

A Study on Partition Layouts for Configuring Independent Spaces in Vehicles

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As autonomous driving technologies advance, vehicle interiors are expected to evolve from conventional driver-centered environments into user-centered spaces that support privacy, relaxation, work, and entertainment. In particular, passengers in autonomous and shared mobility services may require flexible spatial separation from other occupants. This study investigated partition layouts and enabling technologies for configuring independent spaces in autonomous vehicle interiors. A full-cover partition experience inspired by premium aircraft cabins was adapted to passenger vehicles while considering their limited cabin volume, packaging constraints, and relatively short travel durations.

Two representative concepts were initially examined: a cylindrical partition surrounding an individual occupant and a console-type partition positioned between adjacent seats. The console-type concept was selected because it can be applied to various seat arrangements, including shared vehicles and robo-taxis, while enabling the integration of convenience functions close to the passenger. The selected concept was designed to provide lateral and fore-aft spatial separation according to different autonomous driving scenarios.

A first prototype was developed with a motor-wire linkage mechanism. The partition extended upward from the armrest and had a maximum height of 970 mm. A usability study was conducted with 28 in-vehicle technology experts to evaluate spatial perception, openness, partition height, armrest height, and the necessity of frontal separation. The results indicated that the initial armrest height and general spatial perception were acceptable. However, the partition height was insufficient to fully block the occupant's eye line, reducing the effectiveness of visual separation. In addition, the frontal partition was evaluated as less necessary for normal forward-facing seating configurations because it could negatively affect perceived openness and premium quality (Fig.1).

Based on the evaluation results and a benchmark analysis of premium aircraft partitions, an improved console-type partition was developed. The maximum partition height was increased to 1,188 mm, while the default height was set to 788 mm. A rear partition was added to block rearward sightlines, and the forward sliding distance was increased from 105 mm to 150 mm to enhance visual shielding and psychological comfort. A variable armrest linked to seat recline was also introduced to maintain an ergonomically appropriate armrest position in both normal and relaxed postures.

The improved model integrated PDLC film for switchable transparency, a retractable cup holder, and a smartphone holder. The final prototype showed a substantial improvement in satisfaction with side-partition height, increasing from 1.6 to 4.8 on a five-point scale. The rear partition, variable armrest, PDLC film, and cup holder also received positive user evaluations (Fig.2). These findings demonstrate the feasibility of a console-type partition system for creating flexible, private, and immersive independent spaces in future autonomous vehicle interiors.

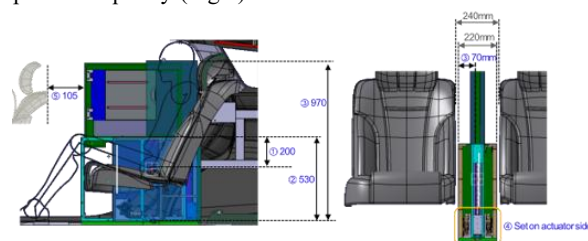


Fig.1 First partition model layout and structure check

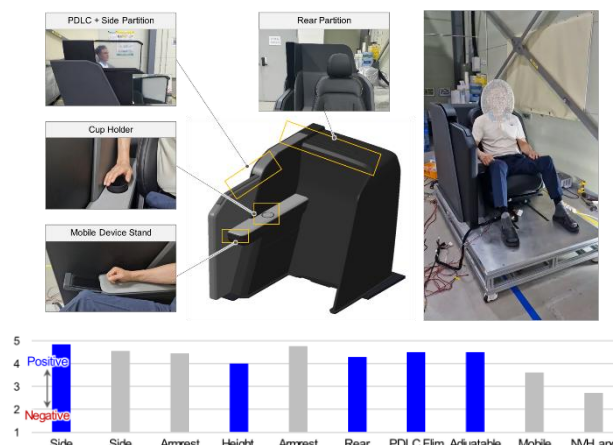


Fig.2 Final model partition layout evaluation results