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Iroda, Budapest(54) **Eljárás és berendezés vezető nélküli szállítóeszköz biztonságos üzemállapotának aktiválására**

Az európai szabadalom ellen, megadásának az Európai Szabadalmi Közlönyben való meghirdetésétől számított kilenc hónapon belül, felszólalást lehet benyújtani az Európai Szabadalmi Hivatalnál. (Európai Szabadalmi Egyezmény 99. cikk(1))

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Assembly and method for activating a secure operating state for a driverless means of transport

The invention relates to an assembly with a driverless means of transport for activating a secure operating state in accordance with the preamble of patent claim 1, and a method for a self-propelled, driverless means of transport for activating a secure operating state in accordance with the preamble of patent claim 8.

As automation takes over more and more transport-related tasks, particularly in the field of the production of automobiles and other goods, so the use of driverless means of transport is also becoming widespread. In the automobile industry, for example, overhead rail conveyors are used to transport motor vehicle bodies and mounting parts for production line. These means of transport - often called Electrical Monorail Systems (EMS) - regularly consist of a rail system and the associated vehicles, usually suspended below the rail. These means of transport are equipped with their own electric drive unit and are supplied with electrical energy by current collectors (pickup shoes) that travel along a multiphase power rail system.

In special travel zones (production areas), work is typically carried out on the respective products they are being transported. This means that people are also in these areas and may be endangered by the moving, driverless means of transport and/or by the items being transported thereby. Therefore, emergency stop buttons or similar (generally: operating means) and sensors (light barriers, proximity sensors etc.) are installed to enable the driverless means of transport to be stopped in the respective zone if items become too close or in the event of other hazards. For this, it is known to switch off the energy supply to the electric rail system by means of the emergency stop buttons or through the control of the sensors in the segment concerned, thereby bringing the one or more means of transport moving there to an immediate standstill. However, this method has proven to be disadvantageous in several respects. The driverless means of transport and the products and components transported thereby often have a substantial mass, so that when they are stopped suddenly a large mechanical impulse is transferred to the bearing structure of the rail system in the form of a jolt. This results in a high material load both in the rail system and for the driverless means of transport, which over time often causes damage despite ample dimensioning of all the parts involved. Moreover, the driverless means of transport are usually equipped with their own accompanying controller, which has to be restarted ("powered up") and parameterised again after such

an "Emergency stop" is made. Consequently, it can often take several minutes to resume regular operation even if such a "Stop" was triggered inadvertently or was only necessary briefly.

For this reason, in advanced assemblies pressing an Emergency stop button or the actuation of a corresponding sensor only switches off one, or at most two of the (usually) three phases of the supply voltage. This partial switch-off is registered by the controller of the driverless means of transport, and enables the initiation of a safe operating state, an Emergency stop for example. Since the digital controller and the power converter for supplying energy to the driverless means of transport are still energised via the remaining phases, the driverless means of transport can be controlled and braked correspondingly "gently". Moreover, it is not necessary to "power up" the digital controller again in order to resume regular operation. For this, however, driverless means of transport must be equipped with a failsafe or "error-proof" controller; such controllers are known in automation technology as "redundant" or "failsafe" components.

Even with the improvement described in the preceding text, the known assemblies still have the disadvantage that the energy supply to the rail system, that is to say the electric rail system, must be divided into segments corresponding to the hazard zones, so that an Emergency stop does not bring the entire production line to a standstill. This means that in a given production area, in which Emergency stop buttons and sensors are installed, the switch-off that is initiated by these buttons and sensors must only be linked to one or more phases of the energy supply in the same segment. As a consequence in the case of long production lines the electric rail system must have a large number of feed-in points, and switch-means associated therewith, even if only a few feed-in points were required for the energy supply as such. A further disadvantage consists in such a system's lack of flexibility, due to the fact that, if the various production areas are reconfigured, the layout of the energy supply segments for the driverless means of transport must be changed accordingly. This then necessitates correspondingly expensive modifications to the "hardware" of the energy supply.

An assembly is known from document DE 10 2007 026 399 B3 - Rebbereh "Zone oriented safety concept for independent transport systems", in which a transport system is divided into shelters, and Emergency stop switches are each assigned to one of these shelters. A means of transport determines which shelter it is located in and stops in the event of an Emergency stop command if its position correlates to the shelter that is assigned to the actuated Emergency stop switch.

Document CH 677 469 A5 - Zimmermann et al. "Method for controlling the movement of rail-guided, self-propelled transport vehicles and a conveyor system for carrying out the method" discloses a driverless means of transport in which barcodes are arranged along the segment network, which are read by a barcode reader mounted on the means of transport and used to determine the position of the means of transport.

One object of the present invention is to suggest an assembly and a method for activating a safe operating state for a self-propelled means of transport, which allows it to be configured flexibly and operated safely without exposing the equipment to undue loads.

In this context, one of the fundamental ideas behind the present invention is the use of two independent measuring systems and a failsafe analysis as part of a failsafe controller to reliably determine and capture a position value for the location of the driverless means of transport. In addition, safety zones are defined within the track layout of the driverless means of transport. Then, safe switching off operations can be executed in the defined safety zones on the basis of information collected by the Emergency stop or safety sensor system, which is also failsafe. On the basis of the failsafe (redundant) position measuring of the driverless means of transport, it is thus possible to determine at any time whether the transport means is within one of the particularly defined segments of the travel path that is also assigned to an Emergency stop switch that has been pressed or a safety sensor that has been triggered. A further safety improvement is realised according to the invention if the digital controller is set up in such a way that the safe operating state or a safe operating state is activated in the event of the failure or interruption of a data network connecting said digital controller to the control element or the sensor, the device for measuring the position of the driverless means of transport, the operating elements or the sensors.

The solution to the problem envisages in particular an arrangement having a driverless means of transport and at least one external operating element or external sensor for activating a safe operating state, wherein the driverless means of transport is set up to use a travel path with preferably a plurality of path segments, and the arrangement is set up to activate the safe operating state in the situations in which the at least one operating element is actuated or the at least one sensor is triggered, and in which the driverless means of transport is in one of the route segments assigned to the actuated operating means or triggering sensor. In this context, the driverless means of transport is controlled preferably using a digital controller, wherein the digital controller is connected to the at least one operating element or the at least one sensor via a data

network, and wherein the digital controller is set up to access a redundant device for detecting the position of the driverless means of transport. The digital controller is set up to receive messages relating to the actuation of the operating means or the triggering of the sensor, the messages each comprising an item of location information relating to the operating means or sensor generating the respective message or relating to one of the route segments respectively linked to the operating means or to the sensor, and wherein the digital controller is set up, when one of the messages is received, to compare the respective current position or the route segments currently used by the driverless means of transport with the location information, and in the event of a positive comparison is set up to activate the safe state. With such an assembly, a large number of "safety zones" can be set up flexibly by a simple definition of segments and simple assignment of switches and/or sensors to these segments. Since it is no longer necessary to switch off the supply voltage to the driverless means of transport, the driverless means of transport can be set in motion again immediately after the "Emergency stop" has been cancelled or after the obstruction has been removed. The digital controller may be mounted on the driverless means of transport, or alternatively it can be disposed in a fixed position. Other information from which the location information can be derived may also be used instead of the location information. This applies particularly for operating elements and sensors that are connected directly to a dedicated controller input; in this case, the location information can be determined from the port number of the respective input. Alternatively, operating elements and sensor may also have unique serial numbers ("ID's"), which are contained in each message. The location information can then be read out from a correspondingly compiled table.

The solution to the problem further envisages a method for a self-propelled driverless means of transport for activating a safe operating state, wherein the driverless means of transport is switched to the safe operating state by actuating an operating element or by triggering a sensor. To enable this, the route of the driverless means of transport is preferably divided into a plurality of route segments, and the operating element or the sensor is assigned to at least one of the route segments. In order to activate the safe operating state, a message is transmitted from the operating element or the sensor to a digital controller of the driverless means of transport, wherein the message includes an item of location information or the like relating to the location of the operating element or of the sensor, or relating to an individual segment of the route to which the command applies, and wherein the digital controller uses a redundant position detection system to detect the position of the driverless means of transport at the time the message is processed or the route segment the driverless means of transport is currently travelling on at said time and compares it with the location information or identification number in

each message processed, and activates the safe operating state for the driverless means of transport in the event of a match. If an identification number or similar is transmitted, linking information between said identification number and the defined route segments is preferably stored in the digital controller, alternatively in an external data memory. The advantages described can be achieved by implementing this method together with the assembly according to the invention.

According to the invention, the safe operating state is an Emergency stop of the driverless means of transport or of a component carried along by the driverless means of transport, a lifting mechanism, for example.

According to the invention, the redundant device for detecting position includes at least two barcode readers for continuously determining the current position of the driverless means of transport or the route segment currently being used by the driverless means of transport in a failsafe manner, wherein the at least two barcode readers are arranged with an offset with respect to one another in the direction of travel in order to scan an individual barcode strip BCL, or are arranged for offset scanning of a double-height barcode strip BCL or of two adjacent barcode tracks of the barcode strip BCL orthogonally to the direction of travel.

Advantageous variants of the assembly according to the invention are described in the dependent patent claims. The features and advantages described therein also apply analogously for the method according to the invention.

In an advantageous variant of the invention, a distinction can be made between various safe operating states. Thus, for example, a certain action may be selected from a number of available actions depending on a preceding operating state and/or depending on the operating element or sensor that results in the activation of the safe operating state. For example, if a sensor is triggered because an obstacle is detected on the travel path during "forward motion" of the means of transport, the safe operating state may consist of reversing the driverless means of transport a little at first, and then stopping it. On the other hand, when a load is being lowered, pressing an Emergency stop button may cause the load to be raised again slightly at first, before the lifting mechanism is deactivated. In this way, a safe operating state may also be achieved by working through a command chain. A preferred operating element is an Emergency stop button. Besides the generally standard fixed position assembly, in an advantageous variant it may also be designed to be mobile, for example as a wireless switch or a "softkey" in a mobile data processing

device. In the mobile configuration, the operating element may advantageously be equipped with a position measuring system to capture the position of said operating element, in order to induce the safe operating state of driverless means of transport in the segment or zone in which the operating element is located at the time of the actuation.

Known and proven sensors for detecting the presence or approach of a person or obstacle are light curtains, light grids, light barriers or laser scanners. Such an approaching obstacle may also be another driverless means of transport. In this latter case, the movement data of the controllers from other driverless means of transport may be compared with the route of the driverless means of transport in question, enabling a safe operating state to be activated and thereby helping to avoid a collision. In this case, the circuit for warning of imminent collisions - usually in the form of software - is considered to be a "sensor".

The digital controller of the driverless means of transport is advantageously failsafe, for example with a double or "redundant" configuration. Alternatively or additionally, special switching circuits, "watchdog circuits" for example, may be used to monitor the operational readiness of the digital controller and to induce a safe operating state automatically if the controller fails, by switching off the energy supply to a drive unit, for example. The digital controller may either be a component of the driverless means of transport, or it may also be configured as a fixed location element. Although in the first case, no other electrical connection besides the rail and current pickup system needs to be established with the driverless means of transport, since the data network for transmitting messages may be wireless in nature, designed as an industrial WLAN, for example, the second case described has the advantage that multiple driverless means of transport or multiple other devices can be controlled using a single digital controller.

An embodiment of the assembly according to the invention will be explained with reference to the drawing. At the same time, this will also serve as an explanation of the method according to the invention.

The only figure is a schematic representation of a driverless means of transport having the essential components necessary for activating a safe operating state.

The figure shows a schematic representation of a driverless means of transport (Electrical Monorail System, EMS) with a current collector box SAK. In current collector box SAK, an energy supply for means of transport EMS is connected to an electric rail system with

phases L1, L2, L3 and earth/neutral conductor PEN via a pickup shoe system (not shown). The electric rail system is supplied with electrical energy via a power cabinet LS. A barcode strip BCL is installed along the travel route, that is to say along a rail system of driverless means of transport EMS, for the purpose of position measuring, and is read by the barcode readers BCR1, BCR2 that are mounted on driverless means of transport EMS. For redundant (failsafe) position measuring, two versions are provided of all components involved in this function, particularly the barcode readers BCR1, BCR2. At the same time, according to the invention and as shown in the figure, in a first alternative the two barcode readers BCR1, BCR2 are arranged side by side and read the same barcode track of barcode strip BCL with an offset; the offset is calculated out of the measured values of one of the barcode readers BCR1, BCR2 by the digital controller software EMS-D. This offset ensures that at least one of the two signals is almost always available even if parts of the barcode strip BCL are dirty or damaged. Alternatively, in a second alternative according to the invention, the barcode strip BCL can also be provided in duplicate or at double height, in which case the two barcode readers BCR1, BCR2 are arranged one on top of the other in different tracks; in this case, an offset is not usually applied. The position measuring devices are also equipped with diagnostic instruments (not shown) which reliably detect and report a malfunction.

Driverless means of transport EMS includes a failsafe (redundant) digital controller EMS-D ("Electrical Monorail System - Driver"), which is connected to the position measuring devices, particularly barcode readers BCR1, BCR2 and the linked diagnostic device described previously. Driverless means of transport EMS is further equipped with an IWLAN-A antenna for an industrial, wireless data network. The IWLAN-A antenna runs along an IWLAN-RCCS ("Industrial W-LAN RCoax Cable Segment") leaky waveguide which is routed parallel to the rail system and functions as a stationary antenna and for this purpose is connected to a fixed position system controller AS via an access point AP. System controller AS is in turn connected to a failsafe data processing network FDV; System controller AS, access point AP and the IWLAN-RCCS antenna thus form a failsafe data network. The Emergency stop buttons N-A, a device for laser-assisted detection of people and obstacles (German "Tastender Laser Scanner" - TLS, often called "Personal Laser Scanner") and - as an example of further visual monitoring of a travel route - a light grid LG are connected to the data network FDV as operating elements.

Operating elements N-A and sensors TLS, LG each have a unique identification number, which is reported to system controller AS when the operating elements are actuated or when the sensors are triggered. A table is stored in system controller AS, in which each identification number is linked to a location identifier. The location identifier identifies

various zones (segments) of an industrial manufacturing facility in which the driverless means of transport EMS is operated.

In the following, let it be assumed that the rail system of driverless means of transport EMS travels through various zones or segments of the manufacturing facility, and the operating elements N-A and sensors TLS, LG shown in the figure are assigned to a specific zone, in which people work on production goods that are being transported by the driverless means of transport EMS. Such a zone, and thus also such a segment of the travel route is considered to be "safety-critical". This means that actuating operating elements N-A or triggering sensors TLS, LG must place any driverless means of transport EMS located in the segment in question defined with these operating elements N-A and/or sensors TLS, LG in a safe operating state (in this case: Emergency stop). For this purpose, the following explains how an item of location information is transmitted via an actuated operating element N-A or a triggered sensor TLS, LG, to the digital controller EMS-D of the driverless means of transport EMS, where it is compared with the current position of driverless means of transport EMS, wherein in the event of a positive comparison the required safe operating state is induced. Alternatively to the assembly and the method described in this context, the test as to whether the driverless means of transport EMS is located in the segment of the travel route in which an operating element N-A or a sensor TLS, LG was activated, may also be carried out in system controller AS or in another device. In this case, the information relating to the position of the driverless means of transport EMS must then be transmitted over appropriate - preferably failsafe - data channels to the comparing instance, for example system controller AS, and then this comparing instance must also be informed about the location of the actuated operating element N-A or the triggered sensor TLS, LG by means of a unique identification number or by position information about the location.

When configuring the transport system with the driverless means of transport EMS described here, a value range of the travel route was stored in digital controller EMS-D, which value range corresponds to a certain value range of barcode strip BCL. In the following, this value range is considered to that segment of the travel route which is linked to the operating elements N-A and sensors TLS, LG shown. This means that in the cases in which the driverless means of transport EMS is located in the defined segment, actuation of one of the operating elements N-A or triggering one of the sensor TLS, LG must result in the activation of a safe operating state. In the simplest case, this is an Emergency stop. In alternative embodiments, however, different actions may be provided for each operating element N-A and for each of the sensors TLS, LG. In particular, the safe operating state may also depend on the respective current "regular"

operating state of the driverless means of transport EMS.

In the following, let it be assumed that the driverless means of transport EMS is located in the zone (segment) of the Emergency stop button shown the middle, and that a lifting mechanism of the driverless means of transport EMS is lowering a load. Now, the Emergency stop button in question is pressed, causing a message to be generated, which message comprises the serial number of the operating element N-A, that is to say the Emergency stop button that was pressed, and which of course also includes the information to the effect that this Emergency stop button has been actuated. This message is transmitted over the failsafe data link FDV to the system controller AS, which - as indicated earlier - is designed to be failsafe, where it is evaluated. In a table in system controller AS, the identification numbers of all operating elements N-A are associated with their (in this case fixed) position; this means that the position of the actuated operating element N-A is read out with reference to the coordinate system of the barcode strip BCL on the basis of the identification number of the received message. This position indication is inserted in the received message and the message that has been altered in this way is then transmitted via a further data link to the access point AP, by which it is transmitted to digital controller EMS-D via the IWALN-RCCS fixed antenna, a corresponding air segment, and the IWLAN-A antenna on the vehicle. There, the message is evaluated and the location information (position information) of the operating element N-A it contains is compared with the current location of the driverless means of transport EMS. The information about current location is provided continuously and in failsafe manner by barcode readers BCR1, BCR2. Digital controller EMS-D ascertains that the message must not be rejected, because the driverless means of transport EMS is currently in a segment of the travel rout to which the actuated Emergency stop button is also assigned. In a table that was compiled when the transport system was being configured, and which is accessible by digital controller EMS-D, it is defined for what operating state of the driverless means of transport EMS a safe operating state must be induced by what action when a message is received. In the present case, the current operating state of the driverless means of transport EMS is: "Drive unit: off; Lifting mechanism: on; Lifting mechanism direction: Lowering". While no action to induce a safe operating state is assigned to operating state "Drive unit: off", the command sequence "Lifting mechanism: stop; Lifting mechanism: raise 20 cm; Lifting mechanism: stop" is assigned to the operating state "Lifting mechanism: on". This action sequence is now carried out, thereby ensuring that a minimum distance is restored between an (assumed) obstacle and the lowered goods. At the same time, a warning message is transmitted to neighbouring means of transport or their controllers in order to prevent undesirable approaches.

In the assembly described in the preceding text, the activation of the safe operating state is realised with functions (failsafe functions) that are present in the components anyway in the failsafe controllers (CPUs). Through the use of two independent measuring systems (in the embodiment: Barcode assisted position measuring systems) and via a failsafe evaluation in a failsafe digital controller, a reliable position value is calculated or detected. With this position value and with the aid of the safety zones (segments) defined within the travel route of the means of transport, it is then possible to switch off safely or carry out other actions via the failsafe detection of Emergency stop and/or safety sensors. In the cases in which multiple driverless means of transport EMS are managed by one controller, of course a vehicle number or similar identification of the driverless means of transport EMS in question must also be assigned to the safety zones or segments in failsafe manner.

Szabadalmi igénypontok

1. Berendezés vezető nélküli szállítóeszközzel (EMS) és legalább egy külső kezelőelemmel (N-A) vagy érzékelővel (TLS, LG) biztonságos üzemállapot aktiválására, ahol a biztonságos üzemállapotot aktiváló berendezés olyan esetekben kerül alkalmazásra, amikor a legalább egy kezelőelem (N-A) működtetve van vagy a legalább egy érzékelő (TLS, LG) aktiválva van, és amikor a vezető nélküli szállítóeszköz a működtetett kezelőszervhez vagy az aktivált érzékelőhöz hozzárendelt út-szegmensen található, miközben a vezető nélküli szállítóeszköz digitális vezérléssel (EMS-D) van vezérelve, a digitális vezérlés (EMS-D) kialakításánál fogva képes hozzáférni a vezető nélküli szállítóeszköz (EMS) helyének meghatározása (BCR1, BCR2) érdekében egy redundáns egységhez, ahol a digitális vezérlés képes jelentéseket venni a kezelőszerv működtetéséről vagy az érzékelő aktiválásáról, és a jelentések helyinformációt tartalmaznak az adott jelentést kiváltó kezelőszervről vagy érzékelőről, vagy a kezelőszervhez vagy az érzékelőhöz (TLS, LG) tartozó út-szegmensről, ahol a digitális vezérlés az egyik jelentés vétele esetén az aktuális hely vagy a vezető nélküli szállítóeszköz által aktuálisan használt út-szakasza és a helyinformáció összehasonlítására alkalmasan van kialakítva, és pozitív összehasonlítás esetén a biztonságos üzemállapot aktiválására van kialakítva, és ahol a biztonságos üzemállapot a vezető nélküli szállítóeszköz (EMS) vész-megállása, azzal jellemezve, hogy a redundáns egység a helymeghatározáshoz (BCR1, BCR2) legalább 2 vonalkód-olvasókészülékkel rendelkezik a vezető nélküli szállítóeszköz aktuális helyének folyamatos és hibabiztos meghatározásához, és a legalább 2 vonalkód-olvasókészülék - egy egyedi vonalkód-léc BCL letapogatásához menetirányban egymáshoz képest eltoltan van elrendezve, vagy - dupla magas vonalkód-léc BCL vagy a vonalkód-léc BCL két szomszédos vonalkód-sávjának letapogatásához egymás fölött vagy különböző nyomvonal mentén van vezetve.
2. Az előző igénypontok bármelyike szerinti berendezés, azzal jellemezve, hogy a vezető nélküli szállítóeszköz (EMS) egy gyártósor villamos függőpályája.
3. Az előző igénypontok bármelyike szerinti berendezés, azzal jellemezve, hogy a kezelőelem (N-A) egy vész-ki-kapcsoló.
4. Az előző igénypontok bármelyike szerinti berendezés, azzal jellemezve, hogy az

érzékelő egy személy vagy egy akadály jelenlétének vagy közeledésének észlelésére alkalmas fényfüggöny, fényrács (LG), fénySOROMPÓ vagy lézeres pásztázó (TLS).

5. Az előző igénypontok bármelyike szerinti berendezés, azzal jellemezve, hogy a digitális vezérlés (EMS-D) hibabiztos kialakítású.

6. Az előző igénypontok bármelyike szerinti berendezés, azzal jellemezve, hogy a digitális vezérlés (EMS-D) úgy van kialakítva, hogy azt a kezelőelemmel (N-A) vagy az érzékelővel (TLS, LG) összekötő adathálózat, a vezető nélküli szállítóeszköz helymeghatározó egységének (BCR1, BCR2), a kezelőelemek (N-A) vagy az érzékelőknek (TLS, LG) a hibája vagy zavara esetén a biztonságos üzemállapot aktiválódik.

7. Az előző igénypontok bármelyike szerinti berendezés, azzal jellemezve, hogy a digitális vezérlés (EMS-D) a vezető nélküli szállítóeszköz (EMS) részét képezi.

8. Eljárás vezető nélküli szállítóeszköznel (EMS) egy biztonságos üzemállapot aktiválására,

melynek során a vezető nélküli szállítóeszközt (EMS) egy kezelőelem (N-A) működtetésével vagy egy érzékelő (TLS, LG) aktiválásával biztonságos üzemállapotba helyezünk,

ahol a vezető nélküli szállítóeszköz (EMS) útvonala több út-szegmensből tevődik össze és a kezelőelem (N-A) vagy az érzékelő (TLS, LG) legalább az egyik út-szegmenshez hozzá van rendelve,

ahol jelentést küldünk a biztonságos üzemállapot aktiválásához a kezelőelemtől (N-A) vagy az érzékelőtől (TLS, LG) a vezető nélküli szállítóeszköz (EMS) digitális vezérléséhez (EMS-D),

ahol a jelentés helyinformációt tartalmaz a kezelőszerv (N-A) vagy érzékelő (TLS, LG) helyéről, vagy az útvonal jelentéssel érintett út-szegmenséről,

ahol a digitális vezérlés (EMS-D) redundáns helymeghatározó rendszerrel a jelentés feldolgozásának időpontjában meghatározza a vezető nélküli szállítóeszköz (EMS)

aktuális helyét, vagy a vezető nélküli szállítóeszközzel (EMS) az adott időpontban

elfoglalt út-szegmenst, és összehasonlítja az éppen feldolgozandó jelentésben található helyinformációval, és egyezés esetén aktiválja a vezető nélküli szállítóeszköz (EMS)

biztonságos üzemállapotát, és

ahol biztonságos üzemállapotként a vezető nélküli szállítóeszköz (EMS) vész-megállását alkalmazzuk, azzal jellemezve, hogy

a redundáns egység a helymeghatározáshoz (BCR1, BCR2) legalább 2 vonalkód-olvasókészülékkel rendelkezik a vezető nélküli szállítóeszköz aktuális helyének

foiyamatos és hibabiztos meghatározásához, és a legalább 2 vonalkód-olvasókészülékkel

- egy egyedi vonalkód-léc BCL letapogatását menetirányban egymáshoz képest eltoltan, vagy
- dupla magas vonalkód-léc BCL vagy a vonalkód-léc BCL két szomszédos vonalkód-sávjának letapogatását egymás fölött vagy különböző nyomvonal mentén végezzük.

