Autonomous Project

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***Index Terms*—component, formatting, style, styling, insert**

I. Introduction

This document is a model and instructions for LaTeX. Please observe the conference page limits.

II. Literature Review

Control Modules in Autonomous Vehicles

The control module is pivotal in managing the dynamic behavior of autonomous vehicles, ensuring safety and efficiency. Recent studies have introduced innovative approaches to enhance control systems:

- **DeepIPC: Deeply Integrated Perception and Control for an Autonomous Vehicle in Real Environments** [5]. This study presents DeepIPC, an end-to-end model that seamlessly integrates perception and control tasks. By processing RGBD images for semantic segmentation and generating bird's eye view mappings, the model utilizes these insights along with GNSS and angular speed measurements to predict navigational waypoints accurately. The approach demonstrates superior performance in diverse real-world scenarios, setting a new benchmark for end-to-end autonomous driving systems.
- **One Stack to Rule them All: To Drive Automated Vehicles, and Reach for the 4th level** [6]. This paper introduces an automated driving stack that combines scalability and adaptability. The modular design allows for the rapid integration and testing of novel research approaches. The stack includes components for localization, perception, planning, control, and additional safety modules, and has been deployed in real-world environments, including passenger transport in urban areas.

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Localization Modules in Autonomous Vehicles

Accurate localization is essential for autonomous vehicles to navigate complex environments. Recent advancements have focused on enhancing localization accuracy and robustness:

- **CV2X-LOCA: Roadside Unit-Enabled Cooperative Localization Framework for Autonomous Vehicles** [2]. This framework leverages cellular-vehicle-to-everything (C-V2X) communications to improve localization performance under GNSS-denied environments. By utilizing C-V2X channel state information, the system achieves lane-level positioning accuracy, even in challenging conditions such as urban canyons and tunnels.
- **A Survey on Localization for Autonomous Vehicles** [3]. This comprehensive survey examines various localization techniques employed in autonomous driving, discussing their potentials and drawbacks. The study provides a broader perspective on localization challenges and solutions, highlighting the importance of sensor fusion and robust algorithm design.

Navigation Modules in Autonomous Vehicles

Navigation modules enable autonomous vehicles to plan and execute paths safely and efficiently. Recent research has introduced novel algorithms and frameworks:

- **Navigation of Autonomous Light Vehicles Using an Optimal Trajectory Planning Algorithm** [7]. This paper presents a new optimal trajectory planning algorithm that assesses the energy efficiency of autonomous light vehicles. The approach addresses various tasks, including localization, mapping, trajectory generation, and object detection, contributing to improved navigation performance.
- **Hierarchical End-to-End Autonomous Navigation Through Few-Shot Learning** [4]. This study explores the integration of localization, path planning, and motion control using various sensors and AI technologies. The hierarchical approach allows for efficient navigation in complex environments, demonstrating the potential of

combining classical control paradigms with modern AI techniques.

Integrated Architectures for Autonomous Vehicles

Integrating control, localization, and navigation modules into a cohesive architecture is crucial for the effective operation of autonomous vehicles. Recent studies have proposed comprehensive frameworks:

- **System, Design, and Experimental Validation of Autonomous Vehicle Architectures** [1]. This research outlines the design of an autonomous vehicle composed of localization, perception, planning, and control modules. The distributed system design and robust algorithms enable efficient performance, with sensor data fusion playing a key role in localization and navigation.
- **One Stack to Rule them All: To Drive Automated Vehicles, and Reach for the 4th level** [6]. As previously mentioned, this paper presents a modular automated driving stack that facilitates the integration and testing of new research approaches. The stack's flexibility allows it to be used across different vehicle platforms, demonstrating its adaptability and scalability in real-world deployments.

References

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