We propose a novel routing system for blind and partially sighted people on a shoreline level of detail.

We rely on openly available geolocation data.

The routing considers actual white-cane based movement along inner & outer shorelines.

We evaluate on 1870 routes between public transit stations and common destinations in an urban area.

The algorithm creates safer routes: avoid informal crossings, prefer accessible pedestrian signals and integrate available shorelines.

Our system improves the users' understanding of the upcoming route, the environment lying ahead and its impediments.

Routing Algorithm:

(1-3) initialize cumulative node (distance, priority) node for shortest connection and distance sorted priority queue

(4-5) while queue not empty, take closest node

(6) check all reachable shoreline or OSM route segments

(7) closest façade point for pu along li

(8-11) if distance to new node < current, store and add new node to queue

Directed Graph to Edge Expanded Graph Transformation:

DG used for routing algorithms, models distances between nodes in edges

Dual EEG allows to model Turn-Restrictions

Here: disallow right turn from e1 to e6 at intersection vi

Allows us to model different ways to cross the same intersection

0) "Please turn north until you reach a façade."
1) "Follow the façade to the left for 8m."
2) "Continue for 18m at 1 o'clock to cross a driveway."
3) "Follow the façade for 16m."
4) "Continue for 12m straight to cross a driveway."
10) "Turn right and follow the façade for 6m."
11) "Continue for 6m at 10 o'clock across the sidewalk."
12) "You have reached your destination."

Public transit station based route evaluation:
distance (d), % pedestrian walkway (r_w), # pedestrian signal (p_s), haptic/aural/pilot-tone APS (p_s_p), % real/virtual shorelines (r_c) and # informal crossings (c).

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<th>d</th>
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</table>

Pre-Defined Weight Constraints: W_C > W_P > W_P_S > W_A_P_S > W_R > W_S > 1

Modified Cost Function: \( \delta_{pu,i} = \begin{cases} 
  W_C \cdot |p_u - p_i|, & (p_u, i) \in S \\
  W_a(p_u) \cdot |p_u - p_i|, & (p_u, i) \in R \\
  \delta_{pu,i}, & \text{otherwise} 
\end{cases} \)

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