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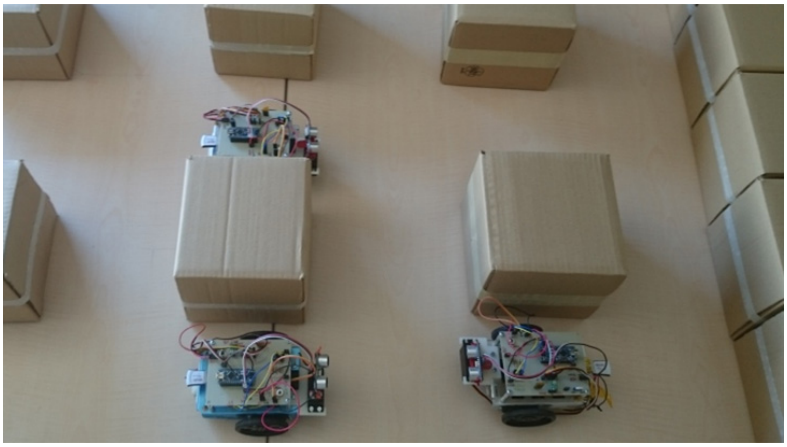
Predictive model to improve electric vehicle fleet management



Researchers from the Department of Microelectronics and Electronic Systems have set up an experimental plant that simulates a warehouse with automated guided vehicles that transport objects. The aim of the study is to analyze the influence of the charge level of the batteries in order to optimize transport operations, with applications not only in factories and warehouses, but also in urban areas.

Scale prototype of a plant with three battery-operated mobile robots

Leading factories and warehouses have internal traffic resembling that of cities, including fleet of taxis for point-to-point automatic transportation. These taxis are known as ‘automated guided vehicles' or AGVs and have become increasingly popular.

Transportation systems based on autonomous vehicles can adapt to the changing needs of every moment, even without any central control. For example, auctioning transportation orders among all available vehicles is a way to facilitate the one with the best bid to pick the material at the collection spot and deliver it to its destination with the least possible cost.

Typically, AGVs are powered by batteries. As the load of the batteries affects their speed significantly, the time required to carry out a transportation order not only depends on the distance to be travelled but also on the available energy.

In this work, we have set up an experimental and scaled plant to study the relation between the charge of the batteries and the time required to carry out a given transportation order. Approximate expenditure of energy for each operation can be foreseen using the model derived from this study. Thus, it is possible to estimate the time needed for each operation, which is more accurate than that derived from theoretical or heuristic models. Experimental results show that the costs of operation can differ up to 25%, depending upon the model. Hence, the use of the new model can significantly improve the planning of the routes, in order to minimize the service time for each operation as well as to optimize the management of the batteries.

This model can be extended to full fleets of electric vehicles to increase the reliability of the predictions and improve the overall efficiency of corresponding transportation systems, not only in factories and warehouses, but also in urban areas.

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References

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