

New app effectively aids blind and visually impaired commuters in finding bus stops

January 29 2024, by Ryan Jaslow



(A) Typical MBTA bus stop signs among the selected trial locations in downtown Boston. Very few bus stops in the area covered by the transit agency are sheltered, and the distinctive sign is often the only visual identification of the bus stop. (B) Operation of the All_Aboard app in the general vicinity of a bus stop. The lower inset shows the app detecting the bus stop sign (the bounding box is drawn around the detected sign in the camera view displayed on the smartphone screen). The percentage value around the bounding box indicates the confidence of detection. The upper inset shows a successful detection at night in low light conditions. Credit: TVST/Mass Eye and Ear

A team of researchers from Mass Eye and Ear have developed a micro-navigation smartphone app to provide assistance to those who are blind or visually impaired (BVI) in finding their bus stops, and a new study [published](#) in *Translational Vision Science & Technology* found the success rate of the app was substantially higher than that of Google Maps.

Current GPS systems have sufficient macro-navigation for planning routes using public transportation. However, micro-navigation, such as finding the exact locations of bus stops and destinations, remains an issue for people who are BVI, as GPS-based localization for this is less accurate. To combat this problem, the researchers developed a [mobile app](#) called [All_Aboard](#), which is meant to be used in conjunction with mainstream GPS systems and focuses on improving micro-navigation.

When a GPS indicates that a BVI user is nearing their destination, that is when All_Aboard should be opened. The app uses the phones' camera to detect street signs from 30 to 50 feet away. It then uses auditory cues to direct the user towards their destination, with the frequency of the sounds changing as they approach the endpoint.

The app is powered by [artificial intelligence](#), using a deep learning neural network trained on about 10,000 images of bus stops collected in a given city or region. The app is currently capable of recognizing bus stops in 10 major cities/regions around the world.

In the study, 24 BVI individuals used All_Aboard along with Google Maps to navigate a set route with 10 bus stops at an urban (Boston) and suburban site (Newton, Mass.). The results of the study were measured in terms of localization error and rate of successful localization.

Localization error, or gap distance, is defined as the distance between the desired destination and maps marked end point. The rate of

successful localization is the probability of getting close enough to the bus stops. The researchers found that in both urban and suburban locations, All_Aboard had a success rate of 93%, whereas Google Maps had a 52% success rate. Additionally, the average gap distance with Google Maps was 6.62 meters and 1.54 meters with All_Aboard.

GPS accuracy is supposed to be acceptable in suburban areas, according to Luo, who added it was not initially expected that the performance with Google Maps in Newton, Mass. would be so low. [Previous research](#) from Luo and his team found this problem may be due to widespread errors in bus stop location mapping data in Google Maps.

"Our findings suggest that the All_Aboard app could help travelers with [visual impairments](#) in navigation by accurately detecting the bus stop, and therefore greatly reducing their chance of missing buses due to standing too far from the [bus stops](#)," said Gang Luo, Ph.D., of the Schepens Eye Research Institute of Mass Eye and Ear. "This study indicates that computer vision-based object recognition capabilities can be used in a complementary way and provide added benefit to purely mapping-based, macro-navigation services in real-world settings."

More information: Shrinivas Pundlik et al, Field Evaluation of a Mobile App for Assisting Blind and Visually Impaired Travelers to Find Bus Stops, *Translational Vision Science & Technology* (2024). [DOI: 10.1167/tvst.13.1.11](#)

Provided by Massachusetts Eye and Ear Infirmary

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