

## AUTONOMOUS VEHICLES FOR TRANSPORT OF MATERIALS IN WAREHOUSES

### DESCRIPTION OF THE TECHNOLOGY

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.

The head researcher of the group explained that the intention was 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.

### MARKET APPLICATION

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 centers where it is necessary to transport materials, or movement of goods in extreme conditions for person (cold storage, waste management, etc.).

### MAIN ADVANTAGES AND INNOVATIVE ASPECTS

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.

Based on current SLAM techniques, researchers have developed new algorithms with important

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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.

### **CURRENT STATE OF DEVELOPMENT**

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

### **INTELLECTUAL PROPERTY RIGHTS**

This technology is protected by patent:

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

### **COLLABORATION SOUGHT**

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.

### **RELATED IMAGES**



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