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Digital infrastructures

AI-Driven Software Enables Better and More Efficient Parking Space Planning

Parking spots are scarce in densely populated areas. To plan parking efficiently, authorities need precise data on the number of spots available on the streets. Street width is an important factor here, as it determines whether vehicles can park on one or both sides of a street. Fraunhofer researchers have developed new software that enables automatic and comprehensive street width detection.

Many German cities have a shortage of parking spots. To design and map street-side parking, authorities require information about the street width. This allows them to plan as efficiently and precisely as possible, which makes it easier for drivers to find parking and promotes sustainable transportation. Exact data on lane width, the street's width excluding peripheral areas such as green spaces and sidewalks, is not always available. Therefore, authorities need to collect this data street by street, either on-site, by analyzing aerial images, or by manually taking digital measurements from mobile mapping data. This process is time-consuming and impractical.

As part of the KI4Straßenbreite project, researchers from the Fraunhofer Institute for Physical Measurement Techniques IPM developed a software solution on behalf of the city of Freiburg that significantly speeds up the process. The software automatically and comprehensively calculates the lane width of all of Freiburg's streets, making it faster and more accurate to plan parking. That way authorities can easily determine how many parking spots are available and whether there is space on both sides of the street.

"Cities and municipalities regularly measure their entire street infrastructure. Vehicles equipped with cameras and laser scanners drive along the streets, generating images of the street environment. This creates an enormous amount of data, which authorities use to manually measure the width of the streets on a screen," explains Alexander Reiterer, Head of the Object and Shape Recording department at Fraunhofer IPM. "We can significantly speed up this lengthy process by loading the entire street network into our software. The software then automatically collects the street width data from the digital maps that were created based on regular mobile mapping surveys carried out by the city of Freiburg." The data from the surveys include georeferenced image data and 3D point clouds, i.e., collections of unorganized 3D data points.

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Software delivers measurement results for the entire street network in just a few minutes

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Curbs are the most important markers for defining the lateral boundaries of streets. In the measurement data, variations in height data indicate the edge of a street. The researchers combine geometric methods with AI-based approaches to identify the location of the curbs. Specifically, they look for local height variations in the point cloud. This is difficult for the human eye because sidewalks hidden by parked cars or flattened curbs complicate the task. "Our software solution has a clear advantage here with its mix of AI algorithms that identify objects on the street and heuristic algorithms," says Reiterer. Another advantage is that it produces objective results.

An orthophoto, an artificial bird's-eye-view image, is also generated from the point cloud. These images can help in the search for limiting objects. The software intelligently selects and combines the results from the heuristic algorithms to calculate the lane width in regular grids with an accuracy of just a few centimeters. "With the press of a button, KI4Straßenbreite can calculate the street width every two meters in just a few minutes," says Reiterer.

The researcher and his team can easily adapt and implement KI4Straßenbreite for any city. "We can even provide cities and municipalities with complete solutions — from survey vehicles that we build and adapt to our customers' needs to the software itself. Deutsche Telekom, for example, is already using our T-Car survey vehicles for broadband rollout and route planning, along with a special AI solution for data evaluation."

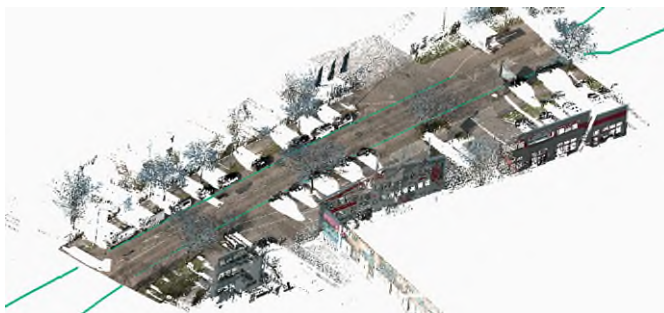


Fig. 1 The Fraunhofer KI4Straßenbreite software collects street width data based on 3D point clouds with deviations of just a few centimeters

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Fig. 2 Automatically collected street width data displayed as an overlay in a geographical information system

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Fig. 3 Complex intersection with different street widths. The data was collected manually, added to a plan and served as a reference for development

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**Fig. 4 Survey vehicle
equipped with cameras and
sensors from Fraunhofer IPM**

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