Remote PED Assistant
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Advanced Pedestrian Assistant

• What is it:
  – A handheld device for activation of pedestrian calls
  – Provides orientation and guidance information to user while in intersection
  – Interacts with traffic controller to protect user

• Why is it needed:
  – 4.3 million Americans are severely visually impaired
  – Incidence increases with age
  – By 2010, expect there to be 20 million visually impaired persons over age 45
November 2\textsuperscript{nd} 2006 Conference

- Infrastructure Problems: impediments for vision and mobility impaired

Inaccessible Pedestrian Button
- Difficult to find

Unusual intersection geometries
- Difficult to know if you’ve gone off course
November 2\textsuperscript{nd} 2006 Conference

- Infrastructure Problems: ergonomics

Difficult to re-orient after pushing the button

Difficult to observe pedestrian signals
- Difficult to know when to cross
Goals – Solve the problem

• Eliminate need for finding the Pedestrian Call Button

• Inform the intersection where the user wish’s to cross

• Provide the user with the state of the Pedestrian Signals
Goals – Solve the problem

• Track user in the cross walk
  – Provide navigational cues to the user
  – Extend walk time to ensure that the user reaches their destination
Goals – Remote assistant specifications

- Low power
  - Small battery
    - Light weight
    - Small size
  - Long battery life

- Low cost
Two Pedestrian Assistant Devices

UI system

Existing Hardware

Same intersection integration for both
System Integration

Advanced Smart Signals Pedestrian Call System

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TS1/TS2 – 170/270/2070 Traffic Controller

Signal Load Switches

Existing Pedestrian Call Inputs

EoP Modem

APS

Advanced Pedestrian Controller

Existing Traffic and Pedestrian Signals

Cabinet Power

APC Maintenance Interface

EoP Modem

APS

Advanced Pedestrian Assistant

EoP Modem

APS

Smart Signals Network

EoP Modem

APS

Smart Ped Signal
Remote Pedestrian Call and Feedback

1. APA pedestrian call APB
2. APB pedestrian call APC
3. APC places call in TC
4. APC reads pedestrian signal status from TC
5. APC sends signal status to APB
6. APB sends signal status to APA
Technology Selected – UI System

- Electronic compass
- Standard GPS
- Standard radio modem (IEEE 802.15.4)
Zigbee - IEEE 802.15.4

• Wireless communications standard
  – Non proprietary
  – Targeted low power devices

• AES data encryption
  – Approved by the NSA for encrypting “Top Secret” information

• Permanent unique hardware address
  – Allows for differentiating between multiple users
Remote PED Assistant

- Less than 1.5 in by 3.5 in
- Operate 5 days on a 9V battery
- Hardware costs less than $250
Technology Selected – Nokia 6210

• Nokia 6210 Navigator
  – Existing hardware
  – Magnetic Compass
  – GPS
  – Bluetooth (IEEE 802.15.1)
  – Java Runtime Environment (JRE)
  • Software APIs
Nokia 6210 Navigator

- Java Software APIs
  - Location
    - GPS Position
  - Sensor
    - Magnetic Compass Heading
  - Bluetooth
    - Communications with pedestrian controller
Bluetooth - 802.15.1

• Common wireless communication standard
• Cell phones are typically Class II Devices
  – “Medium” power
  – 10 Meters (Approx. 30 ft.)
  – Known issues
    • Limited range
    • Class I Bluetooth – (300 ft)
    • Cell phone ergonomics – application management
Pedestrian Direction Detection

Video of Nokia orienting a map based on user orientation
Remote Pedestrian Call

Remote APA call via Nokia cell phone
GPS Tracking

- Green – Crosswalk
- Yellow – Immediately outside of crosswalk
- Red – Danger zone
GPS Tracking Results

- 20 trials of walking 24 feet in a straight line
- Orange lines indicate the edges of a cross walk (8 ft.)
- All of the trials tracked the user within the cross walk
GPS Testing - Straight
GPS Tracking Results

• User travel waypoints:
  – (7, 20) ft North, East
  – (0, 40) ft North, East

• 25 Trials
  – Average < 4ft off at (0,40)
GPS Testing – Off course
HMI? – Your opportunity to guide us

• Device operations user input
  – Key press
  – Audible
  – User orientation
HMI? – Your opportunity to guide us

• Device operation output
  – Static information – intersection geometry
  – Dynamic information – Signal state
    • Audible
    • Vibrotactile
    • Other?
HMI? – Your opportunity to guide us

• How and when to give cues?

• Possibility for cues
  – Wait signal on
  – Walk signal on
  – Time left to cross
  – Distance to destination
  – Presence of an island
  – Preemption
Conclusion

• Research continues on methods for assisting at risk pedestrians in safely crossing signalized intersections
• Technology is promising but not reliable
• Nokia cell phone integrates navigational and orientation with communications
• Infrastructure is needed to enable this technology