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A cover for the single-person pedal-powered vehicle

Introduction

In modern urban transportation, personal mobility devices (PMDs), particularly Single-Person Pedal-Powered Vehicles (SPPVs), plays a pivotal role in addressing the last mile problem. Last mile problem refers to the logistically-challenging issue of bringing commuters from transport hubs to their final location. SPPVs have been extensively integrated into daily commutes of 80% of commuters in urban areas of East Asia (Ronaldo et al., 2024). The cost-efficiency, effectiveness, and environmental friendliness of SPPVs will no doubt allow it to be adopted even more broadly in future urban transportation systems.

However, despite the growing integration of SPPVs, there remains significant challenges in safety and comfort, especially under adverse conditions such as rain and snow. The urgency for improvements is highlighted by statistics from Klopp (2024), showing that bicycles have an injury rate of 20,000 per 100,000 in dry conditions, which escalates to 30,000 per 100,000 in wet conditions. The vulnerability of SPPVs can be attributed to the lack of proper bike paths and inadequate infrastructures for PMDs in car-oriented cities. (Alonso 2022). Historical inertia makes changes in urban construction takes a considerable amount of time and hence making redevelopment solutions impractical (Firmino at el., 2021). Hence, the focus shifts to finding a more immediate improvement of the designs of SPPVs.

In this paper, we present an innovative method to improve the safety and comfortability of SPPVs by integrating a lightweight, aerodynamic carbon fiber cage. The structural integrity and practical effectiveness of the cage is validated through extensive empirical methods such as crash tests and computer simulation of stress analysis of the carbon fiber polymer construction. The modular design of the innovation allows for easy implementation onto most bicycles and scooters, offering a significant improvement in comfort and safety of SPPVs.

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