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 A request for correction (exchanging the contents of figure 1 with figure 2 and vice versa) has been filed pursuant to Rule 88 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

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(54) **Computer security system**

(57) Several embodiments of computer security systems are described and which are adapted to grant an authorized individual access to a secured domain, such as a computer or data stream. In one embodiment, the security system comprises: an analyzing means for receiving first and second passwords, each of said passwords being transmitted over a first communication channel, analyzing said first password, transmitting a first signal output only if said first password is author-

ized, and granting access to said secured domain only if said second password is substantially identical to a code; and a random code generating means for generating said code, transmitting said code over a second communication channel upon receipt of first signal output, and transmitting said code to said analyzing means; and a notification means for receiving said code and for notifying said authorized individual of the identity of said code.

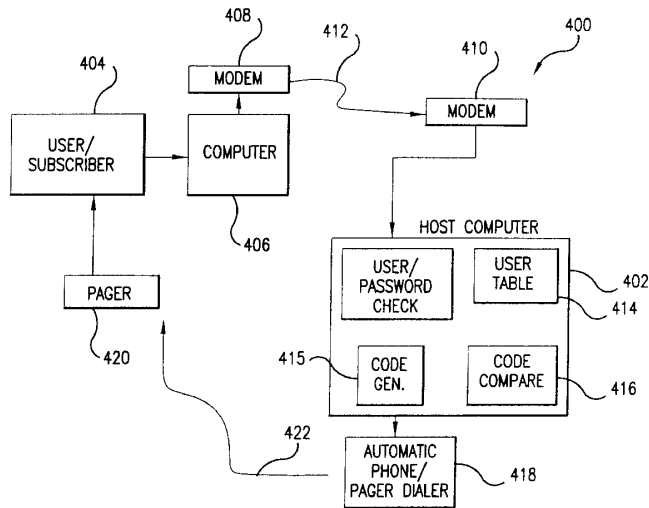


FIG. 6

Description

1. Field of the Invention

The present invention relates to a security and/or access restriction system and, in one embodiment, to a security and/or access restriction system which is adapted to grant only authorized users access to a computer system and/or to certain data which may be resident within the computer system and/or resident within a communications channel and/or other communications medium.

2. Background of the Invention

In recent years, computers have proliferated in all parts of worldwide society, including but not limited to banking, financial services, business, education, and various governmental entities. For instance and without limitation, these computer systems allow individuals to consummate financial transactions, to exchange confidential scientific and/or medical data, and to exchange highly proprietary business planning data. Hence, these computer systems require and/or allow very sensitive and confidential data to be stored and transmitted over great geographic distances.

Moreover, the rise of multinational communications networks, such as the publicly available Internet communications system, has truly made the world a smaller place by allowing these computers, separated by great geographic distances, to very easily communicate and exchange data. In essence, these worldwide communications channels/networks, sometimes collectively referred to as "the Information Superhighway" have electronically connected the peoples of the world - both the good and the very bad.

That is, while these computer systems have increased efficiency and greatly changed the manner in which we work and interact, they have been especially prone to unauthorized "break-ins", viral destruction, and/or unauthorized data modifications. Accordingly, the rather sensitive and confidential data which is stored and used within these computer systems and transmitted between these computer systems has been the target of attack by people known as "hackers" and by high level and very sophisticated espionage and industrial spies. Computer access security and data transmission security has recently come to the forefront of importance and represents one of the great needs of our times.

Many attempts have been made to create and utilize various techniques (hereinafter the term "technique" as used and/or employed in this Application refers to any combination of software, hardware, and/or firmware which comprise an apparatus and a methodology whose components cooperatively achieve an overall security objective) to "ensure" that only authorized users are allowed to gain access to these respective computer systems. These prior techniques, while somewhat ef-

fective, suffer from various drawbacks.

For example, one such prior computer system security technique comprises the use of predetermined "passwords". That is, according to this security technique, each computer system has a list of authorized passwords which must be communicated to it before access is given or allowed. In theory, one or more "trusted" system administrators distribute these "secret" passwords to a group of authorized users of a computer system. The "secret" nature of the passwords, in theory, prevents unauthorized users from accessing the computer system (since presumably these unauthorized users do not have the correct passwords). This technique is not very effective since oftentimes those authorized individuals mistakenly and unwittingly expose their password to an unauthorized user. Moreover, this technique of data security may be easily "broken" by a "hacker's" deliberate and concentrated attempt at automatically inputting, to the targeted computer, hundreds and perhaps thousands of passwords until an authorized password is created.

In addition to the prior password technique other, more sophisticated access techniques are known and used. For example, there are known techniques which require the possession of a physical object or feature, such as "access cards" which are "read" by a card reading device and biometric authentication techniques (e.g. requiring the initial input of such authorized user physical characteristics as fingerprints and eye patterns and the later comparison of these input patterns to those of a "would-be" user). Both of these prior techniques are relatively complicated, are relatively costly, and are prone to error, such as and without limitation, mistaken unauthorized entry due to their complexity. These techniques are also prone to unauthorized entry by use of counterfeit and/or stolen cards, objects, and fingerprint readers. Other prior data security techniques, such as encryption, attempt to prevent unauthorized use of transmitted data or unauthorized access to a computer system by modifying and/or changing the transmitted data in a certain manner, and/or requiring the transmission and receipt of modified data before access is granted. While somewhat effective, these prior encryption techniques are relatively costly and complicated and require one or more known "encryption keys" which are in constant exchange between users and which are themselves susceptible to theft and/or inadvertent disclosure. Furthermore, the best-known and perhaps strongest encryption algorithm is proprietary and cannot be used without a costly license. Moreover, since the encrypted message still provides all of the transmitted data, in some form, it is still possible for one to gain access to the entire data stream by "breaking the encryption code". Since no encryption algorithm is ever considered "unbreakable", encryption is not considered to be a "foolproof" security solution.

There is therefore a need to provide a technique to substantially prevent the unauthorized access to one or

more computer systems and which overcomes the various drawbacks of these afore-described prior techniques. There is also a need to provide a technique to substantially prevent the unauthorized interception and use of transmitted data and which overcomes the various drawbacks of the prior art. Applicant's invention(s) seek and do meet these needs. Applicant's invention, in one embodiment, achieves these objectives by splitting the data into a plurality of separate communication channels, each of which must be "broken" for the entire data stream to be obtained. In essence, in this embodiment of Applicant's invention, cooperatively form the entire message. The splitting of the data in this manner may also "fool" the would be data thief into believing that he or she has obtained all of the data when, in fact, only several communication channels are obtained.

SUMMARY OF THE INVENTION

While a number of "objects of the invention" are set forth below, it should be realized by one of ordinary skill in the art that the invention(s) are not to be limited, in any manner, by these recited objects. Rather, the recited "objects of the invention" are to be used to place Applicant's various inventions in proper overall perspective and to enable the reader to better understand the manner in which Applicant's inventions are to be made and used, especially in the preferred embodiment of Applicant's invention. Accordingly, the various "objects of the invention" are set forth below:

It is a first object of the present invention to provide a technique to substantially ensure that only authorized users gain access to a computer system.

It is a second object of the invention to provide a technique to substantially ensure that only authorized users gain access to a computer system and which overcomes the various previously delineated drawbacks of the prior computer system security techniques.

It is a third object of the invention to provide a technique to substantially ensure that only authorized users have access and use of certain transmitted data appearing, for example, within a data stream.

It is a fourth object of the invention to provide a technique to substantially ensure that only authorized users have access and use of certain transmitted data and/or certain hardware, software, and/or firmware which cooperatively form and/or comprise a computer system, and that this technique overcomes the various previously delineated drawbacks of the prior techniques.

According to a first aspect of the present invention, a security system is provided. Particularly, the security system is adapted to be used in combination with a computer and to only grant an authorized individual access to the computer. The security system comprises, in one embodiment, password means for receiving a password by use of a first communications channel; and code generation means, coupled to said password means, for generating a code by use of a second communications

channel, and to allow that individual access to the computer system only if that individual generates and communicates the code to the code generation means.

According to a third aspect of the present invention, a method is provided for use with a computer and effective to substantially prevent an unauthorized user from accessing the computer. The method comprises, in one embodiment, the steps of assigning a password to the user; receiving the password by use of a first communications channel; generating a code in response to the received password; transmitting the code by use of a second communications channel to the user; transmitting the code to the computer; and allowing access to the computer only after the code is transmitted to the computer.

According to a fourth aspect of the present invention, a security system is provided to grant an authorized individual access to a secured stream of data bits. In one embodiment, the data security system comprises a data stream dividing means for receiving said stream of data bits and dividing said stream of data bits into a plurality of sub-streams; transmitting means for transmitting said sub-streams in a predetermined order over a communication channel; and a decoding means for receiving said sub-streams and for recombining said received sub-streams to create said secured stream of data bits.

Further objects, features, and advantages of the present invention will become apparent from a consideration of the following description, the appended claims, and/or the appended drawings. It should further be realized by one of ordinary skill in the art that the previously delineated objects and aspects of the invention are for illustration purposes only and are not to be construed so as to limit the generality of the inventions and/or to limit the interpretation to be given to the various appended claims. Moreover, it should also be realized by those of ordinary skill in the art that the term "communications channel" as used throughout this Application refers to any physical and/or electromagnetic means or method of transferring and/or communicating information from one or more sources to one or more receivers. Moreover, the term "communications channel" should be given the broadest known interpretation covering any method and/or medium which facilitates the transfer of information and/or over which such information is transferred.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller and more complete understanding of the nature and objects of the present invention, reference should be had to the following drawings wherein:

FIG. 1 is a block diagram of a computer security system made in accordance with the teachings of the preferred embodiment having the preferred security techniques of the invention;

FIG. 2 is a block diagram of another embodiment of a computer security system made in accordance with the teachings of the preferred embodiment having the preferred techniques of the invention; FIG. 3 is a block diagram of yet another embodiment of a security system made in accordance with the teachings of the preferred embodiment having the preferred techniques of the invention; FIG. 4 is a block diagram of another embodiment of a computer security system made in accordance with the teachings of the preferred embodiment having the preferred techniques of the invention; FIG. 5 is a schematic diagram of a password table used by the computer security systems shown in Figures 1 and 2; and FIG. 6 is a block diagram of one embodiment of the preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Figure 1, there is shown a block diagram of a computer security system 10, made in accordance with the principles of the preferred embodiment of the invention and adapted for use in combination with computer 80. More particularly, computer security system 10 selectively allows communication and/or data processing access to computer 80 in a manner which is technically described throughout the remainder of this Application. As shown, security system 10 includes an "analyzing means" 12 and a "random code generating means" 14.

In one embodiment of the preferred embodiment of the invention, analyzing means 12 comprises one or more software subroutines which are adapted to execute upon and/or within computer 80. Alternatively, analyzing means 12 may comprise a microprocessor and/or similar type of computer which is adapted to operate under stored program control in the manner set forth in this Application. One example of another type of computer operating under stored program control and which may be used by the preferred embodiment of the invention is shown and described within chapter eight of the text entitled Advanced Computer Architecture: Parallelism Scalability, Programmability, which was authored by Kai Hwang, which is published by McGraw-Hill, Inc., which has a library reference number of ISBN 0-07-031622-8, and the entire text of all of the chapters of which are fully and completely incorporated herein by reference, word for word and paragraph for paragraph. In either embodiment, analyzing means 12 receives and compares at least two "sets" or streams of data. Should the individually received "sets" match, analyzing means 12 generates and communicates an "access granted" command to computer 80, allowing individual 18 access to the computer 80. Moreover, random code generating means 14 may similarly comprise a conventional pseudo-random number generator which may be constructed or developed on one or more software subroutines

which reside and operate/execute upon and/or within computer 80 or may comprise a microprocessor and/or similar type of computer which operates under stored program control.

5 In operation, individual 18, desiring access to and within computer 80 utilizes a first communication channel 82 (e.g. a first telephone line, radio channel, and/or satellite channel) and communicates, by use of his or her voice or by use of a computer 19 a first password to analyzing means 12. Analyzing means 12 then checks and/or compares this first received password with a master password list which contains all of the authorized passwords associated with authorized entry and/or access to computer 80.

15 As shown in Figure 5, in the preferred embodiment of the invention, analyzing means 12 contains a master password list 200 having a first column of entries corresponding to authorized passwords necessary to gain access to computer 80. Moreover, as further shown in Figure 5, each authorized password 202, contained in this master password list 200, has a unique first entry 204 associated with it and which identifies the name of the authorized user who has been assigned that corresponding password and at least one telephone number 206 and/or network address associated with the identified user.

If the received password matches an entry of the master password list, analyzing means 12 generates a command, by means of connecting bus 17 or software message or function call to random code generating means 14 and causes the random code generation means 14 to generate a substantially random and/or pseudo-random number or code, of programmable length, and to transmit the number and/or code, by means of a second communications channel 84, to the individual 85 associated with the received password 202 in the master password list. That is, as should be apparent to one of ordinary skill in the art, code generation means 14 includes both a random number generator and a conventional and commercially available communications interface (e.g. modem and/or telephone/pager interface), allowing the generated pseudo-random code to be generated or communicated over a wide variety of mediums.

45 Further, it should be apparent that individual 85 may or may not be the same person as individual 18. If individual 18 was the individual identified in the master password list (e.g. "was authorized"), that individual 18 receives the pseudo-random number and transmits the number to the analyzing means 12, by means of communications channel 82. Once the pseudo-random number is received by the analyzing means 12, from channel 82, it is compared with the number generated by generation means 14. If the two codes are substantially the same, entry to computer 80 and/or to a certain part of computer 80 such as, without limitation, the hardware, software, and/or firmware portions of computer 80 is granted to individual 18. For instance, in another em-

bodiment, table 200 of Figure 5 could contain yet another set of entries specifying the directories or portions of computer 80 that the individual 18 was allowed to have access to. In this manner, allowed access to computer 80 would be further restricted to those computer portions which are specified within table 200. It should be apparent to one of ordinary skill in the art that these portions may be different for different users and that each authorized user may have a different portion that may be accessed in an authorized manner.

It should be apparent to one of ordinary skill in the art that Applicant's foregoing computer security technique is a relatively low-cost, but effective technique, for properly ensuring that only authorized users gain access to a computer system, such as computer system 80. That is, Applicant's foregoing computer security embodiment, utilizes two distinct communications channels and a random number generator in order to ensure that an authorized user of a computer system is notified that someone or something is seeking access to the computer system with his or her password. Moreover, Applicant's foregoing invention is very cost effective as it employs substantially "off the shelf" and readily available components. Further, the use of a "secret" password, a "secret" substantially random number, and a "secret" second channel allows for multiple levels of security before access to the computer system is achieved and provides enhanced security over the prior art.

Referring now to Figure 6 there is shown a computer system 400 made in accordance with the teachings of the preferred embodiment of the invention and representing one example and/or implementation which is made in accordance with the various teachings of the preferred embodiment of the invention. As shown, computer system 400 includes a host computer 402 (corresponding to computer 80 of the system shown in Figure 1) to which a user or other individual 404 (corresponding to individual 18 of Figure 1) desires access to. As further shown in Figure 6. As shown, individual 404, in this implementation example, utilizes a commercially available and conventional computer 406 and a commercially available and conventional modem 408 to communicate with a commercially available and conventional modem 410 by means of a typical communications channel (e.g. a conventional "dial-up" telephone line) 412. Hence, the user 404, in this embodiment, only requires conventional computer equipment. Host computer 402, in this embodiment, requires a conventional and commercially available automatic dialer which is altered, in a known manner, to receive and pass one or more passwords and/or codes as data.

In operation, user 404 dials through and/or by means of his or her computer 406 and modem 408 in the usual and conventional manner to connect and access host computer 402. The host computer 402, using the principles of the preferred embodiment of this invention, answers the requester's call, which occurs over channel 412, and requests and receives the user's iden-

tification code. host computer 402 checks the received identification code and cross references the received password code against a pager phone number list resident within the user table 414 which is stored within computer 402. This comparison, is a match is made, causes the "code generator" software subroutine 415, resident within computer 402, to generate a pseudo-random number code and passes the received code along with the authorized user's pager number to the commercially available and conventional automatic dialer 418. The automatic dialer 418 telephones the conventional and commercially available pager 420 by means of conventional and commercially available communication channel 422 (e.g. voice line) and transmits the code to the user's pager. As this happens, the host computer 402 awaits the reply from the user attempting to gain access to the computer.

The user 404 now enters the code he or she has received from the pager 420 and any timing instructions which, in yet another embodiment of the invention may also be transmitted from computer 402, and sends this password or pseudo-random code back to computer 402 where it is compared within the software subroutine module denoted as "code compare" 416 in Figure 6. If the comparison yields a match, the user 404 is allowed access to computer 402 and/or to a portion of computer 402.

Referring now to Figure 2, there is shown a second embodiment of a computer security system made in accordance with the teachings of the preferred embodiment of the invention. This second embodiment 20 is substantially similar to system 10 but also includes a timer or "timing means" 40 which may comprise one or more software subroutines which are adapted to operate and/or execute within and/or upon computer 80 or may comprise a microprocessor which operates under stored program control. In one embodiment, timing means 40 comprises a conventional "watchdog timer" as will be apparent to those of ordinary skill in the art.

In operation, timing means 40 records the time at which the first and second passwords are received by analyzing means 12. Timing means 40, in one embodiment which is coupled to analyzing means 12 and code generation means 14 by bus 42 and in another embodiment which is in software communication with means 12 and 14, then compares the times to determine whether the second password was received within a predetermined period or predetermined "window" of time after the first password was received. In the preferred embodiment of the invention, the predetermined period of time is programmable. The predetermined period of time, will typically need to vary according to the nature or the communications medium used by means 14 to notify individual 85 of the value of the generated code. For example, the predetermined period of time would be shorter when communications channel 84 comprises a pager or cellular phone, since the owner has immediate access to the code upon transmission; and longer

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