Top Trends In Transportation Surveillance

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What impact is rapidly advancing technology having on the quality and ubiquity of transportation surveillance?

Due to the ever-increasing pace of technology, vehicle surveillance has moved beyond simple cameras and ticketing to full integration in complex transportation systems.

These systems are no longer passive expenditure meant to protect companies from worst case scenarios, they have become ongoing investments that improve the quality, safety and efficiency of every aspect of transportation.

These improvements are having a profound effect on both the public and private sectors to varying degrees.

This rapid pace of change has not only meant a drive to keep up with current technologies, but to keep a keen eye on upcoming technologies that will have profound effects in the years to come.

These preemptive changes give a first-mover advantage to the companies that are willing to invest and will pay dividends when they are able to provide better service to their customers.

But navigating these changes becomes a massive undertaking in itself.

This white paper aims to give an overview of the most important technologies at this moment and technologies that may not yet have matured, but are set to come into their own within a few years.

What are the essentials?

Surveillance has moved from simple cameras to full integration into transportation systems.

Advancements in technology are ongoing and numerous, but the important ones have big impacts, rather than being a byproduct of other, smaller upgrades.

In the sections below I'll cover what I think are the most important aspects. Each of those are then distilled down to their bare essentials. No fluff, just what you need to know to make an informed decision when the time comes.

High Brightness Screen

Vibration and Shock Resistance

CAN Bus/OBD-II

Particular Power Solution

X86/ARM solution

Wide Range Temperature

Communication

E-mark Certification

Power over Ethernet

PoE provides power to remote equipment over the same ethernet cables that are used for networking. The power provided is sufficient for specific low-power, end-node devices like PoE clocks, PoE electronic sign boards and PoE electronic displays.

The main advantage of PoE, according to L-com:

> The main advantage of PoE for the Wi-Fi industry is the installation of remote or outside equipment without having to connect to AC power. Equipment can be installed without the need for an electrician. The use of PoE also eliminates the AC/DC connection as a path for surges into the equipment. In a wired network with a lot of remote nodes, PoE based switches or routers eliminate the need for large numbers of AC power supplies or the installation of new AC outlets at the remote nodes.
>
> Source: What is the main advantage of PoE?

The complexity of modern computing setups is increasing. For each added component to a system there is the addition of more cables and connections.

PoE eliminates the AC power requirement for end-node devices.

PoE removes the need to install additional AC power cables by providing the necessary power over the network cable.

PoE is a good choice for remote nodes whether or not they need the networking capabilities. Let's look at why.

For remote nodes that need networking, there would already be network cables installed. The AC power cable could be eliminated completely. This not only provides more flexibility in where nodes can be installed, but eliminates a potential source of damage from power surges. It also saves on the cost of hiring an electrician which can be high. If the current equipment is powered through AC power, then the unit can be upgraded to use PoE without further additions.

Eliminating power cables simplifies installation and reduces overall costs.

For remote nodes that don't need networking, the same flexibility and cost savings apply. If there is no particular need to provide AC power, then providing the required amount of DC along the network cable is safer. The other upside, is that non-networked components are becoming less common and having the cables in place allows for easy upgrades later. In this case PoE is providing a low power, safer alternative to AC power and more options for networked equipment when upgrading.

Reducing cables is always a benefit. The fewer the better. The installation is far more flexible. Cat3 and Cat5 network cables can be routed over long distances and installed easily. This removes at least some of the constraints of having to install both power and network cables.

The ubiquity of network cabling also makes it very cost-effective and increasingly reliable. By taking advantage of these characteristics, the installation becomes that much easier.

The increased ease of installation also lends itself to easy installation in public spaces like airports, libraries and street poles.

Perhaps one of the biggest advantages is the ability to remotely control network devices that need to be connected to servers or central controllers such as PoE clocks, PoE electronic sign boards and PoE electronic displays.

GPS - Dead Reckoning

The ability to pinpoint the location of vehicles, using GPS, has enabled complex tracking strategies to be developed. The central importance of this location data makes accurate and timely GPS readings critical to the effective operation of business.

Dead reckoning ensures that location data is available, even when the GPS signal is not.

Despite the reliability of GPS signals, it is not always available and steady, especially when vehicles move through tunnels or other areas where there is no line of sight with the GPS satellites.

If this situation is not accounted for, then the system simply cannot know where the vehicle is when out of GPS range. This can cause chaos for systems that rely on the accurate reporting of vehicle location.

That's where dead reckoning comes in.

According to Wikipedia:

> In navigation, dead reckoning or dead-reckoning (also ded for deduced reckoning or DR) is the process of calculating one's current position by using a previously determined position, or fix, and advancing that position based upon known or estimated speeds over elapsed time and course.
>
> Source: Dead reckoning

Road networks are well mapped and vehicle routes are, for the most part, very predictable and most of the time the driver is using a predetermined route to get to the next location. When GPS signal is lost, the system doesn't need to give up. By using the last known location and then calculating how far the vehicle has probably gone based on average speed, the system can take a "very good guess" at the current location.

The major benefit is for software or systems that need that information to run correctly. Rather than the software needing to make allowances for inconsistencies, the system compensates to provide consistent data.

It is quite likely that software already does make allowances for these issues, but having an extra layer of protection gives even more certainty to the setup.

Wi-Fi - Still Essential?

With the ubiquity of Wi-Fi, it has become a non-negotiable feature.

Wi-Fi is still the best choice for wireless data transfer over a short distance.

But considering the added expense, does Wi-Fi provide any real benefit over alternative networking options?

In terms of overall networking, Wi-Fi is just part of the picture.

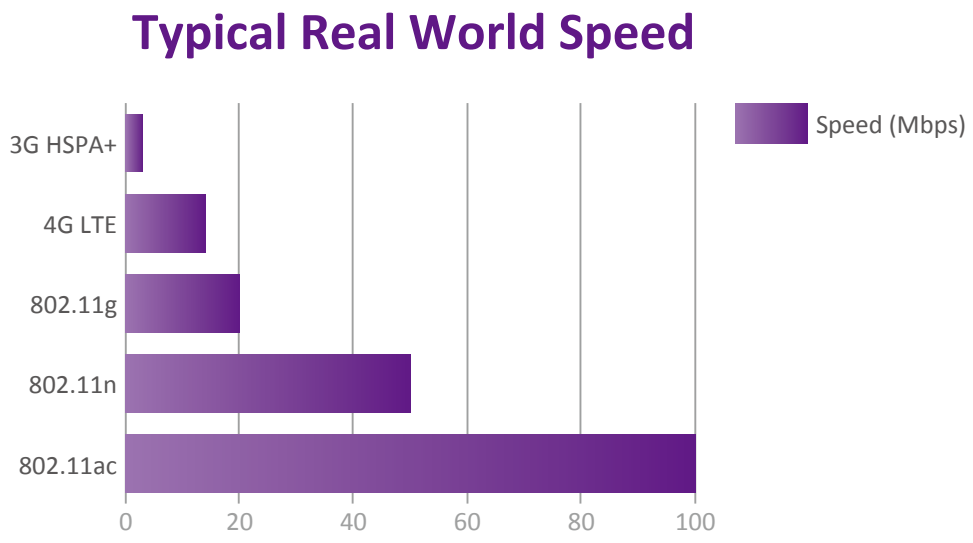
When on the move, Wi-Fi is not really of much use. The limited coverage area of a typical hotspot is limited and not enough to provide consistent connection with a vehicle.

But what if a constant connection is not needed?

It is tempting to think that with the ubiquity of mobile networks, “live” tracking should be standard. Fortunately, that is simply not the case. In many circumstances, data that needs to be transmitted can be processed in batches. All information can be stored locally until a hotspot is detected.

By installing hotspots at certain bases, the information can simply be transferred automatically when the vehicle comes within range of a specific network or network group.

The upside to this non-live method of information processing is the costs that can be saved. Mobile data is much more expensive than any fixed network. Instead of relying on mobile data for every vehicle, they simply transfer the bulk of data at specific data offloading points.



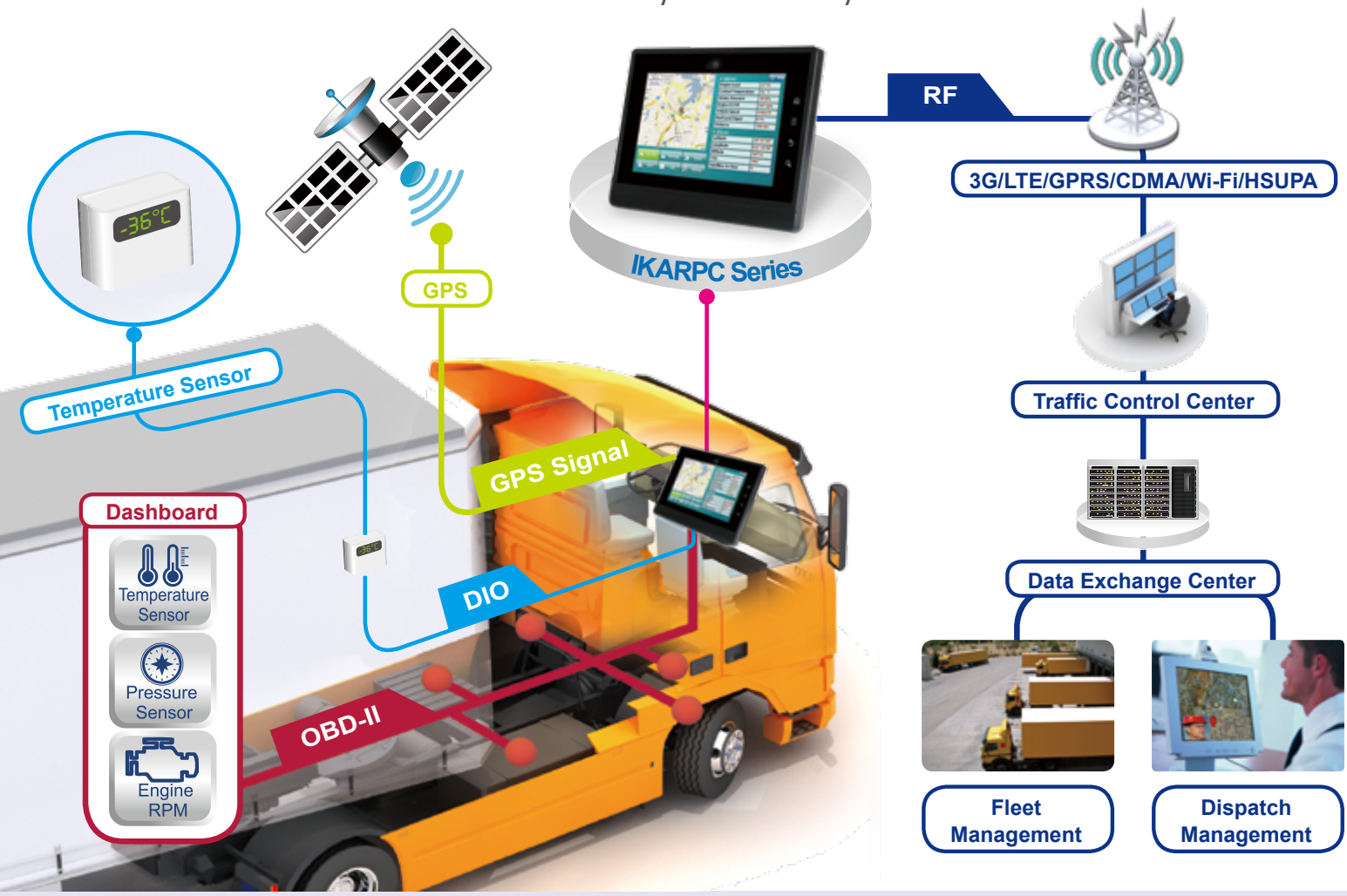
The final advantage is the speed and reliability of data transfer. Fixed networks are faster and there is no additional charge for transfer within the network. There is no need for any manual intervention to download data, all information can be transferred when certain conditions are met and the network is available. This ensures that all data is securely downloaded and available for processing when needed.

3G - Dual SIM & Cloud

Despite the potential advantages of using Wi-Fi, the unrelenting push towards always-connected systems continues. There is possibly no greater invention in this respect than 3G mobile Internet.

The main appeal of 3G mobile Internet is real time updates and data transfer.

Being constantly connected allows changes to be made quickly and effortlessly. They also enable immediate connections with central servers and data centers. The centralization gives the flexibility to adjust and update multiple points of contact at the same time. If a driver's vehicle breaks down, then instead of dispatching a new vehicle, the current items can be distributed to a van or multiple vans that are already in the vicinity.



But the costs of connecting many vehicles to a mobile network are high. Although the expense can often be justified, network roaming is an expense that can drastically reduce the usefulness of the mobile network.

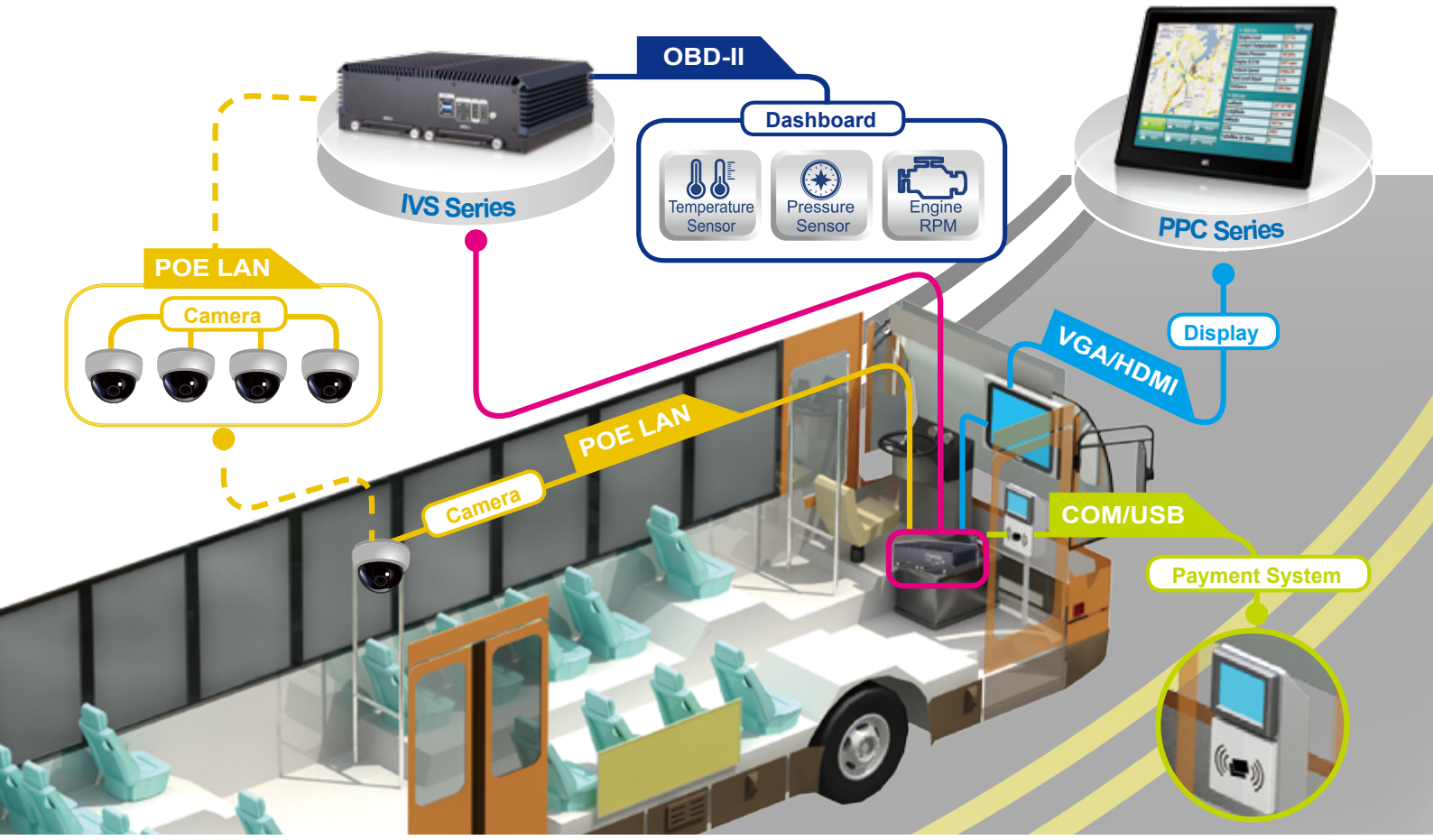
There are multiple reasons while more than one mobile network might be needed. A vehicle that travels long distances might move beyond the coverage area of a single network. Perhaps steep discounts are available from a carrier with coverage in major centers, but rural areas are only covered by a more expensive network operator. Or the vehicle might move between two countries.

Dual SIM slots open up the possibility of getting coverage from two network providers.

OBD II - Better Vehicle Monitoring

OBD is the standard interface for monitoring the functions in a motor vehicle.

The introduction of this standard has allowed for the detailed tracking and monitoring of the critical functions in any motor vehicle. The limited items initially available for monitoring have expanded to include almost every monitorable function including water temperature, voltage, speed, engine speed, mileage, oil level and temperature, average fuel consumption and even tire condition.



Despite these advancements, a major limitation has always been access to the collected data. How do you monitor these functions without the proprietary equipment that often required? Or how do you access this data so that you can process and analyze it to improve how the vehicle is used? Or how do you monitor the performance of a driver?

The OBD II standard allows for tapping into all this data.

Creating an industry standard for vehicle system monitoring, OBD II specifies an interface for connecting with the vehicle. Instead of proprietary connectors with different specifications that can vary not only between manufacturers but between models, OBD II creates a standard connector which most manufacturers are either in the process of integrating, or have already integrated into their lineups.

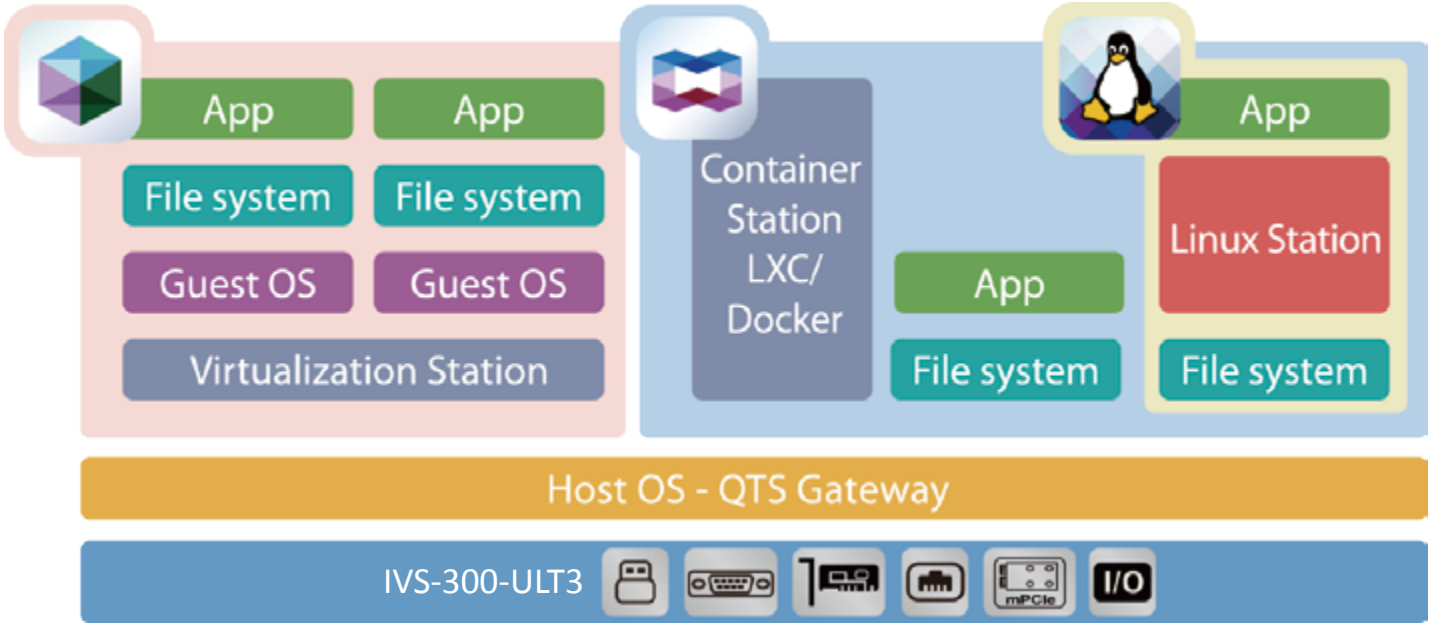
By providing these standard data ports from the vehicle, all data can be captured (often in real time) by an external device and then transmitted live or stored until it's needed later.

Availability of this data is of utmost importance. The choice of how much emphasis to put on this data depends on the use case. But with little overhead to storing the data, retaining it opens up many options for systems analysis, tweaking and optimization.

The OS Conundrum

All surveillance systems need an operating system. The OS can range from a custom setup to a variation on one of the popular PC operating systems.

A custom operating system is very efficient. These are typically found in a traditional setup of a security camera box where all control is done through a small keypad and scrolling through menu items. It's the ultimate simplicity. The machine does only one task, and does it well. Due to its design, it is also very stable.



The downside, however, comes from the simplicity. Modern systems are simply more multi-faceted. Connecting to a network, syncing with online storage and automated backups are amongst the features that are essential to any surveillance system. These features require a fully-featured operating system.

OBD II provides a standardized access to vehicle systems and functions.

Although using an off-the-shelf operating system provides a lot of flexibility and can be upgraded easily there are a few downsides. Due to the complexity, there are more things that could go wrong. The operating system and all software installed on it need to be stable to ensure system integrity. A full operating system is also just too bulky and resource heavy. Unless it is heavily parred down, there are lots of features that are just not needed, but nevertheless use up precious hardware resources.

So a combination of stability and flexibility is required.

Modern software has evolved to a point where you don't need to sacrifice stability to gain flexibility. A Linux-based system is the best approach to this as the Linux ecosystem has matured enough to provide a set of essential software to facilitate these extended services. Linux is very stable, and the most popular software designed for it is also very stable. By cutting down to the basics, the stability is retained, but the ability to extend when needed is still available.

That's where virtualization comes in. By allowing for remote access over a network, the full capacity of the surveillance system is available on any PC on that network. No need to get dedicated equipment, just use what's already there.

What's next?

That's the overview of the most important technologies needed in vehicle surveillance systems.

The main thing to remember is that technology keeps moving forward and to keep an eye on what's coming next, making provision for the possibilities while dealing with the immediate issues at hand.

Making sure you have these most important details covered is the best first step you can take.

IEI provides hardware in this category that is designed to meet all of the specifications mentioned in this document:

- Power over Ethernet
- GPS dead reckoning
- Wi-Fi
- 3G Internet with dual SIM and cloud
- OBD II
- QTS operating system for surveillance devices

So if you think we've provided value, you can have a look at what we offer.

For any questions you may have, you're more than welcome to drop me a line at sale@ieiworld.com, and we'll help you out with anything you need.