Automated modular vehicles: Some future applications

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Abstract: Automated modular vehicle technology (AMVT) has been gaining attention in the last few years. It consists of modular and fully automated vehicle units that can either operate individually or can be combined forming thereby a single modular vehicle of higher capacity. In this presentation, we will discuss how such technology can be beneficial to several transportation systems, ranging from public transportation to emergency medical services.

In the case of public transportation, we propose a novel flexible bus dispatching system, which offers new perspectives and enormous flexibility to better manage the dispatched frequencies and the allocation of the vehicle resources, reducing thereby the operating cost. To do so, we leverage the variable capacity capabilities of the AMVT to better address any variations in passenger demand while minimizing the impacts on the regular traffic system. To address the latter, we propose an optimization framework based on the recently proposed three-dimensional macroscopic fundamental diagram (3D-MFD) that captures the interactions between public transportation and private transportation systems.

In the case of emergency medical services (EMS), we propose a new concept of smart EMS operations to reduce response times and arrival times to hospital while maximizing service coverage. To that end, we leverage the en-route coupling and decoupling feature of the AMVT to enable the en-route transfer of patients and personnel or other resources from one vehicle to another. This could be highly valuable in areas with limited resources (e.g., rural settings) or situations with a high EMS demand (e.g., the COVID pandemic or other disasters such as the recent explosion in Beirut).