

Radio-Frequency Identification (RFID) Technology for Transportation Signage Inventory Management Tian Xia, Byung Lee, Wenzhe Chen, Joshua Childs, Saraf Ray **Department of Electrical and Biomedical Engineering**

Introduction

Traffic signage inventory management is an important part of transportation asset management. 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.

Laboratory 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 and performance (Fig. 1e). The reading range is the area covered by the reader in detecting a tag (Fig. 1f).

Software

A customized program (Fig. 2a) is developed to implement with a number of 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; 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).

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Field test

A comprehensive test is performed 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 are detected at the speed of up to 35mph.



Distance	Vehicle	Average signal strength	Reading Percentage			
(ft)	Speed (mph)	(RSSI)	Antenna1 (circular)	Antenna2 (linear)	Tot	
4	25	-64	100%	100%	100	
4	35	-65	100%	100%	100	
4	55	-77	100%	~	100	
16	20	-63	91.67%	100%	100	
16	35	-70	83.34%	100%	100	
34	20	-65	75%	100%	100	
34	35	-74	50%	100%	100	

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n) ReadCount	✓ Connect	Manufacture Date 3/4/2019 12:00:00	Replaced 12/30/1999 12:00:00 AM
17	Reader Type : Serial Network Custom Transport		Sign Age
14	Reader Name (1748-767534 (169 254 7 67)	Installation Date $7/22/2019 12:00:00$	6979
17			TWN TID UP0 0405
12	Iransport Logs	Field lest lag D, grey	000-0405
15	Refresh Web UI Disconnect		TWN ML C COL
15	Region : NA v		6.681
14	Load/Save Profile		
14	Load Save		QUFLAG 0
15		l o l	
16	Read/Write Options		
14	Performance Tuning	2	
12	Performance Metrics		MAX_TWN_FM 6.96
14	> Display Options		
14	Reader Diagnostics		SR_SID US-7
11	Eirmware/License Undate		
3			Sign Height (30
2	Data Extensions		
	> AutoSave		Sign Width (₃₀
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Figure 2. Software for a) in-vehicle reader; b) handheld reader.



Figure 3. Photos of field test.

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