

PCT INTERNATIONAL APPLICATION FOR PATENT

For

COMBINED RADIO-FREQUENCY IDENTIFICATION
AND TOUCH INPUT FOR A TOUCH SCREEN

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COMBINED RADIO-FREQUENCY IDENTIFICATION
AND TOUCH INPUT FOR A TOUCH SCREEN

CROSS REFERENCES TO RELATED APPLICATIONS

[0001] This application claims priority benefit of U.S. Provisional Patent Application No. 61/584,914, entitled COMBINED RADIO-FREQUENCY IDENTIFICATION AND TOUCH INPUT FOR A TOUCH SCREEN, filed on January 10, 2012 by inventor Gunnar Martin Fröjdh.

[0002] This application incorporates the disclosures of the following six U.S. patent applications by reference.

- U.S. Application No. 12/371,609, entitled LIGHT-BASED TOUCH SCREEN, now U.S. Patent No. 8,339,379, filed on February 15, 2009 by inventors Magnus Goertz, Thomas Eriksson and Joseph Shain;
- U.S. Application No. 12/486,033, entitled USER INTERFACE FOR MOBILE COMPUTER UNIT, filed on June 17, 2009 by inventors Magnus Goertz and Joseph Shain;
- U.S. Application No. 12/667,692, entitled SCANNING OF A TOUCH SCREEN, filed on January 5, 2010 by inventor Magnus Goertz;
- U.S. Application No. 12/760,567, entitled OPTICAL TOUCH SCREEN SYSTEMS USING REFLECTED LIGHT, filed on April 15, 2010 by inventors Magnus Goertz, Thomas Eriksson and Joseph Shain;
- U.S. Application No. 12/760,568, entitled OPTICAL TOUCH SCREEN SYSTEMS USING WIDE LIGHT BEAMS, filed on April 15, 2010 by inventors Magnus Goertz, Thomas Eriksson and Joseph Shain; and
- U.S. Application No. 13/424,592 entitled LIGHT-BASED FINGER GESTURE USER INTERFACE, filed on March 20, 2012 by inventors Thomas Eriksson, Per Leine, Jochen Laveno Mangelsdorff, Robert Pettersson and Anders Jansson.

FIELD OF THE INVENTION

[0003] The field of the present invention is user input devices.

BACKGROUND OF THE INVENTION

[0004] Many consumer electronic devices are now being built with touch sensitive screens, for use with finger or stylus touch user inputs. Often an input includes multiple variables. For example, handwritten input may vary by color, line width and other features. In touch screen environments, each such variable is typically configured through navigating a menu or by selecting from an onscreen palette of colors or line widths. It would be advantageous to communicate this variable selection directly through the input stylus without requiring the user to navigate separately through menus or palettes. In particular, when the users are young children it is important to provide an intuitive user input experience.

[0005] In applications where user identification is important it is beneficial to provide several layers of user verification. For example, users of ATM machines match a value on their card with a PIN code in order to execute a transaction.

SUMMARY OF THE DESCRIPTION

[0006] Aspects of the present invention provide an input stylus for a touch screen, where the stylus includes a passive radio-frequency identification (RFID) tag that stores an input attribute. When the user enters touch information on the touch screen, the stored input attribute is combined with the touch input. The touch screen is thus connected to a processor that receives touch information from the touch screen when the stylus touches the touch screen. This processor is also connected to an RFID reader that reads the RFID tag input attribute when the stylus touches the touch screen. The processor associates the input attribute with the touch information.

[0007] There is thus provided in accordance with an embodiment of the present invention a graphics tablet system including a housing, a touch screen in the housing for receiving touch input, and for displaying graphics corresponding to the received touch input, a plurality of styli for performing touch input, each stylus including an RFID chip storing one or more graphic attributes, and a visible indicator of the one or more graphic attributes, an RFID reader in the housing for reading the stored one or more graphic attributes from a stylus touching the touch screen, and a processor in the housing, connected to the touch screen and to the RFID reader, for rendering a drawing on the touch screen according to the motion of the stylus on the touch screen and according to one or more graphic attributes read by the RFID reader from the stylus, wherein the plurality of styli store different one or more graphic attributes.

[0008] There is additionally provided in accordance with an embodiment of the present invention a method for a graphics tablet including detecting that a stylus is touching a touch screen, the stylus having an RFID chip, in response to the detecting, reading one or more graphic attributes from the RFID chip included in the stylus, and rendering a

drawing according to the motion of the stylus on the touch screen and according to the one or more graphic attributes read from the RFID chip.

[0009] Further aspects of the present invention provide a credit or debit card for entering a personal identification number (PIN) on an automated teller machine (ATM) or sales terminal touch screen and subsequently executing an ATM operation or a sale. The touch screen is connected to a processor that receives touch information from the touch screen when the card touches the screen. The card features a passive radio-frequency identification (RFID) tag that stores user identification information, and the processor is connected to an RFID reader that reads the RFID tag user identification information when the card touches the screen. This allows the processor to check: (a) that the stored user identification information matches the entered PIN, and (b) that identical stored user identification information is received at each touch when the user keys in his PIN.

[0010] There is further provided in accordance with an embodiment of the present invention a point of sale (POS) system including a housing, a touch screen in the housing used for inputting a PIN code by tapping a sequence of keypad characters on the screen with a plastic card, wherein the plastic card has an embedded RFID chip storing a PIN code, an RFID reader in the housing configured to read the stored PIN code from the plastic card tapping the screen, and a processor in the housing, connected to the touch screen and to the RFID reader, configured to determine if the input PIN code matches the stored PIN code.

[0011] There is yet further provided in accordance with an embodiment of the present invention a method for a point of sale terminal, including reading a first PIN code that is stored in an RFID chip that is embedded in a plastic card, identifying a first keypad character on a touch sensitive display screen that is being tapped by the plastic card, reading a second

PIN code that is stored in an RFID chip that is embedded in a plastic card, identifying a second keypad character on a touch sensitive display screen that is being tapped by the plastic card, determining whether the second PIN code matches the first PIN code, and if the determining is affirmative, then appending the second keypad character to the first keypad character to generate a two-character input code, else starting a new one-character input code with the second keypad character alone.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The present invention will be more fully understood and appreciated from the following detailed description, taken in conjunction with the drawings in which:

[0013] **FIGS. 1 - 3** are simplified illustrations of input styli interacting with a touch screen, in accordance with embodiments of the present invention;

[0014] **FIG. 4** is a simplified illustration of an automated teller machine (ATM) keypad and a credit card for entering a personal identification number (PIN) thereon, in accordance with an embodiment of the present invention; and

[0015] **FIG. 5** is a flow chart of a user verification method on an ATM, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

[0016] Aspects of the present invention relate to combining input from two sources: touch input on a touch screen and radio-frequency identification (RFID) input from a passive RFID chip embedded in an object performing the touch input. Two sets of applications are described: drawing applications and banking applications. The description discloses a light-based touch screen, but the scope of the invention includes all touch technologies, inter alia, capacitive, resistive and projected capacitive, and also includes all touch surfaces, with or without an underlying display screen.

[0017] Reference is made to **FIGS. 1 – 3**, which are simplified illustrations of input styli interacting with a touch screen, in accordance with embodiments of the present invention. **FIG. 1** shows an electronic device **826** encased in a housing **827**, and featuring a touch-screen **800**, a calculating unit **770** and an RFID reader **781**. One example device is a child's drawing pad. In this case the child is provided with a variety of styli **931** fashioned as magic markers or crayons. Each provided stylus **931** draws a unique color when used on screen **800**. The color associated with each stylus **931** is provided on a passive RFID tag **780** attached thereto. Passive RFID tag **780** may be embedded in the body of stylus **931** for aesthetic reasons and to prevent it from falling off the stylus. When a child draws on screen **800** with stylus **931**, his strokes are communicated from touch screen **800** to calculating unit **770**. When calculating unit **770** receives information that a touch has occurred, calculating unit **770** activates RFID reader **781** to read RFID tag **780**. RFID reader **781** sends the read information to calculating unit **770**. Calculating unit **770** combines the stroke information and the RFID information to render a line on screen **800** having attributes read from

RFID tag **780**. Thus, for example, stylus **931** is shown drawing red line **932**. The color red is indicated by the dashed line pattern.

[0018] **FIG. 2** shows electronic device **826** used with a second stylus **931** having a wider head than stylus **931** of **FIG. 1**. Accordingly, the drawn line **932** in **FIG. 2** is wider than that of **FIG. 1**. Drawn line **932** in **FIG. 2** is green, indicated by the dash-dot line pattern. Additional attributes of drawn lines may also be included in the RFID tag, such as a pattern, e.g., solid, dashed or dotted.

[0019] In some configurations the width of line **932** is provided together with the line color on tag **780**. Alternatively, the line width is determined by the detected touch area. High resolution touch sensors, such as those described in U.S. Application No. 13/424,592 entitled LIGHT-BASED FINGER GESTURE USER INTERFACE, enable determining the size of a covered area during a touch. The line width corresponds to this area. The different detected touch areas are shown in the graphs depicted in **FIGS. 1** and **2**. The graphs show the detection signals along one screen edge. The extent of the covered area in **FIG. 1**, in which stylus **931** has a narrow nib, is shorter than that of **FIG. 2**, in which stylus **931** has a wide nib, and this is reflected in the lengths of the detection signal peaks.

[0020] **FIG. 3** shows a different configuration. Here, RFID tag **780** includes information about an image of a house. When a user touches screen **800**, a house appears at the touched location. An image of a house **933** is provided on stylus **931** to indicate the resulting screen graphic **934** when the stylus is used. Additional images are provided in additional styli.

[0021] Discussion now turns to banking applications. Reference is made to **FIG. 4**, which is a simplified illustration of an automated teller machine (ATM) keypad and a credit card for entering a personal identification

number (PIN) thereon, in accordance with an embodiment of the present invention. **FIG. 4** shows a light-based touch screen **800** for an ATM surrounded by rows of light emitters **200** and light receivers **300**. A keypad for entering a PIN is presented. Using a credit card **904**, having an embedded RFID tag **780**, as a pointer, a user enters a PIN on screen **800**. Every time credit card **904** touches screen **800**, a touch detection signal is sent to calculating unit **770** that activates RFID reader **781** to read RFID tag **780**. RFID reader **781** sends the read information to calculating unit **770**. Calculating unit **770** combines the entered PIN code and the RFID information to authenticate the user. This method is explained with aid of **FIG. 5**.

[0022] The method illustrated in **FIG. 5** begins at step **1002** polling the touch detectors, e.g., activating emitters **200** and detecting expected light at respective emitters **300**. The expected light values are sent from receivers **300** to calculating unit **770**, which then determines whether a touch has occurred at step **1004**. When expected light is absent a touch is assumed to have occurred. If a touch occurred, calculating unit **770** activates RFID reader **781** at step **1006** and reads RFID information therefrom. At step **1008** if no RFID information was read unit **770** ignores the touch input. If RFID information was read, unit **770** compares that input to previously stored RFID data at step **1010**. The user is required to use the same object to enter each digit in the PIN. Thus, the RFID data must be identical at every touch. If the data are different, it is assumed that this is a new user. Accordingly, the previous RFID information is overwritten and the previously entered PIN digits are discarded at step **1020**. If the data match, the entered PIN digit is appended to the sequence of previously entered PIN digits at step **1012**. This sequence of operations continues until the expected number of PIN digits has been entered, at step **1014**. At step **1016** calculating unit

770 compares the PIN entered by the user with user information read from RFID tag **780**. If the data correspond to a single user, calculating unit proceeds to execute a transaction, e.g., dispense cash at step **1024**. If the data do not correspond to a single user, calculating unit **770** cancels the operation at step **1022**. The same method can be applied to verifying a credit card holder before execution a purchase. In this case, the touch screen is embedded in a sales console.

CLAIMS

- 1.** A graphics tablet system comprising:

 - a housing;
 - a touch screen in said housing for receiving touch input, and for displaying graphics corresponding to the received touch input;
 - a plurality of styli for performing touch input, each stylus comprising:
 - an RFID chip storing one or more graphic attributes;
 - and
 - a visible indicator of the one or more graphic attributes;
 - an RFID reader in said housing for reading the stored one or more graphic attributes from a stylus touching said touch screen; and
 - a processor in said housing, connected to said touch screen and to said RFID reader, for rendering a drawing on said touch screen according to the motion of the stylus on said touch screen and according to one or more graphic attributes read by said RFID reader from the stylus,

wherein said plurality of RFID chips store different one or more graphic attributes.
- 2.** The graphics tablet system of claim **1**, wherein the different one or more graphic attributes comprise different colors and wherein said processor renders strokes in accordance with the motion of the stylus, in the color read by said RFID reader from said RFID chip of the stylus.
- 3.** The graphics tablet system of claim **1**, wherein the different one or more graphic attributes comprise different shapes and wherein said

processor renders strokes in accordance with the motion of the stylus and the shape read by said RFID reader from said RFID chip of the stylus.

4. The graphics tablet system of claim **1**, wherein the different one or more graphic attributes comprise different images and wherein said processor renders the image read from said RFID chip of the stylus.

5. The graphics tablet system of claim **1**, wherein the different one or more graphic attributes comprise different line patterns and wherein said processor renders lines in accordance with the motion of the stylus with the line pattern read from said RFID chip of the stylus.

6. The graphics tablet system of claim **1**, wherein said touch screen is operative to detect a thickness of a contact area when a stylus comes in contact with said touch screen, and wherein said processor renders lines that are as thick as the contact area, in accordance with the motion of the stylus.

7. The graphics tablet system of claim **1**, wherein said processor activates said RFID reader in response to an object touching said touch screen.

8. A point of sale (POS) system comprising:
a housing;
a touch screen in said housing used for inputting a PIN code by tapping a sequence of keypad characters on the screen with a plastic card, wherein the plastic card has an embedded RFID chip storing a PIN code;

an RFID reader in said housing configured to read the stored PIN code from the plastic card tapping the screen; and

a processor in said housing, connected to said touch screen and to said RFID reader, configured to determine if the input PIN code matches the stored PIN code.

9. The POS system of claim **8**, wherein said processor activates said RFID reader in response to the plastic card tapping the screen.

10. The POS system of claim **8**, wherein said processor ignores touch screen input when said RFID reader does not read a PIN code.

11. A method for a graphics tablet comprising:
detecting that a stylus is touching a touch screen, the stylus having an RFID chip;
in response to said detecting, reading one or more graphic attributes from the RFID chip included in the stylus; and
rendering a drawing according to the motion of the stylus on the touch screen and according to the one or more graphic attributes read from the RFID chip.

12. The method of claim **11**, wherein the one or more graphic attributes comprise a color and wherein said rendering renders strokes in accordance with the motion of the stylus, in the color read from the RFID chip of the stylus.

13. The method of claim **11**, wherein the one or more graphic attributes comprise a shape and wherein said rendering renders strokes

in accordance with the motion of the stylus and the shape read from the RFID chip of the stylus.

14. The method of claim **11**, wherein the one or more graphic attributes comprise an image and wherein said rendering renders the image read from the RFID chip of the stylus.

15. The method of claim **11**, wherein the one or more graphic attributes comprise a line pattern and wherein said rendering renders lines in accordance with the motion of the stylus with the line pattern read from the RFID chip of the stylus.

16. The method of claim **11**, further comprising detecting thickness of a contact area when a stylus comes in contact with the touch screen, and wherein said rendering renders lines that are as thick as the contact area, in accordance with the motion of the stylus.

17. A method for a point of sale terminal, comprising:
reading a first PIN code that is stored in an RFID chip that is embedded in a plastic card;
identifying a first keypad character on a touch sensitive display screen that is being tapped by the plastic card;
reading a second PIN code that is stored in an RFID chip that is embedded in a plastic card;
identifying a second keypad character on a touch sensitive display screen that is being tapped by the plastic card;
determining whether the second PIN code matches the first PIN code; and

if said determining is affirmative, then appending the second keypad character to the first keypad character to generate a two-character input code, else starting a new one-character input code with the second keypad character alone.

18. The method of claim **17** further comprising:

repeating said reading a next PIN code, said identifying a next keypad character, said determining whether the next PIN code matches a previous PIN code and, if so, appending the next keypad character to the current input code to generate a longer input code, until the input code includes a pre-determined number of characters;

determining whether the input code having the pre-determined number of characters matches the PIN code stored in the RFID chip; and

if said determining is affirmative, then completing a transaction, else declining the transaction.

19. The method of claim **17** wherein said completing a transaction comprises dispensing cash from a bank teller machine.

20. The method of claim **17** wherein said completing a transaction comprises executing a sale.