Proposal Text

Problem Statement

Regardless of other modes of transportation, travelers and commuters are pedestrians at sometime during each trip. Recent reports show that the risk of the traveler when he or she is a pedestrian is an order of magnitude higher when the traveler is an occupant or operator of a vehicle. Why should the walk from the parking lot or bus stop be the most dangerous part of the daily commute? While elderly pedestrians suffer from loss of visual acuity, younger pedestrians are placing themselves at ever-increasing risk due to technology-based distractions.

As signal timing plans and intersection infrastructure get ever more complex in attempts to reduce vehicle delays at intersections, pedestrians are confronted with pedestrian operations that are shoehorned into traffic plans that so that pedestrians have minimal impact on the travel time for vehicles. Wide radius right turn lanes and roundabouts are long recognized as pedestrian dangerous intersection designs. Just as traffic controllers are programmed for customized operations at each intersection, so too must the systems that interact with pedestrians be customized to provide a consistency of expectation for operations.

Without consistent expectation, pedestrians, regardless of physical capability, lose confidence in the traffic controls and eventually enter the intersection based upon their own assessment of risk. Drivers who unexpectedly find a pedestrian in the street reactively slow down thus disrupting the flow of traffic or precipitating into a rear-end crash. Even worse, the situation can evolve in a vehicle-pedestrian crash. [1]

Modern accessible pedestrian systems require operations that can be easily and quickly customized to allow safe and reliable pedestrian access at signalized intersections. Without the ability to tune the pedestrian information for each intersection, pedestrians will be tempted to assume increased individual risks or are faced with confusing or conflicting directions resulting in unsafe actions. Our research seeks to provide direction and alert pedestrians of potential dangers in ways that are clear and quickly comprehended. The systems are for indented use by pedestrians possessing a wide range of physical and cognitive abilities.

Background

The Americans with Disabilities Act (ADA) of 1990 has had a great impact on the implementation of Accessible Pedestrian Systems (APS) that target accessible and safety impediments faced by pedestrians with mobility and visual impairments. There is evolving a new class of impaired pedestrians who are blinded by pervasive distractions.[2] Human factors studies now reveal that
human multitasking is a myth. The term “death by iPod” has been used to describe pedestrians who are killed when they walk into a busy intersection while distracted by operating handheld electronic devices. [3] The National Research Council publication, “Embedded, Everywhere” readily admits that there is no technology that is ethnically benign and naïve application of modern technologies can and does have unforeseen counterproductive results [4].

However, distractions are not always detrimental. Alerting a person to an impending danger is a positive use of distraction. The question now becomes, “How can technology be used to create a safer environment at signalized intersections with information directed to the intended audience at the proper level of attention?” Embedded within this question are the issues of time and information density. The proliferation of text based traffic signs that populate the structures adorning our intersections is an example an unintended distraction. Who has time to read all of these signs while driving at 35 mph at night on an unfamiliar street? With pedestrian countdown timers, drivers are now adjusting their driving speed based upon information intended for pedestrians.

There are similar dangers with audible pedestrian signals. Our experience is based upon the development of the Advanced Accessible Pedestrian System (AAPS) that is now being produced, marketed, and distributed by Campbell Company of Boise ID. The number of advanced features requested by the customers after the initial introduction in February 2010 indicates that either traffic agencies perceive or users request a much wider range of operating characteristics than can ever be provided by the fundamental open-contact pedestrian button. Our original client base for the advanced controls was the low vision community of pedestrians. With complex intersection geometries, pervasive distractions, and dynamic signal timing plans, the pedestrian stations are now required to provide more site-specific information to all classes of pedestrian.

Objectives

Pedestrian buttons are no longer a simple mechanical switch that indicates to the traffic controller that someone wants to cross the street. APS buttons are now verbal and vibra-tactile traffic signals. The immediate goals are:

1. Continue the development of the AAPS to unambiguously and accurately communicate the state of the visual traffic signals with a minimum of distraction.
2. Investigate new technologies for assisting pedestrians with limited physical and vision abilities to safely cross at signalized intersections.
3. Provide additional opportunities for intersection customization to improve safety for pedestrians at intersections.
4. Assess customization capabilities and recommend practices to help traffic agency engineers and technicians to determine when, how and where to use the advanced customized operations.
Approach

I. We organized a Pedestrian Assess Workshop for May 4, 2012. Attendees will consist of advocacy groups for the disabled, community planners, UI researchers, representatives of companies who manufacturer traffic control equipment, and traffic agency engineers. Attendees to this workshop will access and critique the features the AAPS now provides and make recommendations to direct further research to improve pedestrian controls.

II. Develop a risk-benefit plan for the concepts and ideas presented at the PED ACCESS Workshop.

III. Prioritized the development of new features and concepts and estimate the time required to complete the development.

IV. Establish a schedule for development, integration and test of the selected enhancements.

V. Test enhancements at one of the existing AAPS installations in cooperation with the governing traffic agency.

VI. Evaluate the effectiveness of the enhancements by user feedback from field tests.

VII. Report on the effectiveness of the approach and the success of the design meeting the research objectives.

Relationship to Other Projects

Initial research on Smart Signals Enabling Technology that is the basis of the AAPS started in 2004. Since that time, six electrical and computer engineering students have earned their Masters of Science degrees resulting from this research. Additionally, over 20 undergraduates have worked on this research effort, with two continuing for their master’s degree. Three of the master’s degree students are now working as equipment design engineers in the traffic industry. [5, 6, 7, 8]

Our research has resulted in two journal publications, six conference publications, eight conference presentations, and over ten colloquium and workshop presentations. In 2011, Richard Wall received the University Entrepreneurial Award in recognition of licensing the AAPS technology with Campbell Company.

Our affiliation with Campbell Company of Boise Idaho started in 2009. Since then Campbell Company has provided over $120,000 in research contract in support of AAPS development. Through the commercialization efforts of the UI researchers and Campbell Company, there are AAPS systems installed throughout the United States and Canada.

Over $825,000 additional funding has been received from the USDOT UTC program and the Idaho State Board of Education in support of the Smart Signals and AAPS research.

Expected Benefits

The primary expected result is to improve access and safety for all pedestrians at signalized intersections. It has been estimated that the total cost for each pedestrian fatality is in excess of $300,000. Equally important are the loss of
physical health and productivity for pedestrians who are injured in traffic crashes. The anticipated APS design enhancements will improve access at traffic intersections for people with impaired vision who are represented by a growing elderly population.

Campbell Company, with 23 full-time employees, is an ISO 9001 compliant company that designs, engineers, and manufactures pedestrian accessibility products that focus on the traffic industry - specifically the intersection crosswalk. The AAPS is manufactured and distributed from their Boise facility using 28 US distributees and manufacturer representatives. The AAPS is a major component in their business plan and accounts for 30% of their manufacturing effort. Enhancements to the AAPS will strengthen their sales opportunities. (See [http://pedsafety.com/pedestriansystems/aaps.html](http://pedsafety.com/pedestriansystems/aaps.html))

**Project Diversity Plan, if any**

Our research has a proven record of equal opportunities for women and minorities. Currently, half of the NIATT interns working on research in this area are women.

**Proposed Technology Transfer Activities (Implementation Report)**

The enhancements to the existing AAPS product line are covered by the existing UI / Campbell Company license agreement. The development, integration, and testing will be completed in cooperation with Campbell Company engineers.

**References**


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SELECTED PUBLICATIONS


TRANSPORTATION RELATED GRANT SUMMARY

USDOT UTC: $757,701
Campbell Company $122,187
Idaho Transportation Department $49,246
Idaho State Board of Education $114,400
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SELECTED PUBLICATIONS


