A Geographic Information-Based Cycling Tourism App for Active Seniors

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To stimulate regional economic growth by attracting nearly one billion globally active seniors favoring wellness-oriented long-term travel, we propose an intelligent cycling tourism application. The application is designed to promote elderly-centric stay-type bicycle tourism through the integration of semantic recommendation, route optimization, and real-time navigation. User profiling involves one-hot encoding for categorical variables, while travel and dietary preferences are vectorized into high-dimensional semantic space using Sentence-BERT-based sentence embeddings. The recommendation engine adopts a hybrid model, combining matrix factorization-based collaborative filtering and content-based filtering that leverages semantic tags, and primary ingredients. The user-location interaction matrix is refined with similarity-weighted corrections to enhance prediction accuracy. For route planning, distance matrices between track points are generated via map APIs. Gradient information is extracted using Digital Elevation Models (DEM), enabling the reconstruction of slope-weighted matrices that minimize physical exertion and account for user safety. Depending on the route type, A* search is used for acyclic routes, while exhaustive search-based TSP algorithms are employed for circular routes, optimizing both efficiency and comfort. A real-time guidance module uses geofencing to detect user entry into cycling tracks and integrates with AI voice synthesis to deliver location-based content hands-free. Economic impact analysis indicates a benefit-cost ratio ranging from 58.5 to 87.75, suggesting that each unit of investment could generate 58 to 87 times more in local consumption, demonstrating the platform's significant regional value.

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