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(54) **METHOD AND AUTONOMOUS APPARATUS FOR SUPERVISION OF ILLICIT CASH DISPENSE OF AN ATM, AND SYSTEM THAT COMPRISES IT**

(57) The present invention is within the area of security systems for Automated-Teller Machines (ATM). It is an object of the invention an autonomous apparatus (10, 20) for supervision of illicit cash dispense of an ATM comprising a sensor capable of detecting vibration and computational means configured to, based on a vibration variable obtained by the sensor, identifying an action of illicit cash which consists of a regular cash withdrawal illicitly issued through a malicious computer program.

Such apparatus (10, 20) identifies actions of illicit cash dispensing with resort to physical variables, thereby identifying the illicit action through a specific vibration generated by the illicit withdrawal.

It is also an object of the present invention a system which comprises an ATM and a first autonomous apparatus (10) coupled to dispensing means and a second autonomous apparatus (20) coupled to a cassette, as well as a method for the same purposes.

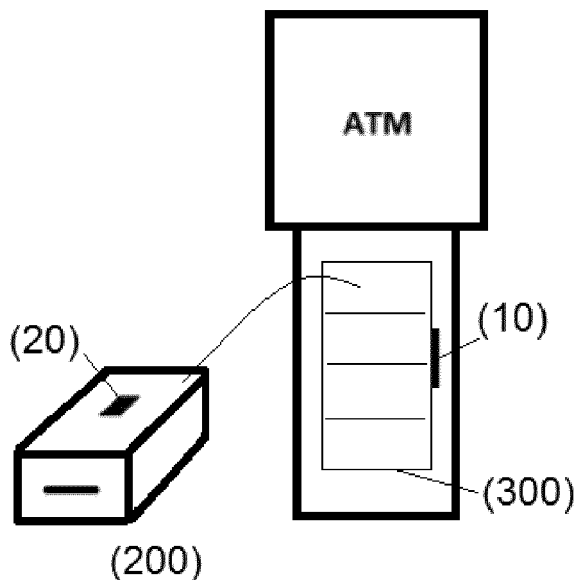


Figure 1

Description**FIELD OF THE INVENTION**

[0001] The present invention is enclosed in the area of security systems for Automated Teller Machines (ATM).

PRIOR ART

[0002] Cash theft techniques directed for logic of an ATM have evolved to placing a computer program in its computer or in one of its peripheral devices, with a behaviour similar to a virus/malware, which will have priority control of the cash dispensing module of the ATM.

[0003] After being installed, this computer program allows a user to activate it through a specific ATM card, or introducing locally or remotely a personal code, or other type of order.

[0004] Through this action, the user is enabled to control directly the dispensing operations of the ATM by means of such malware, allowing to withdraw part or the entirety of the available cash, in an action known as "jackpot", without the control software of the ATM to gain knowledge or the capacity of stopping or preventing the cash withdrawal process.

[0005] Solutions exist in the art where movement of an ATM is monitored, such as the case of patent application GB2365187, which discloses a sensor system directed to securing ATMs, in which a piezoelectric sensor is coupled to the ATM, such that unauthorised movement of the ATM results in the detection of such movement and the consequent issue of an alarm.

[0006] Currently, there exist several techniques based on antivirus or other software techniques placed inside the ATM control program, developed to detect and stop the actions of the described malware.

[0007] However, all the existing solutions have the issue of being mere software based solutions, thereby having weaknesses and requiring constant update, for they are protection actions that coexist in the same computer as the malware, being even subject to -themselves - being infected by said malware.

[0008] The present solution intended to innovatively overcome such issues.

SUMMARY OF THE INVENTION

[0009] It is therefore an object of the present invention an autonomous apparatus (10, 20) for supervision of illicit cash dispense of an automated-teller machine (ATM) which comprises at least one sensor capable of detecting vibration and computational means, such computational means being configured to, based on a vibration variable obtained by said sensor capable of detecting vibration, identify an action of illicit cash dispense of an ATM, such action of illicit cash dispense consisting of a regular cash withdrawal illicitly issued through a malicious computer

program.

[0010] Such apparatus (10, 20) therefore identifies an action of illicit cash dispensing with resort to physical variables, therefore hardware, thereby providing detection such action through a specific vibration generated by the illicit withdrawal. Differently from cited prior art, the apparatus of the present invention monitors vibration and identifies actions of illicit cash dispense which consist of logic attacks, issued by a malicious computer program, thereby remotely or locally, and logically, not physically, producing a different vibration pattern which is identified through the present invention, hence in a different way with regard to such cited prior art.

[0011] In an advantageous configuration of the apparatus (10, 20) of the present invention, said computational means are further configured to, based on a vibration variable obtained by the sensor capable of detecting vibration and a time interval associated to such vibration variable, identify an action of illicit cash dispense of the ATM.

[0012] It therefore provides a better mode of detecting the illicit, malware based, withdrawal.

[0013] In another advantageous mode of the apparatus (10, 20) of the present invention, said vibration variable and said time interval define a vibration pattern, said computational means being configured to, based on the comparison of such measured vibration pattern with a preset vibration pattern associated to said ATM, identify an action of illicit cash dispense of an ATM. Differently from cited prior art, the apparatus of the present invention monitors a vibration pattern, which is compared with a preset vibration pattern of the ATM, thereby not detecting a completely different vibration, as is the case of actions of breaking into the ATM, but detecting specific logic attacks, which provide a vibration pattern which corresponds to that of the equipment, but which may yet be detected.

[0014] In yet another advantageous embodiment of the apparatus (10, 20), it is further configured for comparing the time interval of the measured vibration pattern with the time interval of a preset vibration pattern corresponding to the maximum allowable cash withdrawal of the ATM.

[0015] In another advantageous configuration of the apparatus (10, 20) of the present invention, combinable with any of the preceding, it consists of a bank note neutralisation system. It therefore does not require additional elements to be included in an ATM.

[0016] Advantageous configurations of the apparatus (10, 20) of the present invention, combinable with any of the preceding, provide for actions to avoid illicit dispensing of cash in the ATM by means of malware, through:

- said computational means being further configured for, on identification of an action of illicit cash withdrawal of the ATM, issue a command defined so to cut the power and/or communication of the ATM and/or

- said computational means being further configured for, on identification of an action of illicit cash withdrawal of the ATM, issue a command defined so to actuate neutralisation means and/or cash dispenser blocking means of the ATM.

[0017] It is also an object of the present invention a system for supervision of illicit cash dispense of an ATM which comprises an ATM comprising dispensing means (300) and at least one cassette comprising cash (200), and at least two autonomous apparatus (10, 20) of any of its described configurations, such autonomous apparatus (10, 20) consisting of:

- a first autonomous apparatus (10) coupled to said dispensing means (300) and further configured to compare the measured vibration pattern with a preset vibration pattern associated to the dispensing means (300)
- at least one second autonomous apparatus (20), each second autonomous apparatus (20) being coupled to one of said at least one cassette comprising cash (200) and further configured to compare its measured vibration pattern with a preset vibration pattern associated to the respective cassette comprising cash (200).

[0018] In an advantageous configuration of such system, it further comprises an ATM protection sub-system, in turn comprising bank note neutralisation means and cash dispenser blocking means, such cash dispenser blocking means preferably consisting of a power relay (30) which powers the cash dispenser. The blocking means consisting of a power relay (30), so connected that it controls powering of the cash dispenser, allows to independently - without resort to physical access to any of the electrical or computational means of the ATM - controlling the powering of the dispenser, thereby allowing a quick and reliable way to stop the dispensing of bank notes in a case where an attack is detected.

[0019] In another advantageous mode of the system of the present invention, it comprises an ATM, the computational means of the apparatus (10, 20) being isolated in terms of computational decision logic of any computational means comprised by said ATM and, preferably, the computational means of the second autonomous apparatus (20) consisting of computational means of the bank note neutralisation means (50). It therefore allows the apparatus (10, 20) to be immune to attempts of its own infection by the malware.

[0020] In yet another advantageous embodiment of the system of the present invention, the apparatus (10, 20) comprises power supply means which provide power only to such apparatus (10, 20). It provides another way of immunity to attempts of infection/attack from the malware.

[0021] It is also an object of the present invention a method for autonomous supervision of illicit cash dis-

pense of an ATM which comprises the following steps:

- detecting a vibration variable from dispensing means (300) and/or at least one cassette for cash of an ATM,
- based on said vibration variable detecting an action of illicit cash dispense of an ATM, such action of illicit cash dispense consisting of a regular cash withdrawal illicitly issued through a malicious computer program.

[0022] It also provides detection of an action of illicit cash dispensing with resort to physical variables, therefore hardware, thereby detection such action through a specific vibration generated by the illicit withdrawal.

[0023] In an advantageous configuration of the method of the present invention, it further comprises the step of, based on a vibration variable obtained by the sensor capable of detecting vibration and a time interval associated to such vibration variable, identify an action of illicit cash dispense of an ATM, preferably said vibration variable and said time interval define a measured vibration pattern, said computational means being configured to, based on such vibration pattern, identify an action of illicit cash dispense of an ATM.

[0024] It therefore provides a better mode of detecting the illicit, malware based, withdrawal.

DESCRIPTION OF FIGURES

[0025]

Figure 1 - representation of a system according to the present invention, comprising two autonomous apparatuses (10, 20): a first autonomous apparatus (10) coupled to the dispensing means (300) and a second autonomous apparatus coupled to a cassette (200), in an ATM.

Figure 2 - representation of a system according to the present invention, again comprising two autonomous apparatuses (10, 20), an ATM vault (500) comprising dispensing means (300) and cassettes (200). The ATM of such system also comprises individual computational means (100), an individual power supply (600) and an ATM protection sub-system, which in turn comprises bank note neutralisation means (50).

DETAILED DESCRIPTION

[0026] The more general and advantageous configurations of the present invention are described in the Summary of the invention. Such configurations are detailed below in accordance with other advantageous and/or preferred embodiments of implementation of the present invention.

[0027] In a preferred embodiment of the apparatus (10, 20) of the present invention, the comparison of the meas-

ured vibration pattern with the preset vibration pattern includes the identification of one or more of:

- the maximum number of notes that can be dispensed in each operation per container of the ATM,
- the maximum number of times that a maximum number of notes that can be dispensed in each operation per container of the ATM may be dispensed in a same operation of a same user of the ATM,
- the minimum expected time between maximum withdrawals requested in a same operation by a same client of the ATM,
- the minimum expected time of logical processing of software between reliable cash withdrawal operations from different clients of the ATM.

[0028] In this embodiment, the measured vibration pattern is compared with the preset vibration pattern, identifying through such measured vibration pattern - for instance - how many notes will be dispensed in a single operation, per container of the ATM, and if such value overcomes a predefined maximum value.

[0029] In a preferred embodiment of the apparatus (10, 20) of the present invention, combinable with any above described, the sensor capable of detecting vibration consists of a motion sensor.

[0030] In another preferred embodiment of the apparatus (10, 20) of the present invention, combinable with any above described, it further comprises coupling means.

[0031] In an embodiment of the apparatus (10, 20) of the present invention, it consists of bank note neutralisation means, preferably an intelligent banknote neutralisation system (IBNS), e.g. with a degradation agent consisting of ink.

[0032] And in another embodiment of the apparatus (10, 20) of the present invention, the microcontroller is further configured to identify an identification of a model of the ATM and, based on such identification, define the preset vibration pattern associated to said ATM.

[0033] In a preferred embodiment of the system of the present invention, the computational means of the apparatus (10, 20) consist of the computational means of the bank note neutralisation means, such neutralisation means comprising at least one sensor capable of detecting vibration, which consists of said at least one sensor capable of detecting vibration of the apparatus (10, 20).

[0034] In another embodiment of the system of the present invention, a connection cable (40) connecting the computational means of the ATM to the dispensing means (300) provides a constant supply voltage. The system of the present invention comprises supervision means of such supply voltage. Thus, if the cable is cut off or disconnected, this voltage will no longer exist.

[0035] Alternatively, a closed ring technique is used, such ring passing through said cable and closing inside the computational means of the ATM, thereby enabling to detect if the cable is connected or cut.

[0036] It should be noted that - in any case - supervision is carried out by the system of the present invention inside the ATM vault (500), next to the dispensing means (300), and therefore without external access.

5 **[0037]** As will be clear to one skilled in the art, the present invention should not be limited to the embodiments described herein, and a number of changes are possible which remain within the scope of the present invention.

10 **[0038]** Of course, the preferred embodiments shown above are combinable, in the different possible forms, being herein avoided the repetition all such combinations.

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Claims

1. Autonomous apparatus (10, 20) for supervision of illicit cash dispense of an automated-teller machine (ATM) **characterised in that** it comprises at least one sensor capable of detecting vibration and computational means, such computational means being configured to, based on a vibration variable obtained by said sensor capable of detecting vibration, identify an action of illicit cash dispense of an ATM, such action of illicit cash dispense consisting of a regular cash withdrawal illicitly issued through a malicious computer program.
- 20 2. Apparatus (10, 20) according to the previous claim wherein said computational means are further configured to, based on a vibration variable obtained by the sensor capable of detecting vibration and a time interval associated to such vibration variable, identify an action of illicit cash dispense of the ATM.
- 25 3. Apparatus (10, 20) according to the previous claim wherein said vibration variable and said time interval define a measured vibration pattern, said computational means being configured to, based on the comparison of such measured vibration pattern with a preset vibration pattern associated to said ATM, identify an action of illicit cash dispense of the ATM.
- 30 4. Apparatus (10, 20) according to any of the claims 2-3 wherein it is further configured for comparing the time interval of the measured vibration pattern with the time interval of a preset vibration pattern corresponding to the maximum allowable cash withdrawal of the ATM.
- 35 5. Apparatus (10, 20) according to any of the preceding claims wherein said computational means are further configured for, on identification of an action of illicit cash withdrawal of the ATM, issue a command defined so to cut the power and/or communication of the ATM and/or on identification of an action of illicit cash withdrawal of the ATM, issue a command
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defined so to actuate neutralisation means and/or cash dispenser blocking means of the ATM.

6. Apparatus (10, 20) according to any of the preceding claims wherein said sensor capable of detecting vibration consists of a motion sensor and/or it further comprises coupling means.

7. Apparatus according to any of the preceding claims wherein it consists of bank note neutralisation means, preferably an intelligent banknote neutralisation system (IBNS).

8. Apparatus (10, 20) according to any of the preceding claims wherein the comparison of the measured vibration pattern with the preset vibration pattern includes the identification of one or more of:

- the maximum number of notes that can be dispensed in each operation per container of the ATM,
- the maximum number of times that a maximum number of notes that can be dispensed in each operation per container of the ATM may be dispensed in a same operation of a same user of the ATM,
- the minimum expected time between maximum withdrawals requested in a same operation by a same client of the ATM,
- the minimum expected time of logical processing of software between reliable cash withdrawal operations from different clients of the ATM.

9. Apparatus (10, 20) according to any of the claims 3-8 wherein the microcontroller is further configured to identify an identification of a model of the ATM and, based on such identification, define the preset vibration pattern associated to said ATM.

10. System for supervision of illicit cash dispense of an ATM **characterised in that** it comprises an ATM comprising dispensing means (300) and at least one cassette comprising cash (200), and at least two autonomous apparatus (10, 20) of any of the preceding claims, consisting of:

- a first autonomous apparatus (10) coupled to said dispensing means (300) and further configured to compare the measured vibration pattern with a preset vibration pattern associated to the dispensing means (300)
- at least one second autonomous apparatus (20), each second autonomous apparatus (20) being coupled to one of said at least one cassette comprising cash (200) and further configured to compare its measured vibration pattern with a preset vibration pattern associated to the respective cassette comprising cash (200).

11. System according to the previous claim wherein it further comprises an ATM protection sub-system, in turn comprising bank note neutralisation means and cash dispenser blocking means, such cash dispenser blocking means preferably consisting of a power relay (30) which powers the cash dispenser.

12. System according to any of the claims 9-11 wherein it comprises an ATM, the computational means of each apparatus (10, 20) being isolated in terms of computational decision logic of any computational means comprised by said ATM and, preferably, the computational means of the second autonomous apparatus (20) consisting of computational means of the bank note neutralisation means (50).

13. System according to any of the claims 9-12 wherein each autonomous apparatus (10, 20) comprises power supply means which provide power only to such apparatus (10, 20).

14. Method for autonomous supervision of illicit cash dispense of an ATM **characterised in that** it comprises the following steps:

- detecting a vibration variable from dispensing means (300) and/or at least one cassette for cash of an ATM,
- based on said vibration variable identifying an action of illicit cash dispense of an ATM, such action of illicit cash dispense consisting of a regular cash withdrawal illicitly issued through a malicious computer program.

15. Method according to the previous claim wherein it further comprises the step of, based on a vibration variable obtained by the sensor capable of detecting vibration and a time interval associated to such vibration variable, identify an action of illicit cash dispense of an ATM, preferably said vibration variable and said time interval define a vibration pattern, said computational means being configured to, based on such vibration pattern, identify an action of illicit cash dispense of an ATM.

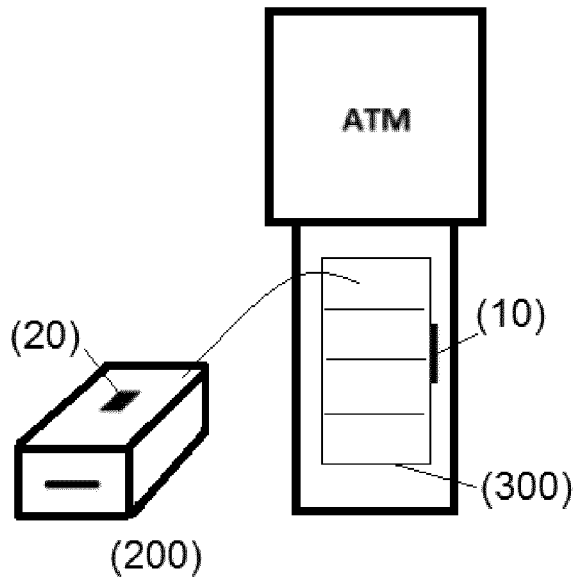


Figure 1

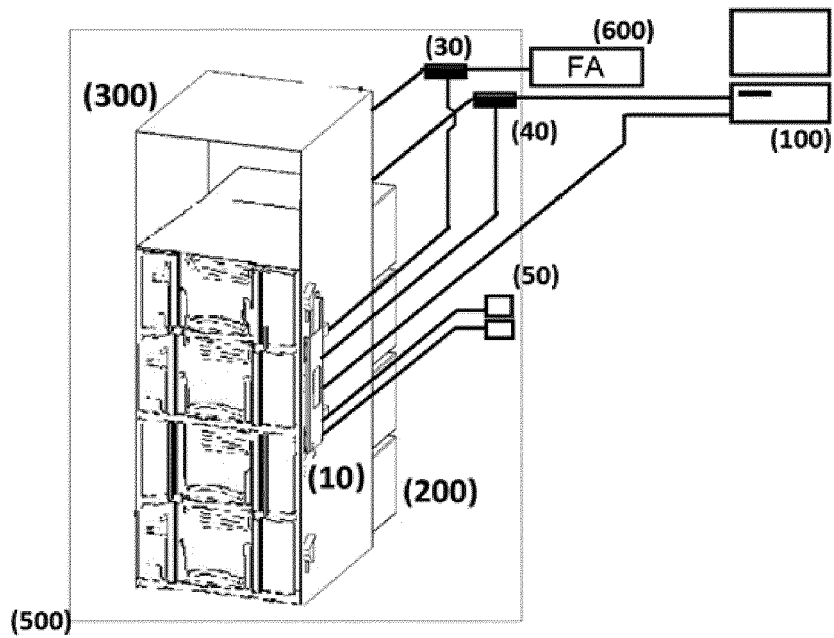


Figure 2



EUROPEAN SEARCH REPORT

Application Number
EP 17 17 4625

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2016/132887 A1 (LACOSS-ARNOLD JASON J [US] ET AL) 12 May 2016 (2016-05-12) * abstract * * figures 2,5-7 * * paragraph [0004] - paragraph [0006] * * paragraph [0016] - paragraph [0025] * * paragraph [0059] - paragraph [0065] *	1-15	INV. G07F19/00
X	US 2015/278818 A1 (HORGAN KEVIN [GB] ET AL) 1 October 2015 (2015-10-01) * abstract * * figures 1-3 * * paragraph [0010] - paragraph [0033] *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			G07F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 20 October 2017	Examiner Diepstraten, Marc
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 17 4625

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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20-10-2017

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
15	US 2016132887 A1	12-05-2016	EP 3218858 A1 US 2016132887 A1 WO 2016077206 A1	20-09-2017 12-05-2016 19-05-2016
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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