AUTONOMOUS VEHICLES FOR TRANSPORT OF MATERIALS IN WAREHOUSE

TECNOLOGÍA PATENTADA

LICENCIADA EN EXCLUSIVA

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RESUMEN

University researchers have developed a low cost device that can be adapted to different types of vehicles, allowing the movement and transport of loads in complex spaces without the need for drivers. This system is ideal for transporting materials in warehouses where it is necessary to make a continuous passage of goods between different points.

The technology, designed by researchers from the UA Research Group in Signals, Systems and Telecommunication, allows the vehicles to be programmed to travel independently, without human intervention, by mapping and pinpointing the area through various sensors such as laser and machine vision systems. This allows for the reconstruction of the area and the identification of possible moving objects. It also reckons the optimal path to reach a certain point, avoiding potential obstacles through reinforcement learning techniques.

This technology presents several advantages. It organizes the information about the vehicle's surroundings captured by several sensors. In this way, the vehicle location can be inferred by the form and position of the detected obstacles. The system operates in dynamic environments, and this allows it to work in places with free movement of persons. The technology can be installed in any kind of vehicle, new or used, without calibration needed.



INTRODUCCIÓN

The automatically guided vehicles (AGV), heretofore used in warehouse management, are based on the use of previously established paths, that is, guided by painted lines or lasers. These systems have a limited flexibility and no ability to solve unforeseen situations, which can lead to hit unexpected objects that hinder the movement of goods and obstruct the passing.

Furthermore, the establishment of new routes involves programming prior work with high temporal and economic cost. Another disadvantage is the difficulty of working in places with people on the move, since it can lead to accidents and collisions.

DESCRIPCIÓN TÉCNICA

The intention is to convert any manually driven vehicle into a high-performed mobile robot to suit the working environment where it is going to operate, rather than having to adapt the environment to the vehicle, with the high cost of doing so.

This research work has led to a technology patented by the University of Alicante that improve processes mapping, association and location of robots over SLAM conventional techniques (Simultaneous Localization and Mapping).

This technology is applicable to any business or industrial environment where autonomous vehicles can be used, for example, in the management of warehouses with large volume of inputs and outputs, production centers in need of displacing objects between different points, movement of goods in settings with extreme human conditions (cold storage, waste management, etc.).

The device is available to be adapted to conventional vehicles, new or used. As a practical demonstration of this technology, a golf cart has been automated and it is currently circulating autonomously on the University of Alicante campus. Also, there is a virtual reality simulator to visualize the application of this technology in specific tasks and facilities of each company. Therefore, the research group has the capacity to automate a fleet of vehicles based on the needs of the company.



Figure 1. Autonomous golf cart circulating on the University of Alicante

VENTAJAS Y ASPECTOS INNOVADORES

MAIN ADVANTAGES OF THE TECHNOLOGY

The development of new strategies in the SLAM technique allows the achievement of several new advantages with respect other technologies for automatically guided vehicles:

• **Versatility** in trajectory planning. The path is not defined previously. It is only necessary to define the start and end points, and the system is able to identify objects in the surroundings, to adapt the route and determine the optimum path. The system is able to avoid obstacle while circulating too. This allows to install the system in complex environments with several elements on the move.

• **Easy adaptation**. The system allows to modify the route or to include a new one, easily.

• The technology **can be installed in any conventional vehicle**, new or used, without calibration. It can be installed in the vehicle fleet of the company. So these vehicles can operate automatically with the new technology, or manually (driven by a person). This means a reduction of implementation costs.

• **Reduced cost**. It doesn't require special vehicles. The equipment needed is reduced and the time to install the system is less than the time required with conventional technologies.

• **Continuous learning**. It is not required a calibration process. The robotic system is able to learn the vehicle dynamics.

INNOVATIVE ASPECTS

Based on current SLAM techniques, researchers have developed new algorithms with important improvements in the map creation, association and location processes. In this way, the vehicle reaches a **better adaptation to the space and organization of the warehouse**. In other words, the vehicle can be adapted to the place and it is not necessary to adapt the place to the vehicle.

The main innovative aspects are:

- The vehicles have a high level of autonomy, due to the dynamic planning of paths.
- Avoid collisions because the system can modify the path in real time.
- The definition of new paths without modification of the environment avoids costly investments.

ESTADO ACTUAL

The technology is being tested and optimized in pilot autonomous vehicles, with successful performance results.

APLICACIONES DE LA OFERTA

The technology is applicable to any industrial environment where industrial vehicles are required. For example, in management of warehouses with continuous passage of goods, production centres where it is necessary to transport materials, or movement of goods in extreme conditions for person (cold storage, waste management, etc.).

COLABORACIÓN BUSCADA

Researchers are looking for companies acquiring the technology for implementation in their facilities.

It is possible to reach license agreements, commercial agreements or technical cooperation agreements.

The research group has know-how to develop systems for automation of vehicles meeting the specific requirements of each company.

DERECHOS DE PROPIEDAD INTELECTUAL

This technology is protected by patent:

- Application number: 201201234
- Application date: 04/12/2012

SECTORES DE APLICACIÓN (4)

Pollution and Environmental Impact
Computer Science, Language and Communication
Engineering, Robotics and Automation
Transport and Automotive