Radio-Frequency Identification (RFID) Technology for Transportation Signage Inventory Management

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Introduction

Traffic signage inventory management is an important part of transportation asset management. However, since the traffic signs have no IDs, the matching and data recording into a database have to be done manually. Due to the large volume of the traffic signs deployed along roadways, such a manual process is tedious, error prone, and time-consuming. This project develops a novel transportation asset inventory management system employing RFID technology for traffic signage management (Fig. 1a). In this system, RFID tags are attached to traffic signs deployed along the roadway, and an RFID reader (Fig. 1b) mounted on a survey vehicle performs RFID tag interrogation and data processing while moving at a normal driving speed. In addition, a handheld RFID reader (Fig. 1c) is used to scan tags in close range, which renders the overall system more versatile to different operation scenarios. A remote database in the backend manages tag attribute data. The database server can communicate with both in-vehicle and handheld readers in real time.

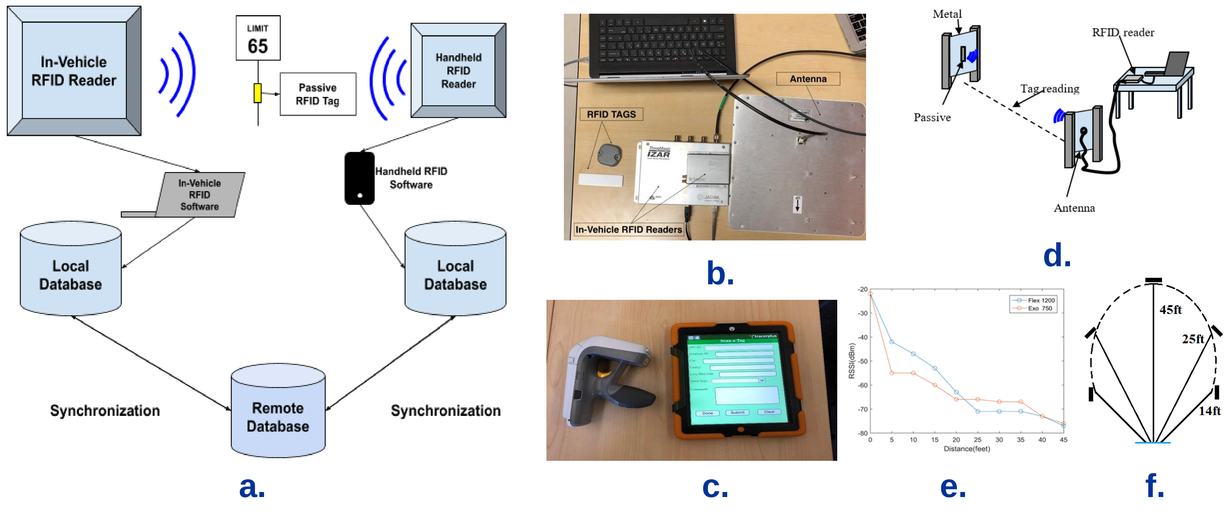

Figure 1. a) System overview; b) in-vehicle RFID reader; c) handheld RFID reader; d) lab test configuration; e) maximum reading distance; f) reading range.

Preliminary test

The developed system is evaluated comprehensively through lab test(Fig. 1d). Received Signal Strength Indicator (RSSI) is used as the primary metric to evaluate the maximum reading distance (Fig. 1e). The reading range is the area covered by the reader in detecting a tag (Fig. 1f).

Software

The reader software is developed based on the open source program of *Universal Reader Assistant* (Fig. 2a). We develop customized program to implement our own GUI functionalities: i) filtering tag IDs based on a designed criterion; ii) reading and displaying tag data and tag ID (EPC); iii) saving the tag data to a CSV file (manually and timer-triggered automatically); iv) writing custom EPC IDs to tags. The handheld reader is used for individual tag reads to display or modify the relevant tag information (Fig. 2b).

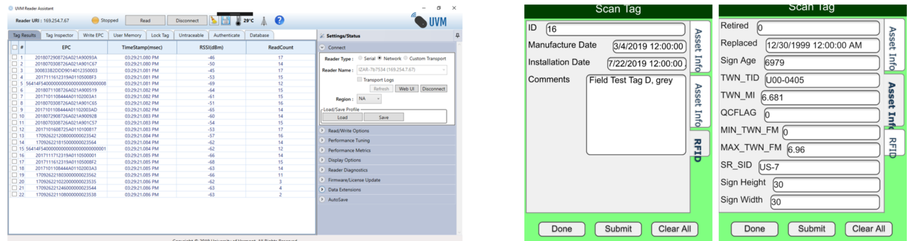

Figure 2. Software for a) in-vehicle reader; b) handheld reader.

Filed test

A comprehensive test is done involving both in-vehicle reader and handheld reader on a real traffic route (VT State Route 63) (Fig. 3). All tags on traffic sign poles and guard rails were detected at the speed of up to 55mph.

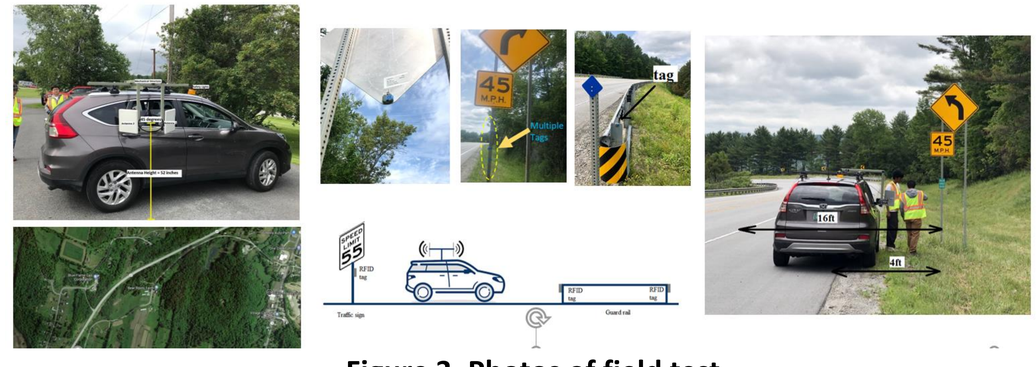

Figure 3. Photos of field test.

Acknowledgments

This research is funded by Vermont Agency of Transportation.
Project #: VTRC018-001

Reference:

W.Chen, J. Childs, S. Ray, B.S.Lee, T. Xia, "Integrating In-Vehicle and Handheld RFID Readers for Developing Traffic Signage Inventory Management System in Rural and Urban Environments," *99th TRB Meeting 2020.*