License Plate Recognition Technology

Innovation in Law Enforcement Use

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Over the past several years, nationwide attention has focused on using technology to deter terrorism; tighten U.S. borders; and allow local, state, and federal law enforcement agencies to share information. However, technology also has allowed police throughout the world to fight street-level crime. In many policing magazines, advertisements abound about technological advancements in internal affairs tracking software, communication hardware, automated fingerprint identification, voice stress analysis, and crime mapping.

One area of technology growing in leaps and bounds, however, has not garnered much attention. License plate recognition (LPR) software and hardware has gone from something only dreamed about in movies to a viable technological tool for local police and sheriff's departments. While certainly not perfect yet, the technology available today can be used to search for vehicles listed in AMBER Alerts, identify those driven by wanted persons, and recover ones reported stolen.

BACKGROUND

Known by many names, LPR technology employs cameras and computer software to discern the letters and numbers of vehicle license

plates and then compares them with records contained in state and federal databases. While recognition software (used to "see" the letters of the license plate) has become increasingly more accurate over the past several years, early programs had severely low recognition rates. Initially, cameras used to obtain images of vehicles—and, therefore, license plates—had to be mounted in a fixed location. New technology allows the imaging cameras to be placed on the front or roof of a vehicle or in a patrol unit's light bar. Where LPR technology originally supplemented or replaced other identification devices (e.g., bar codes or radio equipment) to allow access and egress from secure facilities or charge fines or fees for travel or parking, new applications can enable the user to check information against department of motor vehicle or NCIC records.

Initially designed for use in parking lots (to record the time a vehicle entered), for access control (allowing authorized vehicles into a secure area), and for paying tolls, LPR technology recently has expanded into the realms of border control, identification of stolen vehicles, and traffic-fine enforcement (e.g., red-light running), with vendors marketing systems specifically for use by the law enforcement community.

Combating auto theft represents a particularly applicable use of LPR technology. Law enforcement agencies throughout the United States constantly seek tools to locate and recover stolen vehicles, with the ultimate goal of making arrests that not only help solve open auto-theft investigations but other crimes as well. For example, crime analysts often track auto theft as a precursor to robberies.

LITERATURE REVIEW

As early as 2000, immigration officials in the United States and Canada began promoting LPR technology and cargo X-ray scanners.[1] In 2005, patrol stations along the U.S.-Mexico border also incorporated the technology to record the entry and exit of vehicles.[2] However, little academic research on LPR technology has occurred in the United States.

One of the most complete studies, conducted during a 4-month evaluation period in 2004, examined the effectiveness of the technology in identifying stolen vehicles and license plates, as well as vehicles driven by wanted felons.[3] While the review of the technology was generally favorable, the report indicated that the software produced over 1.8 million scans during the research period but caused 3,286 alarms, of which 108 were positive (meaning the license plate characters and state matched a valid entry in the computer system). Of particular interest, the study found

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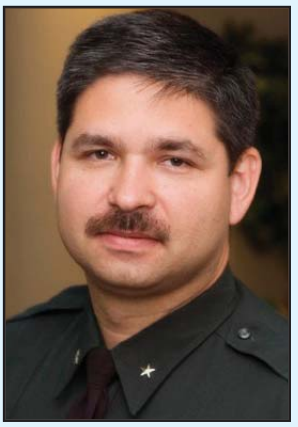

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Case Example

An unmarked police vehicle equipped with mobile LPR technology located an occupied vehicle involved in an armed carjacking 3 days earlier in a jurisdiction several counties away. Local officers had not received any notification concerning this stolen vehicle. Moreover, the perpetrator had driven carefully to lessen the chance of being stopped for traffic offenses. LPR technology "saw" the license plate, ran the number through NCIC, and reported a "hit." The officer obtained pertinent suspect information that matched the occupant of the vehicle, and tactical units effected a traffic stop. Detectives recovered the firearm involved and subsequently solved several other crimes

that the reader could not match stacked or small characters on a license plate. At least one of the companies that produced the technology for LPR claimed that the device could prove instrumental in thwarting terrorist attacks. However, if the system cannot read stacked or small characters (often found on state commercial license plates), this issue becomes moot.

In Europe, the British Home Office also conducted research on the effectiveness of this technology. The pilot study showed that officers using the mobile plate recognition technology produced 100 arrests per officer per year—10 times the national average per officer.[4]

THE TECHNOLOGY

LPR technology involves cameras that feed information into a central processing unit (CPU) that then "reads" the license plate, converts it into optical character recognition (OCR), and then attempts to match it with "hot" plates listed in a state or national database. Currently, the systems usually do not conduct live inquiry into a government database. Instead, users download information daily to keep queries to NCIC and state databases at a minimum. The information is then sent to an agency-supplied mobile data terminal (MDT), usually a laptop.[5]

Types of Units

LPR units come in fixed configurations for mounting on light or sign posts for areas that pose special concerns for particular jurisdictions. Fixed-mount devices require a central dispatch site (possibly also a suitable place to store a central server for the LPR) to verify alarms from multiple locations. This proves crucial because false positive alarms may lead to sending officers on unnecessary calls. The personnel assigned to the fixed LPR conduct confirmation transactions, such as a criminal database check and a visual inspection of the plate photograph. The OCRs currently in use cannot discern license plates from different states or territories and also may read markings on commercial vehicles and confuse them with license plates. Additionally, some fixed-mount units rely on vehicle speeds of less than 35 miles per hour, so selection of an installation point becomes critical. Ideally, agencies should research suitable locations that can cover the traffic present. The more lanes of traffic monitored will require additional fixed-mount devices. LPR cameras typically can perform under low-light conditions, but, in some cases, agencies may encounter an additional cost of lighting the camera site to ensure the accuracy of data collection.

Mobile or portable LPR units also exist that can be mounted on marked or unmarked police, security, or government vehicles. Because of their portability, mobile

devices allow for easy transfer from one vehicle to another. Some require installation onto a cruiser's light bar; others use magnets that temporarily attach to the roof. Each system has its applications, but end users should determine which format best suits their needs. The magnet-mounted device seems to work well with undercover tactical units as it can be easily transported and mounted on a variety of vehicles with minimal downtime. The portable system affixed to a marked vehicle's light bar allows consistent camera angles and familiarity with the equipment. In addition, covert devices that can operate in a variety of conditions and applications are now in production.

Data Input and Output

Getting information into the system is critical. Agencies may need the assistance of their criminal justice information administrators to receive daily lists of stolen vehicles, license plates, felony vehicles, and other relevant data. End users should determine a method of delivering that information to the LPR. Stand-alone units will require either a connection to the agency's network or wireless air card. The other option is a dedicated server connected to all devices, whereby information is collected in real time from respective criminal justice networks and then broadcast to the LPR. Because a combination of fixed and portable units could be deployed, the latter choice may prove the best for agencies with the financial resources to purchase both types. In addition, an important feature would be software that permits individual officers during their tour to input license plate information relevant to vehicles of interest. Because witness descriptions vary, the ability to enter partial license plate data would be useful, similar to entering "wild card" characters into the system.

Uploading stored data also becomes a consideration. Again, the same protocols for retrieval will exist for uploading data. Managers should determine when this will occur, whether at the end of a shift or at a later date, depending on individual needs. Agencies also may consider immediately destroying the data at the end of the shift to alleviate concerns about collecting information. The best course of action lies in developing effective policies and procedures. Also, agencies should examine products that permit remote software updating and troubleshooting. This proves beneficial by keeping all units working properly with minimal downtime.

How the data output may look typically depends on the software installed on the agency's computer. Usually, a positive match, or "hit," on a plate includes the vehicle description, date of theft, originating agency, and any hazards and suspects associated with the incident. The system has an alarm, and action will be predicated on agency protocol. Again, agencies should develop policies

Case Example

LPR technology proved useful in the recovery of a vehicle stolen from a Miami automobile dealership several months earlier. The suspect had taken license plates from other vehicles to continue driving the car. The case resulted in the recovery of several vehicles that the suspect and his conspirators had stolen in ongoing fraud schemes throughout the state. The value of these recovered vehicles totaled well over $100,000.

Mobile LPR unit temporarily attached to vehicle's roof.

LPR unit installed onto cruiser's light bar.

Fixed-mount LPR devices at tollbooth.

LPR unit installed onto cruiser's light bar.

and procedures related to the apprehension of the vehicle by confirming the hit by running the plate live through the criminal databases. Some vendors have developed tools that do not produce an alarm for the officer who encounters a vehicle of interest. Instead, the system sends an alarm to the investigator requesting the information who then decides whether to have the vehicle stopped or surveillance conducted.

CONCERNS

While law enforcement and traffic engineers may applaud the use of LPR technology, citizens do not always appear ecstatic about the implementation. Action groups have maintained a watchful eye, fearing the misuse of the images captured by the cameras. Shrewd manufacturers have entered the scene as well. One company sells a clear spray for $30 per can that it claims will make license plates invisible to LPR technology and cameras, particularly those used to enforce toll violations and red-light running.

A majority of LPR units take photographs of the license plate and the vehicle simultaneously. Some vendors have the global positioning system (GPS) built into their systems. The combination of the photograph, GPS coordinates, and a time and date stamp can further aid in the location of the

vehicle. Because agencies can incorporate GPS into mobile units, they also can implement "geofencing," the virtual boundary of a geographic area. The monitoring of sexual predators can provide an example. Usually, such offenders are prohibited from certain common types of locations as a condition of their probation or parole. Stationary LPR cameras could geofence these areas. Offender license plate information could be listed in the LPR database and the system programmed to send an alert on a sexual offender present in the geofenced area to dispatchers, patrol officers, or investigators. Then, the agency could discern the reason for the offender being in the area and determine if a violation has occurred.

These units have many potential uses in the law enforcement environment. For example, investigators or analysts could compare information collected from the LPR unit to develop a list of likely leads for further investigation or to place a suspect's vehicle in close proximity to a crime. This type of application holds a great deal of potential for the end user; however, privacy concerns also exist. Detractors of this technology insist that government will track the movements of ordinary citizens without regard to privacy. Because of these concerns, agencies should develop policies and procedures regarding storage, dissemination, and destruction of data gathered.

CONCLUSION

Although license plate recognition technology has drawbacks and areas where it needs improvement, it can enhance the quality of police service to the community, coupled with an efficient use of personnel. Law enforcement administrators considering this tool would be wise to develop specific policies and procedures that regulate the use of the data acquired from LPR technology. Perceptions of abuse can occur if the data is not stored securely, and safeguarding this information can be crucial for a successful program that sustains approval by the community. In addition, agencies should regulate those who have access to the database and have standing policies on the deletion of data from the system.

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While the software and hardware utilized for LPR is far from perfect, it still is a significant resource for combating crime that police administrators should consider. A potential for significant growth in the technology available to law enforcement exists, making LPR equipment and software a viable tool for every department in combating terrorism, vehicle theft, and many other criminal activities. ✦

Endnotes

[1] C. Tower, "Customs, Cars, and Canada," *Journal of Commerce* 42 (July 31, 2000).

[2] U.S. Customs and Border Protection, "U.S. Customs and Border Protection and Mexican Officials Officially Open Remodeled Tecate Port of Entry" (March 11, 2005); retrieved on July 8, 2005, from LexisNexis.

[3] Ohio State Highway Patrol Planning Services Section Research and Development, *Automatic Plate Reader Technology* (February 2005).

[4] Police Reform, *Automatic Number Plate Recognition (ANPR)* (April 30, 2004); retrieved on July 6, 2005, from *http://www.policereform.gov.uk/psu/anprnew.html*.

[5] Agencies must know the operating software their vendors require. Some employ the newest versions of operating systems or faster data and memory chips in laptops that may have elaborate displays; others have developed very slim software applications that run in the background on almost any operating system.