(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 May 2017 (11.05.2017)

(10) International Publication Number
WO 2017/079481 A1

(51) International Patent Classification:
G06K 19/073 (2006.01) *G06Q 20/34* (2012.01)
G06K 19/077 (2006.01) *G07F 7/08* (2006.01)

(21) International Application Number:
PCT/US2016/060394

(22) International Filing Date:
3 November 2016 (03.11.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
14/932,670 4 November 2015 (04.11.2015) US

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(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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, SA, 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, ST, 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).

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

WO 2017/079481 A1

(54) Title: INTEGRATED POWER SOURCE ON A PAYMENT DEVICE

(57) **Abstract**: The described payment device includes an integrated power source including a piezoelectric accelerometer. Upon motion of the payment device, kinetic energy may be translated to a mass of the piezoelectric accelerometer to generate electrical energy to power other functions of the payment device. Motion translated to the piezoelectric accelerometer may also be used in combination with other inputs to implement security functions of the payment device.

INTEGRATED POWER SOURCE ON A PAYMENT DEVICE

Cross-Reference to Related Applications

[0001] This application claims the benefit of U.S. Application No. 14/932,670 filed November 4, 2015, the disclosure of which is incorporated by reference herein in its entirety.

Field of Technology

[0002] The present disclosure relates to a credit card configured to include a power source for a variety of applications and, more particularly, a credit card configured to include an accelerometer, such as a piezoelectric accelerometer, as a power source to enhance security and facilitate payment functions.

Background

[0003] The background description provided herein is for the purpose of generally presenting the context of the disclosure. Work of the presently named inventors, to the extent it is described in this background section, as well as aspects of the description that may not otherwise qualify as prior art at the time of filing, are neither expressly nor impliedly admitted as prior art against the present disclosure.

[0004] Credit card transactions have long been the target of criminal fraud. In a digital purchase transaction, a physical credit card is not used and, thus, stolen information alone may be used by the criminal to complete a fraudulent transaction. In a point-of-sale transaction using the physical card, criminals must employ sophisticated techniques to duplicate the physical card using stolen credit card holder information. Credit card companies have gone to great lengths to insure physical cards cannot be copied by incorporating security measures into each physical card. However, advances in small-scale production of these measures have made it increasingly easier for criminals to duplicate even advanced measures for physical credit card security.

[0005] Too, there are numerous different measures credit card issuers might employ to deter or prevent physical credit card fraud. However, cost and size limitations make such measures impractical for a wallet-sized credit card. Increasingly, there is a need for smaller, more sophisticated measures to ensure physical credit card security.

Summary

[0006] Features and advantages described in this summary and the following detailed description are not all-inclusive. Many additional features and advantages will be apparent to one of ordinary skill in the art in view of the drawings, specification, and claims hereof. Additionally, other embodiments may omit one or more (or all) of the features and advantages described in this summary.

[0007] A credit card may be configured to employ an integrated energy source (e.g., an accelerometer), within the card in order to provide power for sophisticated physical security components. In some embodiments, the accelerometer may be a piezoelectric accelerometer. For example, motion of the card such as carrying the card while walking, raising the card, or moving the card around or pressure on the card or on an area of the accelerometer in particular allows generation of electrical energy to power a sensor or other physical security features of the card. Incorporation of a user input or biometric sensor with the integrated energy source may allow the card to be “unlocked” temporarily (e.g., for a specified time period such as 15 seconds). Additionally, the integrated power source might power input of a user ID (e.g., pin code, motion pattern) or a biometric sensor allowing the card to be unlocked so that it only works temporarily. In some embodiments, the card may be unlocked for a specified time period while the card is energized and after the user ID or biometric has been input. An integrated energy source such as a piezoelectric accelerometer may eliminate the need for an on-board battery and allow a card to work without requiring power from the point-of-sale device. These measures would increase security by allowing a card to work only while it is energized and unlocked by a user while increasing the range of use to more mobile applications that might involve payment without a traditional point of sale device. Still further, a card configured as described would allow for on-card token generation as well as on-card displays of information as well as on-card generation of dynamic authorization data without requiring an on-card battery.

[0008] In one embodiment, a payment device may include an integrated power source including a piezoelectric accelerometer, a processor in communication with the integrated power source, and a memory in communication with the processor, the memory storing instructions that are executable by the processor; and an input/output circuit in communication with the processor. Kinetic energy and/or pressure translated to the payment device and, thus, to the piezoelectric material may generate electrical energy to power the processor, memory, and input/output circuit.

Brief Description of the Drawings

[0009] FIGs. 1a, 1b, and 1c illustrate various views of an embodiment of a payment device including an integrated energy source; and

[0010] FIG. 2 is a view of a sample circuit design of the payment device with an integrated power source and various input devices..

[0011] The figures depict a preferred embodiment for purposes of illustration only. One skilled in the art may readily recognize from the following discussion that alternative embodiments of the structures and methods illustrated herein may be employed without departing from the principles described herein.

Detailed Description

[0012] FIGs. 1a, 1b, and 1c generally illustrate a payment device 100. In particular, FIG. 1a illustrates a front outer view of the payment device 100, FIG. 1b illustrates a view of an inner layer of the payment device 100, and FIG. 1c illustrates a back outer view of payment device 100. The payment device 100 may take on a variety of shapes and forms. In some embodiments, the payment device 100 is a traditional card such as a debit card or credit card. In other embodiments, the card may be a fob on a key chain. As long as the payment device 100 may be able to communicate securely with a payment accepting device, the form of the payment device may not be especially critical and may be a design choice. For example, many legacy payment devices 100 may have to be read by a magnetic stripe reader and thus, the payment device 100 may have to be sized to fit through a magnetic card reader. In other examples, the payment device 100 may communicate through near field communication and the form of the payment device 100 may be virtually any form. Of course, other forms may be possible based on the use of the card, the type of reader being used, etc.

[0013] Physically, the payment device 100 may be a card and the card may have a plurality of layers to contain the various elements that make up the payment device 100 as illustrated in FIGs. 1a, 1b, and 1c. In one embodiment, the payment device 100 may have a substantially flat front surface 102 and a substantially flat back surface 104 opposite the front surface. Logically, in some embodiments, the faces 102, 104 may have some embossments. Further, an inner layer 106 may have openings for a processor 108, memory 110, input/output circuit 112, and power source 114. Some embodiments may also include a display 116 and input device 118 that may be part of the payment device 100. In some embodiments, the input device 118 may include a biometric sensor.

[0014] The power source 114 may include transducer such as, for example, a piezoelectric accelerometer including a housing body 119, a mass element 120, a piezoelectric material 122, an actuation means 124, and an energy storage device 126. The actuation means 124 may include any structure to facilitate motion of the mass 120 within the piezoelectric accelerometer. The motion of the mass 120 within the body 119 or pressure exerted by a user will exert a physical force on the piezoelectric material 122 as either bending or compressing the material 122. Compression force on the material 122 includes a force exerted to one side of the piezoelectric material 122 while the opposing side rests against a fixed surface, for example, and inner wall of the power source 114. Bending force may involve the mass 120 or other means exerting a force on the piezoelectric material 122 about an axis of the material 122. In some embodiments, the piezoelectric accelerometer includes a tri-axis accelerometer such as the KX112 or KXCJB as produced by Kionix, Inc., of Ithaca, NY. Of course, other types of piezoelectric accelerometers may be suitable for the power generation and other functions described herein.

[0015] The material 122 may include crystal and ceramic materials. Some embodiments may employ a single-crystal material 122 (e.g., quartz) while other embodiments may employ ceramic materials. Some embodiments of the piezoelectric accelerometer power source 114 may include barium titanate, lead-zirconate, lead-titanate, lead metaniobate, and other piezoelectric materials 122.

[0016] In use, motion of the payment device 100 to actuate the mass 120 against the piezoelectric material 122 or pressure by a user compressing a piezoelectric material of the card generates electrical energy. The energy created by the power source 114 may then be consumed by the processor 118, display 116, or other components of the payment device 100. Too, the energy may be stored for later use in a power storage element 127. In some embodiments, the power storage element is a rechargeable battery, capacitor, or other element capable of frequently receiving and storing electrical energy. Of course, the payment device 100 may also include circuitry or other means to transfer the generated energy from the power source 114 and/or the power storage element 127 to the processor 108, the display, or other components of the payment device 100.

[0017] In embodiments including a display 116, the substantially flat front surface 102 may include a translucent region 126 through which the display 116 may be viewed. Logically, a user may want to view the display 116. At the same time, the display may have to be protected from the elements. Thus a translucent region of either the top 102 layer and/or bottom layer 104 may be placed over the display 105. It also should be noted that there may be a plurality of displays 105, there may need to be room in the inner layer for each display and there may need to be translucent regions in the top and/or bottom layer to see the displays. Embodiments including the display 116 are further described by U.S. Pat. App. Ser. No. 14/587,310 entitled “SELECTABLE DISPLAY OF DATA ON A PAYMENT DEVICE” the entire disclosure of which is entirely incorporated by reference herein.

[0018] The payment device 100 may also have a stiffness layer 128. Many circuits, processors, memories, displays, etc., may not be adapted to bend. In fact, many electronic devices break when the devices 100 are bent beyond a threshold. Thus, a stiffening layer 128 of non-flexible material may be added to the payment device 100. The stiffening layer 128 may be part of the front layer 102, back layer 104, inner layer 106 or the entire payment device 100 may be made of a stiff material.

[0019] Now referring to FIG. 2, the payment device may have a variety of components that make up the payment device 100. A processor 200 may be physically configured to enable the input 118 and display 116 along with the other computing elements. The processor 200 may be any processor that fits in the allotted space and can operate using the limited power in the payment device 100 and not generate excessive heat. The processor 200 may be adapted to turn off sections of the processor 200 when those sections are not needed. For example, the processor may turn off the display functions until an input is received from the input device 118 to save power from the power source 114.

[0020] The memory 202 may be any appropriate memory that fits in the space and can operate in the power environment of the payment device 100. The memory 202 may be physically configured to store steps or instructions that are executable by the processor 200 to enable the input device 118 and the display 116 and other functions as herein described. The memory 202 may be RAM or ROM, may be transitory or may be persistent depending on the needs of the specific embodiment of the payment device 100. The memory 202 may be physically part of or separate from the processor 200.

[0021] Similarly, the input/output circuit 112 may communicate signals to and from the processor 200 and it also may be part of the processor 200 or may be a separate device. In addition, the input/output circuit 112 may be required to fit in the space of the payment device 100 and may be required to operate in the power environment of the payment device 100.

[0022] Maintaining sufficient power in the power source 114 may be a concern as the display 116, input device 118, or other components of the device 100 may not operate if there is not enough power. In some embodiments, when power in the power source 114 or power storage element 127 falls below a threshold, a low power warning may be communicated. In some embodiments, the low power warning may be a message on the display 116, an email or a text message to a preset address, or an activated light indicator (e.g., an LED) on the device. Of course, communicating the low power message may also use power so the low power warning may only be communicated if the payment device 100 receives an acceptable communication signal above a threshold such that the message may be quickly communicated without requiring excessive re-sends or repeats. The message may be communicated via a transceiver 204 using, for example, Wi-Fi signals, cellular signals, near field communication systems or infrared signals. In embodiments using the piezoelectric accelerometer as the integrated power source 114, a user may “charge” the payment device 100 by moving or shaking the device until a sufficient charge is present to activate payment device functions. Since most users carry the payment device on their person, it is envisioned that typical daily movement such as walking, etc., will keep sufficient charge on the device 100. Too, the device may be charged or enter a powered or “wake up” state upon the natural motion of raising the card from a wallet or pocket during a payment transaction. Natural motions may be combined with other actions such as compressing a portion of the card, touching a heat sensor of the card, tapping the card against a surface, etc., to charge and/or wake up the payment device.

[0023] The input device 118 may also take on a variety of forms and be actuated in a variety of ways. Logically, the input device 118 may have to fit with the payment device 100 and may be in communication with the input/output circuit 112. In one embodiment, the input device 118 is a heat sensitive region on the payment device 100 and it may be actuated by warming the heat sensitive region. In another embodiment, the input device 118 is a touch sensitive region on the payment device 100 that is actuated by touching the touch sensitive region. In some embodiments, the input device 118 may be visible and in other embodiments, the input device 118 may be under a logo, such as from the payment device 100 issuer.

[0024] In another embodiment, input device 118 may be a motion sensor or coupled to a motion sensor such as the piezoelectric accelerometer of the integrated power source 114. Such an input device 118 may be actuated by flicking or clicking the payment device 100 which may cause a reading from the motion sensor to be beyond a threshold (e.g., a voltage generated by the piezoelectric accelerometer integrated power source 114). The threshold may be adjusted by a user as some user may be more active than other users. In some embodiments, a unique, user-defined pattern of taps with the device 100 against a surface may activate the device 100 for a period of time. For example, the integrated power source 114 piezoelectric accelerometer may register each tap and the processor 108 may execute instructions to verify the pattern to activate the payment device 100. Similarly, a movement pattern of the device 100 may also cause activation.

[0025] In yet another embodiment, the input device 118 may be an electronic signal and the input device 118 may be actuated by receiving an actuation signal from a trusted device. For example, the trusted device may be a portable computing device like a mobile phone, may be a payment device reader or an RFID device. In one embodiment, a user may communicate a signal from a mobile telephone to the transceiver 204 in the payment device 100 which may be received by the input device 118 and act as the input to actuate the display 118 or activate the payment device 100 itself such that payments may be made using the device 100. In some embodiments, the device activation may only persist for a short period of time (e.g., 15 seconds) such that a user may cause a payment to be processed using the device 100 and then the device may become locked or otherwise disabled until needed again. Logically, the message may be encrypted and may require an exchange of electronic keys to establish trust between the payment device 100 and the trusted computing device. In some embodiments, if the actuation signal is received from a non-trusted device more than a threshold number of times during a period, the device may become locked for an extended time or deactivated completely via a signal to the device 100 via the transceiver. By using an electronic signal as the input, the security of the payment device 100 may be increased.

[0026] In some embodiments, the input device 118 may be a biometric sensor adapted to detect human body characteristics of the user, such as fingerprints, eye retinas and irises, voice patterns, facial patterns, and hand measurements, for authentication purposes. For example, the input device 118 may be actuated by receiving a trusted fingerprint on the fingerprint reader. The memory 202 may include instructions that are executed by the processor 200 which verify the trusted fingerprint as received at the input device 118. By using a biometric sensor for the input device 118, the security of the payment device 100 may be increased.

[0027] In yet another embodiment, the input device 118 may be an image sensor. The input device 118 may be actuated by receiving an acceptable image which may be set up in advance by an approved user. The memory 202 may include instructions that are executed by the processor 200 to verify the image and transmit an approval signal. By using an image sensor, the security of the payment device 100 may be increased.

[0028] In other embodiments, the input device 118 may be a sound sensor such as a microphone. The input device 118 may be actuated by receiving an acceptable sound or voice which may be set up in advance by an approved user. A sound analysis module may be stored in the memory 202 and may include instructions that are executed by the processor 200 to receive sound and communicate an approval signal that may be received in response by the receiver 204. By using a sound sensor, the security of the payment device 100 may be increased.

[0029] The integrated power source 114 may facilitate many further security functions for the payment device 100 to restrict use of the device to authorized users. In use, a user may activate the payment device 100 in a variety of ways that do not require power from a point-of-sale device such as a traditional credit card reader. For example, motion of the payment device 100 may cause motion of the mass 120 within the piezoelectric accelerometer integrated power source 114 and cause it to deform (i.e., compress or bend) the piezoelectric material 122. Thus, any single motion or combination of various motions of the card may generate power that may be stored in the power storage element 127, used by the processor 108, used by the display 116, used by the input device 118, etc. Such motion may cause the card to be “unlocked” or authorized to transmit a signal to facilitate completing a payment using the payment device 100. For example, in some embodiments, a user may remove the payment device 100 from his or her wallet and flick or shake the card causing the piezoelectric integrated power source 114 to generate power which then causes the processor 108 to execute one or more instructions stored in the memory 110 to activate the display 116, input device 118, or other aspect of the payment device as herein described to facilitate a payment transaction using the payment device. In other embodiments, the payment device 100 may be activated using a plurality of different motions or a combination “passcode” motion. A user may configure the payment device 100 to activate upon a series of motions. Upon moving the card in the configured sequence of motions, the card may activate. For example, the piezoelectric accelerometer integrated power source 114 may detect various motions in one or more directional axes and one or more instructions stored in the memory 110 may be executed by the processor 108 to record a signature of the motions in the memory 110. The signature may be an amount of power or voltage produced by the piezoelectric accelerometer integrated power source 114 (e.g., the voltage exactly or substantially meeting or exceeding a threshold), an orientation of the power source 114, or any other measurable and repeatable metric that a user may cause a piezoelectric accelerometer to produce and may be recorded, as known in the art. In use, the user may set a passcode motion sequence of moving the card in a circular motion, back and forth vertically once, then back and forth horizontally twice. Upon executing that same sequence of motions, the device 100 may be temporarily activated to facilitate completing a payment transaction.

[0030] Of course, many other single movements or combinations of movements are possible and may be used as the passcode motion sequence. In some embodiments, activation of the payment device 100 may be caused by motion of the mass 120 within the piezoelectric accelerometer integrated power source 114 to deform the piezoelectric material 122 and generate a voltage coupled with another input to the input device 118. For example, the device 100 may be activated to facilitate a payment by the combination of a movement which translates to the piezoelectric accelerometer integrated power source 114 and input from the input device. A user may remove the device 100 from his or her wallet with his or her thumb or other digit placed on the input device 118. The combined motion of the mass element 120 within the piezoelectric accelerometer integrated power source 114 and pressure on the input device 118 may cause the processor 108 to execute one or more instructions from the memory 110 to activate the device 100 and facilitate the payment transaction. Where the input device 118 is a biometric sensor, the device 118 may read a biometric input (e.g., finger print or other biometric as known in the art and described herein) at the device 118 and use that as input for the combination of motions to activate the payment device 100.

[0031] Other security and ease-of-use functions that may be facilitated by an integrated power source 114 such as a piezoelectric accelerometer may include allowing the device 100 to facilitate payment only when energized and unlocked by the user, increasing a range of devices 100 employing wireless communication elements (e.g., Bluetooth, RFID, Wi-Fi, etc.), and allowing for on-device generation of security tokens, displays, and dynamic authorization data without requiring an on-card battery.

[0032] If the input device 110 is activated, a variety of steps or events might happen. In one embodiment, a portion of the payment device 100 may illuminate such as a logo or the input device 110 itself may illuminate. In addition, the display 105 may display the desired sensitive data 130 (Fig. 1a) when the input device 110 is actuated. The sensitive data 130 may be virtually any data needed to complete a payment transaction such as ccv, expiration date, card number, user name, and issuer.

[0033] In some embodiments, actuating the input device 118 may cause the sensitive data 130 to be displayed in a rotating manner through the display 116. For example, a single input (e.g., motion of the mass within the body of the piezoelectric accelerometer integrated power source 114) may cause the account number to be displayed, an additional input (e.g., pressure or a biometric reading of the input device 118) may cause the expiration date to be displayed and yet another input (e.g., a pattern of motions, combinations of inputs, etc.) may cause the expiration to be displayed.

[0034] In yet some more embodiments, the payment device 100 may include a plurality of displays 116 placed in the payment device 100. A single input may cause the sensitive data 130 to appear in any of the displays 116. In yet another embodiment, the input device 118 may be actuated to display the desired sensitive data 130 in a rotating manner through the displays 116. In other embodiments, the sensitive data 130 may be displayed randomly in the various displays 116.

[0035] Logically, the display of sensitive data 130 on the display 116 may only be for a given period of time. The integrated power source 114 may have a limited life so it may be logical to limit the length of the display. Further, the limited length may make it more difficult for the sensitive data 130 to be stolen. In some embodiments, the length of time for a display 116 to display the sensitive data 130 may have a default value and may be further adjusted by a user.

[0036] In accordance with the provisions of the patent statutes and jurisprudence, exemplary configurations described above are considered to represent a preferred embodiment of the invention. However, it should be noted that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.

CLAIMS

1. A payment device comprising:

an integrated power source including a piezoelectric accelerometer;

a processor in communication with the integrated power source,

a memory in communication with the processor, the memory storing instructions that configure the processor to activate payment functions of the payment device; and

an input/output circuit in communication with the processor;

wherein kinetic energy translated to the payment device also translates to the piezoelectric accelerometer to cause the integrated power source to power the processor, memory, and input/output circuit and activate the payment functions of the payment device.

2. The payment device of claim 1, further comprising an electronic display in communication with the input/output circuit, wherein the electronic display only displays sensitive data in response to kinetic energy translated to the mass of the piezoelectric accelerometer, and the sensitive data includes data to complete a payment transaction.

3. The payment device of claim 1, wherein the payment device comprises a plurality of layers comprising:

a substantially flat front surface;

a substantially flat back surface opposite the front surface; and

an inner region comprising openings for the processor, memory and integrated power source.

4. The payment device of claim 1, wherein the input device comprises a heat sensitive region on the payment device, and wherein the processor is configured to detect warming of the heat sensitive region upon translation of kinetic energy to the integrated power source to determine that the input device has been actuated.

5. The payment device of claim 4, wherein the processor is further configured to deactivate the payment functions after a threshold amount of time.

6. The payment device of claim 1, wherein the kinetic energy is first translated from the payment device and then either to one or more of:

a mass element of the piezoelectric accelerometer, and

a piezoelectric material of the piezoelectric accelerometer

to compress a piezoelectric material of the piezoelectric accelerometer and cause the integrated power source to power the processor, memory, and input/output circuit and activate the payment functions of the payment device.

7. The payment device of claim 1, wherein the input device comprises a biometric sensor on the payment device, and wherein the processor is configured to detect one or more biometrics of a user to determine that the input device is actuated.

8. The payment device of claim 7, wherein the processor is further configured to detect translation of kinetic energy to the mass of the piezoelectric accelerometer in combination with input from the input device.

9. The payment device of claim 8, wherein the determination that the input device is activated includes detection of one or more biometrics of the user.

10. The payment device of claim 9, wherein the one or more biometrics includes a fingerprint.

11. The payment device of claim 1, wherein the processor is configured to determine a pattern of the kinetic energy translation to the integrated power source and compare the pattern to a passcode motion to verify that the input device has been actuated by the user.

12. The payment device of claim 11, wherein the pattern includes one or more of a tapping pattern and a motion pattern.

13. The payment device of claim 12, wherein the motion pattern includes one or more of a circular motion, a back-and-forth horizontal motion, and a back-and-forth vertical motion.

14. The payment device of claim 1, wherein the integrated power source includes a mass element, a piezoelectric material, and an actuation means within a housing body, and an energy storage device.

15. The payment device of claim 14, wherein the actuation means includes a structure to facilitate motion of the mass within the housing body to exert a physical force on the piezoelectric material.

16. The payment device of claim 15, wherein the physical force includes a compression force or a bending force.

17. The payment device of claim 16, wherein the piezoelectric material is selected from the group consisting of barium titanate, lead-zirconate, lead-titanate, and lead metaniobate.

18. The payment device of claim 17, wherein the integrated power source further includes a power storage element.

19. The payment device of claim 1, wherein the processor is further configured to generate one or more security tokens in response to activation of the payment functions of the payment device.

20. The payment device of claim 1, wherein the processor is further configured to generate dynamic authorization data in response to activation of the payment functions of the payment device.

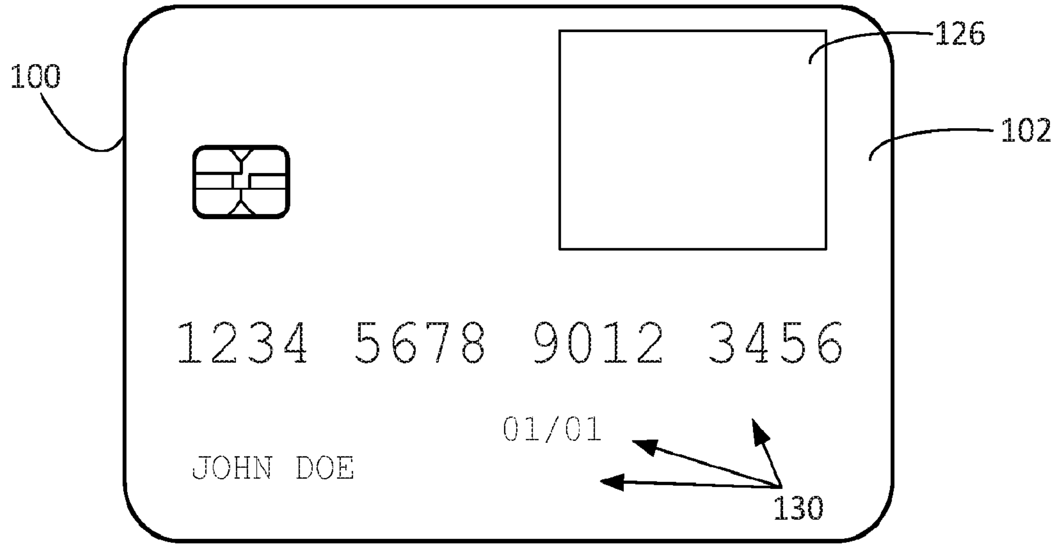

Fig. 1a

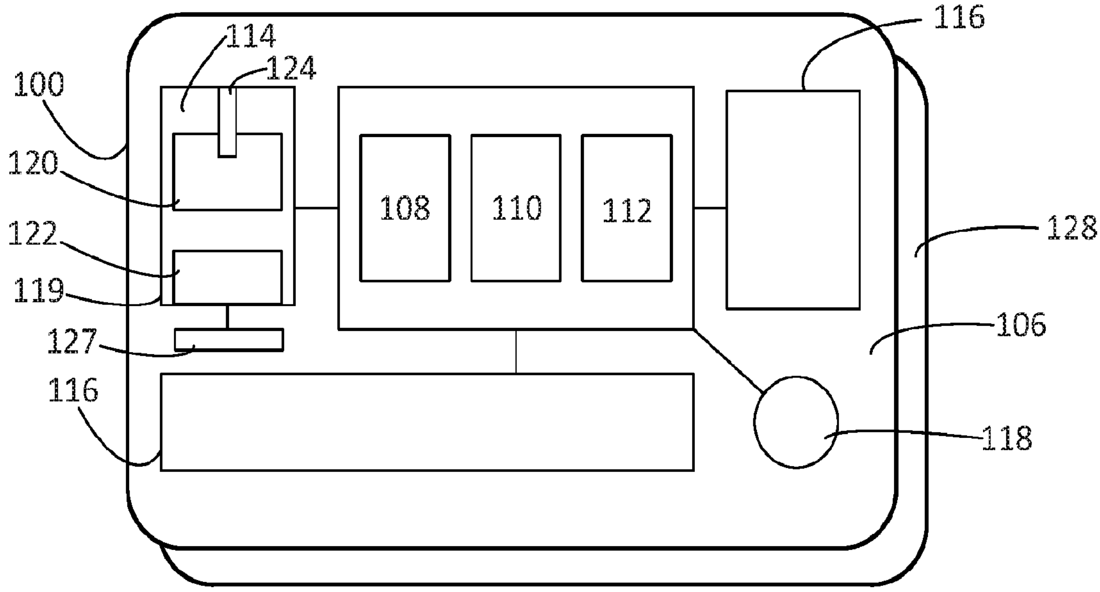

Fig. 1b

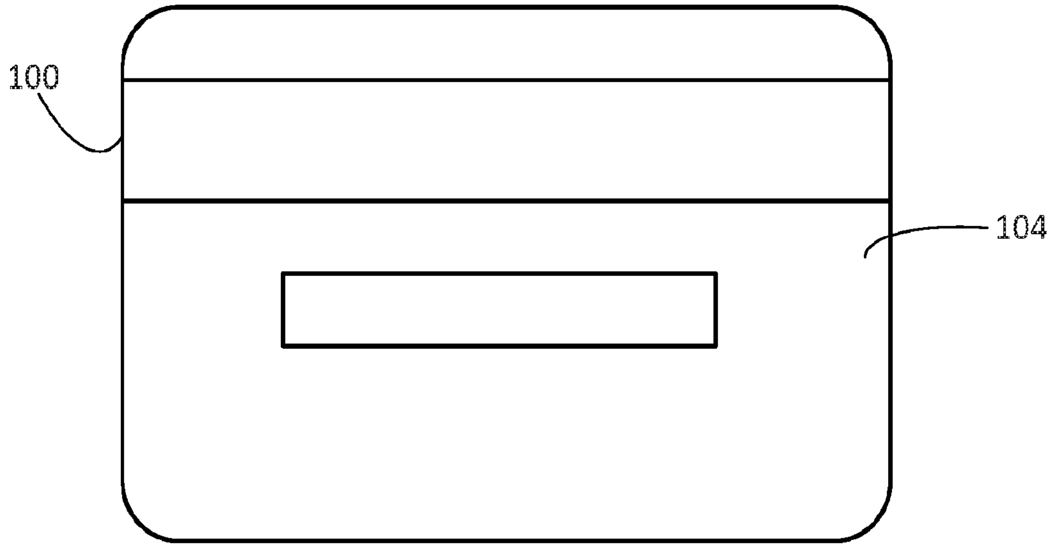

Fig. 1c

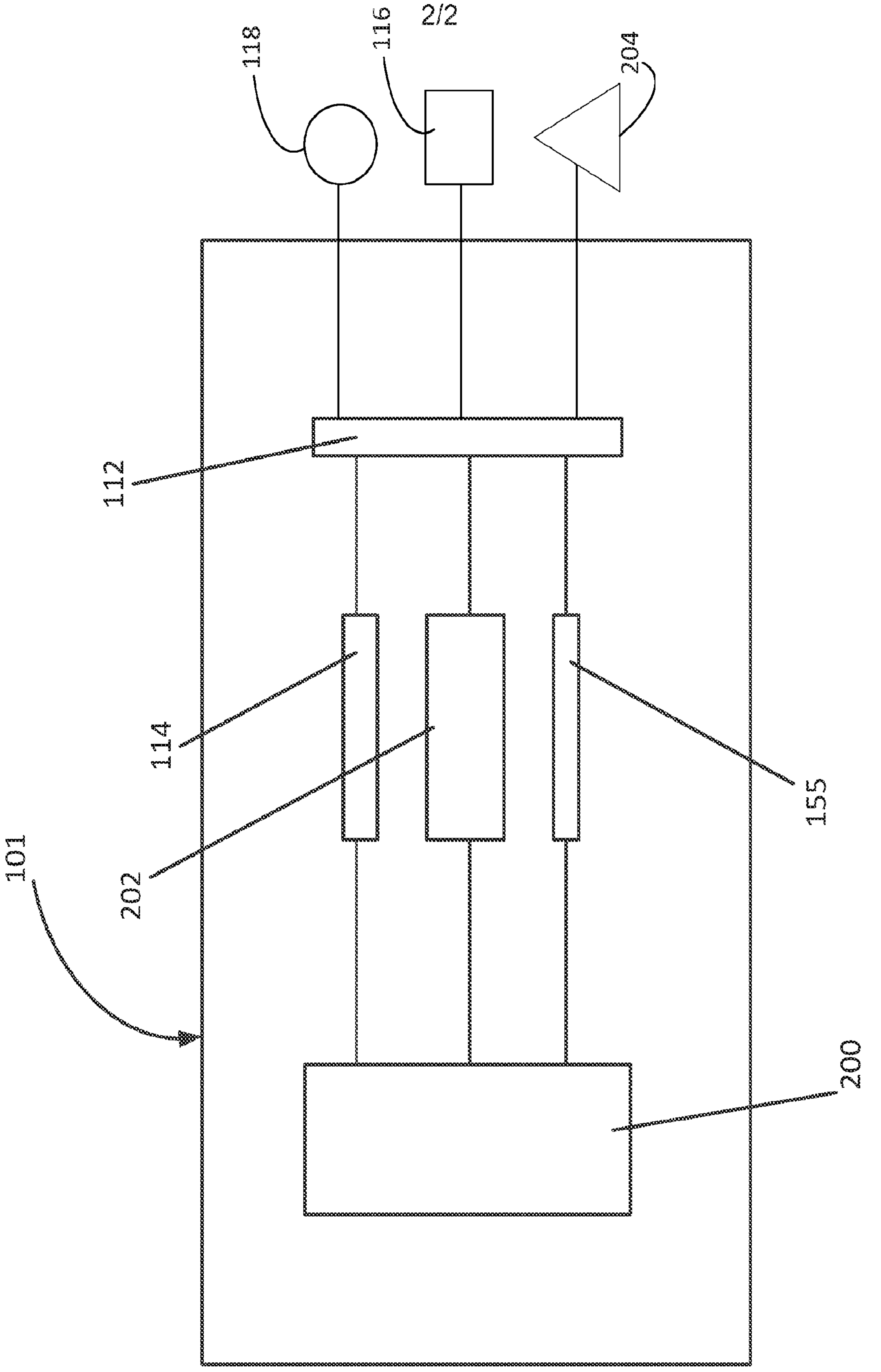

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US16/60394

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06K 19/073, 19/077; G06Q 20/34; G07F 7/08 (2016.01)
CPC - G06K 19/0701, 19/0716, 19/073, 19/077; G06Q 20/04; G07F 7/0806
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(8) - G06K 19/02, 19/06, 19/07, 19/073, 19/077,19/10, 19/18; G06Q 20/04, 20/34, 20/36, 20/40; G07F 7/08, 7/10, 7/12 (2016.01)
CPC - G06K 19/041, 19/06, 19/0701, 19/0702, 19/0714, 19/073, 19/077, 19/083; G06Q 20/3415, 20/346, 20/367; G07F 7/08, 7/0806

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)
PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google; Google Scholar; EBSCO; pay*, finance*, transaction*, credit*, debit*, card*, power*, energy*, electric*, piezo*, mass*, seismic*, acceler*, kinetic*, integrated, memor*, stor*, processor*, controller*, communic*, transmi*, circuit*, secur*, auth*, biometric*, fingerprint*, token*, wallet*, purs*

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2009/0240625 A1 (FAITH, P. L. et al.) 24 September 2009; figures 1, 3A, 4A, 5A-5B, 6; paragraphs [0007], [0027], [0030]-[0035], [0051]-[0053], [0066]	1-2, 6-11, 14-16, 19-20 --- 3-5, 12-13, 17-18
Y	US 2010/0320274 A1 (NIELSEN, F. et al.) 23 December 2010; figure 3; paragraphs [0105]-[0105], [0128]-[0129]	3
Y	US 2005/0194452 A1 (NORDENTOFT, T. et al.) 08 September 2005; figures 1-5; paragraphs [0051]-[0059]	4-5
Y	US 2014/0144984 A1 (PROTEAN PAYMENT, INC.) 29 May 2014; figures 1, 9, 11; paragraphs [0026]-[0028]	12-13
Y	US 3,233,465 A (TOLLIVER, B. R. et al.) 08 February 1996; figure 1, column 2, lines 5-25	17-18
A	US 2013/0185201 A1 (JAIN, B. P. et al.) 18 July 2013; entire document	1-20
A	WO 2009/148418 A1 (CODECARD, INC.) 10 December 2009; entire document	1-20
A	US 2013/0217152 A1 (MULLEN, J. D. et al.) 22 August 2013; entire document	1-20

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

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Date of the actual completion of the international search	Date of mailing of the international search report
31 December 2016 (31.12.2016)	25 JAN 2017

Name and mailing address of the ISA/US	Authorized officer
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 108292370 A
(43)申请公布日 2018.07.17

(21)申请号 201680064328.7

(22)申请日 2016.11.03

(30)优先权数据
14/932,670 2015.11.04 US

(85)PCT国际申请进入国家阶段日
2018.05.03

(86)PCT国际申请的申请数据
PCT/US2016/060394 2016.11.03

(87)PCT国际申请的公布数据
WO2017/079481 EN 2017.05.11

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(51)Int.Cl.
G06K 19/073(2006.01)
G06K 19/077(2006.01)
G06Q 20/34(2006.01)
G07F 7/08(2006.01)

权利要求书2页　说明书6页　附图2页

(54)发明名称

支付设备上的集成电源

(57)摘要

所描述的支付设备包括包含压电加速度计的集成电源。在所述支付设备运动时，动能可被转移到所述压电加速度计的质量块以产生电能，以为所述支付设备的其他功能供电。被转移到所述压电加速度计的运动也可以与其他输入结合使用以实现所述支付设备的安全功能。

CN 108292370 A

1.一种支付设备，包括：

包含压电加速度计的集成电源；

与所述集成电源通信的处理器，

与所述处理器通信的存储器，所述存储器存储配置所述处理器以激活所述支付设备的支付功能的指令；以及

与所述处理器通信的输入/输出电路；

其中转移到所述支付设备的动能还转移到所述压电加速度计，以使所述集成电源给所述处理器、存储器和输入/输出电路供电，并激活所述支付设备的所述支付功能。

2.根据权利要求1所述的支付设备，还包括与所述输入/输出电路通信的电子显示器，其中所述电子显示器响应于转移到所述压电加速度计的质量块的动能而仅显示敏感数据，并且所述敏感数据包括完成支付交易的数据。

3.根据权利要求1所述的支付设备，其中所述支付设备包括多个层，这些层包括：

基本上平的前表面；

与所述前表面相对的基本平的后表面；以及

内部区域，所述内部区域包括用于放置所述处理器、存储器和集成电源的开口。

4.根据权利要求1所述的支付设备，其中，输入设备包括所述支付设备上的热敏区域，并且其中所述处理器被配置为在动能被转移到所述集成电源时检测所述热敏区域的变暖以确定所述输入设备已被驱动。

5.根据权利要求4所述的支付设备，其中所述处理器被进一步配置为在阈值时间量之后停用所述支付功能。

6.根据权利要求1所述的支付设备，其中所述动能首先从所述支付设备转移，然后转移到以下各项中的一个或多个：

所述压电加速度计的质量元件，以及

所述压电加速度计的压电材料

以压缩所述压电加速度计的压电材料，并使所述集成电源为所述处理器、存储器和输入/输出电路供电，且激活所述支付设备的所述支付功能。

7.根据权利要求1所述的支付设备，其中，输入设备包括所述支付设备上的生物特征传感器，并且其中所述处理器被配置为检测用户的一个或多个生物特征以确定所述输入设备被驱动。

8.根据权利要求7所述的支付设备，其中所述处理器被进一步配置为结合来自所述输入设备的输入来检测动能是否被转移到所述压电加速度计的质量块。

9.根据权利要求8所述的支付设备，其中确定所述输入设备被激活包括检测所述用户的一个或多个生物特征。

10.根据权利要求9所述的支付设备，其中所述一个或多个生物特征包括指纹。

11.根据权利要求1所述的支付设备，其中所述处理器被配置为确定转移到所述集成电源的动能的模式，并将所述模式与密码运动进行比较，以验证输入设备已被所述用户驱动。

12.根据权利要求11所述的支付设备，其中所述模式包括敲击模式和运动模式中的一种或多种。

13.根据权利要求12所述的支付设备，其中所述运动模式包括圆周运动、来回水平运动

以及来回竖直运动中的一种或多种。

14.根据权利要求1所述的支付设备，其中所述集成电源包括壳体内的质量元件、压电材料和驱动装置，并且包括能量存储设备。

15.根据权利要求14所述的支付设备，其中所述驱动装置包括便于所述壳体内的质量块在所述压电材料上施加物理力的运动的结构。

16.根据权利要求15所述的支付设备，其中所述物理力包括压缩力或弯曲力。

17.根据权利要求16所述的支付设备，其中所述压电材料选自钛酸钡、锆酸铅、钛酸铅和偏铌酸铅。

18.根据权利要求17所述的支付设备，其中所述集成电源还包括电力存储元件。

19.根据权利要求1所述的支付设备，其中所述处理器被进一步配置为响应于所述支付设备的所述支付功能的激活而生成一个或多个安全令牌。

20.根据权利要求1所述的支付设备，其中所述处理器被进一步配置为响应于所述支付设备的所述支付功能的激活而生成动态授权数据。

支付设备上的集成电源

[0001]　相关申请的交叉引用

[0002]　本申请要求于2015年11月4日提交的美国申请号14/932,670的权益，其公开内容以引用方式全文并入文本。

技术领域

[0003]　本公开涉及被配置为包括用于多种应用的电源的信用卡，更具体地涉及被配置为包括加速度计（诸如压电加速度计）作为用于增强安全性并且便于支付功能的电源的信用卡。

背景技术

[0004]　本文提供的背景描述是为了总体上呈现本公开的上下文的目的。在本背景技术部分中描述的程度上，当前署名的发明人的工作以及在提交时可能不另外作为现有技术的各方面描述，既不明确也不暗示地被承认为本公开的现有技术。

[0005]　信用卡交易一直是犯罪欺诈的目标。在数字购物交易中，不使用实物信用卡，因此犯罪分子可以单独使用被盗信息来完成欺诈交易。在使用实体卡的销售点交易中，犯罪分子必须采用复杂的技术，使用被盗的信用卡持有者信息来复制实体卡。信用卡公司已经竭尽全力确保通过将安全措施结合到每张实体卡中而不能复制实体卡。然而，在这些措施的小规模实施中所取得的进展已使得犯罪分子越来越容易复制为保证实体信用卡安全而采取的即便是先进的措施。

[0006]　而且，信用卡发卡机构可能会采取多种不同措施来阻止或防止实体信用卡欺诈。但是，成本和尺寸限制会使得这种措施对于钱包大小的信用卡不切实际。越来越需要更小、更复杂的措施来确保实体信用卡安全。

发明内容

[0007]　本发明内容和以下具体实施方式描述的特征和优点并非是包括一切的。根据附图、说明书和权利要求书，许多附加的特征和优点对于本领域的普通技术人员将是显而易见的。此外，其他实施方案可以省略本发明内容中描述的特征和优点中的一个或多个（或全部）。

[0008]　信用卡可以被配置成在卡内采用集成能源（例如，加速度计）以便为复杂的物理安全部件供电。在一些实施方案中，加速度计可以是压电加速度计。例如，卡的运动（诸如在行走时携带卡、抬起卡或来回移动卡或在卡上或在加速度计区域施加压力）尤其可以产生电能以向传感器或卡的其他物理安全功能供电。用户输入或生物特征传感器与集成能量源的结合可允许卡临时（例如，在诸如15秒之类的特定时间段）“解锁”。另外，集成电源可以为用户ID（例如，PIN码、运动模式）或生物特征传感器的输入供电，从而允许卡被解锁以使其仅临时工作。在一些实施方案中，当卡被通电并且在输入用户ID或生物特征之后，卡可以被解锁特定的时间段。诸如压电加速度计之类的集成能源可消除对卡内电池的需求，并允许卡

在无需来自销售点设备的电力的情况下工作。这些措施通过允许卡仅在被用户通电和解锁时工作而增强安全性,同时将使用范围扩大到可能涉及没有传统销售点设备的支付的更多移动应用。更进一步,如上所述而配置的卡将允许卡内令牌生成以及信息的卡内显示以及动态授权数据的卡内生成,而不需要卡内电池。

[0009] 在一个实施方案中,支付设备可以包括:包含压电加速度计的集成电源,与集成电源通信的处理器,以及与处理器通信的存储器,存储器存储可由处理器执行的指令;以及与处理器通信的输入/输出电路。转移到支付设备并因此转移到压电材料的动能和/或压力可以产生电能以给处理器、存储器和输入/输出电路供电。

附图说明

[0010] 图1a、图1b和图1c示出了包括集成能源的支付设备的实施方案的各种视图;以及

[0011] 图2是具有集成电源和各种输入设备的支付设备的样本电路设计的视图。

[0012] 仅出于说明的目的,附图描绘优选实施方案。本领域技术人员可以从下面的讨论中容易地认识到,在不脱离本文描述的原理的情况下,可以采用在本文中示出的结构和方法的替代实施方案。

具体实施方式

[0013] 图1a、图1b和图1c一般性地示出了支付设备100。具体而言,图1a示出了支付设备100的正面外视图,图1b示出了支付设备100的内层视图,而图1c示出了支付设备100的背面外视图。支付设备100可以呈多种形状和形式。在一些实施方案中,支付设备100是传统的卡,诸如借记卡或信用卡。在其他实施方案中,卡可以是钥匙链上的钥匙扣。只要支付设备100能够与支付接受设备安全地进行通信,支付设备的形式可能不是特别关键的,并且可以在设计上进行选择。例如,许多传统支付设备100可能必须由磁条读取器读取,并且因此支付设备100的尺寸可能必须适合磁卡读取器。在其他实例中,支付设备100可以通过近场通信进行通信,而支付设备100的形式几乎可以是任何形式。当然,基于卡的用途、正在使用的读取器的类型等,其他形式也是可以的。

[0014] 在物理上,支付设备100可以是卡,而卡可以具有多个层以包含构成支付设备100的各种元件,如图1a、图1b和图1c所示。在一个实施方案中,支付设备100可以具有基本平的前表面102和与前表面相对的基本上平的后表面104。在逻辑上,在一些实施方案中,表面102、104可有一些凸起。此外,内层106可具有用于放置处理器108、存储器110、输入/输出电路112和电源114的开口。一些实施方案还可以包括可以是支付设备100的一部分的显示器116和输入设备118。在一些实施方案中,输入设备118可以包括生物特征传感器。

[0015] 电源114可以包括换能器,比如压电加速度计,压电加速度计包括壳体119、质量元件120、压电材料122、驱动装置124和能量存储设备126。驱动装置124可以包括促进质量块120在压电加速度计内的运动的任何结构。质量块120在壳体119内的运动或由用户施加的压力将在压电材料122上施加物理力以使材料122弯曲或压缩。材料122上的压缩力包括施加到压电材料122的一侧的力,而相对一侧抵靠固定表面,例如电源114的内壁。弯曲力可能涉及质量块120或其他装置围绕压电材料122的轴线在材料122上施加力。在一些实施方案中,压电加速度计包括三轴加速度计,诸如由位于纽约州伊萨卡的Kionix Inc.生产的

KX112或KXCJB。当然，其他类型的压电加速度计也可以适用于本文描述的发电和其他功能。

[0016] 材料122可以包括晶体和陶瓷材料。一些实施方案可采用单晶材料122(例如石英)，而其他实施方案可采用陶瓷材料。压电加速度计电源114的一些实施方案可以包括钛酸钡、锆酸铅、钛酸铅、偏铌酸铅以及其他压电材料122。

[0017] 在使用中，支付设备100使质量块120抵靠压电材料122驱动而发生的运动或由用户压缩卡的压电材料而施加的压力会产生电能。然后，由电源114产生的能量可以供处理器108、显示器116或支付设备100的其他部件消耗。此外，能量也可以被存储在电力存储元件127中，以供随后使用。在一些实施方案中，电力存储元件是能够频繁地接收和存储电能的可再充电电池、电容器或其他元件。当然，支付设备100还可以包括将所产生的能量从电源114和/或电力存储元件127传输到处理器108、显示器或支付设备100的其他部件的电路或其他装置。

[0018] 在包括显示器116的实施方案中，基本上平的前表面102可以包括半透明区域126，可以通过该半透明区域来查看显示器116。在逻辑上，用户可能想要查看显示器116。同时，可能必须保护显示器不受元件的影响。因此，顶层102和/或底层104的半透明区域可以被放置在显示器105上方。还应该注意，可能存在多个显示器105，可能需要在内层中存在空间用于放置每个显示器，并且可能需要在顶层和/或底层中具有半透明区域来查看显示器。包括显示器116的实施方案进一步由标题为“SELECTABLE DISPLAY OF DATA ON A PAYMENT DEVICE”的美国专利申请序列号14/587,310描述，其公开内容以引用方式全文并入本文。

[0019] 支付设备100还可以具有刚性层128。许多电路、处理器、存储器、显示器等可能不适合弯曲。事实上，当设备100弯曲到超过某一阈值时，许多电子设备会损坏。因此，可以将非柔性材料加强层128添加到支付设备100。加强层128可以是正面层102、背面层104、内层106的一部分，或者整个支付设备100都可以由刚性材料制成。

[0020] 现在参考图2，支付设备可以具有构成支付设备100的多种部件。处理器200可以被物理地配置为实现输入设备118和显示器116连同其他计算元件的功能。处理器200可以是装配在分配空间中且可以使用支付设备100中的有限的能量来操作并且不会产生过多的热量的任何处理器。当不需要处理器200的某些部分时，处理器200可关闭这些部分。例如，处理器可以关闭显示功能，直到从输入设备118接收到输入，以节省来自电源114的电力。

[0021] 存储器202可以是适合该空间并且可以在支付设备100的电力环境中操作的任何适当的存储器。存储器202可以物理地配置为存储步骤或指令，这些步骤和指令可由处理器200执行以实现输入设备118和显示器116的功能以及本文所述的其他功能。存储器202可以是RAM或ROM，可以是暂时的或者可以是永久性的，这取决于支付设备100的特定实施方案的需要。存储器202可以在物理上是处理器200的一部分或与该处理器分开。

[0022] 类似地，输入/输出电路112可以传递来往于处理器200的信号，它也可以是处理器200的一部分或者可以是单独的设备。另外，输入/输出电路112可能需要适合支付设备100的空间并且可能需要在支付设备100的电力环境中操作。

[0023] 在电源114中保持足够的电力可能是大家关心的问题，因为如果没有足够的电力，则设备100的显示器116、输入设备118或其他部件可能无法运行。在一些实施方案中，当电源114或电力存储元件127中的电力下降到某一阈值以下时，可发出低电量警告。在一些实施方案中，低电量警告可以是显示器116上的消息、发送到预设地址的电子邮件或文本消

息、或设备上的激活的灯光指示器(例如,LED)。当然,发送低电量消息也可能使用电力,因此只有当支付设备100接收到高于阈值的可接受的通信信号时才可以发送低电量警告,使得消息可以被快速发送出去,而不需要过多的重新发送或重复。消息可以由收发器204使用例如Wi-Fi信号、蜂窝信号、近场通信系统或红外信号来进行发送。在使用压电加速度计作为集成电源114的实施方案中,用户可以通过移动或摇动支付设备100来对该设备进行“充电”,直到有足够的电量来激活支付设备功能。由于大多数用户将支付设备带在身上,因此可以设想,诸如步行等典型的日常活动将会使设备100保持足够的电量。而且,在支付交易期间,在发生将卡从钱包或口袋中取出之类的自然运动时,设备可以被充电或进入通电或“唤醒”状态。自然运动可以与其他动作相结合,例如压缩卡的一部分、触摸卡的热传感器、用卡轻敲某表面等,以进行充电和/或唤醒支付设备。

[0024] 输入设备118也可以呈多种形式并且以多种方式被驱动。在逻辑上,输入设备118可能必须与支付设备100匹配,并且可以与输入/输出电路112进行通信。在一个实施方案中,输入设备118是支付设备100上的热敏区域,并且其可以通过加热热敏区域来驱动。在另一个实施方案中,输入设备118是支付设备100上的触敏区域,其通过触摸触敏区域而被驱动。在一些实施方案中,输入设备118可以是可见的,而在其他实施方案中,输入设备118可以在诸如支付设备100发行方的徽标之下。

[0025] 在另一个实施方案中,输入设备118可以是运动传感器或耦合到诸如集成电源114的压电加速度计之类的运动传感器。这种输入设备118可以通过轻弹或点击支付设备100来驱动,这可以使来自运动传感器的读数超出阈值(例如,由压电加速度计集成电源114生成的电压)。阈值可以由用户调整,因为一些用户可能比其他用户更活跃。在一些实施方案中,设备100靠着某种表面的独特的、用户定义的轻叩模式可以激活设备100一段时间。例如,集成电源114压电加速度计可以记录每一次轻叩,而处理器108可以执行指令来验证模式是否匹配,以激活支付设备100。类似地,设备100的运动模式也可以导致激活。

[0026] 在又一个实施方案中,输入设备118可以是电信号,并且输入设备118可以通过从可信设备接收到驱动信号来驱动。例如,可信设备可以是便携式计算设备,如移动电话,可以是支付设备读取器或RFID设备。在一个实施方案中,用户可以将来自移动电话的信号传送给支付设备100中的收发器204,该信号可以由输入设备118接收并且用作输入以驱动显示器118或激活支付设备100本身,以便可以使用设备100进行支付。在一些实施方案中,设备激活可以仅持续较短的时间段(例如,15秒),使得用户可以使用设备100来处理支付,然后设备可以变为锁定或以其他方式被禁用,直到再次需要。在逻辑上,消息可以是加密的,并且可能需要交换电子密钥以在支付设备100与可信计算设备之间建立信任。在一些实施方案中,如果在一段时间内从非可信设备接收到超过阈值次数的驱动信号,则可以经由收发器,通过到设备100的信号,使该设备锁定较长时间,或完全停用。通过使用电子信号作为输入,支付设备100的安全性可以增强。

[0027] 在一些实施方案中,输入设备118可以是生物特征传感器,其适于检测用户的身体特征(例如指纹、眼睛视网膜和虹膜、语音模式、面型和手测量值)以用于认证目的。例如,可以通过在指纹读取器上接收可信指纹来驱动输入设备118。存储器202可以包括由处理器200执行的指令,所述指令验证在输入设备118处接收到的可信指纹。通过将生物特征传感器用于输入设备118,可以增强支付设备100的安全性。

[0028]　在又一个实施方案中，输入设备118可以是图像传感器。输入设备118可以通过接收可以由经批准的用户预先设置的可接受图像来驱动。存储器202可以包括由处理器200执行以验证图像并发送批准信号的指令。通过使用图像传感器，可以增强支付设备100的安全性。

[0029]　在其他实施方案中，输入设备118可以是诸如麦克风之类的声音传感器。输入设备118可以通过接收可以由经批准的用户预先设置的可接受的声音或语音来驱动。声音分析模块可以被存储在存储器202中，并且可以包括由处理器200执行以接收声音并发送批准信号的指令，批准信号可以作为响应由接收器204接收到。通过使用声音传感器，可以增强支付设备100的安全性。

[0030]　集成电源114可以促进支付设备100的许多其他安全功能，以将设备的使用仅限于授权用户。在使用中，用户可以以多种方式激活支付设备100，不需要来自销售点设备(诸如传统信用卡读卡器)的电力。例如，支付设备100的运动可引起压电加速度计集成电源114内的质量块120的运动，并使其导致压电材料122变形(即压缩或弯曲)。因此，卡的各种运动中的任何单一运动或组合运动都可以产生电力，电力可以存储在电力存储元件127中，供处理器108、显示器116、输入设备118等使用。这样的运动可以使卡被“解锁”或被授权发送便于使用支付设备100完成支付的信号。例如，在一些实施方案中，用户可以从钱包中取出支付设备100并且轻弹或摇动，使得压电集成电源114产生电能，然后使处理器108执行存储在存储器110中的一个或多个指令以激活显示器116、输入设备118或本文描述的支付设备的其他方面，以促进使用支付设备完成支付交易。在其他实施方案中，可以使用多个不同的运动或组合“密码”运动来激活支付设备100。用户可以配置支付设备100以在一系列运动之后激活。在按配置的运动顺序移动卡时，卡可能会激活。例如，压电加速度计集成电源114可以检测一个或多个方向轴上的各种运动，而存储器110中存储的一个或多个指令可以由处理器108执行以将运动的签名记录在存储器110中。签名可以是由压电加速度计集成电源114产生的电力或电压量(例如，完全或基本上符合或超过阈值的电压)、电源114的朝向或如本领域已知的用户可以使压电加速度计产生并且可以被记录的任何其他可测量且可重复的度量。在使用中，用户可以设置移动卡的密码运动序列为圆周运动，竖直地来回运动一次，然后水平地来回运动两次。在执行相同的运动序列后，设备100可以被临时激活以促进支付交易的完成。

[0031]　当然，许多其他单一移动或移动组合也是可以的，并且可以用作密码运动序列。在一些实施方案中，支付设备100的激活可以由压电加速度计集成电源114内的质量块120的运动引起，以使压电材料122变形并且产生与输入设备118的另一输入耦合的电压。例如，设备100可以通过转移到压电加速度计集成电源114的运动和来自输入设备的输入的组合来激活，以促进支付。用户可以用放在输入设备118上的拇指或其他手指从钱包中取出设备100。压电加速度计集成电源114内的质量元件120的运动和施加在输入设备118上的压力的组合可以使处理器108执行来自存储器110的一个或多个指令，以激活设备100并促进支付交易。在输入设备118是生物特征传感器的情况下，设备118可以在设备118处读取生物特征输入(例如，指纹或本领域中已知且在本文中描述的其他生物特征)，并将其用作运动组合的输入，来激活支付设备100。

[0032]　诸如压电加速度计之类的集成电源114可以促成的其他安全性和易用功能可以包

括:仅当用户通电和解锁时才允许设备100促进支付,扩大采用无线通信元件(例如,蓝牙、RFID、Wi-Fi等)的设备100的范围,以及允许安全令牌、显示和动态授权数据的设备内生成,而不需要卡内电池。

[0033] 如果输入设备118被激活,则可能会发生各种步骤或事件。在一个实施方案中,支付设备100的一部分可以发光,诸如徽标或输入设备118本身可以发光。另外,显示器105可以在输入设备118被驱动时显示期望的敏感数据130(图1a)。敏感数据130几乎可以是完成支付交易所需的任何数据,例如ccv、到期日期、卡号、用户名和发卡机构。

[0034] 在一些实施方案中,驱动输入设备118可以使敏感数据130通过显示器116以循环方式显示。例如,单个输入(例如,质量块在压电加速度计集成电源114主体内的运动)可以导致账号被显示,附加输入(例如输入设备118的压力或生物特征读数)可以导致过期日期被显示,而另一输入(例如,运动模式、输入组合等)可以导致到期日期被显示。

[0035] 在又一些实施方案中,支付设备100可以包括放置在支付设备100中的多个显示器116。单个输入可导致敏感数据130出现在任何显示器116中。在又一个实施方案中,输入设备118可以被驱动以通过显示器116以循环方式显示期望的敏感数据130。在其他实施方案中,敏感数据130可以随机显示在各种显示器116中。

[0036] 在逻辑上,敏感数据130在显示器116上的显示可能只有给定的时间长度。集成电源114的寿命可能是有限的,因此限制显示的时间长度可能是合乎逻辑的。此外,有限的时间长度可能会使得敏感数据130更加难以被盗。在一些实施方案中,显示器116显示敏感数据130的时间长度可以具有默认值,并且可以由用户进一步调整。

[0037] 根据专利法规和法理学的规定,上述示例性配置被认为是表示本发明的优选实施方案。然而,应当注意,本发明可以在不脱离本发明的精神或范围的情况下以不同于具体示出和描述的方式实践。

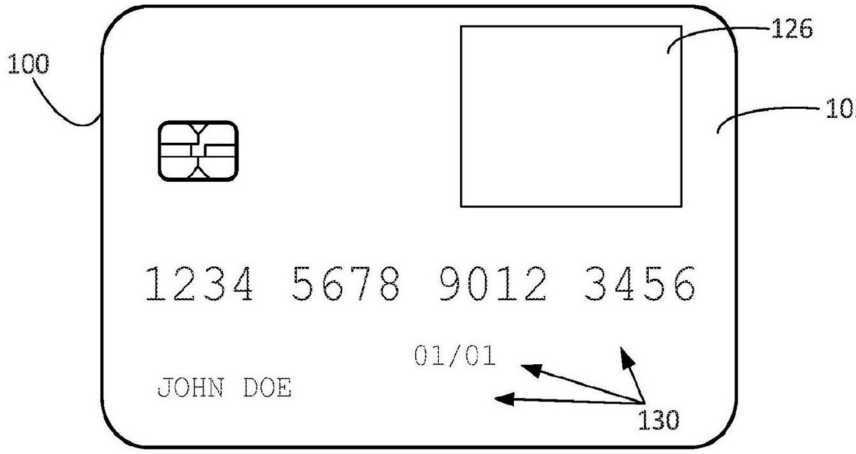
126
100
102
1234 5678 9012 3456
01/01
JOHN DOE
130

图1a

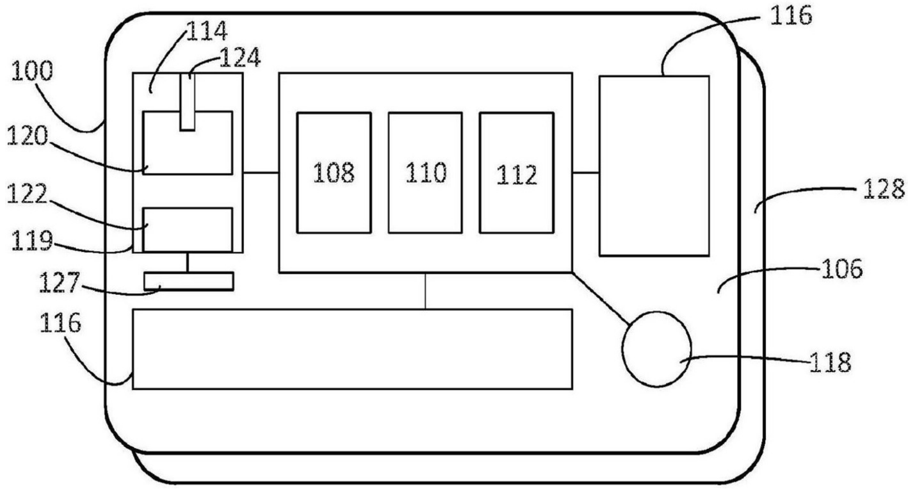
114
124
116
100
120
108
110
112
128
122
119
106
127
116
118

图1b

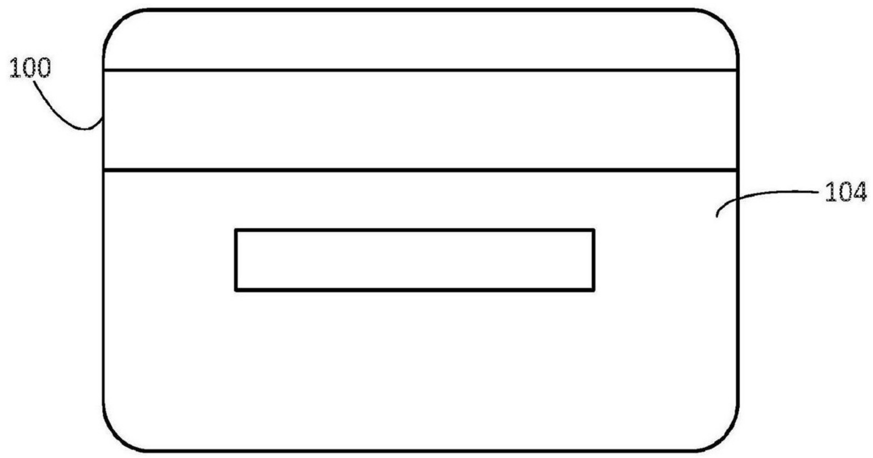
100
104

图1c

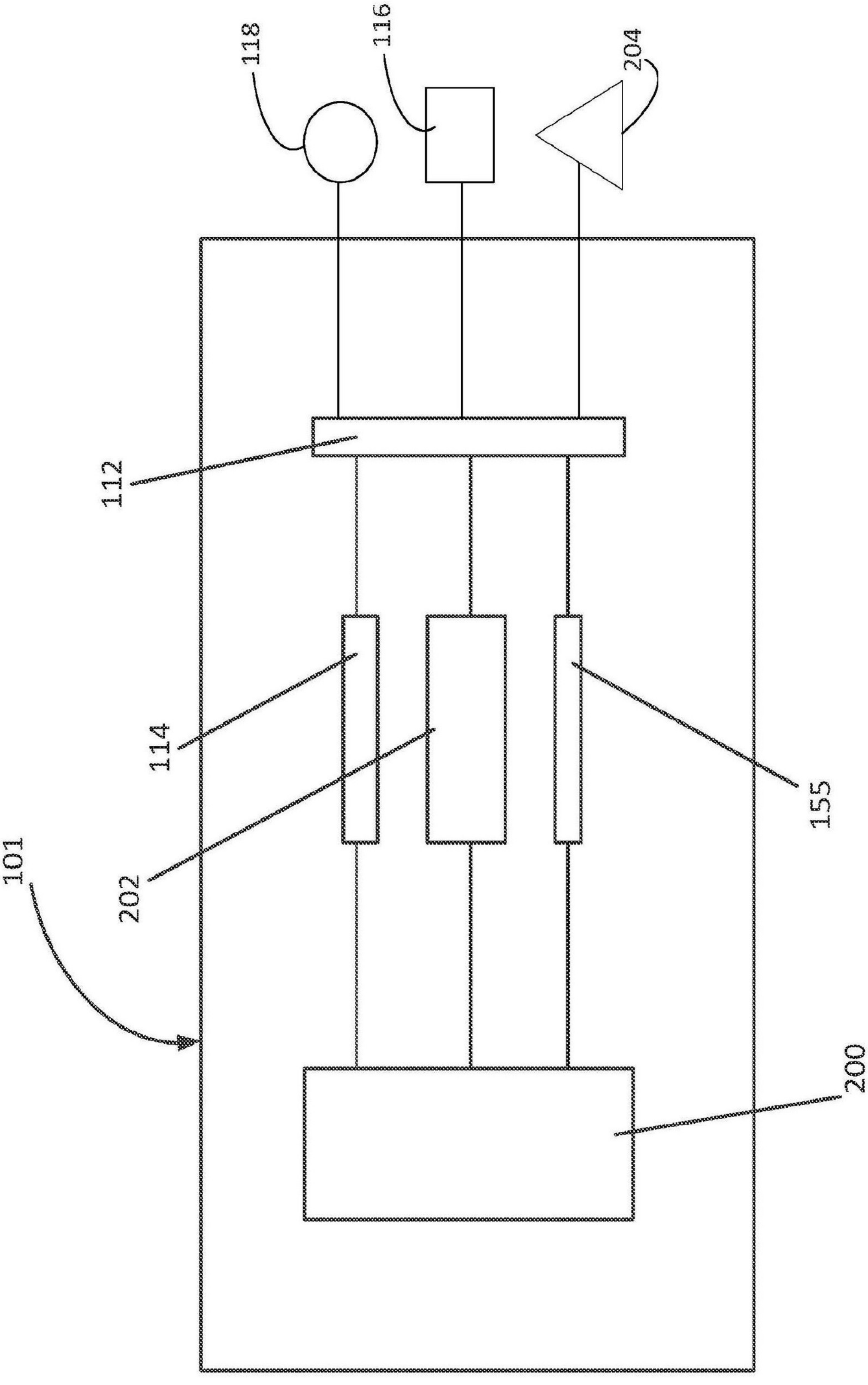

图2