Human Sensing of Wheelchair Users with Smart Devices: Autonomous Digitization of Street Level Accessibility

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This research proposes a methodology for digitizing street level accessibility with human sensing of wheelchair users. The digitization of street level accessibility is essential to develop accessibility maps or to personalize a route in terms of accessibility. However, current digitization methodologies are not adequate because they require a lot of manpower and therefore cost money and time. The proposed method makes it possible to digitize the accessibility semi-automatically.

In this research, a three-axis accelerometer embedded on iPod touch sensed actions of nine wheelchair users across a range of disabilities and age groups, in Tokyo, for a total of approximately 9 hours. With supervised machine learning techniques, these data were classified into four actions that indicate accessibility: climbing up curbs, driving on tactile indicators, driving on slopes, and stopping. Extracted accessibility was visualized on Google Maps.

This research discovered that the human sensing of wheelchair driving could capture accurately the prevailing conditions of streets in an efficient and cost-effective way. Further research will be needed to extend classification targets for rich accessibility visualization and to verify the results with a larger scale dataset.