US012393950B2

(12) **United States Patent**
Horgan et al.

(10) **Patent No.: US 12,393,950 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **FRAUD DETECTION IN SELF-SERVICE TERMINAL**

(71) Applicant: **NCR Atleos Corporation**, Atlanta, GA (US)

(72) Inventors: **Kevin Horgan**, Broughty Ferry (GB); **Gordon David Chisholm**, Perth (GB); **Campbell Benn**, Dundee (GB)

(73) Assignee: **NCR Atleos Corporation**, Atlanta, GA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/588,959**

(22) Filed: **Feb. 27, 2024**

(65) **Prior Publication Data**

US 2024/0202732 A1 Jun. 20, 2024

Related U.S. Application Data

(60) Continuation of application No. 17/699,509, filed on Mar. 21, 2022, now Pat. No. 11,954,687, which is a continuation of application No. 16/705,383, filed on Dec. 6, 2019, now Pat. No. 11,308,499, which is a division of application No. 14/231,011, filed on Mar. 31, 2014, now Pat. No. 10,515,367.

(51) **Int. Cl.**

G06Q 20/40	(2012.01)
G06Q 20/10	(2012.01)
G07F 19/00	(2006.01)

(52) **U.S. Cl.**
CPC ***G06Q 20/4016*** (2013.01); ***G06Q 20/1085*** (2013.01); ***G07F 19/203*** (2013.01); ***G07F 19/207*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,514,623	A *	4/1985	Baus	G06K 13/0893 902/31
5,010,238	A *	4/1991	Kadono	G07F 19/211 902/8
5,945,602	A *	8/1999	Ross	G07F 19/207 73/570
6,390,067	B1 *	5/2002	Haltiner, Jr.	F02M 61/168 123/470
6,390,367	B1 *	5/2002	Doig	G07F 19/20 235/436
6,400,276	B1 *	6/2002	Clark	G07F 19/207 340/568.1

(Continued)

OTHER PUBLICATIONS

B. Reardon, K. Nance and S. McCombie, “Visualization of ATM Usage Patterns to Detect Counterfeit Cards Usage,” 2012 45th Hawaii International Conference on System Sciences, Maui, HI, USA, 2012, pp. 3081-3088 (Year: 2012).*

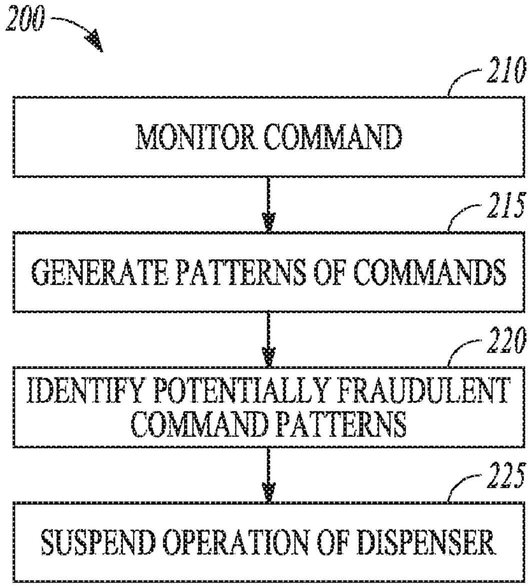
(Continued)

Primary Examiner — Mohammad Z Shaikh
(74) *Attorney, Agent, or Firm* — Schwegman Lundberg & Woessner, P.A.

(57) **ABSTRACT**

A method includes monitoring patterns of commands provided by a self-service terminal controller, identifying potential fraud in the monitored patterns of commands, and suspending operation of a dispenser of the self-service terminal responsive to the identification of potential fraud.

20 Claims, 2 Drawing Sheets


200
210
MONITOR COMMAND
215
GENERATE PATTERNS OF COMMANDS
220
IDENTIFY POTENTIALLY FRAUDULENT COMMAND PATTERNS
225
SUSPEND OPERATION OF DISPENSER

(56) References Cited

U.S. PATENT DOCUMENTS

6,583,864	B1 *	6/2003	Stanners	G07C 9/37 348/78
7,093,750	B1 *	8/2006	Block	G07F 19/20 902/8
7,118,031	B2 *	10/2006	Ramachandran	G07F 19/207 235/382
7,151,451	B2	12/2006	Meskens et al.	
7,194,414	B1 *	3/2007	Savage	G06Q 20/1085 704/E15.044
7,240,827	B2 *	7/2007	Ramachandran	G07F 19/2055 902/8
7,469,825	B2 *	12/2008	Clark	G07F 19/205 235/462.11
7,575,166	B2 *	8/2009	McNamara	G07F 19/20 235/440
7,583,290	B2 *	9/2009	Enright	H04N 7/188 348/150
7,798,395	B2 *	9/2010	Ramachandran	G07F 19/211 235/382
7,856,401	B2 *	12/2010	Ross	G06Q 20/1085 705/42
7,971,779	B2 *	7/2011	Jenkins	G06Q 40/00 235/379
7,995,791	B2 *	8/2011	Flook	G07F 19/207 340/568.1
8,057,737	B2 *	11/2011	Deura	C22C 38/46 420/105
8,255,993	B2 *	8/2012	Cooley	G06F 21/56 726/22
8,395,500	B1 *	3/2013	Dent	G08B 13/1609 348/150
8,397,991	B2 *	3/2013	Mueller	G06K 19/06206 235/449
8,549,212	B2 *	10/2013	Lu	G06F 12/0246 365/185.33
8,556,168	B1 *	10/2013	Lewis	G07F 19/20 235/379
8,640,947	B1 *	2/2014	Lewis	G07F 19/209 235/379
8,944,317	B2 *	2/2015	Lewis	G07F 19/2055 235/379
8,985,298	B2 *	3/2015	Crist	G07D 11/225 194/206
8,998,186	B2	4/2015	Kim et al.	
9,014,845	B2	4/2015	Babu et al.	
9,163,978	B2 *	10/2015	Crist	G01G 19/414
9,401,062	B2 *	7/2016	Koide	G07D 11/225
9,652,772	B1 *	5/2017	Eyges	G06Q 20/4016
9,663,035	B2 *	5/2017	Nakata	G08G 1/0962
9,666,035	B2 *	5/2017	Blower	G07D 11/225
9,767,422	B2 *	9/2017	Ray	G07F 19/2055
10,127,554	B2 *	11/2018	Russell	G06Q 20/40
10,332,205	B1 *	6/2019	Russell	G06Q 40/04
10,515,367	B2 *	12/2019	Horgan	G07F 19/203
11,308,499	B2 *	4/2022	Horgan	G07F 19/203
2001/0025881	A1 *	10/2001	Shepherd	G07F 19/209 235/379
2003/0120597	A1 *	6/2003	Drummond	G06F 16/95 707/E17.107
2004/0149819	A1 *	8/2004	Shepley	G07F 19/209 235/379
2004/0178258	A1 *	9/2004	Scarafile	G07F 19/205 235/379
2004/0200894	A1 *	10/2004	Ramachandran	G07F 19/2055 235/379
2004/0206767	A1 *	10/2004	Haney	G07F 19/20 221/9
2005/0269345	A1 *	12/2005	Sommerville	G07F 19/203 221/12
2006/0169764	A1 *	8/2006	Ross	G07F 19/20 235/375
2006/0273151	A1 *	12/2006	Block	G07F 19/209 235/379
2008/0054063	A1 *	3/2008	MacPhail	G07F 19/206 235/379
2008/0136657	A1 *	6/2008	Clark	G07F 19/20 340/686.6
2008/0195540	A1 *	8/2008	Gee	G07F 19/20 235/379
2009/0199053	A1 *	8/2009	Neilan	G07F 19/206 714/57
2010/0100230	A1 *	4/2010	Babu	G07F 19/20 700/236
2010/0162030	A1 *	6/2010	Schindel, Jr.	G07F 19/20 714/E11.113
2011/0035797	A1 *	2/2011	Slowik	G03G 15/5016 726/17
2012/0197796	A1 *	8/2012	Dent	G06Q 20/1085 705/43
2014/0151272	A1 *	6/2014	Angus	G07F 19/202 271/264
2014/0151450	A1 *	6/2014	Lewis	G07F 19/2055 235/379
2014/0324677	A1 *	10/2014	Walraven	G06Q 20/4016 705/39
2015/0068863	A1 *	3/2015	Blower	G07D 11/22 194/202
2015/0278818	A1 *	10/2015	Horgan	G07F 19/207 705/43
2016/0140563	A1	5/2016	Crist et al.	
2016/0140653	A1 *	5/2016	McKenzie	G07F 7/082 705/69
2016/0225236	A1 *	8/2016	Zhang	G07F 19/204
2017/0004466	A1 *	1/2017	Robles Gil Daellenbach	G07F 19/2055
2022/0215395	A1	7/2022	Horgan et al.	

OTHER PUBLICATIONS

"U.S. Appl. No. 16/705,383, Non Final Office Action mailed Jun. 24, 2021", 9 pgs.

"U.S. Appl. No. 16/705,383, Notice of Allowance mailed Dec. 24, 2021", 15 pgs.

"U.S. Appl. No. 16/705,383, Response filed Sep. 23, 2021 to Non Final Office Action mailed Jun. 24, 2021", 5 pgs.

"U.S. Appl. No. 17/699,509, Notice of Allowance mailed Dec. 21, 2023", 19 pgs.

"U.S. Appl. No. 17/699,509, Preliminary Amendment filed Mar. 24, 2022", 7 pgs.

Reardon, B, et al., "Visualization of ATM Usage Patterns to Detect Counterfeit Cards Usage", 45th Hawaii International Conference on System Sciences, (2012), 3081-3088.

* cited by examiner

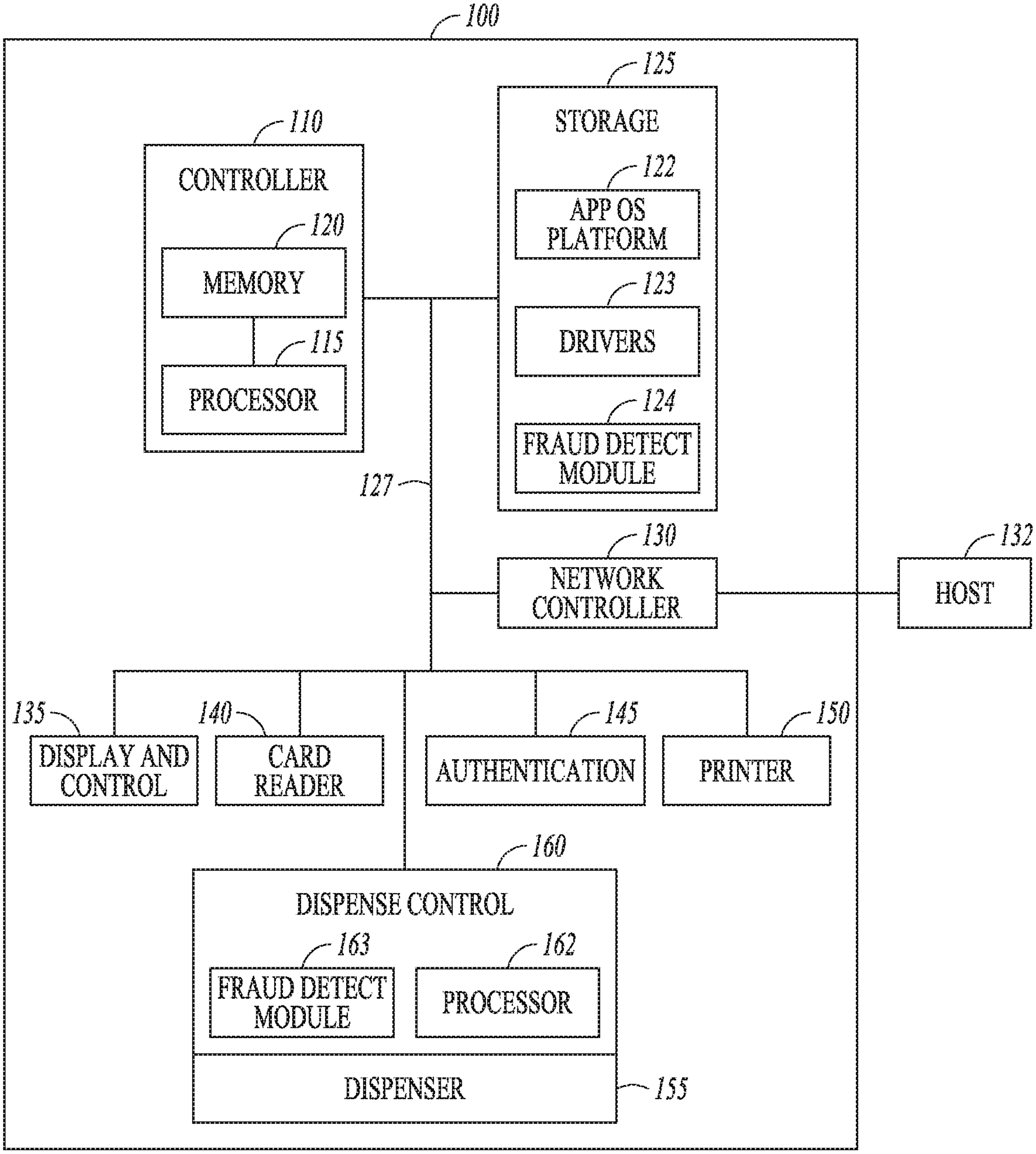

100
125
STORAGE
110
CONTROLLER
122
APP OS PLATFORM
120
MEMORY
123
DRIVERS
115
PROCESSOR
124
FRAUD DETECT MODULE
127
130
NETWORK CONTROLLER
132
HOST
135
DISPLAY AND CONTROL
140
CARD READER
145
AUTHENTICATION
150
PRINTER
160
DISPENSE CONTROL
163
FRAUD DETECT MODULE
162
PROCESSOR
DISPENSER
155

FIG. 1

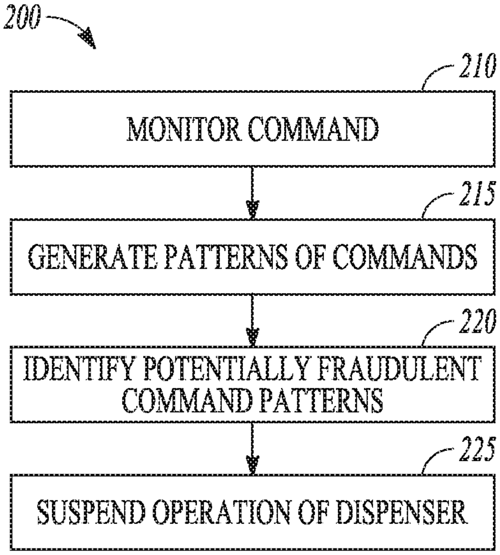

200
210
MONITOR COMMAND
215
GENERATE PATTERNS OF COMMANDS
220
IDENTIFY POTENTIALLY FRAUDULENT COMMAND PATTERNS
225
SUSPEND OPERATION OF DISPENSER

FIG. 2

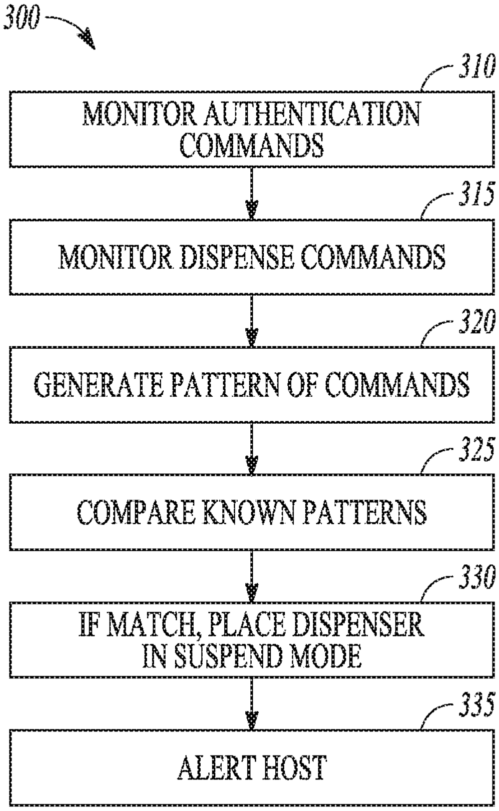

300
310
MONITOR AUTHENTICATION COMMANDS
315
MONITOR DISPENSE COMMANDS
320
GENERATE PATTERN OF COMMANDS
325
COMPARE KNOWN PATTERNS
330
IF MATCH, PLACE DISPENSER IN SUSPEND MODE
335
ALERT HOST

FIG. 3

FRAUD DETECTION IN SELF-SERVICE TERMINAL

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. application Ser. No. 17/699,509, filed on Mar. 21, 2022, which is a continuation of U.S. application Ser. No. 16/705,383, filed on Dec. 6, 2019, which is a division of U.S. application Ser. No. 14/231,011, filed on Mar. 31, 2014, which applications and publications are incorporated herein by reference in their entirety.

BACKGROUND

Increasingly consumers are conducting financial transactions through Self-Service Terminals (SSTs) without the assistance of a clerk. In fact, in many cases these transactions are conducted without any individual in the vicinity of the SSTs; other than, perhaps, a security camera integrated into the SSTs or in proximity to the SSTs.

The most common SST transaction occurs by a customer at an Automated Teller Machine (ATM). Contrary to what the general public believes, ATMs can be compromised and in some ways in a manner that takes advantage of inherent security holes of existing ATMs.

For example, in a typical ATM transaction a customer inserts a bank card into a card reader and then enters a Personal Identification Number (PIN) into an encrypted PIN keypad. Software on the ATM receives that encrypted information, which the ATM software cannot decrypt and sends it to an appropriate backend financial system for authentication. The financial sends returns an authorization code to the ATM software and the customer selects and account and an amount to withdraw. This is then sent to the financial system for verification. Again, the financial system returns an authentication. Next, the ATM sends a dispense command to a dispenser and the dispenser dispenses the currency amount associated with the withdrawal.

In the above scenario, if the ATM software can be replaced or modified then the amount for withdraw sent to the dispenser can be changed or can be repeated multiple times; thereby fraudulently depleting the ATM of all its currency. Such fraudulent depleting is of particular concern to the owners and operators of the ATMs because the financial system tied to a transaction may only honor the initial authorized amount for withdrawal, leaving the ATM owner and operator with no recourse to recoup the stolen funds.

SUMMARY

In various embodiments, dispense transactions are suspended on a self-service terminal upon detection of potentially fraudulent activity.

According to an embodiment, commands performed on the self-service terminal are monitored to detect fraudulent activity. If a pattern of commands appears to be potentially fraudulent, a dispenser may be placed in a suspend mode.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a self-service terminal (SST) having dispense suspend control according to an example embodiment.

FIG. **2** is a flowchart illustrating a method for detecting potentially fraudulent command patterns and suspending a dispenser according to an example embodiment.

FIG. **3** is flowchart illustrating a more detailed method for detecting potentially fraudulent command patterns and suspending a dispenser according to an example embodiment.

DETAILED DESCRIPTION

FIG. **1** is a block diagram of a self-service terminal architecture to detect potential fraudulent patterns of commands and suspend dispense operations. In one embodiment, the self-service terminal is an automated teller machine (ATM) **100** that dispenses value in the form of cash, coupons, and other items of value referred to as dispense media. The various components are illustrated and the arrangement of the components is presented for purposes of illustration only. It is to be noted that other arrangements with more or less components are possible without departing from the onsite automated customer assistance teachings presented herein and below.

The ATM, techniques, methods, and Self-Service Terminal (SST) presented herein and below for detecting fraudulent command patterns and suspending dispense operation can be implemented in whole or in part in one, all, or some combination of the components shown with ATM **100**. The techniques and methods are programmed as executable instructions in memory and/or non-transitory computer-readable storage media and processed on one or more processors associated with the various components.

The discussion of the ATM **100** is within the context of multiple transactions and is also applicable to any enterprise providing Self-Service Terminals (SSTs). Thus, the description that follows below is but one embodiment of the invention and it not intended to limit the invention to only financial transactions on the ATM **100**.

ATM **100** includes a controller **110** that in one embodiment includes a processor **115** and memory **120** for executing commands while processing transactions. Programming for the controller **110** is stored in storage device **125** which is coupled via a connector **127** to the controller **110** and provides operating system code, an operating platform, and various applications to the memory **120** for execution by processor **115**. A network controller **130** is also coupled via connector **127** to communicate with a remote server **132** or for checking account balances and otherwise supporting operation of ATM **100**.

Connector **127** may be a backbone type of connector such as a system bus to connect multiple components of ATM **100**, including a display and display controller represented at **135**, a card reader **140**, an authentication module **145** such as an encrypting keypad for entry of personal identification numbers (PIN), sometimes referred to as a PINpad **145**, and a printer **150** to print receipts and balance information. Each of these components execute commands from the processor resulting from customer transactions.

Controller **110** is also coupled to a dispenser **155** that processes commands to dispense media as part of performing transactions, and implementing diagnostic functions. The dispenser **155** in one embodiment includes a dispense control module **160** which may utilize circuitry such as firmware and a secure microprocessor such as indicated at **162**.

The ATM **100** is presented in greatly simplified form and is used to illustrate portions of components modified for purposes of monitoring commands and suspending dispense operations when a fraudulent pattern of commands is detected.

The memory **120** includes an ATM application **122** providing an application programming interface (API) for interacting with the dispenser **155** and the remote host **132**. The ATM application **122** also includes a forward-facing Graphical User Interface (GUI and not shown in the FIG. **1**) for interaction with a customer to perform a financial transaction with an external financial system coupled to remote host **132**. The ATM application **122** also includes a service GUI (not shown) to allow an authorized person to perform servicing and diagnostic functions on the ATM **100**.

The memory **120** also includes device drivers **123** for providing low-level commands for controlling various ATM devices (including the card reader **140**, the encrypting PINpad **145**, the printer **150**, and the dispenser **155**. The device drivers **123** include a fraud detection module **124** that detects events generated by devices within the ATM **100** and commands issued to devices within the ATM **100**. As will be described in more detail below, the fraud detection module **124** operates to detect patterns of device operation and to identify any patterns that may indicate fraudulent operation of the ATM **100** or any of the devices therein.

The dispenser **155** is coupled to or integrated within the ATM **100** and can perform dispense functions responsive to requests. The coupling can be via a Universal Serial Bus (USB) port interface or other port interface, again represented by connector **127**. The dispenser **155** includes a conventional dispensing mechanism (not shown) for dispensing currency to a customer. The dispensing mechanism is capable of counting the currency from available denominations and activating a door for dispensing the counted currency. The dispenser **155** may only be accessible for interaction through the ATM application **122** in memory **120** as executed on processor **115**.

The dispenser secure microprocessor **162** in one embodiment is not accessible to any of the API calls made by the ATM application **122**. The secure microprocessor **162** may house cryptographic keys, certificates, and one or more cryptographic algorithms (functions). In some cases, the secure microprocessor **162** is pre-manufactured with the keys, certificates, and functions. In other cases, the keys, certificates, and functions can be installed on the secure microprocessor **162** by removing the dispenser **155** from the ATM **100** and interfacing the dispenser **155** to an independent secure device for installation and initial configuration.

The dispenser **155** also includes a dispenser fraud detection module **163** that is operable to monitor dispense commands and to detect any pattern of dispense commands that may be indicative of fraud, as will be described in more detail below.

The interaction of the components is now discussed with an example configuration and operational scenario. It is noted that other scenarios are possible without departing from the beneficial teachings provided herein.

In one typical example ATM transaction, a customer approaches the ATM **100** to withdraw some cash (currency or money). The GUI portion of the ATM application **122** typically presents an attract screen until such time as a customer inserts his/her card into the card reader **140**. The customer's card is then read and the ATM controller **122** presents a sequence of screens to collate transaction information from the customer. The ATM controller **122** also issues commands to various devices as part of the information collation. For example, the ATM controller **122** enables the encrypting PINpad **145** when a PIN entry screen is presented to the customer.

In a typical ATM transaction at the ATM **100**, a customer will insert his/her card, enter his/her PIN, then request a transaction type and amount. The requested transaction will then be authorized by the remote host **132**. If authorized, a dispense command will be issued by the ATM controller **122** to the dispenser **155**. However, if the fraud detection module **124** does not detect any events relating to the card reader **140** and/or the encrypting PINpad **145**, then the fraud detection module **124** will indicate that this is a potentially fraudulent transaction. It should be appreciated that various events (or the absence thereof) from different devices may be used as indicators of potential fraudulent activity.

In addition to fraud detection via the fraud detection module **124** performed for example by the controller **110** of the ATM **100**, the dispenser **155** may also detect potentially fraudulent patterns. Dispenser fraud detection module **163** may recognize a pattern of continual dispensing and identify that as potentially fraudulent. For example, if dispense commands are received within a defined time period that is deemed not sufficient for a transaction to be authorized (the minimum transaction time) then this may be indicative of fraud.

In some embodiments one set of commands may relate to transaction dispenses, whereas, a different set of commands may relate to diagnostic dispenses of the type that an authorized person would use when testing the dispenser **155** during servicing or repair of the dispenser **155**. In such embodiments, if the dispense commands relate to diagnostic tests from an authorized person, then the fraud detection module **124** may not take any action even if the time period between dispense commands is shorter than the defined minimum transaction time. However, if the dispense commands relate to customer transaction commands, then the fraud detection module **124** may put the dispenser **155** into a suspend mode in which no further transactions are performed. A suspend mode may be any type of mode or state that the dispenser **155** may be placed in to prevent execution of dispense commands.

FIG. **2** is a flowchart illustrating a method **200** implemented by either fraud detection modules **124** or **163**. Method **200** may be implemented in firmware, hardware, software running on processor **115** or **162**, or a combination thereof. Performing method **200** in dispenser **155** via fraud detection module **163** insulates the method from being affected by malware which might be introduced by hacking into the controller **110** or replacing storage **125** with a different storage device, such as a disk drive programmed with malware designed to issue dispense commands to fraudulently obtain money from the ATM **100**.

In one embodiment, the fraud detection module **124** monitors a software stack at **210** and uses commands provided from the stack to generate patterns of commands at **215** that are being processed by the ATM **100**. In the case of fraud detection module **163**, the monitored commands may be dispense commands received. The patterns of commands may include several different types of patterns that have been associated or may be associated with attempts to jackpot the ATM **100**. Examples include but are not limited to deviations from typical sets of commands associated with normal withdrawals, such as many dispense commands associated with a single authentication, a high number of dispense commands in consecutive transactions at a frequency approaching ATM capabilities, multiple dispense commands of the same amount, multiple transactions not usually performed by a given customer, and more. As seen from the above examples, the term "pattern" is used to identify both a sequential set of commands as well as a filtered set of commands, and even a statistical analysis of commands, such as the frequency of a dispense command, and including the frequency and relationship of other commands, such as the frequency of the dispense command compared to authentication commands.

At **220**, the patterns may be analyzed to identify potentially fraudulent command patterns. The analysis may be based on thresholds or a combination of thresholds and comparison to known patterns. At **225** the method suspends operation of the dispenser **155** responsive to the identification of potential fraud.

In various embodiments, patterns of potential fraud include a number of dispense commands within an identified time period, a number of consecutive dispense commands associated with a same account number, a pattern of continual dispense commands without corresponding cardholder authentication commands.

FIG. **3** is a flowchart illustrating a more detailed method **300** according to an example embodiment. At **310**, authentication commands on a self-service terminal are monitored. The authentication commands may be monitored by the controller **110** or the PIN pad **145** for example. At **315**, dispense commands on a self-service terminal are monitored. The dispense commands may be monitored at least at controller **110** or dispenser **155**. A pattern of the monitored authentication and dispense commands is generated at **320**. As indicated above, the pattern may include many different types of patterns, including a statistical representation of commands over an identified period of time. The generated pattern is compared at **325** to known patterns corresponding to potential fraud. If the generated pattern matches such a known pattern, the dispenser is placed in a suspend mode at **330** to prevent dispensing of further media. At **335**, the host may be alerted to the dispenser **155** being placed in suspend mode. A service call or other method may be used to remove the dispenser **155** from suspend mode, after checking the ATM **100** for malware.

In one embodiment, a pattern of potential fraud comprises a number of dispense commands within an identified time period. This type of pattern may be detected via fraud detection module **163** in dispenser **155**, and/or alternatively in fraud detection module **124**. The number of dispense commands comprises n in one embodiment, and the identified time period is n times an average transaction time, wherein n is greater than or equal to 4. Each different type of ATM may have a different average time per transaction. In one example, if an average transaction time is thirty seconds, a pattern of four dispense commands in two minutes or less may be suspicious, and constitute a suspicious pattern. An ATM having a different average transaction time may utilize a different time period for identifying suspicious patterns.

In a further embodiment, a pattern of potential fraud comprises a number of consecutive dispense commands associated with a same account number, or a pattern of multiple dispense commands without corresponding cardholder authentication commands. This type of fraud detection may be detected by fraud detection module **124**, or optionally fraud detection module **163** if the dispenser **155** is adapted to monitor multiple types of commands from controller **110**.

In some embodiments, a pattern of potential fraud is location dependent, or based on a pattern of commands deviating from a specific customer's commonly performed transactions. Many other suspicious patterns may be identified and included over time as fraud perpetration attempts change and become more creative.

In a further embodiment a self-service terminal (SST), comprises a controller, a token reader coupled to the controller and operable to receive identification information from a customer, and a dispenser coupled to the controller and operable to dispense media to the customer. The SST includes a fraud module operable to monitor events associated with the token reader and the dispenser and identify potential fraud when the monitored events fulfil a potential fraud criterion. The token reader may for instance provide plain text information such as encrypted PIN pad outputs.

The token reader may be a card reader, near field communication (NFC) device, Bluetooth® device, biometric sensor or other device to authenticate a customer. The fraud module may be provided in the dispenser or elsewhere in the SST, and may be formed of hardware, firmware, software, hardware, application code, or any combination thereof. In one embodiment, the monitored commands may include notifications of events generated by different components of modules of the SST, such as card insert events and dispense events.

The fraud module may be further operable to place the dispenser in a suspend mode when potential fraud is identified, or send an alert to the controller to place the dispenser in a suspend mode when potential fraud is identified.

The potential fraud criterion may comprise: the events not occurring in a pre-defined sequence; more than a defined maximum number of events including information relating to the same customer (optionally within a defined time period); successive dispense operations being performed in less than a minimum transaction time;

EXAMPLES

1. A method comprising:
   - monitoring patterns of commands provided by a self-service terminal controller;
   - identifying potential fraud in the monitored patterns of commands; and
   - suspending operation of a dispenser of the self-service terminal responsive to the identification of potential fraud.

2. The method of example 1, wherein the method is performed by firmware in the dispenser of the self-service terminal.

3. The method of any of examples 1-2 wherein one pattern of potential fraud comprises a number of dispense commands within an identified time period.

4. The method of any of examples 1-3 wherein one pattern of potential fraud comprises a number of consecutive dispense commands associated with a same account number.

5. The method of any of examples 1-4, wherein one pattern of potential fraud comprises a pattern of continual dispense commands without corresponding cardholder authentication commands.

6. The method of any of examples 1-5, wherein suspending operation of the dispenser comprises placing the dispenser in a suspend mode.

7. The method of any of examples 1-6, wherein the method is performed by firmware in the dispenser of the self-service terminal comprising an automated teller machine.

8. A method comprising:
   - monitoring authentication commands on a self-service terminal;

monitoring dispense commands on a self-service terminal;

generating a pattern of the monitored authentication and dispense commands;

comparing the generated pattern to known patterns corresponding to potential fraud; and

placing a dispenser in a suspend mode when the generated pattern matches a known pattern corresponding to potential fraud.

9. The method of example 8 wherein one pattern of potential fraud comprises a number of dispense commands within an identified time period.

10. The method of example 9 wherein the number of dispense commands comprises n, and the identified time period is n times an average transaction time, wherein n is greater than or equal to 4.

11. The method of any of examples 8-10 wherein one pattern of potential fraud comprises a number of consecutive dispense commands associated with a same account number.

12. The method of any of examples 8-11 wherein one pattern of potential fraud comprises a pattern of multiple dispense commands without corresponding cardholder authentication commands.

13. The method of any of examples 8-12 wherein one pattern of potential fraud is location dependent.

14. The method of any of examples 8-13 wherein one pattern of potential fraud is based on a pattern of commands corresponding to a specific customer's commonly performed transactions.

15. The method of any of examples 8-14, wherein the method is performed by firmware in the dispenser of the self-service terminal comprising an automated teller machine.

16. A Self-Service Terminal (SST), comprising:

a controller to execute SST commands;

a data entry pad to receive customer authentication information from the customer; and

a dispenser to dispense media, the dispenser further comprising processing circuitry to:

monitor authentication commands executing on the controller;

monitor dispense commands from the controller;

generate a pattern of the monitored authentication and dispense commands;

compare the generated pattern to known patterns corresponding to potential fraud; and

place the dispenser in a suspend mode when the generated pattern matches a known pattern corresponding to potential fraud.

17. The SST of example 16 wherein one pattern of potential fraud comprises a number of dispense commands within an identified time period.

18. The SST of any of examples 16-17 wherein the number of dispense commands comprises n, and the identified time period is n times an average transaction time, wherein n is greater than or equal to 4.

19. The SST of any of examples 16-18 wherein one pattern of potential fraud comprises a number of consecutive dispense commands associated with a same account number.

20. The SST of any of examples 16-19 wherein one pattern of potential fraud comprises a pattern of multiple dispense commands without corresponding cardholder authentication commands.

It should be appreciated that where software is described in a particular form (such as a component or module) this is merely to aid understanding and is not intended to limit how software that implements those functions may be architected or structured. For example, modules may be illustrated as separate modules, but may be implemented as homogenous code, as individual components, some, but not all of these modules may be combined, or the functions may be implemented in software structured in any other convenient manner.

Furthermore, although the software modules are illustrated as executing on one piece of hardware, the software may be distributed over multiple processors of a single device, or in any other convenient manner.

The above description is illustrative, and not restrictive. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of embodiments should therefore be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

In the foregoing description of the embodiments, various features are grouped together in a single embodiment for the purpose of streamlining the disclosure. This method of disclosure is not to be interpreted as reflecting that the claimed embodiments have more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive subject matter lies in less than all features of a single disclosed embodiment. Thus the following claims are hereby incorporated into the Description of the Embodiments, with each claim standing on its own as a separate exemplary embodiment.

The invention claimed is:

1. A method, comprising:

receiving, by a processor integrated within a self-service terminal (SST), a sequence of transaction-related commands during a customer interaction;

analyzing, by the processor, the sequence of transaction-related commands to detect deviations from expected transaction patterns;

determining, by the processor, a likelihood of fraudulent activity based on the analyzing of the sequence of transaction-related commands; and

controlling, by the processor, operation of a transaction component of the SST, in response to the determined likelihood of fraudulent activity, wherein the transaction component is a currency dispenser;

wherein controlling the operation of the transaction component includes placing the transaction component in a suspend mode to prevent execution of dispense commands.

2. The method of claim **1**, wherein the sequence of transaction-related commands includes at least one of a card insertion command, a personal identification number (PIN) entry command, and a currency withdrawal command.

3. The method of claim **1**, wherein analyzing the sequence of transaction-related commands further includes comparing a timing of the sequence of transaction-related commands to an expected timing intervals for a legitimate transaction.

4. The method of claim **1**, wherein determining the likelihood of fraudulent activity is further based on a comparison with historical transaction data associated with a customer.

5. The method of claim **1**, wherein controlling the operation of the transaction component includes temporarily disabling the transaction component from executing further transactions.

6. The method of claim **1**, wherein controlling the operation of the transaction component further includes adjusting a dispense limit for a subsequent transaction.

7. The method of claim **1**, wherein the processor is further configured to generate an alert notification to a remote monitoring service in response to the determined likelihood of fraudulent activity.

8. The method of claim **1**, wherein the processor is further configured to request additional customer authentication in response to the determined likelihood of fraudulent activity.

9. The method of claim **1**, wherein the processor is further configured to record details of the sequence of transaction-related commands and the determined likelihood of fraudulent activity in a secure log for subsequent analysis.

10. The method of claim **1**, wherein the processor is further configured to implement a delay in transaction processing if the likelihood of fraudulent activity exceeds a predetermined threshold.

11. The method of claim **1**, wherein the processor is further configured to revert the operation of the transaction component to a normal state upon receiving a verification of transaction authenticity.

12. The method of claim **1**, wherein the processor is further configured to update a database of known transaction event patterns based on newly detected patterns of legitimate transactions.

13. A method, comprising:

monitoring, by a processor of a self-service terminal (SST), transaction events including customer authentication inputs and transaction execution outputs for a transaction;

identifying, by the processor, irregular transaction event patterns by comparing the monitored transaction events with a database of known transaction event patterns associated with legitimate transactions;

inferring, by the processor, potentially unauthorized transaction activity based on an identification of irregular transaction event patterns; and

implementing, by the processor, a security protocol that alters transaction processing capabilities of the SST upon inferring the potentially unauthorized transaction activity;

wherein implementing the security protocol includes placing a disperser of the SST in a suspend mode to prevent dispensing of further media.

14. The method of claim **13**, wherein the database of known transaction event patterns is updated dynamically based on transaction events processed by the SST over time.

15. The method of claim **13**, wherein the security protocol includes notifying a financial institution associated with the transaction.

16. The method of claim **13**, wherein the security protocol includes capturing image data of a user during the transaction for subsequent identification.

17. The method of claim **13**, wherein the irregular transaction event patterns include patterns indicative of rapid, sequential transactions exceeding a normal usage rate.

18. The method of claim **13**, wherein the security protocol includes locking a user interface of the SST to prevent further user interaction until an administrative override is performed.

19. A system comprising:

a self-service terminal (SST) including a user interface for receiving transaction instructions from users and a transaction execution unit for carrying out the transaction instructions;

a control unit housed within the SST and comprising a processor and a memory, the memory storing instructions that, when executed by the processor, cause the control unit to:

record transaction instructions and corresponding transaction outcomes to form a transaction record;

compare the transaction record to a set of predefined criteria indicative of transaction integrity;

assess transaction risk based on a comparison, wherein the transaction risk is indicative of potentially fraudulent activity; and

modify transaction execution parameters of the transaction execution unit based on the assessed transaction risk to mitigate potentially fraudulent activity;

wherein modifying the transaction execution parameters includes placing a dispenser of the SST in a suspend mode to prevent execution of dispense commands.

20. The system of claim **19**, wherein the set of predefined criteria indicative of transaction integrity include a comparison of transaction frequency and amounts against established customer behavior profiles, and wherein the control unit is further configured to adjust the set of predefined criteria based on time of day, location of the SST, and historical transaction patterns for enhanced fraud detection accuracy.

* * * * *