

State of the art of some of the major systems of automatic navigation.

Navigation systems automatically find its natural industrial environment and are used mainly in logistics.

We define such vehicles with the term **AGV** It is the acronym for Automatic Guided Vehicle (from English: Automatic guided vehicle) and identifies vehicles, mainly used in the industrial field for the handling of products within a plant. However, there are also vehicles designed to work outside, although much less used.

The market more and more companies have set their industrial organization choosing such systems that are constantly growing market. One could cite the example of the "Barilla" like many others who have delegated the management of its warehouse management or the shift of goods to such systems.

Breaking technologies

There are several technologies used to drive an AGV system, each with advantages and disadvantages. There are systems particularly flexible in relation to variations of the route others that work well even in particularly severe conditions.

Guide wire

The first to be developed was the guide wire. Realized by means of a wire arranged immediately below the surface of the floor and path from an electrical signal at a given frequency. A pair of solenoids arranged on the carriage is able to detect the position of the wire and relatively simple electronics can control the steering. If you must have multiple paths using different frequencies. It is well suited for use in situations demanding especially in the presence of dirty environments that make critical the use of optical systems. The route modification is very costly as it requires the implementation of a cut in the floor for the insertion of the wires and the subsequent resin-coating of the same.

Magnets

The path is delimited by a series of magnets inserted in the pavement or magnetic tape. Respect to the guide wire requires intervention easier on the pavement as they are only required a series of holes. The individual magnets may be replaced by tapes or magnetic

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stripes. It is possible to identify certain positions using different combinations of polarity of the magnets

Laser triangulation

The technology driving the laser uses as a reference a number of reflectors placed on walls or objects along the path of the carriages. Each vehicle is equipped with a laser head that rotates 360 ° and articulates, with average interval of 50 ms, the entire surrounding area. When the beam emitted by the laser head, hits one of the reflectors, is reflected and the head itself detects the direction from which the reflection. With the detection of at least three reflectors, previously measured by means of a theodolite, And reported with absolute coordinates in a system where the cart will know the zero position, the computer board is able to calculate the position of the carriage and to drive it along predetermined paths. The main advantage of the laser system is the absence of devices connected to the paths is then possible to change the location of the vehicle using only the software control of the same.

GPS

If the vehicle has to move only on the outside you can adopt the system GPS, Adopting the technique differential with a base of reference, to know precisely the position of the carriage. The guidance system then operates in a similar manner to that of systems with laser triangulation.



Here you can see the side of a cart AVG Cassioli.

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Description of the inertial guidance system

The inertial navigation systems incorporate linear and angular accelerometers (to measure the changes in position); some include gyroscopic element (for maintaining an absolute reference angle).

The accelerometers measure the angular rotation of the aircraft in space. Generally, there is at least one sensor for each of the three axes: axispitch(Raise / lower the bow), axisyaw(Bow to the right or to the left), and axisroll(Oscillation around its horizontal axis).

The linear accelerometers measure the way in which the aircraft moves through space. Since it can move along three axes (up and down, left and right, and back and forth) there exists a linear accelerometer for each of the two axes or three axes.

The automatic steering systems for trucks are based in part on an inertial guidance system generally simpler that acts primarily on the various organs that transmit values such as space, steering angle, speed etc .. These values are the basis for calculating the trajectory / and that the vehicle has to fulfill in accordance with the programming. In this navigation intervene then a series of factors that introduce errors in the guide, therefore the carriage or the vehicle is to be recalibrated in order to stay aligned with respect to the theoretical path established.

The guidance systems such as wire or magnetic or colored band are conceptually simpler because the system has as reference a lead, but vice versa are very rigid in their functions. In fact, once a path is established this is traced on the ground, or drowned (in the case of wires or magnets), this precludes both as a dynamic navigation requires a good job of preparation on the field to be installed.

The system via Laser triangulation requires a series of markers or feedback reflectors arranged along the path in order that the vehicle via the laser edge that rotates by intercepting them through a series of calculations can deduce its position with respect to these references.

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Below, an image of a model



Rotating laser protractor

Each of these systems outlined above has its advantages as flaws that will be placed near the system NAVIGATOR to understand the differences and what are the merits of the system.

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The ability to change the configuration of the course work is the key factor that led to the spread of automatic trolleys.

Control. The control system CASSIOLI is able to monitor both all the information relating to the positioning and to the state of the trolleys, both the requests made by the production system. In this way the system processes and streamlines instantaneously the most suitable route to the situation (vehicle scheduling and vehicle routing).

Double navigation system. The decades of experience and expertise of the company in the field of automatic trolleys has shown that there is no single system of effective guidance and valid for all industrial environments. In certain warehouse areas such as, for example, corridors narrow and long, the tunnel in proximity to industrial furnaces, and, in general, the outdoor spaces of establishments, is not obtainable a correct triangulation with the fixed references required by laser technology. In this particular context, then, the AGV - LGV CASSIOLI can incorporate the technology of self-guided trucks with a double system of navigation: Laser-guided and guided inductive technology based on the detection of magnetic fields generated by tablets drowned in the pavement. In certain cases you can also use a special camera that provides information to the navigation system.

Wireless technology. Our researchers are always ready to grasp the opportunities offered by new technology or any exchange of information between individual trolley and the central control system it is via Wi-Fi technology. In fact the possible overload of communications and the possible presence of electromagnetic interference have always been a limit of traditional AGV systems connected with the central system in radiofrequency. On the contrary, through the performance obtainable with the Wi-Fi technology, the control system of the truck CASSIOLI receives information from the management system of first level directly through the Ethernet network. As a result the entire logic of the truck is not controlled by a PLC but directly from a PC, thanks to its characteristics, can control some functions of traffic management. The transition from a centralized control system, typical of the traditional trolleys driven by PLC, to a distributed control system, peculiar to the new trolleys CASSIOLI with PC architecture, results in an improvement of the computation speed and response with the PC for the management " on the ground "thus obtaining a series of vehicles characterized by improved reliability.

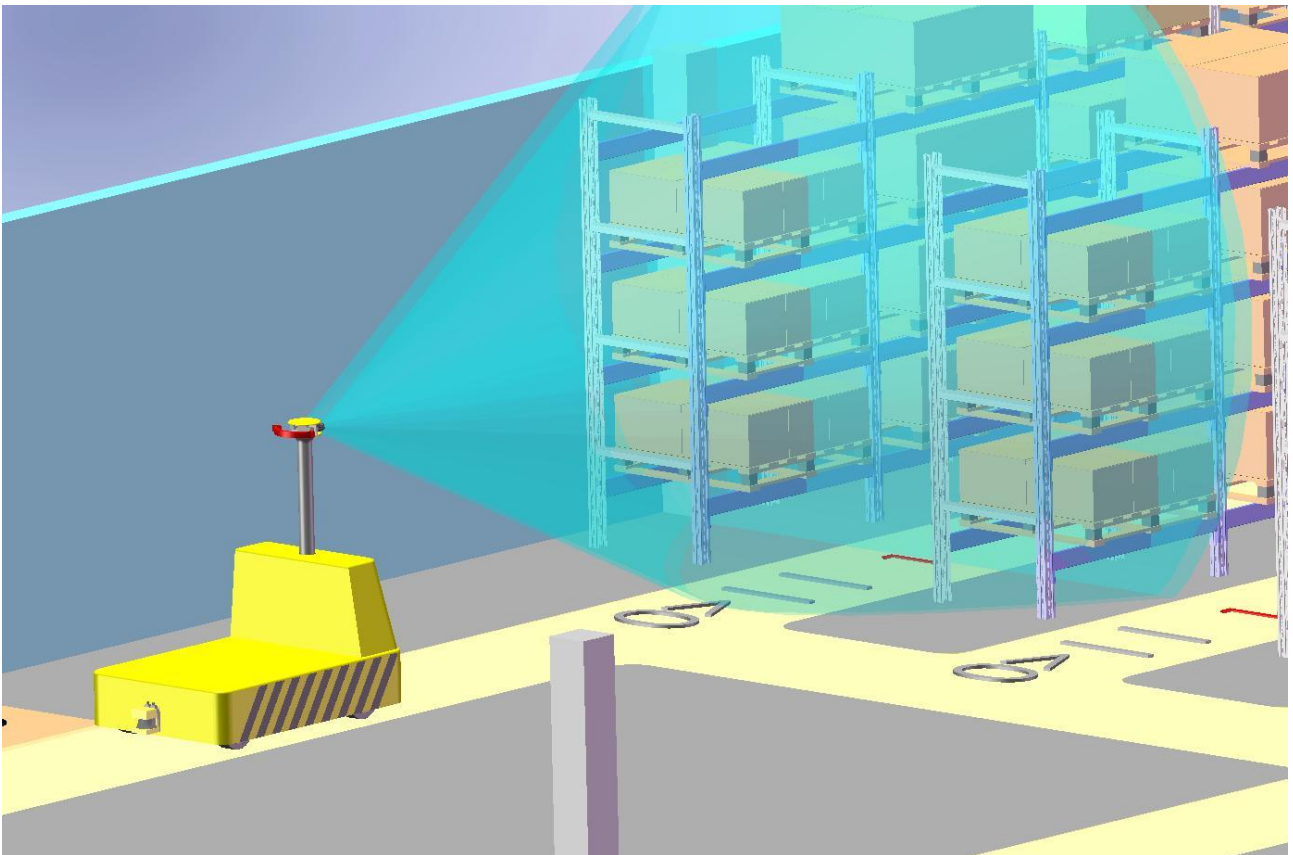
Integration. The AGV - LGV - AGC CASSIOLI are fully integrated with any other device handling: palletizers, robotic cells, end of line and automated warehouses. Forms of supervision of the carriages can be interfaced with any enterprise information system level (SAP, departmental, etc.).

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System Description NAVIGATOR

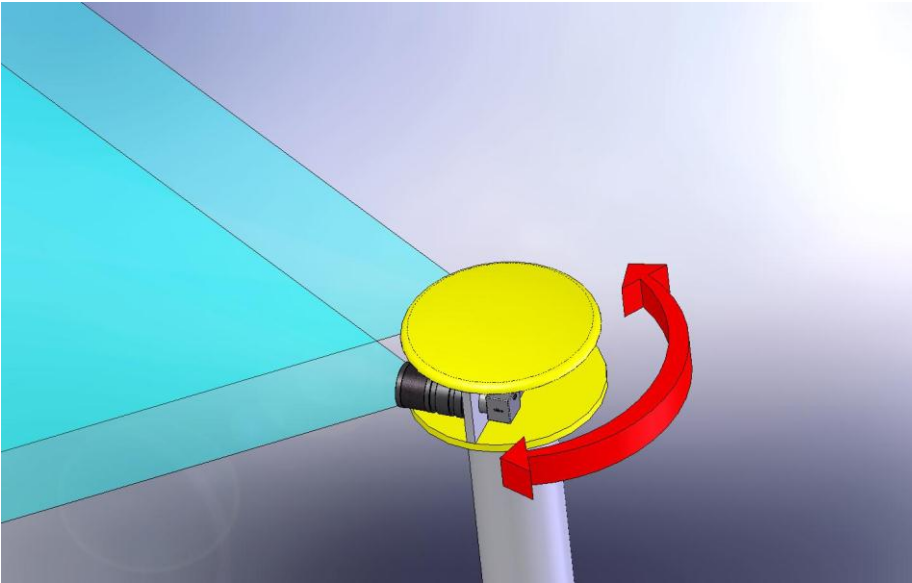
The system is based NAVIGATOR, wanting to simplify for easy understanding, a concept that dynamically determines the position of the medium compared to markers placed into the dormant and two cameras for stereo vision placed on the vehicle or vehicle. On the vehicle are placed two cameras with high resolution (mink stereoscopic) in order to determine with the vision of only one point is that the distance position.

The vehicle is equipped with two cameras and a light source, object with a light invisible to the human eye momentarily active markers in order to get them to take action with a light code.



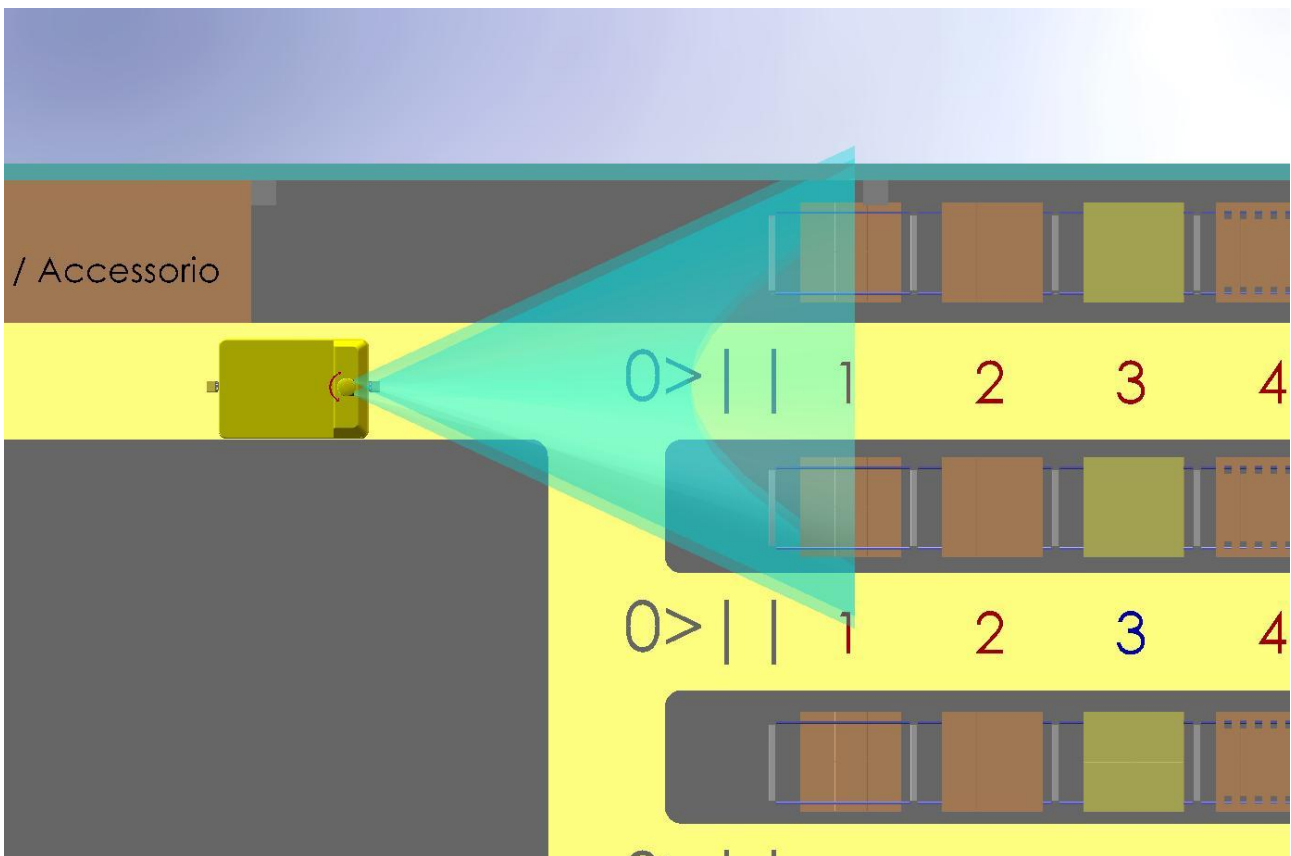
The two cameras with a system of subtraction picture, strip off the vision of each particular highlighting only the light emitter or marker, its point light is analyzed by correcting the optical distortion of the objectives in order to be able

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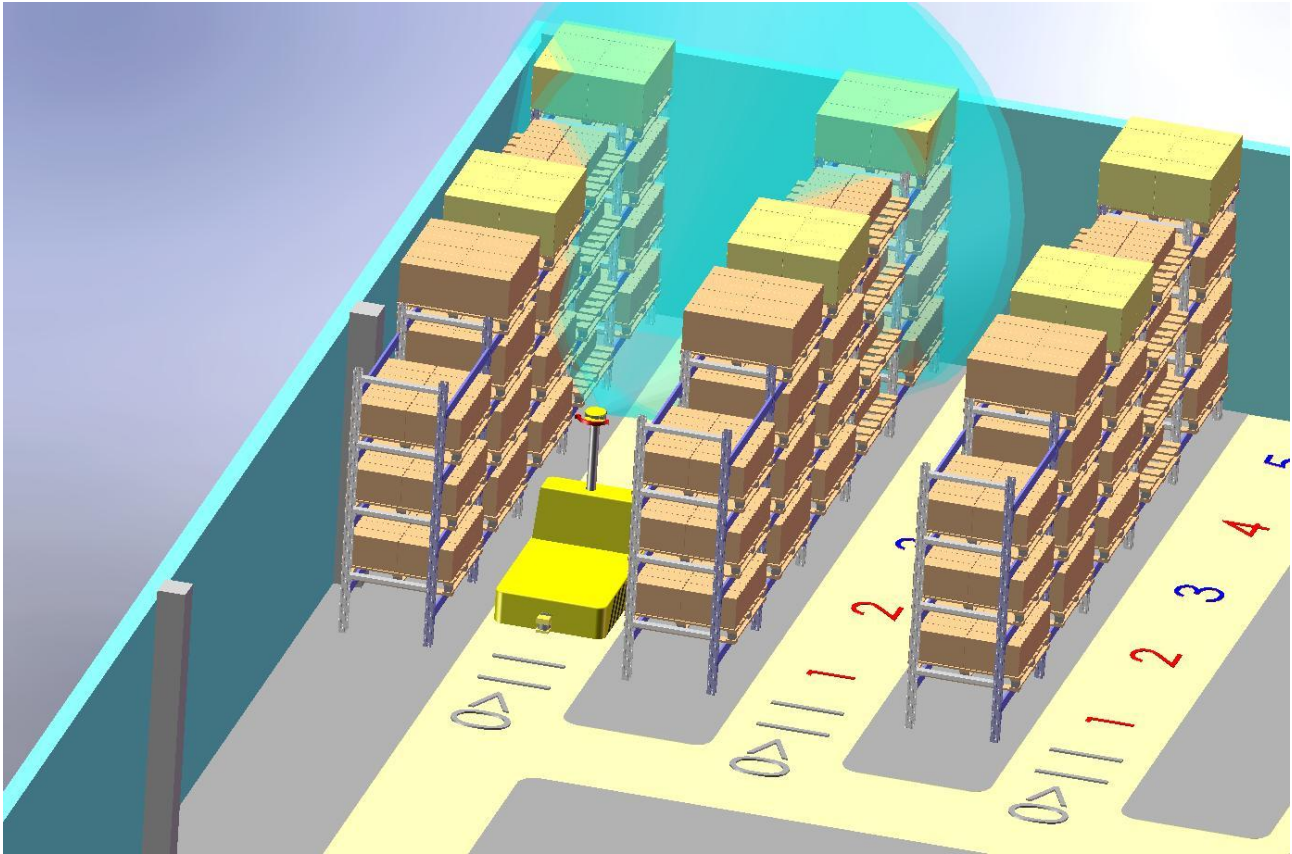
establish with great accuracy, and the margin of error of 1 cm from tests done at our company. Codification impulsive transmits the identification of the marker. The score remains dormant, then we can imagine a system powered by solar cells if the environment is the least

enlightened, or with a battery if it is completely dark, lighting up sporadically and for a short time ago is that this system has a very long autonomy.



The two cameras can also be used as an aid to the outlet or driving with intelligent software mink or remote the vision in order that an operator can visually check if there are problems or encumbrances on the course.

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Then the vehicle is found to have integrated into their system two precious eyes that can be used as well as for dynamic positioning also to monitor the path or other automated tasks in aid of manipulators or blades or other.

The advantage of such a system and that it can correct its position dynamically without having to stop, as is the AVG Laser system must do.

Conclusion:

It 'clear that this brief and succinct description introduces some of the technical aspects of the system without going into specific techniques that would make it only more difficult to understand the system. We remain at your disposal for any further specific and also illustrate the benefits.