

BARCODE

Field of the invention

- 5 The present invention relates to a barcode. In particular, the present invention also relates to devices, systems, and methods to track the origin of goods using the barcode.

Background of the invention

- 10 Counterfeit goods are a major problem for manufacturers and intellectual property rights (IP) owners around the world, as counterfeiters circumvent the development process and duplicate a successful product. Counterfeit goods could also affect the health and well-being of the public; this is pertinent for perishable and consumable goods, for example food and pharmaceuticals.

- 15 Patents and registered designs offer a degree of protection to these manufacturers but only if the counterfeits and counterfeiters can be found. Copyright is another example of intellectual property right used to protect artistic and literal works. The widespread availability of photocopiers and image capturing devices makes it easy to record, copy
20 and duplicate products and works.

- Anti-counterfeiting methods and devices have been developed to detect and deter counterfeits. Some of these include the use of radio frequency identification (RFID) tags and special ink to mark the goods.

- 25 RFID tags can be passive or active (powered with a battery) tags. Passive tags can potentially work perpetually as long as the tag is not damaged, and are activated upon receiving transmissions from a RFID detector. Active tags offer the advantage of a longer detection range, but the battery limits the lifespan of the tag. As a RFID tag
30 communicates with a RFID detector via electromagnetic waves, there does not need to be a line of sight between the tag and detector. Hence, the RFID tag can be embedded

within an object if desired making it difficult to remove; however this is limited to certain goods, for example it is difficult to embed RFID tags in printed matter.

RFID tags are popular in the manufacturing industry to track goods. However, if RFID tags are used on each and every piece of good, the cost could become prohibitive; especially if the tags are not recycled by the manufacturer, retailer and consumer. The use of RFID tags require additional equipment to prepare and read the RFID tags, which is only cost effective with economies of scale. A problem with the use of non-embedded RFID tags to detect and prevent counterfeiting is the visible presence of these tags alerts a counterfeiter to the anti-counterfeit measure employed. Hence, a counterfeiter will likely remove or alter these visible tags or the information within. Alternatively, the RFID tag can be shielded to prevent communication with the RFID detector.

Another anti-counterfeit measure is the use of a special ink to print on or mark the goods. The special ink is generally an ink that is visible only under certain conditions, for example applying heat, adding at least one chemical to initiate a chemical reaction, or viewing under ultraviolet (UV) light. The problem with using a special ink is that the ink needs to be specially prepared and printed separately on the goods. In certain cases, the material may require preparation before it can be printed on. In addition, some special inks have a limited lifespan (e.g. a few months) before it fades limiting the utility of the special ink. The special ink method is usually employed with printed matter, for example books and documents, to counter forgery and unauthorised copying.

The additional steps in the manufacturing process with use of a special ink increases the overall manufacturing cost of the goods to the detriment of both the manufacturer and consumer. The special ink mark cannot be duplicated without the special ink, accordingly the mark is not transferable to a counterfeit. Although this allows people to determine the authenticity of the good, it does not provide additional information and allow for the tracking of the source of the fake copy.

Existing anti-counterfeit measures generally have a high cost and are directed towards determining if a good is genuine, but provides little other information. This limits the

application of such measures to only high value goods. Therefore, there is a need for improved methods and systems to determine the authenticity of goods, and track the source of counterfeits.

5 Summary of the invention

In a first aspect of the invention, there is provided a barcode associated with an article, the barcode comprising: an encoded identifier that allows an authorized user to access a database using a private key, wherein the identifier is associated with the article and, is
10 compared with entries in a table in the database to determine private information associated with the article, each entry in the database contains the identifier and a corresponding set of private information associated with the article.

The term “article” refers to a good or product. The barcode could be physically printed on
15 the article itself, or on an object separate from the article but sold to a consumer together, for example a packaging or label for the article itself, such that the object is associated with the article.

The authorised user could be any person or organisation, from or hired, by the
20 manufacturer of the article and or the owner of the intellectual property rights of the article to track the origin of the article.

For example, the identifier may be an integer equal of greater than 1 and assigned to a particular article, i.e. the identifier may be unique to that particular article. In the entries
25 in the table in the database would be a series of identifiers. Each identifier corresponds to information associated with the article. Therefore, for each unique identifier would be a set of information that would be unique to the article. As such, by obtaining the unique identifier from the barcode and then accessing the database, an authorised user would be able to determine information associated with the article by checking against the
30 identifier in the corresponding table.

Preferably, the private reference is encrypted.

Preferably, the barcode may further comprise an encoded reference that is accessible to an unauthorised general public. As such, to an unauthorised person accessing the barcode, he will be directed to publication information and not the private information that may only be accessed by an authorised user. The identifier and reference may form a single string of resource reference, or may be separate from each other but encoded onto the same barcode.

In an embodiment, the barcode may further allow a consumer of the article access to consumer information associated with the article. In an embodiment, the identifier also provides a consumer of the article access to the consumer information. Advantageously, by reading the same barcode, a reader will be able to provide different levels of access to different groups of people, i.e. an authorised user (e.g. manufacturer of article), a consumer (e.g. purchaser of the article), and the unauthorised public at large. Such access levels include the database providing private information, consumer information (which may reside in said database), and general publicly available content on the Internet. The consumer information may be distinct from the public information that is accessed by the unauthorised general public. Consumer information may be any information relevant to a consumer of the article. For example, such information may include any loyalty programme or any such information which allows the consumer to register oneself so that the manufacturer of the article can interact with the consumer. The consumer information may form part of the table that resides in the database, but such information may be distinct from the private information which is only accessible to an authorised person. As such, a consumer of the article will not have access to the private information.

Preferably, the private information is any one selected from the group comprising: the location of manufacturing of the article, the time and date of manufacturing of the article, any restriction of sales of the article in respect of geographical locations, the total number of manufactured articles in a batch, identity of the manufacturer, the identity of at least one customer who ordered the manufacturing of the article, the identity of at least one distributor of the article, the identity of at least one retailer selling the article, the time and date of shipment of article, name of the shipment vendor, size of the article,

weight of the article, weight of the shipment containing the article and, in the case where the article is a book, the title and ISBN number of the book. Some of the private information may be known to the public e.g. the title of the book, but allows the authorised user to readily determine the source of the book in combination with other private information.

Preferably, the reference is a resource on the Internet.

Preferably, the identifier may be any code that allows an authorised user access to the database for extraction of private information associated with the article. For example, such code may be any private key that allows an authorised user access to the database via a web-based application. For example, such web-based application may provide\ private access to authorised users using a user ID and a password. Such private keys provide a secure connection between the authorised user and the database. For unauthorised readers of the barcode, they will be directed to publicly available information on the Internet such as a website provided public information associated with the article. For example, if the article is a book, then public information may include any website providing details of the book/title/synopsis of the book/publisher/author etc. Such publication information does not include the location of manufacturing of the article, the time and date of manufacturing of the article, any restriction of sales of the article in respect of geographical locations, the total number of manufactured articles in a batch, identity of the manufacturer, the identity of at least one customer who ordered the manufacturing of the article, the identity of at least one distributor of the article and the identity of at least one retailer selling the article.

Preferably, the barcode is a two-dimensional barcode.

In an embodiment, the two-dimensional barcode is any one selected from the group comprising: data matrix, quick response (QR) code, Aztec code, EZcode, High Capacity Colour Barcode, MaxiCode, NexCode, PDF417, Qode, and Shotcode.

In a second aspect of the invention, there is provided a method for preparing and printing a barcode associated with an article, the method comprising: (a) assigning the article with an identifier; (b) encoding the barcode with an identifier that allows an authorized user to access a database using a private key, the identifier is compared with entries in a table in the database to determine private information associated with the article; (c) positioning the barcode for printing on a surface of the article, or within the contents of the article or on a label separate from but associated with the article; and (d) printing the barcode.

10 In an embodiment, the method may comprise creating entries in a database which has a series of identifiers that correspond with a set of private information associated with the article.

The term “printing” refers to the transfer of text or designs to a surface of a material.

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Preferably, the method further comprises the step of encrypting the identifier.

The private information is any one selected from the group comprising: the location of manufacturing of the article, the time and date of manufacturing of the article, any restriction of sales of the article in respect of geographical locations, the total number of manufactured articles in a batch, identity of the manufacturer, the identity of at least one customer who ordered the manufacturing of the article, the identity of at least one distributor of the article, the identity of at least one retailer selling the article, the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the article and, in the case where the article is a book, the title and ISBN number of the book.

Preferably, the method further comprising encoding a reference that is accessible to an unauthorised general public. The reference and the identifier may or may not be linked or stringed together such that when an authorised user reads the barcode, only the identifier is read and provides the authorised user access to the database for extracting private information associated with the article. On the other hand, when an unauthorised

person reads the same barcode, he/she would only read the reference that would lead him/her to a publicly available resource on the Internet. The unauthorised person would not be able to access the identifier or code that provides access to the database. As such, for the same reading of the barcode and without being able to read the identifier or code
5 (and without access to the private key), an authorised user would not have access to the database. Therefore, for the same barcode, different access levels of sorts may be provided to different sets of people.

Preferably, the identifier further allows a consumer of the article access to consumer
10 information associated with the article. The consumer information may be distinct from the public information accessed by the unauthorised general public. Therefore, consumers would be able to access information relating to the article, e.g. loyalty programmes organised by the manufacturer or seller of the article etc. In addition, consumers may register themselves with the system and complete surveys relating to the
15 article and/or their purchase. This, in turn, may provide the manufacturer or seller of the article some market intelligence on who their buyers are.

Preferably, the article is any one selected from the group comprising: a printed matter, a luxury good, a pharmaceutical product, and a food product. More preferably, the printed
20 matter is any one selected from the group comprising: a book, a magazine, a journal, a document, and a manual.

In an embodiment, the barcode is printed within the contents of the book. For example, the barcode is printed among the words or pictures that form the content of the book. As
25 such, the location of the barcode is not immediately obvious.

In a third aspect of the invention, there is provided a method of determining private information associated with an article, the method comprising: (a) reading a barcode according to the first aspect of the invention; (b) decoding an identifier in the barcode; (c)
30 accessing a database using the private key; and (d) obtaining the private information by comparing the identifier associated with the article with entries in a table in the database.

Preferably, each entry in the database contains the identifier and a corresponding set of private information associated with the article.

- 5 Preferably, the identifier is encrypted and the method further comprising the step of decrypting the identifier.

Preferably, the barcode comprises an encoded reference that is accessible to an unauthorised general public, and the method further comprises ignoring or omitting the encoded reference. The reference and the identifier may or may not be linked together such that when an authorised user reads the barcode, only the identifier is read and provides the authorised user access to the database for extracting private information associated with the article. On the other hand, when an unauthorised person reads the same barcode, he/she would only read the reference that would lead him/her to a publicly available resource on the Internet. The unauthorised person would not be able to access the identifier or code that provides access to the database. As such, for the same reading of the barcode and without being able to read the identifier or code (and without access to the private key), an authorised user would not have access to the database. Therefore, for the same barcode, different access levels of sorts may be provided to different sets of people.

Preferably, the device is a mobile device.

Preferably, obtaining the private information determines the source of the article, the private information is any one selected from the group comprising: the location of manufacturing of the article, the time and date of manufacturing of the article, any restriction of sales of the article in respect of geographical locations, the total number of manufactured articles in a batch, identity of the manufacturer, the identity of at least one customer who ordered the manufacturing of the article, the identity of at least one distributor of the article, the identity of at least one retailer selling the article, the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the article and, in the case where the

article is a book, the title and ISBN number of the book. Once the private information of the article is determined, its source and authenticity may then be determined.

5 Preferably, the article is a book and the barcode is contained within the contents of the book.

10 In a fourth aspect of the invention, there is provided a system for determining private information associated with an article, the system comprising: (a) a means for receiving an identifier associated with the article; and (b) a processing unit for comparing the identifier associated with the article with entries in a table in the database, wherein each entry in the database contains the identifier and a corresponding set of private information associated with the article.

15 Preferably, the system further comprises (a) a device adapted to read a barcode associated with the article, wherein the identifier is encoded in the barcode, the barcode according to the first aspect of the invention. Still more preferably, the system further comprises a private key for allowing an authorised user access to the database.

20 Preferably, the device for reading the barcode is a mobile device.

25 Preferably, obtaining the private information determines the source of the article, the private information is any one selected from the group comprising: the location of manufacturing of the article, the time and date of manufacturing of the article, any restriction of sales of the article in respect of geographical locations, the total number of manufactured articles in a batch, identity of the manufacturer, the identity of at least one customer who ordered the manufacturing of the article, the identity of at least one distributor of the article, the identity of at least one retailer selling the article, the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the article and, in the case where the article is a book, the title and ISBN number of the book.

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In an embodiment, the article is a book and the barcode is contained within the contents of the book.

Preferably, the system further comprises a communication means for transmitting data
5 between the device and the database.

Preferably, the device is a mobile device.

In some embodiments of the third aspect of the invention, the barcode and article are
10 selected as described in the embodiments of the first aspect of the invention.

In a fifth aspect of the invention, there is provided a computer program encoding a set of computer instructions for determining private information associated with an article, which when running on a data processing system is adapted to perform the method
15 according to the third aspect of the invention.

In a sixth aspect of the invention, there is provided a computer usable storage medium having encoded thereon data and computer instructions for determining private information associated with an article, for causing a data processing system to implement
20 the method according to the third aspect of the invention.

The barcodes used in the embodiments of the present invention are cost effective to produce and use. The barcodes are unlikely to require special additional equipment beyond what is normally used by the producer of the article, and a user of the barcode.
25 The information in the barcodes are transferable when the barcode is copied, and the embodiments of the present invention deter counterfeiters from removing or damaging the barcodes. The embodiments of the present invention allows the origin of an article to be determined and to track the source of the origin for a counterfeit good, or at least the possible source of counterfeiting, which is not commonly available with other anti-
30 counterfeit measures.

Brief Description of Figures

In order that the present invention may be fully understood and readily put into practical effect, there shall now be described by way of non-limitative examples only preferred embodiments of the present invention, the description being with reference to the accompanying illustrative figures.

In the Figures:

Figure 1 shows a method to print a barcode used in one or more embodiments of the present invention for an article;

Figure 2 shows a detailed method to prepare the barcode; and

Figure 3 shows a method of using an embodiment of the present invention.

Detailed description of the preferred embodiments

The present invention is related to a barcode. In particular, it relates to a barcode that can encode an identifier that is only accessible by an authorised user. More particularly, the barcode may appear like any other ordinary barcode to an unauthorised general public, providing general public information on the product or article that it is associated with. However, to an authorised user, the barcode provides more information associated with the product or article. The identifier may be presented in different physical forms. The identifier may be a fully or partially encrypted URL (Uniform Resource Locator) that allows an authorised user to access a database, thus extracting information associated with the barcode (and hence, article). The identifier may be encoded directly in the barcode, or as part of a URL. For example, the barcode may provide information relating to the source of the article, i.e. name of manufacture, date and time of manufacturer or, in the case of a book or publication, name of publisher and date and time of printing, the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the article and, in the case where the article is a book, the title and ISBN number of the book. The private information may

also include information relating to the publication, e.g. total number of books published in the batch, number in a batch etc.

In addition to the identifier that is encoded in the barcode, the invention also relates to the placement of the barcode in the article. In the embodiment where the article is a book, the barcode is carefully placed within the contents of the book, i.e. within the book's pages of words and pictures (if any). Therefore, the presence of the barcode is not immediately obvious to the unauthorised general public. This makes it less likely for someone to reproduce the book without the barcode.

Therefore, in the event a book is copied or reproduced, an authorised person or user may read the barcode and obtain information associated with the book. Investigative work may be carried out and records may be checked to determine whether the book was intended for the geographical location it was found. If not, it can then be determined whether there was unauthorised copying of the book and who that unauthorised party may be.

The invention will now be described in greater detail below.

A barcode associated with an article is provided to allow tracking of the origins of the article. The barcode could be physically printed on the article itself, or on an object separate from the article but sold to a consumer together; for example, a packaging or label for the article, such that the object is associated with the article. This includes the object being given free with the purchase of the article. In an embodiment, the barcode comprises an encoded identifier that allows an authorized user to access a database using a private key. The identifier is associated with the article and, is compared with entries in a table in the database to determine private information associated with the article, each entry in the database contains the identifier and a corresponding set of private information associated with the article.

Each entry in the database contains the identifier and a corresponding set of private information associated with the article. The identifier may be an integer greater than or equal to one (i.e. a positive integer), or a combination of alphanumeric characters.

- 5 In an embodiment, the identifier serves to find the private information associated with the article in the database. The private key serves to allow access only to authorised users. The private key may serve as a connection between the authorised user and the database. The private key may be any suitable connection, for example a password-login system using an application (app) over the Internet, or an application on a processing unit
10 like a mobile or computing device.

In another embodiment, the barcode further comprises an encoded reference that is accessible to a general public (i.e. unauthorised users). The advantage of such a barcode is the concealment of the presence of the identifier, and potential tracking ability to
15 determine a possible source of copying of the article. Hence, an unauthorised user accessing the barcode would only access the reference which brings them to a webpage or interface that contains public information, for example publicly available information concerning the article which may include any marketing or publicity material. Unlike the unauthorised user, an authorised user would read the encoded identifier on the barcode
20 and would have access to the database which then provides private information concerning the article. In particular, when the barcode contains the encoded reference, the authorised user utilises a device with an application that allows the omission of the reference to decode the identifier, and access the database using the private key. The identifier may be further encrypted before encoding.

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In a further embodiment, the identifier encoded in the barcode may also allow a consumer of the article access to information that is targeted to the consumer. For example, such consumer information may include a loyalty programme which the consumer can subscribe to, or any portal that allows the consumer to log in his/her
30 details so that the manufacturer or seller of the article can track consumer trends.

Hence, an advantage of the present invention allows a single barcode to allow different set of users to access different sets of information. An unauthorised user would not have access to the identifier. Even if he did, he would not be able to access the private database without the private key.

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The article could be any good or item. In particular, the article could be a printed matter, a luxury good, or a pharmaceutical product. For example, the printed matter could be a book, a magazine, a journal, a document, or a manual. Luxury goods, pharmaceutical and food products are often provided with a stamped mark on the good or product itself that serves to identify its brand; but it could also come with an object that is associated with the good. For example, the object could be a certificate, label, or packaging. The barcode could be printed on the certificate, label, or packaging rather than on the good itself.

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For example, luxury goods are often provided with a certificate of authenticity by an expert or manufacturer that certifies that the luxury good is genuine. To illustrate this, some non-limiting examples are an expert certifying that an art work is an original work of an artist and not an imitation copy, and a diamond is of a certain standard and quality, and other similar examples. It will be understood that the certificate could also be provided for consumables and perishables, like food and pharmaceuticals. Counterfeiters will often produce fake certificates, labels or packaging in an attempt to pass off their goods as genuine products.

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The printed matter includes both actual physical printed material and electronic matter that could be printed (i.e. electronic documents like a portable document format (PDF) file and other available electronic formats, and even photographs). This is an important advantage of the barcode over existing methods as the information encoded in the barcode is transferred with the image of the barcode. The copying of the image could be with the use of a photocopier, scanner, or camera. All of these copying methods will be able to transfer the encoded information.

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The reference is accessible to anyone that reads the barcode with a normal barcode reader. A normal barcode reader is typically any device that has an image viewing

component (to view or capture the image of the barcode) and a software to decode the image of the barcode. There are many software applications that can be downloaded to a consumer's mobile device, e.g. smart phone, tablet etc. that allows a user to decode and view the contents of the barcode. This allows the use of barcodes to convey information to consumers. In contrast, RFID scanners are not commonly available to a typical consumer. The accessibility of the public information in the barcode to consumers creates a demand for the barcode that deters the counterfeiter from removing the barcode.

On the other hand, the identifier is only accessible to an authorised user with a device adapted to read the identifier and access the private information. The device may be any suitable mobile device, for example a mobile phone, but is adapted with an app for providing access to the database. The identifier is encoded in such a manner such that only an authorised user is able to access the private information that resides in the database. The authorised user could be any user or organisation, from or hired, by the manufacturer of the article and or the owner of the intellectual property rights (IP owner) of the article to track the origin of the article.

The corresponding set of private information associated with the article allows an authorised user, manufacture or IP owner to track the origin of the article. The set of private information may comprise at least one of the following: location of manufacturing of the article, time and date (a timestamp) of manufacturing of the article, restriction of sales of the article in geographical locations, number of manufactured articles, identity of a manufacturer/s, identity of a customer/s who ordered the article, identity of a distributor/s, identity of a retailer/s the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the article and, in the case where the article is a book, the title and ISBN number of the book. The corresponding set of private information could include other details that allows the origin of the article to be tracked. The private information is typically generated during the manufacturing or creation process of the article.

The set of private information may be generated for each article, for a batch of articles, or all articles of a product range, become associated with the article, batch, or product, and is provided with an identifier that allows for easy retrieval of the set of private information. The identifier and set of private information may be stored in a database, which may be a physical and or electronic database, in the form of a table for comparison and retrieval of the private information. Each article may have a unique identifier. As such, given an order of about 10 articles, each article in that order would have its own unique identifier.

- 10 For increased security, the identifier could be encrypted before encoding. The encryption could be by any suitable method, including cryptographic hash function, symmetric encryption and asymmetric encryption methods. Some possible examples include an internal mapping method, a MD5 encryption method, and a 128 or 256 bit encryption method. In an embodiment, the authorised user has an application in a barcode reader device (reader device) that decrypts the private information to allow access to the private information.

- The database could be stored in the reader device, or it could be stored at a remote server, depending on the preference and requirements. In an embodiment, a desktop computer could serve as both the reader device and database server. In an embodiment, the reader device is a mobile device (e.g. smart phone, tablet, and laptop) to allow the authorised user to visit multiple locations in a short period of time such that the counterfeit good can be tracked quickly and effectively.

- 25 This is another advantage of using barcodes as the reader device may be an existing mobile device that is available to the consumer and authorised user without requiring additional specialised equipment.

- With a remote database, an additional layer of security is added since the decoding of the private information is separate from the database. This arrangement requires minimal processing and memory resources from the reader device, which is important for a mobile device. This requires a communication means (or communication network)

between the reader device and remote database. Some examples of communication means include a wireless data network, a wired data network, a public network, a private network, or combinations thereof.

- 5 When the database is stored in the reader device, the database can be easily accessed without the need for a network connection to the database. This could be a preferred option in locations where the communications network is not suitable to access the database (e.g. poor connection speed, or poor security network). The downside is that the database would require more storage space. In addition if the reader device is lost
- 10 the database is possibly compromised.

It is also possible that the set of private information associated with the article being investigated is temporarily stored on the mobile device in part, rather than the whole database, to gain advantages from both arrangements.

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An additional benefit of using a database is that the database can be regularly updated to add or remove details in the private information. This allows for a dynamic database and prolongs the utility of the barcode. This is equally applicable to a database stored on a device or on a remote server.

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The public information that is encoded in the barcode is meant to present the barcode as relevant and useful information associated with the article, or product, to the consumer. Coupled with the easy availability of barcode readers, the consumers may specifically seek or purchase articles provided with the barcode, hence deterring the removal of the

25 barcode by counterfeiters.

The article could contain more than one barcode, of which at least one comprises the identifier while the remaining barcodes comprises only a reference. Only the authorised user will know which barcode contains the identifier. The plurality of barcodes further

30 serves to reinforce the impression that the barcodes only provides useful information on the article, and is not an anti-counterfeit measure. Additional barcodes could be added as needed for operational reasons, for example conventional barcodes used by retailers at

the point of sale, and conventional barcodes containing the international standard book number for a book.

The reference may be any resource on the Internet. The reference could be internet accessible information (or publicly available information) associated with the article (e.g. a uniform resource locator (URL) of a website). The unauthorised general public would simply be directed to a publicly available resource on the Internet. Such resource may be any webpage that concerns the article or the seller of the article or, in the case of the article being a book, a synopsis of the book.

The consumer information may also be any entry of information found in the database but is accessed only by the consumer. For example, the consumer could provide feedback on the article, search or request for assistance on the article, register to provide information, receive information from the manufacturer on the product bought, existing products and future products, and other services. This has the benefit of acting as a marketing and advertising platform for the manufacturer, or author, of the article.

In some embodiments, upon first accessing the website, the consumer will be required to register for a user account, and the unique URL allows only one user account to be registered for each article. Subsequent attempts to register a user account with the same unique URL will indicate that there is a high possibility that the article has been counterfeited, and the manufacturer is alerted. The consumer could be probed for further information to track the source of counterfeiting. For example, the consumer could be prompted to provide further details of the date and place of purchase. Multiple copies of an article with the same unique URL purchased from the same retailer (or distributor) will provide the manufacturer, or IP owner, with a starting point to investigate and gather evidence of counterfeit activity.

Instead of a user account, the unique URL could be used to activate an online product, for example an electronic version of the physical hard copy of a book or magazine. The activation could be a one-time use activation code; hence, subsequent attempts to activate the online product will be flagged out as possible counterfeit activity.

In an embodiment, the website could track and log the Internet Protocol address (IP address) of a device used to access the unique URL. If multiple users simultaneously access the website, or in different countries in a period of time impossible to travel between the countries, an alert could be sent to the manufacturer, or IP owner, and logged. Multiple occurrences of such events, or combination of events, could indicate the circulation of counterfeit products. Based on the access to the public information, a pattern could emerge which assists the manufacturer, or IP owner, to trace a possible source of counterfeiting.

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In an example, the article is a book, and the website further expands on the contents of the book. If the book content is on cars or the human anatomy, the website could allow the consumer to view the cars or human anatomy in a three dimensional view. The website may allow the consumer to rotate the view for an alternate perspective view, and a better understanding of the contents of the book. Such encoded public information provides value to the article while deterring a counterfeiter from damaging or removing the barcode. This example could be similarly applied to the other examples as per the nature of the article.

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20 In an example, the manual could contain a company's trade secrets. Industrial espionage or leakage of the trade secrets could be possibly traced to the source by the private information.

In an example, the document could be a legal document, like a contract. Some counterfeiters may attempt to forge such documents in an attempt at fraud.

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The barcode could be a one-dimensional (1D) barcode, a two-dimensional (2D) barcode or a three-dimensional (3D) barcode. The general difference between these barcodes is the increasing amount of information or data that can be stored with each added dimension. In an embodiment, a 2D barcode is used as it allows for the storage of a sufficient amount of data without excess complexity. The 2D barcode may be sized according to the amount of data to be encoded, thus providing flexibility to the

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dimensions of the article that it may be applied to. A 3D barcode uses an additional height of the lines or colour as the third dimension. A 3D barcode will also be workable to replace the 2D barcode and could be a preferred choice if a large amount of data is to be encoded.

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Some of the 2D barcodes that could be used include data matrix barcode, quick response (QR) code, Aztec code, EZcode, High Capacity Color Barcode, MaxiCode, NexCode, PDF417, Qode and Shotcode. In an embodiment, a data matrix barcode is used.

10 Figure 1 shows a general method 100 to prepare a barcode for an article. The identifier to be encoded is prepared and could be encrypted 110, if required or desired. If the barcode comprises a reference, the reference is prepared for encoding as well.

The preparation of the identifier for encoding could include assigning the article with an
15 identifier, and further creating an entry in the database comprising of the identifier and the corresponding set of private information associated with the article.

The identifier (and reference if present) in the barcode is encoded in block 120 to generate the barcode. In Block 130, a position for the barcode on the article is selected.
20 The barcode could be placed at any position on the article, including a surface of the article, within the contents of the article or on a label (packaging) separate from but associated with the article. The selected position should be important to the article in question and will not be omitted easily. A preferred position depends on the nature of the article, and how easily the barcode may be printed and read at the preferred
25 position. Block 140 is the printing of the barcode at the selected position. The printing here refers to affixing the barcode onto an electronic document, or the actual physical printing on a material. This is an advantage of using barcodes as it can be printed by a conventional printer (laser or inkjet) or printing press, and it is likely that no additional equipment needs to be procured to print the barcode. It is possible to print the barcode
30 on the article or good directly itself using a printing stamp, and it may be possible for a counterfeiter to replicate the printed barcode by duplicating the image. The same method is applicable to the object associated with the article.

Figure 2 illustrates a specific method 200, wherein the article is a book or publication. A customer places an order 205 with a publisher for a print run of a book title. The publisher generates an order number 210, which may conveniently serve as the identifier. A corresponding set of private information relevant to the article will be created as well. Some examples include the customer identity, publisher identity, number of books in the order, title of the book and so forth. An Enterprise Resource Planning software, or other software could be used for this purpose, or even manually by a person. As the order progresses, additional details could be generated and added to the set of private information. For example, the time and date of printing (a timestamp of the printing event), identity of distributor/s, identity of retailer/s, restriction of sales in geographical locations and others. The private information may also include the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the article and, in the case where the article is a book, the title and ISBN number of the book.

The order number (or identifier) and corresponding set of private information is used to create a database, or a database entry in an existing database 215. The order number may be used to retrieve the set of private information. The order number may be further modified to generate a unique identifier for each article in a batch process. For example, an additional number could be added to the order number, in running order starting from one to the total number of books in the print run. The increased logistical burden could be outweighed by the importance or value placed on the book title (or article in general).

The order number (serving as the identifier) is encrypted 220. The reference is selected as a URL of a relevant website of the article. The reference and encrypted identifier is encoded to generate a barcode 225. It will be appreciated that the reference and identifier may each be independently unique, or identical, for each book (or article in general) in the batch process. For example, the reference may direct the general public to different websites based on the region the article is to be sold, or based on the language of the country the article is to be sold, and other variants.

For a book or publication in general, the pre-printing process 230 involves a one-time file preparation process. In this process, files are pre-flighted (checking that the images, graphics, fonts are in the correct file format, and the colour output is correct) and other amendments are made to the file to ensure that the soft copy of the book is print ready.

5 During this process, an operator will identify a suitable location on the book that is suitable to place the barcode. The exact coordinates (x,y) of the barcode are identified and entered into a prepress software to generate a preprinting file that will be sent to the printer.

10 For example, the barcode could be placed on a page containing substantial text of the book rather than a blank page, which has a higher tendency to be removed when the book is copied. Another position could be the front cover of a book, which is typically provided with an elaborate design that is aesthetically pleasing and is usually not removed while copying. By placing the barcode on the front cover of the book, the
15 barcode is easily accessible without requiring an outer wrapping, if present, to be removed. In particular for a shrink wrapped book or article in general, the authorised user is able to read the barcode and access the private information by scanning through the outer wrapper without removing the shrink wrap. The barcode on the front cover also allows a general public to access the reference if present to find relevant information
20 to the article, which may be useful to promote the sales and advertisement of the article and to allow the manufacture, IP owner, or other relevant party to determine the interest in the article. The same principles can be similarly applied to other articles, in particular for printed matter as described herein.

25 The barcode and preprinting file is combined by an imposition software 235, which imposes the barcode on the preprinting file to generate a final printing file 240. The final printing file is subsequently released to the printer to print the physical copy of the book 245. It will be appreciated that the final printing file could be in an electronic format that constitutes an electronic version of the book or publication.

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An application programming interface (API) may be provided to allow the Enterprise Resource Planning software, prepress software, and imposition software to interact with

each other. Two or more of these software could possibly be integrated into a single program. The API should be able to work with different software provided and used by different vendors.

- 5 The API, or part of the other software could possibly be provided online via a web browser or cloud interface, to generate the final printing file as a subscription service.

It is contemplated that the publisher, editor of the book, and/or author of the book could individually or collaboratively select the placement and contents of the barcode. An
10 author or editor could insert the barcode in the manuscript given to a publisher to allow integration with the contents of the book.

It will be appreciated that the methods 100, 200 described may be applied similarly to other articles, in particular for printed matter.

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The manufacturer of the article, or book publisher as exemplified, do not need special equipment beyond what is typically available to them in the course of their normal activities – an existing printing device which is being used to print on the article. This includes the manufacturer of the counterfeit good, otherwise the barcode cannot be
20 transferred successfully to the counterfeit article. This is in contrast to existing tracking and anti-counterfeit measures.

Although, the method 200 described here describes the printing of the content of the article with the barcode, it is possible for the printing to be separate. The printing of the
25 barcode does not require a special printing process, and any method that is able to transfer the image onto the article suffice. This makes the embodiments described applicable by almost any user as long as a barcode with private information can be generated, positioned on the article, and printed.

30 After the barcode is printed, the article may be sold to consumers via a variety of distribution channels. These distribution channels could include direct sales, through one or more distributors, and one or more retailers. It is possible that a batch of products sold

through each channel has a different identifier, or each and every product has a different identifier. This largely depends on the nature of the article and the costs involved. This allows the manufacturer, or IP owner, to track the sales, authenticity of the article, and possible source of counterfeiting.

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A system may be established to determine the private information associated with an article having a barcode as described in the embodiments herein. The system may be used to allow the tracking of an article bearing the barcode and determine the source of the article.

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The system comprises a means for receiving an identifier associated with the article and a processing unit for comparing the identifier associated with the article with entries in a table in a database. Each entry in the database contains the identifier and a corresponding set of private information associated with the article. A device adapted to read the barcode associated with the article may be provided as well. The device may contain a private key for allowing an authorised user access to the database. The system may further comprise a database to store the identifier and corresponding set of private information. The processing unit may be present with the reader device, the database, or is a separate unit. The means for receiving the identifier may be a communication means between the processing unit and reader device as aforementioned.

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The reader device of the authorised user stores a computer implemented method of reading the barcode and accessing the set of private information. The computer implemented method comprises reading a barcode comprising an encoded identifier with the device, the identifier being associated with an article; accessing the private information; and comparing the identifier associated with the article with entries in a table in the database.

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A general method of determining private information associated with an article with the system comprises the authorised user reading the barcode with the device adapted to read and access the private information (for example by decoding the identifier), accessing the database using a private key, and obtaining the corresponding set of private

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information by comparing the identifier associated with the article with entries in a table in the database. The method could further comprise decrypting the encoded private information in the barcode. The barcode could be as described in the embodiments herein.

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A computer program comprising a set of computer implementable instructions to perform the abovementioned method of determining private information associated with an article is provided as well. The computer implementable instructions may be stored on a computer usable storage medium for causing a data processing system to implement the abovementioned method.

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Figure 3 shows the method 300 in greater detail. In block 305, a user reads a device to read the barcode. The device subsequently determines if the user is authorised to access the database or private information 310. For the authorised user, the reader device has been adapted to access and decode the identifier 315, and decrypts the identifier if required 320. If the barcode comprises a reference, the reader device of the authorised device omits the reference and decodes the identifier only. This provides the authorised user access to the private information. The identifier is compared to entries in a table in the database 330 by the processing unit to provide the private information to an authorised user. The private information allows the authorised user to determine and track the origin of the article. The comparison could be done automatically upon receipt of the accessed identifier, or could require input from the authorised user. If the authorised user determines that the article origin is not correct, the authorised user continues to investigate the origin of the article in question.

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If an unauthorised user reads the barcode with a normal barcode reader device without the private key, at block 310 the unauthorised user is directed to block 340 instead, where the reference is decoded and the identifier is ignored as it is unreadable by the normal barcode reader device. The public information is subsequently displayed to the public user 345. In an embodiment, the website that is linked by the URL could further track access to the website 350 as described.

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The tracking system and method disclosed allows the authorised user to track the origin of the article based on the corresponding set of private information.

The use of the system is further described in two examples. In a first example, the authorised user visits retailers and or distributors, and uses the reader device to access the private information as described herein. The authorised user is able to determine if the article retailed or distributed in a particular location matches the details in the corresponding set of private information. If the details do not match, the authorised person is able to alert the manufacturer, or IP owner, upon which an investigation can be carried out, or immediately commence the investigation.

If it is a genuine article, it could be further investigated if the genuine article is an allowed parallel import. For example, some products may be licenced to be manufactured and or retailed in specific countries or regions only. The manufacturer, or IP owner, may take appropriate measures as desired by them.

If a counterfeit article is found, the details in the corresponding set of private information may reveal where the counterfeiting may have occurred. For instance, a counterfeiter may have bought a genuine article and reproduced the article with the barcode in whole to sell. In other possible scenarios, a distributor or retailer may have attempted to make copies of the genuine article for sale in place of the genuine articles.

In a second example, a retailer or distributor returns a portion of a batch of articles to the manufacturer, these could be unsold or customer returned articles. The authorised user is able to access the corresponding set of private information with the reader device, and records the number of returned articles and number of circulating articles in the market. The manufacturer, or IP owner, is able to periodically verify if the number of circulating articles matches their records; an excess of circulating articles will indicate a possible copying of the article has occurred. The checking can be done via the authorised user as in the first example, or via consumers accessing the public information. This allows the manufacturer, or IP owner, to detect copying of their articles as early as possible, and to trace a possible source of copying.

The embodiments of the present invention allows the authorised user to track the origin of an article, and determine if the article is being distributed, or sold in the intended location. The private information encoded in the barcode provides the authorised user,
5 or investigators, with more information to start with.

The overt display of the barcode, and the presence of the reference in the barcode in some embodiments, conceals the presence of the identifier in the barcode. The reference and related information serves various purposes including deterring the removal by
10 counterfeiters by serving a useful educational purpose for the consumers, allowing for engagement between the consumers and manufacture or IP owner, and allows a manufacture to monitor consumers trends by tracking access to the public information (i.e. tracking consumer's access to the article). This allows the successful transfer of the barcode to a counterfeit or copied product, which allows an authorised user to track the
15 origin of the article, in particular a point where a counterfeit activity may have occurred.

The barcode, and tracking system described herein may be combined with other existing anti-counterfeit measures.

20 While it is important to detect counterfeits, it is even more important for the manufacturer or intellectual property rights owner to be able to track the source of the counterfeits to solve the root of the problem.

Advantageously, the present invention provides for a barcode that provides and allows
25 different levels of access to different groups of people. Here, we have identified possibly three different groups of people, i.e. an authorised user (e.g. manufacturer of article), a consumer (e.g. purchaser of the article), and the unauthorised public at large. An application that resides in a reader that reads barcode may achieve such differential access levels. As described above, the barcode may encode both a public reference and
30 an identifier. The application will be able to distinguish access levels by reading the appropriate portion of the barcode. An unauthorised reader will only read the public reference which may be a URL that provides a link to publicly available information on the

Internet; while an authorised reader will only read the identifier which acts like a code and/or a private key to provide access to a database for the extraction of private information associated with the article. In addition, the identifier may provide access to a consumer having the relevant application designed for consumers such that the
5 consumer will also have access to the database but information that is only relevant to the consumer, i.e. consumer information.

Whilst there has been described in the foregoing description preferred embodiments of the present invention, it will be understood by those skilled in the technology concerned
10 that many variations or modifications in details of design or construction may be made without departing from the present invention.

Claims

1. A barcode associated with an article, the barcode comprising:

- (a) an encoded identifier that allows an authorized user to access a database using a private key; and
- (b) an encoded reference that is accessible to an unauthorised general public, the encoded reference and encoded identifier forms a single string

wherein the encoded identifier is associated with the article and, is compared with entries in a table in the database to determine private information associated with the article, each entry in the database contains the identifier and a corresponding set of private information associated with the article, and the barcode is configured such that, when read, it allows a device of an authorized user reading the barcode to omit the encoded reference.

2. The barcode according to any one of the preceding claims, wherein the identifier is encrypted.

3. The barcode according to any one of the preceding claims, wherein the identifier further allows a consumer of the article access to consumer information associated with the article.

4. The barcode according to any one of the preceding claims, wherein the identifier is an integer equal or greater than 1.

5. The barcode according to any one of the preceding claims, wherein the identifier is unique to the article.

6. The barcode according to any one of the preceding claims, wherein the private information is any one selected from the group comprising: the location of manufacturing of the article, the time and date of manufacturing of the article, any restriction of sales of the article in respect of geographical locations, the total

- number of manufactured articles in a batch, identity of the manufacturer, the identity of at least one customer who ordered the manufacturing of the article, the identity of at least one distributor of the article, the identity of at least one retailer selling the article, the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the article and, in the case where the article is a book, the title and ISBN number of the book.
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7. The barcode according to any one of the preceding claims, wherein the reference is a resource on the Internet.
- 10
8. The barcode according to any one of the preceding claims, wherein the barcode is a two-dimensional barcode.
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9. The barcode according to claim 8, wherein the two-dimensional barcode is any one selected from the group comprising: data matrix, quick response (QR) code, Aztec code, EZcode, High Capacity Colour Barcode, MaxiCode, NexCode, PDF417, Qode, and Shotcode.
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10. A method for preparing and printing a barcode associated with an article, the method comprising:
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- (a) assigning the article with an identifier;
- (b) encoding the identifier that allows an authorized user to access a database using a private key, the identifier is compared with entries in a table in the database to determine private information associated with the article;
- 30
- (c) encoding a reference that is accessible to an unauthorised general public, wherein the identifier and reference forms a single string, and the barcode is configured to allow a device reading the barcode to omit the encoded reference;
- (d) positioning the barcode for printing on a surface of the article, or within the contents of the article or on a label separate from but associated with the article; and
- (e) printing the barcode.

11. The method according to claim 10, further comprising encrypting the identifier.
- 5 12. The method according to any one of claims 10 or 11, wherein the identifier further allows a consumer of the article access to consumer information associated with the article.
- 10 13. The method according to any one of claims 10 to 12, wherein the private information is any one selected from the group comprising: the location of manufacturing of the article, the time and date of manufacturing of the article, any restriction of sales of the article in respect of geographical locations, the total number of manufactured articles in a batch, identity of the manufacturer, the identity of at least one customer who ordered the manufacturing of the article, 15 the identity of at least one distributor of the article, the identity of at least one retailer selling the article, the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the article and, in the case where the article is a book, the title and ISBN number of the book.
- 20 14. The method according to any one of claims 10 to 13, wherein the article is any one selected from the group comprising: a printed matter, a luxury good, a pharmaceutical product, and a food product.
- 25 15. The method according to claim 14, wherein the printed matter is any one selected from the group comprising: a book, a magazine, a journal, a publication, a document, and a manual.
- 30 16. The method according to claim 15, wherein the barcode is printed within the contents of the book.

17. A method of determining private information associated with an article, the method comprising:
- 5 (a) reading a barcode, the barcode comprising an encoded identifier that allows an authorised user to access a database using a private key, an encoded reference that is accessible to an unauthorised general public, and the identifier and the reference forming a single string;
- (b) omitting the encoded reference;
- (c) decoding only the encoded identifier;
- (d) accessing the database using the private key; and
- 10 (e) obtaining the private information by comparing the identifier associated with the article with entries in a table in the database.
18. The method according to claim 17, wherein each entry in the database contains the identifier and a corresponding set of private information associated with the article.
- 15 19. The method according to any one of claims 17 or 18, wherein the identifier is encrypted and the method further comprising the step of decrypting the identifier.
- 20 20. The method according to any one of claims 17 to 19, wherein obtaining the private information determines the source of the article, the private information is any one selected from the group comprising: the location of manufacturing of the article, the time and date of manufacturing of the article, any restriction of sales of the article in respect of geographical locations, the total number of manufactured articles in a batch, identity of the manufacturer, the identity of at least one customer who ordered the manufacturing of the article, the identity of at least one distributor of the article, the identity of at least one retailer selling the article, the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the
- 25 30

article and, in the case where the article is a book, the title and ISBN number of the book.

21. The method according to any one of claims 17 to 20, wherein the article is a book
5 and the barcode is contained within the contents of the book.

22. The method according to any one of claims 17 to 21, wherein the barcode is read with a mobile device.

10 23. A system for determining private information associated with an article, the system comprising:

(a) a device adapted to read a barcode associated with the article, the barcode comprising an encoded identifier that allows an authorized user to access a database using a private key, an encoded reference that is accessible to an
15 unauthorised general public, and the identifier and the reference forming a single string, the barcode configured to allow the device reading the barcode to omit the encoded reference and only decode the encoded identifier;

(b) a means for receiving the identifier associated with the article; and

(c) a processing unit for comparing the identifier associated with the article
20 with entries in a table in a database,

wherein each entry in the database contains the identifier and a corresponding set of private information associated with the article.

24. The system according to claim 23, wherein the device for reading the barcode is a
25 mobile device.

25. The system according to any one of claims 23 to 24, wherein obtaining the private information determines the source of the article, the private information is any one selected from the group comprising: the location of manufacturing of the
30 article, the time and date of manufacturing of the article, any restriction of sales of the article in respect of geographical locations, the total number of manufactured articles in a batch, identity of the manufacturer, the identity of at

least one customer who ordered the manufacturing of the article, the identity of at least one distributor of the article, the identity of at least one retailer selling the article, the time and date of shipment of article, name of the shipment vendor, size of the article, weight of the article, weight of the shipment containing the article and, in the case where the article is a book, the title and ISBN number of the book.

26. The system according to any one of claims 23 to 25, wherein the article is a book and the barcode is contained within the contents of the book.

27. The system according to any one of claims 23 to 26, further comprising a communication means for transmitting data between the device and the database.

28. A computer program encoding a set of computer instructions for determining private information associated with an article, which when running on a data processing system is adapted to perform the method as claimed in any one of claims 17 to 22.

29. A computer usable storage medium having encoded thereon data and computer instructions for determining private information associated with an article, for causing a data processing system to implement the method as claimed in any one of claims 17 to 22.