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(54) GEOGRAPHIC LOCATION RECEIVER BASED COMPUTER SYSTEM SECURITY

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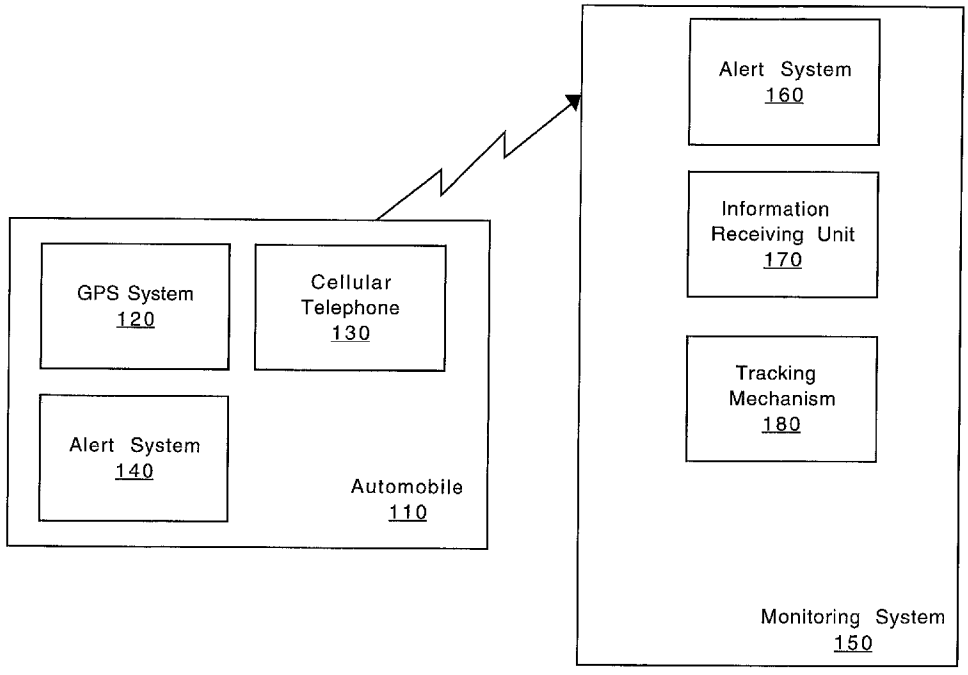
(57) ABSTRACT

A method and apparatus using a location receiver for computer security is provided. A system includes a processor and a bus coupled to the processor. The system further includes a location receiver for receiving a current location of the system, and a database including at least one authorized location for the system. The system further includes a comparator for comparing the current location with the authorized location. The system also includes a response unit for responding if the current location does not correspond to the authorized location.



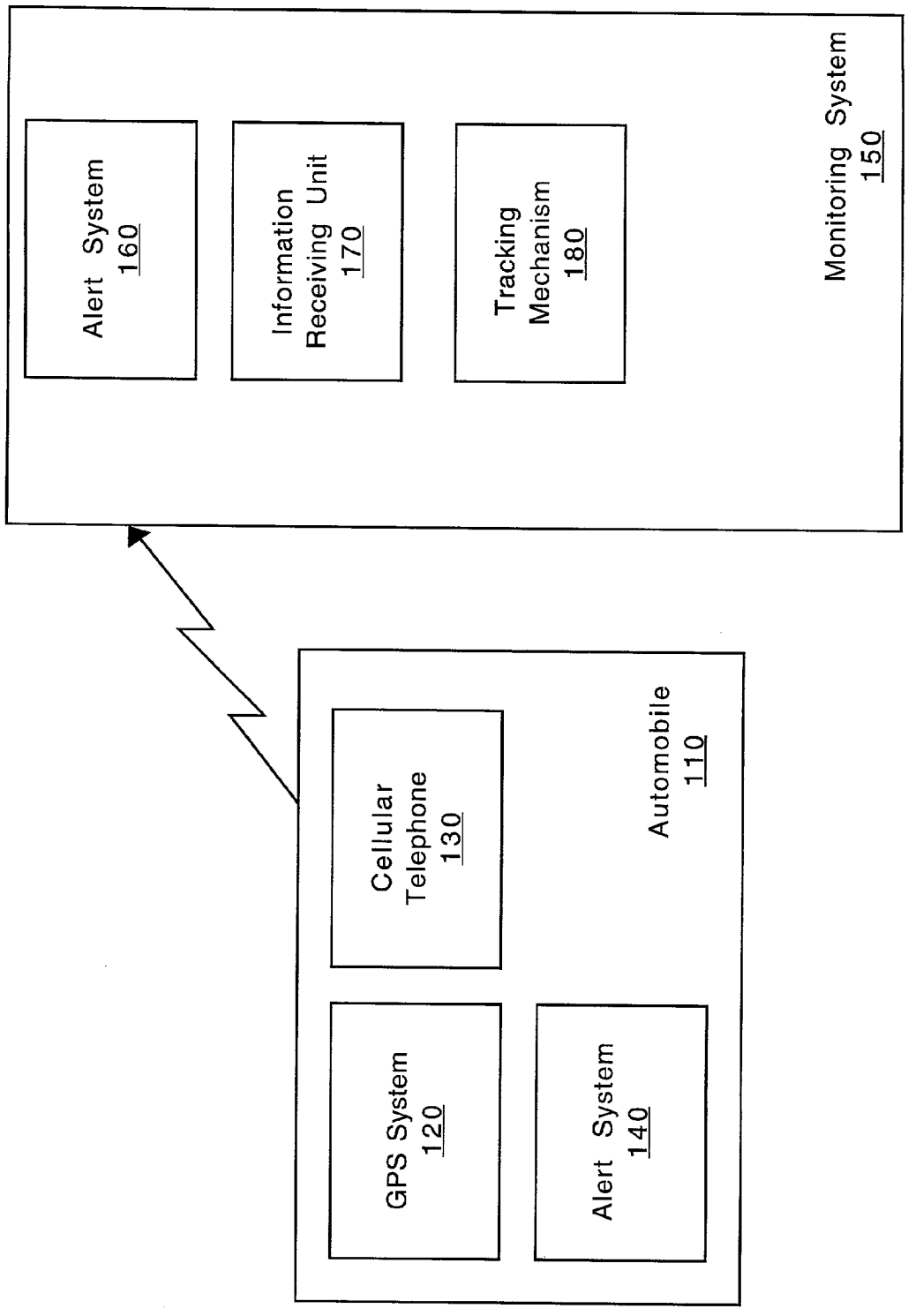


Fig. 1 (Prior Art)

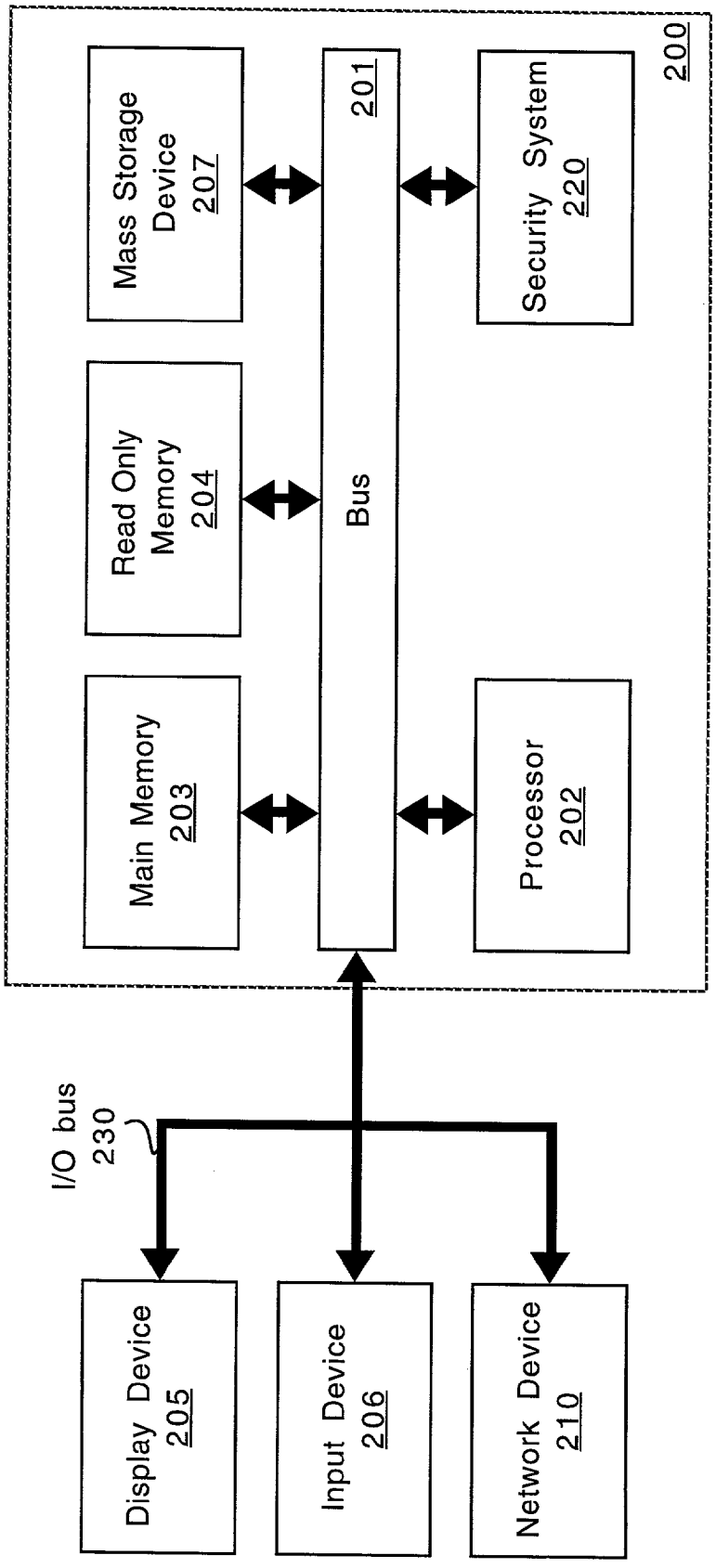

200
Mass Storage Device 207
Read Only Memory 204
Main Memory 203
201
Bus
Security System 220
Processor 202
I/O bus 230
Display Device 205
Input Device 206
Network Device 210

Fig. 2

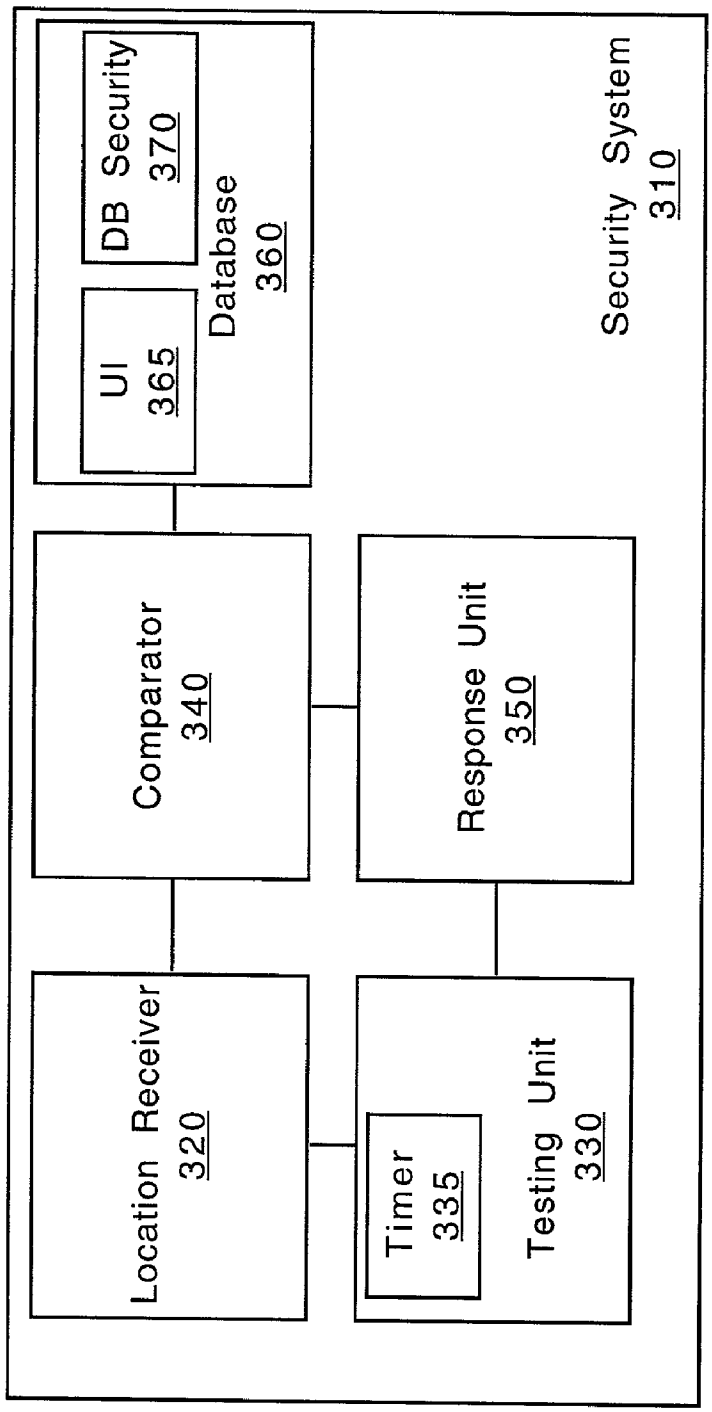

Security System
310
Database
360
DB Security
370
UI
365
Comparator
340
Response Unit
350
Location Receiver
320
Timer
335
Testing Unit
330

Fig. 3

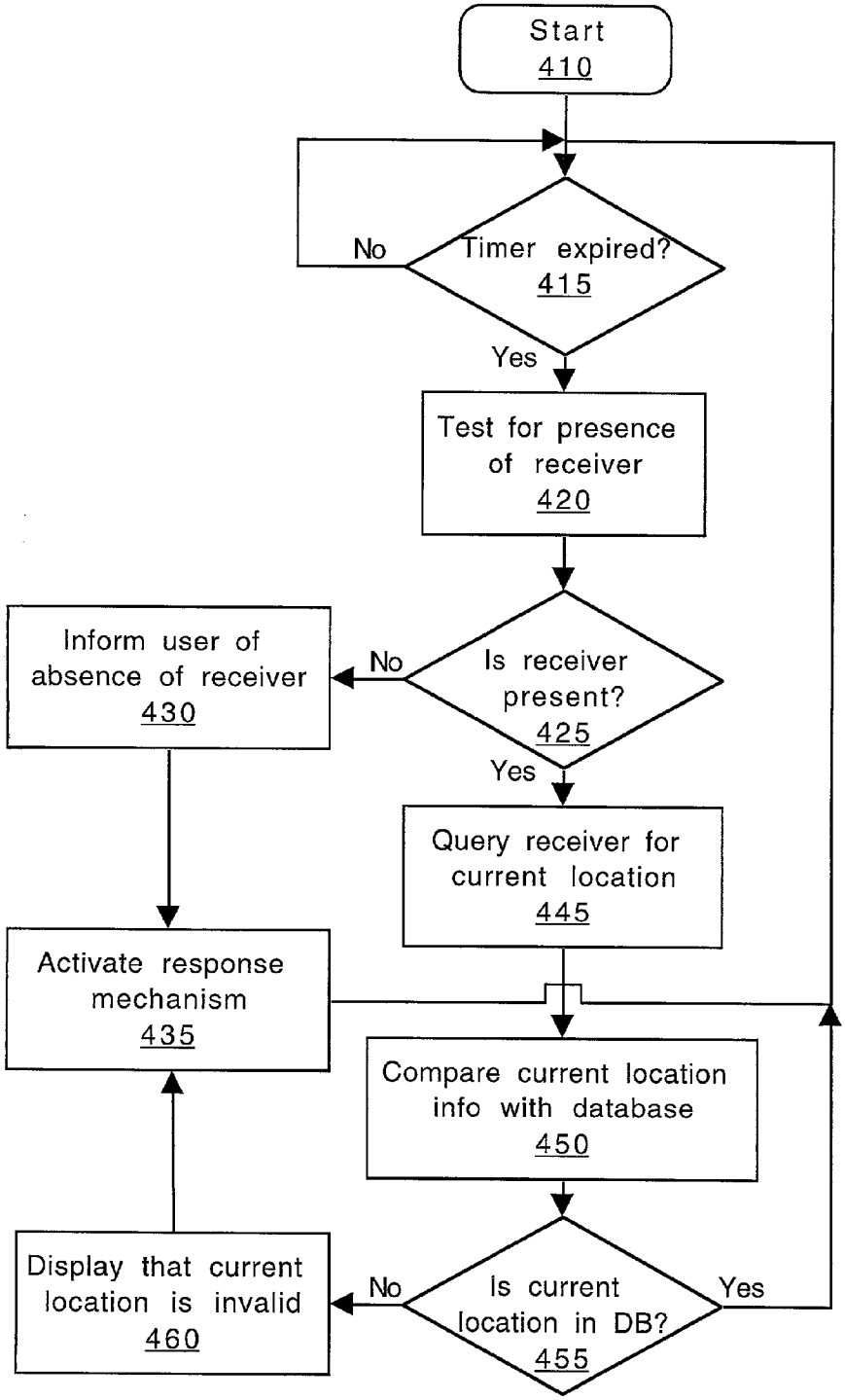

Start
410
Timer expired?
415
No
Yes
Test for presence of receiver
420
Is receiver present?
425
No
Yes
Inform user of absence of receiver
430
Query receiver for current location
445
Activate response mechanism
435
Compare current location info with database
450
Is current location in DB?
455
No
Yes
Display that current location is invalid
460

Fig. 4

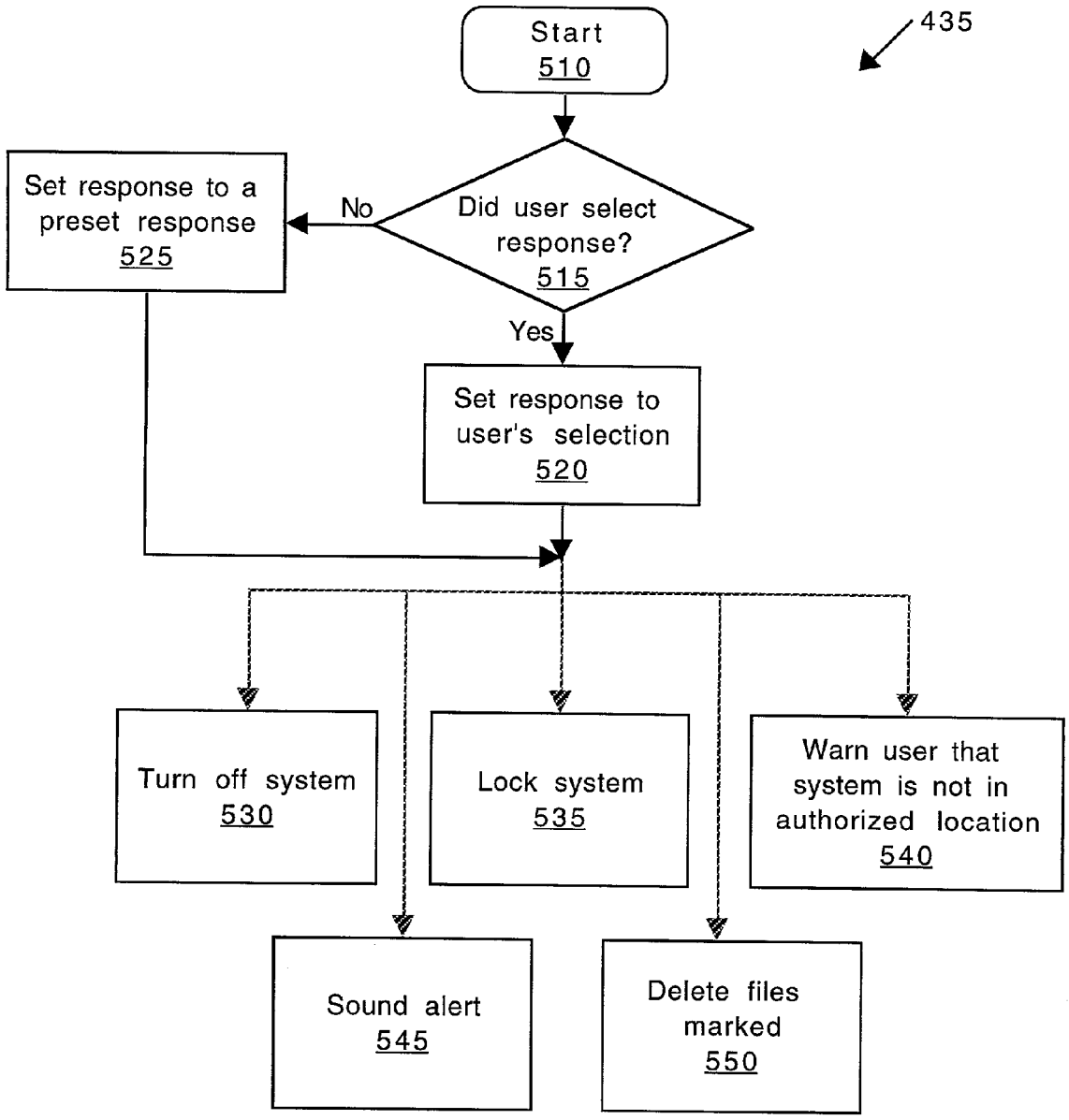

435
Start
510
Did user select response?
515
No
Yes
Set response to a preset response
525
Set response to user's selection
520
Turn off system
530
Lock system
535
Warn user that system is not in authorized location
540
Sound alert
545
Delete files marked
550

Fig. 5

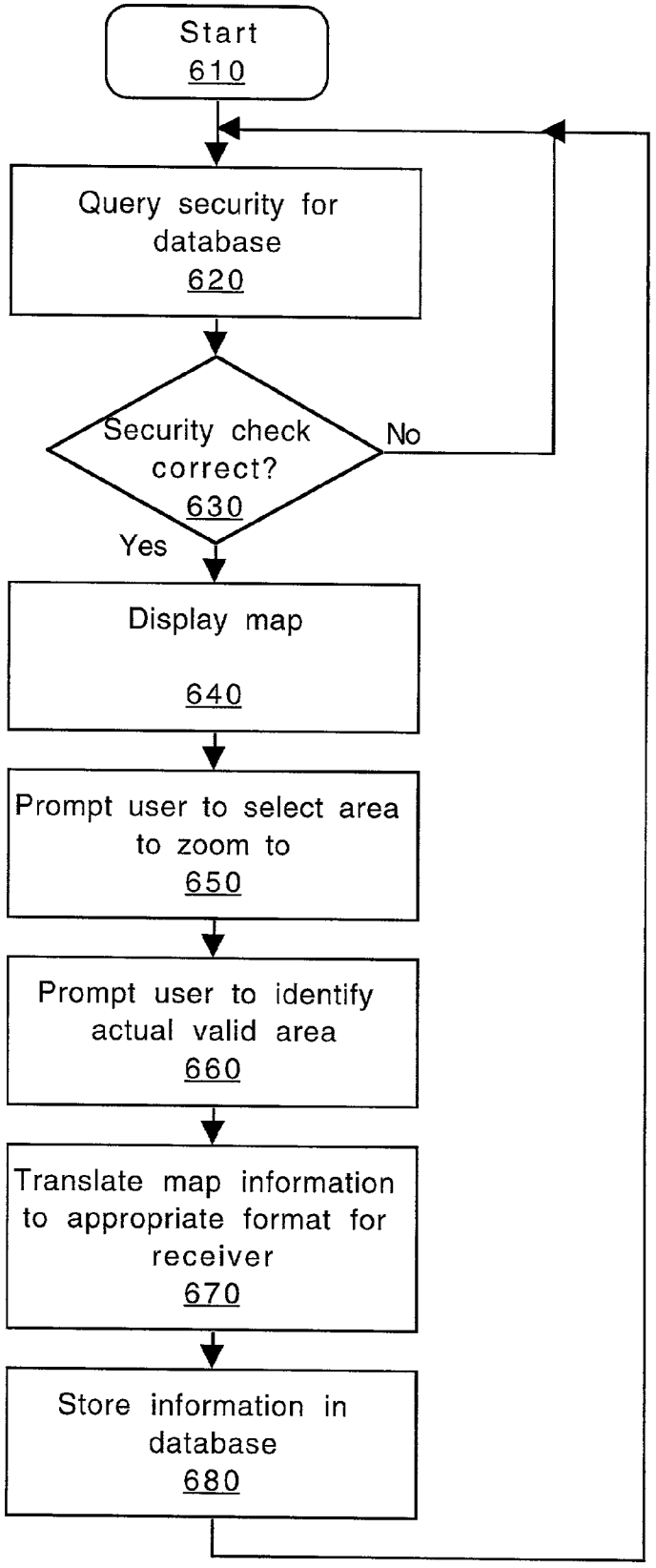

Start
610
Query security for database
620
Security check correct?
630
No
Yes
Display map
640
Prompt user to select area to zoom to
650
Prompt user to identify actual valid area
660
Translate map information to appropriate format for receiver
670
Store information in database
680

Fig. 6

GEOGRAPHIC LOCATION RECEIVER BASED COMPUTER SYSTEM SECURITY

FIELD OF THE INVENTION

[0001] The present invention relates to computer security, and more specifically, to using a geographic location for computer security.

BACKGROUND

[0002] Local identification systems provide a geographic location for a location identification system. One known location identification system is a the global positioning system.

[0003] The Global Positioning System (GPS) is a "constellation" of **24** satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location. The location accuracy is anywhere from 100 to 10 meters for most equipment. Accuracy can be pinpointed to within one meter with special military-approved equipment or by using differential GPS. Differential GPS uses a fixed location receiver in addition to a GPS satellite, to determine the exact location of the receiver.

[0004] GPS equipment is widely used in science and has now become sufficiently low-cost so that almost anyone can own a GPS receiver. The GPS is owned and operated by the U.S. Department of Defense but is available for general use around the world. The system encompasses twenty-one GPS satellites and three spare satellites in orbit at 10,600 miles above the Earth. The satellites are spaced so that from any point on Earth, four satellites will be above the horizon. Each satellite contains a computer, an atomic clock, and a radio. With an understanding of its own orbit and the clock, it continually broadcasts its changing position and time. On the ground, any GPS receiver contains a computer that "triangulates" its own position by getting bearings from three of the four satellites.

[0005] The result is provided in the form of a geographic position —longitude and latitude. If the receiver is also equipped with a display screen that shows a map, the position can be shown on the map. If a fourth satellite can be received, the receiver/computer can figure out the altitude as well as the geographic position. If the receiver is moving, the receiver may also be able to calculate its speed and direction of travel and provide an estimated time of arrival to a specified destination.

[0006] GPS receivers are becoming consumer products. In addition to their outdoor use (hiking, cross-country skiing, ballooning, flying, and sailing), one prior art use of GPS receivers is in cars to relate the driver's location with traffic and weather information.

[0007] **FIG. 1** illustrates a prior art security system for vehicles. A GPS system **120** and a cellular telephone **130** are in the vehicle **110**. When a vehicle **110** including the GPS system **120** and cellular telephone **130** is stolen, the user notifies a monitoring station which includes a monitoring system **150**. The monitoring system **150** includes an alert system **160**, an information receiving unit **170** for receiving GPS information transmitted by the vehicle **110**, and a tracking mechanism **180** that includes a GPS receiver. When the user alerts the monitoring system **150**, the information receiving unit **170** the dials into the cellular telephone **130** in the stolen vehicle **110**. The GPS system **120** on the stolen vehicle **110** transmits details of the vehicle's **110** location via the cellular telephone **130**. These longitude and latitude details are displayed on the tracking mechanism **180** of the monitoring system **150**. This permits the monitoring system **150** to direct the police to recover the vehicle.

SUMMARY OF THE INVENTION

[0008] A method and apparatus for a location based security system is described. The system includes a processor and a bus coupled to the processor. The system further includes a location receiver for receiving a current location of the system, and a database including at least one authorized location for the system. The system further includes a comparator for comparing the current location with the authorized location. The system also includes a response unit for responding if the current location does not correspond to the authorized location.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

[0010] **FIG. 1** illustrates a prior art security system for an automobile.

[0011] **FIG. 2** illustrates a computer system on which the present invention may be implemented.

[0012] **FIG. 3** illustrates a block diagram of one embodiment of the security system of the present invention.

[0013] **FIG. 4** is a flowchart illustrating one embodiment of the process of location verification.

[0014] **FIG. 5** is a flowchart illustrating one embodiment of the selection of the response.

[0015] **FIG. 6** is a flowchart illustrating one embodiment of the process of adding authorized locations to the present system.

DETAILED DESCRIPTION

[0016] A method and apparatus for a computer security system is described.

[0017] **FIG. 2** is a block diagram of the computer system **200** in which an embodiment of the present invention can be implemented. Computer system **200** comprises a bus **201** or other communication means for communicating information, and a processor **202** coupled with bus **201** for processing information. Computer system **200** also comprises a read only memory (ROM) and/or other static storage device **206** coupled to bus **201** for storing static information and instructions for processor **202**.

[0018] The computer system **200** further comprises a main memory **203**, a dynamic storage device for storing information and instructions to be executed. Main memory **203** also may be used for storing temporary variables or other intermediate information during execution of instructions. In one embodiment the main memory **203** is dynamic random access memory (DRAM).

[0019] Computer system **200** can also be coupled via I/O bus **230** to a display device **205**, such as a cathode ray tube (CRT) or liquid crystal display (LCD) screen, for displaying information to a computer user. An input device **206** is typically coupled to I/O bus **230** for communicating information and command selections to processor **202**. Another type of user input device **206** is cursor control device **206**, such as a mouse, a trackball, trackpad, or cursor direction keys for communicating direction information and command selections to processor **202** and for controlling cursor movement on display device **205**. Alternatively, other input devices **206** such as a stylus or pen can be used to interact with the display.

[0020] The computer system **200** may further be coupled via the I/O bus **230** to a network device **210** for communicating with other computers. The network device **210** may be a modem, a network card, or other device to communicate between the computer system **200** and other systems or networks.

[0021] The computer system **200** further includes a security system **220** for determining the geographic location of the computer system **200**. For one embodiment, the security system **220** is coupled to the computer system **200** via the main bus **201**. For another embodiment, the security system **220** is coupled to the computer system **200** via the I/O bus **230** or the PCI bus. Alternatively, the security system **220** may be included in the processor **202**.

[0022] **FIG. 3** illustrates a block diagram of one embodiment of the security system of the present invention. The security system **310** includes a location receiver **320**. For one embodiment, the location receiver is a global positioning system (GPS) receiver **320**. For another embodiment, the location receiver may be based on cellular telephone cell locations. Alternative systems that determine a current location may also be used.

[0023] The security system **310** further includes a database **360**. The database **360** stores authorized locations for the system. For one embodiment, the database **360** includes a user interface **365** that permits a user to modify the list of authorized locations. Furthermore, the database **360** includes a database security unit **370** that restricts access to modifying the database **360**, as will be described below. For one embodiment, the database **360** is located on a flash memory device, and the user interface **365** is a flash memory user interface **365**.

[0024] A testing unit **330** initiates location receiver **320** to test the current location. The testing unit **330** is initialized by a timer **335**. The timer **335** may include multiple functions. For one embodiment, the timer **335** simply tests the time expired since the location was last determined. For an alternative embodiment, the timer **335** tests whether the computer has been off since the last time the location was tested. For yet another embodiment, the timer **335** tests whether the computer has been in the standby state since the last time the location was tested. Alternatively, a combination of the above testing conditions, or other conditions, may be used to indicate that a new test is appropriate.

[0025] A comparator **340** is further included. The comparator **340** receives the current location information from the location receiver **320**, and compares the current location to a list of authorized locations in the database **360**. The comparator transmits a yes/no response, indicating whether or not the current location is an authorized location to the response unit **350**.

[0026] The response unit **350** responds to an affirmative answer by resetting the timer **335**. The response unit **350** responds to a negative answer by one of a variety of possible responses. These responses are described in more detail with respect to **FIG. 5** below.

[0027] The security system of the present invention is different from prior art security systems in that it is self-contained. The database included in the security system and the location receiver **320** together act as a complete system. Prior art systems generally require outside participation. The automobile security system described above requires a user to alert a monitoring station, which then can receive location data from the vehicle. The vehicle itself does not respond to the theft. Additionally, the prior art response is merely permitting monitoring of the location of the vehicle, rather than an affirmative response, as in the present system.

[0028] **FIG. 4** is a flowchart illustrating one embodiment of the process of location verification. At block **410** the process starts. At block **415**, the process tests whether timer **335** has expired. The timer may have expired because a certain period of time has expired or another event occurred. If the timer is not expired, the process loops back to block **415**, to query again. For one embodiment, this system is an interrupt driven system. The process does not continuously query the timer, rather when the timer expires, the timer sends an interrupt to the processor to initiate the process illustrated in **FIG. 4**. For one embodiment, the entire process runs in the background, without alerting the user. If, at block **415**, the timer has expired, the process continues to block **420**.

[0029] At block **420**, the system tests that the location receiver is present in the system. At block **425**, the system queries whether the location receiver was found in the system. If the location receiver was found, the process continues to block **445**.

[0030] At block **445**, the location receiver is queried for the current location of the computer system. For one embodiment, the location receiver is a GPS receiver, and the GPS receiver determines a current latitude and longitude, and possibly altitude.

[0031] At block **450**, the current location, as determined by the location receiver, is compared with location information in the database. At block **455**, the process tests whether the current location corresponds to an "authorized location" within the database. As will be discussed below, the locations within the database identify those areas to which the computer system may be moved.

[0032] If at block **455**, it is determined that the current location is in the database, the process returns to block **415**, waiting for timer to expired.

[0033] If, however, at block **455**, it is determined that the current location is not in the database, the process continues to block **460**.

[0034] At block **460**, for one embodiment, a dialog is displayed indicating that the computer is outside of the area for which its use is authorized. For an alternative embodiment, no such dialog is displayed. The process then continues to block **435**.

[0035] At block **435**, the response mechanism is activated. The response mechanism responds to the computer system being outside of the authorized locations. The specific responses may be any of a range of responses, including turning off the computer, deleting files, etc. The responses will be described in more detail below. After the response mechanism is activated, at block **435**, the process returns to block **415**, waiting for the timer to expire.

[0036] At block **425**, the system determined whether the location receiver was present in the system. If no receiver is found, the process continues to block **430**. At block **430**, the user is informed of the absence of the receiver, for one embodiment. For an alternative embodiment, no such notification is provided. The process then continues to block **435**, where the response mechanism is activated. From there, the process returns to block **415**, to wait for the timer to expire again.

[0037] **FIG. 5** is a flowchart illustrating one embodiment of the selection of the response. This flowchart is initiated when the response mechanism is activated, in block **435** of **FIG. 4**. Returning to **FIG. 5**, the process starts at block **510**.

[0038] At block **515**, the system tests whether the user has selected a response mechanism. The user may select one of a set of responses to the failure of the location testing. This selection mechanism is protected via known security techniques. For one embodiment, the user has to enter a password in order to select a response. For one embodiment, after a set number of attempts, the preset mechanism is locked, preventing a thief from breaking into the preset mechanism. Alternative protection for the selection mechanism may be used. For an alternative embodiment, the preset response may not be modified by the user. If the user did not select a response, the system proceeds to block **525**. At block **525**, the response is set to a default response. If the user selected a response, the system proceeds to block **520**. At block **520**, the response is set to the user's selected response. The chart then illustrates some of the possible routes. The system may implement any or all of the responses illustrated.

[0039] At block **530**, the system is turned off. The system may turn off and set the timer such that next time the system is turned on, it tests the location prior to doing anything else. For one embodiment, only part of the system is turned off, such as the input devices.

[0040] At block **535**, the system is locked. Locking the system prevents access to the system, without turning off the system. This may be useful, for example, if the system were simultaneously sounding an alert, for which the system needs to be turned on. For one embodiment, the system is automatically unlocked when the computer is returned to the designated area. For an another embodiment, the system can only be unlocked by using a special unlocking device such as a key, card, password, or similar system. For one embodiment, the user does not own this special unlocking device. Rather, for example, the system administrator may hold the unlocking device.

[0041] At block **540**, the user is warned that the system is not in an authorized location. This may include an audio as well as a visual warning. For one embodiment, the "authorized location" is indicated to the user. Thus, for example, the warning may read "This computer system is only authorized to be used within location X."

[0042] At block **545**, an alert is sounded. Two types of alerts may be sounded. One may be an audible alert similar to a car alarm, indicating to surrounding persons that the system was stolen. In addition, or alternatively, a silent alarm may be transmitted to a predetermined site. For one embodiment, the system may include a cellular telephone or a similar means of communicating with the outside world. In that instance, a telephone alert number may be included within the system to alert the user, the owner of the system, the police, the manufacturer, or another number that the system has been taken outside the authorized area. For an alternative embodiment, if wireless modem is included in the system, the alert may be via e-mail, or other means.

[0043] At block **550**, the system deletes sensitive files marked for deletion in the event the system is removed from the authorized area. For one embodiment the system on which this security system is implemented may include highly sensitive files. These sensitive files may be marked for automatic deletion if the system is taken out of the designated geographic area. For one embodiment, the deletion permits recovery, once the system is returned to the appropriate location. For another embodiment, such a deletion is permanent.

[0044] Any one or combination of the responses listed in blocks **530-550** may be implemented in the present system. Alternative mechanisms may be used to protect the system from removal from a designated geographic location.

[0045] **FIG. 6** is a flowchart illustrating one embodiment of the process of adding authorized locations to the present system. The system includes a database of authorized locations. These locations may be as narrow as a particular building, or as broad as all of the United States. For one embodiment, the location is defined by a latitude and longitude information. At block **610**, the process starts.

[0046] At block **620**, security is queried for the database. Adding authorized locations to the database is restricted. Otherwise, a thief could simply access the database and add the whole world as authorized area. For one embodiment, the security is a password. For one embodiment, the security is encrypted by a public key of the user, requiring the user's private key to decrypt. For one embodiment, the security includes a hardware device, such as a flash memory device, making it harder to break. Other means of ensuring that only those authorized to alter the database are permitted to access it may be used. For one embodiment, the security check includes testing whether the computer is in an authorized location at the time of access. If the computer is not in an authorized location, the security check fails.

[0047] At block **630**, the system tests whether the security check is correct. That is, the system tests whether the user attempting to access the database is authorized to do so. If the security check fails, the system returns to block **620**. If the security check is correct, the system continues to block **640**.

[0048] At block **640**, for one embodiment a map is displayed. For one embodiment, this map is of the United States. For another embodiment, this is a map of the world. For a third embodiment, the user can select the map area to be displayed from a menu or via user entry.

[0049] At block **650**, for one embodiment the user is prompted to select an area of the map. This step may be

repeated until the map is of sufficient detail to permit the user to select the actual location or locations for authorization.

[0050] At block **660**, the user is prompted to identify actual valid area. For one embodiment, this is done by marking an area within the displayed map. For an alternative embodiment, the steps illustrated in blocks **640** and **650** may be left out, leading the user directly to block **660**. In one embodiment, after block **630**, the user can directly enter latitude and longitude information. For yet another embodiment, the user may add names of designated areas, such as cities, counties, countries, etc. Alternative methods of adding information about a geographic location may be used.

[0051] At block **670**, the map information is translated into the appropriate information for the location receiver. For one embodiment, the location receiver is a GPS system, and the appropriate format is latitude and longitude information. For another embodiment, a different system may be used. For one embodiment this step may be skipped, and the information about the current location may be translated during the testing process illustrated in **FIG. 4**.

[0052] At block **680**, the information is stored in the database. The system then returns to block **610**, the starting position. The user may continue adding locations, or in the alternative, end the location addition. For one embodiment, the location addition mechanism is automatically terminated after a certain number of idle minutes.

[0053] The security system **310** may be implemented in a wide variety of systems. For example, the security system **310** may be included in a portable computer. For another embodiment the system **310** may be included in systems that have an authorized area of use, such as rental cars/vans. For example, some rental car companies prohibit removing the vehicle from the state or country. This could be monitored using the security system. Other transportable goods which may have an authorized set of locations, for example freight being transported, may also include the security system **310**. This may prevent theft of such goods. For one embodiment, the security system **310** may be implemented on the primary chip or motherboard.

[0054] For yet another embodiment, the security system **310** may be included in expensive stereos, video camcorders, high end audio equipment, military systems, defense/military items, kiosks, multimedia systems, mainframes, PBX systems, server systems, routers & hubs, super computers, etc. The security system **310** may further be included in any organizer that includes sensitive information. Additionally, the system **310** may be incorporated into sensitive equipment—f.e. systems under development. Other uses for the security system may be found as well.

[0055] 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 thereto 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 a restrictive sense.

What is claimed is:

1. A system coupled to a device, the system comprising:

a location receiver for receiving a current location of the system;

a database in the memory including at least one authorized location for the system;

a comparator for comparing the current location with the authorized location; and

a response unit for responding if the current location does not correspond to the authorized location.

2. The system of claim 1, wherein the response unit further includes means for disabling the device to which the system is coupled if the current location does not correspond to the authorized location.

3. The system of claim 1, wherein the response unit is further includes means for sending a warning to a user.

4. The system of claim 1, wherein the response unit is further includes means for alerting authorities if the current location does not correspond to the authorized location.

5. The system of claim 1, wherein the response unit is further includes means for deleting files.

6. The system of claim 1, wherein the response unit is further includes means for locking the computer system until the current location corresponds to the authorized location.

7. The system of claim 1, further comprising a timer for triggering a comparison by the comparator of the current location and the authorized location on a periodic basis.

8. The system of claim 1, wherein the location receiver comprises a global positioning system (GPS) receiver.

9. The system of claim 1, further comprising:

a user interface for adding authorized locations to the database.

10. The system of claim 9, wherein access to the user interface is protected by a security mechanism.

11. The system of claim 10, wherein the security mechanism is a password system.

12. The system of claim 9, wherein the database is on a flash memory card, and wherein the user interface is a flash memory user interface.

13. The system of claim 9, wherein the user interface further comprises:

a map display mechanism for displaying a map; and

a selection mechanism for selecting an area within the map as an authorized location.

14. The system of claim 13, further comprising a translation mechanism for translating the area to geographic coordinates for the location receiver.

15. A method of security for an item including a processor and a database, the method comprising the computer implemented steps of:

periodically receiving a location information corresponding to a current geographic coordinates of the item from a location receiving unit;

comparing the current location of the item with an authorized location in a database of authorized locations;

reacting if the current location of the item does not correspond to an authorized location.

16. The method of claim 15, wherein said step of reacting comprises the step of disabling a computer system.

17. The method of claim 16, further comprising the step of preventing the computer system from being enabled until the current location corresponds to an authorized location.

18. The method of claim 15, wherein said authorized location may be a plurality of authorized locations, and said step of comparing the current location comprises the step of comparing each of the plurality of authorized locations with the current location.

19. The method of claim 15, further comprising the steps of:

receiving a request for changing the database of authorized locations;

verifying an authorization to change the database of authorized locations; and

if an authorization is received, enabling a user to add additional authorized locations to the database of authorized locations.

20. The method of claim 19, wherein said step of enabling a user to add additional authorized locations comprises the steps of:

displaying a map;

prompting the user to select a new authorized location on the map.

21. The method of claim 20, further comprising the step of translating the new authorized location into a set of location coordinates.

22. The method of claim 20, wherein said step of displaying a map comprises the steps of displaying a plurality of increasingly detailed maps based on the user's selections.

23. A system comprising:

a processor;

a bus;

a memory coupled to the processor and the bus, the memory including a database including at least one authorized location for the system;

a location receiver for receiving a current location of the system;

the processor for comparing the current location with the authorized location; and

a response unit for responding if the current location does not correspond to the authorized location.

24. The system of claim 23, wherein the response unit is further for disabling the processor if the current location does not correspond to the authorized location.

* * * * *