

Project Title: Intersection Safety for the Vulnerable

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Center Name: Safety21 National University Transportation Center for Promoting Safety

Research Priority: Promoting Safety

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Project Partners:

- Pittsburgh Department of Mobility and Infrastructure
- Easterseals Massachusetts
- Blind & Vision Rehabilitation Services of Pittsburgh
- PathVu

Research Project Funding: \$97,194.00

Project Start and End Date: 07-01-2023 to 06-30-2024

Project Description:

Vulnerable road users are considered people that are not in a vehicle and are, consequently, at a higher risk for serious injury because they have less crash protection than a vehicle occupant. Pedestrians, bicyclists, motorcyclists, and road workers are common vulnerable road users. Vulnerable road users can be further categorized by their degree of mobility, perception, and cognition. For example, running on a sidewalk in the middle of the day has an associated very low index. However, jaywalking across the road during rush hour might have a high or very high vulnerability index. The goal of the proposed work is to enhance the safety of the vulnerable at intersections because these are locations of planned conflict and thus have an inherent risk. To accomplish this goal, we propose a cyber-physical system that detects vulnerable road users, calculates a vulnerability index, then takes an appropriate action or actions to minimize the opportunity for injury. For example, if a person falls out of their wheelchair in the middle of a signalized intersection, all the traffic signals would stay red, emergency medical vehicles would be dispatched, and audiovisual warnings would be broadcast. Warnings could also be sent via wireless communication to personal devices and even connected autonomous vehicles. The core of the system is based on detecting the vulnerable in visual data captured from cameras. Accomplishing this task requires an annotated dataset of people with vulnerabilities, e.g., walking cane, bicycle, etc. There are some public datasets available with annotated wheelchair users for example, but not nearly enough vulnerable road users are available. To fill the dataset gap, we will deploy cameras in areas with expected high vulnerable activity. If we are unable to capture enough image examples, we will augment the dataset with synthetic images (e.g., project a 3D model of a man using crutches into an image) and/or perform enactments. Then we will train models for detecting the vulnerable, develop a method for calculating a vulnerability index, and develop a warning system. We have a longstanding deployment partnership with the City of Pittsburgh Department of Mobility and Infrastructure (DOMI). DOMI has already approved a camera deployment at the intersection of Forbes and Morewood. We also have a relationship with Easterseals Massachusetts in an advisory capacity for issues related to people with vulnerabilities.

Outputs:

We anticipate the following outputs: - Novel dataset of vulnerable road users - Algorithms for detecting vulnerable road users - Method for assigning a vulnerability index.

Outcomes/Impacts:

The result of this study is a system that identified vulnerabilities at an intersection then communicates that information to everyone at the intersection. This is achieved through wireless communication to personal devices or connected vehicles, audible alerts, and visual warnings. Widespread adoption of such a system would make navigating an intersection much safer for the vulnerable.