METHOD AND APPARATUS FOR DETECTING AND IDENTIFYING FIREARMS

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ABSTRACT

A system for detecting the presence of firearms and identifying their unique status includes a radiofrequency identification chip supported within each firearm either by the manufacturer or by later retrofit. The RFID chip stores the unique serial number for the firearm, preferably in nonvolatile form. A reader for the chips may be used to transmit an interrogating signal from a distance which causes the chip to send a responsive signal including its serial number. The reader picks up the serial number and provides it to an associated computer. The serial number so obtained may be used with databases to maintain inventories of firearms or determine the history of firearms.
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RELATED APPLICATION

[0001] This application claims priority of U.S. Provisional Patent Application Ser. No. 60/549,128 filed Mar. 1, 2004, which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] This invention relates to a system for remotely detecting the presence of a firearm and identifying the serial number of the firearm employing radiofrequency identification (RFID) tags embedded in firearms and remote readers for the RFID tags.

BACKGROUND OF THE INVENTION

[0003] There are many situations in which it is desirable to have the ability to detect the presence of a firearm from a distance and, in certain situations, to determine a serial number assigned to the firearm. For example, when police officers approach a parked vehicle it is often of importance for them to know whether a firearm is contained in the vehicle. The officers’ approach to the situation can be critically dependent upon this knowledge. Similarly, it is common practice to screen persons entering public places such as schools, airports, concert halls and the like for firearms. In these applications it would be very advantageous to be able to determine whether a firearm was carried by a person without actually searching the person. Present systems for conducting such searches, including x-ray systems and the like, are extremely expensive and relatively slow in operation.

[0004] Systems that can detect and identify a serial number of firearms from a distance would also be extremely useful to inventory firearms in police stations and the like to prevent them from being misplaced or stolen.

SUMMARY OF THE INVENTION

[0005] The present invention detects the presence of firearms by embedding an RFID tag into the firearm in such a manner that it could be interrogated by a remote reader. Conventional RFID chips incorporate nonvolatile memories which can store information such as the serial number of the firearm and further include electronic circuitry for receiving an interrogating signal from a remote reader device and responding to the interrogation signal by sending out a signal including the serial number stored in the RFID chip.

[0006] Those RFID chips which are commercially available have employed digital circuitry, but development work is underway on RFID chips employing analog circuitry which could be readily employed with the present invention. While commercially available chips have employed silicon circuitry, reports of development work on chips employing quartz crystals have been made and they could be equally employed in the present invention.

[0007] The RFID chips employed with the present invention are preferably of the passive type which include circuitry for converting at least a portion of the received signals from the interrogator into electrical power required by the chip for signal processing and transmission. Thus, no data is required and the unit is essentially permanent. Alternatively, the present invention could be employed with active chips employing long life, low power batteries. The RFID chips are preferably programmed to store the serial number of the firearms in their nonvolatile memories.

[0008] Broadly, the method of the present invention involves detecting a firearm from a distance by transmitting an interrogating signal to RFID chips and detecting the responses which will preferably include the serial number. The absence of any response indicates that there is no firearm equipped with an RFID chip in the immediate area. If a plurality of responses are received, the reader preferably includes computer circuitry for separating and identifying the separate signals. These techniques are well known to those skilled in the RFID art. The reader may be associated with a computer system which can include, either locally or remotely, a database of firearm serial numbers for the purpose of identifying firearms which have been stolen or the like. A central database might be provided and the Internet or other public network used to communicate information from a local reader to the database.

[0009] The RFID chips of the present invention may be built into the firearm during manufacture or added subsequently. Preferably, laws could be passed requiring the implantation of chips in firearms prior to the sale. The serial numbers of firearms sold with the RFID chips would be transmitted to a central database which might be interrogated to determine the identity of a particular firearm. The database might further store information relating to a particular firearm after sale such as resale, use in criminal activity, etc.

[0010] By way of example, a police officer who has stopped a vehicle might transmit an interrogating signal to the vehicle, and upon receiving the serial number of a firearm located in the vehicle, send that serial number, via the Internet or the like, to the central database to retrieve any available history relating to the firearm. If the history included the fact that the firearm had been stolen or had been used in a criminal activity, the officer would be alerted as to precautions to be used with respect to the vehicle. In the preferred embodiment of the invention the computer system associated with the reader would automatically communicate with the central database to retrieve stored information relating to a particular serial number when that serial number was received in response to an interrogating signal.

[0011] The RFID chips of the present invention are preferably retained in a recess formed in the body of the firearm having an exposed surface so as to allow the easy reception and transmission of interrogating and responding signals. If the body of the firearm is of a ferromagnetic material such as steel, the chip might be supported on a radiofrequency absorbing elastomer layer or other absorbing substrate material to prevent interference with the transmission and reception of signals.

[0012] The RFID chip may be of any conventional commercially available form but preferably takes the form of a polyester film with a printed or etched antenna embedded with a silicon chip. This is the type of chip that is commonly used to identify commercial shipments. The reader may take the form of a portable device which may be carried by police officers and the like or may alternatively be a permanent device stationed at the entrance to stadiums, theaters, schools and other mass attendance venues in which it would
be desirable to detect the presence of firearms. The reader incorporates a transmitter which sends an RF signal of the frequency to which the RFID chips are sensitive and a receiver for the transponder signals returned by the RFID chips. It also preferably includes a computer for processing the signals and for communicating with the central database to obtain the history of a particular firearm.

[0013] If the firearm is made of a nonferromagnetic material or has a nonferromagnetic section such as a butt or handle, the cavity for the chips may be formed directly in this nonferromagnetic section. Weapons which are made from steel typically have wood or plastic handgrips, and this affords a convenient position in which to place the chip. In the case of weapons made entirely from ferromagnetic materials, a cavity in the weapon may be lined with a radiofrequency-absorbing elastomer or other radiofrequency-absorbing material to shield the chip from fields which might be induced through the ferromagnetic sections.

[0014] Inventory systems for firearm repositories in a police station, army base or the like may be monitored by having a reader that periodically reads the serial numbers of all of the weapons in the repository and stores this information on a computer. When a firearm is removed from the repository, means will be provided to allow an authorized person to enter his identification so that the computer may store a record of all firearms contained in the facility and those which are checked out and to whom they were checked out. An alarm system may be activated by removal of a weapon without providing the proper identification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Other objects, advantages and applications of the invention will be made apparent by the following detailed description. The description makes reference to the accompanying drawings in which:

[0016] FIG. 1 is a schematic diagram of a system for detecting and identifying a handgun including a reader for RFID chips which communicates with a chip supported in the handgun, a computer which receives the output of the reader and communicates with a remote database associated with a central computer to determine the history of the identified weapon, and a display for providing associated information to the user of the system;

[0017] FIG. 2 illustrates a typical handgun having an RFID chip disposed in a recess formed in the hand stock;

[0018] FIG. 3 is a cross-sectional view of the hand stock of FIG. 2 taken along lines 3-3 of FIG. 2; and

[0019] FIG. 4 is a schematic diagram of an inventory system for handguns involving a controlled area and a computer for maintaining an inventory of the weapons in the area through an RFID reader.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0020] Referring to the drawings, a typical system employing the method of the present invention is illustrated in FIG. 1. A handgun 10 having a handgrip 12 is conventional except for the formation of a socket 14 which constitutes a recess in the surface of the handgrip. The socket supports an RFID chip 16 which is programmed to retain the serial number of the handgun as assigned during its manufacture or later retrofit. The RFID chip is preferably of the digital, passive type typically employed with shipment containers. The RFID chip is of relatively small dimensions, such as one or two centimeters, and of a thickness of a fraction of a centimeter. The cavity 14 has sufficient thickness so that the surface of the chip does not extend into the grip area. It may be covered in such a way as to be substantially invisible.

[0021] A reader 18 for the RFID chip 16 is capable of sending an interrogating signal to the chip from a substantial distance such as in excess of fifty feet away. Improved versions of the RFID chips and their readers will in the future likely have a substantially greater range. The reader is of the conventional type which may be commercially available and, when actuated, operates to send an interrogating signal out on an omnidirectional basis. If a chip compatible with the interrogating signal is within range of the reader, the chip will receive the signal, store RF energy contained in the interrogating signal, and use that energy to transmit a response which encodes the serial number stored in the chip 16. If no compatible RFID chip is within the range, no response signal will be received. In the event a number of devices embedded within RFID chips are within the range, a plurality of signals will be received and conventional technology will be used to separate the signals. This program is embedded in a computer 20 connected to the reader 18. The computer includes a display 22 which may be a numeric or graphic display for displaying the serial number of responding chips.

[0022] In a preferred embodiment of the invention the computer 20 has transceiver capability and connects through a network, preferably a public network such as the Internet 24, with a central computer 26. A single central computer will preferably be located to service a large area such as a state or the entire nation. The computer 26 includes a database 28 which stores information relating to the serial numbers such as their date of manufacture and any history of the particular firearm which may be entered from time to time, such as the gun's registered owner, its use in crimes, having been reported stolen, etc. This information is transmitted back from the central computer 26 to the local computer 20 through the Internet 24 and an output is generated on the display 22 indicating the reported history of the particular firearm 10.

[0023] In a typical application a police officer stops a vehicle for a traffic infraction or other reason. A reader is supported on the police officer's person or in the police officer's vehicle and includes a reader which sends out an interrogating signal. If the vehicle contains a firearm equipped with an RFID chip in accordance with the present invention, the tag will receive the interrogating signal and send back to the reader its unique serial number. The fact that the vehicle contains a firearm may be sufficient information for the police officer to take appropriate action. In alternative situations the computer associated with the police officer's vehicle will send a signal to the central computer 26 to obtain the stored history of the firearm to further provide the police officer with information which will enable an appropriate action for the situation. There may be a wireless communication system between a portable reader carried by
the police officer and a computer located in the police vehicle which can then communicate with the central database.

[0024] FIG. 2 is a more detailed view of a typical handgun 30 equipped with an RFID chip. The handgun 30 has steel sections but it employs a plastic handgrip 32. The recess 14 is formed in the handgrip and supports an RFID chip 16. The surface of the chip is preferably flush with or below the surface of the handgrip so as to not interfere with the firing of the handgun. The chip may be covered in such a way as to make removal of the RFID chip very difficult. As illustrated in the cross-sectional view of the hand stock 32 of the gun, illustrated in FIG. 3, an RF absorbing base such as an elastomer material 32 may be placed beneath or around the chip 16 to minimize interference from the steel parts of the gun.

[0025] An embodiment of the invention used for inventorizing a number of firearms equipped with the RFID chips of the present invention is illustrated in FIG. 4. The controlled storage area 40, generally indicated at 40, may be a closed cage accessed by a door 42. An RFID chip reader 44 is centrally disposed within the storage area 40 and is in communication with a computer 46. At regular intervals, such as once a minute, the computer energizes the reader 44 to send out an interrogating signal. The responses from the firearms within the controlled area 40 will be picked up by the reader 44 and provided to the computer 46 which includes software for separating the responses and storing the serial numbers of the firearms responding. The computer may also store a list of the firearms that are normally stored in the controlled area and compare the two lists and feed the information to a display 48.

[0026] The controlled area 40 may include a card reader 50 or other input device which allows a person removing a firearm from the area 40 to provide authorizing input. That person may then remove a handgun and the computer 46 will maintain a record of who removed a particular handgun. When a firearm is removed from the controlled area 40 without authorization, an alarm 52 may be energized to alert responsible parties. When a firearm is replaced within the enclosure 40, the party doing so will indicate his authorization to the input unit 50 and the computer 46 will correct the inventory.

[0027] It should be recognized that the systems of the present invention could be used with walk-through systems of the type used at airports and the like which would incorporate RFID readers. The system might also be used with crowd control officers and for general security purposes.

[0028] Having thus disclosed my invention, I claim:

1. A method of detecting firearms, comprising:
   embedding a transponder unit encoded with a serial number for the firearm in the firearm; and
   transmitting an interrogating radiofrequency signal from a reader which is received by the transponder and causes the transponder to trigger transmission of a responding signal for reception by the reader, including an identification of the serial number of the firearm.
   2. The method of claim 1 wherein the transponder comprises an RFID unit.
   3. The system of claim 2 where the RFID unit is a single chip.
   4. The method of claim 1 further including transmitting the serial number of the firearm from the reader to a computer having access to a database relating to the firearm.
   5. The method of claim 4 in which the database is located remotely from the computer and communication between the two is wireless.
   6. A system for detecting firearms comprising:
      a plurality of firearms having RFID chips embedded within them, each RFID chip being encoded with the serial number of the associated firearm;
      a reader for transmitting a radiofrequency interrogating signal which may be picked up by RFID chips within its transmission area and will trigger the RFID chips responding to a signal, including the serial number of the associated handgun for reception by the reader; and
      a computer operative to receive the serial numbers received by the reader and to generate an output signal.
   7. The system of claim 6 in which the RFID chips are digital and passive, using the energy in the interrogating signal to generate a responding signal.
   8. The system of claim 6 wherein the RFID chips are active, employing a battery to power the chip.
   9. The system of claim 6 wherein the RFID chip is supported in a cavity formed in the hand stock of the firearm.
10. The system of claim 9 wherein the RFID chip is supported within the cavity on a base of a radiofrequency absorbing material.
11. The system of claim 10 wherein the radiofrequency absorbing material is an elastomer.
12. The system of claim 10 wherein the RFID chip is formed on a polyester film with an imprinted antenna embedded with a silicon chip.
13. The system of claim 10 wherein the RFID chip is formed on polyester film with an etched antenna embedded with a silicon chip.
14. A firearm for use with a firearm detection and identification system, comprising:
   a cavity formed on the surface of the firearm; and
   an RFID chip supported within the cavity, the RFID chip being encoded with the serial number of the firearm; whereby an RFID chip reader can determine the presence and serial number of the firearm bearing the chip remotely.
15. The firearm of claim 14 further including an RF absorbing elastomer base separating the chip from the cavity.
16. The firearm of claim 15 wherein the RFID chip is formed on a polyester film with a printed antenna embedded with a silicon chip.