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Comfort and Energy in Public Passenger Vehicles in Urban Environments

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INTRODUCTION & AIM

Public passenger vehicles are subject to external environmental conditions in the city and a high level of occupancy inside. To promote occupant comfort conditions, these vehicles should adapt to different climates and external environment conditions. When developing more energy-sustainable public passenger vehicles, it is important to consider not only these factors but also the vehicle design and HVAC systems. The main contribution of this work to the state of the art focuses on adapting the vehicle design, the internal occupation, and the HVAC system to the urban environment.

CONCLUSION

External environments (e.g., solar radiation, air temperature, relative air humidity, wind direction, wind velocity, and others) and heat generated were considered in the thermal comfort analysis. Air quality will be guaranteed through air renewal rates and ventilation topologies implemented in the vehicles. Based on the results, the applied methodology ensures acceptable thermal comfort and contributes to sustainable transportation in urban environments.

METHOD

Air temperature and humidity, wind velocity, carbon dioxide concentration, solar radiation, occupancy levels, and HVAC systems were considered in evaluating passenger thermal comfort and indoor air quality. Numerical software will be used to simulate the thermal response of passenger transport vehicles. This software evaluates several layers of opaque (i.e., vehicle panels) and transparent (i.e., surrounding glass surfaces, such as lateral, back, frontal, and roof) bodies and respective temperatures.

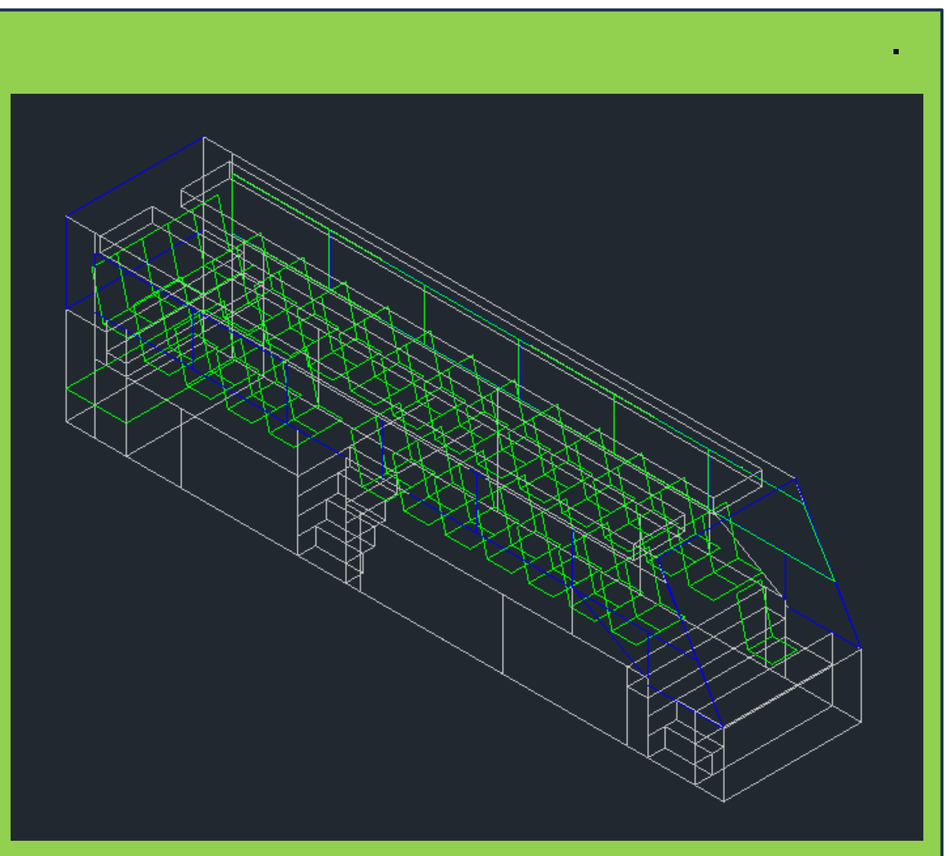

Figure 1. 3D scheme of the bus considered in this study.

The solar radiation, convection and radiative coefficients, energy flux, mass flux, thermal comfort (i.e., PMV index), indoor air quality (i.e., CO2 level), and other factors are also calculated by the software. This numerical study considers a bus equipped with glass bodies on the lateral, frontal, back, and roof surfaces, a high occupancy level, and the internal HVAC system. This study will be conducted in winter conditions, namely on the winter solstice, on a clear day without clouds, in a Mediterranean environment.

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