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Framework for geofence planning of dockless bike-sharing.

Dockless bike-sharing is growing in many cities around the globe. In contrast to traditional bike-sharing dockless bike-sharing lets the user rent and return their bike at any place within the service area. Recently issues related to this type of urban mobility such as illegal or improper parking behavior are becoming more frequent. The implementation of parking zones delineated by geofences has been discussed as a possible solution for these issues. *Geofences* are virtual zones that can be used to track a vehicles or devices location. This tracking can be utilized to disable the parking function for shared bikes that are not within such a geofence.

This master thesis project aims to develop a GIS-based multi-criteria analysis framework for the planning of geofences for dockless bike-sharing. The framework will use geographical data and *multi-criteria analysis* methods which can be used to analyze complex information that affect decision problems. These methods use criteria to predict the suitability of a location for a specific type of use. Criteria that contribute to bike-sharing usage were determined from the literature and data to represent them was generated using GIS. A case study was conducted and its result assessed using bike trip data. The bike trip data was obtained from a bike-sharing company operating in Zürich. The results indicate that the bike-sharing suitability computed in this study has a significant correlation with bike-sharing demand. It was shown that the presented framework was capable of planning a geofence network that had good coverage of the study area. The proposed geofences had equivalent coverage of the study area as an existing bike-sharing docking station network. The capacity computed in the case study was shown to be mostly sufficient for the demand in the study area. The method presented in this thesis can be used to plan an initial geofence network for a new dockless bike-sharing system. This is possible as the framework, in contrast to other methods, does not require usage data of dockless bike-sharing. Instead the multi-criteria analysis is utilized to predict suitability from explanatory factors for bike-sharing usage.

Keywords: Geomatics, GIS-MCDA, multi-criteria analysis, bike-sharing, dockless, geofence, AHP, VIKOR

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Master degree project 30 credits in Geomatics, 2021

Department of Physical Geography and Ecosystem Science, Lund University. Student thesis series INES nr xx

Full title: GIS-based multi-criteria analysis framework for geofence planning of dockless bike-sharing.