Police Technology Review

Independent Technology Review For Law Enforcement

Competitive Survey and White Paper of Automated License Plate Recognition (ALPR) Vendors

Police Technology Review

Independent Technology Review For Law Enforcement

REVIEW and Recommendations of License Plate Reader Vendors

Introduction

This report was originally produced under contract for a police department in the Western United States in a mid-sized city of 50,000 people with a force of 70+ officers. The original report has been modified to remove any information specific to this agency, so that it can be made available to other agencies as a tool in evaluating automated license plate recognition (ALPR) technology vendors' capabilities and claims.

Executive Overview

ALPR technology is not altogether new, but has evolved quickly in recent years and is now achieving rapid deployment with departments and agencies nationwide. These systems are a complex and expensive investment in public safety, so the selection of the right solution is important to avoid wasting budget dollars on equipment, training and deployment.

Of almost equal weight to the technology is the nature and financial security of the companies that offer ALPR technology in today's market. Buying the right technology from a company that may not be viable in the long-term can be a costly mistake. Likewise the service, support, training and upgrade policies of each company will be reviewed and reported, since these factors have a dramatic effect on the Total Cost of Ownership (TCO) of any technology.

Findings: The Bottom Line

Given the selection criteria and especially the inter-agency and intra-agency sharing of law enforcement-related data we conclude that the PIPS technology from Federal Signal provides the best alignment to this Department's short term and long term objectives when compared with other vendors in the market space.

PIPS' products, services, maintenance, support and product roadmap goals are aligned with the agency's. Specifically, in addition to the data sharing capability both between local ALPR users as well as other agencies, PIPS shows thought leadership and innovation by working with key business partners like Motorola and Carbon Motors.

The PIPS solution provides novice users with the ability to get up and running quickly and then use the more advanced capability of the system as their experience and knowledge of features expands.

PIPS also appears to be gaining a foothold in midsize and larger agencies in surrounding states, which will be key for inter-agency sharing of data for investigations as well as becoming a standard in various agencies. Several statewide sharing initiatives are already underway using the data sharing capabilities resident within the Back Office System Software (BOSS) offered by PIPS. A regional data sharing initiative is likely to emerge quickly among three or four western states that all have a critical mass of agencies using PIPS. Motorola's popular MW Series mobile data terminal (MDT), and Carbon Motors has featured PIPS in its purpose built law enforcement vehicle.

Taking all of these factors into account and recognizing that the PIPS system meets or exceeds every critical selection criteria, PTR strongly recommends the PIPS ALPR solution.

Background

Automated License Plate Recognition (ALPR) technology features state-of-the-art image-processing technology to find, "read" and identify standard automobile license plates in real-time. Current systems use infra-red illumination and a digital camera to take the image of the front or rear of the vehicle using what is termed a "frame-grabber." A powerful on-board computer running dedicated and proprietary software then processes the resulting digital image, with the license plate being extracted or isolated from the image. This plate image is further processed to extract the characters using Optical Character Recognition (OCR) software. Then the resulting plate identification can be used in many ways in support of public safety:

- Compared against a database of stolen cars
- Compared to current DMV records to insure currency of registration
- Compared against a database of scofflaws or unpaid vehicle taxes
- Compared against a database of wanted felons, Amber Alerts or terrorism suspects
- Stored for use by detectives in future crime prevention or investigation

Today's ALPR system's work autonomously with little assistance after initial set-up and calibration. Current systems are capable of scanning, processing and evaluating thousands of license plates per hour. This real-time, high volume capability allows the patrol unit to perform routine patrol while the ALPR system automatically reads nearby license plates. Then the ALPR system can immediately identify a stolen car and alert the officer, while they are still in close contact and can take immediate action to effect a stop.

ALPR technology may also be referred to by one or more of the following monikers/abbreviations:

- License Plate Reader (LPR)
- Automatic Vehicle Identification (AVI)
- Car Plate Recognition (CPR)
- Automatic Number Plate Recognition (ANPR)
- Car Plate Reader (CPR)

Overall Effectiveness

Current ALPR systems deliver a significant performance improvement over early systems that were subject to many limitations in practical application. Improvements in camera technology, the computational hardware, image processing software, license plate identification algorithms and OCR software have made the current crop of ALPR systems much easier to operate and far more robust and reliable. These systems are now gaining widespread implementation and are providing many departments and agencies with accurate, reliable and robust enforcement and investigative capability.

The Challenge of OCR

The Optical Character Recognition (OCR) portion of these systems is still one of the most challenging aspects of building a reliable ALPR solution. The environment in North America differs substantially from that in other parts of the world. Therefore, it presents challenges to many of the vendors that are based in Europe or the United Kingdom where license plates are standardized. License plates are a major source of revenue for many states, with many states offering upward of 200 unique plate types. Variables such as font or typeface, color of characters and background, and whether the characters are raised or flush, stacked, the use of special characters, specialty graphics, variable character spacing all affect the ability of the OCR software to effectively, quickly and accurately translate a digital image to data that can be used to interrogate a database. Other factors such as weather, ambient lighting and the condition of the license plate can all adversely affect the image captures, which impacts the ability for the OCR software to accurately interpret the image.

Based on the dynamic environment within North America, it is also important to consider a vendor's capability to respond to changes in a state or region. The successful ALPR vendor should have a library of OCR engines tuned to the specific state or region of interest. The vendor should also have resources dedicated to modifying and maintaining this library.

Keeping Up

The capabilities of OCR software are evolving and improving. Also, states continue to make changes to their plate protocols that require the ALPR system vendor to make changes to the OCR software. For these reasons, it is imperative that the OCR software be easy to update and that the vendor have a simple and effective method of maintaining the OCR software in each vehicle.

No Perfect Solution

Because many states use similar or even identical plate protocols, it is often difficult for the OCR software to distinguish one state from another. For this reason, it is still common to get false positives when the characters from a plate match those in the database when the plates are from different states. These false positives require the officer to distinguish the state of origin, sorting the false positives for the real ones. This annoyance can be mitigated with better OCR software, which delivers more reliable data.

How ALPR is Being Used

The most common application for ALPR technology is identifying and recovering stolen cars. In this application the ALPR system is set to read as the patrol car is on routine patrol. Plates are automatically read, compared to an on-board stolen database with an alarm sounded when a match is detected. The officer is then presented a display of the license and the reason for the alarm. They can then decide the appropriate action and manually confirm that the ALPR system did make an accurate match. It is not uncommon for these systems to read 8,000 or more license plates per shift and in high

activity areas to flag five or more stolen vehicles per shift. In some areas, notably Arizona, insurance companies are proactively helping to pay for ALPR systems because of the increase in stolen vehicle recovery.

In a similar application, the on-board database is loaded with the license plates of drivers with suspended or revoked operator licenses. In cooperation with insurance companies, the plates can be matched against a list of licensed vehicles that have expired liability insurance coverage or are known to be uninsured.

Enforcement of parking, delinquent taxes and other revenue violations is allowing many jurisdictions to increase revenue and thereby justify the purchase of ALPR systems.

ALPR systems can also be used to acquire and store license plate information flagging each read with the date, time and GPS location. This is often helpful in crime Investigation such a placing a suspect or witness at a particular location at a fixed time.

Elements of Typical ALPR systems

ALPR systems normally consist of the following units:

Digital Camera(s) – Specialized ALPR cameras are mounted on the police car (or fixed location) and take digital images of the subject car. Most applications use multiple cameras to cover a broad array of areas to the front, side, and rear of the patrol car. It is important to consider the size of the camera and mounting location of the cameras to meet the agencies' needs for covertness, and to also not obstruct visibility of the light-bar. In most applications, the smaller the camera the more utility it will have.

Infra-Red (IR) Source – The IR light source provides illumination for the camera in almost any ambient light condition day or night. IR is used so that the source is invisible to the human eye yet proves excellent illumination for the IR sensitive cameras. IR is also used because almost all license plates are highly reflective to IR, producing a very clear black and white image to pass to the OCR engine. Most advanced vendors have now incorporated the IR source and the cameras into a single small housing. It is important to make sure that the vendor has tested their IR cameras for Class 1 Eye Safety to eliminate any potential liabilities.

Frame Grabber – A proprietary hardware interface between the camera and the computer. The Frame Grabber grabs the digital image from the camera, stores it temporarily and then submits it to the computer for processing.

Computer – A ruggedized PC running either the Windows or Linux operating system which is loaded with the proprietary ALPR application that controls the system, reads the images, analyzes and identifies the plate, and interfaces with other applications and systems.

ALPR Software - The proprietary application and OCR software. In most systems, the OCR software is supplied by Dynamic Link Library (DLL) a specialist in OCR software.

Interface Modules – These modules provide the various interface capabilities between the ALPR system and other systems. Examples include networking interfaces, GPS interface and both digital and analog I/O modules.

Database – The database is a dedicated software application specific to the vendor that holds both the data to be matched (stolen plates as an example) as well as provides a place to store a large volume of plates that are read plus the date, time and GPS tags. Most systems also record the actual plate image and in some cases the drivers image as well in the on-board database.

Back Office Software - The back office software resides on a server in the agency and provides many functions: 1) User and hotlist administration, 2) Data aggregation from fixed and mobile cameras, 3) Data mining of previously collected data for investigations and pattern analysis, 4) Enables compliance to the agency's data retention policy, 5) Allows for sharing of data with other agencies, 6) Enables mapping of data for clustering and patterns, and 7) provides alert notifications to vehicles, email addresses, wireless devices, or other back office software.

Key Vendors Reviewed

After a market survey and overview of vendors in the ALPR market, it was decided that an evaluation would be made against the top vendors. This report evaluates vendors in this space based on interviews, feedback and demonstrations that were available at the time of this report.

It should be noted that one or more vendors were excluded for this report when they failed to respond to inquiries for information and/or it was found they had significant supply chain or financial issues. It was also determined that only vendors who had deployed systems on a paid commercial basis would be considered.

Vendor Analysis

Every vendor claims to have the best ALPR technology on the market and can do everything an agency would ever need to accomplish. In reality, each vendor has their strengths and weaknesses. It is therefore critical that any evaluation be done only after a careful review of requirements for a specific agency has been conducted. In this report we will review the vendors against the requirements set forth by the subject agency and how they would use ALPR technology to accomplish their objectives.

Agency Requirements

The agency is looking for an ALPR solution to address the following requirements.

They are listed in order of priority from highest to lowest.

1) Stolen vehicle recovery
2) Better Intelligence for investigations, gangs, Amber Alerts, Crimes Against People
3) Enforcement of outstanding registrations
4) Inter-Agency sharing of ALPR data for investigations

Ideally the chosen-vendors solution will provide a technological platform that enables officers to learn as novices, while allowing advanced users to utilize advanced features and capabilities without the need to reconfigure the system.

Customer/Industry Feedback (Good, Bad & They Ugly)

Interviews were conducted with several agencies regarding their use of ALPR and their experience with the vendors. Most people interviewed were not involved or proactive during purchase decisions and chose a vendor due to convenience or based on the basic features/functionality they saw at the time. People we spoke with were always very forthcoming and welcome any additional follow-up calls regarding their comments.

The interviews followed a format of understanding their involvement and role at the agency, their evaluation and purchasing process, key influencers and objectives needed, and finally where the final purchasing authority approved the vendor.

In most every instance, ALPR was evaluated by someone that either had read about it in an article or had been contacted by a sales person at a show or thru a network contact. General advertising provided an awareness of the vendor but the motivation to take action was based on reading the article or speaking with a salesperson based on an overall objective a sergeant or command-level person had outlined for the agency in their yearly goals and objectives. In other agencies, officers in task forces that had experienced another agency utilizing the technology to gain a significant advantage generated initial interest (the "word of mouth" scenario).

Nearly everyone conducted some preliminary research which quickly narrowed the search down to two to three vendors. Once they had narrowed the vendors, they would request system trials to prove a certain set of objectives. The success of these trials was usually limited to the level of participation and technological understanding of the officer using the products. Most recent purchases were allocated thru grant funding..

Many people also felt that the agencies were late adopters and waited to see the technology being used successfully by other agencies before making a decision. No one wanted to make a poor purchasing decision and would look to their officer network to learn who was good, what worked and what didn't, and who provided good support pre- and post- sales.

The primary objectives for which most agencies used the ALPR were;

1) Identification of stolen vehicle and plates, warrants, wanted persons and registered owners,
2) Data collection for investigative purposes,
3) Amber Alerts and attempt to locate vehicles of interest.

Recently, given extreme budget cuts, agencies are formalizing their evaluation, purchase process and buying criteria, which lends itself to a more consistent purchasing decision. Officers that might have been impressed with an initial vendor's demonstration and purchased have learned to evaluate not only the technology but the organization and the individuals that stand behind the technology.

Finally, agencies that have made thoughtful process based decisions have had the most success with their initial purchases, deployments and subsequent add on purchases. Almost without exception, these agencies independently selected PIPS.

Vendor Comparison

The following table was prepared for the original agency, and completed by PTR to aid in the agency's evaluation of available vendors. This table has been cleansed of the original research, and it is encouraged for agencies to use this table as a format for conducting their own research in evaluating the available vendors.

Criteria	PIPS	Competitor A	Competitor B	Comments
Business Organization	Public - FSS			NYSE
Ownership	Federal Signal Oakbrook, IL			Stock Symbol: FSS
Location	Knoxville, TN			PIPS: Closely integrated engineering, sales, and service organizations
Management				PIPS: Management is stable & seasoned having been acquired by FSS
Innovation	Leader			PIPS: Innovative Leader in ALPR Technology (see Note 1_
Qualified Diversity Enterprise	No			
Engineering - SW	Knoxville, TN			PIPS: All technology including hardware engineering, OCR Development, and software engineering based in USA.
Engineering - HW	Knoxville, TN			PIPS: Release schedules for hardware and software updates and patches seems by far the most frequent and predictable
Service & Support				
Installation	Included			PIPS: Installations done by licensed contractors not sales people or untrained amateurs
Training	On-Site Included			PIPS: Professional trainers offer training on-site making training more professional & consistent.
Hardware Warranty	1 Year – FSS Backed			

Software Warranty	90 Days – FSS Backed			PIPS: Only 90 days but backed by FSI
Hardware Repair	Return for Repair*			See note under loaners.
Loaners	Yes Under Premium Maintenance Package			PIPS: Premium Maintenance Package provides for onsite service replacements; otherwise, return for repair
Software Support	1 Year - 24/7 Call Center			PIPS: Professional Call Center manned 24X7
Hardware Upgrades	1 Year			
Maintenance Agreement/Extended Warranty	Yes			
Offer SLA (Service Level Agreements)	Yes			PIPS: Written policy available for review
Pricing/Terms				
Initial System Cost	Competitive			Recent price decrease with new camera platform
Optional Equip Cost	Yes			PIPS: Menu style pricing - pay for feature set and options you need. Not one size fits all.
Cost of Maintenance	Average			
Cost of Infrastructure	Average			
Total Cost of Ownership (TCO)	Lowest			PIPS: Given this criteria has the lowest TCO of all units and companies evaluated
Standard terms	Net 30			
GSA Contract	In Works			
Made in USA	Yes			
NASPO HGAC Ohio DAS Target Safe City	Yes Yes Yes Yes			See Notes 2 & 3
Other Master Purchase Agreements	State of NY			

Summary Viewpoint ~ Caveat Emptor

Considering all factors from technology, from how the units will be used by this specific Agency to various business and commercial factors, including price, total cost of ownership, deploy-ability, and performance, it is the recommendation of PTR to the agency that the PIPS solution from Federal Signal best meets the selection criteria.

It is important to note that all three companies offer good units but for this specific agency at this specific time, PIPS is, in our opinion, the better solution.

That being said, it should also be noted that there are no "perfect" solutions and the purchase and deployment of any system as complex as ALPR technology will require financial, resource allocation and organizational policies to support the systems during deployment and during the term of ownership.

Care should be exercised in negotiating the best price and terms of sale as well as post-sales support commitments from the final vendor as these factors can make a significant difference in the overall cost, performance and reliability of any complex system.

Officers and/or agencies that have access to reports specific to law enforcement would be wise to utilize the technical process/matrix that the report in Appendix A highlights.

Key Vendors in ALPR for Law Enforcement

A Federal Signal Company

PIPS Technology
http://www.pipstechnology.com

PIPS Technology, a Federal Signal company, is the worldwide leader in automated license plate recognition (ALPR) technology, according to a market research study published by IMS Research in 2005. PIPS designs, manufactures, and supports its complete line of ALPR products and services for use in law enforcement, parking, tolling, and intelligent transportation systems. PIPS maintains its worldwide headquarters in Knoxville, TN, and also maintains offices in California, and the United Kingdom. Federal Signal, headquartered in Chicago, has more than 100 years of experience providing innovative solutions to improve public safety and security.

With over 17,000 cameras deployed around the world and a wide range of patents covering its technology and its application, PIPS Technology is easily recognized as a leading provider of traffic related video imaging and license plate capture technology. See PIPS Technology in action at www.youtube.com/fedsigpublicsafety.

Elsag
http://www.elsagna.com

ELSAG North America Law Enforcement Systems is dedicated to providing proprietary advanced Automatic License Plate Recognition (ALPR) systems and other innovative imaging technology to North American law enforcement.

Elsag's goal is to support law enforcement in their missions of public safety and homeland security with Automatic ALPR capabilities and other related technologies aimed at advancing and expanding those missions. The MPH-900 is deployed in hundreds of agencies across the United States, with nearly 4,500 deployments worldwide, all of which are supported by a 24/7 commitment to customer service.

ELSAG North America Law Enforcement Systems is a Finmeccanica company, a global leader in defense and security solutions. Elsag is headquartered in Italy, with North American headquarters in Brewster, NY.

Vigilant Video
http://www.vigilantvideo.com/

The CarDetector™ – Mobile LPR Edition video analysis engine automatically scans, detects and performs license plate recognition (LPR) for mobile law enforcement vehicles. When any license plate is detected in the mobile video camera's field of view, powerful adaptive optical character recognition (AOCR) engines extract the plate image, apply image enhancement filters and analyze each individual character of the plate, regardless of the plate colors or backgrounds. Mobile LPR Edition is a proven way to enable police cruisers to detect stolen or suspect cars automatically by driving on the highway or while passing through a parking lot. This technology automatically triggers "in-car" audio/visual alarms based on LPR "Hot-Lists" associated with stolen autos and other criminal activities via matching against federal, state and local databases. Download the Product Data Sheet by clicking here.

Platescan
http://www.platescan.com

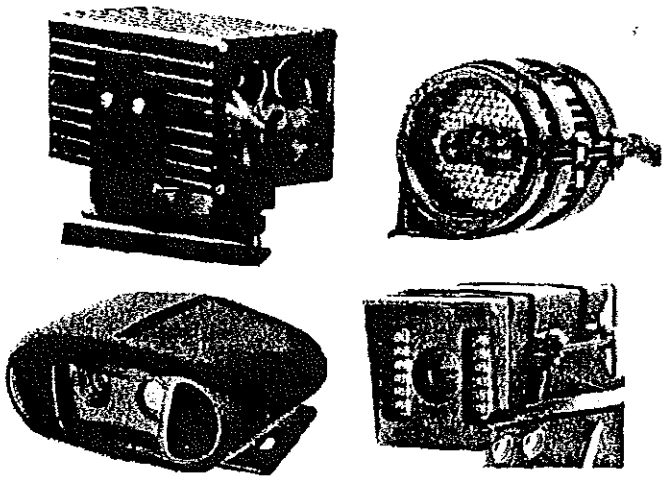
PlateScan, Inc., is a privately held, Newport Beach, CA-based Company with offices in New York, NY, Dallas, TX, Columbus, OH and Asheville, NC. Originally a division of Civica Software, it has recently been incorporated as a stand alone company in order to focus exclusively on providing its customers with the very highest standards of Automatic License Plate Recognition software and hardware, including a robust suite of data analysis software.

Genetec Inc.

http://www.genetec.com/English/Products/Pages/license-plate-recognition.aspx

AutoVu™ is a license plate recognition (LPR) solution developed to read vehicle license plates from practically all states, provinces and countries in the world. This rugged and fully integrated solution facilitates the vehicle identification process by automating the recognition of vehicle plates. AutoVu is used within a variety of fixed and mobile applications such as wanted vehicle identification, city-wide surveillance, parking enforcement, parking permit control, vehicle inventory, security and access control and by numerous organizations found throughout industries such as transportation, education, retail, gaming and more.

Appendix A - Department of Homeland Security SAVER report



SYSTEM ASSESSMENT AND VALIDATION FOR EMERGENCY RESPONDERS (SAVER)

Mobile License Plate Recognition Systems Assessment Report

October 2008

FEMA

U.S. Department of Homeland Security
SAVER

Prepared by Space and Naval Warfare Systems Center, Atlantic

NOTE: This report is restricted to Law Enforcement Personnel ONLY and is therefore not included in this report. It is available to authorized law enforcement personnel.