INTRALOGISTICS SYSTEM FOR MONITORING LOCATION-SPECIFIC INTRALOGISTICAL ACTIONS

Abstract

The disclosure refers to an intralogistics system (**10**) for monitoring predetermined location-specific action being uniquely associated with one location (**68**) of a plurality of different locations (**68**) in the intralogistics system (**10**) and being uniquely associated with a movable system entity (**16**), which is to perform the action, wherein the intralogistics system (**10**) comprises: a control (**12**) communicating an order (**64**) being uniquely associated with the action to the movable system entity (**16**) and being configured for: maintenance (**26**) of a system component (**70**) of a plurality of system components (**70**); material-flow control (**30**); and/or picking guidance (**32**); a reading device (**24**), which the movable system entity (**16**) carries along and which is connected, for data exchange, to the control (**12**); and a projector (**14**) configured to project location-specific codes (**34**), on command from the control (**12**), onto several ones of the locations (**68**) within the intralogistics systems (**10**); wherein the control (**12**) is further configured to verify performance of the action based on the order (**64**) and a received confirmation signal, which is generated by the reading device (**24**) and transmitted to the control (**12**) as soon as the reading device (**24**) has read one of the location-specifically projected codes (**34**).

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a national stage application under 35 U.S.C. 371 of PCT Application No. PCT/EP2023/072304 having an international filing date of 11 Aug. 2023, which designated the United States, which PCT application claimed the benefit of German Application No10 2022 120 389.1, filed 12 Aug. 2022, each of which are incorporated herein by reference in their entirety.

BACKGROUND
[0002] The present disclosure generally relates to the field of intralogistics, and in particular to an intralogistics system which is capable of monitoring maintenance processes and material-flow control. In doing so, a person is guided by light to a predetermined location at which an (only) machine-readable location-specific code is displayed for verification (by a higher-level control) of an action to be carried out there.
[0003] Light-based picking guidance for navigation through a warehouse and finding a removal location, or delivery location, is known.
[0004] The document U.S. Pat. No. 8,423,431 discloses a picking facility including a plurality of stationarily installed projectors for visual wayfinding (navigation). The projectors project 2D symbols (e.g., an arrow including a picking person's name, text description of the route, etc.) along a route onto the floor or onto the walls of the facility in order to guide a picking person (spatially) through the facility to a removal or delivery location. When the picking person arrives at the removal or delivery location, this location itself is illuminated and, if necessary, information (e.g., an image of the article, a contour of the article, a name of the article, etc.) on the to-be-handled object is displayed. The picking person carries along a communication unit being wirelessly connected to a higher-level control for determining (e.g., by means of triangulation) the current location of the picking person. Based on this so-determined location information the control may select one of the projectors for facilitating display of suitable information to the picking person in order to find the location and/or identify the object to be handled. In addition, one of the (location) projectors, such as a laser pointer, may also be mounted on a picking trolley which the picking person carries along while walking through the facility.
[0005] For effectively guiding the person (i.e. navigating him/her through the sys-tem), it is also necessary to know the current position of the person as exactly as possible. Therefore, the person carries along the communication unit which permanently transmits position data to the control, from which the position of the person is calculated periodically at high rate. This is labor and resource intensive. The constantly recurring position determination cannot be omitted.
[0006] The document DE 10 2018 203 175 A1 (cf. FIGS. 5 and 6 there) discloses a movable picking trolley, which includes a frame-fixedly mounted autostereoscopic projector for picking guidance (removal and/or delivery). The projector generates a (three-dimensionally appearing) image, such as an arrow indicating to a picking person a removal or delivery location. Thus, picking guidance based on pick-by-light or put-by-light is disclosed. One of several storage containers, which are arranged in levels of a rack frame beneath the projector, is arranged at the

indicated location. The picking person gets a depth impression by viewing a stereoscopically represented symbol (e.g., a number of a removal quantity, the arrow for this location, a photo of the article, a name of the article, or a contour of the article) at the location where the corresponding container is arranged. Upon stereoscopic illustration two images (respectively one for the left and right eye) are generated which are combined in the observer's brain for creating depth perception.

[0007] The document EP 2 554 496 A1 in turn discloses visual navigation guidance in a picking facility (rack warehouse). The picking person is guided by a laser projector through the warehouse up to a rack compartment by projecting corresponding navigation information (e.g., arrows or text) onto the floor. The laser projector is mounted movably on the ceiling of the warehouse.

[0008] The document DE 10 2016 005 691 A1 also discloses a picking guidance by means of a stationary projection unit which illuminates rack compartments of a storage rack for finding a removal location. The projection unit is capable of visually marking several ones of the rack compartments at the same time. The image information displayed by the projection unit includes: graphical contents, different colors, numbers, letters, tickers, patterns, and/or images. The information may be displayed flashing. The rack compartments may be highlighted with an index projection (frame around the compartment, or flashing effect). Removal confirmation is performed via a mobile wireless confirmation device, or via gesture recognition. The confirmation device comprises a button which is operated after removal for signaling the removal to the control. This signal may also contain position data of the mobile device so that the control knows which of the rack-compartment projections can be turned off since the removal has happened at the corresponding rack compartment.

[0009] Another problem area concerns the maintenance of components of an intralogistics system.

[0010] Maintenance orders are conducted by maintenance technicians who are to walk to the components to be maintained in order to inspect the components and, if necessary, replace them. The technician gets a list containing all the components to be maintained, either in printed form or as a file. It is expected that the technician walks to the components, scans an identifier thereof, and carries out the inspection. In practice, it has been found that technicians obtain the component identifiers as copies in advance, and, at the time of the actual maintenance, scan the identifier copy only without actually inspecting the component. This saves the technicians the trip to the components, and they are also finished much faster because the maintenance actually is not carried out. Nevertheless, system operator must pay for the alleged maintenance. Furthermore, the reliability of the system suffers because the maintenance has not been carried out at all. It would be desirable to create a system that prevents such work bypass, or work avoidance, and that ensures that the technician can perform the maintenance only at the location of the component to be maintained.

[0011] Yet another problem area concerns the tracking of the material flow, as will be described in more detail below.

[0012] Therefore, it is an object of the present disclosure to create an improved intralogistics system.

[0013] This object is solved by an intralogistics system for monitoring a predetermined location-specific action (maintenance, tracking, picking, etc.) being uniquely associated with a (single) location of a plurality of different locations in the system and being uniquely associated with a movable system entity which is to perform the action, wherein the intralogistics system comprises: a control communicating an order, which is uniquely associated with the action and corresponds to the order, to the movable system entity (human, robot, AGV, etc.), and being configured for: maintenance of one system component of a plurality of system components; material-flow control; and/or picking guidance; a reading device, which the movable system entity carries along and is connected to the control for data exchange; and a projector configured to project location-specific codes, on command from the control, onto several ones of the locations within the intralogistics system, wherein (exactly) one of the codes is assigned to the order; wherein the control is

configured further to verify performance of the action based on the order and a received confirmation signal, which is generated by the reading device and transmitted to the control as soon as the reading device has read one of the location-specifically projected codes.

[0014] The location-specific code is projected onto a specific location, which is uniquely associated with the action to be performed. Thus, this code can only be read at the relevant location. This requires that the reading device is located at this location. The code cannot be printed in advance and read at a different location.

[0015] The control receives, by the reading of the location-specific code, a direct feedback including the information that the reading device is located at the desired location. The code read by the reading device is part of the confirmation signal, or even corresponds to the confirmation signal. Based on this signal, the control may verify whether the proper code (e.g., from the proper entity) has been read. It can also be verified whether the proper reading device has read the proper code. In addition, it may be verified whether the code has been read at the proper time.

[0016] Preferably, the control is configured to project one of the codes at a time only.

[0017] In this manner it can be ensured that, in case if several actions are to be performed, a desired sequence is followed when the actions are performed.

[0018] Alternatively, the control may be configured to project several ones of the codes at the same time onto the corresponding locations.

[0019] In this case, a person or machine can decide for themselves, and thus determine a sequence of performance, which of the actions is to be performed first and which of the actions is to be performed last.

[0020] In this case, it is advantageous if the confirmation signal further comprises: a component-specific identifier; an entity-specific identifier; and/or a reading-device-specific identifier.

[0021] The specific identifiers contain additional information which may be used upon the check of the proper performance of the action for comparison purposes.

[0022] Preferably, the one code is projected (directly) onto the location being associated with the associated action.

[0023] Thus, the projection indicates the location where the action is to be performed. In particular, this is advantageous in case of maintenances since the maintenance technician is guided by light to a component to be maintained, and may inspect the same. The projection assists the technician in navigating through the system and in identifying the component to be maintained. Finally, the code may be used for feedback to the control for verification purposes.

[0024] In particular, the projector is high resolution to project the one code from a distance of at least 3 m, 4 m, 5 m, or from a distance of more than 5 m onto the location.

[0025] Thus, the projector has a large coverage. This means that the (steerable) projector can illuminate many different locations without being moved. In a particularly advantageous configuration the projector is stationarily mounted, and therefore does not have to be configured movable, whereby costs can be reduced. Also, the control effort is reduced because the projector does not have to be moved. Nevertheless, the projector, due to its high resolution, is capable of displaying the location-specific code with sufficient resolution despite the large distance to the projection location. This particularly applies if the code has to be machine-readable, and has a high information density.

[0026] Preferably, the intralogistics system comprises a data structure defining one or more of the actions and including, for each of the defined actions, a single one of the location-specific codes describing uniquely a coordinate in the intralogistics system, onto which the one code is to be projected by the projector.

[0027] The data structure is the basis for data comparison, which may be performed in the context of the verification. The data structure allows simply comparing information that is expected to match.

[0028] In particular, the data structure includes further, for each of the actions, an order type, one of

the entities, a system component, and/or a time specification.

[0029] Further, the codes may be machine-readable, preferably exclusively, by the reading device, and evaluated by the control.

[0030] Thus, the code may not be evaluated by the picking person itself, which reduces the risk of corruption.

[0031] Further, it is advantageous if the code is formed one-dimensionally or two-dimensionally for imaging the location coordinate uniquely in terms of a pattern.

[0032] The code may not be read by the technician, which reduces the possibility of tricking the system. But the code is machine-readable, and may have a high information density.

[0033] Further, it is desirable that the verification is performed, in case of the maintenance, by reading and transmitting, by the reading device, a system-component identifier, and checking it by the control; and/or by checking, by the control, whether the system component, which is also associated with the order, goes offline during a predetermined period of time after the code was read.

[0034] Preferably, in case of the material-flow control, the verification is performed by the reading device attached to the vehicle, which is the movable entity, reading the one code at a waypoint, which needs to be passed by the vehicle in accordance with a preplanned material-flow control and onto which (or within the immediate vicinity thereof) the code is projected, the confirmation signal further comprising a vehicle-specific identifier, and preferably a timestamp corresponding to the reading of the one code, and the control checking the pre-planned material-flow control by comparison against data resulting from an evaluation of the confirmation signal.

[0035] In particular, the verification by the control includes a check that the received code, which was read, matches with the code being assigned to the corresponding action; and that the control, when the codes match, outputs a further confirmation signal to the corresponding movable system entity and causes this system entity to continue its current action, or that the control, when the codes do not match, outputs a correction signal to the corresponding movable entity and causes this system entity to perform the predetermined action instead of its current action.

[0036] It is important for effective material-flow control that a pre-planned material flow is implemented in reality as good as possible because each error leads to delays. Therefore, a plurality of stationary scanners is employed, which read the material-flow items again and again for comparing (and equalizing) these real-time data to the planned data in order to take corrective actions, if necessary. Stationary scanners are expensive, require maintenance, and have to be put into operation. Therefore, it is desirable to create a system in which the number of scanners may be reduced, or the scanners may be eliminated completely.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] It is understood that the features mentioned above, and those to be explained below, can be used not only in the respectively given combination, but also in other combinations or on their own, without departing from the scope of the present disclosure. Embodiments of the disclosure are shown in the drawings and explained in more detail in the following description.

[0038] FIG. **1** shows a block diagram of an intralogistics system.

[0039] FIGS. **2**A and **2**B show an exemplary 1D code (FIG. **2**A) and an exemplary 2D code (FIG. **2**B).

[0040] FIG. **3** illustrates a DLP projector integrated into car headlights.

[0041] FIG. **4** shows a data structure, for example, in tabular form.

[0042] FIG. **5** shows a block diagram of a reading device.

[0043] FIG. **6** illustrates a maintenance situation.

DETAILED DESCRIPTION

[0044] The present disclosure generally relates to the field of intralogistics, and in particular to an (automated) monitoring of maintenance operations, as well as to tracking of material flow performed, for example, by driverless transport vehicles (DTVs), in an intralogistics system (storage and/or picking system, for example, in production logistics or in goods-distribution logistics).

[0045] The term "intralogistics" encompasses the organization, control, performance, and optimization of an internal material flow, information streams, and the handling of goods in industry and retail. The term "material flow" refers to all processes and their interlinking in the manufacturing, processing and distribution of goods and objects within certain defined areas (e.g., goods receipt, warehouse, order picking, and/or goods issue). The material flow is controlled by a material-flow computer (MFC), which checks source-destination relationships and coordinates a sequence in which individual orders (transport orders) are processed.

[0046] FIG. **1** shows a block diagram of an intralogistics system **10**, which will be referred to in the following as system **10** and can be, for example, a storage and order-picking system. Typically, the system **10** is accommodated in a building (such as a hall).

[0047] The system **10** includes a (higher-level) control **12**, at least one projector **14**, and at least one movable (system) entity **16**, such as a (maintenance) technician **18**, a (driverless transport) vehicle **20** and/or a picking person **22**, each entity **16** carrying along a reading device **24**.

[0048] As the reading device **24**, the technician **18** can carry along, for example, a smartphone.

[0049] The reading device **24** can be integrated into the vehicle **20**, wherein the reading device **24** and the vehicle **20** can commonly share required functional units, such as a transmitting/receiving unit **74**, and/or a data memory **81** (cf. FIG. **5**).

[0050] The control **12** of FIG. **1** can be provided centrally, or in a decentrally distributed manner. The control **12** includes a data-processing system (not shown) including one or more processors (not shown) and one or more data memories (not shown), where one or more programs are stored, which are executed by the processors for implementing functions of the system **10**.

[0051] Exemplary functions of the control **12** are: performing and monitoring a maintenance **26** of a system component **70** (e.g., an automated picking device **28**, or one of the vehicles **20**), tracking a material flow **30**, and/or performing a picking guidance **32** (e.g., removal by means of Pick-by-Light (PbL), or delivery by means of Put-to-Light (PtL)). "Tracking" means tracking of movable objects (articles, load carriers, vehicles **20**, etc.) in real time. Based on tracking data, it can be verified whether the preset material flow **30** is executed, or runs, in accordance with its planning.

[0052] Each of the projectors **14** is configured to project a location-specific code **34**, for example, onto a floor, onto a wall, or onto one of the system components. Location-specific means that the code **34** includes a unique information on its respective projection location.

[0053] The projection is caused by the control **12**, which transmits corresponding control signals (not shown) via a (wireless and/or wired) communication network **36** (e.g., a bus system, WiFi network, and/or 5G network) to the projector(s) **14**. Each of the projectors **14** is configured to generate projections in terms of visible light at many different (projection) locations within the system **10**, even during the day. The projections can be generated simultaneously, or sequentially one after the other, by each of the projectors **14**.

[0054] Preferably, the projectors **14** are installed stationary (e.g. on the ceiling of a hall), but may also be formed movable (e.g. via a rail-carriage system) in order to cover large areas of the system **10**, or the entire system **10**, by some few or even only one single projector **14**. The projectors **14** basically cover larger (functional) areas (e.g., a rack arrangement **38** in a warehouse **40**) of the system **10** so that each of the projectors **14** can project, in particular at the same time, location-specific codes **34** onto many different locations **68** (cf. FIG. **4**). For achieving a large coverage the distances between the projectors **14** and the (freely selectable) projection surfaces should be selected large, which requires sufficient high resolution from the projectors **14**, in particular

because the location-specific codes **34** need to be machine-readable.

[0055] Each of the codes **34** may be a one-dimensional code **34** (1D code, such as a barcode, cf. FIG. **2**A) or a two-dimensional code **34** (2D code, such as a QR code, cf. FIG. **2**B). The code **34** is machine-readable, preferably exclusively, by the reading device **24**, and can be evaluated electronically by the control **12**. The code **34** is location-specific, i.e. each of the codes **34** is uniquely assigned to one (single) location within the system **10**. With other words, each location in the system **10** may be illuminated with a different code **34**. The location information is included in the code **34**.

[0056] Therefore, the projectors **14** can be equipped with a steering and autofocusing system (not shown) for projecting the codes **34** even from greater distances, e.g., from more than 3 m, 4 m, 5 m or more, in a machine-readable manner onto the desired location.

[0057] For example, projectors **14**, which are suitable for the present applications, are "DLP" projectors from the company "Texas Instruments" offered, for example, under the product name "DLP5531". FIG. **3** illustrates an example where the DLP projector is integrated into a car headlight for projecting information, for a driver, in terms of text onto the road.

[0058] The 1D and 2D codes **34** of FIG. **2** are opto-electronically readable information consisting of lines and/or dots of varying widths and spaces in-between, with the greatest possible contrast. In the broadest sense, the term optoelectronics encompasses all products and methods allowing the conversion of electronically generated data and energy into light emission, and vice versa. In contrast to the 1D codes **34**, the data in the 2D code **34** is not coded in one direction only, but in the form of a surface over two dimensions. The 2D advantage is a higher density of usable information. In the present disclosure the term "code" is not a type of encryption, but refers to presentations of data in terms of symbols. The data in the code **34** is machine-read by the reading devices **24**, such as camera scanners.

[0059] The system **10** may further comprise (optionally): a goods receipt (WE) **42**; a goods issue (WA) **44**; the warehouse **40** including the rack arrangement **38** consisting of one or more racks **46**; one or more work stations **48**, such as a picking station **50**, a packing station, etc.; and/or a conveyor system **52**. These are functional areas and functional components of the system **10**.

[0060] The conveyor system **52** generally refers to technical systems for implementing the material flow **30**, i.e. conveying device(s), which substantially cause internal location changes, i.e. transport, of (conveying) items. The conveying devices include two groups (not shown): continuous conveyors and discontinuous conveyors. Continuous conveyors (e.g., roller conveyors, belt conveyors, chain conveyors, overhead conveyors, etc.) operate continuously and are usually installed stationary. Discontinuous conveyors, such as the vehicles **20** (driving robots, flying drones, etc.), convey and transport the conveying items either free, i.e. autonomously or independently, or track-guided or force-guided, along conveying lines (route between source and destination). The conveying devices connect the WE **42**, the WA **44**, the warehouse **40**, and/or the work stations **48** to each other in terms of material flow. The material-flow control takes care that the items are transported along the conveyor system **52** in accordance with transport orders, which can be caused by picking orders.

[0061] Hereinafter, the term navigation is understood to mean, in accordance with DIN 13312:2005-02, wayfinding (routing) through a travelling course and position determination within the travelling course. A path, or route, from an arbitrary starting point to an arbitrary destination point in the travelling course is preset by the control **12** as part of the material flow **30**. A check, whether the planned route is actually taken, occurs as part of the tracking using the location-specific codes **34**, as will be explained in more detail below.

[0062] The location-specific code **34** is also used for maintenance purposes, in particular for ensuring that the technician **18** actually walks to a system component **70** and maintains the same. Each component **70** of the system **10** requires maintenance over (operation) time. Exemplary system components **70** are the vehicles **20**, or the automated picking devices **28**. During the

maintenance the system component may be, for example, checked, lubricated, re-adjusted, or the like. The maintenance may include a repair, a component exchange, a conversion, putting into operation, a re-installation (e.g. correct installation and positioning), and the like.

[0063] Hereinafter, an automated picking device **28** is exemplarily considered, which comprises a plurality of (product) dispensers **54**, which in turn represent components **70**, in order to separate individually products, which are stored within the automaton **28**, according to a picking order, cf. also FIG. **6**. One or all of the dispensers **54** are to be maintained. In this case, these dispensers **54** exemplarily are the system components **70**, which are to be maintained. It is understood that the automaton **28** itself may also be the component **70** to be maintained. Further, it is understood that the to-be-maintained component may be each object within the system **10**, even software being installed in a device of the system **10**.

[0064] The control **12** further includes a data structure **55** which is schematically shown in the block diagram of FIG. **4**. FIG. **4** exemplarily shows a tabular representation of the data structure **55** consisting of lines **56** (**56-1**, **56-2**, . . . , **56-***i*) and columns **58** (**58-1**, **58-2**, . . . , **58-***j*), each of data fields **60**. One line **56** of the data structure **55** may consist of one or more data fields **60** of different types of data field **62**. Each of the lines **56** represents an action to be performed within the system **10**, such as the component-specific maintenance **26**, the tracking of the material-flow control **30**, or even the picking guidance **32**, if necessary. Each of the lines **56** further represents an order, into which the action is converted by the control **12**. The data structure **55** of FIG. **4** also represents several actions, or orders.

[0065] The orders can be processed subsequently or simultaneously. The location-specific codes **34** are correspondingly projected subsequently or simultaneously onto corresponding locations **68**.

[0066] Possible types of data-field **62** of the data structure **55** are: an order number **64**, a code number, or the code **34**, an order type **66**, the system entity **16**, a location (i.e. a coordinate) **68** within the system **10**, a system component **70**, and/or a time specification **72**. The time specification **72** may include information on when the associated code **34**, and/or how long the associated code **34**, is to be projected. The entity-data field may include information on the associated entity **16**, such as an individual entity identifier **78**, a reading device **24** belonging to the entity **16**, or the reading-device identifier **78** thereof, and the like, as will be explained in more detail below.

[0067] Hereinafter, the first line **56-1** is examined in more detail, which exemplarily concerns a (control-initiated) maintenance action. The control **12** generates the corresponding maintenance order ("order #**1**"). The generation may be alternatively caused (manually) by an operator of the system **10**. Upon the automatic generation the control **12**, for example, may access a database (not shown) where an actual service life, inspection intervals, an average lifespan, etc. of a component **70** are stored. If the actual service life approaches the average lifespan the control **12** recognizes this and automatically generates the corresponding maintenance order.

[0068] The first line **56-1** represents this first order #**1**, proper performance of which is to be ensured by the control **12**. The (maintenance) order #**1** defines that, for example, the fourth dispenser **54** of the fourth automated picking device **28** is to be maintained (e.g., inspected including component exchange, if necessary), which is to be executed by a first technician **18** ("technician #**1**"). Experience has shown that an (arbitrary) technician **18** requires **10** min in average for this maintenance, cf. the associated time specification ("10 min"). The (location) coordinates of the fourth automated picking device **28** (in relation to the system **10**) are stored in the data of the location **68**. Also, (location) coordinates (e.g., in relation to the fourth automated picking device **28**) may be stored in the data of the component **70**. The control **12** can use these coordinates for selecting, at first, a suitable projector **14** having a field of view in which the to-be-maintained component **70** is arranged. At second, the control **12** can use these coordinates for causing the corresponding projector **14** to project the associated location-specific code **34** in an (immediate) vicinity relative to the to-be-maintained component **70**. From the location of the

projection it must be unambiguously clear which of the components **70** is to be maintained, since the code **34** itself is not readable by the technician **18**.

[0069] Thus, by means of the projection, the location **68** of the component **70**, as well as the to-be-maintained component **70** itself, is visualized to the technician **18**. This facilitates navigating the technician **18** through the system **10**, and finding and identifying of the to-be-maintained component **70**. This situation is illustrated in FIG. **6**, where code **34** is projected, for a first dispenser **54-1**, immediately in front of the first dispenser **54-1** of an automated picking device **28** (here: an A frame) in a uniquely assignable way.

[0070] As soon as the technician **18** has arrived at the location **68** of the to-be-maintained component **70**, the projected code **34** is read by the optoelectric sensor **73** of the reading device **24**, which is carried along by the technician **18**. The reading device **24**, cf. FIG. **5**, generates a signal corresponding to the code **34** read, and transmits this signal by means of a transmitting and receiving unit **74** via a (data) interface **76** as confirmation (confirmation signal) to the control **12**. This signal may include an individual reading-device identifier **78** and/or an individual technician identifier **78**, which is stored in the reading device **24** within a data memory **81** and which may be stored (even) in the data field **60** of the entity **16** for comparison purposes. This signal may also include a timestamp (not shown) indicating when the corresponding code **34** was read.

[0071] The control **12** receives the signal from the reading device **24**. The receipt of the signal confirms to the control **12** that the technician **18** has arrived at the to-be-maintained component **70**. The signal is electronically evaluated by the control **12** for verifying the (proper) performance of the control-initiated action (here: maintenance order) based on the data of order #**1** and the data from the confirmation signal received. Based on this information, the control **12** may ensure, by means of a comparison, that the right technician **18** is at the right component **70**, which is to be maintained.

[0072] In case of maintenance, the verification is exemplarily performed by: the reading device **24** reading a (component-specific) system-component identifier, which is attached to the component **70** in terms of an additional code, by means of the reading device **24**, and transmitting it to the control **12**, and checking this read identifier **78** of the control **12** against the component-identifier **78**, which is stored in the order #**1** in the data field **60** of the component **70**, for consistency; and/or by the control **12** checking whether the system component **70**, which is associated with the order #**1**, goes offline during a predetermined period of time after the associated code **34** was read. Usually, the technician **18** removes the component **70**, i.e. must separate the component from a supply of energy, so that the component goes offline. This separation may be monitored by the control **12** for verification purposes.

[0073] In case of discrepancies, the control **12** may contact the corresponding entity **16**, in this case the technician #**1**, and transmit corrective advice being communicated, for example, visually (display device **80** in FIG. **5**) or audible (spoken text) to the technician #**1**. For example, the control **12** may cause that a corrective information is indicated to the technician **18**, for example, in case that the technician **18** is at the wrong location **68** and therefore has read the wrong code **34** not being assigned to this technician #**1** but, for example, to a different maintenance technician **18** or to one of the vehicles **20** (e.g., the one of the line **56-2**), which information tells the technician #**1** the proper location **68**.

[0074] After the maintenance **26** of the to-be-maintained component **70** is completed, the technician #**1** may read, through the reading device **24**, the code **34** again which is (optionally) still projected onto the location **68**, in order to communicate to the control **12** the end of the maintenance **26**. Alternatively, the technician **18** may use an (optional) input device **82** (cf. FIG. **5**) of the reading device **24**. The control **12** may verify, based on the associated time specification **72** (in FIG. **4**: 10 min) and an actual time passed between the two readings being tracked, whether the technician #**1** has actually performed the maintenance. In this way it may be prevented, for example, that the technician #**1** reads the code **34** simply twice in quick succession in order to

merely pretend that the maintenance **26** has been performed although the maintenance **26** actually has not taken place. Thus, the control **12** may verify by means of feedback that the maintenance **26** has actually taken place. The technician #**1** cannot predict how the specific code **34**, which is individual for this maintenance **26**, looks like so that the corresponding process is fraud-proof.

[0075] The projection of the location-specific code **34**, which belongs to one of the orders **64**, may also occur by coincidence. This means that the associated code **34** is not displayed to the technician **18** at each of the to-be-maintained components **70**. In this case the corresponding maintenance order is (also) communicated to the technician **18** via a different medium, such as via a visual display (coordinate, component type, etc.) on the display device **80** of the reading device. Thus, in this case, the technician **18** can never be sure when and where an (automatic) confirmation of the proper performance of the maintenance **26** is requested by the control **12**. However, system operator can be sure that the maintenance **26** was performed properly, since the technician **18** cannot outwit the control **12** since, for example, the technician **18** reads component-identifiers **78** printed in advance without having actually inspected the corresponding component **70**.

[0076] The procedure described above in connection with the maintenance **26** may also be applied analogously to check of the material-flow control **30**.

[0077] The case of checking the material-flow control **30** will be described exemplarily based on the second line **56-2** of the data structure **55** of FIG. **4**. The second line **56-2** describes the order #**2**, which defines material-flow tracking in the second column **58-2** as an action to be performed. The order #**2** is associated with one vehicle **20** being designated as AGV ("autonomous guided vehicle") #**3**. The AGV #**3** is supposed, according to the planned material flow, to be at a crossing #**2** of the conveyor system **52** at 14:35. The control generates a corresponding code #**2**, which is projected onto the floor for a certain period of time at the coordinate, or at the location **68**, corresponding to the crossing #**2**. If the AGV #**3** passes at 14:35, as planned, the crossing #**2**, the vehicle-integrated reading device **24** can read the code #**2**, which is projected onto the crossing #**2**, together with the identifier **78** of the AGV #**3**, and transmit a corresponding timestamp to the control **12** for further evaluation, i.e. check. The control **12** may check, based on the transmitted signal, whether the AGV #**3** has actually passed the crossing at 14:35, and may intervene, if necessary. A possible correction is that the planned material flow is adjusted in a timely manner to the actual conditions (AGV #**3** has passed the crossing #**2**, for example, earlier or later). Another possible correction is that the AGV #**3** is decelerated or accelerated for reaching the next waypoint of its route in time, i.e. at the planned time.

[0078] The above-described procedure may also be applied analogously to the picking guidance **32**, which will be described below using the third line **56-3** of the data structure **55** of FIG. **4** as an example.

[0079] According to the order #**3**, the picking person #**2** processing a picking order #**8** is supposed to remove articles from a rack compartment #**5**. A corresponding location-specific code #**3** is projected onto the corresponding coordinate, or onto the location **68**, of the rack compartment #**5**. In this case there is no time specification **72** because it is not clear in advance when the picking person #**2** will perform the removal at the rack compartment #**5**. As soon as the picking person #**2** has reached the rack compartment #**5**, due to optical guidance by means of the code #**3** being projected there, it scans the code #**3**. The corresponding signal is transmitted together with the corresponding reading-device identifier **78** and/or the corresponding picking-person identifier to the control **12**. The control **12** evaluates this signal and checks, based on the data resulting from the evaluation, whether the picking order #**8** was processed properly. If the picking person #**2** has scanned the wrong code **34** belonging to a different compartment, or to another picking order, the control **12** may correctively intervene in the above-described way.

[0080] Thus, different applications have been described that are based on the data structure **55**, which is exemplarily described in FIG. **5**. It is understood that the data structure **55** does not necessarily have to be in tabular form. The data structure **56** can also be stored in a relational

database.

[0081] However, the data structure **55** allows the control **12** to verify different actions, which are to be performed in the system **10** by humans or machines, in order to avoid errors and to ensure proper performance of a planned action.

LIST OF REFERENCE SIGNS

[0082] **10** (intralogistics) system [0083] **12** control [0084] **14** projector [0085] **16** (system) entity, movable [0086] **18** (maintenance) technician [0087] **20** (transport) vehicle [0088] **22** picking person [0089] **24** reading device [0090] **26** maintenance [0091] **28** automated picking device [0092] **30** material flow/material-flow control [0093] **32** picking guidance [0094] **34** code [0095] **36** communication network [0096] **38** rack arrangement [0097] **40** warehouse [0098] **42** goods receipt (WE) [0099] **44** goods issue (WA) [0100] **46** rack [0101] **48** work station [0102] **50** picking station [0103] **52** conveyor system [0104] **54** dispenser [0105] **55** data structure [0106] **56** line [0107] **58** column [0108] **60** data field [0109] **62** type of data field [0110] **64** order number [0111] **66** order type [0112] **68** location [0113] **70** (system) component [0114] **72** time (specification) [0115] **73** optoelectric sensor [0116] **74** transmitting/receiving unit [0117] **76** (data) interface [0118] **78** identifier [0119] **80** display unit [0120] **81** data memory [0121] **82** input device

Claims

1. An intralogistics system for monitoring a predetermined location-specific action being uniquely associated with a location of a plurality of different locations in the intralogistics system and being uniquely associated with a movable system entity, which is to perform the action, wherein the intralogistics system comprises: a control communicating an order, which is uniquely associated with the action, to the movable system entity and being configured for at least one of: maintenance of one system component of a plurality of system components; and tracking of material-flow control; a reading device, which the movable system entity carries along and is connected to the control for data exchange; and a projector configured to project location-specific codes, on command from the control, onto several ones of the locations within the intralogistics system; wherein the control is configured further to verify performance of the action based on the order and received confirmation signal, which is generated by the reading device and transmitted to the control as soon as the reading device has read one of the location-specifically projected codes.

2. The intralogistics system of claim 1, wherein the control is configured to project one of the codes at a time only.

3. The intralogistics system of claim 1, wherein the control is configured to project several ones of the codes at the same time onto the corresponding locations.

4. The intralogistics system of claim 1, wherein the confirmation signal further comprises at least one of: a component-specific identifier; an entity-specific identifier; and reading-device-specific identifier.

5. The intralogistics system of claim 1, wherein the one code is projected onto the location being associated with the associated action.

6. The intralogistics system of claim 5, wherein the projector is high resolution to project the one code from a distance of at least 3 m, 4 m or 5 m, or from a distance of more than 5 m, onto the location.

7. The intralogistics system of claim 1, comprising a data structure defining one or more of the actions and including, for each of the defined actions, a single one of the location-specific codes describing uniquely a coordinate in the intralogistics system, onto which the one code is to be projected by the projector.

8. The intralogistics system of claim 7, wherein the data structure includes further, for each of the actions, at least one of: an order type, one of the entities, a system component, and a time specification.

9. The intralogistics system of claim 1, wherein the codes are machine-readable by the reading device and are evaluated by the control.

10. The intralogistics system of claim 9, wherein the codes are one-dimensional or two-dimensional in order to uniquely represent a location coordinate in terms of a pattern.

11. The intralogistics system of claim 1, wherein the verification in case of the maintenance is performed by at least one of: reading further and transmitting, by the reading device, and checking, by the control, a system-component identifier; and checking by the control whether the system component, which is also associated with the order, goes offline during a predetermined period of time after the one code was read.

12. The intralogistics system of claim 1, wherein the verification in case of the material-flow control is performed by the reading device attached to a vehicle, which is the movable entity, reading the one code at a waypoint, which has to be passed by the vehicle in accordance with a pre-planned material-flow control and onto which the one code is projected, the confirmation signal further comprising a vehicle-specific identifier, and the control checking the pre-planned material-flow control by comparison against data resulting from an evaluation of the confirmation signal.

13. The intralogistics system of claim 1, wherein the verification by the control includes a check that the received code read matches with the code being associated with the corresponding action; and the control, when the codes match, outputs a further confirmation signal to the corresponding movable system entity and causes this system entity to continue its current action, or the control, when the codes do not match, outputs a correction signal to the corresponding movable system entity and causes this system entity to perform the predetermined action instead of its current action.

14. The intralogistics system of claim 1, wherein the control is configured for at least one of: the maintenance of the system component of the plurality of system components; the tracking of the material-flow control; and performance of a picking guidance.

15. The intralogistics system of claim 9, wherein the codes are exclusively machine-readable by the reading device.

16. The intralogistics system of claim 11, wherein the confirmation signal further comprises a timestamp corresponding to the reading of the one code.