Technology **Profile**

The role of automatic license plate recognition in the Smart City

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Any urban area with ambitions of becoming a Smart City needs a number of essential elements in place before it can consider adopting the title. Although not limited to these measures, accurate control and knowledge of traffic conditions, an increase in safety and surveillance and improved incident prevention and management should be top among the priorities.

Automatic license plate recognition (ALPR) plays a key role in the planning and control of modern cities and can be deployed for a variety of applications, some of which are obvious but others less so.

Public safety is one of the growing applications for ALPR, with it becoming increasingly commonplace to link video surveillance cameras with license plate recognition solutions. This extra back-up increases security in a city as it enables alarms to be launched automatically when vehicles that may be of interest to authorities are detected.

ALPR is also a powerful tool when it comes to counts and statistics. Data such as average speed calculations and even instant speed calculations can be provided efficiently and non-invasively. Hence adjustments or corrective actions can be taken based on the data collected, as well as the creation of various graphs, comparisons and trend analyses, which all help managers to improve traffic control and flow.

Urban congestion charges have been implemented in several cities with the goal of reducing traffic in city centers. Others use the license plate to determine which vehicles should be permitted to drive into the congestion charge zones and on which day – for instance based on odd and even numbers. ALPR technology can be central to both approaches for the automation of payment and location of offenders.

(Above) **ALPR is critical in helping to monitor the flow and movement of vehicles around a road network** (Main) **In-vehicle ALPR is helping police officers intercept suspect or wanted vehicles**

Safety and access

License plate recognition systems are integral to traffic safety cameras that have the capability to automatically fine vehicles jumping red lights, exceeding given speed limits or even entering restricted traffic or parking areas.

On the subject of the latter, bollards and arm barriers can be vital dissuasive elements to prevent unauthorized vehicles entering restricted or off-limit areas. But what happens if these mechanical elements break down or someone loses the ID card permitting them to enter legitimately? What if an emergency vehicle wants to enter the same area but cannot, as it lacks the appropriate clearance method?

One of the most simple solutions would be to remove the mechanical elements prone to failure or which can even result in damage to vehicles (a frequent occurrence when drivers don't notice rising bollards, for example). ALPR cameras could replace barriers or bollards so if a vehicle is unauthorized, the ALPR system will notify the driver directly, potentially issue a fine or – if necessary – inform the nearest police patrol of the detected infringement.

In the regulation of surface parking in controlled zones, ALPR cameras or OCR engines have helped to completely or partially automate many previously manual operations. Now systems can detect the entry and exit of vehicles in the controlled zone and apply the rate according to the time parked, charging the amount to drivers' accounts or credit cards (pre-registration required). If there is no pre-registration, the license plate can be entered using a phone app or street parking meter just before leaving the parking lot. The system then calculates the rate and requests payment using a credit card, in cash or any other form of payment, and even grants a grace period to vacate the controlled parking zone. Attendants only have to take a photo of the license plate on their handheld device (replete with internet connection to the central database) to establish the vehicle's payment status online.

Need to know?

The growing adoption of ALPR for multiple safety and traffic control applications in today's modern, smarter cities

- As cities strive to become smarter, the popularity of ALPR technology is rising – as are the number of diverse applications it can be used for
- Today companies in the fields of mobility statistics generation, traffic light management, security (video recording and analysis), and more are embracing ALPR solutions

Law enforcement

One of the most impressive and also demanding applications for ALPR is when cameras are fitted in-vehicle in police patrol cars. The cameras are constantly scanning license plates and comparing them with their databases, which are constantly updated on a central server.

Urban applications of this technology include searching the database for stolen vehicles, vehicles wanted in relation to crimes, etc, and searching for vehicles without compulsory insurance. Other popular applications include the identification of vehicles in reserved lanes (such as bus lanes) and in restricted areas (pedestrian zones, for instance).

Vehicles can also be checked to ensure they have passed the relevant technical inspections, with the consequent reduction in defective vehicles driven in cities reducing the number of deaths and injuries due to accidents caused by mechanical malfunction.

Law enforcement agencies around the world see ALPR as a powerful tool to reduce crime and increase police efficiency and arrests. Vitally it achieves these goals while maximizing the security of police resources and reducing inconvenience to drivers to a minimum, as officers only stop vehicles that are flagged up by the system.

However, effective police management requires more than just keeping an up-to-date database. There are many other factors that can potentially impede the correct operation of an ALPR system.

For manufacturers of these solutions, in-vehicle law enforcement represents one of the toughest, most demanding working environments for ALPR. Unlike other applications where the camera, the vehicle, or even both are stationary, in the case of a patrol car, the OCR has to overcome three main challenges.

Changing light conditions for one – not only due to weather but also due to the movement of the police vehicle, which will pass through well-lit areas, poorly lit areas, will encounter shadows (from trees, for instance), unlit areas such as tunnels and bridges, and is exposed to sun from all angles. Second, the technology also has to tackle changing sizes and angles of the license plate characters. And last but by no means least, there is the short response time required, a factor given the relative speeds of the vehicles to be read are constantly changing.

ALPR is already widely used at traffic intersections and will becoem an inherent part of Smart Cities

Faced with all these challenges, the design and implementation of an ALPR system requires a number of goals to be met. The right choice of hardware such as camera, lens and lighting is a prerequisite. Similarly, a good vehicle recognition engine that can work with images that may be less than perfect (as some images inevitably reach the engine with little contrast, out of focus or other problems) is non-negotiable. Lastly, advice that only the OCR developer can provide through intimate knowledge of the engine's requirements is invaluable.

Budget-friendly technology

Many cities face futures with rising costs and lower incomes and increasingly limited budgets for law enforcement. But technologies are available to help optimize, manage and improve the resources available for traffic control and safety. Hence there is much interest in developing and implementing these types of technologies in both large and small cities, hence engineering is being attracted from fields that were previously unrelated to ALPR.

What's critical but under-appreciated is having a partner as a consultant on all aspects affecting ALPR – a vital factor in achieving the accuracy rates that make systems useful. ○

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