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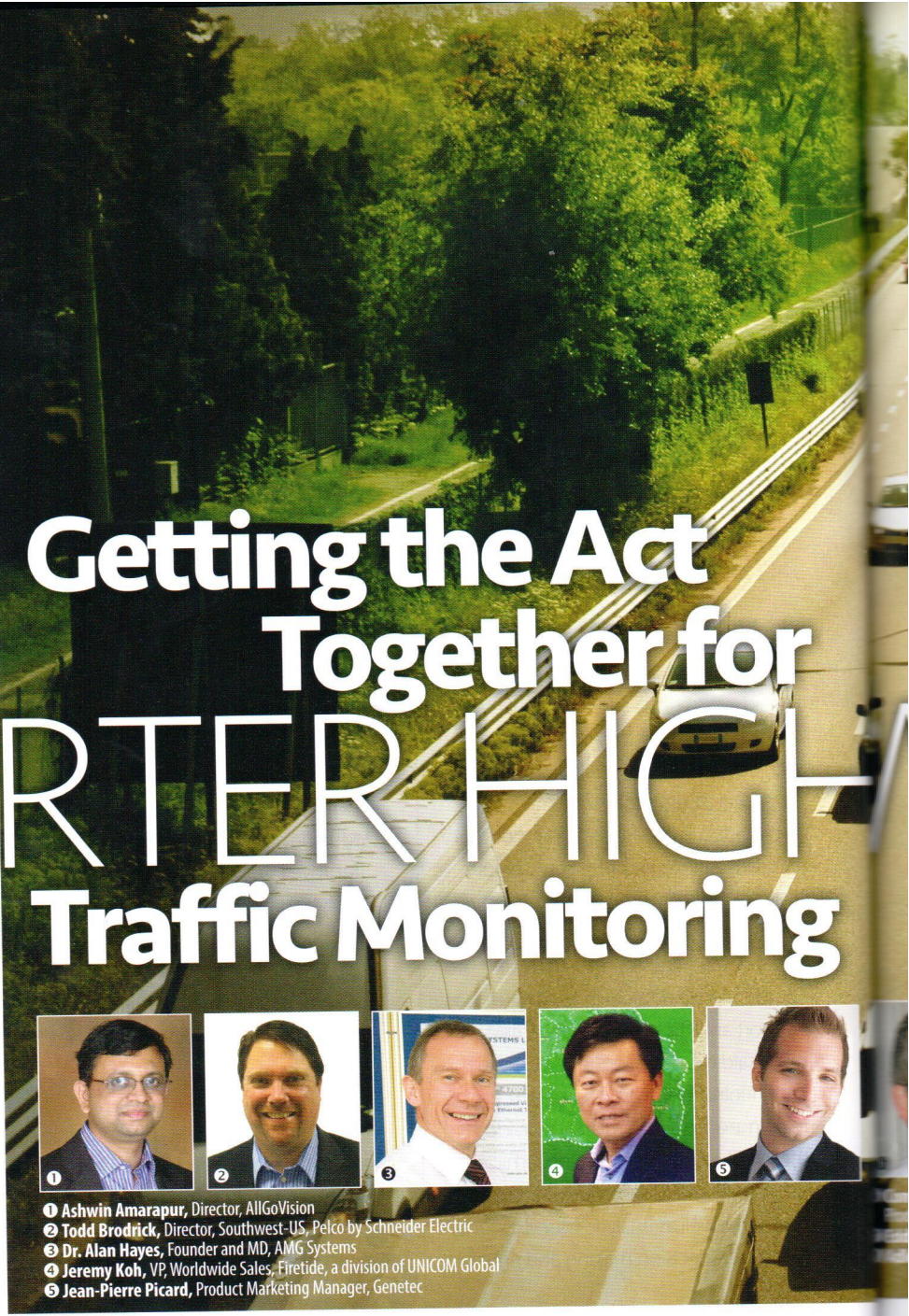
PSIM: Critical Element in Safe City

In a safe city project, the command center acts as the brain. Operators charged with maintaining the security and order of the city are constantly on the lookout for unusual situations and, in the event of an emergency, must respond to it quickly and effectively.

Monitoring traffic on highways come with a host of unique challenges, ranging from low light, vehicles' speed, and operations in remote locations. In this article, we take a closer look at the common challenges in the vertical and possible workarounds for them.

● BY *Prasanth Aby Thomas*

Getting the Act Together for SMARTER HIGHWAY Traffic Monitoring



❶ **Ashwin Amarapur,** Director, AllGoVision
❷ **Todd Brodrick,** Director, Southwest-US, Pelco by Schneider Electric
❸ **Dr. Alan Hayes,** Founder and MD, AMG Systems
❹ **Jeremy Koh,** VP, Worldwide Sales, Firetide, a division of UNICOM Global
❺ **Jean-Pierre Picard,** Product Marketing Manager, Genetec

As security solutions rapidly move beyond their conventional functions, traffic management is increasingly becoming a potential vertical for the industry. Although there are several subsections within this vertical, highway traffic monitoring is a specific segment with several unique requirements that deserve a deeper understanding.

Vehicles on highways often move at a very high pace. The speed is usually a hindrance to receiving optimum results from video content analysis (VCA) solutions. Compounding this problem is the lack of adequate light, not just because of the remote locations of installations, but also because of specific structures such as tunnels.

In fact, such conditions could only get worse, according to Eddy Vermeulen, Product Manager at FLIR Intelligent Transportation Systems, as highways are increasingly being unlit due to energy saving and environmental concerns, even in countries where roads were historically bright at night.

For systems integrators (SI) working in the vertical or looking to diverge to it, such issues could be daunting. But manufacturers and solution providers insist there are several ways to overcome these difficulties and provide effective systems.

MONITORING VEHICLES IN VARYING LIGHT

Optimizing the solutions for low light is among the first priorities in this vertical. Fortunately, several modern cameras are able to provide usable images in such conditions, but installers will have to consider various parameters while installing them.

"For accurate analytics, camera mounting height and angle towards the road need to be chosen with the exact VCA application in mind," said Constant Rutten, Marketing Application Design for Video Systems at Bosch Security Systems. "For

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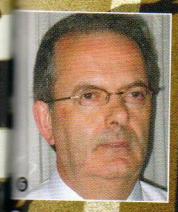
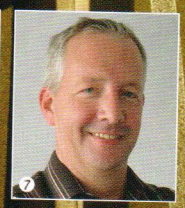
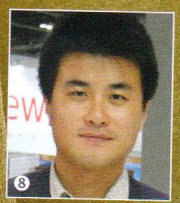




Constant Rutten, Marketing Application Design, Bosch Video Systems and Products, Bosch Security Systems
Eddy Vermeulen, Product Manager, FLIR Intelligent Transportation Systems
Adler Wu, Product Marketing Manager, Hikvision Digital Technology

example, for traffic monitoring the camera projection should be selected to minimize occlusion of cars, prevent direct sunlight, and glare of reflecting surfaces. The glass window in the protective camera housing should be designed to minimize reflections in the optical path."

Todd Brodrick, Director of Southwest-US at Pelco by Schneider Electric expanded the point further. "Many of the challenges can be solved with correct application and set end-user expectations," he said. "Application challenges can be resolved with proper placement of the high-resolution camera, with the proper mounting mechanisms. For environmental challenges though, it is more difficult to bring a one-size-fits-all resolution as different locations have different issues."

Rutten also indicated that in extremely low light situations, cameras with highest light sensitivity should be chosen and may be combined with optional IR illumination for better results.

Adler Wu, Product Marketing Manager at Hikvision Digital Technology agreed to this, suggesting that IR products with high performance and precise algorithm can capture vehicle information, such as license plate, vehicle number, vehicle color, and even vehicle type among other things.

PROCESSING LICENSE PLATES ON THE HIGHWAY

An important part of any traffic surveillance solution is license plate recognition (LPR). According to Wu, the key aspects for efficient LPR include taking into account the differences in the license-plate types, traffic rules, and road infrastructure.

"In terms of different vehicle types, with different symbol and text, we optimize the algorithm to improve accuracy," Wu said adding that LPR could still be a challenge if a vehicle license plate is damaged or covered.

Jean-Pierre Picard, Product Marketing Manager at Genetec acknowledged such concerns, but added that countering them is not too difficult.

"The most common challenges have to do with vehicles whose license plate is not visible — either because it is hidden by an object, such as a trailer hitch or a bike rack, or because there is no license plate, such as new vehicles," Picard said. "But because the percentage of vehicles with blocked or missing license plates is fairly

stable over time, it is still possible to produce an accurate vehicle count estimation, using LPR as the baseline data."

Speaking along similar lines, Ashwin Amarapur, Director of the India-based VCA solutions provider, AllGoVision, said that customizing the VCA solution to identify license plate layout in different countries is critical. The solution has to be able to recognize and understand the differences in layout.

"There is always a trade-off between having a high-contrast setting that allows capturing a wide image with all the surroundings, and selecting the region of interest, with a setting that is focused to understand what's happening in that area," Amarapur said.

OPTIMIZING BANDWIDTH CONSUMPTION

Modern streaming technology has come a long way since its initial days, but as image quality and application-requirements increase, there is a constant need to optimize bandwidth consumption. At present, H.264 is the most common standard on the market, and although there is much anticipation on the next version, H.265, the latter's application- and device-support is still limited.

According to Rutten, bandwidth consumption can be controlled in a number of ways. Smart cameras dynamically adjust camera settings to ensure most efficient bandwidth consumption and allow compression parameters to be set for different parts of the visuals, which are known as encoder regions. This gives SIs the ability to adapt the encoder compression ratio for various regions of an image. An unimportant region can be set to use more compression and thus reduce bitrates, while important regions can be assigned a lower compression ratio to show more details.

Although this is a potential solution, Vermeulen suggests the use of analytics at the edge as an alternative to do away with bandwidth-consumption concerns.

"For proper video analytics performance, one needs a high quality image and sufficient processing power," Vermeulen said. "By performing the video analytics at the edge, near or in the camera, video transfer can be limited to human eye viewing or even be discarded at all until a significant incident occurs."

On the other hand, as the available bandwidth rates continue to increase, some solution providers downplay concerns on bandwidth consumption.

"There is no reason why you can't open up the bandwidth," said Dr. Alan Hayes, Founder and MD of AMG Systems. "10 gigabytes is readily available and 4 gigabytes is within reach. Shaving off a few gigabytes at the edge becomes irrelevant as network bandwidth is generally increasing. The more compression you put in, the more information you throw away, which ultimately hampers the VCA in the control room to a certain extent."

CHOOSING THE RIGHT FRAME RATE

Solution providers are generally of the opinion that a framerate of 30 fps is sufficient in most cases, but Rutten opined that 60 fps combined with high light sensitivity and dynamic range is needed for free-flow

Installing Solutions in Remote Locations

Given that highways are often spread over long distances, ensuring constant power supply for each security installation could be a tough task. To counter this problem, solution providers are considering options such as solar power and enhanced battery backup.

Eddy Vermeulen, Product Manager at FLIR Intelligent Transportation Systems, believes that the evolution towards more power-efficient electronics have given rise to the possibility of solar-powered remote-sensor installations.

Citing the case of a sensor produced by FLIR, he added that it can be used as a complete standalone system without external power supply if installed with a modern wireless modem, battery with a calculated capacity, and a solar panel.

Todd Brodrick, Director for Southwest-US at Pelco by Schneider Electric concurred to the concept, adding that the decreasing costs of solar panels are encouraging this.

However, Adler Wu, Product Marketing Manager at Hikvision Digital Technology warned that while solar power can be used when there aren't many devices, most traffic solutions need complex installations such as radar, light compensation, and specialized traffic cameras, demanding a lot of power.

Alternate energy solutions such as solar panels are increasingly being considered for installations in remote locations.

Vehicles often move at a fast pace on highways. This, along with the varied lighting conditions, complicate highway traffic monitoring.

applications at high speed to provide consistent results in widely varying lighting conditions.

"The image quality of each frame will be more or less the same, as shutter speed, etc., are determined by other factors like the speed of the objects and lighting conditions," Rutten said. "When applying VCA or LPR on the captured images, ask your supplier if the analytics software can make use of the additional frames captured at 60 fps."

FROM FIBER TO WIRELESS TECHNOLOGY

According to Jeremy Koh, VP of Worldwide Sales at Firetide, a division of UNICOM Global, there are two scenarios where wireless technology comes in handy during traffic monitoring installations. The first is where there is no fiber connection, while the second is when you have to fix a fiber-cutoff issue.

Speaking specifically on scenarios where there are no fiber connections at all, and where the distance that need to be covered could be long, Koh said that a multi-hop wireless network may be the preferred option. But here, the challenge would be to create an ideal network for real-time monitoring, in which the datarate doesn't drop from hop to hop.

"You would need wireless technology that has very low latency," said Koh. "If possible with a latency number that is linear, for example, for 10 hops, there should be a latency number of 10 milliseconds, while 20 hops should have 20 milliseconds."

Speaking on the different options available, Hayes said three kinds of wireless technologies could be used for traffic monitoring — line of sight (LoS), cellular and non-line of sight.

While selecting a wireless solution for any situation, the major factors to consider are bandwidth and distance capability, resilience of the technology, and the environment. In Hayes' opinion, LoS is better than the rest due to their higher bandwidth availability. Non-LoS solutions are also more expensive, while cellular networks can be intermittent and irregular.

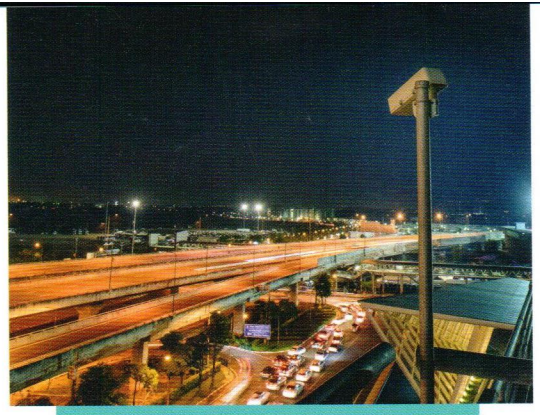
The downside of LoS solutions is that they are limited by the "line of sight," which could cause an issue when it comes to connections over long distances. But Hayes feels this shouldn't be a concern in this vertical, where the role of wireless technology is often limited to short stretches. Usually wireless systems are used to cover small gaps in cabled network, especially on undivided highways (carriageway) where data needs to be transmitted from one side to another.

REACHING THE BEST SOLUTION?

Highways are a potential segment for SIs, as traffic management is increasingly becoming an important aspect of security. But the technological challenges presented here could create considerable difficulties for those seeking to work in the vertical.

To make things complicated, requirements of a project could significantly vary depending on the location, in effect doing away with the concept of a single best solution.

The key then, is to understand the individual conditions and concerns in each project and tailor a solution that could make it unique. There is also a need to remain up-to-date with the technological developments that could potentially improve the quality or solve a current issue. In short, a proactive approach to solving problems is ideal for providing solutions in this vertical. ASS



Solutions That Combine Cameras With Radar

The most reliable and practical solution for highway monitoring could be a combination of high-performance license plate recognition (LPR) cameras and radar, according to Adler Wu, Product Marketing Manager at Hikvision Digital Technology.

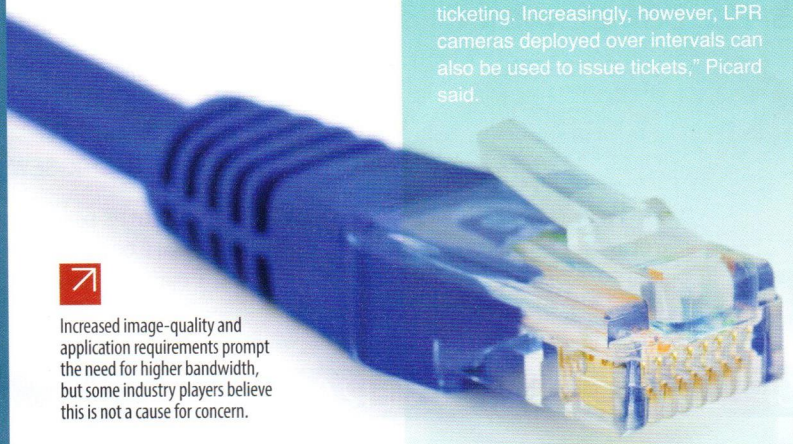
Eddy Vermeulen, Product Manager at FLIR Intelligent Transportation Systems also acknowledged this, indicating that radar could be combined with thermal cameras for optimum results.

"Thermal cameras generate an image, based on the thermal radiation that is originating from every object, even at the lowest temperatures," Vermeulen said. "This way, a detailed video is possible even without any light source at all. Clearly, this improves the detection performance a lot in dark and harsh weather circumstances. For some applications, radar can contribute to the video detection performance."

Others like Todd Brodrick, Director for Southwest-US at Pelco by Schneider Electric, too agree that this combination could be effective. But some observers suggest that with further technological developments, radar could become dispensable.

For instance, Jean-Pierre Picard, Product Marketing Manager at Genetec, believes that for applications such as vehicle counting, LPR technology is getting smarter.

"For speed enforcement, LPR+radar would be required for single-point ticketing. Increasingly, however, LPR cameras deployed over intervals can also be used to issue tickets," Picard said.



Increased image-quality and application requirements prompt the need for higher bandwidth, but some industry players believe this is not a cause for concern.