Title: AVIATION HANDLING QUALITY MEASUREMENT

Abstract: Method of and a system for monitoring and improving aviation handling performance, in particular for automatically providing objective aviation quality measurement. An aviation environment is provided with at least one registration location in a handling flow, and identification means are provided to at least one potential object of such an aviation handling flow. Presence and/or passing of identification means in a handling flow is automatically registered at or near said registration locations, and processing, storing, distribution and/or presentation of registered data is performed.
AVIATION HANDLING QUALITY MEASUREMENT

Field of the invention

The present invention relates to a method of and a system for monitoring aviation handling performance, in particular for automatically providing aviation quality measurement and thus providing aviation quality improvement. The invention further relates to uses of such a method and/or such a system.

Background of the invention

Presently, aviation quality measurements, e.g. measurements of quality of passenger and/or luggage handling, are only performed through time studies. Such conventionally performed time studies require a lot of manpower and are time consuming. Furthermore, such time studies are currently made only for a limited number of handling operations because of the labour-intensity etc. of the time study processes, and thus presently time studies are only made for check-in counters, baggage sortation, security check, baggage loading and baggage reclaim.

Presently, time studies are carried out manually and will therefore influence the process being measured, in particular since people, e.g. service personnel tend to perform better, when being watched by assessors. Furthermore, manual time studies are subject to individual perceptions by the participants in the time study set-up. Therefore, such time studies will not give correct and/or objective measurements of quality and performance.

Further drawbacks are related to the fact that there are locations in airports, where human time studies are not possible, e.g. in X-ray scanners, at luggage trolleys stacked with baggage, or where time studies are very difficult to perform. Thus, the number of handling processes that might be measured using time studies is in practise very limited.
It must also be kept in mind that measurement of handling quality in aviation environments using manual time studies requires that the handling of a specific item must be observed and that the item must be identifiable. Therefore, manual time studies are difficult to use where tagged objects, e.g. suitcases, can not be visually identified.

Furthermore, prior art performance measurements are handled manually, e.g. by manually time stamping, manually key-in of data, etc. Besides from the fact that this is labour-intensive, such a manual process is a potential source for errors.

Finally, creation of performance reports from time studies is time consuming and such performance reports are published after events have occurred.

Since, according to the prior art method of measuring handling quality, any performance reports are available subsequently to, and possibly even a considerable time after the handlings events have taken place, the remedies, if any, will of nature be reactive and lagging. Further, these performance reports tend to identify symptoms of a problem and not the problem itself, and therefore attempts may be made to remedy the symptoms only and not the problems.

If attempts are made to interpret these prior art time studies in order to discover problems and/or problem areas, this may lead to inaccurate interpretations or worse interpretations that are totally wrong. In both cases the real cause of any problem will not be identified and therefore the handling flow or handling operation can not be improved or optimized.

Therefore, the prior art methods are not suitable for optimizing handlings flows, and all in all this may lead to a number of drawbacks, such as loss of goodwill, loss of passengers, that passengers may prefer other airlines or other airports, that airlines may prefer other airports etc.
It is therefore desirable to provide a system and a method that automatically provides objective time study reports as events occur. The present invention addresses such a need.

Thus, it is an objective of the present invention to provide an improved method and an improved system for measuring aviation handling quality.

In particular, it is an objective of the invention to provide such a method and such a system that does not suffer from the drawbacks related with the above-mentioned prior art.

Further, it is an objective of the invention to present such a method and such a system that will provide objective measurements of the handling quality.

These and other objectives are achieved by the invention as explained in the following.

**Summary of the invention**

As specified in claim 1, the invention relates to a method of monitoring aviation handling performance whereby

- an aviation environment is provided with at least one registration location in a handling flow,
- identification means are provided to at least one potential object of or part of an aviation handling flow,
- presence and/or passing of identification means in a handling flow is automatically registered at or near said registration locations, and
- processing, presenting and/or storing of registered data is performed.

By aviation shall in this context be understood any activity related to travel and transportation by means of aircraft, including travel or transportation preceding aircraft travel and transportation and travel or transportation subsequent to any
aircraft travel or transportation. Thus, aviation handling is defined as activity or activities incurred with travel and/or transportation by means of an aircraft, therein all activities in and around airports, be it among or between one or more airlines, one or more airports, one or more baggage or cargo handlers, passengers and/or their belongings, and other parties involved in the above activities, e.g. security, customs, immigration, ground transportation, travel agencies, special interest groups etc.

The potential objects that are associated with identification means may be any object that is subjected to any aviation handling or any object that forms part of an aviation handling. Thus, the term object shall in this context include passengers, cabin crew personnel, ground crew personnel such as e.g. customs personnel, luggage loaders, service personnel, personnel related to airport shops and/or lounges etc., luggage or baggage such as e.g. hand luggage, briefcases, trunks, suitcases etc, cargo including e.g. packages, parcels, containers, cargo load devices such as a unit load device (ULD), transportation means used for transporting persons, luggage and/or cargo, etc.

It shall furthermore be emphasized that for the purpose of this application the terms “luggage” and “baggage” will be used synonymously, e.g. meaning any object such as a suitcase, a trunk, a briefcase, a package, a container of any type etc. that has to be transported and/or handled in the aviation handling environment, either associated with a person such as a passenger or handled independently of such a person.

By the method according to claim 1 it is achieved that monitoring of handling flows may be performed automatically. Furthermore, such monitoring will result in objective measurements being made, especially since manually performed observations, e.g. time studies will not be involved. Thus, the method will also be cost effective, since labor intensive time studies are avoided, and the handling processes will not or at least to a less degree be influenced by (unnecessary) manual interference or intervention.
By the method according to the invention an improved utilization of resources may be achieved and furthermore quality improvements may be attained. A detailed and/or an overall process analysis and/or control may be performed and overall process visibility may be provided when using the method according to the invention. Such process visibility may apply to an aviation chain or part of such a chain, and furthermore complete airline and airport process visibility may be achieved.

The method may provide a proactive manner of facilitating optimization of aviation handling processes, since e.g. bottlenecks may be identified, less than optimal processes may be identified, real-time data may be provided to the user and all in all transparency in object handling, e.g. passenger and baggage handling may be achieved.

By the method an improved security may be provided and the risk of theft, pilferage and loss of luggage and unauthorized intervention may be decreased.

Furthermore, since the handling flows may be optimized when utilizing the method according to the invention, less personnel/staff stress will be achieved as well as less passenger stress.

The competitiveness of parties to the handling flows, e.g. airlines, airports, baggage handlers etc. may be improved, and increased revenue may result. Costs incurred by exception handling and/or compensations will be reduced, and the overall throughput of the handling processes may be increased.

Improvements in customer and user feedback may be achieved, resulting in an improved level of quality.

Facilitated by the improved monitoring measures may be taken to assure that baggage will follow a passenger, and overall an increased passenger service will be achieved by the method according to the invention.
Preferably, as specified in claim 2, said at least one registration location may be provided with reader means, with other means or type of data capture and/or with means for communication with a data capture system for registration of said identification means.

Advantageously, as specified in claim 3, said identification means may comprise barcode, magnetic stripe, smart card and/or biometric operating means.

Advantageously, as specified in claim 4, said identification means may comprise radio frequency operating means.

In a preferred embodiment, as specified in claim 5, said identification means may comprise a tag. Hereby said identification means may be provided in a relatively simple form.

In a further preferred form, as specified in claim 6, said identification means may comprise a radio frequency identification (RFID) tag.

According to a further preferred embodiment, as specified in claim 7, said identification means may comprise a transponder, in particular a radio frequency transponder, whereby the method according to this embodiment may be performed using readily available means in a relatively simple manner.

Preferably, as specified in claim 8, said identification means may be associated with an object, e.g. carried by a passenger, attached to or inserted into a piece of luggage, e.g. a suitcase, a piece of hand luggage etc. Hereby, handling quality may be monitored in an advantageous manner.

According to an advantageous embodiment, as specified in claim 9, at least two of said identification means may be associated with interrelated objects, e.g. identification means carried by a passenger and one or more co-passengers, carried
by a passenger and attached to or inserted into a piece of luggage belonging to said passenger, attached to at least two pieces of luggage belonging to a passenger etc.

Hereby, said interrelated objects may be monitored and the measured data may be correlated, whereby further information regarding the handling quality may be provided.

According to a further advantageous embodiment, as specified in claim 10, said identification means may be associated with an object forming part of and/or facilitating said handling flow or handling flows, e.g. identification means carried by a member of a cabin crew, carried by a person from ground personnel, attached to or inserted into transportation means, a cargo load device such as a unit load device (ULD) etc. Hereby it is achieved that presence, performance etc. of such objects may be monitored and that the influence on aviation handling quality may be monitored, measured and possibly controlled/corrected if necessary.

Advantageously, as specified in claim 11, said at least one registration location may be located in a passenger and/or corresponding luggage handling flow and each of said at least one registration locations may be located at any suitable and/or user-defined point in said handling flow or handling flows, including start and end point for said handling flow or flows.

In a further embodiment, as specified in claim 12, said at least one registration location may be selected from a group comprising e.g.

- a check-in location for registration of luggage,
- a drop-off location for registration of luggage,
- a check-in counter luggage drop,
- a luggage take-away conveyor location,
- an X-ray luggage scanner location,

- a luggage ULD (Unit Load Device) handling location,
- a cargo ULD (Unit Load Device) handling location,
- an airplane luggage compartment,
- a luggage claim location,
- a check-in location for registration of passengers,
- a shopping area,
- a departure gate location,
- a passport check location,
- a customs location,
- an immigration location,
- a cargo center entry/exit location
- a security checkpoint location,
- a curb-side check-in location,
- a courtesy pickup location,
- a courtesy drop-off location,
- off-terminal locations,
- inter-terminal transport,
- inter-airport transport,
- a hotel location,
- a car park location,
- a train station location and
- a bus station location.

It will be evident to a skilled person that a registration location may be associated with one or more, e.g. two, three, four etc. and possibly all of these locations and that registration locations may be placed at other locations than those mentioned above.

Advantageously, as specified in claim 13, said identification means, e.g. in the form of tags may be associated with a sample group of objects, e.g. belong to, attached to etc. a sample group of objects such as passengers, luggage, cargo. Identification means, e.g. tags, may be supplied to such objects, e.g. passengers, in suitable numbers in order to attain sufficient registration events, e.g. a number of registration events that will provide reliable measurements.
Such a sample group of passengers may e.g. be all passengers on a single aircraft, selected passengers to a specific destination, passengers or other objects selected in consideration of other criteria.

Preferably, as specified in claim 14, said sample group may be configured in consideration of statistical criteria. Hereby, quality of the measurements may be enhanced.

Alternatively or in addition, as specified in claim 15, said identification means, e.g. in the form of tags may be used independently of a sample group of objects, e.g. individual passengers, all passengers etc.

Preferably, as specified in claim 16, said sample group of objects, e.g. passengers, luggage etc. may be selected from e.g. an airline frequent flyer programme. Hereby it may be assured that tags supplied to passengers will result in frequent registration events. Other criteria may be used as well, e.g. business class passengers etc.

Preferably, as specified in claim 17, said sample group of objects, e.g. passengers may acknowledge their participation in said aviation handling performance monitoring.

In a preferred embodiment, as specified in claim 18, said sample group of objects, e.g. passengers may be provided with additional services in reward for their participation in said aviation handling performance monitoring.

Hereby it is achieved that objects, e.g. passengers will be motivated to use, e.g. carry a tag and/or attach a tag to luggage such as suitcases and hand luggage, resulting in an increased amount of registration incidents and thereby an increased accuracy in the output data, e.g. quality reports, payment due reports etc.
Advantageously, as specified in claim 19, said identification means may be used for objects, e.g. passengers, luggage and/or cargo subject to further security, handling and/or service.

In a further preferred embodiment, as specified in claim 20, said identification means may be used for objects such as e.g. luggage, cargo etc. subject to pilferage.

Hereby the method may be applied to alleviate and prevent events such as pilferage as reading points/registration locations can provide start/stop times to monitor object movement on e.g. an airport conveyor system.

In a still further preferred embodiment, as specified in claim 21, said identification means may be used for objects such as e.g. luggage, cargo etc. subject to mishandling.

In a still further advantageous embodiment, as specified in claim 22, said identification means may be used for objects such as e.g. luggage, cargo etc. subject to loss.

Advantageously, as specified in claim 23, said identification means may be used for objects, e.g. passengers, who are targets for event driven services, e.g. direct marketing, flight information, boarding calls, passenger and baggage announcement via e.g. sms-messaging, mms-messaging, voice response systems or message-board information.

Advantageously, as specified in claim 24, said identification means may be used for objects, e.g. passengers, who are targets for shopping behaviour analysis.

Hereby it is achieved that the method may be applied as a marketing method to constitute information and decision basis for such events as airport lay-out planning, store optimization, shopper's behavior, therein be used as a means of automatic measurement of marketing effects and conduct passenger/shopper questionnaires to
be generated and compiled automatically for future planning and other managerial usage.

In a further preferred embodiment, as specified in claim 25, said identification means may be used for objects, e.g. passengers, who are targets for customer satisfaction analysis.

Hereby it is achieved that the method may be applied to conduct passenger/customer satisfaction tests/questionnaires as a means of providing tooling for enhanced perception of passenger experience. Subsequently, the method may automatically interface to modules for generating and compiling such marketing information as well as integrate to e.g. customer loyalty programmes.

In a further advantageous embodiment, as specified in claim 26, said identification means may be used for objects such as e.g. luggage, cargo etc. that constitutes a basis for payment between reconciling parties, e.g. airports, airlines, cargo handlers and/or baggage handlers.

Hereby it is achieved that the method may be applied to increase and address the dependability and transparency of inter-baggage, inter-cargo and inter-passenger payment between reconciling parties such as airports, airlines, cargo handlers and baggage handlers.

In a preferred embodiment, as specified in claim 27, said registered data may be processed in order to produce data indicative of handling performance, e.g. luggage handling, cargo handling and/or passenger flow handling.

Preferably, as specified in claim 28, said data indicative of handling performance may comprise data indicative of current handling performance, e.g. process times, hand-over locations and times etc. for a handling flow or for part of such a handling flow.
Advantageously, as specified in claim 29, said data indicative of handling performance may comprise data indicative of long-term handling performance, e.g. process times, hand-over locations and times etc. for a handling flow or for part of such a handling flow.

Preferably, as specified in claim 30, said data indicative of handling performance may comprise data indicative of comparative before-and-after handling performance, e.g. process times, hand-over locations and times etc. for a change in handling flow or for a change in part of such a handling flow.

In a further preferred embodiment, as specified in claim 31, said data may be processed in order to provide time-study reports relating to said handling flow/flows or part thereof.

Advantageously, as specified in claim 32, said data indicative of handling performance may be provided to and/or supplied from any stakeholder in an aviation handling process, e.g. airport, airline, ground-handler, travel agency.

Further, as specified in claim 33, said data indicative of handling performance may comprise data provided to and/or supplied from a flight information system.

Preferably, as specified in claim 34, said data indicative of handling performance may comprise data provided to and/or supplied from a flight reservation system.

Advantageously, as specified in claim 35, said data indicative of handling performance may comprise data provided to and/or supplied from a baggage handling system.

Advantageously, as specified in claim 36, said data indicative of handling performance may comprise data provided to and/or supplied from a security and alarm system.
As specified in claim 37, the invention also relates to a system for monitoring aviation handling performance comprising:

- at least one registration location in a handling flow of an aviation environment,
- identification means provided to at least one potential object of or part of an aviation handling flow,

wherein registration means at said registration location are designed to automatically register presence and/or passing of identification means in a handling flow at or near said registration locations, and wherein said system comprises means for processing, presenting and/or storing of said registered data.

By the system according to claim 37 it is achieved that monitoring of handling flows may be performed automatically. Furthermore, such monitoring will result in objective measurements being made, especially since manually performed observations, e.g. time studies will not be involved. Thus, the system will also be cost effective, since labor intensive time studies are avoided, and the handling processes will not or at least to a less degree be influenced by (unnecessary) manual interference or intervention.

By the system according to the invention an improved utilization of resources may be achieved and furthermore quality improvements may be attained. A detailed and/or an overall process analysis and/or control may be performed and overall process visibility may be provided when using the method according to the invention. Such process visibility may apply to an aviation chain or part of such a chain, and furthermore complete airline and airport process visibility may be achieved.

The system may provide a proactive manner of facilitating optimization of aviation handling processes, since e.g. bottlenecks may be identified, less than optimal processes may be identified, real-time data may be provided to the user and all in all transparency in object handling, e.g. passenger and baggage handling may be achieved.
By the system an improved security may be provided and the risk of theft, pilferage and loss of luggage and unauthorized intervention may be decreased.

Furthermore, since the handling flows may be optimized when utilizing the system according to the invention, less personnel/staff stress will be achieved as well as less passenger stress.

The competitiveness of parties to the handling flows, e.g. airlines, airports, baggage handlers etc. may be improved, and increased revenue may result. Costs incurred by exception handling and/or compensations will be reduced, and the overall throughput of the handling processes may be increased.

Improvements in customer and user feedback may be achieved, resulting in an improved level of quality.

Facilitated by the improved monitoring measures may be taken to assure that baggage will follow a passenger, and overall an increased passenger service will be achieved by the system according to the invention.

Preferably, as specified in claim 38, said at least one registration location may be provided with reader means, with other means or type of data capture and/or with means for communication with a data capture system for registration of said identification means.

In an advantageous embodiment, as specified in claim 39, said identification means may comprise barcode, magnetic stripe, smart card and/or biometric operating means.

In a further preferred embodiment, as specified in claim 40, said identification means may comprise radio frequency operating means.
Advantageously, as specified in claim 41, said identification means may comprise a tag. Hereby said identification means may be provided in a relatively simple form.

In a particular preferred embodiment, as specified in claim 42, said identification means may comprise a radio frequency identification (RFID) tag.

Advantageously, as specified in claim 43, said identification means may comprise a transponder, in particular a radio frequency transponder, whereby the system according to this embodiment may be performed using readily available means in a relatively simple manner.

Preferably, as specified in claim 44, said identification means may comprise means for association with an object, e.g. means for attachment to a passenger, attachment to or insertion into a piece of luggage, e.g. a suitcase, a piece of hand luggage etc. Hereby, handling quality may be monitored in an advantageous manner.

According to an advantageous embodiment, as specified in claim 45, at least two of said identification means may be associated with interrelated objects, e.g. identification means carried by a passenger and one or more co-passengers, carried by a passenger and attached to or inserted into a piece of luggage belonging to said passenger, attached to at least two pieces of luggage belonging to a passenger etc.

Hereby, said interrelated objects may be monitored and the measured data may be correlated, whereby further information regarding the handling quality may be provided by the system according to this embodiment.

According to a further advantageous embodiment, as specified in claim 46, said identification means may be associated with an object forming part of and/or facilitating said handling flow or handling flows, e.g. identification means carried by a member of a cabin crew, carried by a person from ground personnel, attached to or inserted into transportation means, a cargo load device such as a unit load device (ULD) etc. Hereby it is achieved that presence, performance etc. of such objects may
be monitored by the system and that the influence on aviation handling quality may be monitored, measured and possibly controlled/corrected if necessary.

Advantageously, as specified in claim 47, said at least one registration location may be located in an object handling flow, e.g. a passenger and/or corresponding luggage handling flow and said at least one registration location may be located at any suitable and/or user-defined point in said handling flow or handling flows, including start and end point for said handling flow or flows.

In a preferred embodiment, as specified in claim 48, said at least one registration location may be selected from a group comprising e.g. a check-in location for registration of luggage, a drop-off location for registration of luggage, a check-in counter luggage drop, a luggage take-away conveyor location, an X-ray luggage scanner location, a luggage ULD (Unit Load Device) handling location, a cargo ULD (Unit Load Device) handling location, an airplane luggage compartment, a luggage claim location, a check-in location for registration of passengers, a shopping area, a departure gate location, a passport check location, a customs location, an immigration location, a cargo center entry/exit location, a security checkpoint location, a curb-side check-in location, a courtesy pickup location, a courtesy drop-off location, off-terminal locations,
- inter-terminal transport,
- inter-airport transport,
- a hotel location,
- a car park location,
- a train station location and
- a bus station location.

It will be evident to a skilled person that a registration location may be associated with one or more, e.g. two, three, four etc. and possibly all of these locations and that registration locations may be placed at other locations than those mentioned above.

Preferably, as specified in claim 49, said identification means, e.g. in the form of tags may be associated with a sample group of objects, e.g. belong to, attached to etc. a sample group of objects such as passengers, luggage, cargo. Identification means, e.g. tags, may be supplied to such objects, e.g. passengers, in suitable numbers in order to attain sufficient registration events, e.g. a number of registration events that will provide reliable measurements.

Such a sample group of passengers may e.g. be all passengers on a single aircraft, selected passengers to a specific destination, passengers or other objects selected in consideration of other criteria.

Advantageously, as specified in claim 50, said sample group may be configured in consideration of statistical criteria. Hereby, quality of the measurements may be enhanced.

Alternatively or in addition, as specified in claim 51, said identification means, e.g. in the form of tags may be used independently of a sample group of objects, e.g. individual passengers, all passengers etc.

Advantageously, as specified in claim 52, said sample group of objects, e.g. passengers, luggage may be selected from e.g. an airline frequent flyer programme.
Hereby it may be assured that tags supplied to passengers will result in frequent registration events. Other criteria may be used as well, e.g. business class passengers etc.

Preferably, as specified in claim 53, said sample group of objects, e.g. passengers may acknowledge their participation in said aviation handling performance monitoring.

Advantageously, as specified in claim 54, said sample group of objects, e.g. passengers may be provided with additional services in reward for their participation in said aviation handling performance monitoring.

Hereby it is achieved that objects, e.g. passengers will be motivated to use, e.g. carry a tag and/or attach a tag to luggage such as suitcases and hand luggage, resulting in an increased amount of registration incidents and thereby an increased accuracy in the output data, e.g. quality reports, payment due reports etc.

In an advantageous embodiment, as specified in claim 55, said identification means may be used for objects such as e.g. passengers, luggage and/or cargo subject to further security, handling and/or service.

In a further embodiment, as specified in claim 56, said identification means may be used for objects such as e.g. luggage, cargo etc. subject to pilferage.

Hereby the system may be applied to alleviate and prevent events such as pilferage as reading points/registration locations can provide start/stop times to monitor object movement on e.g. an airport conveyor system.

In a further advantageous embodiment, as specified in claim 57, said identification means may be used for objects such as e.g. luggage, cargo etc. subject to mishandling.
In a still further embodiment, as specified in claim 58, said identification means may be used for objects such as e.g. luggage, cargo etc. subject to loss.

Advantageously, as specified in claim 59, said identification means may be used for objects, e.g. passengers, who are targets for event driven services, e.g. direct marketing, flight information, boarding calls, passenger and baggage announcement via e.g. sms-messaging, mms-messaging, voice response systems or message-board information.

Preferably, as specified in claim 60, said identification means may be used for objects, e.g. passengers, who are targets for shopping behaviour analysis.

Hereby it is achieved that the system may be applied as a marketing system to constitute information and decision basis for such events as airport lay-out planning, store optimization, shopper's behavior, therein be used as a means of automatic measurement of marketing effects and conduct passenger/shopper questionnaires to be generated and compiled automatically for future planning and other managerial usage.

Advantageously, as specified in claim 61, said identification means may be used for objects, e.g. passengers, who are targets for customer satisfaction analysis.

Hereby it is achieved that the system may be applied to conduct passenger/customer satisfaction tests/questionnaires as a means of providing tooling for enhanced perception of passenger experience. Subsequently, the system may automatically interface to modules for generating and compiling such marketing information as well as integrate to e.g. customer loyalty programmes.

In a further advantageous embodiment, as specified in claim 62, said identification means may be used for objects such as e.g. luggage, cargo etc. that constitutes a basis for payment between reconciling parties, e.g. airports, airlines, cargo handlers.
and/or baggage handlers. The payment can depend on the actual handling performance measured.

Hereby it is achieved that the system may be applied to increase and address the dependability and transparency of inter-baggage, inter-cargo and inter-passenger payment between reconciling parties such as airports, airlines, cargo handlers and baggage handlers.

Preferably, as specified in claim 63, said means for processing, presenting and/or storing of said registered data may be designed to produce data indicative of handling performance, e.g. luggage handling, cargo handling and/or passenger flow handling.

Further, as specified in claim 64, said data indicative of handling performance may comprise data indicative of current handling performance, e.g. process times, hand-over times etc. for a handling flow or for part of such a handling flow.

Advantageously, as specified in claim 65, said data indicative of handling performance may comprise data indicative of long-term handling performance, e.g. process times, hand-over locations and times etc. for a handling flow or for part of such a handling flow.

Still further, as specified in claim 66, said data indicative of handling performance may comprise data indicative of comparative before-and-after handling performance, e.g. process times, hand-over locations and times etc. for a change in handling flow or for a change in part of such a handling flow.

In a still further preferred embodiment, as specified in claim 67, said means for processing and/or storing of said registered data may be designed to provide time-study reports relating to said handling flow/flows or part thereof.

Advantageously, as specified in claim 68, said system may comprise means for providing data indicative of handling performance to and/or for supplying data from
any stakeholder in an aviation handling process, e.g. airport, airline, ground-handler, travel agency.

Further, as specified in claim 69, said system may comprise means for processing and/or including data from and/or for supplying data to a flight information system when providing said data indicative of handling performance.

In a further advantageous embodiment, as specified in claim 70, said system may comprise means for processing and/or including data from and/or for supplying data to a flight reservation system when providing said data indicative of handling performance.

In a still further advantageous embodiment, as specified in claim 71, said system may comprise means for processing and/or including data from and/or for supplying data to a baggage handling system when providing said data indicative of handling performance.

Advantageously, as specified in claim 72, said system may comprise means for processing and/or including data from and/or for supplying data to a security and alarm system when providing said data indicative of handling performance.

The invention also relates to a use of a method and/or a system as specified in claim 73 for monitoring a luggage handling system or systems.

Advantageously, as specified in claim 74, said use may be intended for activating an alarm system or systems and/or for providing alert messages.

The invention further relates to a use of a method and/or a system as specified in claim 75 for providing information and/or measurements relevant for aviation handling related lay-out, planning and/or managerial usage.
The invention also relates to a use of a method and/or a system as specified in claim 76 for providing information relating to passenger and/or customer experience, behaviour and/or evaluation.

Further, the invention relates to a use of a method and/or a system as specified in claim 77 for providing information relating to shopping evaluation and/or optimisation.

The invention also relates to a use of a method and/or a system as specified in claim 78 for providing information regarding inter-baggage, inter-cargo and/or inter-passenger relations.

Further, the invention relates to a use of a method and/or a system as specified in claim 79 for facilitating passenger handling processes, e.g. remote check-in, check-in, remote passenger identification etc.

The present invention relates to a system and a method for measuring aviation handling performance of aviation handling flows. By use of e.g. a Radio Frequency Identification (RFID) tag attached to an object, e.g. a passenger’s hand luggage and/or suitcase, the objects will automatically be identified when they pass a reader or is in the vicinity of a reader, other means of data capture and/or means for communication with a data capture system. The system does not require alterations to the existing structure of bag-tag barcode labels and can be based on a sample of e.g. frequent flyers or any other group of objects. The system locates bottlenecks in the aviation handling process/processes, such as for example luggage, cargo and passenger handling processes, and provides end-to-end and on-the-spot visibility.

The present invention is directed towards a method and a system for measuring airline and airport handling performance of e.g. luggage, cargo and passenger flows.

The system locates bottlenecks in the luggage, cargo and passenger handling processes, and provides end-to-end and on-the-spot visibility in the handling and
distribution process of passengers, cargo and luggage. This enables immediate and corrective actions to be carried out based on data output.

The system is ideally suited to carry out time-studies of virtually every process in an aviation environment, and provides easy-access tooling for interpreting results and taking action.

The system is based on the needs for accessing up-to-date information, and using this information actively to improve a variety of processes.

The system is a means for long-term measurements as well as performing short-term process analysis and process improvement(s).

The system will actively optimize, e.g. the luggage handling process, thus also providing reports and enable parties responsible to actively take measures to reduce costs incurred in e.g. lost and delayed luggage today.

By use of a Radio Frequency Identification (RFID) tag attached to a passenger’s hand luggage or suitcase, the items will automatically be identified when they pass a reader or is within the vicinity of a reader in the aviation handling flow.

The system does not require alterations to the existing structure of bag-tag barcode labels and can be based on a sample of e.g. frequent flyers or any other group of passengers. It is not necessary to equip all passengers with e.g. RFID tags in order to carry out handling process analysis. Passengers can be selected according to statistical criteria.

Every piece of data detected through the reader infrastructure is sent to a central computer, which, in turn, hosts all readings to comprise a variety of time-study reports.
The data carried by the "tagged" suitcases provides vital information about process times, hand-over times, etc.

Through a data distribution system, a user will be able to access information. Some of this information can be graphical tools to give real-time and interactive picture of the actual luggage, cargo and/or passenger flow.

The figures

10 The invention will be explained in further detail below with reference to the figures of which
fig. 1a – 1b is a schematic illustration of examples of embodiments of a tag, e.g. an RFID tag according to the invention,
fig. 2a - 2c shows an illustration of examples of tags associated with, e.g. attached to a passenger, a piece of luggage and/or a unit load device (ULD),
fig. 3a –3e illustrates examples of different reader configurations in accordance with the invention,
fig. 4a – 4d show examples of different types of readers utilized in accordance with the invention,
fig. 5 shows a block diagram for an example of an interface to an airline passenger database,
fig. 6 is a block diagram for an example of an interface to airport IT systems,
fig. 7 illustrates a block diagram of an example of an embodiment of the invention by means of which e.g. quality reports are produced,
fig. 8 illustrates a block diagram for an example of an embodiment of the invention in combination with other airport IT systems
fig. 9 illustrates an example of a handling flow for departing objects, e.g. passengers and luggage,
fig. 10 illustrates an example of a handling flow for arriving objects, e.g. passengers and luggage, and
fig. 11 illustrates an example of a handling flow for a total aviation handling flow.
Detailed description

Identifications means in the form of a tag 1 are illustrated in fig. 1a and 1b. Fig. 1a shows a tag 1a which comprises an enclosure 3, e.g. a plastic covering, sheathing or the like, for an identification element 2. The tag 1a may be inserted in a piece of luggage, in a suitcase, a briefcase, in a cargo device, a transportation device or the like, or may be carried by a person in a pocket or the like.

The tag 1b shown in fig. 1b is essentially similar to the tag 1a, but has been provided with special features for attachment. The enclosure 3 may be provided with attachment means, for example in the form of a strap 4 which have means 5 for opening and closing of the strap in order to be able to attach the tag 1b to e.g. the handle of a suitcase, a briefcase or the like.

Evidently, various means may be utilized for associating, e.g. attaching, inserting carrying etc. such a tag 1 with an object such as a person, a piece of luggage or another object, e.g. straps, Velcro means, clips, snap attachments means, glue, moulding etc.

As regards the identification element 2, this may also be designed in various forms and using various materials and/or techniques. This element may for example be in the form of a barcode printed on a sheet or directly on the tag 1a or 1b. The identification element 2 may instead or in addition comprise electric or electronic elements and/or circuits and may be in the form of an active or a passive element.

Such an active or a passive element may operate by means of electromagnetic waves and in particular by means or radio frequency waves. A passive element may preferably be laid out in the form of a transponder, preferably operating in the radio frequency wave band.

Further, the identification element 2 may comprise identification means in the form of magnetic stripe, smart card and/or biometric operating means.
Evidently, reader means for detecting and/or registering an identification of such a tag must be made available and designed corresponding to the type of identification element used, e.g. operating by optical detection means, electromagnetic means, radio frequency means, etc. which will be evident to a skilled person. Further, it will be obvious to a skilled person that various types of tags and reader means may be used in connection with the present invention.

The utilization of a tag and reader means according to the invention has been illustrated in fig. 2a to 2c. In fig. 2a a person, e.g. a passenger or potential passenger has been illustrated with a briefcase 11 or another piece of hand luggage. An identification tag 1b may be attached to this briefcase 11, and when the passenger or is in the vicinity of reader means, which are schematically illustrated by a reader 20 placed above the passenger 10, this reader 20 will generate a signal comprising an identification associated with the tag 1b. This signal is transmitted to a measurement system generally designated 21, and further processing, presenting and/or storing may be performed as explained later on.

Communication between the reader 20 and a tag 1a or 1b is indicated by the arrows 22, and although these indicate communication both ways, it will be understood that the communication may be a one-way communication. Likewise, it will be understood that the communication from these units 20, e.g. to the measurement system 21 and/or between these units 20 may also be a one way communication and likewise that communication from/to these units 20 and between these units and 1a/1b may comprise multiple consecutive signals being communicated, which will be obvious to a skilled person. The communication may comprise an identification (ID) of the tag, e.g. a unique code identifying the tag, and/or the communication may comprise other information such as an identification of the registration location, e.g. a unique code identifying the registration location.

Furthermore, it shall be mentioned that instead of using a configuration having a tag 1a/1b that is registered by a reader of any general type, a tag 1a or 1b may comprise means for capturing data when being in the vicinity of registration location, e.g. data
comprising information regarding e.g. the registration location in question, the actual time of registration and/or other type of information. In this case the tag 1a or 1b may comprise means for storing such information for subsequent retrieval and/or means for communication of such information to a data capturing system, data logging system and/or data retrieval system.

Instead or in addition to a tag 1b attached to a piece of hand luggage, a tag of the type 1a may be inserted in the hand luggage 11 (not shown) and/or a tag 1a may be carried by the person, e.g. the passenger as indicated in a pocket or the like.

Similarly, a suitcase 12 or a similar piece of baggage, which may be handled in relation to an aviation activity, e.g. by a luggage handling system or flow as a passengers baggage, may also be associated with a tag 1a, e.g. inserted into the suitcase, whereby this piece of luggage also will be registered or a registration will be performed by the tag when passing or being in the vicinity of the registration location, e.g. the reader 20.

Instead of a tag 1a, a tag 1b having attachment means may be associated with a piece of luggage, a briefcase or the like and used in a similar manner as illustrated by the suitcase 12 in fig. 2b.

Furthermore, other objects may similarly be associated with an identification means e.g. in the form of a tag 1a or 1b as illustrated in fig. 2c. Here, a device for transportation and/or for holding cargo, e.g. a unit load device (ULD) suitable for transportation of cargo by aviation transport, e.g. by aircraft, is illustrated associated with a tag 1a. Hereby, the unit load device will be registered or a registration will be performed when passing or being in the vicinity of a registration location as explained above. It will be understood that such a load device, e.g. a unit load device 13 may contain cargo in the form of e.g. packages, suitcases etc. that may be individually associated with identification means in the form of e.g. a tag 1a or 1b.
Various reader and/or registrations arrangements and configurations are illustrated in fig 3. It will be understood that a reader and/or registration unit 20 may be designed in various manners and by using various techniques. In this context it will be understood that a reader and/or registration unit 20 may contain one or more means of communication and/or registration, e.g. one or more receivers, one or more transmitters, one or more transceivers, one or more responders etc. Such a reader and/or registration element is for the sake of simplicity indicated in figs. 3a to 3e as a generally plate- or box-shaped unit, but it will be understood that various designs may be utilized in practical constructions.

An arrangement corresponding to the one shown in fig. 2a is illustrated in fig. 3a, e.g. with the reader element 20a placed above the ground or floor level in such a manner that objects, e.g. luggage, cargo and/or passengers may pass beneath the reader element 20a.

Fig. 3b illustrates a configuration having the reader element 20b placed on or beneath a ground or floor level, whereby this arrangement will be able to register, e.g. identify objects, e.g. luggage, cargo and/or passengers passing along the floor or ground level.

In fig. 3c an arrangement having a reader element 20c placed at a location in such a manner that objects, e.g. luggage, cargo and/or passengers will pass the reader 20c at the side of this. As indicated, two such reader elements 20c may be placed at a location, defining a passage for objects, e.g. luggage, cargo and/or passengers. It will be understood that two (or more) such reader elements may communicate with a common measurement system 21 or with individual measurement systems 21 as indicated.

A similar passageway arrangement is illustrated in fig. 3d. This arrangement comprises three reader elements 20d defining a passage for objects such as passengers and/or luggage. It will be understood these three reader elements may
communicate with a common measurement system 21 as indicated or with individual measurement systems 21.

Finally, fig. 3e illustrates a configuration generally in the shape of a tunnel-arrangement, e.g. comprising four reader elements 20e placed around a passage. Such a configuration may advantageously be utilized in connection with e.g. luggage or cargo transportation, for example wherein a conveyor or similar transportation means passes through the reader arrangement. It will be understood these four (or more) reader elements may communicate with a common measurement system 21 as indicated or with individual measurement systems 21.

Other configurations will of course be possible, which will be obvious to a skilled person.

In fig. 4 various means of registering identification means e.g. in the form of a tag are schematically illustrated.

Figs. 4a to 4d shows a suitcase 12 being transported on transportation means generally designated 15. It will be understood that instead of suitcase 12 any other object may apply in accordance with the invention, e.g. another piece of luggage, cargo in general, a container, a unit load device (ULD), a passenger, crew personnel etc. Similarly, it will be understood that although the transportation means 15 has been illustrated in the form of conveyor means, e.g. a conveyor belt, other transportation means such as transport carts, transport containers, shopping carts etc. apply as well.

The suitcase 12 is associated with an identification tag 1a inserted in the suitcase but obviously, a tag 1b attached to the suitcase may be utilized instead.

A person 14, e.g. an employee is schematically illustrated in fig. 4a holding a handheld reader arrangement 16, by means of which the tag 1a will be detected,
registered and/or whereby a registration will be performed, e.g. by the tag. It will be understood that transmission of the registered data may be facilitated by means of wireless communication or by wired communication, either continuously or in bulk. Also, temporary storage of the data in the handheld unit and transferal to a data processing system, e.g. at a docking station is possible.

In fig. 4b it is illustrated that a reader/registration arrangement 17a may be placed in a stationary position alongside the transportation means 15. Furthermore, it has been indicated that similar reader/registration arrangements 17b, 17c, and/or 17d may be placed above, at the other side of and/or below the transportation means 15, respectively.

In fig. 4c a reader/registration arrangement 18 is illustrated in the form a stationary frame or tunnel arrangement surrounding the transportation means 15 in such a manner that objects, e.g. the suitcase may pass through the arrangement 18, whereby a registration will take place. Obviously, such an arrangement 18 may comprise one or more, e.g. four reader/registration elements fixed in the frame or tunnel 18.

Finally, in fig. 4d a reader/registration arrangement is illustrated comprising a reader/registration element 19 associated with the transportation means 15 themselves. The reader/registration element 19 may e.g. be fixed to, embedded in or otherwise attached to a conveyor belt, other transportation means such as transport carts, transport containers, shopping carts etc. in such a manner that the reader/registration element 19 will move together with the transportation means 15. Such a reader/registration element 19 will facilitate a registration of an object being placed in the vicinity of the reader/registration element 19 and further it will register the removal of the object.

The invention will be further described with reference to fig. 5 that shows a block diagram for an interface to an airline passenger database 25. An appropriate number of tags 1a, for example in the form of radio frequency identification (RFID) tags, are distributed to a number of objects, in this example a number of (selected) airline
passengers. These passengers are registered in an airline passenger database 25, that may contain name, address, frequent passenger information etc. for each passenger, and the identification (ID) of the tags are linked to or added to the respective passengers in the database 25. Relevant information may be transferred to and/or supplied from an measurement system 21 operating on the basis of registrations provided by the interaction of the registration locations and the identification means associated to objects, e.g. passengers.

Thereby data output, e.g. quality reports may be generated concerning the object flow, e.g. the passenger handling flow and/or concerning the luggage handling flow. The tags distributed to the selected passengers may comprise information regarding the type of object associated with the tag, e.g. a tag associated with the passenger or a tag designed to be associated with a piece of luggage. Furthermore, tags may otherwise be associated with objects, e.g. tags attached to suitcases in connection with luggage handling etc.

On the basis of this information data output may be generated for passenger handling and/or luggage handling. It will be understood that the measurement system in addition to the registration of passing or presence of an object may register the actual time for the occurrence. Further, the measurement system 21 may store information for a definite or an indefinite period of time and such previously performed measurements may be utilized for generating data output, e.g. quality reports concerning before-and-after handling quality, reports concerning improvements or reduction in quality regarding certain handling flows, handling operations, bottlenecks in handling flows, hand-over-times for certain objects and/or between certain parts of handling flows etc.

Obviously, the system, e.g. the measurement system 21 may comprise commonly available means, e.g. computer devices, systems and software applications for processing, storing, outputting and distributing data, e.g. in order to provide the necessary or desired output such as quality reports etc.
In fig. 6 a block diagram is illustrated showing an interface to various airport IT systems. As shown a system according to the invention, e.g. a system comprising a tag 1a which may communicate with a reader and/or registration arrangement 20, whereby information may be transmitted to a measurement system 21, may by means of communications means generally designated 41, e.g. a gateway etc. be connected to various aviation, e.g. airport and/or airline information and/or processing systems generally designated 42. Such airport and/or airline information and/or processing systems may for example be flight information systems, flight reservation systems etc. Information from such systems may be supplied to the measurement system 21 according to the invention when generating various quality reports, and/or information from a measurement system according to the invention may also be supplied to one or more of these airport and/or airline information and/or processing systems.

Fig. 7 illustrates a block diagram of an embodiment of the invention by means of which quality reports may be produced. Such an embodiment comprises as described above a number of tags 1a which may communicate with a reader and/or registration arrangement 20, whereby information may be transmitted to a measurement system 21. This measurement system is as described in connection with fig. 5 connected to an airline passenger database 25, although it will be understood that the measurement system may communicate with other databases, e.g. database containing information relating to other objects, e.g. ground or crew personnel, transportation means etc.

The measurement system will be able to generate various data output, e.g. quality reports, for example 60a, 60b, ..., 60n, which may be designed as standard reports or designed in consideration of user-specified needs etc.

Fig. 8 illustrates a block diagram for a further embodiment of the invention in combination with other airport IT systems. This embodiments corresponds in part to the embodiment shown in fig. 7, but in addition the measurement system 21 is connected by means of communication means generally designated 66, e.g. a communication gateway, to a database system 67, e.g. a database system comprising
for example flight information systems, flight reservation systems, baggage handling systems, cargo handling systems, alarm and/or security systems etc. Information may be supplied from one or more of these systems to the measurement system 21, and information from the measurement system 21 may be supplied to one or more of the databases of the database system 67. Further, the database system 67 may be connected via communication means generally designated 68, e.g. a communication gateway, to display means 69, e.g. a computer screen or the like, for displaying information relating e.g. to the aviation handling quality. Such information may be accessed by e.g. stakeholders in an aviation handling process, parties otherwise involved in the system etc., and the information may be in the form of e.g. a number of standard quality reports and/or user specified quality reports. It will be understood that such information can be provided by means of graphical tools to give a real-time and interactive picture of the actual luggage, cargo and/or passenger flow.

The aviation handling flows may vary in dependence on the type of object and may vary from location to location, e.g. from one airport to another, and further handling flows may be subjected to alterations caused by development in techniques, demand, needs etc. Thus, it will not be possible to define a standard aviation handling flow. However, fig. 9 illustrates an example of a typically used handling flow for departing objects, e.g. passengers and luggage, and fig. 10 illustrates an example of a typically used handling flow for arriving objects, e.g. passengers and luggage.

As illustrated in fig. 9 a starting point for an aviation handling flow or flows may be a hotel, a train station or a parking area 70, where objects, e.g. a passenger 10 and/or his luggage 12 enters a handling flow and where registration location(s) may be placed. The passenger and his luggage may proceed to a departure hall 71, e.g. to a ticketing location 72 and/or to a check-in location 73 where the luggage 12 may be taken to the luggage take away location 74. The luggage may be transported via a baggage sorter location 80 in a terminal area 76 and possibly to a baggage storage 81. Subsequently, the luggage may be transported via a sorter outlet 82 to a concourse area 83, where the luggage may be loaded into a baggage unit load device (ULD) 86. This may then be transferred via a baggage loader 89 to the aircraft 87.
The passenger may proceed from the check-in location 73 via a security checkpoint 75 to the terminal 76, where he/she may enter a shopping area 77 and possibly a lounge 78. Further, the passenger may proceed via a security checkpoint 79 to a gate lounge 84 in the concourse area 83, and finally via a boarding control 85 to the aircraft 87, possibly via some sort of airside transport 88.

In fig. 10 it is similarly illustrated that a passenger 10 and his/her luggage arrives by means of an aircraft 87, and the luggage may be transported via a baggage loader 92 to a baggage sorter 98. Possibly, the luggage may be transported to a luggage transit location 99. If not, the luggage will be transferred to a baggage claim location 101, where the passenger may pick it up. The passenger has, possibly by means of airside transportation 91 proceeded to a gate location 94 in a concourse area 93. From here, the passenger may proceed to a security checkpoint 96 and possibly to a transit location 97 in a terminal area 95. From the security checkpoint 96 the passenger may proceed to the baggage claim location 101 in the arrival hall 100, pick-up the luggage and proceed to a customs location 102. From this location the passenger may proceed to a hotel, a train station, a parking area or the like 90 which may define an ending point of a handling flow.

Obviously, a number of registration locations may be selected in such handling flows and start/end points may be selected according to specific needs. To illustrate the possibilities further, registration location maybe selected from a group comprising e.g.

- a check-in location for registration of luggage,
- a drop-off location for registration of luggage,
- a check-in counter luggage drop,
- a luggage take-away conveyor location,
- an X-ray luggage scanner location,
- a luggage ULD (Unit Load Device) handling location,
- a cargo ULD (Unit Load Device) handling location,
- an airplane luggage compartment,
- a luggage claim location,
- a check-in location for registration of passengers,
- a shopping area,
- a departure gate location,
- a passport check location,
- a customs location,
- an immigration location,
- a cargo center entry/exit location
- a security checkpoint location,
- a curb-side check-in location,
- a courtesy pickup location,
- a courtesy drop-off location,
- off-terminal locations,
- inter-terminal transport,
- inter-airport transport,
- a hotel location,
- a car park location,
- a train station location and
- a bus station location.

In order further to illustrate the options made available by the invention, a number of observations are listed in the following. These observations may provide input to data output, e.g. quality reports generated according to the invention and illustrate the versatility of the invention.

Did a passenger pass a specific registration point?

Did he stay at the airport hotels?
Did he arrive by train, by rented car, by taxi?
Did he use self check-in, airport hotel check-in?
Did he visit the shopping area?
Did he visit the business class lounge?
Did he pass through a security checkpoint?
Did he wait in the gate lounge?
Did he board the aircraft?
Did he visit the shopping area upon arrival?
Did he pass through ‘green tag’ customs upon arrival?
Did he leave the airport by train, by rented car, by taxi?
Did he check-in at an airport hotel upon arrival?
In total - what was the passengers travel pattern locations?

When did a passenger pass a specific registration point?

How long was the travel time between hotel and airport?
How long did it take at check-in, self check-in?
How long did it take through security, business class fast track?

How long did he stay in the shopping area?
How long did he stay in the business class lounge?
How long did it take from check-in to boarding?
How long did he stay at a transit airport?
How long did it take from arrival at gate to baggage claim?

How long did it take to the airport hotel?
In total - what was the total passenger travel pattern durations?

Did a piece of luggage pass a specific registration point?

Was it dropped at self check-in, airport hotel check-in?
Was it on the take away conveyor?
Did it pass the X-ray?
Was it in the early baggage storage?
Was it loaded on a business class ULD?

Was it loaded on the aircraft?
Did it leave the aircraft in transit airport?
Did it arrive at the destination airport?
Was it unloaded by the business class baggage loader?
Was it picked up at baggage claim?
Did it pass customs, was it examined further by security?
Was it picked up by hotel forwarding service?

In total - what was the luggage trail locations?

When did a piece of luggage pass a specific registration point?

How long did it take from hotel pick-up to baggage drop at check-in?
How long did it take from check-in counter to aircraft?
How long did it take at peak-hours?
How long did it take outside peak-hours?
How long did it take at transit airport?
How long did it take from baggage claim to hotel delivery?

In total - what was the luggage trail durations?

Accumulated reports for passengers and luggage.

What is the mainstream travel pattern for business class passengers?
What is the mainstream travel pattern for economy class passengers?
What is different in travel patterns for business class and economy class passengers?
What is the difference in peak-hours?
What is the difference outside peak-hours?

How efficient is fast track security compared to standard security?
How efficient is separate business class baggage handling?
What is the mainstream business class luggage trail?
What is the mainstream economy class luggage trail?

Furthermore, target data may form part of the data supplied to, processed by and/or supplied by the system, e.g. passenger and luggage handling targets, that may be defined according to check-in times and on-block times.
Example:

Check-in handling target: 95% of all business class passengers must be serviced within 10 minutes at the check-in counters.

Data input:

Registration of passenger RFID tag at entry to check-in area.

Check-in time from Flight Reservation System.

Data output: Duration from entry to check-in.

Finally, fig. 11 illustrates a handling flow for a total aviation handling flow, e.g. a handling flow covering two or more airports and comprising passengers, luggage and cargo.

A passenger 10, a piece of luggage 12 and cargo in the form of a unit load device (ULD) 13 are schematically illustrated next to a schematically indicated airport (A1) 110, which is selected as a departing airport for an example of a total aviation handling flow. The (final) destination airport (A2) is designated 112, and the total journey may include one or more transit airports (An) designated 111. Fig. 11 illustrates that according to the invention monitoring of handling flows may cover inter-airport handling and may even cover a total journey from departure airport, via one or more transit airports to a destination airport, and that the monitoring may apply for objects associated with each other, e.g. a passenger and his/her luggage, whereby data relating to such depending objects may be correlated, e.g. did a passenger and his luggage follow the same route, did they arrive at transit airports at the same time etc.

It will be understood that the invention is not limited to the particular examples described above but that the invention may be designed and utilized in a multitude of varieties within the scope of the invention as specified in the claims.
Patent Claims

1. Method of monitoring aviation handling performance whereby
- an aviation environment is provided with at least one registration location in a
handling flow,
- identification means are provided to at least one potential object of or part of an
aviation handling flow,
- presence and/or passing of identification means in a handling flow is automatically
registered at or near said registration locations, and
- processing, presenting and/or storing of registered data is performed.

2. Method according to claim 1, characterized in that said at least one
registration location is provided with reader means, with other means or type of data
capture and/or with means for communication with a data capture system for
registration of said identification means.

3. Method according to claim 1 or 2, characterized in that said
identification means comprises barcode, magnetic stripe, smart card and/or biometric
operating means.

4. Method according to claim 1 or 2, characterized in that said
identification means comprises radio frequency operating means.

5. Method according to claim 1, 2, 3 or 4, characterized in that said
identification means comprises a tag.

6. Method according to one or more of claims 1 to 5, characterized in
that said identification means comprises a radio frequency identification (RFID) tag.

7. Method according to one or more of claims 1 to 6, characterized in
that said identification means comprises a transponder, in particular a radio
frequency transponder.
8. Method according to one or more of claims 1 to 7, characterized in that said identification means are associated with an object, e.g. carried by a passenger, attached to or inserted into a piece of luggage, e.g. a suitcase, a piece of hand luggage etc.

9. Method according to claim 8, characterized in that at least two of said identification means are associated with interrelated objects, e.g. identification means carried by a passenger and one or more co-passengers, carried by a passenger and attached to or inserted into a piece of luggage belonging to said passenger, attached to at least two pieces of luggage belonging to a passenger etc.

10. Method according to claim 8 or 9, characterized in that said identification means are associated with an object forming part of and/or facilitating said handling flow or handling flows, e.g. identification means carried by a member of a cabin crew, carried by a person from ground personnel, attached to or inserted into transportation means, a cargo load device such as a unit load device (ULD) etc.

11. Method according to one or more of claims 1 to 10, characterized in that said at least one registration location is located in an object handling flow, e.g. a passenger and/or corresponding luggage handling flow and that said at least one registration location may be located at any suitable and/or user-defined point in said handling flow or handling flows, including start and end point for said handling flow or flows.

12. Method according to one or more of claims 1 to 11, characterized in that said at least one registration location is selected from a group comprising e.g. a check-in location for registration of luggage, a drop-off location for registration of luggage, a check-in counter luggage drop, a luggage take-away conveyor location, an X-ray luggage scanner location,
- a luggage ULD (Unit Load Device) handling location,
- a cargo ULD (Unit Load Device) handling location,
- an airplane luggage compartment,
- a luggage claim location,
- a check-in location for registration of passengers,
  - a shopping area,
  - a departure gate location,
  - a passport check location,
  - a customs location,
- an immigration location,
  - a cargo center entry/exit location
  - a security checkpoint location,
  - a curb-side check-in location,
  - a courtesy pickup location,
- a courtesy drop-off location,
  - off-terminal locations,
  - inter-terminal transport,
  - inter-airport transport,
  - a hotel location,
- a car park location,
  - a train station location and
  - a bus station location.

13. Method according to one or more of claims 1 - 12, characterized in that said identification means, e.g. in the form of tags are associated with a sample group of objects, e.g. belong to, attached to etc. a sample group of objects such as passengers, luggage, cargo.

14. Method according to claim 13, characterized in that said sample group is configured in consideration of statistical criteria.
15. Method according to one or more of claims 1 - 14, characterized in that said identification means, e.g. in the form of tags are used independently of a sample group of objects, e.g. individual passengers, all passengers etc.

16. Method according to claim 13, 14 or 15, characterized in that said sample group of objects, e.g. passengers, luggage etc. can be selected from e.g. an airline frequent flyer programme.

17. Method according to one or more of claims 13 to 16, characterized in that said sample group of objects, e.g. passengers may acknowledge their participation in said aviation handling performance monitoring.

18. Method according to one or more of claims 13 to 17, characterized in that said sample group of objects, e.g. passengers may be provided additional services in reward for their participation in said aviation handling performance monitoring.

19. Method according to one or more of claims 1 to 18, characterized in that said identification means are used for objects, e.g. passengers, luggage and/or cargo etc. subject to further security, handling and/or service.

20. Method according to one or more of claims 1 to 19, characterized in that said identification means are used for objects such as e.g. luggage, cargo etc. subject to pilferage.

21. Method according to one or more of claims 1 to 20, characterized in that said identification means are used for objects such as e.g. luggage, cargo etc. subject to mishandling.

22. Method according to one or more of claims 1 to 20, characterized in that said identification means are used for objects such as e.g. luggage, cargo etc. subject to loss.
23. Method according to one or more of claims 1 to 22, characterized in that said identification means are used for objects, e.g. passengers, who are targets for event driven services, e.g. direct marketing, flight information, boarding calls, passenger and baggage announcement via e.g. sms-messaging, mms-messaging, voice response systems or message-board information.

24. Method according to one or more of claims 1 to 23, characterized in that said identification means are used for objects, e.g. passengers, who are targets for shopping behaviour analysis.

25. Method according to one or more of claims 1 to 24, characterized in that said identification means are used for objects, e.g. passengers, who are targets for customer satisfaction analysis.

26. Method according to one or more of claims 1 to 25, characterized in that said identification means are used for objects such as e.g. luggage, cargo etc. that constitutes a basis for payment between reconciling parties, e.g. airports, airlines, cargo handlers and/or baggage handlers.

27. Method according to one or more of claims 1 to 26, characterized in that said registered data are processed in order to produce data indicative of handling performance, e.g. luggage handling, cargo handling and/or passenger flow handling.

28. Method according to claim 27, characterized in that said data indicative of handling performance comprises data indicative of current handling performance, e.g. process times, hand-over locations and times etc. for a handling flow or for part of such a handling flow.

29. Method according to claim 27 or 28, characterized in that said data indicative of handling performance comprises data indicative of long-term handling
performance, e.g. process times, hand-over locations and times etc. for a handling flow or for part of such a handling flow.

30. Method according to claim 27, 28 or 29, characterized in that said data indicative of handling performance comprises data indicative of comparative before-and-after handling performance, e.g. process times, hand-over locations and times etc. for a change in handling flow or for a change in part of such a handling flow.

31. Method according to claim 27, 28, 29 or 30, characterized in that said data are processed in order to provide time-study reports relating to said handling flow/flows or part thereof.

32. Method according to one or more of claims 27 - 31, characterized in that said data indicative of handling performance may be provided to and/or supplied from any stakeholder in an aviation handling process, e.g. airport, airline, ground-handler, travel agency.

33. Method according to one or more of claims 27 - 32, characterized in that said data indicative of handling performance comprises data provided to and/or supplied from a flight information system.

34. Method according to one or more of claims 27 - 33, characterized in that said data indicative of handling performance comprises data provided to and/or supplied from a flight reservation system.

35. Method according to one or more of claims 27 - 34, characterized in that said data indicative of handling performance comprises data provided to and/or supplied from a baggage handling system.
36. Method according to one or more of claims 27 - 35, characterized in that said data indicative of handling performance comprises data provided to and/or supplied from a security and alarm system.

37. System for monitoring aviation handling performance comprising
   - at least one registration location in a handling flow of an aviation environment,
   - identification means provided to at least one potential object of or part of an aviation handling flow,

wherein registration means at said registration locations are designed to automatically register presence and/or passing of identification means in a handling flow at or near said registration locations, and wherein said system comprises means for processing, presenting and/or storing of said registered data.

38. System according to claim 37, characterized in that said at least one registration location is provided with reader means, with other means or type of data capture and/or with means for communication with a data capture system for registration of said identification means.

39. System according to claim 37 or 38, characterized in that said identification means comprises barcode, magnetic stripe, smart card and/or biometric operating means.

40. System according to claim 37 or 38, characterized in that said identification means comprises radio frequency operating means.

41. System according to claim 37, 38, 39 or 40, characterized in that said identification means comprises a tag.

42. System according to one or more of claims 37 to 41, characterized in that said identification means comprises a radio frequency identification (RFID) tag.
43. System according to one or more of claims 37 to 42, characterized in that said identification means comprises a transponder, in particular a radio frequency transponder.

44. System according to one or more of claims 37 to 44, characterized in that said identification means comprises means for association with an object, e.g. means for attachment to a passenger, attachment to or insertion into a piece of luggage, e.g. a suitcase, a piece of hand luggage etc.

45. System according to claim 44, characterized in that at least two of said identification means are associated with interrelated objects, e.g. identification means carried by a passenger and one or more co-passengers, carried by a passenger and attached to or inserted into a piece of luggage belonging to said passenger, attached to at least two pieces of luggage belonging to a passenger etc.

46. Method according to claim 44 or 45, characterized in that said identification means are associated with an object forming part of and/or facilitating said handling flow or handlings flows, e.g. identification means carried by a member of a cabin crew, carried by a person from ground personnel, attached to or inserted into transportation means, a cargo load device such as a unit load device (ULD) etc.

47. System according to one or more of claims 37 to 46, characterized in that said at least one registration location is located in an object handling flow, e.g. a passenger and/or corresponding luggage handling flow and that said at least one registration location may be located at any suitable and/or user-defined point in said handling flow or handling flows, including start and end point for said handling flow or flows.

48. System according to one or more of claims 37 to 47, characterized in that said at least one registration location is selected from a group comprising e.g.
   - a check-in location for registration of luggage,
- a drop-off location for registration of luggage,
- a check-in counter luggage drop,
- a luggage take-away conveyor location,
- an X-ray luggage scanner location,
- a luggage ULD (Unit Load Device) handling location,
- a cargo ULD (Unit Load Device) handling location,
- an airplane luggage compartment,
- a luggage claim location,
- a check-in location for registration of passengers,
- a shopping area,
- a departure gate location,
- a passport check location,
- a customs location,
- an immigration location,
- a cargo center entry/exit location
- a security checkpoint location,
- a curb-side check-in location,
- a courtesy pickup location,
- a courtesy drop-off location,
- off-terminal locations,
- inter-terminal transport,
- inter-airport transport,
- a hotel location,
- a car park location,
- a train station location and
- a bus station location.

49. System according to one or more of claims 37 to 48, characterized in that said identification means, e.g. in the form of tags are associated with a sample group of objects, e.g. belong, attached to etc. a sample group of objects such as passengers, luggage, cargo.
50. System according to claim 49, characterized in that said sample group is configured in consideration of statistical criteria.

51. System according to one or more of claims 37 to 50, characterized in that said identification means, e.g. in the form of tags are used independently of a sample group of objects, e.g. individual passengers, all passengers etc.

52. System according to claim 49, 50 or 51, characterized in that said sample group of objects, e.g. passengers, luggage is selected from e.g. an airline frequent flyer programme.

53. System according to one or more of claims 49 - 52, characterized in that said sample group of objects, e.g. passengers may acknowledge their participation in said aviation handling performance monitoring.

54. System according to one or more of claims 49 to 53, characterized in that said sample group of objects, e.g. passengers may be provided additional services in reward for their participation in said aviation handling performance monitoring.

55. System according to one or more of claims 37 to 54, characterized in that said identification means are used for objects, e.g. passengers, luggage and/or cargo subject to further security, handling and/or service.

56. System according to one or more of claims 37 to 55, characterized in that said identification means are used for objects such as e.g. luggage, cargo etc. subject to pilferage.

57. System according to one or more of claims 37 to 56, characterized in that said identification means are used for objects such as e.g. luggage, cargo etc. subject to mishandling.
58. System according to one or more of claims 37 to 57, characterized in that said identification means are used for objects such as e.g. luggage, cargo etc. subject to loss.

59. System according to one or more of claims 37 to 58, characterized in that said identification means are used for objects, e.g. passengers, who are targets for event driven services, e.g. direct marketing, flight information, boarding calls, passenger and baggage announcement via e.g. sms-messaging mms-messaging, voice response systems or message-board information.

60. System according to one or more of claims 37 to 59, characterized in that said identification means are used for objects, e.g. passengers, who are targets for shopping behaviour analysis.

61. System according to one or more of claims 37 to 60, characterized in that said identification means are used for objects, e.g. passengers, who are targets for customer satisfaction analysis.

62. System according to one or more of claims 37 to 61, characterized in that said identification means are used for objects such as e.g. luggage, cargo etc. that constitutes a basis for payment between reconciling parties, e.g. airports, airlines, cargo handlers and/or baggage handlers.

63. System according to one or more of claims 37 to 62, characterized in that said means for processing, presenting and/or storing of said registered data is designed to produce data indicative of handling performance, e.g. luggage handling, cargo handling and/or passenger flow handling.

64. System according to claim 63, characterized in that said data indicative of handling performance comprises data indicative of current handling performance, e.g. process times, hand-over locations and times etc. for a handling flow or for part of such a handling flow.
65. System according to claim 63 or 64, characterized in that said data indicative of handling performance comprises data indicative of long-term handling performance, e.g. process times, hand-over locations and times etc. for a handling flow or for part of such a handling flow.

66. System according to claim 63, 64 or 65, characterized in that said data indicative of handling performance comprises data indicative of comparative before-and-after handling performance, e.g. process times, hand-over locations and times etc. for a change in handling flow or for a change in part of such a handling flow.

67. System according to one or more of claims 63 to 66, characterized in that said means for processing, presenting and/or storing of said registered data is designed to provide time-study reports relating to said handling flow/flows or part thereof.

68. System according to one or more of claims 63 to 67, characterized in that said system comprises means for providing data indicative of handling performance to and/or for supplying data from any stakeholder in an aviation handling process, e.g. airport, airline, ground-handler, travel agency.

69. System according to one or more of claims 63 to 68, characterized in that said system comprises means for processing and/or including data from and/or for supplying data to a flight information system when providing said data indicative of handling performance.

70. System according to one or more of claims 63 to 69, characterized in said system comprises means for processing and/or including data from and/or for supplying data to a flight reservation system when providing said data indicative of handling performance.
71. System according to one or more of claims 63 to 70, characterized in that said system comprises means for processing and/or including data from and/or for supplying data to a baggage handling system when providing said data indicative of handling performance.

72. System according to one or more of claims 63 to 71, characterized in that said system comprises means for processing and/or including data from and/or for supplying data to a security and alarm system when providing said data indicative of handling performance.

73. Use of method according to one or more of claims 1 to 36 and/or system according to one or more of claims 37 to 72 for monitoring a luggage handling system or systems.

74. Use according to claim 73 for activating an alarm system or systems and/or for providing alert messages.

75. Use of method according to one or more of claims 1 to 36 and/or system according to one or more of claims 37 to 72 for providing information and/or measurements relevant for aviation handling related lay-out, planning and/or managerial usage.

76. Use of method according to one or more of claims 1 to 36 and/or system according to one or more of claims 37 to 72 for providing information relating to passenger and/or customer experience, behaviour and/or evaluation.

77. Use of method according to one or more of claims 1 to 36 and/or system according to one or more of claims 37 to 72 for providing information relating to shopping evaluation and/or optimisation.
78. Use of method according to one or more of claims 1 to 36 and/or system according to one or more of claims 37 to 72 for providing information regarding inter-baggage, inter-cargo and/or inter-passenger relations.

79. Use of method according to one or more of claims 1 to 36 and/or system according to one or more of claims 37 to 72 for facilitating passenger handling processes, e.g. remote check-in, check-in, remote passenger identification etc.
Fig. 5

Airline passenger database

Sample passenger profile

Measurement system

Tag - ID
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

| IPC | US7C11/00 | G07B15/00 | G07C9/00 | G06F17/00 |

According to International Patent Classification (IPC) or to both national classification and IPC.

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

| IPC | G07C | G07B | G06F | G08B | B64F | B64D |

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

Electronic database consulted during the international search (name of database and, where practical, search terms used)

**EP0-Internal**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Further documents are listed in the continuation of box C. Patent family members are listed in annex.

**Date of the actual completion of the international search**

3 February 2003

**Date of mailing of the international search report**

24. 02. 2003

**Name and mailing address of the ISA**

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Fax (+31-70) 340-0018

**Authorized officer**

GORDANA NINKOVIC/JA A
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