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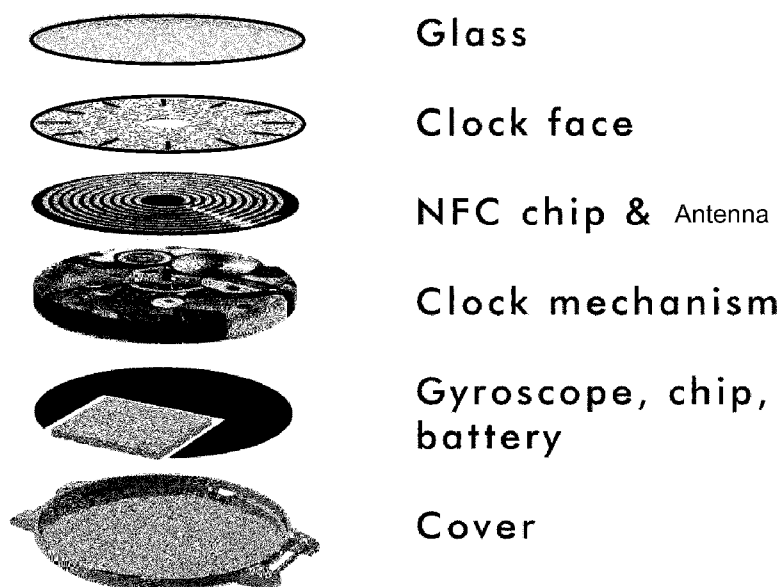


FIGURE 3

(57) Abstract: The field of the invention relates to wristwatch devices including a near field communications (NFC) system, to uses of such wristwatch devices, to NFC systems suitable for use in wristwatch devices, and to related methods and computer program products. There is provided a wristwatch device including a near field communications (NFC) system, the near field communications system including a processor, a NFC transceiver coupled to the processor, and a processor-readable non-transient storage medium storing identification data, wherein the processor is configured to: (i) establish a NFC link between the wristwatch device and another device, and (ii) transmit identification data to the other device via the established NFC link.

WRISTWATCH DEVICE

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The field of the invention relates to wristwatch devices including a near field communications (NFC) system, to uses of such wristwatch devices, to NFC systems suitable for use in wristwatch devices, and to related methods and computer program
10 products.

2. Technical Background

Near field communication (NFC) includes technology for smartphones and similar
15 devices to establish radio communication with each other by touching them together or bringing them into close proximity, usually zero cm to no more than a few centimeters.

NFC includes a set of short-range wireless technologies, typically requiring a communication distance of zero cm to 10 cm or less. NFC may operate at 13.56 MHz on
20 the international standard ISO/IEC 18000-3 air interface and at rates ranging from 106 kbit/s to 424 kbit/s. NFC may involve an initiator and a target; the initiator actively generates a radio frequency (RF) field that can power a passive target. This enables NFC targets to take very simple form factors such as tags, stickers, key fobs, or cards that do not require batteries. NFC peer-to-peer communication is possible, provided both
25 devices are powered.

Near-field communication may use magnetic induction between two loop antennas located within each other's near field, effectively forming an air-core transformer. Near-field communication may operate within the globally available and unlicensed radio
30 frequency industrial, scientific and medical (ISM) band of 13.56 MHz. Typically, most of the RF energy is concentrated in the allowed ± 7 kHz bandwidth range. The theoretical working distance with compact standard antennas is zero cm up to 20 cm, with a practical working distance of zero cm up to about 4 cm.

3. Discussion of Related Art

In prior art reference WO2010138592A2 there are disclosed devices and methods for storing provisioning data for use in one or mobile devices within a subscriber identity module (SIM) card enclosed within a personal article, such as a wrist watch or item of jewelry. A close range communication link, such as a near field communication (NFC) protocol link, is used to transmit the provisioning data from the personal article to one or more mobile devices. The close range communication link may also be used to transmit updated provisioning data received by a mobile device in an over the air updating procedure via a cellular communications network link to the personal item for storage in the SIM card housed within a personal article. The mobile device may authenticate itself to the personal article prior to the transmission of provisioning data between the devices.

Prior art **Figure 4** disclosed in WO2010138592A2 is a system diagram of a communication network 100 including a plurality of mobile devices 130, 140, 150, 160 in communication with a personal article 105 which is a wristwatch. A SIM card is housed within the personal article 105. The SIM card stores provisioning data which contains the necessary settings and information to enable any of the plurality of mobile devices 130, 140, 150, 160 to communicate over a wireless digital communications network, such as a cellular communications network 180. The personal article 105 further includes a close-range wireless transceiver capable of establishing a close range communications link with and transmitting the provisioning data stored in the internal SIM card to any of a plurality of mobile devices 130, 140, 150 and/or 160. The plurality of mobile devices include an internet enabled cellular telephone 130, a personal digital assistant (PDA) 140, a cellular telephone 150, and/or a laptop computer 160. Each of the plurality of mobile devices 130, 140, 150, 160 is configured with an antenna and close range communications (CRC) transceiver for receiving provisioning data from the personal article 105.

However, a problem with a device of WO2010138592A2 is that identification data provided by the device may not identify the device itself. A further problem with the devices of WO2010138592A2 is that a SIM card may be readily replaced during normal use of the device, which provides no protection against device theft followed by SIM card replacement.

SUMMARY OF THE INVENTION

According to a first aspect of the invention, there is provided a wristwatch device including a near field communications (NFC) system, the near field communications system including a processor, a NFC transceiver coupled to the processor, and a processor-readable non-transient storage medium storing identification data, wherein the processor is configured to:

- (i) establish a NFC link between the wristwatch device and another device, and
- (ii) transmit identification data to the other device via the established NFC link.

An advantage is that the wristwatch device provides identification data which can be obtained by another device using NFC communications; that identification data may uniquely identify the wristwatch device.

The wristwatch device may be one wherein the processor-readable non-transient storage medium is a secure element. An advantage is that the processor-readable non-transient storage medium is therefore tamper-resistant.

The wristwatch device may be one wherein during normal use of the wristwatch device the NFC system is not removable as a whole from the wristwatch device, or the non-transient storage medium is not removable from the wristwatch device. An advantage is that identification data can be held securely in the device without being readily switched by an impostor or a thief. An example in which the NFC system is removed as a whole during non-normal use is if a skilled technician opens up the device for replacing the NFC system, using specialist tools.

The wristwatch device may be one wherein the device is not operable to receive a SIM card. An advantage is that the device hardware is entirely self-contained.

The wristwatch device may be one wherein the non-transient storage medium stores a first authentication credential, wherein the processor is configured to:

- (i) receive a second authentication credential from the other device;
- (ii) perform authentication verification using the first authentication credential and the second authentication credential, and

(iii) transmit identification data to the other device via the established NFC link only if authentication of the other device is verified.

An advantage is that the identification data cannot be obtained automatically by a NFC enabled other device, which makes the protection of the identification data more secure.

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The wristwatch device may be one wherein the processor is configured to request the second authentication credential from the other device. An advantage is that this protects from an attack in which the other device ‘pushes’ an authentication credential onto the wristwatch device.

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The wristwatch device may be one wherein the processor includes memory, wherein the processor is configured to delete the second authentication credential from memory after performing authentication verification. An advantage is that the second authentication credential cannot be obtained by a later disassembly of the wristwatch device because the

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The wristwatch device may be one wherein the processor is configured to terminate the NFC link prior to transmitting identification data to the other device via the established NFC link if authentication of the other device is not verified. An advantage is that this eliminates the communication link and hence eliminates possible attack via the communication link.

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The wristwatch device may be one wherein the NFC system includes a GPS receiver coupled to the processor, wherein the GPS receiver is activated by the processor only when an NFC link has been established. An advantage is that the NFC system only attempts to determine a GPS location, which is a relatively power intensive process, when it has a NFC power source.

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The wristwatch device may be one wherein the other device is a smartphone, a mobile phone, an automated teller machine, a vehicle, or a controlled entry system of a premises.

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The wristwatch device may be one wherein the NFC system is situated directly behind a display face of the wristwatch. An advantage is that the NFC system may readily provide output to the display face.

The wristwatch device may be one wherein the NFC system is a planar component of the wristwatch. An advantage is that planar components are well-suited to a wristwatch housing geometry.

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The wristwatch device may be one wherein the NFC system is a thin disc. An advantage is that a thin disc is well-suited to many wristwatch housing geometries.

- 10 The wristwatch device may be one wherein the NFC system forms part of a display face component of the wristwatch. An advantage is that the NFC system may readily provide output to the display face.

- 15 The wristwatch device may be one wherein a display face component of the wristwatch includes a liquid crystal display, a bistable display or a low power display, for user interactions or notifications. Such displays have low power demands on a wristwatch device battery.

- 20 The wristwatch device may be one wherein messages and notifications are receivable by the wristwatch from a smartphone via short range wireless communications or Bluetooth. An advantage is that the wristwatch device is provided with smartphone-like functionality without the hardware requirements of a smartphone.

- 25 The wristwatch device may be one wherein a display face component of the wristwatch includes a LED for user notifications, such as flashing when a payment is taken.

The wristwatch device may be one wherein the wristwatch includes a small digital display that shows value/credits stored on watch.

- 30 The wristwatch device may be one wherein the NFC system includes one or more additional components selected from the list of: an antenna for Bluetooth communications, a light emitting diode (LED), a graphical display.

The wristwatch device may be one wherein the wristwatch further includes one or more additional components selected from the list of: a printed circuit board (PCB) with extended functionality, a further processor unit, a memory, a wireless interface (such as Bluetooth or Wi-Fi), sensors for a user's pulse, a movement sensor, a reserve power
5 source, or an inductive charging apparatus.

The wristwatch device may be one wherein the wristwatch includes: a back and side covering; a layer including an accelerometer component, a chip and a battery; a further layer including a clock mechanism; a further layer comprising the NFC system; a clock
10 face, and a glass cover. An advantage is that the device can be used to provide NFC functionality in relation to measured movement, such as enabling NFC communication in response to a shake gesture.

The wristwatch device may be one wherein the wristwatch includes a computer in
15 connection with the NFC system, wherein the computer is operable to download and run an application which uses the NFC system. An advantage is that the wristwatch device acquires some of the programming versatility of a smartphone, but without the full hardware requirements of a smartphone.

20 The wristwatch device may be one wherein the processor is configured to receive account data from the other device via the NFC link and to store the account data in the non-transient storage medium. Advantages include that the wristwatch device may top up credits, such as for use in a public transport system, for accessing a particular premises, for use in gaming activities, for use in a premises for paying for food and/or drink, for
25 use in a shop for payment, or for use in accessing exercise or sports facilities. Advantages include that user account data may be updated, such as with new payment card details, or with new security authorization details.

The wristwatch device may be one wherein the NFC system includes data which are
30 changeable through interaction via a NFC link with the other device. Advantages include that the wristwatch device may top up credits, such as for use in a public transport system, for accessing a particular premises, for use in gaming activities, for use in a premises for paying for food and/or drink, for use in a shop for payment, or for use in accessing exercise or sports facilities. Advantages include that user account data may be

updated, such as with new payment card details, or with new security authorization details.

5 The wristwatch device may be one wherein the data are credit data, and the credit data are changeable through interaction via a NFC link with a smart phone running a banking application. Hence a smartphone running a banking application can be used to pay for credits for the wristwatch device.

10 The wristwatch device may be one wherein the data are loyalty points data, and the loyalty points data are changeable through interaction via a NFC link with a smart phone running a loyalty application.

The wristwatch device may be one wherein the NFC system is operable to download an application program from the other device using the NFC link. An advantage is that the short range of NFC links makes it difficult to eavesdrop on such a wireless download.

20 The wristwatch device may be one wherein the NFC system provides a unique identity for the wristwatch. An advantage is that the wristwatch device may be used for identification purposes.

The wristwatch device may be one wherein the NFC system is integral to the wristwatch during normal use of the wristwatch. An advantage is that the NFC system cannot easily become detached inadvertently from the device.

25 According to a second aspect of the invention, there is provided a near field communications (NFC) apparatus suitable for use in a wristwatch device, the near field communications apparatus including a processor, a NFC transceiver coupled to the processor, and a processor-readable non-transient storage medium storing identification data, wherein the processor is configured to:

- 30 (i) establish a NFC link with another device, and
(ii) transmit identification data to the other device via the established NFC link.

Advantages include that the apparatus can be retrofitted to a wristwatch device, such as within the wristwatch housing, on the outside of the wristwatch housing, or in or on a strap of the wristwatch.

- 5 The NFC apparatus may be such that the processor-readable non-transient storage medium is a secure element. An advantage is that the processor-readable non-transient storage medium is therefore tamper-resistant.

- 10 The NFC apparatus may be such that the NFC apparatus is not removable as a whole from the wristwatch device, or the non-transient storage medium is not removable from the wristwatch device, during normal use of the wristwatch device.

The NFC apparatus may be such that the NFC apparatus is not operable to receive a SIM card. An advantage is that the NFC apparatus hardware is entirely self-contained.

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The NFC apparatus may be such that the NFC apparatus is retrofittable to a wristwatch.

The NFC apparatus may be such that the NFC apparatus includes a printed circuit board.

- 20 The NFC apparatus may be such that the NFC transceiver includes a spiral antenna. Such an antenna is compact.

The NFC apparatus may be such that the NFC apparatus has a maximum lateral extent between 1 cm and 5 cm.

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The NFC apparatus may be such that the NFC apparatus is a disc with a diameter of between 1 cm and 5 cm.

- 30 The NFC apparatus may be such that the NFC apparatus includes a casing, and is retrofittable to an outside of a wristwatch case.

The NFC apparatus may be such that the NFC apparatus includes a casing, and is retrofittable to a wristwatch strap, wherein the strap is in contact with a wristwatch case.

According to a third aspect of the invention, there is provided a method of verifying authenticity between a wristwatch device and another device, the wristwatch device including a near field communications (NFC) system, the near field communications system including a processor, a NFC transceiver coupled to the processor, and a processor-readable non-transient storage medium storing identification data, the non-transient storage medium storing a first authentication credential, the method comprising the steps of:

- (i) establishing a NFC link between the wristwatch device and the other device;
- (ii) receiving a second authentication credential from the other device via the NFC link;
- (iii) performing authentication verification using the first authentication credential and the second authentication credential, and
- (iv) transmitting identification data to the other device via the established NFC link only if authenticity of the other device is verified.

The method may include the step of requesting the second authentication credential from the other device.

The method may be one wherein the processor includes memory, the method including the step of deleting the second authentication credential from memory after performing authentication verification.

The method may be one including the step of terminating the NFC link prior to transmitting identification data to the other device via the established NFC link if authenticity of the other device is not verified.

According to a fourth aspect of the invention, there is provided a computer program product embodied on a non-transient storage medium, the computer program product operable to perform the method according to any statement according to the third aspect of the invention.

According to a fifth aspect of the invention, there is provided use of the wristwatch according to any statement according to the first aspect of the invention, as a NFC banking card.

According to a sixth aspect of the invention, there is provided use of the wristwatch according to statement according to the first aspect of the invention, as a vehicle key.

- 5 According to a seventh aspect of the invention, there is provided use of the wristwatch according to any statement according to the first aspect of the invention, in a controlled entry system to verify entry to premises.

- 10 According to an eighth aspect of the invention, there is provided a system comprising the wristwatch device according to any statement according to the first aspect of the invention, and the other device.

According to an ninth aspect of the invention, there is provided a method of retrofitting a near field communications (NFC) apparatus to a wristwatch, comprising the steps of:

- 15 (i) opening the wristwatch;
(ii) inserting a NFC apparatus according to any statement according to the second aspect of the invention into the wristwatch, and
(iii) closing the wristwatch.

An advantage is that a wristwatch can be readily upgraded with NFC functionality.

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According to an tenth aspect of the invention, there is provided a method of manufacturing a wristwatch, comprising the steps of:

- (i) starting with a design representation for a pre-existing wristwatch,
(ii) modifying the design representation by increasing the thickness of the wristwatch
25 so as to accommodate a near field communications (NFC) apparatus according to any statement according to the second aspect of the invention within the wristwatch, and
(iii) manufacturing the wristwatch according to the modified design representation, including the step of inserting the NFC apparatus into the wristwatch.

- An advantage is that a wristwatch can be readily redesigned and manufactured to
30 incorporate NFC functionality.

According to an eleventh aspect of the invention, there is provided a method of modifying a design representation of a wristwatch, comprising the steps of:

- (i) starting with a design representation for a pre-existing wristwatch, and

(ii) modifying the design representation by increasing the thickness of the wristwatch so as to accommodate a near field communications (NFC) apparatus according to any statement according to the second aspect of the invention within the wristwatch.

5 An advantage is that the modified design representation is much cheaper to produce than a design for a new watch which incorporates NFC functionality.

10 An advantage of an implementation of the invention is that it can be included into an existing design of wristwatch, such as a conventional wristwatch with a mechanical movement, or a quartz movement, with no or very limited modifications to the design of the watch casing or the assembly or manufacturing processes. This is very important because conventional watch manufacturers face significant competitive threats from new players with entirely electronic watches, with functionality such as smartphone connectivity. It is very valuable for those conventional watch manufacturers to be able to update the functionality of their existing watches with NFC capability without having to
15 discard the heritage and skills developed over many decades in conventional watch making.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects of the invention will now be described, by way of example only, with reference to the following Figures, in which:

5

Figure 1 shows a schematic diagram of an example of a wristwatch structure.

Figure 2 shows a schematic diagram of an example of an incorporation of a NFC module into an otherwise conventional watch.

10 **Figure 3** is an exploded view showing an example structure of a wristwatch device including a near field communications (NFC) system, wherein the NFC system is not removable as a whole or in part from the wristwatch device during normal use of the wristwatch device.

Figure 4 shows a system block diagram of a wireless network including a number of mobile devices according to prior art reference WO2010138592A2.

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DETAILED DESCRIPTION

The invention relates to bringing near field communication (NFC) functionality to the watches industry.

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A purpose of this invention is to minimize NFC technology adaptation expenses and to shorten the project timeframe.

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Typical watches structure consists of Dial/Display and front-glass (1), Mechanical mechanism movement and/or printed circuit board (PCB) and power source part (3) and bottom enclosure (5). Reference may be had to **Figure 1**, by way of example.

In an example, we put NFC functionality in part (2), which is very thin disk and can be combined with Dial (1), or can be a separate part.

15

When combined with Dial Part (1), NFC functionality Part (2) can contain additional components, like antennas for Bluetooth communications, light emitting diode (LED) signal lighting for user iteration, graphical display.

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Part (4) is optional and can consist of additional printed circuit board (PCB) with extended functionality, like processor unit, memory, wireless interfaces (like Bluetooth, Wi-Fi), sensors for pulse, movement, reserve power source, as well as inductive charging scheme.

25

Part (4) can be bonded together with bottom enclosure (Part 5).

Part (4) can be linked electrically or mechanically with watches power source within Part (3).

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Parts (1) and (4) may be linked together with wired or inductive connection.

Part (4) can be connected to existing watches controls, like rotary selectors or buttons.

Part (1) when combined with (4) can have liquid crystal display (LCD) or Bi-Stable or low power display for user interactions or notifications. Display can be segmented or active matrix.

- 5 Part (1) when combined with (4) can have LED for user notifications.

Antennas for part (1) can be implemented as a part of cover glass, electrically contacting with wired connection with part (1).

- 10
- Watch can include small digital display that shows value/credits stored on watch; could double up as date display.
 - Watch can include small LED that flashes once payment has been taken.
 - Self-contained NFC portion can be retrofitted to outside of existing watch case.

- 15 **Figure 2** shows a schematic diagram of an incorporation of a NFC module into an otherwise conventional watch.

In an example, a watch includes a back and side covering, a layer including a gyroscope (or an accelerometer component), a chip and a battery, a further layer including a clock mechanism, a further layer including a NFC chip and antenna component, a clock face, and a glass cover. **Figure 3** shows a schematic diagram of an incorporation of a NFC chip and antenna component into a watch.

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In an example, an NFC chip and antenna component is on a PCB which is watch-sized and includes the antenna. In an example, the NFC chip and antenna component is situated under the clockface. In an example, an NFC chip and antenna component includes a spiral antenna.

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Existing watch manufacturers can add the NFC modules into existing (or slightly adapted) watch designs (even mechanical watches) and watch assembly methodologies. These NFC module designs are suitable for adding to conventional watches for example because they are really tiny and can go anywhere, as long as the antenna is not obstructed. The NFC/smart module may be tiny and may be put under the clockface of mass-production models.

30

A key, core idea is to make smart watches. Use of a watch as a NFC banking card is an example. Further use examples are: car keys, elite club keys, sensors (movement, etc.).

- 5 In an example of use of a wristwatch as a NFC banking card, the wristwatch is brought into close proximity to form a NFC connection with an automatic teller machine, and used to identify a user in the same way that insertion of a bank card into an automatic teller machine can be used to identify a user. Further security steps such as a user entering a PIN code into the automatic teller machine may be used.

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- In an example of use of a wristwatch as a NFC banking card, the wristwatch is brought into close proximity to form a NFC connection with a wireless payment device (such as, but not limited to, one operable to receive a credit card), and used to identify a user in the same way that insertion of a bank card into a wireless payment device can be used to
15 identify a user. Further security steps such as a user entering a personal identity number (PIN) code into the wireless payment device may be used.

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A screen may be included in the clock face, to show messages and notifications sent from a connected smartphone, which may be connected by Bluetooth or by short range wireless communication.

An idea is to build a module, which may fit almost every elite watch design without huge hardware redesign.

- 25 In an example, the NFC module includes an NFC chip, a secure element and an antenna.

An adaptation that will need to be made to a conventional mechanical watch to accommodate the NFC module is to free some room under the clockface.

- 30 Other ways to add NFC functionality to a conventional watch include retro-fitting to an outside of the case, adding to wrist strap or wristband, or adding to a clasp.

In an example, the watch can run NFC enabled apps. Payment data is pre-installed in a factory. But there is factory-encoded data and there is other data which can be changed,

for example through interaction with a mobile phone app.

Examples of new use cases for a NFC-enabled watch include payment cards, car keys, elite club keys, or loyalty cards.

5

The NFC-enabled watch can interact with NFC enabled smartphones by managing data on smartphone. The NFC-enabled watch can interact with an NFC enabled system extension by managing data on the NFC enabled system extension.

- 10 For payment use case, how will the watch be loaded with credit? In an example, it is done via a banking app on a connected smartphone. In another example, it is personalized after production. Regarding uploading a credit card into a watches, this may be done in a personalisation process after production. Regarding how to top-up the watch with credits, it may be performed just like a usual credit card: internet transfers,
- 15 banks, cash-machines, etc.

For a loyalty card use case, how will watch share points status and bonuses with user? In an example, via a loyalty app on a connected smartphone. In another example, via an app on NFC-enabled smartphone. Watches in this case may share only loyalty ID.

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In an example, a NFC chip and antenna module is not removable from a watch during normal use. An advantage is that the NFC chip and antenna module may be used to provide a unique identity for the watch. This may make the watch less attractive to a thief because the thief risks being identified as a thief through possession of the watch.

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In an example, a NFC chip and antenna module is integral to a watch during normal use. An advantage is that the NFC chip and antenna module therefore cannot fall out of the watch, which could lead to inadvertent loss of functionality of the watch.

- 30 In an example, a NFC chip and antenna module for use with a wristwatch has a maximum lateral extent between 1 cm and 5 cm; in an example a NFC chip and antenna module is disc-shaped and has a diameter between 1 cm and 5 cm.

Note

It is to be understood that the above-referenced arrangements are only illustrative of the application for the principles of the present invention. Numerous modifications and alternative arrangements can be devised without departing from the spirit and scope of the present invention. While the present invention has been shown in the drawings and fully described above with particularity and detail in connection with what is presently deemed to be the most practical and preferred example(s) of the invention, it will be apparent to those of ordinary skill in the art that numerous modifications can be made without departing from the principles and concepts of the invention as set forth herein.

CLAIMS

1. A wristwatch device including a near field communications (NFC) system, the near field communications system including a processor, a NFC transceiver coupled to
5 the processor, and a processor-readable non-transient storage medium storing identification data, wherein the processor is configured to:
 - (i) establish a NFC link between the wristwatch device and another device, and
 - (ii) transmit identification data to the other device via the established NFC link.
- 10 2. The wristwatch device of Claim 1, wherein the processor-readable non-transient storage medium is a secure element.
3. The wristwatch device of Claims 1 or 2, wherein during normal use of the wristwatch device the NFC system is not removable as a whole from the wristwatch
15 device, or the non-transient storage medium is not removable from the wristwatch device.
4. The wristwatch device of any of Claims 1 to 3, wherein the device is not operable to receive a SIM card.
- 20 5. The wristwatch device of any of Claims 1 to 4, the non-transient storage medium storing a first authentication credential, wherein the processor is configured to:
 - (i) receive a second authentication credential from the other device;
 - (ii) perform authentication verification using the first authentication credential and the second authentication credential, and
 - 25 (iii) transmit identification data to the other device via the established NFC link only if authentication of the other device is verified.
6. The wristwatch device of Claim 5, wherein the processor is configured to request the second authentication credential from the other device.
- 30 7. The wristwatch device of Claims 5 or 6, the processor including memory, wherein the processor is configured to delete the second authentication credential from memory after performing authentication verification.

8. The wristwatch device of any of Claims 5 to 7, wherein the processor is configured to terminate the NFC link prior to transmitting identification data to the other device via the established NFC link if authentication of the other device is not verified.

5 9. The wristwatch device of any previous Claim, wherein the NFC system includes a GPS receiver coupled to the processor, wherein the GPS receiver is activated by the processor only when an NFC link has been established.

10 10. The wristwatch device of any previous Claim, wherein the other device is a smartphone, a mobile phone, an automated teller machine, a vehicle, or a controlled entry system of a premises.

11. The wristwatch device of any previous Claim, wherein the NFC system is situated directly behind a display face of the wristwatch.

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12. The wristwatch device of any previous Claim, wherein the NFC system is a planar component of the wristwatch.

13. The wristwatch device of Claim 12, wherein the NFC system is a thin disc.

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14. The wristwatch device of any previous Claim, wherein the NFC system forms part of a display face component of the wristwatch.

15. The wristwatch device of any previous Claim, wherein a display face component
25 of the wristwatch includes a liquid crystal display, a bistable display or a low power display, for user interactions or notifications.

16. The wristwatch device of any previous Claim, wherein messages and notifications
30 are receivable by the wristwatch from a smartphone via short range wireless communications or Bluetooth.

17. The wristwatch device of any previous Claim, wherein a display face component of the wristwatch includes a LED for user notifications, such as flashing when a payment is taken.

18. The wristwatch device of any previous Claim, wherein the wristwatch includes a small digital display that shows value/credits stored on the wristwatch.

5 19. The wristwatch device of any previous Claim, wherein the NFC system includes one or more additional components selected from the list of: an antenna for Bluetooth communications, a light emitting diode (LED), a graphical display.

10 20. The wristwatch device of any previous Claim, wherein the wristwatch further includes one or more additional components selected from the list of: a printed circuit board (PCB) with extended functionality, a further processor unit, a memory, a wireless interface (such as Bluetooth or Wi-Fi), sensors for a user's pulse, a movement sensor, a reserve power source, or an inductive charging apparatus.

15 21. The wristwatch device of any previous Claim, wherein the wristwatch includes: a back and side covering; a layer including an accelerometer component, a chip and a battery; a further layer including a clock mechanism; a further layer comprising the NFC system; a clock face, and a glass cover.

20 22. The wristwatch device of any previous Claim, wherein the wristwatch includes a computer in connection with the NFC system, wherein the computer is operable to download and run an application which uses the NFC system.

25 23. The wristwatch device of any previous Claim, wherein the processor is configured to receive account data from the other device via the NFC link and to store the account data in the non-transient storage medium.

24. The wristwatch device of any previous Claim, wherein the NFC system includes data which are changeable through interaction via a NFC link with the other device.

30

25. The wristwatch device of Claim 24, wherein the data are credit data, and the credit data are changeable through interaction via a NFC link with a smart phone running a banking application.

26. The wristwatch device of Claim 24, wherein the data are loyalty points data, and the loyalty points data are changeable through interaction via a NFC link with a smart phone running a loyalty application.

5 27. The wristwatch device of any previous Claim, wherein the NFC system is operable to download an application program from the other device using the NFC link.

28. The wristwatch device of any previous Claim, wherein the NFC system provides a unique identity for the wristwatch.

10

29. The wristwatch device of any previous Claim, wherein the NFC system is integral to the wristwatch during normal use of the wristwatch.

30. Near field communications (NFC) apparatus suitable for use in a wristwatch
15 device, the near field communications apparatus including a processor, a NFC transceiver coupled to the processor, and a processor-readable non-transient storage medium storing identification data, wherein the processor is configured to:

- (i) establish a NFC link with another device, and
- (ii) transmit identification data to the other device via the established NFC link.

20

31. Apparatus of Claim 30, wherein the processor-readable non-transient storage medium is a secure element.

32. Apparatus of Claims 30 or 31, wherein during normal use of the wristwatch
25 device the NFC apparatus is not removable as a whole from the wristwatch device, or the non-transient storage medium is not removable from the wristwatch device.

33. Apparatus of any of Claims 30 to 32, wherein the apparatus is not operable to receive a SIM card.

30

34. Apparatus of any of Claims 30 to 33, wherein the apparatus is retrofittable to a wristwatch.

35. Apparatus of any of Claims 30 to 34, wherein the NFC apparatus includes a printed circuit board.
36. Apparatus of any of Claims 30 to 35, wherein the NFC transceiver includes a spiral antenna.
37. Apparatus of any of Claims 30 to 36, wherein the NFC apparatus has a maximum lateral extent between 1 cm and 5 cm.
38. Apparatus of Claim 37, wherein the NFC apparatus is a disc with a diameter of between 1 cm and 5 cm.
39. Apparatus of any of Claims 30 to 33 including a casing, wherein the NFC apparatus is retrofittable to an outside of a wristwatch case.
40. Apparatus of any of Claims 30 to 33 including a casing, wherein the NFC apparatus is retrofittable to a wristwatch strap, wherein the strap is in contact with a wristwatch case.
41. Method of verifying authenticity between a wristwatch device and another device, the wristwatch device including a near field communications (NFC) system, the near field communications system including a processor, a NFC transceiver coupled to the processor, and a processor-readable non-transient storage medium storing identification data, the non-transient storage medium storing a first authentication credential, the method comprising the steps of:
- (i) establishing a NFC link between the wristwatch device and the other device;
 - (ii) receiving a second authentication credential from the other device via the NFC link;
 - (iii) performing authentication verification using the first authentication credential and the second authentication credential, and
 - (iv) transmitting identification data to the other device via the established NFC link only if authenticity of the other device is verified.

42. Method of Claim 41, the method including the step of requesting the second authentication credential from the other device.

43. Method of Claims 41 or 42, the processor including memory, the method
5 including the step of deleting the second authentication credential from memory after performing authentication verification.

44. Method of any of Claims 41 to 43, including the step of terminating the NFC link
10 prior to transmitting identification data to the other device via the established NFC link if authenticity of the other device is not verified.

45. Computer program product embodied on a non-transient storage medium, the computer program product operable to perform the method of any of Claims 41 to 44.

15 46. Use of the wristwatch of any of Claims 1 to 29 as a NFC banking card.

47. Use of the wristwatch of any of Claims 1 to 29 as a vehicle key.

48. Use of the wristwatch of any of Claims 1 to 29 in a controlled entry system to
20 verify entry to premises.

49. System comprising the wristwatch of any of Claims 1 to 29 and the other device.

50. Method of retrofitting a near field communications (NFC) apparatus to a
25 wristwatch, comprising the steps of:

- (i) opening the wristwatch;
- (ii) inserting a NFC apparatus according to any of Claims 30 to 38 into the wristwatch, and
- (iii) closing the wristwatch.

30

51. Method of manufacturing a wristwatch, comprising the steps of:

- (i) starting with a design representation for a pre-existing wristwatch,

- (ii) modifying the design representation by increasing the thickness of the wristwatch so as to accommodate a near field communications (NFC) apparatus according to any of Claims 30 to 38 within the wristwatch, and
 - (iii) manufacturing the wristwatch according to the modified design representation,
- 5 including the step of inserting the NFC apparatus into the wristwatch.

52. Method of modifying a design representation of a wristwatch, comprising the steps of:

- (i) starting with a design representation for a pre-existing wristwatch, and
- 10 (ii) modifying the design representation by increasing the thickness of the wristwatch so as to accommodate a near field communications (NFC) apparatus according to any of Claims 30 to 38 within the wristwatch.

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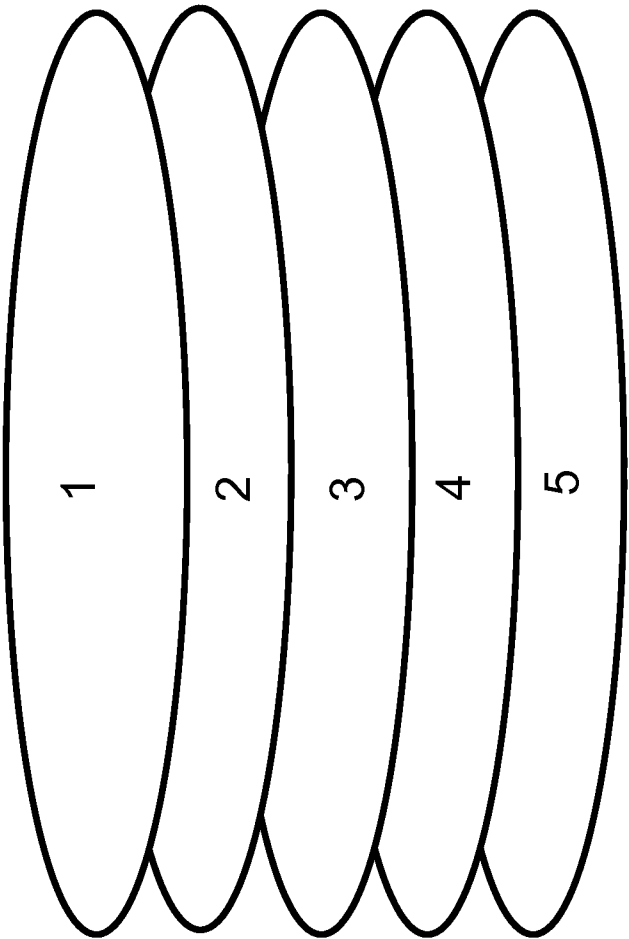


FIGURE 1

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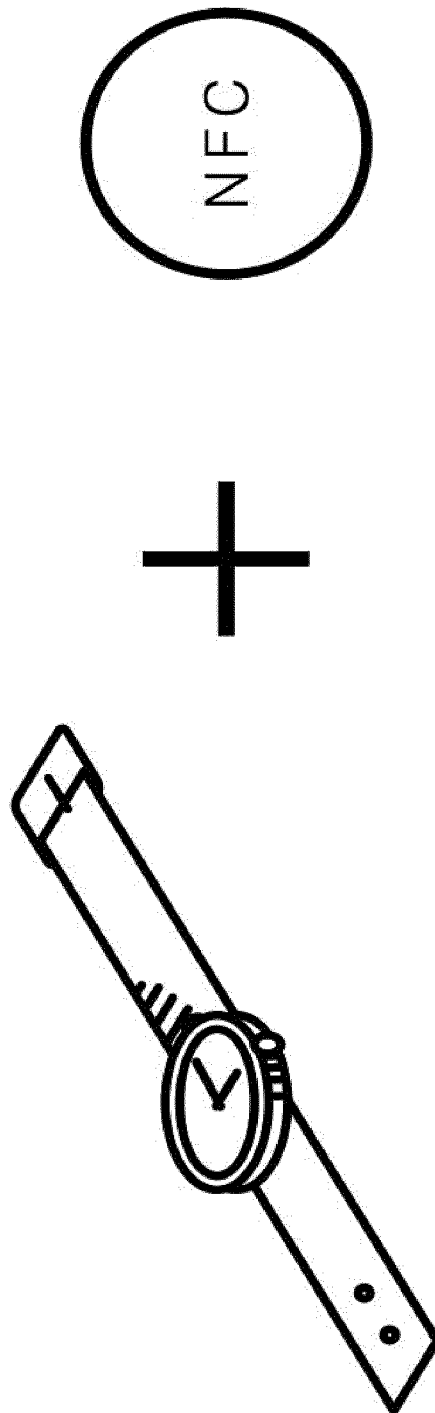


FIGURE 2

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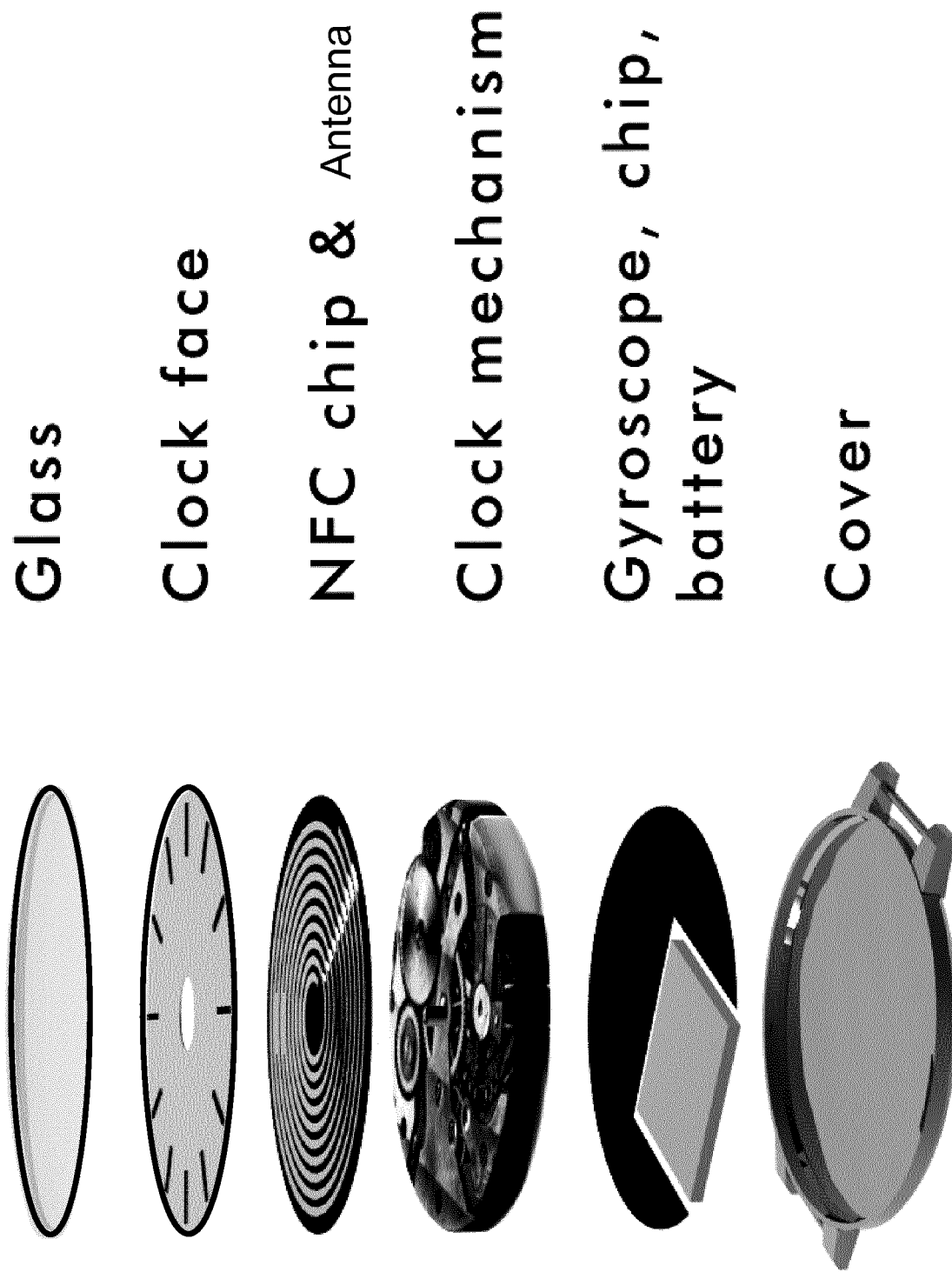


FIGURE 3

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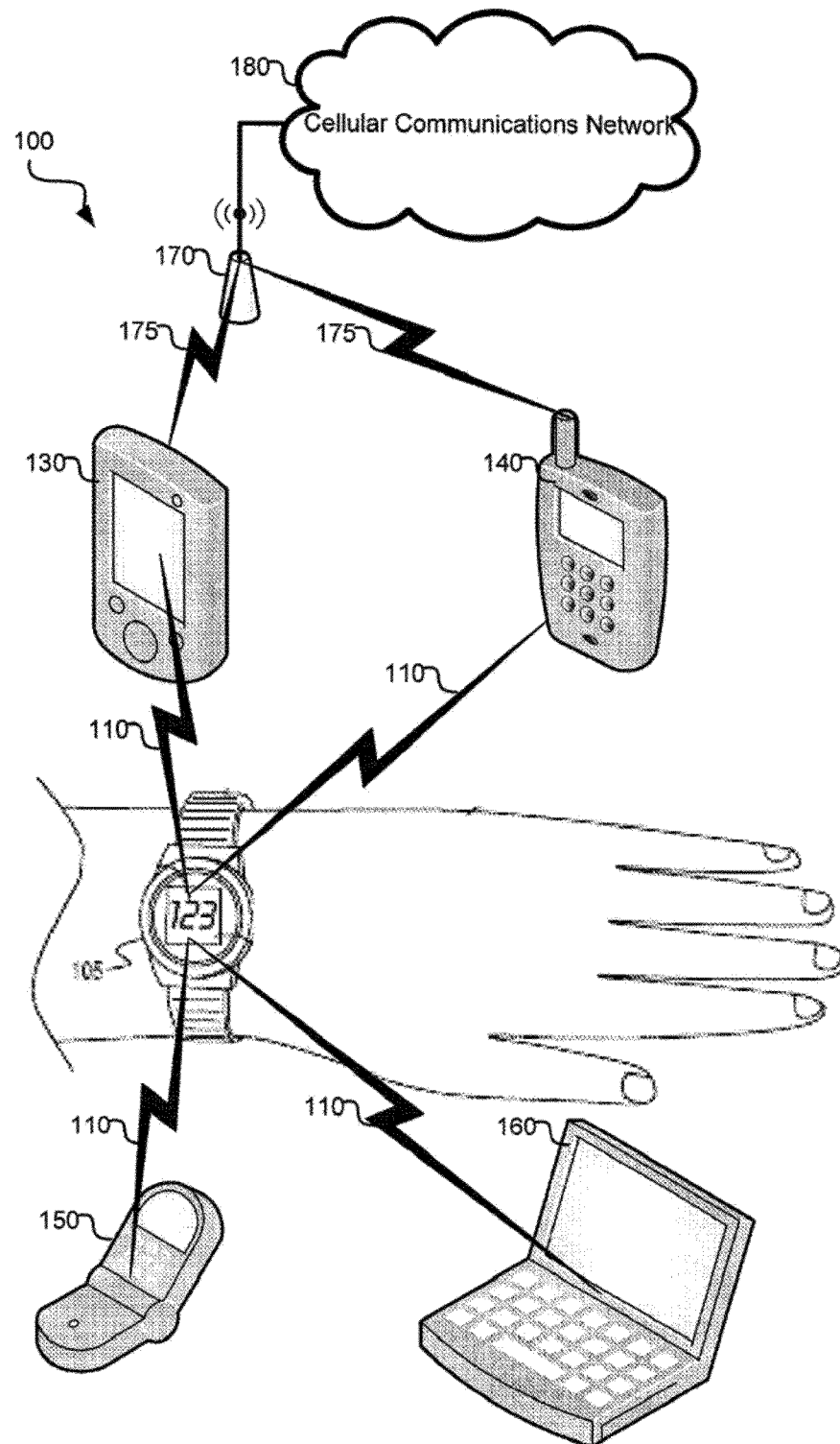


FIGURE 4 PRIOR ART