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論　文　要　旨
Thesis Abstract

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主論文題名　（Title）

STUDY ON FEASIBLE PLANNER FOR AUTOMATED DRIVING PERSONAL VEHICLE

内容の要旨　（Abstract）

The complete experience of an automated driving system (ADS) often requires sophisticated hardware. As the personal mobility vehicle (PMV) is classified as a small vehicle, incorporating such a setup is challenging without direct modification and tempering of the original vehicle. Therefore, the modular design architecture approach for autonomous vehicles is imperative to prevent total malfunction of PMV in the case of system failure.

In chapter 3 of this study, the author developed a standalone-modular autonomous PMV (SMAD-PMV), which the operation is limited to two sensors, namely LiDAR and omnidirectional camera, both retrofitted externally using a custom metal bracket without needing internal modifications. The SMAD-PMV's motion planner was investigated in three cases: a global path planning deployment and two local planning approaches, the dynamic artificial potential field (APF) with the virtual obstacle (VO) method, and the region-based planning strategy (RBPS). The RBPS corresponds to the modularity aspect of the SMAD-PMV, where the planner behaves locally based on a predetermined behavior. The validation was done in a combined outdoor and indoor environment, with the SMAD-PMV excel in planning a trajectory and navigating it in real-time without crashing into any obstacle or landmarks. The system has been proven to operate satisfactorily despite the significantly reduced number of sensors.

Chapter 4 related map orientation to the path planning results. The point cloud map is discretized and rotated, and comparison between two path planning algorithms, APF, and A* algorithm, is included for validation. It is observed that for indoor cases, the map with right-angled orientation results in a path that is well distanced from the wall.

Chapter 5 proposes improving the APF algorithm by including VO to local escaped minima and the dynamic potential map to store dynamic obstacle information. The result and discussion section also highlight the perspective of RBPS in reducing the number of VO needed.

Finally, Chapter 6 concluded the thesis content, and all objectives are revisted once again. The future works are also highlighted.