Development of an Automated Sidewalk Quality Assessment System

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Overview

Sidewalks are a critical part of transportation infrastructure, supporting pedestrian travel and healthy lifestyles. Sidewalk maintenance and design significantly impact pedestrian safety, mobility, accessibility, and quality of life.

The Georgia Institute of Technology has developed a tablet application that can be used to assess sidewalk quality. Sidewalk presence, width, and condition have been identified as important indicators of sidewalk quality and accessibility.

When a smart tablet is attached to a basic wheelchair, the tablet application automatically collects data and records video, which are used to evaluate where sidewalks may need repair or reconstruction. Researchers will analyze the data and video from the application to assess sidewalk width and the presence of pavement cracks and obstructions. Researchers will then be able to assign a rating to individual sidewalk segments, as well as integrate sidewalk assessment information into an online mapping system hosted by Georgia Tech.

The project objectives include:

- **System setup and calibration**
- **Stakeholder engagement and focus groups**
- **Sidewalk Quality Index development**
- **Field deployment**
- **Outreach and Training**

Data Collection

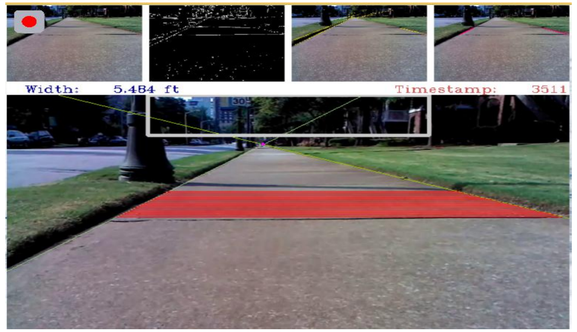
The team is currently collecting data in the City of Atlanta using Android software developed by Georgia Tech and deployed on a tablet mounted to a standard wheelchair. Data collection entails running the app while walking the wheelchair along the sidewalk segment of interest.

- The Sidewalk Sentry Android App is used to collect data
- The app collects video, accelerometer, and gyroscope data
- Researchers take data in city block-length segments
- Diverse locations, land use, and sidewalk quality are included in the sidewalk segment evaluation database

Once the project reaches the field deployment and outreach stage, volunteers and community members will become involved in data collection.

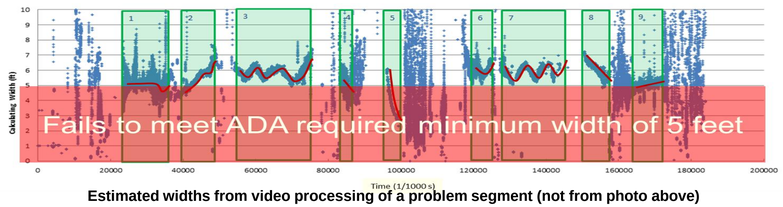
Video Analysis

Width Estimation



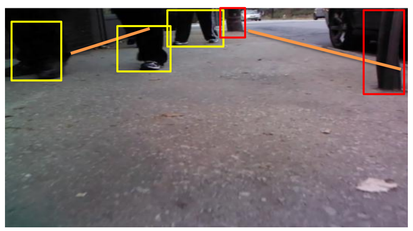
Video processing interface for width estimation

- Line-detection of sidewalk edges
- Relevant line intersection points are taken as view perspective vanishing points
- Pixel dimensions between two lines are measured and converted to the real-world space via field of view calibration
- Distance from edge to edge can be estimated



Estimated widths from video processing of a problem segment (not from photo above)

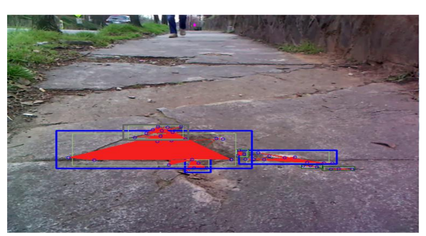
Identification of Obstructions



- Identify moving objects such as people, dogs, bicycles, etc. to omit them in analysis processes
- Identify immovable objects such as poles, columns, trees, to include them in analysis processes

Crack Detection

- Identify irregularities in pavement patterns
- Derive crack detection algorithms through experimentation
- Verify result with the accelerometer data (large cracks significantly change acceleration readings)



Sidewalk Quality Index

The researchers will develop a sidewalk quality index to objectively rate sidewalks on a scale showing prioritization for repairs, improvements, and replacements.

- Expert survey
  - 40-60 segments serve as test sections
  - Sent out to experts (planners and engineers) and stakeholders
  - Online survey platform to collect opinions regarding test sections
- Evaluation variables will likely include:
  - Width
  - Cracks and potholes
  - Obstacles
  - Grade changes
- Statistical analysis of survey results and field data to correlate expert recommendations with field variables

Applications

- Aid efforts for infrastructure asset management and prioritization of facility improvements
- Identify and plan improvements for areas where pedestrian facilities do not meet ADA and local requirements
- Establish a base of sidewalk data for large-scale inventory and pedestrian planning in Atlanta, and ultimately nationwide

Design Feature	Federal Standards (ADAAG/PROWAG)	State Standards	Local Standards
Clear Width	•36" minimum • If less than 60", provide a 60" x 60" passing space every 200 feet	• Florida DOT: 48" minimum 60" w/buffer strip 72" next to curb	• City of Atlanta: 60" minimum clear width
Running Slope	• 5% Maximum	na	na
Cross-Slope	• 2% Maximum	na	na
Obstructions	• None within pedestrian access route	na	na
Pavement Material	• "Firm, stable, and slip-resistant"	na	na

Accessibility Standards and Guidelines

Summary

- Improved quality of life
  - Healthier, more sustainable transportation mode choices
  - Improved accessibility
- Safety
  - Reduce hazardous areas, particularly for children, elderly, and disabled
  - Improved pedestrian facilities and increased pedestrian traffic can lead to safer communities
- Overcome economic restrictions by creating an efficient means of identifying and evaluating problem areas

This research was sponsored by STRIDE and the Georgia Department of Transportation under contracts 10-03. Opinions expressed here are those of the authors and not necessarily those of STRIDE or the Georgia Department of Transportation.