



POWER-EFFICIENT, ALWAYS-ON VEHICLE VIDEO SECURITY—MULTI-DAY PROTECTION WITH NO COMPROMISE

The Lattice External Monitoring System Enables 360° Threat Detection at Ultra-Low Power for EVs and ICE Platforms



Executive Overview

Automotive theft and vandalism continue to be costly challenges worldwide. While protective solutions exist, these centralized “always-on video” systems consume excessive battery power and computing resources. Lattice offers a smarter solution: event-driven, 360° threat detection using existing cameras—operating at just ≤ 200 milliwatt. The Lattice External Monitoring System (EMS) records only when a threat is detected, enabling multi-day parked protection for both electric (EV) and internal combustion engine (ICE) vehicles. The result? Scalable security without adding bill of materials (BOM) or compute overhead.

Overview

Vehicle theft and vandalism remain serious global concerns, making external security a must-have for today’s automotive platforms. Supporting data makes it clear: OEMs need to take a proactive approach to protect their vehicles and customers.

- In the United States, over 850,000 vehicles were stolen in 2024, with one vehicle theft occurring every 38 seconds.¹
- Across Europe, countries like France, Italy, and the UK report hundreds of thousands of vehicle thefts each year, placing them among the highest in the region for auto-related crime.²
- In the U.K., nearly 1 in 5 drivers experience vehicle vandalism each year, resulting in damages totaling close to £2 billion. The average repair cost per incident is around £661 per vehicle.³
- Commercial fleet losses, also known as motorized vehicle theft, are on the rise—with 23% of fleets in Europe lacking even basic security measures. Millions of commercial vehicles are left vulnerable to theft.⁴ Cargo theft alone costs Europe over €8 billion annually.⁵
- Nearly 28,000 catalytic converters were stolen across the US in 2023, according to the National Insurance Crime Bureau (NICB). Replacing stolen converters can cost as much as \$1,500 to \$3,000.⁶

Always-on external video security was first introduced in 2017 in an EV by a leading OEM, using a centralized compute approach to monitor the vehicle’s surroundings. Such designs keep a domain controller awake to ingest continuous camera streams, operating orders of magnitude above target parked-state budgets of ~ 0.6 W parasitic once asleep.⁷ These representative AI compute modules run ~ 15 – 60 W when active, and historical high-end perception stacks reached ~ 250 W⁸—illustrating why multi-watt parked loads cannot sustain multi-day operation on a 12V battery. Even consumer dashcams in parking mode draw ~ 1 – 4 W,⁹ enough to drain 12V systems within days.

To protect customer assets, OEMs must invest in a new generation of security solutions—low-power, distributed, and cost-efficient architectures that can reliably safeguard vehicles, even when parked for extended periods.

KEY CHALLENGES

- **Power Efficiency:** Deliver multi-day parked protection with minimal battery impact across EV and 12V ICE platforms.
- **Full-Perimeter Detection:** Achieve reliable 360° coverage with low false alarms and near-instant response.
- **Minimize Central Compute Utilization:** Keep domain controllers asleep; avoid moving or processing continuous video; reduce bus traffic and storage.
- **Integration and Cost:** Reuse existing cameras; avoid BOM, thermal, and validation overhead.

LATTICE SOLUTION

- ≤ 200 mW total (< 25 mW per camera) enables multi-day operation for both EV and 12V ICE vehicles with negligible battery impact.
- Edge AI in each camera delivers real-time 360° coverage with tuned thresholds to reduce false alarms.
- Event-driven detection activates central compute only when verified threats are detected—no continuous video streaming.
- Event-only clips and metadata reduce storage needs and lighten bus traffic.
- **Integration and Cost:** Drop-in, inline with ADAS/surround-view data paths; reuse existing cameras/ECUs; minimal BOM/thermal impact.
- Deployed on AEC-Q100-qualified Lattice CrossLink™-NX FPGAs

Challenge

The vision for next-generation external vehicle security includes always-on monitoring while the vehicle is stationary—whether parked overnight at home or unattended for days at an airport.

Drivers expect their vehicles to remain precisely as they left them—secure, undisturbed, and fully operational—even after being parked for days. This expectation extends beyond protection from theft or vandalism. It includes ensuring the battery isn't drained, the vehicle is ready to drive, and that external systems haven't silently degraded the user experience.

For OEMs, meeting consumer expectations across both EV and ICE vehicles presents critical challenges:

- **Power Efficiency Across All Vehicle Types:** While EVs often include large battery packs, they represent only ~25% of global vehicle sales. The vast majority of vehicles on the road today are internal combustion engine-based, relying solely on a 12V battery to support auxiliary systems while parked. Any effective security solution must operate on ultra-low power, enabling multi-day operation without compromising engine start-up or requiring costly power redesigns. Security shouldn't be exclusive to EVs—it must scale across the full market.
- **360° Surveillance Coverage:** Comprehensive protection requires input from multiple cameras to monitor all sides of the vehicle. Processing these inputs in real-time—without overwhelming the vehicle's compute or draining power—requires a distributed approach.
- **Event-Based Intelligence:** Recording video continuously is inefficient, especially when no threat is present. A scalable solution must use event-based AI detection to trigger recording only when suspicious activity is present. This not only reduces memory use but also minimizes unnecessary processing by the main compute system, allowing the vehicle to remain in a low-power state.

- **Minimal Cost Impact:** OEMs need a solution that leverages existing advanced driver assistance systems (ADAS) infrastructure with minimal BOM impact and without extensive reengineering. Plug-and-play capability is essential for scalability across multiple trim levels and platforms.

The centralized, always-on video security system keeps the domain controller and high-performance processors active to continuously ingest and analyze camera streams. While familiar, this approach typically draws hundreds of watts when active, making it infeasible for 12V ICE platforms and significantly impacting EV range. It also requires substantial onboard storage to retain video, increasing BOM, thermal load, and complex design.

Other currently available options have trade-offs: aftermarket dashcams in parking mode consume watts of power and aren't integrated with vehicle electronic control units (ECUs); traditional alarms (tilt, glass-break, ultrasonic) are low power but provide limited coverage, high false positives, and no visual evidence; telematics-only alerts notify owners but lack reliable classification or video for forensics. Some OEMs explore wake-on-motion image sensors or radar-based perimeter sensing to reduce power consumption, but these often struggle to deliver accurate, 360° detection while reusing existing camera pipelines.

A more scalable solution is needed—one that preserves battery life, reduces storage demands, and works across all vehicle types, enabling security as a standard feature—not a premium EV add-on. See table 1.

Table 1: Platform Constraints - EV vs. ICE for Always-On Security

FEATURE	ELECTRIC VEHICLE	ICE VEHICLE
Battery capacity while parked	High-voltage battery (but limited access)	12V battery only
Auxiliary power budget	Moderate (but still range-sensitive)	Extremely limited
Impact of security power draw	Reduces range; can trigger battery alerts	Risk of battery drain; may prevent vehicle start
Share of vehicles sold (2024)	~25% of global vehicle sales	~75% of vehicles still use ICE platforms
Design requirement	Efficient to avoid unnecessary wake cycles	Ultra-efficient to avoid full battery drain

The Lattice Solution

To meet the growing demand for intelligent, always-on external vehicle security—without draining battery life or overloading compute—the Lattice External Monitoring System delivers a decentralized architecture that embeds AI-powered threat detection directly into each surround-view camera. Built on the Lattice CrossLink™-NX FPGA and Lattice sensAI™ pre-trained AI models, the Lattice external monitoring system solution enables each camera to analyze its environment in real time, avoid storing video frames, and wake the central processor only when a verified threat is detected. The result is efficient, scalable protection that's always alert—without the power or compute burden. See table 2.

Table 2: System Architecture Overview

COMPONENT	FUNCTION
Lattice CrossLink-NX FPGA	Executes real-time AI inference inline with the camera data path.
Lattice sensAI Pre-Trained Models	Detects proximity, motion, and tamper cues relevant to parked security.
Threat Signal Output	Wakes the ECU or triggers logging only on verified events.
Event/Video Interface	Streams video to the central computer only when an event is verified.

Key Architectural Innovations

- **Real-Time Edge AI:** Each camera module includes a CrossLink-NX FPGA running purpose-built sensAI models. These models process the video stream in real-time, identifying potential threats such as motion near the vehicle or suspicious behavior. Because detection happens instantly at the edge, no video storage or buffering is required.
- **Ultra-Low Power Consumption:** Each AI-enabled camera uses less than 25 milliwatts of power, and a full system with four cameras typically operates below 200 milliwatts. This power profile allows for multi-day operation on a standard 12V battery, making the solution ideal for both EVs and ICE platforms without impacting start-up reliability or battery longevity.
- **Event-Triggered System Wake-Up:** Only when a threat is detected does the system signal the central processor or ECU to wake up, record, or respond. This event-driven design drastically reduces unnecessary compute usage, storage requirements, and power draw—keeping the central system dormant unless something important happens.
- **Drop-In Integration with Existing Cameras:** The CrossLink-NX FPGA connects directly into the existing video data path of ADAS or surround-view cameras, avoiding the need for new sensors or complete platform redesign. This approach enables fast time-to-market and minimizes BOM impact.
- **Scalable and Configurable:** The architecture supports flexible deployment—from a single rear-facing camera to a full 360°

surround-view configuration. OEMs can adapt coverage and AI complexity by trim level or regional requirements without needing different compute architectures.

This stateless, real-time architecture enables vehicles to remain in a deep sleep mode while maintaining full environmental awareness, offering significant gains in power efficiency, responsiveness, and cost-effectiveness compared to centralized, power- and storage-intensive solutions.

Why This Matters for Automotive OEMs

- **Production-Ready and Proven:** Built on Lattice's established low power FPGA platform, the solution benefits from a track record of deployment in over 50 million devices worldwide.
- **No Buffering, Low Latency, Less Waste:** By eliminating video buffering and centralized inference, Lattice's approach reduces hardware footprint, lowers power consumption, and simplifies system design—making it ideal not just for flagship EVs, but for mainstream models as well.
- **Security Friendly by Design:** Localized inference and minimal data movement reduce the system's attack surface and make it easier to audit or certify from a software security perspective.

Competitive Analysis

While there are other external monitoring solutions on the market today, each comes with significant trade-offs:

- **Centralized always-on video systems** require continuous streaming to a central processor, keeping high-power compute awake and consuming hundreds of watts. This approach is impractical for 12V ICE vehicles and negatively impacts range in EVs. Additionally, large storage demands increase thermal load and BOM costs, adding complexity and expense.
- **Traditional Alarms/Telematics-Only:** Low power and simple to deploy, but limited coverage, high nuisance alerts, and no proactive video for claims or prosecution.
- **Aftermarket Dashcams (Parking Mode):** Typical power consumption ranges from 1–4 W, with continuous video processing, limited ECU integration, and a noticeable drain on 12V systems over extended periods.

In comparison, Lattice offers an advantage with semantic, object-level detection embedded directly at the sensor, enabling event-driven wake-up without constant video streaming. The solution delivers full 360° coverage at ultra-low power—just ≤200 mW—and integrates seamlessly into existing camera data paths. This architecture is scalable across both EVs and 12V ICE vehicles, without requiring new compute or storage systems. See table 3.



Table 3: Comparison of Parked-Mode Security Solutions

APPROACH	LATTICE	ALWAYS-ON VIDEO (CENTRALIZED)	TRADITIONAL ALARMS/TELEMATICS-ONLY	AFTERMARKET DASHCAM
Typical Average Power	≤ 0.20 W Four Cameras	Up to 250 W	0.2-0.6 W	1-4 W
Evidence Quality (Forensics)	✓ Event-only clips (relevant frames)	✓ Full streams	✗ No video, or after the fact	⚠ Continuous video (hours)
Touch/Proximity Tamper Detection (No Vehicle Motion Required)	✓	✓	✗	⚠
Main Computer Wake Frequency	✓ Event-driven (rare)	✗ Constant (always-awake)	⚠ Seldom/none	Standalone (no ECU wake)
ICE 12V Compatibility	✓	✗	✗	⚠
Estimated Monitoring Time on a 12V Battery (60AH @ 50% DoD)	75 days	1.8 hours	75-25 days	15-3 days

Why Lattice

Lattice is an experienced and committed automotive production partner. We deliver automotive-grade devices, long product lifecycles, and supply assurance so programs can scale with confidence. Our stable roadmaps align with OEM governance and sourcing requirements, reducing approval friction across organizations.

We lead in ultra-low power programmable technology at the edge, giving engineering teams headroom on 12V ICE vehicle's power budgets today and margin for future features—without re-architecting the pipelines. Time-to-value is faster because we provide reference designs, MIPI/CSI-2 IP, and Lattice sensAI model packages that map directly to existing camera pipelines, so teams start from working blocks rather than a blank page.

Programmability brings agility. Thresholds, models, and policies can be fine-tuned late in the development cycle—without requiring a hardware respin—reducing non-recurring engineering (NRE) costs and lowering risk for multi-trim, multi-region launches. Security and compliance are built in: encrypted bitstreams, secure update flows, and event-only capture minimize the attack surface and data-handling overhead, simplifying cybersecurity reviews. The AEC-Q100-qualified CrossLink-NX FPGA can also be reprogrammed post-deployment via over-the-air updates throughout the systems lifetime.

Lattice is backed by a well-established ecosystem of Tier-1 suppliers, camera module partners, and global FAEs who support bring-up, tuning, and production testing. With tens of millions of edge-AI deployments already in the field, Lattice delivers the credibility, tools, and total-cost advantages needed to standardize always-on video security across both EV and 12V ICE platforms—at scale.

Results

Lattice's Edge AI architecture delivers advantages in power efficiency, responsiveness, and ease of integration for vehicle security—making it practical for both EVs and ICE vehicles.

A complete four-camera system consumes less than 200 milliwatts, enabling multi-day operation on a standard 12V battery. In contrast, centralized architecture AI compute modules run ~15–60 W of power when active,¹⁰ a level of power that is incompatible with ICE platforms and contributes to range limitations in EVs.

Unlike centralized systems that stream video to a main processor for analysis, Lattice's solution performs real-time threat detection within each camera module. This reduces system-wide data movement and eliminates the need to keep high-performance processors constantly active—overcoming a key barrier to enabling external security for parked vehicles where the only power source is a 12V battery.

The system remains in a low power state until a verified threat is detected, at which point it signals the main processor to wake and respond. This event-driven architecture minimizes compute usage and data logging, thereby reducing storage requirements and enabling the use of smaller, more cost-efficient memory components.

Integration is straightforward: the CrossLink-NX FPGA connects directly to the data path of existing ADAS or surround-view cameras, requiring minimal hardware or software changes. The solution scales across vehicle platforms and trim levels without adding compute or thermal overhead.

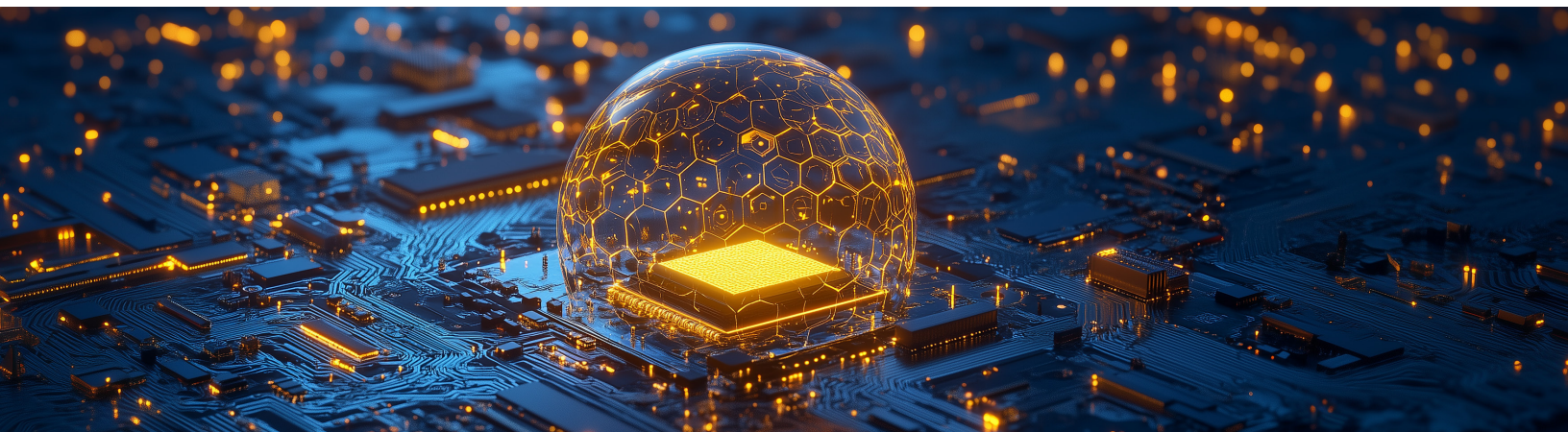
Built on proven silicon and software, with over 50 million Lattice sensAI-powered systems deployed globally and AEC-Q100-qualified CrossLink-NX FPGAs, the solution is robust, reliable, and ready for automotive production.

Conclusion

The Lattice External Monitoring System makes parked protection practical for 12V platforms, delivering ≤ 200 mW total power, 360° event-driven detection, and seamless drop-in integration. Ready for both EV and ICE programs at scale, Lattice's production-ready architecture combines real-time threat detection with ultra-low power consumption—empowering OEMs to deploy intelligent vehicle security without compromising battery life, compute resources, or time to market.

References

1. <https://www.nicb.org/news/news-releases/vehicle-thefts-united-states-fell-17-2024>
2. <https://www.motor1.com/news/723537/car-theft-top-five-countries-europe/>
3. <https://www.firstvehicleleasing.co.uk/blog/the-true-cost-of-car-vandalism>
4. <https://www.fleeteurope.com/en/safety/europe/features/protecting-fleet-vehicles-car-theft-rises-across-europe>
5. <https://trans.info/en/cargo-theft-surges-419606>
6. <https://www.consumerreports.org/money/theft/how-to-prevent-catalytic-converter-theft-a6785016673>
7. https://gm-techlink.com/wp-content/uploads/2021/01/GM_TechLink_24_Mid-December_2020.pdf
8. <https://arstechnica.com/gadgets/2016/01/nvidia-outs-pascal-gpu-in-new-supercomputer-for-self-driving-cars>
9. <https://dashcamtalk.com/forum/threads/parking-mode-power-consumption.48882>
10. <https://gzhls.at/blob/ldb/f/9/d/d/5633fb3e3218e1908bb2032278c63e176dc0.pdf>



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