ACCESSIBLE TRAFFIC SIGNALS FOR BLIND AND VISUALLY IMPAIRED PEDESTRIANS

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Background – Blind Navigation

- Accessing printed material – TTS, Braille displays
- Safe and efficient navigation (store name, street signs, bus stops, maps) - Cost constraints
- Navigational technology - Understand perceptual factors and user needs
- Position/velocity based navigation – Visual cues
- Auditory, olfactory, tactile – Less accurate
- Unsighted navigation – Cognitively demanding and need O&M training
Background – Intersection Crossing

- Visually impaired were dissatisfied with a general lack of information while crossing intersections - Ponchillia et al. (2007)

- Train pedestrians to use new cues or enhance their judgments with technology may be a more effective method of reducing crash events - Guth et al. (2005)

- 48.6% of crossings started during walk interval and 26.9% of all crossings (w/o assistance) ended after the onset of the perpendicular traffic; 72% started with appropriate alignment, 42% ended outside the crosswalk – Barlow et al. (2005)
Challenging Tasks at Crossing

- Locate the edge of street
- Locate crosswalk
- Interpret signal & traffic patterns
- Align toward crosswalk
- Locate pushbutton, if exists
- Determine when to cross
- Maintain alignment while crossing
Accessible Pedestrian Signals (APS)

Brief History

- Audible pedestrian signals starting in 1920 in U.S.
- Not included in U.S. standards and regulations until MUTCD 2000
- Cuckoo/cheep signals mounted on the pedestrian signal heads (pedhead-mounted APS) – mid 70’s
- Integrated APS in pushbutton – mid 90’s
Newer Generation of APS

- Audible and/or Vibrotactile WALK signal indications
- Pushbutton locator tone - repeats constantly at 1Hz to provide information about the presence and location of a pushbutton
- Tactile arrow that points in the direction of travel on the crosswalk
- Automatic volume adjustment
Concerns about APS

- Costs - $6,000 per intersection plus labor
- Noisy. Add 5 decibels of noise within 6 to 12 feet of pushbutton
- Require additional stub, pushbutton station poles
- Pushbutton location
- Maintenance issue
- Braille verification
GPS for the Blind (No Signal Info)

- Trekker talking GPS (TTS output)
- StreetTalk VIP (TTS & Braille output)
- Mobile Geo (TTS & Braille support)
- Sendero GPS for BrailleNotes (TTS & Braille)
- Loadstone GPS (Symbian phone)
- Wayfinder Access (Symbian phone)
Pedestrian Navigation Systems

- **e-Adept (Stockholm)** - A detailed digital pedestrian network to assist visually impaired or disabled.
- **NOPPA (Finland)** - Provide door-to-door guidance for visually impaired or sighted users taking public transportation.
- **ASK-IT (EU)** - Provide user with navigation, transportation and accessibility information.
- **Mobiville (France)** - Real-time multimodal transportation information service and location based navigation service.
Key Criteria for MAPS

- Auditory and tactile information shall not interfere with the pedestrian’s ability to use their cane or listen to traffic cues.
- Tactile cues are recommended as warnings when a pedestrian puts themselves in a dangerous situation, in tandem with auditory instructions.
- Output from the system should be primarily short auditory phrases.
- A method to repeat warnings / output is necessary.
- Present additional information about the intersection.
- Allow for automatic activation of walk signal when mobile APS is present at an intersection; or allow the user to activate the signal through the mobile APS interface.
Mobile APS (MAPS)

Mobile Accessible Pedestrian System
(MAPS)

Traffic Controller Cabinet
Sniffer System

Traffic Signal Monitoring
Wireless Communications
Traffic Controller Interface

GPS
Digital Map

GPS

Intersection Info.

Text to Speech
Digital Compass

WALK
DONT WALK

Digital Compass
Mobile APS Prototype

- Integrate GPS, digital compass, accelerometer sensors and digital map on Google phone
- Include Bluetooth geo-ID to correct GPS location at intersection
- Text to speech user’s interface
- Single/double tap on mobile phone screen
Challenges & Ongoing Work

- GPS reception in urban canyon
- Veering Warning
- Refine heading accuracy and resolution
- Understand the cognitive demand and spatial knowledge of blind people – field experiments
- Use MAPS to support decision making strategy