

Access control systems and methods

The invention relates to access control and/or administering access to events, facilities and the like. More particularly, the invention relates to systems and
5 methods for administering access using a token, such as a card, carried by user and bearing data by which the bearer's entitlement to access an event, facility or the like is determined.

As indicated above, the system is adapted to administer access to events, facilities
10 and the like. Elsewhere in this specification, the events, facilities and the like are collectively referred to as "matters". This term is to be taken to include, but not to be limited to, events such as concerts, screenings of movies, seminars, and so on, facilities such as buildings (including secure and/or restricted access buildings and/or areas there within), museums, libraries, theme parks or other leisure facilities,
15 transportation, resources such as printers, photocopiers, and other matters such as services such as massages, free exit from a car park or garage, and retail offerings including reductions on certain items (whether or not contingent on the purchase of another item), free items, and so on.

20 A first aspect of the invention provides a portable access token comprising: memory configurable to store simultaneously information relating to a plurality of access rights; a processor for causing information to be stored in the memory, for retrieving information from the memory and for processing information; and a transponder for receiving incoming signals and transmitting response signals; the processor being
25 adapted, in response to an incoming signal relating to a particular matter for which access rights are required, for retrieving information from the memory and for causing the transponder to transmit a response signal in dependence thereupon.

Thus, the token is able to store information indicating that the bearer is to be
30 granted access to more than one matter. The matters may be packaged at the

preference of the consumer or, for example, they may be complementary to one another: a particular theme park and to transportation to the theme park.

5 In one embodiment, the token is an RFID device: perhaps a passive RFID device such as a smart card.

10 Preferably, wherein the processor is responsive to an incoming signal (e.g. an RF signal) for storing information in the memory or updating information stored in the memory.

15 In one embodiment, the memory also stores conditional rules relating to the access rights. For example, a particular matter might be accessible an unlimited number of times for a predetermined period following the first access. In another example, matters might be packaged to allow a user to select a limited subset of a broader selection: two matters from a possible six, for example.

20 In one example in which the token stores conditional rules, the processor is adapted to cause the transponder to transmit a response signal in dependence upon the conditional rules. That is to say, the token is responsible for determining the impact of the rules. In an alternative, the token transmits the rules to an interrogating device, together with information relating to access to a particular matter, and the interrogating device determines the impact of the rules.

25 In either case, in some embodiments, the processor is adapted to update the information stored in the memory in dependence upon the conditional rules. For example, following expiry of a time limit for multiple access to a matter, the information relating to that matter might be updated simply to indicate that access to the matter is no longer allowed. Thus the question of access can thenceforth be determined by simple reference to that information, without requiring determining
30 whether the limit period had yet expired.

A second aspect of the invention provides an apparatus for administering access to a plurality of matters, the apparatus comprising: a user interface for allowing a user to indicate that access to a plurality of matters is to be granted; and a transmitter for transmitting to a portable access token a signal for causing the token to store
5 information indicating that access to the plurality of matters is to be granted.

In one embodiment, the apparatus is located in an agency where an operator initializes a token to allow access to a predetermined selection of matters. In another embodiment, the apparatus might be self-service in nature, allowing the
10 user of the token to select matters (individually or in packages) and, if appropriate, to pay for the matters by credit card or other means.

The token is preferably as discussed above.

15 As discussed above, the matters may be packaged in ways in which conditional rules apply. In such cases, the apparatus may further include a processor responsive to the user interface for causing the transmitter to transmit to the token a signal for causing the token to store conditional rules relating to the access rights.

20 A further aspect of the invention provides an apparatus for administering access to a plurality of matters, the apparatus comprising: a transmitter for transmitting a signal, including information relating to a particular matter for which access rights are required, to a token having memory storing information indicating that access to a plurality of matters is to be granted, for causing the token to respond in
25 dependence upon whether information indicating that access to that particular matter is to be granted is among the stored information; and a receiver for receiving a response signal from the token.

Thus, at an access point for a matter (the entrance to theme park, the exit to a
30 garage, or the check-out at a food & beverage outlet, for example), the token may be interrogated to determine whether the bearer has access.

Preferably, the transmitter is adapted to transmit to the token a signal for causing the token to modify the stored information. For example, where the token includes information indicating that access to a particular matter is to be granted, and subject
5 to any conditional rule for example allowing repeat access for a predetermined period, the apparatus may modify the information stored on the token to prevent future access to that matter.

In further embodiments, the apparatus may be adapted to receive from the token
10 conditional rules relating to access rights to a plurality of matters, and the transmitter may then be adapted to transmit to the token a signal for causing the token to modify the stored information in a manner determined in dependence upon the conditional rules. Thus, the apparatus may update the information on the token, for example once a predetermined period of access to a matter has expired.

15 In other embodiments, the processor on the token may perform this updating of information.

A further aspect of the invention provides a method for administering access to a plurality of matters, the method comprising storing on a token information
20 indicating that access to the plurality of matters is to be granted.

The method preferably further comprises storing on the token conditional rules relating to access to the plurality of matters. For example, the conditional rules may include, in respect of at least one of the plurality of matters, information indicating
25 that access is to be granted for a predetermined period following a first access to the matter. Additionally or alternatively, the conditional rules may include information indicating that access is to be granted to a predetermined maximum number of the plurality of matters.

30 A further aspect of the invention provides a method for administering access to a plurality of matters, the method comprising, at an access point for a particular

matter, interrogating a token having stored upon information indicating that access to a plurality of matters is to be granted to determine whether that particular matter is among the plurality of matters.

- 5 In some embodiments, the method may further comprise causing the token to modify information stored upon it. For example, the method may comprise obtaining from the token conditional rules relating to access to the plurality of matters, and the step of causing the token to modify information stored upon it may be performed in dependence upon the conditional rules.

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Also disclosed herein is an RFID access card comprising a plurality of memory partitions, each of the plurality of memory partitions configured to store data relating to a user's right to access one or more of a corresponding plurality of events.

- 15 Various advantages may be realized with such a token, apparatus and methods. For instance, at least in one preferred form, they may make it simpler and faster to enter attractions and may reduce the paper required to be carried by a tourist attending attractions.

- 20 The invention will now be described, by way of example only, and with reference to the accompanying figures, in which:

Figure 1 is a schematic view of an RFID smart card;

Figure 2 is a schematic view of a first apparatus;

Figure 3 is a schematic view of a second apparatus;

- 25 Figure 4 is a flow chart illustrating an algorithm for initializing an RFID smart card to be able to store information relating to a plurality of matters;

Figure 5 is a flow chart illustrating a method for initializing a card with information relating to a plurality of matters;

Figure 6 is a flow chart illustrating a method of determining whether access to a

- 30 matter is to be allowed, with reference to whether the bearer is an adult or a child;

Figure 7 is a flow chart illustrating a method of using a token to obtain multiple access to a matter for a time-limited period;

Figure 8 is a flow chart illustrating a method of using a token to administer access to matters where a user has access to a number of matters chosen from a broader selection; and

Figure 9 is a flow chart illustrating a method of uploading information from the apparatus shown in Figure 2 or Figure 3 to a central database.

Turning now to Figure 1, a portable access token in the form of a RFID smart card 100 (e.g. a passive RFID card) comprises memory 102 configurable to store simultaneously information 104a ... 104n relating to a plurality of access rights. A processor 106 is operable to cause information to be stored in the memory 102, for retrieving information from the memory and for processing information. Memory 102 is partitioned into a plurality of memory partitions for storing information 104a ... 104n. A transponder 108 receives incoming signals and transmits response signals.

As discussed in more detail below, the processor 106 is adapted, upon receipt of an incoming signal by the transponder 108 relating to a particular matter for which access rights are required, for retrieving information from the memory and for causing the transponder to transmit a response signal in dependence thereupon.

The memory 102 also stores conditional rules 110 relating to the access rights. For example, one or more particular matters might be accessible an unlimited number of times for a predetermined period following the first access. In another example, matters might be packaged to allow a user to select a limited subset of a broader selection: two matters from a possible six, for example. Both examples will be discussed in further detail below.

In one example in which the token stores conditional rules, the processor is adapted to cause the transponder to transmit a response signal in dependence upon the conditional rules. That is to say, the RFID smart card is responsible for determining

the impact of the rules. In an alternative, the smart card transmits the rules to an interrogating device (as discussed below), together with information relating to access to a particular matter, and the interrogating device determines the impact of the rules.

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In a preferred embodiment, the memory is configured to be able to store information relating to 64 matters. In another preferred embodiment, information relating to 256 matters may be stored. In some embodiments, this is achieved using discrete sections (or partitions) of memory which store information relating to a
 10 respective matter, and conditional rules relating to that matter and whether the bearer currently has access to the matter. In other cases, separate memory sections may include information about a matter and any conditional rules relating to it, while whether or not the bearer currently has access may be stored in a single bit in a sequence of bits relating to the various matters. In another alternative
 15 arrangement, the token contains data relating to the user's access rights for interrogation by a reading device which is configured – e.g. having conditional rules stored therein – to determine whether the user has access rights to a particular matter.

20 In one embodiment, the segmenting of memory on the token is achieved using a Java Applet within the token that determines the content of the card.

In a preferred embodiment, the memory also includes information relating to the identity of the bearer, such as name and address. In this way, the bearer's use of the
 25 card may be tracked and demographic information derived.

Turning to Figure 2, a token writing apparatus 200 for administering access to a plurality of matters comprises a user interface 202 for allowing a user to indicate that access to a plurality of matters is to be granted. A transmitter 204 transmits to
 30 a portable access token (in the preferred embodiment, a token in the form of an

RFID smart card as discussed above) a signal for causing the token to store information indicating that access to the plurality of matters is to be granted.

5 The apparatus further includes a receiver 205 for receiving a response from the token, and a processor 206.

In some embodiments, the token writing apparatus 200 may be a dedicated standalone device with a dedicated user interface. In other embodiments, however, the apparatus comprises a computer peripheral device 208 which may be operably
10 connected to a general purpose computer 210, the device including the transmitter 204 and the computer providing the user interface 202 and the processor 206.

In one embodiment, the token writing apparatus 200 is located in an agency where an operator initializes a smart card to allow access to a predetermined selection of
15 matters. In another embodiment, the apparatus might be self-service in nature, allowing the user of the smart card to select matters (individually or in packages) and, if appropriate, to pay for the matters by credit card or other means.

Turning to Figure 3, a token reading apparatus 300 for administering access to a
20 plurality of matters comprises a transmitter 302. The transmitter is operable for transmitting a signal to a token, for example an RFID smart card as discussed above, having stored in memory information indicating that access to a plurality of matters is to be granted. The signal includes information relating to a particular matter for which access rights are required and is adapted to cause the smart card to respond
25 in dependence upon whether information indicating that access to that particular matter is to be granted is among the stored information. The apparatus further includes a receiver 304 for receiving a response signal from the smart card.

As with the token writing apparatus discussed above, the token reading apparatus
30 300 may be a dedicated standalone device or it may be a device 306 which may be

operably connected to a general purpose computer 308 including a processor 310 and user interface 312.

5 The token reading apparatus 300 may be located at an access point for a matter (the entrance to theme park, the exit to a garage, or the check-out at a food & beverage outlet, for example), at which the smart card may be interrogated to determine whether the bearer has access.

10 The transmitter may be adapted to transmit to the smart card a signal for causing the smart card to modify the stored information. For example, where the smart card includes information indicating that access to a particular matter is to be granted, and subject to any conditional rule for example allowing repeat access for a predetermined period (as discussed below), the apparatus may modify the information stored on the smart card to prevent future access to that matter.

15 In a preferred embodiment, a public key is placed in the smart card and a private key is placed in the token reading apparatus. When tapping the smart card against the reader both will first check for a match with keys. If this matches it will continue to validate the smart card.

20 In further embodiments, the apparatus may be adapted to receive from the smart card conditional rules relating to access rights to a plurality of matters, and the transmitter may then be adapted to transmit to the smart card a signal for causing the token to modify the stored information in a manner determined in dependence upon the conditional rules. Thus, the apparatus may update the information on the token, for example once a predetermined period of access to a matter has expired. 25 In other embodiments, the processor on the smart card may perform this updating of information.

30 As indicated above, the matters may be packaged in a number of ways. For example, a particular matter may be packaged to allow entry as often as desired

within a period of seven days commencing with the first entry. In another example, the user of the smart card may be allowed to access a number of matters at their choice selected from a broader set of matters. For example, the user may be allowed to access any two attractions from a group of six. Both of these examples are discussed in greater detail below. In these and other examples, conditional rules apply for determining whether access to a matter should be granted. In such cases, the processor 310 may be responsive to the user interface for causing the transmitter to transmit to the token a signal for causing the smart card to store conditional rules relating to the access rights.

Further examples of ways in which matters may be packaged, discussed with reference to Singapore by way of example only, include:

- Bundling matters on a seasonal basis. For example, bundling attractions, tours and night spots into a Singapore Christmas Program card. Tourists will be encouraged to hop on and hop off a hopper bus at attractions on a Christmas light up route, as well as drinks at food and beverage outlets. Sponsors can also step in and contribute their value adds to this program, in which the card can control redemption.
- Bundling matters on an experience basis. For example, bundling stops, events and meals into a Singapore Makan Jalan Program card (during the Singapore Gourmet Summit). Tourists will be encouraged to hop on and hop off a hopper bus at stops to partake of local specialities.
- Bundling matters on a business to business basis. For example, Singapore inbound operators might bundle the services of other operators with their services. As another example, a cinema might bundle free exit from a shopping mall garage with access to a movie.
- Bundling matters on an events basis. For example, bundling night spots and pre- and post-events into a Singapore Grand Prix Program card. These can be a mix of events just off the GP circuit (like concerts), with attractions that tourists can part take off during the day, as well as drinks at food and

beverage outlets. Sponsors can also step in and contribute their value adds to this program, in which the card can control redemption.

In other embodiments, cards may have installed relating to matters at events such as
5 ITB Asia. Such cards may include branding for the event and/or for sponsors

In a preferred embodiment, the token reading apparatus includes communications modules such as a GSM module 312 and a SIM card 314 for allowing the apparatus to communicate with a central computer, as discussed in further detail below.

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Turning to Figure 4, the process for initializing a smart card includes placing the card on a reader (i.e. the token writing apparatus 200). The reader interrogates the card and identifies it as a card suitable for use with the system. In one embodiment, the card is authenticated at this stage using the public and private keys. In another
15 embodiment, the public key is established at this stage and stored on the card. The token writing apparatus is then operable to cause the Java applet on the card to segment the memory on the card.

Turning to Figure 5, once the card has been initialized generally for use in the
20 system, in one embodiment, it is initialized with respect to the package of matters for which it is to be used. To perform this step, the token writing apparatus may require a password to be entered. In some situations, for example agencies responsible for the sale of packages, multiple cards may be initialized at the same time. In such cases, for increased security, the token writing apparatus may require
25 that serial numbers of the first and last cards to be initialized be entered. The operator may then name the package (e.g. Singapore at Christmas) and enter information relating to the validity of the package (e.g time limited), whether the cards are to be for use by adults or children, and the matters to form part of the package. Then the cards are written to, in serial number order, by placing them on a
30 card reader.

In a preferred embodiment, for the purposes of security, a password may be required in the event that the cards are not presented in serial number order.

5 In a further preferred embodiment, the segmentation process and/or the initialization process may require that the operator present a master card for reading in addition to or instead of providing a password.

10 There now follows discussion of how the card is used by a bearer to obtain access to matters in dependence upon his age and the package installed on the card.

In overview, at an access point for a matter, a smart card reader validates whether the card is allowed to access the terminal. It then proceeds to validate whether the card is for an adult or child. After this process it will validate what kind of package is installed. For example, the tourist has purchased a 2 out of 6 attractions package (as
15 discussed below) and wants to visit the zoo. It will be validated and allow the tourist to enter. If he were to try to enter the zoo again, the algorithm will check and validate that he has already entered the zoo and will not grant entry again.

Turning to Figure 6, token reading apparatus (preferably RFID smart card readers)
20 are located at the point of access to all matters which might be accessible using the card. For example, they may be located at the entrance to attractions such as zoos, theatres, aquaria and the like, and at retail and food and beverage outlets.

Upon being presented with a smart card by a person seeking access to a matter, an
25 operator places the card on the card reader. A user interface allows the operator to indicate whether the bearer of the card is an adult or a child. The token reading apparatus then interrogates the card to determine whether it may be used by a person of that age. For example (and as shown in Figure 6), the card may have been initialized to be used only by an adult or only by a child. In alternative embodiments,
30 when the package was installed, a matter may have been specified as being

accessible by an adult or a child or a predetermined number of each (i.e. a family ticket).

Returning to the embodiment shown, once the system has determined that the
 5 bearer of the card is of the appropriate age, the token reading apparatus proceeds to consider the package installed on the card to determine whether access is to be granted.

In addition to discriminating between bearers of cards on the basis of age, in
 10 preferred embodiments, discrimination may be performed, and thus access determined, on another basis. For example, where the system is used entry to certain events and conferences and/or certain sections of a particular event. By using user information stored in the card, the system can determine what conference and section the user can access. The system will also be able to track
 15 where the user visited within that particular event. A user can be a buyer, seller, agent, exhibitor, and so on. By tracking where they visit, the system is able to derive data about their profiles, purchases or redemptions and to track whether the user attended the event.

20 Turning to Figure 7, and as indicated above, a package installed on a card may provide access to a matter for a predetermined period commencing on a fixed date (e.g. the date of purchase), ending on a fixed date or, as shown, commencing upon the first use of the card to access the matter in question.

25 In such a case, whether access is to be granted may not simply be a matter of checking a bit of information. Conditional rules are preferably stored in connection with the matter in question. Upon interrogation, the card notifies the reader that such rules apply (in another embodiment in which all matters are time limited, the card does not notify the reader of such rules). The reader then checks the validity of
 30 the card for access to the matter by:

- Checking whether data has been set indicating that the card has previously been used to access the matter.
 - If not, setting the data.
 - If so, checking whether the current date/time is within the validity period and
- 5 granting or denying access accordingly.

In one such embodiment, the card reader may cause the card to update the stored information to indicate that the card may not be used to access the matter in question. Thereafter, the question of access to that matter can be determined by

10 simple reference to that information, without requiring determining whether the limit period had yet expired.

Here and elsewhere in the specification, where reference is made to updating information on the card, the updating may be achieved by means of the card reader

15 causing memory to be written directly or it may be achieved via the Java applet stored on the card.

Turning to Figure 8, as indicated above, a package may allow a user to access a chosen subset of matters from a broader selection. For example, a user may be

20 entitled to access any two attractions out of six available options, at his choice.

As shown, the card is first read by the card reader and the system determines whether the bearer is of the appropriate age to use the card, as discussed elsewhere. The card reader then checks whether the matter to which the bearer

25 desires access forms part of the package installed on the card; that is to say, whether it is among the six available options. If not, access is denied. If so, the card reader checks whether the number of remaining accesses is greater than zero. If not, access is again denied. Otherwise, information on the card relating to the number of available accesses is decremented, and access is granted.

In a preferred embodiment, a receipt may be printed showing the remaining availability of the package.

Turning to Figure 9, the system allows operators of token reading apparatus and
5 token writing apparatus to cause the apparatus to upload information relating to activity at that apparatus to a central computer. This may be achieved, for example, using the communications modules in the card reading apparatus 300.

Using a user interface, an operator selects an upload or "Settlement" option. The
10 apparatus then checks whether an upload batch file exists. This batch file is created on an ongoing basis as transactions occur. If such a file does exist, the apparatus checks that a communications link (such as a GPRS, 3G or other wireless connection) can be established and, if so, it uses the link to upload the batch file.

15 In a preferred embodiment, this action is taken at shift changes for operator personnel. In other embodiments, it is performed on some other basis, such as periodically. In further embodiments, the data is uploaded on a transaction-by-transaction basis.

20 It will be appreciated that the invention has been described by way of example only and various modifications may be made to the techniques described herein without departing from the spirit and scope of the appended claims. Features presented in relation to one aspect may also be combined with features relating to another aspect.

25

Claims

1. A portable access token comprising:
5 memory configurable to store simultaneously information relating to
a plurality of access rights;
 a processor for causing information to be stored in the memory, for
retrieving information from the memory and for processing information;
and
10 a transponder for receiving incoming signals and transmitting
response signals;
the processor being adapted, in response to an incoming signal relating to a
particular matter for which access rights are required, for retrieving
information from the memory and for causing the transponder to transmit a
15 response signal in dependence thereupon.
2. An access token according to claim 1, wherein the processor is responsive to
an incoming signal for storing information in the memory or updating
information stored in the memory.
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3. An access token according to claim 2, wherein the memory is further
configurable to store conditional rules relating to the access rights.
4. An access token according to claim 4, wherein the processor is adapted to
25 cause the transponder to transmit a response signal in dependence upon
the conditional rules.
5. An access token according to claim 3 or claim 4, wherein the processor is
adapted to update the information stored in the memory in dependence
30 upon the conditional rules.

6. Apparatus for administering access to a plurality of matters, the apparatus comprising:
- a user interface for allowing a user to indicate that access to a plurality of matters is to be granted; and
- 5 a transmitter for transmitting to a portable access token a signal for causing the token to store information indicating that access to the plurality of matters is to be granted.
7. Apparatus according to claim 6, wherein the transmitter is adapted to
- 10 transmit the signal to a token as claimed in any of claims 1 to 5.
8. Apparatus according to claim 6 or claim 7, further including a processor responsive to the user interface for causing the transmitter to transmit to the token a signal for causing the token to store conditional rules relating to
- 15 the access rights.
9. Apparatus for administering access to a plurality of matters, the apparatus comprising:
- a transmitter for transmitting a signal, including information relating
- 20 to a particular matter for which access rights are required, to a token having memory storing information indicating that access to a plurality of matters is to be granted, for causing the token to respond in dependence upon whether information indicating that access to that particular matter is to be granted is among the stored information; and
- 25 a receiver for receiving a response signal from the token.
10. Apparatus according to claim 9, wherein the transmitter is adapted to transmit the signal to a token as claimed in any of claims 1 to 5.

11. Apparatus according to claim 9 or claim 10, wherein the transmitter is adapted to transmit to the token a signal for causing the token to modify the stored information.
- 5 12. Apparatus according to claim 10, adapted to receive from the token conditional rules relating to access rights to a plurality of matters, and wherein the transmitter is adapted to transmit to the token a signal for causing the token to modify the stored information in a manner determined in dependence upon the conditional rules.
- 10 13. A RFID access card comprising a plurality of memory partitions, each of the plurality of memory partitions configured to store data relating to a user's rights to access one or more of a corresponding plurality of events.
- 15 14. A method for administering access to a plurality of matters, the method comprising storing on a token information indicating that access to the plurality of matters is to be granted.
15. A method according to claim 14, the method further comprising storing on
20 the token conditional rules relating to access to the plurality of matters.
16. A method according to claim 15, wherein the conditional rules include, in respect of at least one of the plurality of matters, information indicating that access is to be granted for a predetermined period following a first
25 access to the matter.
17. A method according to claim 16, wherein the conditional rules include information indicating that access is to be granted to a predetermined maximum number of the plurality of matters.

18. A method for administering access to a plurality of matters, the method comprising, at an access point for a particular matter, interrogating a token having stored upon information indicating that access to a plurality of matters is to be granted to determine whether that particular matter is among the plurality of matters.
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19. A method according to claim 18, further comprising causing the token to modify information stored upon it.
- 10 20. A method according to claim 19, further comprising obtaining from the token conditional rules relating to access to the plurality of matters, and wherein the step of causing the token to modify information stored upon it is performed in dependence upon the conditional rules.