Development of Immersive Virtual Reality System for Planning of Cargo Loading Operations

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Abstract : The real-time planning visualisation, precise allocation and loading optimisation in air cargo load planning operations are increasingly important as more considerations are needed on dangerous cargo loading, locations of lithium batteries, weight declaration and limited aircraft capacity. The planning of the unit load devices (ULD) can often be carried out only in a limited number of hours before flight departure. A dynamic air cargo load planning system is proposed with the optimisation of cargo load plan and visualisation of planning results in virtual reality systems. The system aims to optimise the cargo load planning and visualise the simulated loading planning decision on air cargo terminal operations. Adopting simulation tools, Cave Automatic Virtual Environment (CAVE) and virtual reality technologies, the results of planning with reference to weight and balance, Unit Load Device (ULD) dimensions, gateway, cargo nature and aircraft capacity are optimised and presented. The virtual reality system facilities planning, operations, education and training. Staff in terminals are usually trained in a traditional push-approach demonstration with enormous manual paperwork. With the support of newly customized immersive visualization environment, users can master the complex air cargo load planning techniques in a problem based training with the instant result being immersively visualised. The virtual reality system is developed with three-dimensional (3D) projectors, screens, workstations, truss system, 3D glasses, and demonstration platform and software. The content will be focused on the cargo planning and loading operations in an air cargo terminal. The system can assist decision-making process during cargo load planning in the complex operations of air cargo terminal operations. The processes of cargo loading, cargo build-up, security screening, and system monitoring can be further visualised. Scenarios are designed to support and demonstrate the daily operations of the air cargo terminal, including dangerous goods, pets and animals, and some special cargos.

Keywords : air cargo load planning, optimisation, virtual reality, weight and balance, unit load device
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