

Automatic License Plate Recognition Systems

by Thomas M. Manson

Every now and then, a technology comes along that changes the way we do business. Automatic license plate recognition (ALPR) systems will revolutionize law enforcement procedure by providing officers instant information about their contacts via the automobile license plate.

The current process for a license plate check is generally standardized throughout the country. If an officer sees a plate of interest, he “runs” the plate by typing the number into a mobile data terminal (or he radios in the plate if so equipped). The data unit connects to a centralized computer through one of several communication standards and checks the license plate number against a centralized database to see if the plate or car is stolen. The information is then relayed back to the officer who proceeds with a traffic stop or continues on to another vehicle. The entire process can take several minutes.

An experienced officer working traffic in this manner might reasonably expect to process 150 plates over the course of a shift. But this is about to change. An inexperienced officer driving an ALPR-equipped patrol vehicle could process several hundred or even several thousand plates in the same time period without even taking his hands off the wheel.

What is ALPR?

ALPR products vary by manufacturer, but the general process and the equipment is very similar for all the major players. The systems are usually composed of one or more infrared and color video cameras that take pictures at a rate of 60 frames a second. Each image is then processed by a computer that “looks” for a license plate-sized object in the frame. If a plate is identified, it is further analyzed by the computer using optical character recognition (OCR) software to determine its sequence of numbers and letters. This alphanumeric string is then compared against a database of “wanted” license plates numbers.

This database may contain daily downloads from the FBI’s NCIC database on wanted vehicles or plates, or any number of other databases of stolen vehicles, wanted felons, outstanding warrants, or scofflaw citations. Manually entered numbers for AMBER Alerts can also be included. If the plate isn’t captured or if no “hit” is registered, the system disregards the information and proceeds to look for another plate.

If a hit is registered, the officer is notified with an audible or visual alert. Most ALPR systems display the image of the hit vehicle and return additional information from the onboard database. This information usually includes: Plate number, state and county, description, reporting agency, and date entered. After receiving notification of a stolen vehicle, most agencies require their personnel to verify the plate and re-check it before proceeding with a traffic stop.

The entire ALPR process is totally automated, requires no officer intervention and takes less than a second to perform.

An ALPR-equipped patrol vehicle traveling at 60 mph closing a distance of 50 feet with a stolen vehicle in the opposing lane traveling at 60 mph will have imaged the other vehicle’s front plate, processed it, performed OCR, checked the plate number against 300,000 NCIC records of stolen vehicles and license plates, and returned an audible alert before the gap between the two vehicles

closes. And if there were a hundred cars in the opposite lane, with visible plates, it would do the same thing for every one. It is reasonable for a single officer working in a high-traffic area to scan 5,000 or 6,000 license plates in a single shift.

New Technology?

ALPR technology has only recently been available in the U.S., but the technology isn't new. ALPR was originally developed from OCR technology, which traces its roots to Europe more than 50 years ago. OCR is the ability of a machine to "read" numbers and letters. In the 1950s, "reading machines" became the first OCR commercial deployments. Postal services in several countries were quick to employ machines that could "read" and sort mail faster than a person. While OCR technology had its beginnings in America, it was in Europe that the technology was first applied to law enforcement and license plates.

European Influence and Early Models

Practical ALPR systems were developed in Europe first because of politics and the relative ease of reading the large standardized European license plates.

London deployed its fixed ALPR system, known as the "Ring of Steel" in response to IRA attacks during the 1990s. Currently, ALPR check points around London read and verify the plates of every vehicle entering the city.

Another factor that facilitated Europe's ALPR deployment ahead of the U.S. was its big, easily read license plates. Unlike America, where some states have dozens of separate plates for every college and cause, the European Union has a generally standardized numbering system on a larger plate with larger numbers.

You can see the foreign influence in the several of the major U.S. ALPR companies and distributors: AutoVu is located in Canada, Civica and PIPS Technology have lineage in the United Kingdom, and Remington Eltag has origins in Italy. Israel also has provided a variety of players to the field.

Lights, Cameras, Action

The cameras on ALPR systems come in two varieties: Infrared and color. Infrared cameras have the advantage of creating usable images in adverse weather conditions or the dark. This advantage is made possible by an incorporated infrared spotlight that is invisible to the human eye but bathes the cameras field of vision in infrared light. Infrared cameras are then able to resolve high-quality black-and-white vehicle images, even in total darkness.

Color video cameras are often used as secondary systems providing true color renditions of suspect vehicles. They are primarily used in daytime ALPR applications and lose their effectiveness in the dark. Color cameras can, however, be mounted on the inside of a patrol vehicle and acquire images through glass, a feature infrared cameras cannot claim.

The current standard deployment is one or two cameras mounted on the lightbar facing forward. The cameras are angled several degrees to the right and left to better image the rear plates on cars the patrol vehicle is passing and the front plates of cars closing distance in the opposite lane. Variations on this theme include placing cameras at dash level, on the trunk, or in configuring cameras at 90 degrees from forward to better image parked vehicles. PIPS Technology has recently introduced a

portable window mount for its ALPR systems, which allows agencies to easily move their units from one vehicle to another. Its lower profile will also increase effectiveness in covert operations.

How Well do They Work?

Several ALPR companies indicate accuracy rates of 95% and higher for acquired plates. Better funded companies generally appear to have an advantage over smaller startups. While a couple of smart guys with a camera, a computer and a vision might be able to put together a functional ALPR system, it appears to take more research and money to post the 95% accuracy rates.

Scott McCallum, system analyst for Pinellas County Sheriff's Department in Florida, manages data processing for several of his agency's ALPR units. He addresses its success at reading the variety of national plates, "We can pretty much read any plate in the U.S. As long as it's a standardize plate with a maximum of seven characters, we're not going to have an issue reading it."

What Does it Cost?

A hefty price tag is probably the biggest obstacle hindering the pace of ALPR system deployments. Due to the various deployment options, ALPR manufactures and dealers are reticent to put a single price tag on the box. Many companies offer single and multiple camera setups and various methods to connect, transfer and store data in addition to various levels of support required to make the systems work and to keep them working.

The bottom line: To equip a single patrol vehicle with a two-camera ALPR system currently costs between \$20,000 and \$25,000. For this amount, an agency could reasonably expect to have a mounted (or portable) ALPR system with all the necessary parts and training for personnel to use it. Reducing the overall cost of the system is the underlying goal of several ALPR companies. Using fewer cameras is one method of cost reduction. Some integrators prefer single-camera solutions. Because much of the system costs are tied to the infrared camera and its accompanying infrared light source, a reduction in the number of cameras directly impacts the total cost of the system. Additionally, there is strong evidence that one camera in a multi-camera deployment will be responsible for the vast majority of all of the successful reads. This is particularly true in the states that require vehicle display only a single rear plate.

Another method to reduce cost is to integrate ALPR systems with existing technology is onboard video recording systems. Civica Software has recently announced its ALPR integration with the Panasonic Toughbook® Arbitrator™ video capture systems. About 65% of law enforcement agencies currently deploy some version of the Panasonic Toughbook® in their patrol vehicles. For vehicles equipped with the Arbitrator video capture system, the addition of an ALPR will be substantially less expensive than buying a system independently.

Digital recording cameras usually only record during a traffic stop or other incident, otherwise they are inactive. By adding an ALPR system, the onboard camera is working 100% of the time; when the camera's not recording, it can process license plates.

While the cost of the integrating an ALPR with existing equipment may lower the purchase price, other variables still impact an agency's decision. These include the importance of nighttime operations and system portability from one vehicle to another. Color video recording cameras don't perform as well in the dark or in adverse weather conditions as infrared cameras, and they are much more likely to be permanently mounted.

The End of Profiling?

In the past, due to limitations of radios and communications, law enforcement personnel would make a determination ahead of time whether or not a plate was worth the time it would take to run. If something looked suspicious, a plate could be called in or entered on a mobile data unit. As a result, expertise and experience played a big role in successfully acquiring a wanted plate or stolen vehicle, and the novice officer was at a substantial and noticeable disadvantage.

This process of “finding” wanted vehicles, while arguably successful for experienced officers, also increased the charges of racial profiling. And even though several agencies have shifted training away from profiling drivers to profiling the vehicle itself, charges of officer bias still remain. An aspect of the ALPRs that is often overshadowed by the initial cost is their virtual elimination of the claims of racial profiling. Because the systems look at the license plate instead of car or the person driving it, they will as likely hit one plate as another and in fact will more likely hit every plate in view. Several agencies have reported picking vehicles out of traffic that would have otherwise gone unnoticed by personnel but for the ALPR systems. An agency in New York actually had to stop one ALPR system trial because the overwhelming number of hits was exceeding the agencies ability to respond with towing equipment.

Minimal training is required to operate the systems, and once started, they are virtually hands free. Some training is required to properly calibrate the cameras if the system is moved from vehicle to vehicle.

The Case for ALPR

The most noted use for ALPR systems is to locate stolen license plates and vehicles. For many agencies and vehicle theft task forces, this is reason enough to acquire the technology. Often touted as a “force multiplier,” ALPR will certainly cause more plates to be processed than the previous MDT or radio methods. But while ALPR is often viewed as a more efficient method of recovering stolen vehicles, it should be noted that the systems will become an important officer safety tool with the addition of other databases.

There are several times more people with outstanding warrants than there are stolen vehicles, and most officers would appreciate that information before making a vehicle approach. After becoming accustomed to the information provided by a well-informed ALPR system, an officer will likely never want to be without it.

ALPR systems will not only allow an officer to become exponentially more valuable at checking plates, but the system itself will enhance individual officer safety by providing information that currently is not available.

To Tell or Not to Tell

In addition to its other functions, ALPR is a surveillance device. And as with any surveillance technology, the question arises among law enforcement, “Do we tell the public what we have, or do we keep it to ourselves?” Each agency will handle this question differently, and in many cases, the answer to the question is based more on the application of the technology than on the technology itself.

Several major state agencies have had long, successful ALPR trials but have not wished to gloat about their successes hoping their stealthy deployments will continue to yield results. But other agencies take a contrary approach, preferring to use ALPR systems as a deterrent for crime or as a display of proactive measures ensuring the safety and security of the community. Agencies will surely take this on a case-by-case basis until the technology becomes so well-known in the general public that an agency will be thought to possess it, even if it does not. At that time, the need for secrecy may be rendered moot.

ALPR for Everyone

Even with the undeniable gains ALPR systems offer in the areas of officer productivity and the future gains they will provide in officer safety, many law enforcement agencies will be hesitant to spend \$20,000 for a system they currently exist happily without. Even the possibility of deflecting costly profiling litigation will not be enough to make many agencies separate with their hard-earned dollars. Still, there are several funding sources that even the smallest agencies can access to acquire their own ALPR system.

For agencies with grant-writing personnel, the Department of Homeland Security is the largest potential funding source. The National Insurance Crime Bureau (NICB), State Auto Theft Prevention Authorities and local insurance companies all have an interest in reduced auto theft. One agency was even offered an ALPR system by a local tow truck operator with the hope that the recovery of more stolen vehicles by the department would increase their business.

And never underestimate the public's level of support. After Officer Craig Herbert was killed by a driver in a stolen vehicle in 2005, the Lawrence, IN Police Department received funds donated by local insurance companies and Wal-Mart to buy the state's first ALPR system. That system, incidentally, was responsible for recovering 21 stolen vehicles in its first seven weeks of deployment. And beyond finding a way to pay for the systems, some departments are actually generating income with their ALPR systems by going after scofflaw violators who fail to pay parking fines.

The Future of ALPR

In the future, systems that now are generally separate, radar, in-car video, and ALPR will likely be integrated into seamless onboard systems requiring less operator interaction (and training) while enjoying increased connectivity to more centralized databases. The costs will also come down as more agencies adopt the technology. ALPR systems are currently deployed in less than 1% of law enforcement patrol vehicles in the United States, but through their own merits, they will quickly change the way law enforcement does business.

Author's Biography

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