Safe Intersection Crossing for Pedestrians with Disabilities

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Project Objective: Develop a smartphone application that allows pedestrians to
- *interact directly* with the intersection and
- *actively influence* traffic signals for safe and efficient crossing

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Target Capabilities

- Use personalized crossing constraints to set crossing duration
- Monitor crossing progress and extend green as needed
- Use route information to anticipate arrival and streamline crossing
- Adjust green to help make bus connections
Technical Approach

- Use “connected vehicle” technology to enable pedestrian to communicate
  - Couple DSRC “sleeve” w/ iPhone to produce device
  - Integrate with smart traffic signal system (surtrac)

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**Goal:** Real-time optimization of urban road networks

**Technical Approach:**
Collaborative Online Planning
- Decentralized control
- Coordinated Action
Advantages:

– Optimizes signals for the actual traffic on the road right now
– Coordination for networks, not just arterials
– Optimizes for multiple travel modes
– Scalable, incremental deployment
In the field ...

- 25% lower travel times
- 40% less time idling
- 30-40% fewer stops
- 21% lower emissions

Key Capabilities

- True real-time response to traffic conditions
- Manages multiple dominant flows
- Scalable to road networks of arbitrary size
- Multi-modal optimization
Broader Deployment

- Beverly Hills
- Las Vegas
- Pittsburgh
- Kane County
- Traverse City
- St Albert, CAN
- Scarborough
- Portland
- Boston
- Needham
- Quincy
- Manchester
- Hoboken
- Newark
- Scarsdale
- Johns Creek
- Chapel Hill
- Orlando
- Atlanta
- Traverse City
- Quaker Town
- Quakersdale
- Hoboken
- Newark
- Needham
- Quincy
- Manchester
- St Albert, CAN
- Portland
- Scarborough
- Boston
- New York
- Chicago
- San Francisco
- Los Angeles
- Chicago
- New York
- San Francisco
- Los Angeles

- Live (4)
- Implementing 2018-19 (4)
- Sales Cycle (14)
Integration with Connected Vehicle Technology

- Better sensing
- Use of mode, route information
The *PedPal* Prototype

- Universal design philosophy
- Multiple interaction modalities
  - interactive display, voiceover, haptic
- Inter-operable with native iPhone accessibility features
  - font scaling, zoom, ...

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• Communication via DSRC messages (J2735 2016 Std)
• Message encoding and decoding at each end
• Message transmission through RSU and sleeve
Basic *PedPal* Crossing Process

1. Approach signal (receive MAP, SPAT)
2. Select street to cross (send SRM, receive SSM)
3. When told to, start crossing (countdown of time remaining)
4. Indicate when crossing is complete
Year 1 Field Test

- 12 volunteer participants
  - Visually impaired, wheelchair users, elderly, deaf individual
- Each engaged for a 90 - 120 minute session
  - Pre-test survey / Training
  - Multiple crossing tours around the test intersection (with and without the App)
  - Post-test survey
• User reaction was overwhelmingly positive
  □ Perceived usefulness varied according to specific user disabilities and needs

• 3 basic advantages identified
  □ Announcement when it is time to cross
  □ Countdown of the time remaining
  □ Extended crossing duration

• Some participants had usability problems
  □ Mostly attributed to lack of experience with App and use of test phones that weren’t configured properly
Lessons Learned

- Need to better explain data privacy issues
- Having proper accessibility configuration is key
- Crossing time may not be a useful indicator of user safety and confidence
- Extension of crossing time can have side-effects beneficial to vehicular traffic
Year 2 Technical Objectives

- *PedPal* refinement and hardening
  - Incorporation of user suggestions
  - Addition of a cellular communication option
- Extension to more complex intersections
- Localization for monitoring progress and alerting when the user veers
- Sharing and exploiting route information
  - Anticipate user arrival to minimize wait time
  - Adjust green time to help make bus connections
Open Issues

• Continue with DSRC communication or switch to cellular?
  □ Decision has been made to add a cellular V2I option (exploiting same DSRC messaging infrastructure)

• How do we solve the tracking problem?
  □ Exploring the use of regional localization centers (nearest is at Univ. of Pgh)

• How much effort (if any) do we spend integrating with 3rd party navigation/route planning apps?
  □ Still looking for easy integration opportunities (e.g., with Blindsquare)