Virtual Guide Dog: Next Generation Pedestrian Signal for the Visually Impaired

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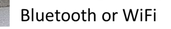
Introduction

Accessible pedestrian signal (APS) was proposed as a mean to achieve the same level of service required by the American with Disability Act (ADA) for the visually impaired (VIs). One of the major issues of existing APSs is the failure to delivery adequate crossing information for the VIs. Four most important aspects of pedestrian crossing for VIs are

- Locating the street (am I around an intersection)
- Street Recognition (e.g., street names)
- Intersection Assessment (how complicate the intersection)
- Crossing Roadway(Am I OK to cross)

GPS & Compass



Bluetooth or WiFi

Wireless Communications

Signal Controller

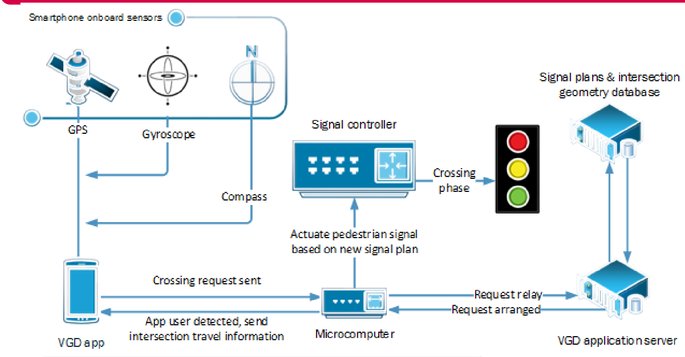
Mini PC (Raspberry Pi)

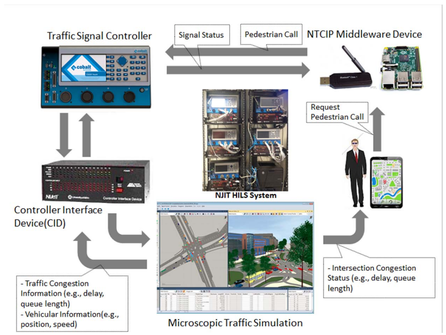
Bluetooth or WiFi

Major Function

- Constant GPS-based localization for a pedestrian on a roadway and crossing information based on proximity to the intersection
- Touch and audible user interface for users to exchange information
- Pedestrian phase actuation without the need to press the pushbutton
- Wireless communication with a traffic signal controller through Bluetooth

High-level Application Framework



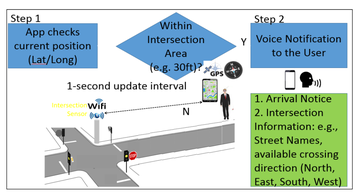


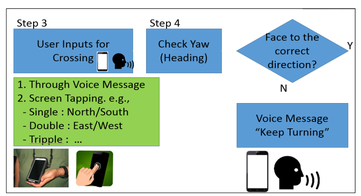
VGD Flowchart

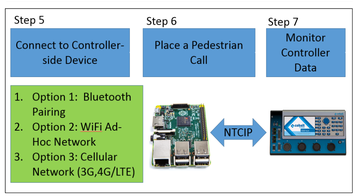
Step 0 : User Registration

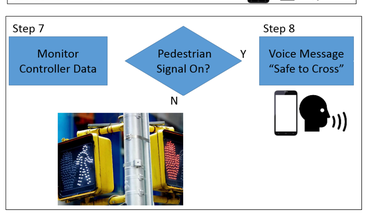
To identify qualified users and prevent potential misuse

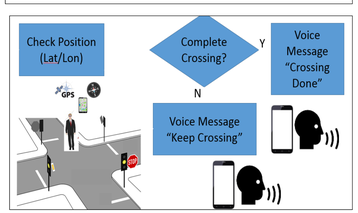
To register device information to detect qualified users: e.g., Bluetooth/WiFi MAC address, UUID, etc.



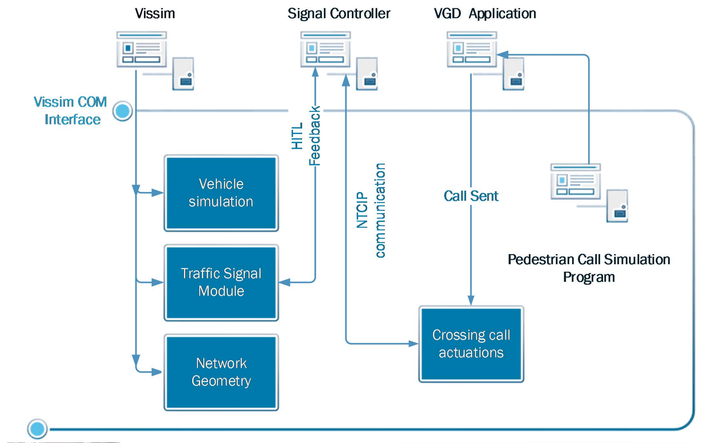


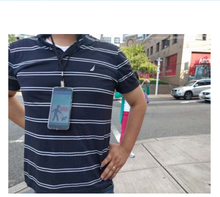


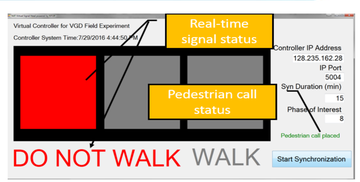




Hardware-in-the-loop Simulation

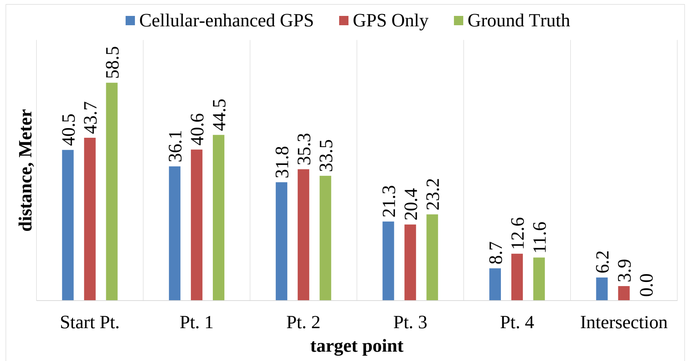






Proof-of-concept Test

Preliminary Results



- The VGD application could be an attractive alternative for conventional APSs for VIs.
- The cost of implement VGD is only a fraction of that of conventional APSs.
- GPS only mode exhibited more fluctuations than cellular-enhance mode: the deviation was jumping between negative and positive values among target points