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Keyboard with Built-in Calculator

ABSTRACT

Calculator applications are available for most platforms, e.g., as a built-in feature of an operating system or as an add-on application. Mobile devices such as smartphones, tablets, etc. provide software keyboards that can be used for data entry with a touchscreen display. To use a calculator, a user needs to leave a current application includes data or context for a calculation, open the calculator application, and toggle between the two applications to perform a calculation. This is both inconvenient and prone to mistakes as the user loses the context of the original application when switching to the calculator application. Techniques described herein integrate calculator functionality in a software keyboard. Such integration eliminates the need for a user to leave the original application to perform a calculation. The user can enter a query to be calculated, and the corresponding result is displayed as part of the software keyboard user interface, e.g., above the keypad. Results for different types of calculations such as basic arithmetic, unit conversion, etc. are provided by the software keyboard.

KEYWORDS

calculator; software keyboard; smart keyboard; mobile UX

BACKGROUND

Users of mobile devices often encounter scenarios during use of a device where there is a need to perform a calculation. Such calculations can include arithmetic, unit conversion (e.g., between different systems of measurement, such as metric system and US system), etc. While mobile devices provide calculator applications, e.g., as a built-in feature of the operating system or a standalone application, such application needs to be opened separately from a current

application that includes the user's data and context. A user needs to toggle between the current application and the calculator application to perform a calculation. This is an interruption in the user's current activity and causes the user to lose context. It may also result in inadvertent errors, e.g., if the user memorizes a number from the current application, but enters it wrongly in the calculator application.

Further, many calculator applications do not provide certain types of calculations such as unit conversion as built-in features. Consider, for example, an American user Alice that is engaged in a chat conversation with a friend that lives in India in a chat application. Alice decides to send the distance they ran during a marathon as a chat message. To ensure that the friend understands the distance, Alice needs to convert the distance, e.g., 26.2 miles to a target unit, e.g., kilometers, that the friend is familiar with. In order to accomplish such task, Alice needs to know a conversion formula to convert the distance from miles to kilometers. Also, once the calculator application provides a result, Alice needs to perform a copy-paste operation to use that result in the chat application. Copy-paste operations on a mobile device are often unfamiliar to users.

The disclosure describes a software keyboard that includes calculator and unit converter features seamlessly, without a dedicated calculator user interface. Moreover, calculator and unit conversion features are illustrative only and similar features involving translation of data can be incorporated into the keyboard functionality as discussed here.

DESCRIPTION

This disclosure describes a software keyboard with built-in calculator and unit converter functionality. The software keyboard is suitable for use with any type of device, e.g., a touchscreen or wearable device such as a smartphone, tablet, smartwatch, etc. A user can simply

enter, using the keyboard, a desired calculation or value to be converted to a different unit. The keyboard is available across all applications on the mobile device, and thus provides access to calculator and unit converter functionality irrespective of a current application in use. In this manner, the software keyboard addresses the problems listed above, e.g., loss of context, need to toggle between different applications, need to copy-paste data between applications, etc. Moreover, since the calculator is available in the keyboard, the user can get a calculation result more quickly than with a separate calculator application.

The automatic recognition and suggestion capability of the software keyboard is enabled upon specific user permission. If the user does not provide permission, e.g., to recognize a formula or equation, the software keyboard does not perform any recognition operation, and instead, switches to a default mode that is similar to a keyboard without the automatic calculation functionality. The user is provided with options to change permission settings at any time. The user may provide permission for certain types of recognition and automatic suggestions, while denying permission for other types. In different implementations, the software keyboard also provides indications to the user when user-entered data is analyzed and/or used to provide smart keyboard functionality, such as automatic calculation, unit conversion, etc.

The software keyboard has built-in capability to recognize when an equation is being typed, if the user permits such recognition. To ensure responsiveness, the software keyboard application makes smart predictions as to whether the typed matter is an equation or a unit of measurement. As a user types data, the software keyboard interprets the data to determine if an equation is being entered. When an equation is recognized, the keyboard calculates and displays the answer, e.g., in a separate area of the keyboard. For example, the separate area can be a suggestions area that is displayed above the keypad. If the user continues to enter further data or

modifies previously entered data, such that the equation changes, the answer provided by the keyboard application is updated automatically.

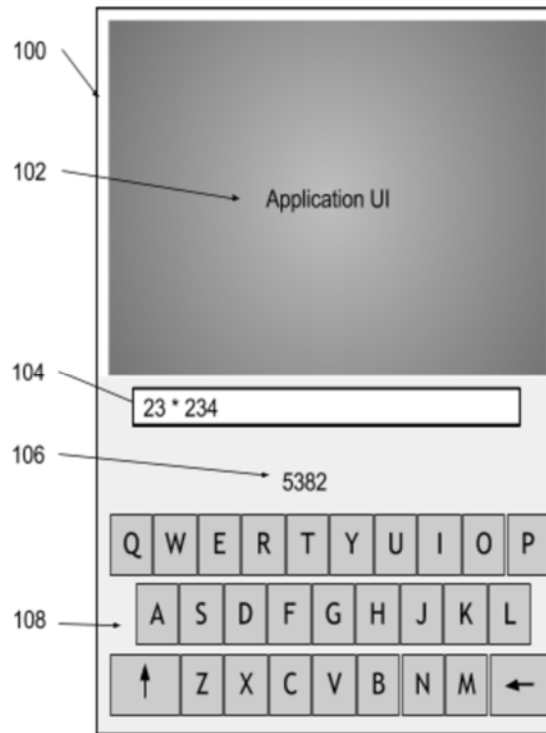


Fig. 1 Keyboard with built-in calculator

Fig. 1 illustrates a mobile device (100) with a built-in software keyboard (108) with built-in calculator functionality. For example, while an application (102) is under execution, the user enters the data $23 * 234$ (104) with the software keyboard. The data entry proceeds one letter at a time, e.g., the first letter entered is “2,” the next letter is “3,” the next is “*,” and so on. As the data is received, e.g., at an intermediate, where the data received is “ $23*2$,” a corresponding result, e.g., “46” is calculated and displayed on the mobile device. As the user continues to enter further data, e.g., “ $23*23$,” the answer is updated, e.g., “46” is replaced with “529”. As shown in Fig. 1, the current state is that the user has entered “ $23*234$ ” (104) and the corresponding answer “5382” is automatically calculated and displayed (106). As shown in Fig. 1, the answer is displayed above the keypad area of the keyboard, but it is possible to display the answer in any

position, e.g., alongside the keyboard, as an overlay, etc. In different implementations, the answer is selectable, such that upon tapping the answer, the corresponding value is entered in a text input area for inserting into the application. Further, if the equation is not followed by a = symbol, selecting the result (e.g., by tapping, clicking, etc.) replaces the equation in the text input area. Alternately, if the equation is followed by a “=” symbol, selecting the result places the result after the “=” symbol in the text input area.

The software keyboard also enables users to find answers to common conversions. When the keyboard detects that a user has entered a value in a particular unit of measurement, corresponding values in other systems of measurement are automatically displayed, as illustrated in Fig. 2.

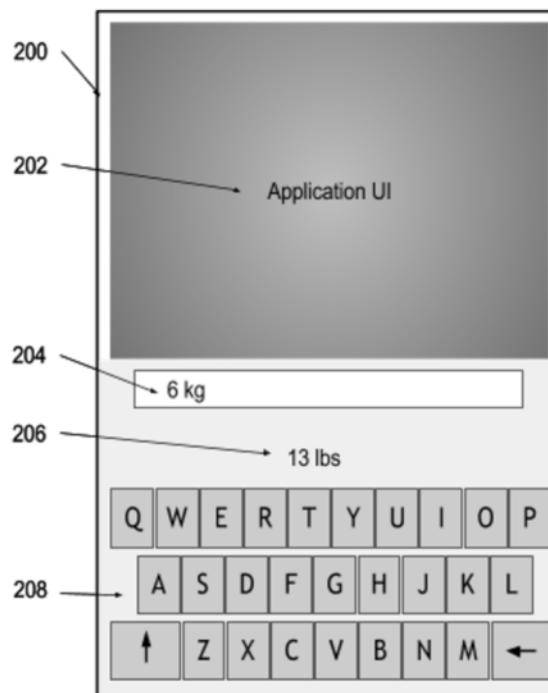


Fig. 2 Keyboard with built-in unit converter

As shown in Fig. 2, a mobile device (200) runs an application (202). The user has entered a value “6 kg” (204). The software keyboard (208) automatically detects that the value is a unit

of weight, and determines a corresponding value in a different unit, e.g., pounds. As illustrated in Fig. 2, the software keyboard displays “13 lbs” (206). The software keyboard can include any type of unit conversion, e.g., length (meter, foot, etc.) distance (kilometer, mile, yard, etc.), volume (liter, American gallon, etc.), temperature (in degrees Celsius, in degrees Fahrenheit, etc.) Other conversions such as teaspoons-to-grams, cups-to-milliliters, etc. are also supported.

The software keyboard also supports conversions within a same system of measurement, as illustrated in Fig. 3.

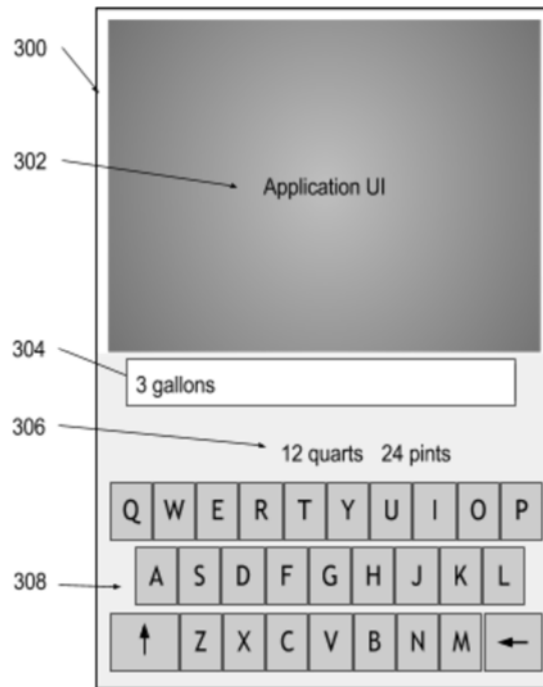


Fig. 3 Keyboard with sub-unit converter

Fig. 3 illustrates a mobile device (300) running an application (302). The user has typed a value “3 gallons” (304). The software keyboard (308) automatically calculates a corresponding value in smaller units of the measurement system, e.g., “12 quarts” and “24 pints” (306).

Example of use

A user Bob is engaged in a chat conversation via a chat application on his smartphone. The chat conversation includes six other users. Bob has charged his credit card a certain amount, e.g., \$134 for a dinner that the friends went to. Using the software keyboard described herein, Bob can type in a phrase such as “each of you owes me” followed by “\$134/7” on his smartphone. In response, the software keyboard displays the answer - \$19.14 - on the touchscreen. Bob can now tap the answer to complete the phrase as “each of you owes me \$19.14” and send it as a chat message.

In situations in which certain implementations discussed herein may collect or use personal information about users (e.g., user data, information about a user’s social network, user's location and time at the location, user's biometric information, user's activities and demographic information), users are provided with one or more opportunities to control whether information is collected, whether the personal information is stored, whether the personal information is used, and how the information is collected about the user, stored and used. That is, the systems and methods discussed herein collect, store and/or use user personal information specifically upon receiving explicit authorization from the relevant users to do so. For example, a user is provided with control over whether programs or features collect user information about that particular user or other users relevant to the program or feature. Each user for which personal information is to be collected is presented with one or more options to allow control over the information collection relevant to that user, to provide permission or authorization as to whether the information is collected and as to which portions of the information are to be collected. For example, users can be provided with one or more such control options over a communication network. In addition, certain data may be treated in one or more ways before it

is stored or used so that personally identifiable information is removed. As one example, a user's identity may be treated so that no personally identifiable information can be determined. As another example, a user's geographic location may be generalized to a larger region so that the user's particular location cannot be determined.

CONCLUSION

Techniques described herein integrate calculator and unit converter functionality in a software keyboard. Such integration eliminates the need for a user to leave the original application to perform a calculation. The user can enter a query to be calculated, and the corresponding result is displayed as part of the software keyboard user interface, e.g., above the keypad. Results for different types of calculations such as basic arithmetic, unit conversion, etc. are provided by the software keyboard. The software keyboard as described herein provides several advantages. By integrating calculation and unit conversion in the keyboard, it eliminates the need to toggle between multiple applications, or copy-paste/ memorize values, etc. It also provides a faster and universal user interface that is available in any application on the device.