TACTICAL EDGE

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Tactical Edge's Total Visibility Anywhere (TVA) Platform Supports USTRANSCOM's Initiative to Explore the Limits of Near Real-Time Asset Tracking

The Cooperative Research and Development Agreement Designed to Compare the Limits of Cellular Asset Tracking to the Current Radio-Frequency Identification Technologies

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Tactical Edge, Inc.

Tactical Edge is a San Diego-based software engineering company, responsible for designing, developing, and deploying software solutions for the U.S. military and commercial clients. Supporting customers in San Diego, CA, Washington, D.C., Huntsville, AL, and Aberdeen Proving Ground, MD. Tactical Edge solves real-world problems using a combination of emergent and proven technologies, best practices, and innovative thinking.

Its product, Total Visibility Anywhere (TVA), was built in conjunction with the Office of Naval Research, Code 30 and Small Business Administration. Once accredited, it will bi-directionally communicate with various Department of Defense (DoD) Authoritative LOG Data Sources; including Integrated Development Environment/Global Transportation Network (IDE/GTN) Convergence (IGC) and Federal Logistics Data (FEDLOG). It queries a Big Data environment with Machine Learning algorithms to provide users with accurate and timely information about where an asset is now, as well as projects when it will be arriving to its destination. This allows subscribers of TVA to answer the ever-important questions of "where is my stuff?" and "will my stuff arrive in time for me to complete my mission?"

United States Transportation Command

The United States Transportation Command (USTRANSCOM) is one of nine unified commands of the United States Department of Defense. This command is the single manager of the United States' global defense transportation system. USTRANSCOM is tasked with the coordination of people and transportation assets to allow the US to project and sustain forces, whenever, wherever, and for as long as they are needed. Its mission is to provide full-spectrum global mobility solutions and related enabling capabilities for supported customers' requirements in peace and war.

Introduction

The effort with Tactical Edge and USTRANSCOM was conducted as a Cooperative Research and Development Agreement (CRADA). Tactical Edge volunteered its TVA system for a teamed USTRANSCOM/Tactical Edge field experimentations and demonstrations under the CRADA. USTRANSCOM looks to industry to explore innovative and emerging technologies that increase efficiency of the DoD supply chain.

For years, USTRANSCOM has relied on radio-frequency identification (RFID) technology to track

shipments in transit. However, RFID infrastructure is not as prevalent around the world as it is within the United States, USTRANSCOM is interested in experimenting with leading industry providers to discover if there are other options that would provide additional flexibility.

The Challenge

USTRANSCOM worked with its industry partners, including Tactical Edge, to track real packages that were in transit to posts around the world. The tracking devices, supplied to USTRANSCOM at no charge by the industry partners, were required to track the packages around the world and report position locations hourly for a period of up to 90 days. The position locations were formatted and submitted directly into the National RF-ITV Server.

The industry partners were free to submit any device of their choosing, and USTRANSCOM staff worked with the partners to ensure it was configured and attached correctly before the asset left port. As a baseline measurement for the effectiveness of the industry tools, the packages were also tracked using standard RFID technology.

Solution

Tactical Edge's TVA solution is a government-owned solution, developed in partnership with the Office of Naval Research and the Small Business Association through the Small Business Innovation Research (SBIR) program. At the conclusion of our Phase II portion of the SBIR, Tactical Edge will be able to offer Program Offices interested in the technology a sole-source procurement option, with the competitive portion of the contract having already been fulfilled.

Through our SBIR efforts, Tactical Edge has built a data service on a foundation of best-in-class COTS products, and tested it in high-latency environments across multiple devices and platforms. Our solution uses sensors to periodically send GPS updates to the data service. The data service associates those sensors with shipments. Manifests are then created for each shipment, and that relationship allows the data service to track the location of the shipments cargo.

While TVA has been tested with a variety of sensors, the ones used with the USTRANSCOM experiment came in durable plastic covers, allowing them to survive the harsh conditions experienced by the shipments while at sea.

The data service then makes the data available to other authoritative source systems. In this case, the data source was integrated with the National RF-ITV server.

In addition to sharing the data it collects, the TVA data service stores a local copy for its internal analytics. Those analytics are made available to the system users when they log in with a username and password, and other systems when they subscribe to the data service.

An additional benefit of the data service keeping a local copy of the data is that the data service can perform additional calculations. For instance, the data service can use historical data to determine the length of time a route normally takes, compare that where the particular asset actually is, and project with confidence whether the shipment will meet its required delivery date.

Implementation

For this worldwide demonstration under the CRADA, the TVA data service was hosted on Tactical Edge servers. The data service would push position reports received hourly to the National RF-ITV server, hosted on government hardware. Our tracking GPS sensors were sent to various distribution ports along the eastern seaboard and in Europe and attached to shipments using a combination of magnets and zip ties.

Installation instructions were provided with each of the sensors, and the USTRANSCOM staff verified each sensor was correctly installed through direct communication with Tactical Edge employees.

Results

The results from the experiment were encouraging, and are further elaborated on in the following section and in Figure 2 and Figure 3 below. The four sensors provided by Tactical Edge combined to submit over 3,000 position reports, with a combined success rate (defined as the message making it into the National ITV server) of over 99%.

Even though the scenario was designed to stress-test the various sensors, each sensor made it a minimum of 55 days, reporting 24 times each day. Under normal conditions, sensors would be reporting every 12-24 hours. Under those conditions, our team's expectations are that the battery life of the sensors would extend to a minimum of a year and a half.

For data tracking, TVA proved it was able to track shipments across the US and overseas, displaying

shipment movements into Europe, Africa, and the Middle East in near real-time. Over the course of the effort, Tactical Edge's TVA sensors moved thousands of miles without fault or other flaws.

Compared to the readings from the RFID tags placed alongside our tags, the National RF-ITV server received an additional 3,019 reports from the Tactical Edge sensors throughout the during of the trip.

An additional feature that TVA provides its users is the ability to turn position reports from a set of coordinates to points on a map as shown in Figure 1. Displaying these points on a map, or leveraging other visualizations and enrichments, provides a Logistician with additional context not provided by grid coordinates alone.

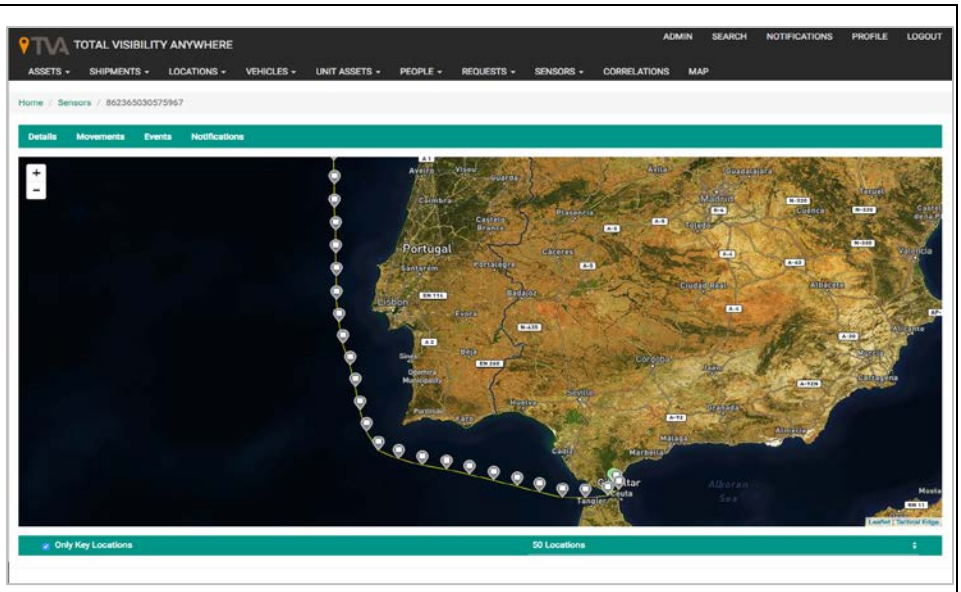

Figure 1: TVA Tracking an Asset off the West Coast of Portugal

Statistics

We will single out two statistics that best demonstrate TVA's success during our cooperative agreement with USTRANSCOM. One is the comparison between the total number of position reports submitted by the TVA sensors that were successfully received by the National RF-ITV server and the total number of position reports submitted by the TVA sensors that were not received by the National RF-ITV server. And the second is comparing the number of position report submitted by TVA sensors against the number of position reports submitted by the RFID tags.

Figure 2 below shows the disparity between position reports submitted to the National RF-ITV server by the TVA sensors that were received versus those that were submitted but NOT received. As the graph shows, only a very small subset of all position reports submitted were not received. Statistically, the system captured over 99% of the overall submitted position reports.

Figure 3 below compares the number of reports received by the National RF-ITV server from TVA to those received by the from the baseline RFID tags. As the graph shows, RFID tags were only able to submit a small fraction of the location reports that TVA sensors are able to because of the lack of infrastructure around the world. This difference in reporting frequency, coupled with the high percentage of accepted position reports, allowed TVA to provide logisticians more granular and accurate location information during the CRADA.

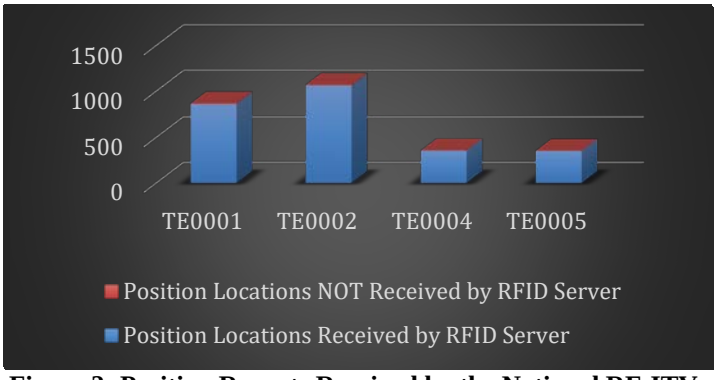

Figure 2: Position Reports Received by the National RF-ITV Server versus Position Reports NOT Received by the National RF-ITV Server

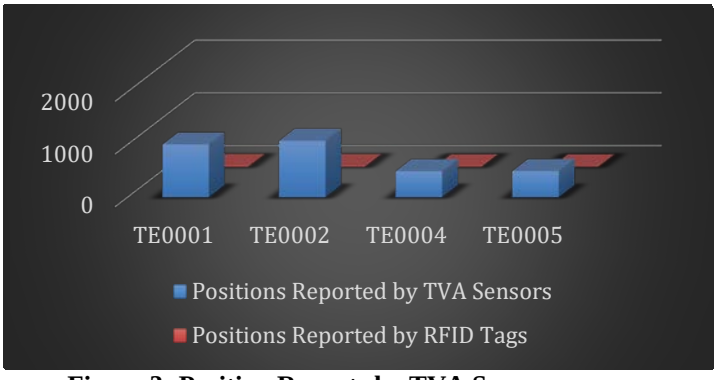

Figure 3: Position Reports by TVA Sensors versus Position Reports Submitted by RFID Tags

Conclusion

TVA provides capabilities beyond what, in some instances, DoD Logisticians currently have. They are asked to perform analysis on where an asset currently is without being provided with much context other than possibly out-of-date position reports and small action summaries. They are asked to manage their entire supply chain, focusing on every asset in motion. To perform this analysis, they need to reference multiple systems as asset locations aren't tracked by the systems that make the asset requests. And they are forced to perform this analysis from the confines of their desk.

With TVA, the system performs an initial analysis of all shipments in movement. It pulls in information from the disparate information sources, combining them to a crystal-clear picture of who needs the asset, where it is going, and whether it will arrive on time or not. Our system provides additional context by placing points on a map and providing additional information about points of embarkation and debarkation including its current weather conditions. TVA users are able to work where it makes sense based on the given task, as TVA is available across any device or platform.

Finally, TVA provides Logisticians with the ability to manage by exception. Our algorithms are constantly poring over and analyzing all the data that gets injected into our system. And then, using past deliveries as a baseline, we look at how current deliveries are performing and estimate whether the asset will meet the expected arrival date. As soon as the system determines an asset won't be arriving on time, an alert is sent to interested stakeholders allowing them to take action. This management by exception allows Logisticians to focus their efforts on getting troubled packages back on track, and to manage by exception or predicted exception, saving time and effort within the organization.

Contact Information

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