Notice

DESCRIPTION EP3287412A1

[0001]

13 The present invention relates to an industrial truck, in particular an order-picking vehicle, and a method for controlling an industrial truck.

[0002]

18 A method for controlling an industrial truck has become known from EP 2 851 331 B1, in which the industrial truck has an optical sensor with a monitoring area, the optical sensor being connected to a control device which detects the position of a person within a predetermined area for the optical sensor Determines and tracks the monitoring area.

22 Within the monitoring area, monitoring limits are specified in the form of boundary lines, with which the control device monitors whether the position of the person exceeds the monitoring limit. If it is determined that the limit line has been exceeded, a travel drive on the industrial truck is activated until the person's position is back on the original side of the monitoring limit. In this way, for example, a minimum distance between a person and the vehicle can be ensured.

[0003]

30 DE 10 2012 018 427 A1 discloses a method for locating a mobile part relative to a target device.

31 A distance measurement based on radio signals is described for the relative positioning between a handset and a target device. With this, runtimes of the radio signals or also phase angles of the radio signals can be evaluated. The distance measurements are used for a so-called trilateration, in which the distances of the handset from at least three different reference points (anchors) are determined. The reference points can be separate antennas or transmitter/receiver units on the target device, whereby the arrangement of the reference points in relation to one another must be known and included in the evaluation.

[0004]

41 A disadvantage of the known method for controlling an order-picking vehicle is that with the optical system, movements by the operator in the area of perception of the optical sensor can lead to unclear situations.

[0005]

47 The object of the invention is to provide an industrial truck and a method for controlling an industrial truck that allow safe working with the moving industrial truck without the risk of injury.

[0006]

52 According to the invention, the object is achieved by an industrial truck with the features of claim 1 and a method with the features of claim 12.

54 Advantageous configurations form the subject matter of the dependent claims.

[0007]

58 The industrial truck according to the invention is equipped with a drive part and a load part.

59 The drive part has a travel drive and a steering system.

60 The load part is suitable for transport, in particular for order picking of products.

61 At least three transmitting and receiving units are attached to the drive part of the industrial truck according to the invention in a predetermined spatial arrangement relative to one another. The three transmitting and receiving units have a defined spatial position relative to one another, which does not change relative to one another even when the industrial truck is in operation. Furthermore, the industrial truck according to the invention is equipped with an evaluation unit that determines a position of a portable transmitting and receiving unit relative to the industrial truck by measuring signal propagation times. The measurement of the signal propagation times is not only limited to a pure time measurement, but can also, for example, fall back on phase differences between incoming and outgoing signals. The industrial truck according to the invention also has a control unit that issues a control command for the traction drive and/or the steering when the relative position of the mobile transmitting and receiving unit is within a predetermined spatial area relative to the industrial truck.

73 The predetermined spatial area does not necessarily have to be a three-dimensional spatial area, but can also be a two-dimensional plane depending on the result of the evaluation unit. With the approach according to the invention, triggering control commands for the industrial truck via predetermined spatial areas, whether for driving or steering the industrial truck, it is possible to interact with the vehicle, for example when picking goods, and to control the vehicle by changing position.

[0008]

82 In a preferred embodiment, the control unit has two or more predetermined spatial areas, each of which is assigned control commands.

84 In this way, two different control commands can be executed on the vehicle, the control commands being triggered by the relative position of the mobile transmitting and receiving unit relative to the vehicle.

[0009]

90 In a preferred refinement, the predetermined spatial areas to which control commands are assigned are arranged symmetrically with respect to a longitudinal direction of the vehicle.

92 This means that if a spatial area is provided on the right-hand side of the vehicle to which a control command has been assigned, then a spatial area is also provided on the left-hand side to which the same control command is assigned. The driver and user of the industrial truck according to the invention therefore does not need to distinguish whether he is on the left or the right side of the industrial truck.

[0010]

100 In a preferred refinement, the control unit has a first predetermined spatial area which includes the load part and to which a control command for stopping and/or braking the vehicle is assigned.

103 The first predetermined spatial area is located in the load part, which is also particularly suitable for order picking. If the portable transmitting and receiving unit is located in this spatial area, a control command for stopping and/or braking the vehicle is assigned. Stopping and/or braking can include both motor braking and the use of a brake. Assigning the control command for stopping and/or braking the vehicle to the first predetermined spatial area ensures that the industrial truck does not change its position when the portable transceiver unit is in the area of the load part. In a preferred embodiment, a relative position can be selected for the control command of the first spatial region, in which the braking and/or stopping of the industrial truck takes place. This relative position can be a position close to one end of the load part, for example, so that an ergonomically favorable working position is achieved.

[0011]

116 In a further preferred embodiment of the industrial truck, a second predetermined spatial area is provided on each side of the drive part, each of which is assigned a control command for a journey.

119 If the portable transmitting and receiving unit is in the second predetermined spatial area, the industrial truck drives at a predetermined speed, for example walking speed. The second room area can be used to set a walk-along mode or follower mode for the industrial truck. If the

industrial truck stops, for example, when the portable transmitter and receiver unit leaves the second spatial area, a person carrying the portable transmitter and receiver unit can walk next to the industrial truck. In a preferred development of the invention, the control unit has a third predetermined spatial area on the side of the drive part facing away from the load part. A control command, which stops and/or brakes the industrial truck, is assigned to the third predetermined spatial area. In a preferred embodiment, the first, second and third spatial area completely cover the area around the industrial truck, with the second spatial area being provided on both sides of the vehicle.

[0012]

133 In a preferred further development of the industrial truck according to the invention, at least a fourth transmitting and receiving unit is arranged on the drive part.

135 The transmitting and receiving unit is designed to additionally determine a height above the ground for the mobile transmitting and receiving unit. While the height of the portable transmitter and receiver unit above the floor in the spatial areas has no meaning, the height can be evaluated as separate information. As a rule, this requires the transmitting and receiving units to be in a predetermined position in relation to one another.

[0013]

143 For example, the height of the portable transmitting and receiving unit can be evaluated by the control unit such that a control command for the load part/vehicle is issued in response to the detected height of the mobile transmitting and receiving unit.

146 The control command can be, for example, a control command for stopping and/or braking the vehicle when the detected height is below a minimum height. The minimum height can be selected in such a way that falling below the minimum height is a clear indication that the portable transceiver is on the ground or is close to the ground. The reason for this may be that the portable transmitter and receiver unit has fallen or that a person carrying it has fallen.

[0014]

154 In a further expedient embodiment, the control unit is designed to issue a control command for raising or lowering the load part when the relative position of the portable transceiver unit is in the first spatial area.

157 In the first area it is already ensured that the industrial truck is not moving. With the additional control commands, the load part can be raised and lowered during the activity, for example when order picking. The height of the load part can also be adjusted to the detected height of the portable transmitter and receiver unit in other processes.

[0015]

164 The object according to the invention is also achieved by a method for controlling an industrial truck, in particular an order-picking vehicle, with the features of claim 12.

[0016]

169 The method according to the invention is provided and intended for controlling an industrial truck, in particular an order-picking vehicle.

171 The industrial truck has at least three transmitting and receiving units which are provided in a predetermined spatial arrangement relative to one another on the drive part and are designed for a transit time measurement with a portable transmitting and receiving unit.

174 The method according to the invention provides for determining a relative position of the portable transmitter and receiver unit with respect to the industrial truck by measuring the transit time of the transmitter and receiver units fixed to the vehicle. The method also provides for the industrial truck to be actuated when the position relative to the industrial truck is within a predetermined spatial range. In this case, there is a content-related assignment of the type of control of the industrial truck and the predetermined spatial area in which the portable transmitting and receiving unit was determined. In the method according to the invention, a control command is preferably sent as long as the portable transmitting and receiving unit is located in a predetermined spatial area. This means that in the method according to the invention, no attempt is made to keep an operator on one side of a frontier, but rather the transmitting and receiving unit in a spatial area triggers a control command.

[0017]

188 In a preferred development of the method, the industrial truck is controlled in two or more predetermined spatial areas.

190 Two or more control commands for the industrial truck can be sent through two or more room areas.

[0018]

195 In a preferred development of the method, the industrial truck is stopped and/or braked when the relative position of the portable transmitter and receiver unit is in a first spatial area that includes a load part of the industrial truck.

198 If the portable transmitter and receiver unit is located in a spatial area around the load part, the industrial truck is prevented from driving or steering, with any steering or driving movement being stopped and/or braked. In a preferred development of the method according to the invention, the industrial truck is stopped and/or braked in a selectable position relative to the portable transmitter and receiver unit. The selectable relative position makes it possible to use the industrial truck to select one of a number of positions relative to the portable transmitter and receiver unit. For example, this can be a beginning or an end of the load part.

[0019]

208 In a further preferred refinement, the selectable position can be selected on the portable transmitting and receiving unit.

210 If the portable transmitting and receiving unit is carried by a user of the industrial truck, he can move the vehicle to a desired position relative to him.

[0020]

215 In a preferred embodiment of the method according to the invention, the industrial truck is driven to travel, in particular to travel straight ahead, when the relative position is in a second predetermined spatial area that is provided on both sides in relation to the longitudinal direction of the vehicle.

219 The second predetermined space includes the driving part. If the speed of the industrial truck when it is activated from the second spatial area is approximately walking speed, a person carrying the portable transmitter and receiver unit can walk next to the vehicle, which then stops when the person and thus the portable sensor stop leaves the second room area. A predetermined relative position, for example at the end of the load part, can be approached by a control command from a spatial area adjoining the second spatial area.

[0021]

228 In a preferred embodiment, the industrial truck is stopped and/or braked when the relative position is in a third predetermined spatial area, which is on a side of the drive part that faces away from the load part.

231 The first, second and third spatial areas preferably enclose the industrial truck completely.

[0022]

235 In a preferred development of the method according to the invention, a height above the ground is determined for the mobile transmitting and receiving unit and the industrial truck is controlled as a function of the height.

238 The height-dependent activation can also be used under security aspects, for example if the height of the portable transmitter and receiver unit is below a predetermined minimum height. In this case, the transmitter and receiver unit could have fallen and lie on the ground, or the person carrying it may have fallen. Furthermore, it is possible to raise and lower the load part depending on the height of the portable transceiver unit, which significantly simplifies loading and unloading for a user.

[0023]

247 A preferred example of the invention is explained in more detail below.

248 Show it:

249 figure 1

250 a picking vehicle and a person with a portable transmitter and receiver unit in a schematic view from above and

252 figure 2

253 the vehicle from FIG. 1 , with an operator being located next to the vehicle.

[0024]

257 1 shows an industrial truck 10 in a view from above.

258 The industrial truck 10 has a load part 12 with two load forks 14.

259 The forks 14 have a length to accommodate multiple pallets that are designed for picking goods.

261 A drive part 16 of the industrial truck is designed with a short tiller 18 and a driver's station 20 .

262 Standing in the driver's seat 20, a vehicle driver 22 can guide the vehicle via the short tiller 18.

[0025]

266 The drive part 16 is equipped with three transmitting and receiving units 6a, 6b, 6c.

267 In relation to the vehicle-fixed coordinate system 7, the transmitting and receiving units 6a, 6b have the same X and Z position at a positive and negative Y value, while the transmitting and receiving unit 6c has a Y value of zero.

270 Basically, the position of the three transmitter and receiver units 6a, 6b, 6c can be largely arbitrary on the industrial truck.

272 For the evaluation of the propagation times, it is only necessary that the coordinates in the vehicle-fixed coordinate system 7 are known for each of the transmitting and receiving units 6a, 6b, 6c.

[0026]

278 The transmitting and receiving units 6a, 6b, 6c communicate with a portable transmitting and receiving unit 9, which the driver 22 carries with him.

280 The portable transmitter and receiver unit can be attached to the upper arm, for example, but it can also be integrated into the clothing as a piece of clothing, such as put on as gloves, put on as headgear or worn around the neck in the form of a pendant.

[0027]

286 The transit times t1, t2 and t3 are determined between the portable transmitting and receiving unit 9 and the vehicle-mounted transmitting and receiving units 6a, 6b, 6c.

288 The position of the portable transmitting and receiving unit 9 in the vehicle-fixed coordinate system 7 can then be determined from the three propagation times.

290 When using three transmission and reception units, it is not absolutely possible with three propagation times t1, t2, t3 to also locate the portable transmission and reception unit 9 correctly with regard to the Z-axis.

293 The position of the portable transmitting and receiving unit 9 is therefore preferably determined in the XY plane.

295 For precise resolution in the Z-axis, a fourth vehicle-mounted transmitting and receiving unit (not shown) is preferably used.

297 The position of the portable transmitting and receiving unit 9 can then also be precisely determined in three-dimensional space via the fourth transit time t4.

[0028]

302 The entire area in the XY plane around the industrial truck 10 is divided into four areas 1, 2a, 2b and 3.

304 The areas are divided among themselves by boundaries 5a, 5b, 5c and 5d.

305 Individual boundaries 5a to 5d may be a straight line.

306 Other borders may have a more complex course.

[0029]

310 The spatial area 1 includes the load part 12 of the industrial truck 10.

311 The load forks 14 are completely within the spatial area 1.

312 The driver's platform is also still in the spatial area 1, so that when the driver 22 leaves the driver's platform 20, he is directly in the spatial area 1.

314 The control command that the industrial truck brakes or stops is assigned to area 1.

315 This means that if the vehicle is moving, it will be brought to a standstill.

316 Driving is not possible for the stationary vehicle if the portable transmitting and receiving unit 9 is located in the spatial area 1, unless the vehicle driver 22 is in the driver's position 20 and controls the vehicle 10 manually with the short tiller 18.

[0030]

322 The dividing line for the boundary to spatial area 2 with its sectors 2a and 2b originates at the drive-side end of standing platform 20.

324 The borders 5b and 5c each run as straight lines that form an acute angle to the longitudinal direction of the vehicle toward the load part 12 of the industrial truck.

326 A control command is provided in areas 2a and 2b, in which case the vehicle moves at a defined walking speed in the direction of the X-axis.

328 As long as the driver 22 with the portable transmitter and receiver unit is in the spatial area 2b or 2a, the vehicle continues to drive.

330 The spatial area 2b borders on the spatial area 1 in the direction of the load part 12.

331 In addition to the vehicle body, the spatial area 2b also extends beyond the drive part, for

example by one or more vehicle lengths or lengths of the drive part.

[0031]

336 A third spatial area 3 is located on the side of the drive part 16 facing away from the load part 12.

338 The third spatial area 3 is delimited by the drive part of the vehicle and laterally delimited by the two spatial areas 2a and 2b.

340 At the end of the lateral spatial areas 2a and 2b only spatial area 3 is provided until this ends, for example due to the range of the sensors.

[0032]

345 Fig. 2 shows the driver staying in the spatial area 2b, causing the vehicle to move at a predetermined speed in the direction of the X arrow.

[0033]

350 If the person stops, the vehicle continues to drive until the driver crosses the limit 5c.

351 Here the vehicle does not try to change its position so that the driver returns to spatial area 2b, but remains standing, since the driver is now in spatial area 1.

353 Here the driver can then pick goods from the shelf positions 8.

[0034]

357 If a fourth transmitter and receiver unit is installed in the industrial truck, the additional signal propagation time t4 can also be used to determine the Z coordinate.

359 With the information about the Z-coordinate, the possibilities of vehicle control can be expanded.

361 The vehicle can execute different commands depending on the altitude range in which the portable transmitting and receiving unit 9 is located.

363 For example, if the person with the portable transmitter and receiver unit 9 falls and falls below a minimum height in the Z coordinate, the vehicle can be braked, regardless of the area in which the person is at that time.

366 It is also possible to provide for the load part to be raised or lowered for specific heights when the person is in spatial area 1 .

368 Reference List

[0035]

372 1

373 space area

2

377 a

378 space area

379 2 B

380 space area

3

384 space area

5

388 a

389 Border

390 5b

391 Border

392 5c

393 Border

394 5d

395 Border

6

399 a

400 Transmitting and receiving unit

401 6b

402 Transmitting and receiving unit

403 6c

404 Transmitting and receiving unit

7

408 vehicle coordinate system

8

412 shelf spaces

9

416 portable transmitter and receiver unit

10

420 industrial truck

12

424 load part

14

428 load forks

16

432 drive part

18

436 short drawbar

20

440 driver's station

22

444 vehicle driver