Radio Frequency Identification (RFID) Technology for Transportation Signage Management

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Research Background

Traffic signage management is an important part of transportation asset management from an inventory management perspective. Signage management involves several key steps, such as locating signs and guardrail and terminals, checking their physical integrity and replacing those compromised or damaged, and recording their attribute data, as well as taking any other necessary actions. In order to implement these steps, a unique ID is assigned to each sign to facilitate interrogation, recording, and management operations of the signage data effectively. Traditional barcoding technology is ineffective due to its labor-intensive operation, lack of remote sensing ability, and easy susceptibility to performance degrading contaminations. In this study, we are exploring using radio frequency identification (RFID) as a novel technique to overcome limitations and achieve higher efficiency and efficacy of the operations.

Research Goals

The goal of this research is to investigate wireless RFID technology to develop a mobile transportation signage management system. The technology will involve three main functional elements: RFID reader, RFID tag and RFID software. RFID tags will be attached to traffic signs deployed along the roadway, and an RFID reader mounted on a survey vehicle will perform RFID tag interrogation and programming while moving at a driving speed. In addition, a backend database will be developed to manage the tag attribute data transmitted by the moving survey vehicle.
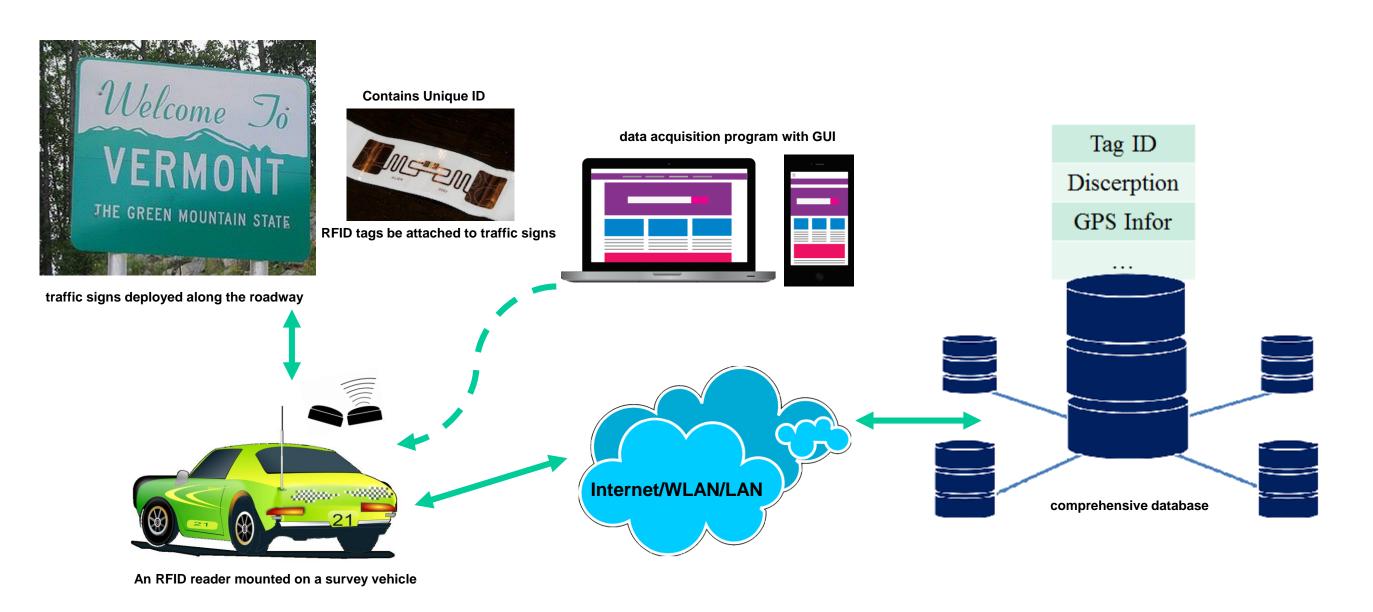

Figure 1. RFID transportation signage management system diagram

Methodology

- To investigate a vehicle-mounted RFID reader that performs remote RFID tag data interrogation from a moving vehicle.
- To investigate a handheld RFID reader that provides the additional flexibility of close range traffic signage interrogation.
- To investigate and evaluate RFID tags that can withstand harsh environmental conditions and can operate reliably on materials of different dielectric properties.
- To investigate the effectiveness of remotely scanning RFID tags mounted on traffic signs, with a focus on guardrail terminals.
- To develop a comprehensive database to support the RFID-based traffic signage management.

Preliminary Study

A commercial mobile RFID reader and a set of passive RFID tags were adopted in an experimental study. The experiments showed promising results where RFID tags could be remotely scanned in a moving cart.

Figure 2. Laboratory setup for preliminary experimental study

Potential Impacts and VTrans Benefits

A successful completion of the project will bring the VTrans transportation asset (particularly traffic signage) management capabilities to the next level, reducing costs while enhancing the efficiency and efficacy of the transportation services. The developed techniques will overcome challenges stemming from a *mobile* RFID system, and will have broader impacts beyond the State of Vermont.

Acknowledgments