SUMMARY OF THE INVENTION

The invention provides a dual-display reusable electronic bag tag that can wirelessly receive bag tag data via RFID (HF) or via other wireless means, that is backward compatible with visual bag tag data and barcode in-line-of-sight scanning and tracking technology, that is compatible with track & tracing technology and that is adaptive to fit other (emerging) wireless communication technology regardless of whether nor not this requires a local power supply.

According to an aspect of the invention an electronic bag tag is proposed that is configured to display bag tag data received from a first external source. The electronic bag tag comprises miniaturized electronics. The miniaturized electronics comprises a processor configured to process the bag tag data to obtain processed bag tag data. The miniaturized electronics further comprises a wireless communication interface that is communicatively connected to the processor. The wireless communication interface is configured to receive the bag tag data from the first external source. The miniaturized electronics further comprises a non-volatile memory that is communicatively connected to the processor. The non-volatile memory is configured to store the bag tag data and/or processed bag tag data. The miniaturized electronics further comprises a first display and a second display. Each of the first display and the second display is configured to display at least a part of the processed bag tag data. The non-volatile memory is preconfigured with one or more templates (60a,60b). The processor is configured to select a template from the one or more templates for displaying the at least part of the processed bag tag data on at least one of the first display and the second display using the template.

The electronic bag tag may also be called a smart tag or a smart label.

The processor and non-volatile memory can be integrated in a single integrated circuit, possibly together with further components.

The bag tag data as received in the electronic bag tag is processed to make it suitable for displaying on the first and second display. It is possible that the tag data or parts of the tag data can be displayed without processing, in which case the

processor simply processes the tag data by storing it in the non-volatile memory.

For backward compatibility purposes the use of embedded active matrix displays is preferred and would be most cost effective given the amount of data and barcodes that need to be displayed on the displays. However the electronic bag tag's system architecture can accommodate other types of displays such as segmented displays and passive matrix displays or a combination of display types.

The first display and second display typically have identical outputs, but it is possible that the two displays output different parts of the processed bag tag data.

By using and integrating two, thin, flexible or inflexible displays in a programmable flexible or inflexible tag, the electronic bag tag can advantageously be made to display all bag tag data including e.g. horizontally and vertically positioned 1D barcodes on two sides of the bag tag in conformance with IATA specifications as described in the IATA Baggage Services Manual, making it backward compatible with visual bag tag data and barcode in-line-of-sight scanning technology as used at airports worldwide. The electronic bag tag can advantageously be integrated with e.g. a RFID UHF assembly to make it compatible with the scanning and tracking & tracing technology as used in some airports. Advantageously, the electronic bag tag is reprogrammable and can be wirelessly updated eliminating the baggage labeling process and making the bag tag reusable.

The predefined templates stored within the electronic bag tag may advantageously be used for formatting the output on the displays. This avoids having to transmit the layout information to the electronic bag tag.

The embodiment of claim 2 advantageously enables the electronic bag tag to be battery-less.

The embodiment of claim 3 advantageously enables the electronic bag tag to be read by external RFID readers in addition to visual bag tag data and barcode in-line-of-sight scanners.

The first, second and/or third external sources can be one and the same.

The embodiment of claim 4 advantageously enables components that typically cannot be powered by power inducted by

the inflexible versions) like a credit card in a wallet when not used.

The embodiment of claim 12 advantageously enables sensor data to be used e.g. to detect that the electronic bag tag is inside an airplane and disable the wireless communication interface while inside the airplane.

The embodiment of claim 13 advantageously enables backward compatibility and compliance with existing visual barcode in-line-of-sight scanners.

The embodiment of claim 14 advantageously enables only limited amounts of data, i.e. only the license plate number e.g. coded in ASCII instead of a graphical bitmap of the bar code corresponding to the license plate number, to be received in the electronic bag tag, from which the processor generates the graphical bitmap of the barcode to be displayed.

The embodiment of claim 15 advantageously enables each display to have two small green bars printed on top of the display's left and right side using e.g. green transparent ink to indicate a so-called "Schengen" baggage label conform the IATA specifications, which can be switched to black by e.g. positioning black pixels exactly behind the green bars in order to indicate a regular baggage label.

~~The embodiment of claim 16 advantageously enables predefined templates stored within the electronic bag tag to be used for formatting the output on the displays. This avoids having to transmit the layout information to the electronic bag tag.~~

The embodiment of claim ~~17~~ 16 advantageously enables the electronic bag tag to be used only by its true owner as identified by the external smart card, e.g. by a fingerprint reader on the external smart card. This can be used e.g. to check and safeguard the owner of the luggage to which the electronic bag tag is attached during check-in/drop-of.

According to another aspect of the invention a use of the electronic bag tag having one or more of the above-described features is proposed. The electronic bag tag receives the tag data for displaying on the first display and on the second

display. At least one of the first display and the second display is scanned by an external scanner.

Thus, the electronic bag tag can be used with the above-mentioned advantages.

The embodiment of claim ~~19~~ 18 advantageously enables the electronic bag tag to be traced or located.

According to another aspect of the invention a suitcase is proposed. The suitcase comprises the electronic bag tag according to claim 9. The first display is visibly attached on a first outer side of the suitcase. The second display is visibly attached on a second outer side of the suitcase opposite of the first outer side.

The suitcase makes use of the electronic bag tag with the above-mentioned advantages.

The embodiment of claim ~~21~~ 20 advantageously enables the electronic bag tag to be embedded in the suitcase, preventing it from being ripped of the suitcase.

The embodiment of claim ~~22~~ 21 advantageously enables the displays and possibly the electronics to be detached for maintenance or replacement.

The embodiment of claim ~~23~~ 22 advantageously enables a power supply external to the electronic bag tag to be used for powering the electronic bag tag.

The embodiment of claim ~~24~~ 23 advantageously enables the electronics to be moved to the power supply to thereby minimize the dimensions of the first part of the electronic bag tag with the first display and the second part of the electronic bag tag with the second display.

Hereinafter, embodiments of the invention will be described in further detail. It should be appreciated, however, that these embodiments may not be construed as limiting the scope of protection for the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Aspects of the invention will be explained in greater detail by reference to exemplary embodiments of the invention shown in the drawings, in which:

of the airport of arrival, the airline code and/or flight number.

An information area 12a, 12b next to the display 13a, 13b can be used to print non-variable information, such as e.g. the name of the passenger (i.e. the owner of the electronic bag tag), a barcode with the name of the passenger and/or an identification code of the electronic bag tag encoded therein, advertorial information e.g. in the form of an airline logo, and etcetera. Alternatively or additionally the non-variable information can be displayed on the displays 13a and 13b.

The electronic bag tag 1 can have one or more punched or drilled holes 14 for attaching a baggage strap.

Fig.2a and Fig.2b show a front side (Fig.2a) and back side (Fig.2b) of a flexible electronic bag tag 2 of an exemplary embodiment of the invention. The electronic bag tag 2 has wireless communication capabilities and an embedded flexible display 23a, 23b on both the front side 21a and the rear side 21b of the tag 2. The front side 21a and backside 21b can be identical from a construction point of view, however the content on the displays 23a, 23b may differ.

The displays 23a and 23b are typically used to display variable information such as e.g. the license plate number, place and date of issue, the final destination name, the final destination and/or transfer routing in IATA airport code, the airline code and/or flight number.

An information area 22a, 22b next to the display 23a, 23b can be used to print non-variable information, such as e.g. the name of the passenger (i.e. the owner of the electronic bag tag), a barcode with the name of the passenger and/or an identification code of the electronic bag tag encoded therein, advertorial information e.g. in the form of an airline logo, and etcetera. Alternatively or additionally the non-variable information can be displayed on the displays 23a and 23b.

The electronic bag tag 2 can have one or more punched or drilled holes 24 for attaching a baggage strap.

Fig.3a and Fig.3b show one side of a foldable electronic bag tag 3, 3b of an exemplary embodiments of the

display part 41a. The antenna assemblies are preferably located at the first part 41a for better reception. The battery 47 can be embedded in the suitcase within a housing on the inside of the suitcase and is connected to the first part 41a via power line 48 and the second part 41b via display cable 45.

The electronics can be integrated with the battery 47, such as shown in Fig.4c, in which case the power cable 48 is replaced by a display cable 45 in Fig.7.

By using and integrating two, large enough, thin, flexible or inflexible active matrix displays on both sides of the flexible or inflexible electronic bag tag, the electronic bag tag can be made to display all bag tag data including horizontally and vertically positioned 1D barcodes on both sides of the electronic tag conform IATA specifications as described in the IATA Baggage Services Manual. This makes the electronic bag tag of the invention backward compatible with visual bag tag data and barcode in-line-of-sight scanning technology as used at airports worldwide. An integrated RFID UHF assembly makes it further compatible with the scanning and tracking & tracing technology as used in some airports.

Conform the IATA specifications each display can have two small green bars 61 as shown in Fig.12a and Fig.12b, which are printed on top of the display's left and right side using green transparent ink to indicate a so-called "Schengen" baggage label, which can be switched to black by positioning black pixels exactly behind the green bars in order to indicate a regular baggage label.

Fig.8 shows an example of the layers build-up of an inflexible dual display electronic bag tag.

The first layer 180a on the first side of the inflexible electronic bag tag is a laminated or glued transparent polymer based film.

The second layer 170a on the first side of the inflexible electronic bag tag is a laminated pre-printed PVC substrate (or other polymer like polycarbonate (PC), polyphenyl delta-butylene (PdB) or polyester, and etcetera) which may come in any kind of color combination and contain preprinted

Re function 3, for backward compatibility purposes the use of embedded active matrix displays are preferred and would be the most cost effective given the amount of data and barcodes that need to be displayed on both sides of the tag. However the electronic bag tag's system architecture can accommodate other types of displays such as segmented displays and passive matrix displays or a combination of.

Using the electronic bag tag's stored templates 60a, 60b, the variable bag tag data and 1D barcodes are then pushed towards the two active matrix displays and presented such that the tag is compliant with IATA specifications for baggage labels as described in IATA's Baggage Services Manual.

Conform the same IATA specifications the tag also needs to be able to function as what's known as a "Schengen" baggage label. To achieve this, each display may have two small green bars 61 printed on top of the display's left and right side using green transparent ink to indicate a so-called "Schengen" baggage label, which can be switched to black by positioning black pixels exactly behind the green bars in order to indicate a regular baggage label.

Re function 1 and function 3, in business critical operational environments such as airport check-in and baggage check-in, the operational efficiencies are gained when devices carried by passengers are non-reliant on batteries. The dual display electronic bag tag is therefore extremely energy efficient and can operate without a local power supply (battery) and still maintain data on both displays. A battery-less electronic bag tag can nonetheless be written to using an external RFID HF reading device as a power supply source. The electronic bag tag's power management module ensures that power derived by the electronic bag tag's embedded RFID HF interface from the RF field of an external RFID HF device, which is usually around 5V, is exactly regulated to the supply voltage required by the tag's main controller and the electronic bag tag's two integrated displays such that the electronic bag tag's main controller can receive and process data and present this data on both its displays. The battery-less operation of the

CLAIMS

1. An electronic bag tag (1,2,3a,3b,4) that is configured to display bag tag data received from a first external source, the electronic bag tag comprising miniaturized electronics comprising:

a processor (110) configured to process the bag tag data to obtain processed bag tag data;

a wireless communication interface (103,104,105,106) communicatively connected to the processor and configured to receive the bag tag data from the first external source;

a non-volatile memory (110) communicatively connected to the processor and configured to store the bag tag data and/or processed bag tag data;

a first display (13a,23a,33a,43a) and a second display (13b,23b,33b,43b) each configured to display at least a part of the processed bag tag data,

wherein the non-volatile memory is preconfigured with one or more templates (60a,60b) and wherein the processor is configured to select a template from the one or more templates for displaying the at least part of the processed bag tag data on at least one of the first display and the second display using the template.

2. The electronic bag tag according to claim 1, wherein the first display and the second display are bi-stable displays, wherein the communication interface comprises a RFID HF and/or RFID UHF interface and wherein the electronics are powered by a power inducted by a RF field originating from a second external source.

3. The electronic bag tag according to claim 2, wherein the communication interface is further configured to transmit the at least part of the processed bag tag data to a third external source.

4. The electronic bag tag according to claim 1, further comprising a power supply (125) and wherein the electronics are powered by the power supply.

5. The electronic bag tag according to claim 4, wherein the wireless communication interface comprises at least one of a DASH7 (124), Bluetooth (124), GSM (115,116), GPRS (115,116),

bag tag (2,3) is flexible.

12. The electronic bag tag according to any one of the preceding claims, further comprising a sensor (122) communicatively connected to the processor, wherein the sensor is at least one of a 3-axis accelerometer, 3-axis magnetic sensor, single-, dual- or tri-axis gyroscope or pressure sensor.

13. The electronic bag tag according to any one of the preceding claims, wherein the at least part of the processed bag tag data comprises a barcode to be displayed on the first display and on the second display in conformance with IATA specifications.

14. The electronic bag tag according to claim 13, wherein the bag tag data comprises a license plate number in conformance with IATA specifications, wherein the processor is configured to convert the license plate number into the barcode and wherein the processed bag tag data comprises the bar code.

15. The electronic bag tag according to claim 13 or claim 14, wherein the first display and the second display each comprise two bar portions (61a) positioned at opposite edges of the display that are switchable between a green color and a black color depending on the bag tag data.

~~16. The electronic bag tag according to any one of the preceding claims, wherein the non-volatile memory is preconfigured with one or more templates (60a,60b) and wherein the processor is configured to select a template from the one or more templates for displaying the at least part of the processed bag tag data on at least one of the first display and the second display using the template.~~

~~17~~16. The electronic bag tag according to any one of the preceding claims, wherein the electronics further comprising a security controller (111), and wherein the wireless

communication interface is further configured to communicate only upon presenting a matching or paired external smart card which is used to authenticate the owner of the electronic bag tag using the external smart card and the security controller.

~~18~~17. Use of the electronic bag tag according to any one of the claims 1-~~17~~16, wherein the electronic bag tag receives the tag data for displaying on the first display and on the second display, and wherein at least one of the first display and the second display is scanned by an external scanner.

~~19~~18. Use according of the electronic bag tag according to claim ~~18~~17, wherein the position of the electronic bag tag is located by an external location device.

~~20~~19. A suitcase (46) comprising the electronic bag tag (4) according to claim 9, wherein the first display (43a) is visibly attached on a first outer side of the suitcase and wherein the second display (43b) is visibly attached on a second outer side of the suitcase opposite of the first outer side.

~~21~~20. The suitcase according to claim ~~20~~19, wherein the suitcase comprises a first recess (49) on the first outer side to fit the first display (43a) and a second recess (49) on the second outer side to fit the second display (43b).

~~22~~21. The suitcase according to claim ~~20~~19 or claim ~~21~~20, wherein the display cable (45) is integrated in the suitcase and wherein the first display and the second display are detachably connected to the suitcase and the display cable.

~~23~~22. The suitcase according to any one of the claims ~~20~~19-~~22~~21, wherein the bag tag comprises a power supply (47) that is integrated in a cover of the suitcase or in a housing inside the suitcase.

~~24~~23. The suitcase according to claim ~~23~~22, wherein the electronics are separated from the first display (43a) and wherein the electronics are integrated with the power supply (47).