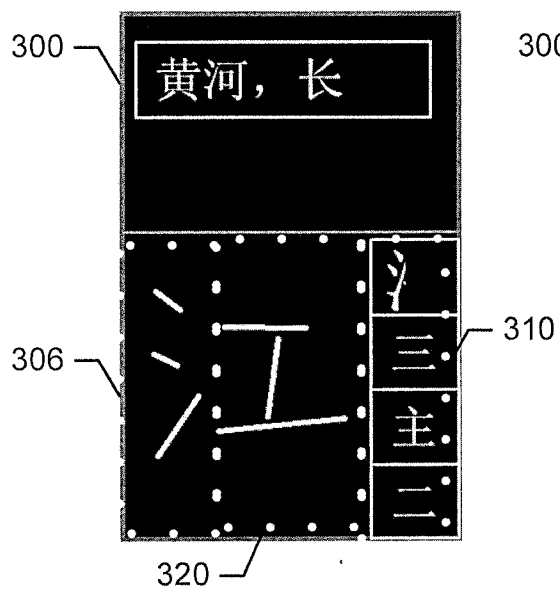


Figure 3C

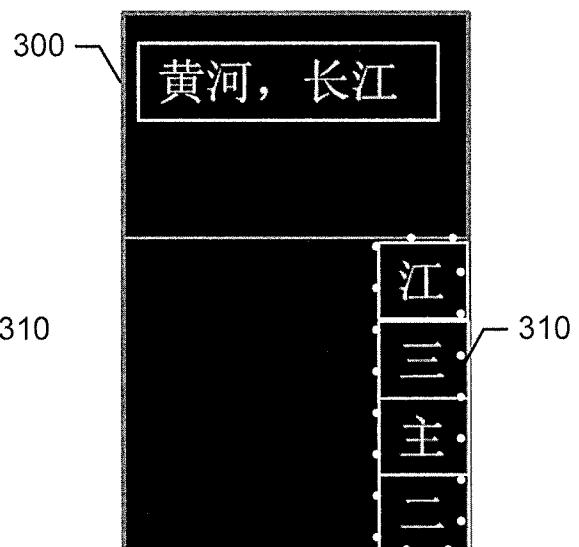


Figure 3D

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2013/077169

A. CLASSIFICATION OF SUBJECT MATTER

G06F 3/041 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI,EPODOC,CNPAT,CNKI,IEEE: timeout, handwrit+, symbol or word, chinese, time w period

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN1996219A(XU, Shuangjun) 11 July 2007 (11.07.2007) description, pages 1 and 3-5, and figures 1 and 3-8	1-2,4-9,11-16,18-21
Y		3,5-7,10,12-14,17,19-21
Y	WO2012093657A1(PANASONIC CORPORATION) 12 July 2012 (12.07.2012) description, paragraphs [0069]-[0085]	3,5-7,10,12-14,17,19-21
A	CN102184051A(SHENG YUE INFORMATION TECHNOLOGY(SHANGHAI) CORPORATION) 14 September 2011(14.09.2011) the whole document	1-21
A	CN101853126A(CHINESE ACADEMY SCIENCE AUTOMATION INSTITUTION) 06 October 2010 (06.10.2010) the whole document	1-21

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
“A” document defining the general state of the art which is not considered to be of particular relevance	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
“E” earlier application or patent but published on or after the international filing date	“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
“L” document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	“&” document member of the same patent family
“O” document referring to an oral disclosure, use, exhibition or other means	
“P” document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 26 February 2014 (26.02.2014)	Date of mailing of the international search report 20 Mar. 2014 (20.03.2014)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer WANG Jing Telephone No. (86-10)62413627

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2013/077169

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN1996219A	11.07.2007	None	
WO 2012093657 A1	12.07.2012	CN 103299322 A	11.09.2013
		TW 201234280 A	16.08.2012
		JP 2012145971 A	02.08.2012
CN102184051A	14.09.2011	None	
CN101853126A	06.10.2010	None	