SmartPhone as a CV Sensor

By Florida Department of Transportation

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Benefits Statement

Florida's Turnpike Enterprise (FTE) responded to delays in connected vehicle (CV) technology adoption by developing smartphone applications to serve as surrogate CV sensors. Safety applications, such as vehicle speed detection and wrong-way detection, were prioritized and tested at FTE's SunTrax Test Facility. Collaboration with stakeholders, including procurement and FDOT, ensured successful execution. FTE's efforts to leverage smartphone data contribute to enhanced road safety and mobility. These applications offer real-time alerts for safety conditions and can adapt to future CV expansion, promoting consistent safety experiences as vehicles transition to connected systems.

In this case study you will learn:

1. How Florida's Turnpike Enterprise developed smartphone applications to gather Connected Vehicle (CV) data, enhancing safety and mobility.
2. How FTE engaged stakeholders, including FDOT and procurement specialists, and communicated project progress regularly.
3. How he project yielded real-time safety applications like Vehicle Speed Detection, Wrong Way Detection, and more, utilizing smartphone data and cloud infrastructure to improve road safety. Future plans include early adoption incentives and extensive customer outreach.

Case Study #176

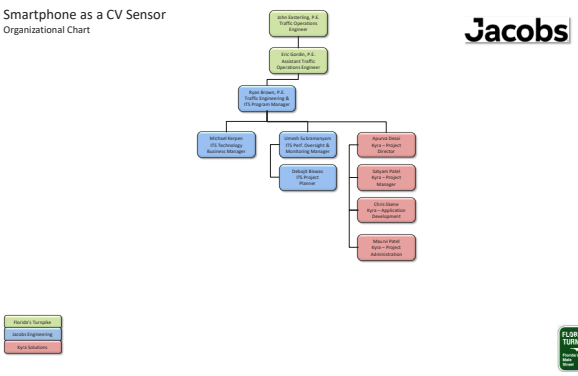
Version Number: 1

BACKGROUND

Florida's Turnpike Enterprise (FTE) has been observing market trends with connected vehicle technology and eagerly awaiting the implementation of CV On-board Units (OBUs) so that CV deployment could begin on a large scale and FTE customers could realize the safety and mobility benefits. For many years, Automotive OEMs were few and far between in announcing implementation of OBUs in new vehicles, with some commitments coming and going. As this back and forth continued, FTE leaders wanted to capitalize on research that has proven that smartphone sensors could be utilized to provide a surrogate for CV basic safety message (BSM) data.

TSMO PLANNING, STRATEGIES AND DEPLOYMENT

Excited, and faced with an unprecedented opportunity to accelerate the CV capabilities on FTE roadways and advance the CV TSM&O Strategy, FTE leaders and engineers began the concept development, requirements building/gathering, and technical design for an application that would reside on the smartphone and provide surrogate CV data. The team developed the contract and advertised a GSA Schedule 70 Scope of Services for application buildout. After selection and execution, work was performed methodically in an agile development process. Specific safety applications were grouped and prioritized based on safety benefit, application rule and logic development, and data necessary to satisfy the logic. Applications were developed and lab tested, then unveiled at FTE's SunTrax Test Facility with FTE engineers and CV subject matter experts. Applications reside in beta version available to selected users for testing purposes.



COMMUNICATIONS PLANNING AND EXECUTION

Communications began immediately with this project and covered many aspects of FTE's internal organization but also has gained significant traction within the broader FDOT. As the concept was realized and while it was being documented, FTE leaders and engineers worked diligently with procurement specialists to identify the most pragmatic procurement avenue for work of this nature, which clearly is not the traditional road construction, operations, or maintenance. Collaboration was successful with the procurement team, and collaboration began with the vendor and test facility staff to vet the requirements and logic parameters, and schedule the SunTrax test facility to prove the applications. The project-development itself included collaboration and awareness for all FDOT stakeholders via regularly scheduled Statewide CV Working Group Meetings. The applications have been-delivered and are highly configurable, scalable and transportable, which has received interest from FDOT Central Office as well as other Districts, to incorporate the data and/or alerts into other motorist feedback solutions, such as a revamped 511 application. In addition, as the application moves to market on the Apple and Android platforms and integrates with infotainment systems, FTE is concepting a loyalty program to provide an incentive for early adoption and a springboard to expansion. This latter phase will include extensive customer outreach and education to maximize use and resulting safety benefits.

OUTCOME, BENEFITS AND LEARNINGS

Through this project the team generated multiple successful safety and mobility-centric applications that can provide near real-time alerts to safety conditions along any roadway where adequate cellular coverage exists. The development process included many opportunities to learn about the technology and provide a better solution by applying this knowledge. The applications that were delivered and accepted by FTE engineers have many real-world benefits that will be realized by the public, communities, customers, and other engineers. These applications utilize smartphone data, however via the backend cloud infrastructure the applications can also ingest direct BSM messages from vehicles as CV expansion continues. This technology-agnostic platform will provide both near-term and long-term benefits for CV adoption as motorists have options to receive the alertfunctions today via their cell phone, and in the future via CV radio, allowing a consistent experience as the vehicle fleet transitions from legacy vehicles and smartphones, to trulyconnected vehicles.

The applications are as follows:

• Vehicle Speed Detection – This application can be used for curve warning, end of ramp / terminal, work zone speed warnings, stopped vehicle alerting, etc. This application usesGPS speed data and a pre-determined geofenced area to provide alerts when a smartphone/vehicle is in the geofenced area and exceeds the max or minimum speed.

• Disabled Vehicle Detection – This application is used to determine when a vehicle has stopped in a lane or shoulder for a pre-determined period of time. This application uses GPS location and speed to provide alerts to TMC and other approaching vehicles.

• Wrong Way Detection – This application also uses GPS speed and heading information to determine that a vehicle is travelling in the wrong direction, and generate alerts for the wrong way driver, the TMC and approaching right-way drivers.

• Queue Warning – This application uses GPS location and speed for multiple vehicles entering a dynamic geofence that determines when multiple vehicles have stopped to form a queue. This alert is sent to the TMC and drivers approaching the queue.

• Lane Departure - This application uses GPS location to determine when a vehicle has departed the roadway and shoulder area. When a lane departure is detected, alerts are provided to the TMC.

• Loss of Control – This application uses the smartphone's gyroscope to determine when a major shift in axis has occurred and transmits an alert to the TMC and approaching vehicles.

• Emergency Electronic Brake Light – This application uses GPS acceleration to determine when an emergency braking maneuver has been performed and generates an alert to approaching vehicles.