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Evans

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(54) **BIOMETRIC ACCESS CONTROL TRANSACTIONS**

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G06F 7/04 (2006.01)

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USPC **713/186**; 713/182; 726/9; 726/20

(58) **Field of Classification Search**
USPC 726/20, 9; 713/182, 186; 725/5; 382/115, 116, 121, 124
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,253,086	A	2/1981	Szwarcbier	
4,582,985	A	4/1986	Lofberg	
5,072,103	A	12/1991	Nara	
5,546,471	A	8/1996	Merjanian	
5,613,012	A	3/1997	Hoffman et al.	
5,615,277	A	3/1997	Hoffman	
5,623,552	A *	4/1997	Lane	382/124
5,737,439	A	4/1998	Lapsley et al.	
5,764,789	A	6/1998	Pare, Jr. et al.	
5,802,199	A	9/1998	Pare, Jr. et al.	
5,805,719	A	9/1998	Pare, Jr. et al.	
5,838,812	A	11/1998	Pare, Jr. et al.	
5,870,723	A	2/1999	Pare, Jr. et al.	
5,870,895	A	2/1999	Fally	
5,982,914	A	11/1999	Lee et al.	
6,012,039	A	1/2000	Hoffman et al.	
D425,873	S	5/2000	Anderson et al.	
6,131,464	A	10/2000	Pare, Jr. et al.	
6,154,879	A	11/2000	Pare, Jr. et al.	
6,182,892	B1 *	2/2001	Angelo et al.	235/380

(Continued)

FOREIGN PATENT DOCUMENTS

AU	750154	B2	7/2002
KR	10-2001-0054151	A	7/2001

(Continued)

OTHER PUBLICATIONS

International Search Report for PCT/US2008/086414 (Filed Nov. 12, 2008); Visa U.S.A. Inc.

(Continued)

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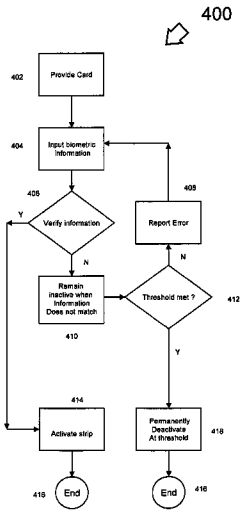
(57) **ABSTRACT**

Aspects and embodiments of the present disclosure provide devices and methods for biometric authentication of a user during access control transactions. In one aspect, an access control processor device, comprising a biometric input sensor configured to receive user biometric information; a biometric verification processor configured to authenticate the input user biometric information; and a communication element configured to activate when the biometric information entered into the biometric verification system is authenticated and maintain an inactive status for the communication element on the payment processor device when the biometric information entered into the biometric verification system is not authenticated.

23 Claims, 4 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

6,185,318	B1	2/2001	Jain et al.	
6,192,142	B1	2/2001	Pare, Jr. et al.	
6,209,104	B1	3/2001	Jalili	
6,230,148	B1	5/2001	Pare, Jr. et al.	
6,269,348	B1	7/2001	Pare, Jr. et al.	
6,366,682	B1	4/2002	Hoffman et al.	
6,391,198	B1	5/2002	Porter et al.	
6,397,198	B1	5/2002	Hoffman et al.	
6,411,728	B1	6/2002	Lee et al.	
6,581,042	B2	6/2003	Pare, Jr. et al.	
6,591,002	B2	7/2003	Lee et al.	
6,594,376	B2	7/2003	Hoffman et al.	
6,662,166	B2	12/2003	Pare, Jr. et al.	
6,728,397	B2	4/2004	McNeal	
6,879,966	B1	4/2005	Lapsley et al.	
6,920,435	B2	7/2005	Hoffman et al.	
6,950,810	B2	9/2005	Lapsley et al.	
6,957,770	B1	10/2005	Robinson	
6,980,670	B1	12/2005	Hoffman et al.	
6,985,608	B2	1/2006	Hoffman et al.	
7,004,389	B1	2/2006	Robinson et al.	
7,082,415	B1	7/2006	Robinson et al.	
7,152,045	B2	12/2006	Hoffman	
7,185,807	B1	3/2007	Robinson et al.	
7,248,719	B2	7/2007	Hoffman et al.	
7,269,737	B2	9/2007	Robinson	
7,272,247	B2 *	9/2007	Hamid	382/124
7,308,584	B2 *	12/2007	Himmel et al.	713/193
7,319,987	B1	1/2008	Hoffman et al.	
7,334,735	B1	2/2008	Antebi	
7,367,049	B1	4/2008	Robinson et al.	
7,387,240	B2	6/2008	Ziegler	
7,389,269	B1	6/2008	Robinson et al.	
7,437,330	B1	10/2008	Robinson et al.	
7,464,059	B1	12/2008	Robinson et al.	
7,483,862	B1	1/2009	Robinson et al.	
7,497,372	B1	3/2009	Robinson et al.	
7,502,761	B2	3/2009	Siegal et al.	
7,512,567	B2	3/2009	Bemmel et al.	
7,526,652	B2	4/2009	Ziegler	
7,533,066	B1	5/2009	Robinson et al.	
7,533,809	B1	5/2009	Robinson et al.	
7,536,352	B2	5/2009	Lapsley et al.	
7,542,590	B1	6/2009	Robinson et al.	
7,543,156	B2 *	6/2009	Campisi	713/186
7,545,621	B2	6/2009	Haddad	
7,558,406	B1	7/2009	Robinson et al.	
7,558,407	B2	7/2009	Hoffman et al.	
7,565,329	B2	7/2009	Lapsley et al.	
7,606,401	B2	10/2009	Hoffman et al.	
7,613,659	B1	11/2009	Hoffman et al.	
7,620,605	B2	11/2009	Hoffman et al.	
7,624,073	B1	11/2009	Robinson et al.	
7,631,193	B1	12/2009	Hoffman	
7,698,567	B2	4/2010	Hoffman	
7,747,528	B1	6/2010	Robinson et al.	
7,765,164	B1	7/2010	Robinson et al.	
7,769,695	B2	8/2010	Robinson et al.	
7,778,933	B2	8/2010	Robinson et al.	
7,831,468	B1	11/2010	Conte et al.	
7,836,485	B2	11/2010	Robinson et al.	
7,882,032	B1	2/2011	Hoffman	
7,970,678	B2	6/2011	Lapsley	
8,015,118	B1	9/2011	Robinson et al.	
8,260,716	B2	9/2012	Hoffman et al.	
8,370,218	B2	2/2013	Robinson et al.	
2002/0090117	A1	7/2002	Kramer	
2002/0153424	A1	10/2002	Li	
2002/0188842	A1	12/2002	Willeby	
2002/0188872	A1	12/2002	Willeby	
2004/0044739	A1	3/2004	Ziegler	
2004/0073510	A1	4/2004	Logal et al.	
2004/0129787	A1	7/2004	Saito et al.	
2004/0177045	A1	9/2004	Brown	
2004/0215615	A1 *	10/2004	Larsson et al.	707/9
2005/0035200	A1	2/2005	Hendrick	
2005/0085931	A1	4/2005	Willeby	
2005/0110103	A1	5/2005	Setlak	
2005/0153779	A1	7/2005	Ziegler	
2005/0194452	A1	9/2005	Nordentoft et al.	
2005/0207624	A1	9/2005	Ehlers et al.	
2005/0229007	A1 *	10/2005	Bolle et al.	713/186
2005/0240778	A1	10/2005	Saito	
2005/0253683	A1	11/2005	Lowe	
2005/0269402	A1	12/2005	Spitzer et al.	
2005/0278222	A1	12/2005	Nortrup	
2006/0032908	A1	2/2006	Sines	
2006/0106734	A1	5/2006	Hoffman et al.	
2006/0111977	A1	5/2006	Hawkins	
2006/0113381	A1 *	6/2006	Hochstein et al.	235/382
2006/0123465	A1	6/2006	Ziegler	
2006/0136332	A1	6/2006	Ziegler	
2006/0170530	A1 *	8/2006	Nwosu et al.	340/5.53
2006/0213970	A1 *	9/2006	Trajkovic et al.	235/380
2006/0265602	A1	11/2006	Robinson	
2007/0131759	A1	6/2007	Cox	
2007/0162337	A1	7/2007	Hawkins	
2007/0189581	A1	8/2007	Nordentoft et al.	
2007/0220272	A1 *	9/2007	Campisi et al.	713/186
2007/0282677	A1	12/2007	Carpenter	
2007/0288319	A1	12/2007	Robinson et al.	
2007/0288320	A1	12/2007	Cooper et al.	
2008/0019578	A1 *	1/2008	Saito et al.	382/124
2008/0097851	A1	4/2008	Bemmel et al.	
2008/0147481	A1	6/2008	Robinson et al.	
2008/0223925	A1	9/2008	Saito et al.	
2008/0271116	A1	10/2008	Robinson et al.	
2009/0066239	A1	3/2009	Yabunouchi	
2009/0070270	A1	3/2009	Robinson et al.	
2009/0074256	A1	3/2009	Haddad	
2009/0099944	A1	4/2009	Robinson	
2009/0138366	A1	5/2009	Bemmel	
2009/0177587	A1	7/2009	Siegal	
2009/0228362	A1	9/2009	Lapsley	

FOREIGN PATENT DOCUMENTS

KR	10-2001-0069593	A	7/2001
KR	10-2004-0036850	A	5/2004
WO	WO 96/36934	A1	11/1996
WO	WO 98/09227	A1	3/1998
WO	WO 98/15924	A1	4/1998
WO	WO 98/41947	A1	9/1998
WO	WO 99/31621	A1	6/1999
WO	WO 00/26849	A1	5/2000
WO	WO 00/45247	A1	8/2000
WO	WO 00/45320	A1	8/2000
WO	WO 00/46710	A1	8/2000
WO	WO 00/46737	A1	8/2000
WO	WO 0049561	A1 *	8/2000
WO	WO 00/67187	A1	11/2000
WO	WO 01/06440	A1	1/2001
WO	WO 01/20531	A1	3/2001
WO	WO 02/14984	A2	2/2002
WO	WO 2007/092715	A2	8/2007
WO	WO 2008/002979	A2	1/2008

OTHER PUBLICATIONS

International Preliminary Report on Patentability issued Jun. 15, 2010 with Written Opinion.

Office Action mailed on Aug. 3, 2010 in related U.S. Appl. No. 12/001,499; 9 pages.

Office Action mailed on Jan. 24, 2011 in related U.S. Appl. No. 12/001,499; 21 pages.

International Search Report mailed on Oct. 1, 2009 in PCT/US2008/086404; 9 pages.

U.S. Appl. No. 10/678,646, filed Oct. 6, 2003; Robinson et al. (31 pages).

Non-Final Office Action for U.S. Appl. No. 12/001,449, dated Jul. 11, 2011, 16 pages.

AliveCor, Inc. Exhibit 1008
IPR2023-00948
Ex. 1008.2

(56) **References Cited**

OTHER PUBLICATIONS

Final Office Action for U.S. Appl. No. 12/001,449, dated Oct. 26, 2011, 16 pages.

Non-Final Office Action for U.S. Appl. No. 12/001,449, dated Jul. 23, 2012, 20 pages.

Final Office Action for U.S. Appl. No. 12/001,449, dated Feb. 4, 2013, 12 pages.

* cited by examiner

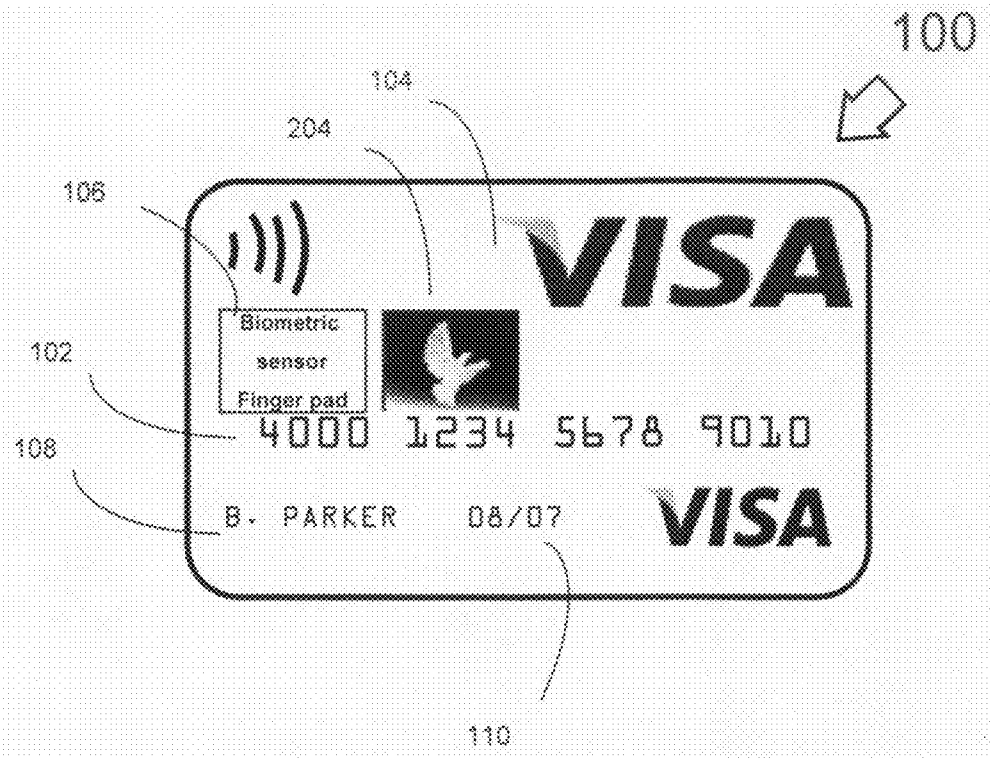

100
104
204
106
VISA
Biometric
sensor
Finger pad
102
4000 1234 5678 9010
108
B. PARKER 08/07
VISA
110

FIGURE. 1

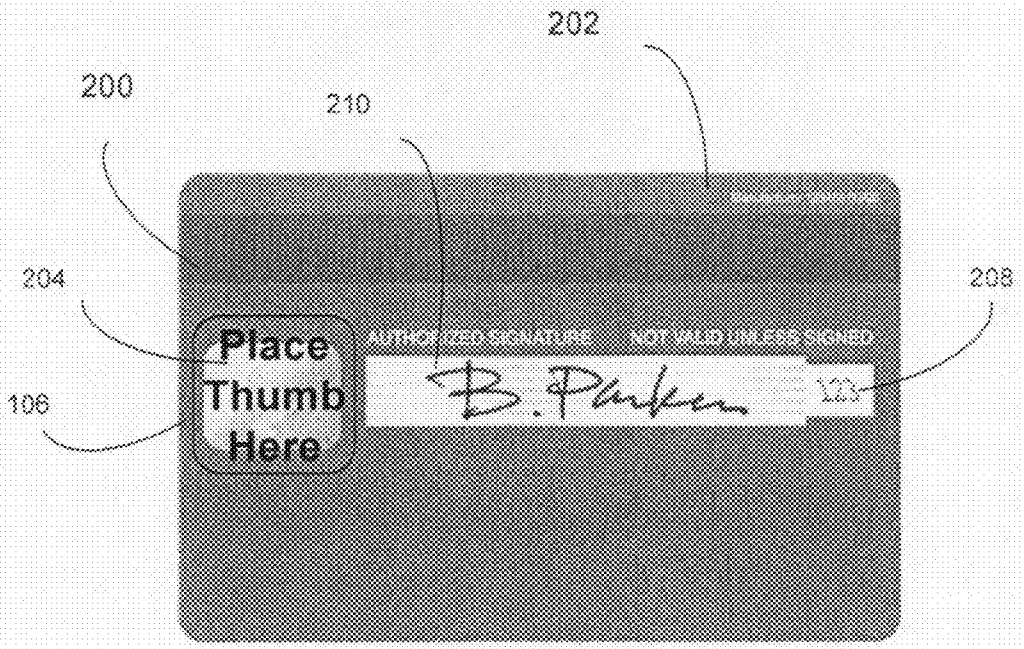

202
200
210
204
208
Place
Thumb
Here
106
AUTHORIZED SIGNATURE
NOT VALID UNLESS SIGNED
B. Parker

FIGURE. 2

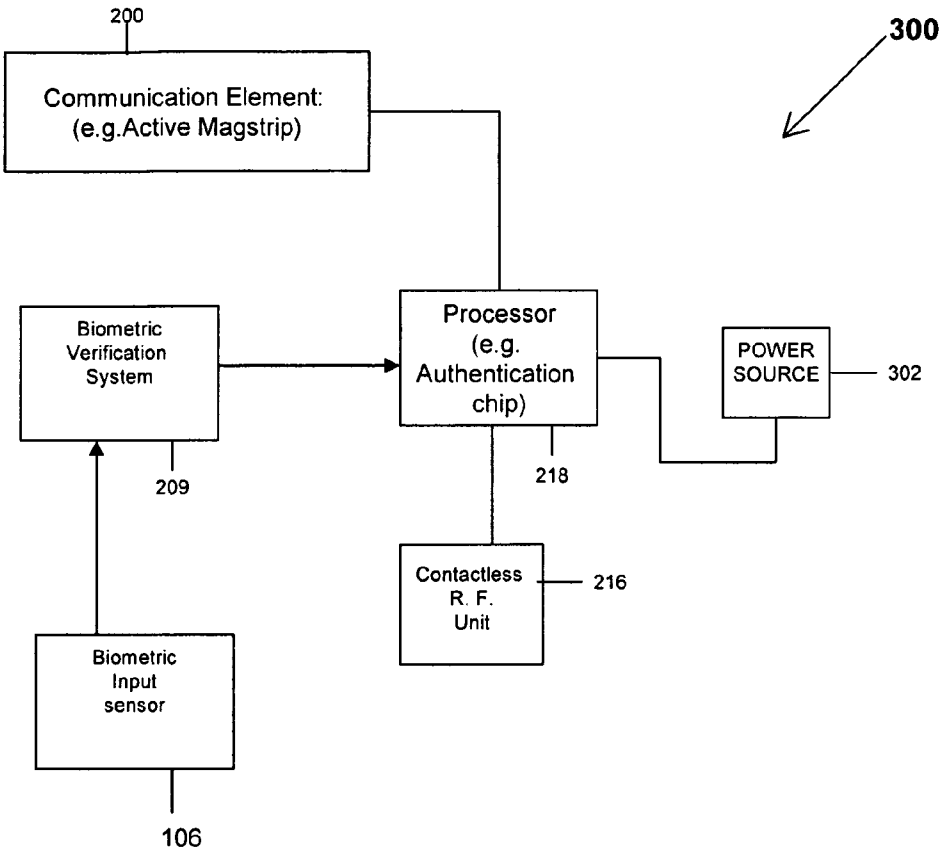
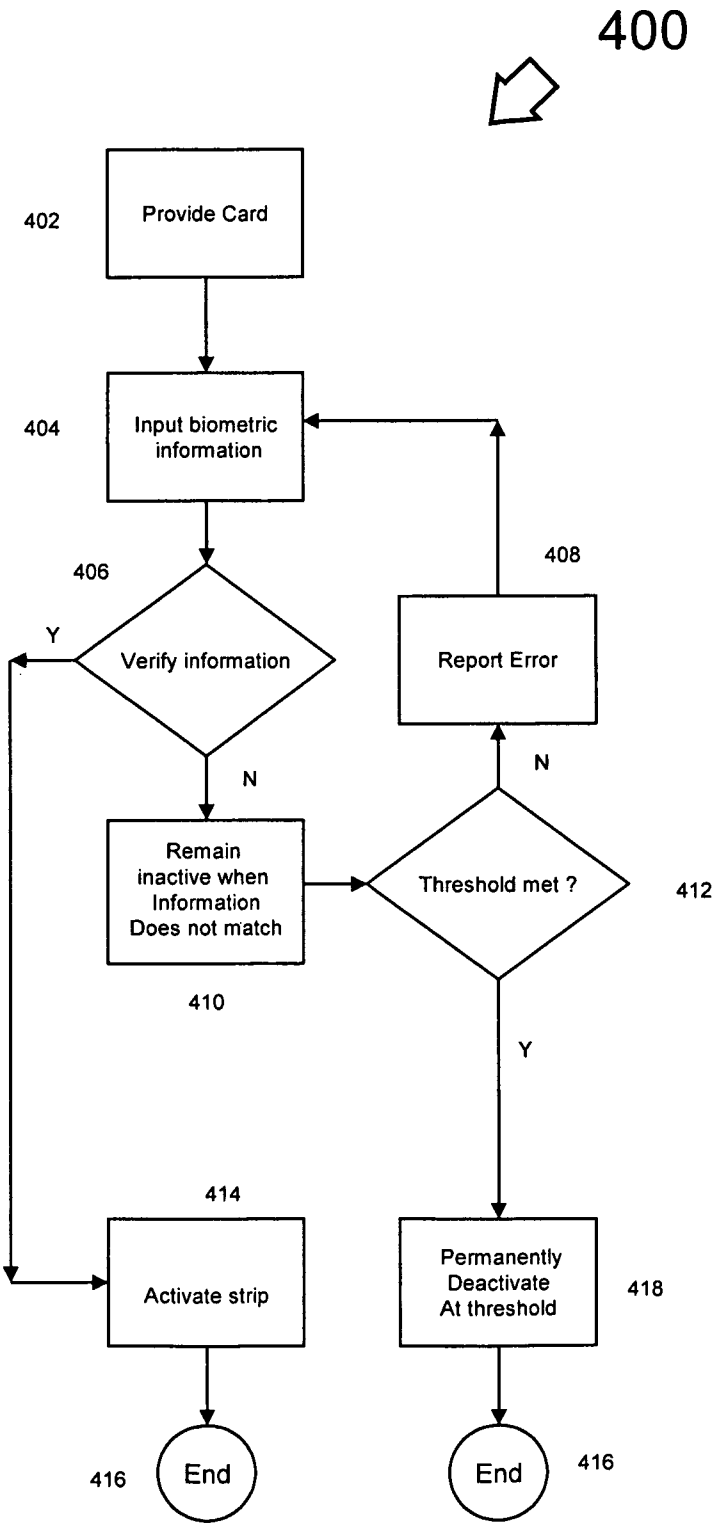

200
300
Communication Element:
(e.g.Active Magstrip)
Biometric
Verification
System
Processor
(e.g.
Authentication
chip)
POWER
SOURCE
302
209
218
Contactless
R. F.
Unit
216
Biometric
Input
sensor
106

FIGURE 3

FIGURE. 4


400
402
Provide Card
404
Input biometric information
406
Verify information
Y
N
408
Report Error
N
Remain inactive when Information Does not match
410
Threshold met ?
412
Y
414
Activate strip
Permanently Deactivate At threshold
418
416
End
End
416

BIOMETRIC ACCESS CONTROL TRANSACTIONS

FIELD OF THE INVENTION

Aspects and embodiments of the present invention relate in general to methods and devices for biometrically identifying and authenticating a user during an access control transaction. More specifically, certain aspects and embodiments of the present invention provide methods and access control processor devices for biometric authentication of a user to prevent unauthorized access to a secured location, object and/or data.

BACKGROUND

Currently, a variety of devices and methods have been developed in an attempt to improve authentication fidelity and to safeguard sensitive personal identity and private information in light of the increasing security threat due to the rapid advancements in networking and mobile communication technologies. However, certain authentication technologies in use today are still based on the traditional "knowledge-based factor" or "possession-based factor" identification and verification approaches. In a typical knowledge-based authentication approach, only one authentication factor (such as knowledge of a password is required in order to gain access to a system. In a possession-based authentication approach, possession of one authentication factor (e.g. possession of card or token) is required in order to gain access to a system. More recently, some of these technologies have been implemented in combination as two-factor authentication schemes wherein both knowledge-based and possession-based factors are required simultaneously for authentication. These types of authentications have recently gained increasing acceptance. An example of such authentication scheme is the common bank card transaction wherein the card itself represents the authorizing possession factor (bearer has the card) and the corresponding personal identification number (PIN) represents the authorizing factor that is known only to the account holder. However, despite these apparent additional layers of security, misplacement of the possession factor such as lost or stolen cards and a breach of the knowledge factor (such as compromised password) remain problematic for these types of transactions. As a result, when the possession factor (e.g. card) and the password are simultaneously compromised or duplicated, there is no apparent suitable countermeasure for the breach as it is no longer possible to authenticate the true identity of the holder of said device.

In a typical access control transaction using the traditional two factor verification system, a bearer of the access control-processor device, such as, for example, an access card, presents the card to gain access or entry to a secured site. The card presented by the bearer is read or swiped using a magnetic reader or other similar devices. The information contained on the magnetic stripe of the card is read and transmitted to the issuing institution. The institution then interrogates its database of active cards against the information received. If the institution verifies that the card is valid and active, and/or when additional verification parameters are met, an approval is provided to the card holder to gain entry. In some instances, additional authentication scheme based on interrogation of information only known to the user such as, for example, a password, may be used to supplement and/or enhance the security scheme.

However, despite these apparent additional layers of security, misplacement of the possession factor such as lost or stolen cards and a breach of the knowledge factor (such as

compromised passwords) remains problematic for these types of transactions. Within these conventional authentication systems, when the possession factor (e.g. card) and the password are simultaneously compromised or duplicated, there is no apparent suitable countermeasure for this type of security breach as it is no longer possible to authenticate the true identity of the holder of said device.

In light of these security threats, the use of access control processor devices (e.g. cards or badges) by non-authorized bearers continues to present a difficult and costly problem for institutions. Various security features have been designed and implemented with mixed success to minimize these types of fraud and security breach. Thus, there remains a need for improved methods and devices for user authentication during access control transactions.

SUMMARY OF THE INVENTION

To address some of the problems and needs as stated in the forgoing, aspects and embodiments of the presented invention directed to methods and devices for conducting access control transactions using biometric authentication are provided.

Aspects and embodiments of the present disclosure provide methods and devices for authenticating the identity of the account holder associated with an access control processor device. In once aspect, an access control transaction processor device with a front face and a back face, a communication element, a power source affixed to the device, the power source connected to the communication element on the device, and a biometric detection system connected to the power source, is provided. In certain embodiments, the biometric detection system may include a contact surface configured for the placement of user finger(s) to receive biometric input, a biometric sensor or detector for obtaining an electronic profile of the finger of the user that is placed on the contact surface, and/or a sensor, including pressure sensor, for detecting the pressure profile generated by applying the finger of the user to the contact surface.

Aspects of the invention also provide a method of authenticating a user for an access control transaction. The method comprises providing an access control transaction processor device (e.g. card) by inputting user biometric information into a biometric verification system of the access control processor card, verifying the biometric information entered into the biometric verification system with pre-stored biometric information of the access control processor card, activating a communication element on the card when the biometric information entered into the biometric verification system is successfully verified, and maintaining an inactive status for the communication element on the card when the biometric information entered into the biometric verification system is not successfully verified.

Other systems, methods, and/or products will be or become apparent to one with skill in the art upon review of the following drawings and detailed description. It is intended that all such additional systems, methods, and/or products be included within this description, be within the scope of the present invention, and be protected by the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an illustration of a front face of an exemplary access control processor card constructed and operative in accordance with an embodiment of the present invention.

AliveCor, Inc. Exhibit 1008
IPR2023-00948
Ex. 1008.8

FIG. **2** is a back view of an exemplary access control processor card constructed and operative in accordance with an embodiment of the present invention.

FIG. **3** is a schematic view of components within an exemplary access control processor device constructed and operative in accordance with an embodiment of the present invention. Exemplary biometric information verification system logic processor may include an authentication processor chip.

FIG. **4** is a flow chart of an exemplary method of biometrically authenticating a bearer of an access control processor card constructed and operative in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

Accordingly, aspects and embodiments of the present invention provide an access control processor device configured to allow for authentication of the bearer of the card. In addition, there is provided an access control processor device that will allow for authentication of the user based on biometric information. Furthermore, there is provided an access control processor card configured for biometric authentication of the user, while having the capability of being used with conventional access control card reading devices, systems, and/or networks.

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which illustrative embodiments of the invention are shown. However, this 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 be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises," "comprising," "includes" and/or "including" when used in this specification, specify the presence of stated features, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, steps, operations, elements, components, and/or groups thereof.

Aspects of the present invention relate generally to methods and devices for conducting access control transactions. Certain exemplary embodiments relate to biometric authentications in connection with these transactions.

As used herein, access control processor device embodiments of the present invention may include, for example, contact cards, contactless cards, tokens, or badges. As used herein, an access control processor device may be broadly understood as being a portable access control processing device associated with an account or authorized user within an access control system. Suitable access control card embodiments may include a plastic card, a badge or other access control devices comprising a solid support, including for example, plastic support such as PVC or ABS plastic. In certain embodiments, the device may include imprinting feature's and/or a hologram to avoid counterfeiting.

In one aspect, an access control transaction card embodiment configured to allow for authentication of the bearer of the card is provided.

In certain embodiments, the authentication is based on successful verification of biometric information.

In certain embodiments, the authentication is based on successful verification of the biometric information in combination with successful verification of a password. In certain other embodiments, the biometric authentication scheme may be optionally combined with an additional authentication feature based on verification of additional information known only to the user during a transaction.

In certain embodiments, the access control processor device comprises a biometric information verification system or components thereof.

In certain embodiments, the access control processor device comprises a biometric information input detector and an authentication logic processor.

In certain other embodiments, the biometric detector may further comprise a thin-film biometric sensor pad configured to acquire the card holder's biometric profile.

In another aspect, an access control processor card configured to allow for authentication of the user, while having the capability of being used with conventional card reading apparatus, system, and/or networks, is provided.

In certain embodiments, the biometric information verification/input system may comprise a thin-film biosensor pad. The biometric information verification system may be configured to capture, store, and authenticate (include identification and/or verification) of biometric information via a logic processor.

In an exemplary embodiment of the invention, the access control processor device may further comprise at least one hologram on at least one of the front and the back face of the card. Furthermore, the access control processor device may be configured to include a power source.

In other embodiments, the access control processor device may further comprise a unique identification number on the face (e.g. front face) of the card.

In other embodiments, the method may further comprise entering the biometric information into the biometric verification system, deactivating the communication element on the card when the pre-stored biometric information does not match after a predetermined amount of time.

In other embodiments, the method can further comprise deactivating the one of the active magnetic strip, the contactless radio frequency (R.F.) unit and the processor (e.g. computer chip) on the card when the biometric information and the pre-stored biometric information do not match. Additionally, the method may further comprise permanently deactivating all functions of the card after the biometric information entered into the biometric input system and the pre-stored biometric information do not match after three or more attempts.

In other embodiments, the method may also comprise providing a master unlocking code for the card to re-activate functions of the card deactivated after the biometric information entered into the biometric input system and the pre-stored biometric information do not match after prescribed number of attempted entries (e.g. three or more attempts).

As used herein, access control transaction includes all transactions wherein access to a site, whether physical or virtual, is permitted only after authentication. Authentication may include identification and/or verification of the identity

of the person requesting entry thereto. Exemplary physical access sites may include, for example, buildings, perimeters, rooms, floors, gates, and/or airport terminals. Exemplary virtual access sites may include, for example, computers, networks, data, and/or websites.

As used herein, a biometric information verification system may include a biometric information input and verification components and/or subsystems configured to read, acquire, and authenticate the input biometric information/data profile of a user. The systems may include a biometric input detector or sensor and a logic processor (e.g. chip) to acquire, store, verify, process, interrogate, and/or authenticate user biometric information, such as, for example, fingerprint profile data. Sensors, detectors, processors, and various components or subsystems of the biometric information verification systems may be integrated into a single payment processor device or may be separately located within a system or network. Exemplary biometric detectors may include a thin-film substrate, or a thin-film transistor (TFT) layer on the thin-film substrate, and an array of electric field sensing electrodes adjacent the TFT layer for receiving a finger profile. The TFT layer may include a plurality of TFTs defining a respective TFT amplifier stage for each electric field sensing electrode. The sensor may further include a finger excitation electrode adjacent the array of electric field sensing electrodes, and at least one integrated circuit adjacent the thin-film substrate. The integrated circuit may include a monocrystalline substrate and processing circuitry adjacent the monocrystalline substrate and connected to the TFT amplifier stages. Optical, ultrasonic and other type fingerprint sensors may also be used as would be readily understood by those skilled in the art. Biometric input apparatus and related technology are well known in the art, including those described in U.S. Pat. No. 6,131,464.

In certain embodiments, a finger to be scanned is placed upon the contact surface of a biometric information input sensor, such as, for example, a pressure sensor. The pressure sensor detects the amount of pressure exerted by the finger upon contact surface. The pressure sensor inputs data from measured pressure and the user fingerprint profile data is acquired, stored, and processed by the biometric information system processor. During operation, the applied pressure of a finger upon contact surface may be monitored to ensure proper finger pressure is maintained throughout the scanning process. Once the fingerprint profile data of a user is acquired, the processor of the biometric information system will determine whether the image obtained is a suitable for subsequent interrogation with known user profile data. In certain embodiments, optical fingerprint scanners may be utilized and such exemplars are commercially available from companies such as L-1 Identity Solutions, Digital Persona, Inc., Digital Biometrics, Inc., and Startek, Inc. In certain other embodiments, non-optical finger image scanners may be used, exemplars are commercially available through companies such as, for example, SGS-Thomson.

In certain embodiments, the pressure detector comprises a thin-film pressure sensor, such as, for example, commercially available Uniforce sensors from Force Imaging Technologies. The pressure sensor generates an electric resistance that is proportional to the pressure placed on the pressure sensor. This variable resistance is then converted to an analog voltage via a conventional op amp circuit. This analog voltage can then be processed by the biometric information processor.

In certain other embodiments, the biometric information detection system may have the ability to sequentially or simultaneously acquire multiple information profiles, such as, for example, optical images in combination with pressure profile data. In certain embodiments, the pressure sensor may comprise a piezoresistive strain gauge. This strain gauge may be attached to the back of the finger image sensor. When a finger is placed on the sensor, the pressure from the finger deforms the sensor package slightly. The strain gauge converts this deformation into a variable resistance that is proportional to the finger's pressure. In certain embodiments, multiple sensors may be configured into one verification system or device.

In yet another embodiment, the image sensor and the pressure sensor may be combined in a single integrated circuit. In this embodiment, the capacitive pressure sensors are distributed on the surface of a capacitive fingerprint sensor via a complementary metal oxide semiconductor (CMOS)—compatible silicon micromachining process. Averaging the output of the collection of pressure sensors provides an overall indication of the amount of pressure on the finger print sensor. In other embodiments, the pressure sensor comprises compressive load cells, linear variable differential transformer (LVDT) transducers, capacitive transducers, piezoelectric transducers, and quartz transducers, as is known in the art. Other embodiments will place the pressure sensor relative to the finger image scanner and contact surface in other configurations, as will be apparent to one of skill in the art; all are to be considered within the scope of the present invention.

As used herein, biometric information includes biometric information profiles that may be authenticated singly or in combination with passwords or tokens, to improve the security of existing authentication systems. Authenticating factors may include knowledge based factors such as, for example, a password; or possession factors such as, for example, a credit card or security token.

As used herein, the authentication may include processes of identification and verification of individuals based on unique physical or behavioral characteristics. Certain of these processes may include matching patterns of individuals against databases of records, including gathering proof of identities, enrolling biometric data and converting the data into templates, and/or matching templates to stored records using algorithms.

As used herein, biometric-based authentication applications may include workstation, network, and domain access, single sign-on, application logon, data protection, remote access to resources, transaction security and web security. As used herein, biometric authentication may be used alone or integrated with other technologies such as smart cards, encryption keys and digital signatures, to enhance security.

As used herein, biometric information may include unique physiological information that related to the account holder. Exemplary information includes fingerprints and related profiles, which may include optical, physiological and/or morphological characteristics; as well as differential profiles, including differential pressure profiles generated based on the distinct impressions between the ridges and valleys of the papillary lines in the finger of the account holder. Other exemplars may also include temperature, electrical resistance, pulse, finger pressure, blood pressure, face recognition, hand geometry and iris recognition profiles. It is understood that authentication scheme may be based on single biometric information profile or combinations thereof.

As used herein, fingerprint may include an impression of the friction ridges of all or any part of the finger. A friction ridge may include a raised portion of the epidermis on the palmar (palm and fingers) or plantar (sole and toes) skin, consisting of one or more connected ridge units of friction ridge skin. These ridges are sometimes known as "dermal ridges" or "dermal papillae". Fingerprints may be deposited

in natural secretions from the eccrine glands present in friction ridge skin (secretions consisting primarily of water) or they may be made by ink or other contaminants transferred from the peaks of friction skin ridges to a relatively smooth surface such as a fingerprint card. Fingerprint includes impressions transferred from the pad on the last joint of fingers and thumbs. In certain embodiments, fingerprint may include portions of lower joint areas of the fingers (which may also used to make identifications).

As used herein, fingerprint identification includes art understood processes related to the field of dactyloscopy. It may include the process of comparing questioned and known friction skin ridge impressions (e.g. Minutiae) from fingers, palms, and toes to determine if the impressions are from the same finger (or palm, toe, etc.). The flexibility of friction ridge skin means that no two finger or palm prints are ever exactly alike (never identical in every detail), even two impressions recorded immediately after each other. Fingerprint identification (also referred to as individualization) occurs when an expert (or an expert computer system operating under threshold scoring rules) determines that two friction ridge impressions originated from the same finger or palm (or toe, sole) to the exclusion of all others.

As used herein, fingerprint types may include latent prints. Exemplary latent prints include hidden, invisible, or accidental impression left by friction ridge skin on a surface, regardless of whether it is visible or invisible at the time of deposition, whether they are from natural secretions of the eccrine glands present on friction ridge skin (which produce palmar sweat, sebum, and various kinds of lipids), or whether the impression is in a contaminant such as motor oil, blood, paint, ink, etc.

As used herein, fingerprint types may include patent prints. Exemplary patent prints may include friction ridge impressions of unknown origin which are obvious to the human eye and are caused by a transfer of foreign material on the finger, onto a surface.

As used herein, fingerprint types may also include plastic prints. Exemplary plastic print include friction ridge impressions from a finger or palm (or toe/foot) deposited in a material that retains the shape of the ridge detail.

As used herein, fingerprints may also include all the art understood fingerprint and related print profiles from the following categories: Roscher system, the Vucetich system, and the Henry system. In the Henry system of classification, fingerprint patterns may include Arch, Loop and Whorl profiles. Fingerprints may also include patterns to plain arches or tented arches. Loops may be radial or ulnar, depending on the side of the hand the tail points towards. Whorls may also have sub-group classifications including plain whorls, accidental whorls, double loop whorls, and central pocket loop whorls.

As used herein, suitable biometric information useful for interrogation and authentication of individual identify may include profiles from the following standards and specifications: International Committee on Information Technology Standards M1 (biometrics section of national organization that produces technical standards for the American National Standards Institute (INCITS M1) and International Standards Organization (ISO) SC37 Minutiae-Based Fingerprint Data Interchange Format: International Standards Organization JTC1 SC17 WG3; ANSI/INCITS 378-2004, ANSI/INCITS 385-2004; BioAPI: ANSI/INCITS 358-2002: CBEFF: ANSI X9.84-2002: and X.509 Attribute Certificate.

As used herein, communication element may include one of an active magnetic strip, a contactless radio frequency unit, and an authenticating processor (e.g. chip). The magnetic strip may contain unique user-associated data. In certain embodiments, the magnetic strip may be activated after initial authentication of user identity so the unique user-associated data encoded on the strip may become accessible to the processor.

As used herein, authentication processor may include a chip or logic processor configured to acquire, store, verify, analyze, interrogate, or authenticate unique user data and/or biometric information profiles. It is understood by those known in the art that instructions for authentication methods and device embodiments may be stored on a non-volatile programmable memory and executed by a processor. Non-volatile programmable memory is configured to be an application memory device, and may store information such as the primary account number, current balance information, and/or user biometric profiles. Examples of non-volatile programmable memory include, but not limited to: a magnetic stripe, flash memory, Electrically Erasable Programmable Read-Only Memory. (EEPROM), or any other non-volatile computer memory or storage known in the art. The processor and the non-volatile programmable memory may be coupled to one another through an internal bus system. Data can be interchanged between the biometric sensors, the processor, and the non-volatile programmable memory.

As used herein, biometric sensor may be configured to recognize directionality and orientation of the fingerprint profile (e.g. right or left thumb). Additionally, the biometric sensor may be configured to accommodate various readers' geometry at the points of transaction (POT). Exemplary biometric detector or sensor may include temperature (e.g. heat) sensors; optical sensors (e.g. optical properties, images), capacitive sensors; solid-state sensors (e.g. electrical resistance); pulse sensors, blood pressure sensors, pressure sensor (e.g. differential pressure between the ridges and valleys of the papillary lines, ultrasonic sensors, light sensors; and/or movement detectors.

Referring to FIG. **1**, an exemplary access control processor card embodiment **100** for conducting access control transactions is illustrated. The card **100** is provided with individual components so access control transactions may be accomplished in a safe, secure, and convenient process. A serial number **102** is provided on the card **100**, wherein the serial number is a unique identifier for the card **100**. The serial number **102**, in the illustrated embodiment, is a series of numbers that are unique to the card **100**. Although illustrated as having a series of numbers, letters or a combination of numbers, letters and symbols, for example, may be used to identify one card **100** from different cards. The serial number **102** is imprinted in the body of the card **100** in the illustrated embodiment. The card **100** has a front face **104** that illustrates the serial number **102**. The front face **104** of the card **100** is also configured with a name section **108** and an expiration date section **110**. Although listed as an expiration date section **110**, an issue date for the card **100** may also be included. The face of the card may also be configured with a biometric information input sensor/detector **106** positioned on the card **100**. The biometric information input sensor/detector **106** is connected to (or may be a component of) the biometric verification system **209**, the power source **302** and the communication element (e.g. active magnetic strip) **200**.

Referring to FIG. **2**, a back surface **202** of an access control processor card **100** is illustrated. The back surface of the card **100** is provided with a magnetic strip **200** that is used to identify the card **100** through a conventional magnetic strip reader. In the illustrated embodiment, the magnetic strip **200** is an active magnetic strip that is configured to have a permanently encoded set of data provided by the issuing institution. In the illustrated embodiment the magnetic strip **200** is an

active magnetic strip that allows the encoded set of magnetic data to be read only when the magnetic strip **200** is activated through a power source **302** on the card **100**. At times that the magnetic strip **200** is not activated, a conventional card reader will not be able to access data placed upon the magnetic strip **200**.

In addition to the magnetic strip **200**, a hologram **204** is provided at the back of the card **100** to allow a merchant to visually identify if the card **100** has been officially produced by the issuing institution. A security code feature **208** is also provided at the back of the card **104** for further identification purposes if needed. The card **100** is also provided with a signature block **210** upon which a bearer provides a signature for visual authentication purposes if required.

The back surface **202** may also be configured with a biometric information input sensor/detector **106** positioned on the card **100**. The biometric information input sensor/detector **106** is connected to (or may be a component of) the biometric verification system **209** and/or the communication element (e.g. active magnetic strip) **200**. The card **100** may also have a contactless radio frequency unit **216** and a logic processor **218** on the card **100**.

Referring to FIG. **3**, a section **300** illustrating the components of the card **100** is presented. In the illustrated embodiment, a power source **302** is connected to a biometric information input sensor/detector **106** that in turn is connected to a logic processor (e.g. chip) **218**. The power source **302** is configured to supply electrical power to the other components of the section **300** when necessary. The biometric information input sensor/detector **106** is configured such that a person bearing the card **100** may input biometric information into the processor **218** through the biometric information input sensor/detector **106**. The individual sensors or detectors may receive power from the power source **302**. Once biometric information are entered into the into the processor **218**, an internal check is performed between a unlocking biometric information combination that is stored in the processor **218** and the biometric information that are entered and stored and analyzed on the biometric information verification system **209**. If the internal check performed indicates that the biometric information input in the biometric information verification system **209** is the same as the unlocking biometric information combination that is stored in the processor **218**, then the processor **218** allows power to flow from the power source **302** to the active magnetic strip **200**. The active magnetic strip **200** is then electrically powered for a pre-determined amount of time and then de-energized. During the time the magnetic strip **200** is activated, the magnetic strip **200** may be read by a conventional magnetic strip reader.

The processor **218** may also be configured to permanently lock the active magnetic strip **200** when a predetermined number of incorrect biometric information entries are provided to the biometric information verification system **209**. In the illustrated embodiment, the processor **218** is configured to allow three (3) incorrect biometric information entries before permanently locking the active magnetic strip **200**.

The power source **302** may also be charged through use of the biometric sensor as they are compressed by the bearer. Alternative power source configurations are also possible. In all situations, the power source **302** is configured to provide electrical power to the biometric information verification system **209** in a sufficient amount to allow the processor **218** and the biometric information verification system **209** to function for authentication purposes. Alternative configurations of the present invention are also provided wherein instead of an active magnetic strip **200**, a contactless radio frequency unit **216** may be activated. In a still further alternative configuration, the processor **218** may itself provide an authorization code.

The power source **302** may be positioned on any layer of the card **100** as well as any position along the body of the card **100**. The biometric input sensor/detector **106** may also be configured underneath the front surface **106**, as a non-limiting example.

The biometric input sensor/detector **106** may be positioned along any section of the card **100** as a surface feature of the card **100** or may be internally positioned within the card **100**. In an exemplary embodiment of the invention, when the sensor pad is located within the body of the card **100**, a plastic surface may be placed over the top of biometric input sensor/detector from abrasion during use of the card **100**. The biometric input sensor/detector **106** is also connected to the processor **218** such that when activated, the system **209** may accept and verify biometric information related to a bearer of the card **100**. To this end, the biometric input sensor/detector **106** may be connected to a separate processor **218**, or may have the processor placed within the biometric verification system **209** or input sensor/detector apparatus that will verify both pad information and biometric information.

Referring to FIG. **4**, which illustrates an exemplary method comprising inputting **404** biometric information into a biometric input sensor/detector **106** of the access control transaction card **100**. In the exemplary embodiment, the biometric information is a finger/thumb print. The biometric information entered into the biometric input sensor/detector **106** is processed and verified **406** against the pre-stored biometric information of the access control transaction card **100** by the biometric verification system **209** or the processor **218** as an alternative embodiment. The biometric input sensor **106** in the exemplary embodiment contains a window that allows a users fingerprint, for example, to be entered into the system **209**. The system **209** may then check the input biometric information with a pre-stored biometric information data set on the card **100**. If the data do not match, then the card **100** can not be activated. The user can be prompted to reenter the biometric information **408**. The re-entry request for the correct biometric information can be repeated until a pre-determined threshold **412** (e.g. number of aborted entries or attempts) is reached. At which time, the device is permanently inactivated **418**. If the biometric data match, then the card functions such as the magnetic strip information can be activated for further processing. The pre-stored biometric information may be entered by the issuer of the card **100** or may be input by the user during the initial receipt of the card **100** during activation. During activation, various card features are activated, including providing the card code information and enable the active magnetic strip to energize so that it may be read by a card reader. In addition, a contactless radio frequency unit **216** or the processor **218** on the card **100** can also be activated if the card **100** is so featured.

The pre-stored biometric information may be entered by the issuer of the card **100** or may be input by the user during the initial receipt of the card **100** during activation.

During the interrogation/verification process (e.g. when the device is not fully activated or reached a permanent inactivation), the method provides for maintaining an inactive status **410** for one of the active magnetic strip, the contactless radio frequency unit **216** and the processor **218** on the card **100** when the biometric information and the pre-stored biometric information do not match and requiring the user to re-enter the information. If the strip is activated **414** upon verification, then the strip is deactivated after completion of the transaction or after a pre-defined amount of time has

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elapsed after activation. The amount/time of activation may also be related to the power requirements for card functions so that the power supply is not overburdened during a transaction. The method **400** may be completed again after deactivation of the active strip has been completed. In addition, an additional security measure may be used in the invention, where the issuing entity may have a master lock combination that may be input into the card **100** to allow further attempts at strip activation, or may allow for instantaneous strip activation as necessary, thereby minimizing the amount of replacement cards that would be necessary if permanent deactivation occurs. The method may also provide for a master unlocking code for the card to re-activate functions of the card after at least one of the input biometric information and the pre-stored biometric information do not match after a predefined number of attempts. By providing for the master unlocking code, an issuer may allow reactivation of the card **100** that has been locked due to inappropriate biometric or numeric data input.

Embodiments of the invention provide an access control processor card configured to allow for both power generation on the card **100** and verification of the authenticity of a user. The authentication of the bearer/user of the access control card **100** that is based on a verification scheme using biometric information profile has a higher fidelity compared to that of conventional card transactions. This authentication process is difficult to replicate, and therefore fraud is prevented or substantially reduced. The card **100** has a configuration that will also allow for the user to store biometric information to allow authentication of the card **100**. Embodiments of the invention also provide a card **100** that will allow for authentication of the user, while being cost efficient in production. The card **100** presented above also has the capability of being used with conventional card reading apparatus, systems and networks.

Embodiments of the invention also provide a card **100** that will have a configuration that will allow for the power generated on the card **100** to be stored for use by components/circuitry on the card **100**.

In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made thereunto without departing from the broader spirit and scope of the invention as set forth in the appended claims. The specification and drawings are accordingly to be regarded in an illustrative rather than in a restrictive sense.

What is claimed is:

1. An access control processor card, comprising:

a fingerprint sensor configured to receive input biometric information from a finger of a user;

a processor, coupled to the fingerprint sensor, configured to authenticate user identity by interrogating the input biometric information against a pre-stored user biometric profile stored within the card and by verifying a password or a token, the input biometric information including both a pressure profile and an optical image for the user;

a communication element coupled to the processor and configured to activate upon the authentication of the input biometric information;

permanently deactivate one or more functions of the access control processor card after determining that the input biometric information and the pre-stored biometric information do not match after a predetermined number of attempted entries; and

reactivate the one or more permanently deactivated functions of the access control processor card when a master lock combination is input into the card.

2. The access control processor card of claim **1** wherein the communication element is a magnetic stripe.

3. The access control processor card of claim **1** wherein the communication element is a contactless radio frequency (R.F.) unit.

4. The access control processor card of claim **1**, further comprising a power source, wherein the power source is electrically coupled to the processor, the fingerprint sensor, and the communication element.

5. The access control processor card of claim **4**, wherein the power source is charged when the biometric sensor is compressed by the user.

6. The access control processor of claim **1** wherein the fingerprint sensor includes a one or more thin-film transistors (TFT) disposed on a thin-film substrate.

7. A method of authenticating a user for an access control transaction, comprising:

receiving user biometric information into a biometric verification system in an access control processing device, the user biometric information including both a pressure profile and an optical image for the user;

authenticating the user biometric information entered into the biometric verification system in combination with a password or a token;

activating a communication element in the access control processing device when the input biometric information entered into the biometric verification system is authenticated;

maintaining an inactive status for the communication element in the access control processing device when the biometric information entered into the biometric verification system is not authenticated;

permanently deactivating one or more functions of the card after the user biometric information entered into the biometric verification system and a pre-stored biometric information do not match after a predetermined number of attempted entries; and

reactivating the one or more permanently deactivated functions of the card when a master lock combination is input into the card.

8. The method according to claim **7** wherein the communication element is an active magnetic stripe.

9. The method according to claim **7** further comprising:

authenticating user identity by interrogating input biometric information profile against pre-stored user biometric information profile.

10. The method according to claim **7**, wherein the biometric verification system comprises a biometric fingerprint pressure sensor.

11. The method according to claim **7** wherein the fingerprint is a thumbprint.

12. The method according to claim **10**, wherein the sensor is configured to recognize the directionality and the orientation of the fingerprint information.

13. The method of claim **7**, wherein receiving the user biometric information includes receiving the user biometric information via a piezoelectric sensor on the access control processing device.

14. The method of claim **7** wherein the predetermined number of incorrect biometric entries is three.

15. The method of claim **7** wherein during authentication:

monitoring an applied pressure while receiving the pressure profile; and

determining if a threshold finger pressure is maintained throughout a scanning process.

16. An access control processor device, comprising:

a biometric input sensor configured to receive user biometric information;

a biometric verification processor configured to authenticate the input user biometric information in combination with a password or a token, the user biometric information including both a pressure profile and an optical image for the user;

a communication element configured to activate when the biometric information entered into the biometric verification system is authenticated and maintain an inactive status for the communication element on the payment processor device when the biometric information entered into the biometric verification system is not authenticated;

permanently deactivate one or more functions of the access control processor device after the biometric information entered into the biometric verification system and a pre-stored biometric information do not match after a predetermined number of attempted entries; and

reactivate the one or more permanently deactivated functions of the access control processor device when a master lock combination is input into the card.

17. The access control processor device according to claim **16**, wherein the processor is configured to authenticate user identity by interrogating input biometric information profile with pre-stored user biometric information profile.

18. The access control processor device according to claim **16**, wherein the communication element is an active magnetic stripe.

19. The access control processor device according to claim **16**, wherein the communication element is a contactless radio frequency (R.F.) unit.

20. The access control processor device according to claim **16**, wherein the biometric verification system comprises a biometric fingerprint sensor.

21. The access control processor device according to claim **20**, wherein the biometric fingerprint sensor is a fingerprint pressure sensor.

22. A non-transitory computer readable medium, encoded with data and instructions, such that when executed by an access control processing device, the instruction causes the device to:

receive user biometric information into a biometric verification system, the user biometric information including both a pressure profile and an optical image for a user;

generate input user biometric information profile;

authenticate input user biometric information entered in the biometric verification system with pre-stored authorized user biometric profile in combination with a password or a token;

activate a communication element on the access control processing device when the biometric information entered into the biometric verification system is authenticated;

maintain an inactive status for the communication element on the access control processing device when the biometric information entered into the biometric verification system is not authenticated;

permanently deactivate one or more functions of the access control processing device after the user biometric information entered into the biometric verification system and a pre-stored biometric information do not match after a predetermined number of attempted entries; and

reactivate the one or more permanently deactivated functions of the access control processing device when a master lock combination is input into the card.

23. The non-transitory computer readable medium of claim **22** wherein the access control processing device includes:

a communication element configured to activate;

a non-volatile programmable memory configured to store an authorized user biometric information profile; and

a biometric verification system configured to authenticate input biometric information of the user.

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