ACCESSIBLE TRANSPORTATION TECHNOLOGIES
RESEARCH INITIATIVE

Safe Intersection Crossing for Pedestrians with Disabilities

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Federal Transit Administration

U.S. Department of Transportation
Federal Highway Administration

U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

Safe Intersection Crossing

- **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

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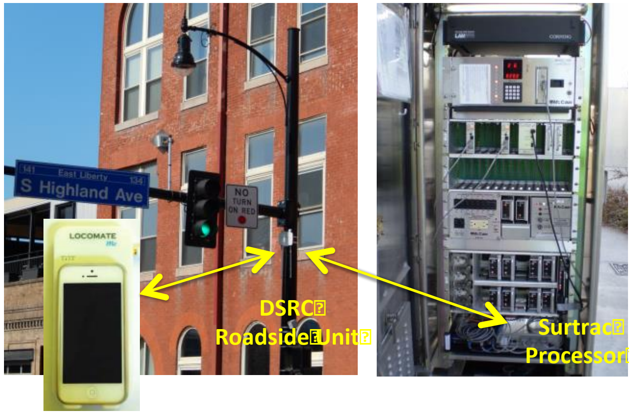
- Use “connected vehicle” technology to enable pedestrian to communicate
  - Couple DSRC “sleeve” w/ iPhone to produce device
  - Integrate with smart traffic signal system (surtrac)

Pittsburgh surtrac deployment



surtrac

Scalable Urban Traffic Control

Goal: Real-time optimization of urban road networks

Technical Approach: Collaborative Online Planning

- *Decentralized control*
- *Coordinated Action*

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Five surprising ways AI could be a part of our lives by 2030

By Ben Panko | Sep. 12, 2016 , 5:45 PM

Smart traffic lights

Smart traffic lights using artificial intelligence technology to learn and adapt to traffic patterns in real time could make intersections safer and more efficient. AsianDream/iStockphoto

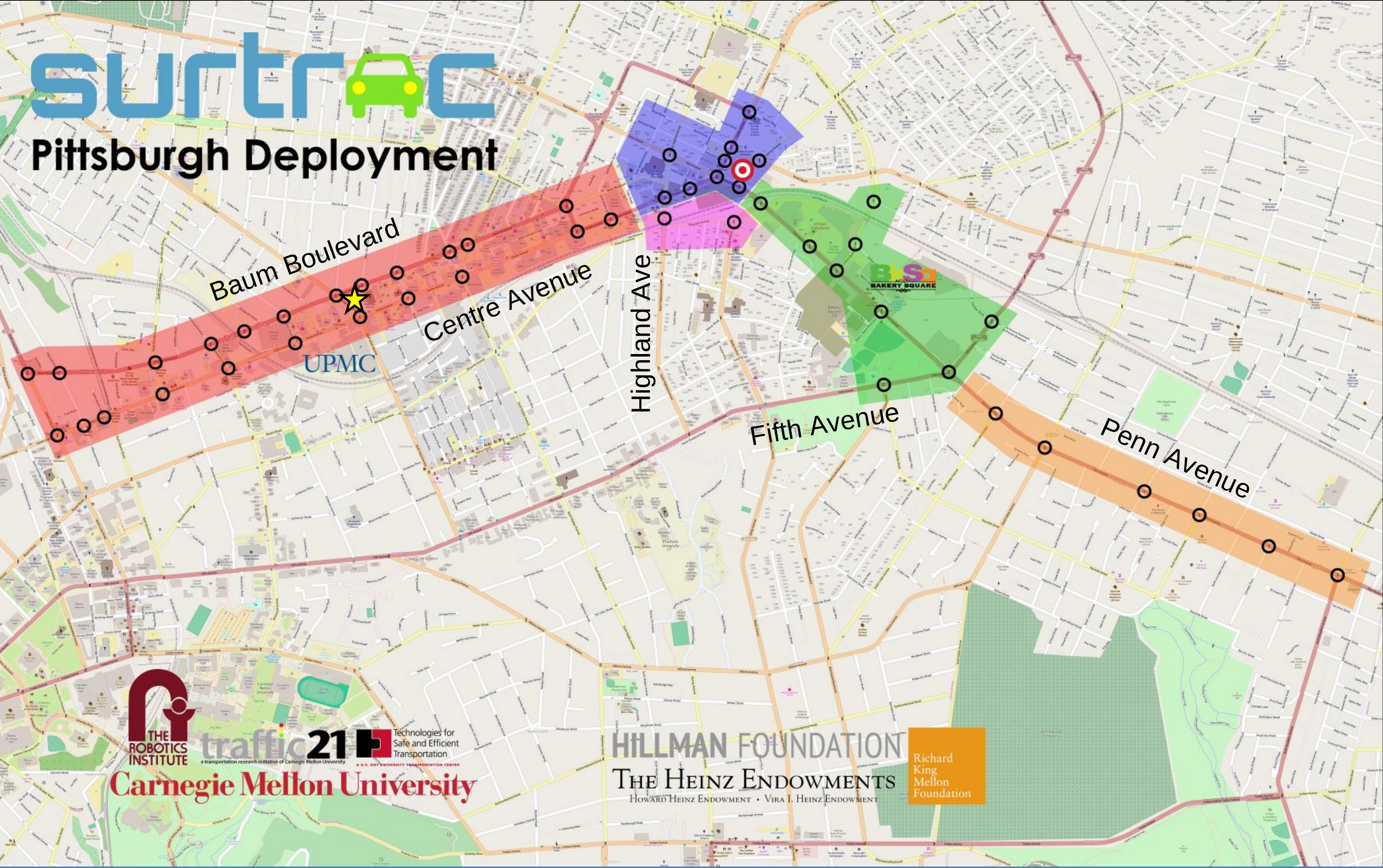
Many people know the frustration of waiting at red lights while no traffic is moving through the intersection. Modern traffic lights typically run on a fixed schedule, with police officers occasionally intervening during special events and emergencies. So-called smart traffic lights are already able to use cameras and road sensors to adjust their timing minute by minute to handle traffic and pedestrians faster and more safely. By collecting data and making decisions independent of human guidance, such lights harness AI to adapt to the randomness of traffic. Easing traffic congestion in this way would not simply reduce commuting stress, but it would also cut down on air pollution from idling cars. Carnegie Mellon University is **already testing smart traffic lights in Pittsburgh, Pennsylvania**, which are also being tested in Los Angeles, California, and Bellevue, Washington. By 2030, they will likely be on your corner.

Rapid Flow

surtrac
Scalable Urban Traffic Control

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



surtrac

intelligent traffic signals

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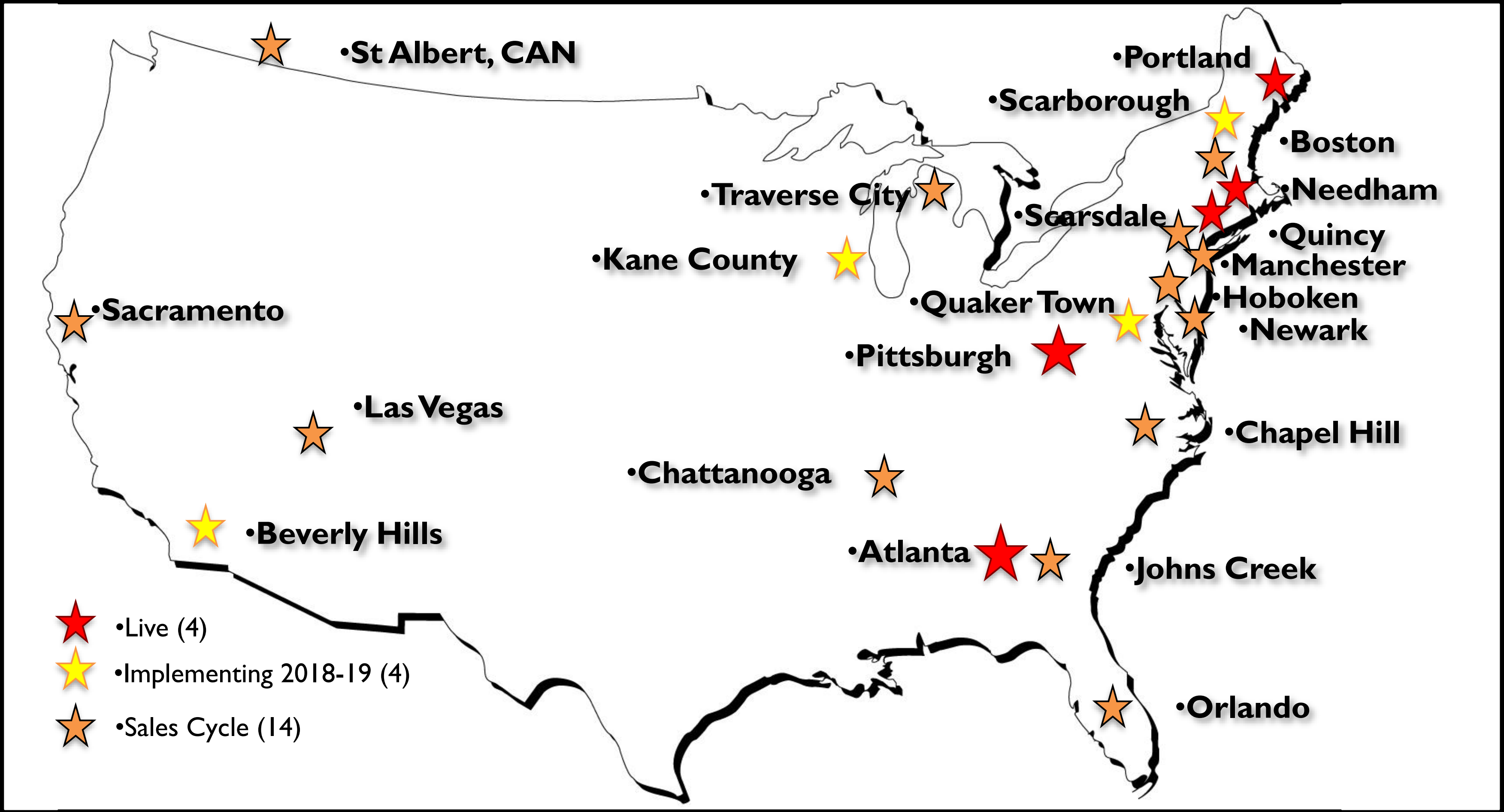
In the field ...

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

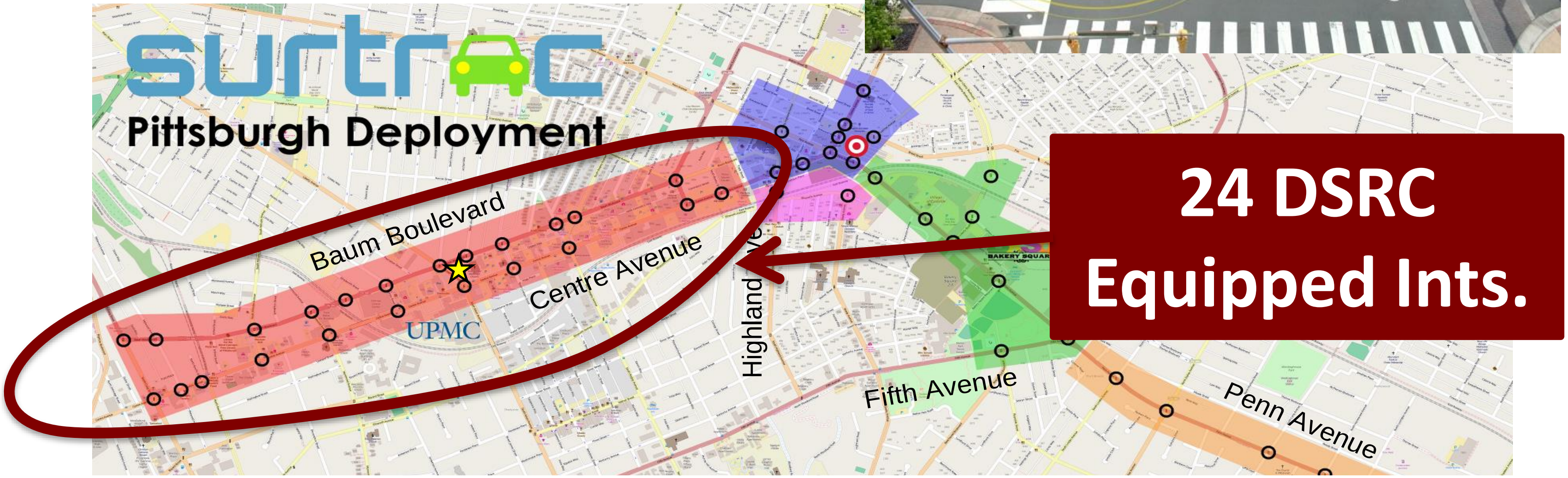
Broader Deployment



Rapid Flow

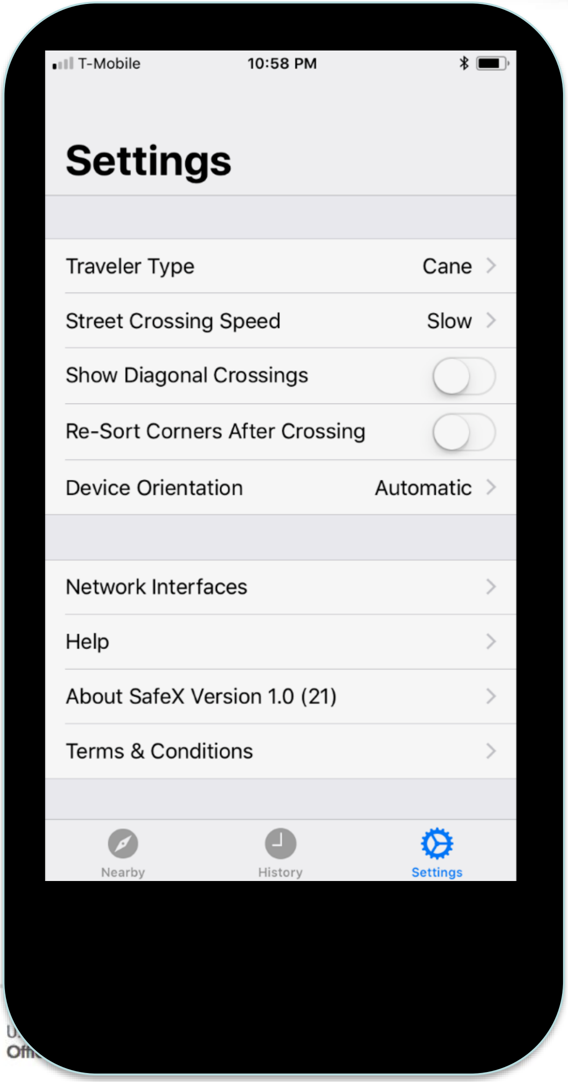
Integration with Connected Vehicle Technology

- Better sensing
- Use of mode, route information



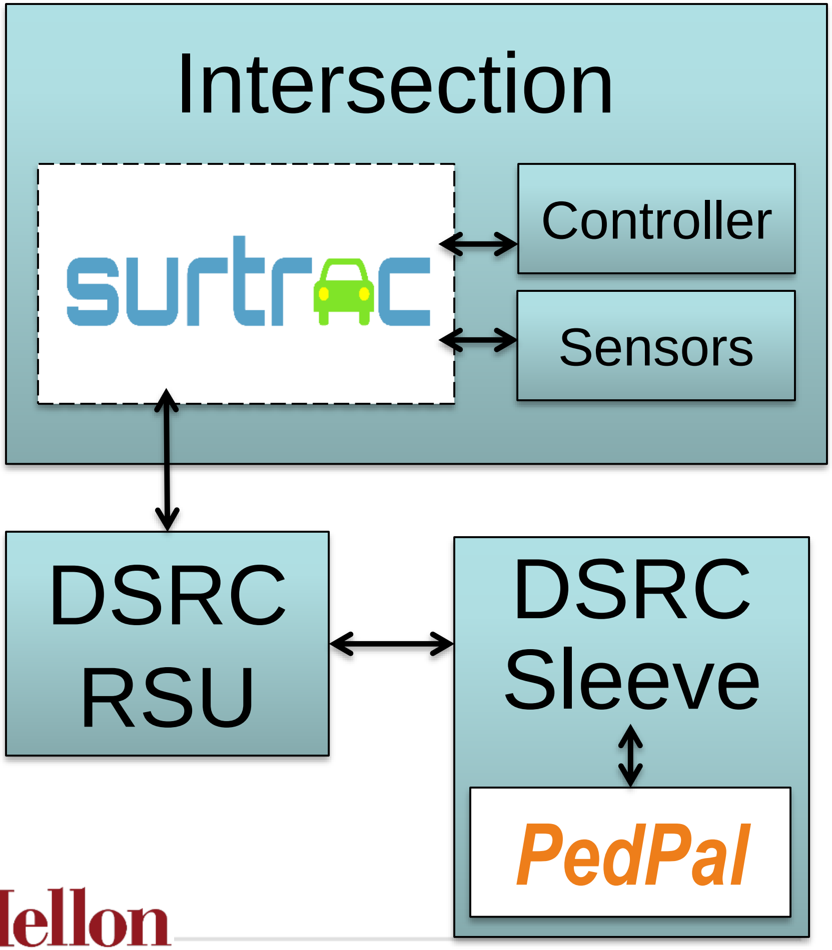
The *PedPal* Prototype

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



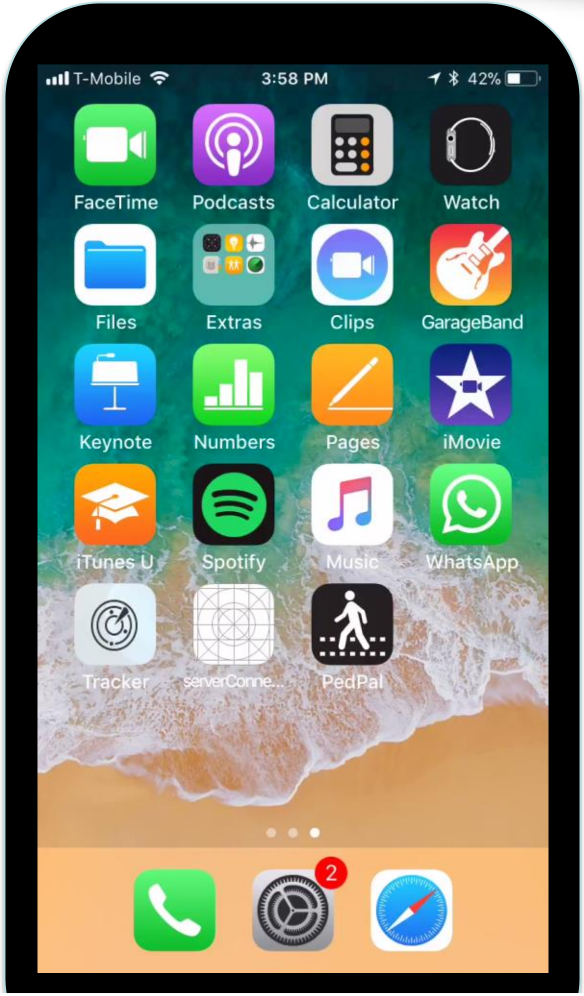
Overall System Architecture

- Communication via DSRC messages (J2735 2016 Std)
- Message encoding and decoding at each end
- Message transmission through RSU and sleeve



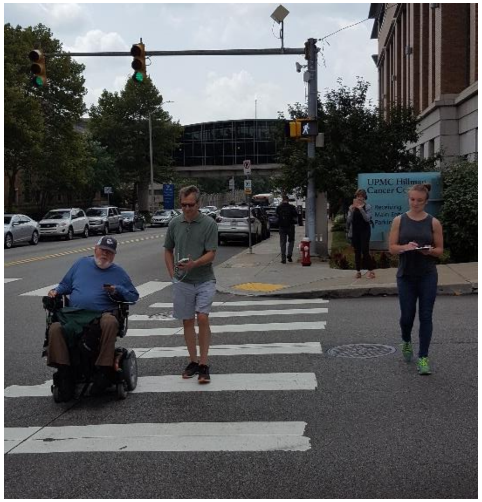
Basic *PedPal* Crossing Process

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



Results

- 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 opportuinties (e.g., with Blindsquare)