A Survey of Truck Tracking Implementation Issues

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INTRODUCTION

With the rise of terrorist activities in recent years there has been an increased interest in tracking the whereabouts and contents of trucks and other large land-based vehicles. Previous efforts to track trucks have largely focused on operational and efficiency issues. The research in tracking trucks has an established foundation of prior work that solves a different problem but has applications to the prevention of terrorist activities. Information systems have been combined with RF and satellite technologies to help trucking companies track vehicles since the early 70's. Current technology trends include the use of computerized maintenance management systems (CMMS) and application service providers (ASP) to help manage truck maintenance, and the use of Radio Frequency Identification (RFID) systems and local area networks (LAN) to track the status of trucks in a fleet. The most advanced of these vehicle tracking applications include components that disable vehicles using satellites. All of these approaches provide only a partial solution to the terrorist threat problem.

TRACKING AND CONTROLLING

In 2002 the U.S. Transportation Department conducted a two-year project to test satellite-tracking systems with devices that can disable a truck if an unauthorized driver takes control.[1] Such systems are already in use in countries such as Brazil, where hijackings are common. The major obstacle to this type of initiative is retrofitting all of the trucks in a given area. Efforts have been initiated to make this type of technology part of licensing requirements, but face resistance from trucking organizations because of the increased costs.

Technology from the Johns Hopkins Applied Physics Lab (JHU APL) has been applied to add efficiency to the vehicle inspection process. This project was trialed in Maryland on a major interstate, I95. When a truck approaches a weigh station on I95, it moves to the right lane, where sensors begin communicating with the unique transponder on board. Once the truck is identified, computers call up safety and infraction records. While the truck is still about a mile away from the station, it runs at highway speed over a scale embedded in the pavement. A light sensor measures the truck's height. Within seconds, software computes whether the various factors warrant stopping the truck for closer inspection. If not, the system signals the driver to keep going, making a stop at the weighing station unnecessary.[2] This same approach has been applied to a variety of other traffic monitoring and control applications such as tolls. In all of these implementations the truck requires retro-fitting with new custom devices and hardware.

Attempts have been made to combine technologies and utilize the existing transponders in trucks. These transponders provide positioning information but do not indicate the contents of the truck. To further reduce the cost and increase the resolution of locating trucks, GPS systems have been combined with cellular technology and even WiFi. The cost of these systems has decreased significantly over the past few years and most of the trucks on the road today contain transponders. However, these solutions only solve a portion of the problem in terms of security against terrorism. These systems identify where a truck is located but do not effectively identify the truck's contents.

INVENTORY IDENTIFICATION

Radio Frequency Identification (RFID) tags and sensors have been combined with GPS to not only track the trucks, but also inventory their contents. However, this is not effective unless the tags or sensors are placed inside of the truck or on its contents. Anti-terrorism officials concede that bombs are not necessary since many trucks contain cargo that is dangerous enough in itself. About 50,000 trips are made each day by gasoline tankers, many of which hold as much fuel as a Boeing 757, according to a New York Times article.[3] Identifying trucks containing this kind of material is a difficult task, beyond just tracking that a truck capable of carrying this material complicates the problem. Even if it were

possible to accurately locate and identify a truck carrying material to be used for terrorist acts, developing a system to collect, monitor, and alert based on this information adds a 3rd dimension to the problem.

A senior terrorism analyst for the federal government said American truckers needed to be alert to the heightened risk. "Information sharing is particularly important when a technique has been looked at or tried overseas.[4] In the absence of an efficient system to collect and manage information from tracking systems, significant amount of manual effort must be expended. The California Highway Patrol has hired 150 new officers to bolster patrols, said Dwight O. Helmick, the highway patrol commissioner. The state is also installing radiation detectors at weigh stations. Florida has ordered two gamma ray systems to scan trucks. They are similar to systems being installed at ports to scrutinize cargo containers. State officials said the scanners can identify small details inside an 18-wheeler in 10 to 20 seconds — including modifications hinting that a truck has been turned into a weapon.[5] These approaches while delivering a measure of success, requires a great deal of human interaction.

INFORMATION SYSTEMS AND DATA MANAGEMENT

The current systems are limited to tracking a single company's fleet or accessing state safety records. To be successful in preventing terrorist threats, a system would need to track not only the location of hundreds or thousands of trucks but also identify their contents dynamically. This would create volumes of data on par with the volume of data collected by credit card transaction systems. Business Activity Monitoring (BAM) systems are capable of handling this volume. A successful system would also need to address significant privacy and data security as well because it would hold a complete picture of truck movements and contents across corporate, public and private sectors. According to an article in Technology Review , Mike Russell of the American Trucking Associations says it [a tracking system with these features] smacks of Big Brother, and is an attempt "to use electronically collected information as an enforcement tool, and we have some serious concerns with that."[6] An article in "Fleet Owner" by Jim Mele gives a convenient overview of the existing tracking systems and some of their data limitations (http://www.findarticles.com/p/articles/mi_m3059/is_2_98/ai_97611247).

POLITICAL ISSUES

Any complete solution to this problem faces a myriad of issues in its implementation. Because of the stratification of transportation regulation, when implemented the system would have to cross federal, state local jurisdictions. At the federal level mandates could be made that required this level of tracking on vehicles carrying hazardous materials. But this creates the same problem as any regulatory law: criminals will simply not abide by the rules. There may even be complications with regulatory conflicts at the state and local levels.

Without an effective way to dynamically monitor the contents of any truck as well as its location this problem cannot not be completely solved. Dynamically monitoring the location of trucks and their contents has a tremendous social impact in terms of privacy. As with most security related issues there will need to be some balance between protection and civil liberties.

CONCLUSION

Several vendors such as Sprint, Qualcomm, 3M, Aether Systems, PeopleNet Communications, Delphi Electronics and researchers such as JHU APL have developed solutions to tracking trucks. However, these solutions largely addressed operational and logistical problems faced by the trucking industry as compared to the threat of terrorism. There has been additional research into addressing the requirements for the prevention of terrorist threats. The three obstacles facing any complete solution can be summarized as follows: identifying the actual contents of the truck, the cost of retrofitting trucks with modern tracking sensors or devices, addressing the political and social issues of implementing tracking/monitoring systems and management of the data. Any complete solution to the problem will have to address all four of these issues, not just the operational aspects. The successful solution is likely to combine technologies perhaps benefiting from emerging innovations such as sensor networks and smart dust.

REFERENCES

1. "TruckingSolutions.com | New York Times :: Possibility of Using Trucks For Terror," <http://www.truckingsolutions.com/terroristsusingtrucks.html> (21 Aug. 2004).

2. Gary Nurenberg. "G4 TechTV - Feature - Tracking Trucks Saves Time," May 21, 2002, <http://www.g4techtv.com/techtvvault/features/37812/Tracking_Trucks_Saves_Time.html> (20 Aug. 2004).

3. "nada.org - National Automobile Dealers Association," <http://www.nada.org/Content/NavigationMenu/MemberServices/AmericanTruckDealers/ATD_Headlines1/ATD_Headlines_110703.htm> (21 Aug. 2004).

4. PDE Publication. "Drivers.com: Trucks a real terror concern," Professional Drivers. 2002-10-22, <http://www.drivers.com/article/595/> (21 Aug. 2004).

5. "Drivers.com: Tracking trucks and tolls," <http://www.drivers.com/article/502/> (20 Aug. 2004).

6. "American City & County: Tools for tracking trucks," <http://www.findarticles.com/p/articles/mi_kmacc/is_200402/ai_kepm378101> (20 Aug. 2004).

17. "View by Component," <http://www.benefitcost.its.dot.gov/its/benecost.nsf/SingleLinkBenefits?OpenForm&Tax=Intelligent+Infrastructure+Commercial+Vehicle+Operations+Carrier+Operations+%26+Fleet+Management+AVL/CAD> (20 Aug. 2004).

8. "Tracking Trucks by GPS," <http://www.andrew.com/access/0502/articles/tracking_trucks.asp> (20 Aug. 2004).

9. "Innovation: New technology helps advertisers track trucks and impressions," <http://www.3m.com/us/about3M/innovation/truck/index.jhtml> (20 Aug. 2004).

10. "RFID Journal - RFID for Tracking Tools of the Trade," <http://www.rfidjournal.com/article/articleview/728/1/1/> (20 Aug. 2004).

11. "Truck Tracking For Mom And Pop Outfits," <http://www.alk.com/products/business/trucking/trucktracking.html> (20 Aug. 2004).

12. TrackYourTruck.com. "Vehicle Tracking, GPS Tracking, Automatic Vehicle Location," Copyright 2003, <http://www.trackyourtruck.com/uses.html> (20 Aug. 2004).