Community Security with Low-Cost AI Cameras: Scenario-Based Applications and Trends in Edge Computing and Lightweight Models

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Abstract

With the refinement of grassroots community governance, the demand for low-cost, wide-coverage video surveillance tools in community security continues to grow. Using the M-brand AI-enabled camera, which integrates edge computing and AI model lightweighting technologies, as a practical case study, this paper addresses core needs such as monitoring special groups and identifying fire hazards. It analyzes the technical requirements, application scenarios (e.g., equipment hazard identification, fire lane monitoring), and commercial advantages (cost, installation, efficiency, customer stickiness, value-added services) of low-cost video surveillance tools, considering the characteristics of grassroots governance—budget constraints, data sensitivity, and system interoperability. The paper also explores commercial challenges related to performance compatibility, cost controllability, data security, and system integration. Furthermore, it predicts future development trends across four dimensions: intelligence, collaboration, low-cost high performance, and policy drive. The study concludes that such tools must focus on "functional adaptability, cost controllability, and compliance/security" to address key pain points. In the future, they are expected to evolve from edge-assisted products into mainstream solutions for community security, providing technical support for refined grassroots emergency management and governance. Enterprises that align with these trends will gain a market advantage.

Keywords Community Security; Video Surveillance Tools; Scenario Application; Commercial Trends; Smart Cameras; Low-Cost

1 Introduction

Domestic enterprises are currently accelerating the development of edge computing AI camera cores integrated with intelligent visual algorithms.Their core features include multi-task collaboration, lightweight models, and domestic chips, making them suitable for a wide range of scenarios including public safety, smart transportation, and culture-education-health sectors. In the form of low cost, low power consumption, and high computing power, they enable accurate real-time monitoring (e.g., fire/smoke detection, person fall detection, illegal vehicle parking), significantly improving the efficiency of public safety hazard monitoring.

With the continuous advancement of refined grassroots community governance, community security, as a core link in livelihood protection and emergency management, is experiencing sustained growth in demand for low-cost, wide-coverage video surveillance tools [1]. These tools, with "low procurement cost" as their core competitive advantage, are widely used in budget-constrained grassroots scenarios such as old communities and urban-rural fringes. However, their commercial implementation still faces multiple practical contradictions from the dual perspectives of community workers (frontline users) and grassroots governments (procurement managers) [2-4].

This paper is based on the practical needs of community security, including core scenarios like special group monitoring, fire hazard investigation, and personnel flow control. It considers the typical characteristics of grassroots governance—"strict budget constraints, sensitive data security, and high system interoperability requirements"—and combines the real-world practice of the low-cost M-brand AI camera in community hazard identification scenarios. It analyzes the application and commercial challenges of low-cost community video surveillance tools based on edge computing and AI model lightweighting technologies. Furthermore, based on technological iteration and policy orientation, it predicts their development trends, aiming to provide theoretical support for functional optimization and market promotion of these tools [5-6].

2 Visual Monitoring Technology Requirements in the Community Security Field

In the community security field, visual identification for hazard investigation requires electronic cameras with core technologies such as Edge computing capability (localized real-time processing to reduce bandwidth pressure), AI chip empowerment (NPU/ASIC, etc., supporting lightweight model operation) and Multi-task real-time analysis (object detection, tracking, structured data extraction).

The M camera, utilizing edge computing and AI model lightweighting technologies, encapsulates complex algorithms into "one-click photo capture," empowering frontline community security personnel with expert-level capabilities. The successful low-cost application of the M camera in communities demonstrates the irreplaceability of lightweight AI + edge computing in community security technology. As the computing power of edge chips increases (e.g., the 35 TOPS computing power of the A18 chip), the lightweight AI + edge computing model is expected to be replicated in pan-industrial scenarios involving large-scale hazard inspections of public facilities (e.g., power line inspection, maintenance of transportation facilities). This positions it to become the public safety foundation for new infrastructure, capable of reducing the economic cost of security while improving the efficiency of security work.

Table 1. Visual monitoring technology requirements in the community security field

Scenario	Application Requirement	Technical Solution
Power Inspection	Real-time identification of power line defects	Model pruning at the edge + local inference
Campus Security	Monitoring intrusions into restricted areas, falls, bullying behavior	Lightweight CNN + Edge Server
Industrial Internet	Computing platform enabling predictive maintenance of equipment	Edge-Cloud Coordination + Lightweight Model

3 Application of Smart Cameras in the Community Security Field

Taking the M camera as an example, its main application scenarios in the community security field are summarized below:

Table 2. Application of smart cameras in the community security field

Application Scenario	Technical Application
Equipment Hazard Identification	AI automatically frames risk points (e.g., unlocked power distribution cabinet doors, overly low guardrails) and labels the type
Inspection & Attendance Management	Manages community security patrols and dynamically records the process
Fire Escape Monitoring	Analyzes live surveillance footage to automatically identify obstructions and push alerts
Personnel Safety Supervision	AI face recognition for attendance + safety gear detection (hard hats, reflective vests), with data anonymized locally
Infrastructure Inspection	Combines GPS watermarking with AI recognition to automatically generate hazard reports with coordinates (e.g., pipeline corrosion location maps)
Emergency Incident Management	sed during the pandemic for reporting home quarantine and recording nucleic acid test results, with watermarks ensuring authenticity; real-time identification of incidents (e.g., person collapsing) and linkage to emergency response.
Routine Safety Publicity	One-click generation of safety drill photo albums/comparative rectification images to showcase work results to residents; one-click editing of community safety awareness short videos.

3.1 Intelligent Equipment Hazard Identification

AI cameras, trained on massive databases of community safety hazard images (e.g., pipeline corrosion, cracks, equipment abnormalities, blocked fire escapes, exposed wires), utilize deep learning models. These deeply trained models can keenly capture subtle anomalies in complex scenes, such as patches of corrosion on pipes, unlocked power distribution cabinet doors, or overly low guardrails. Leveraging edge computing, they achieve millisecond-level local identification, automatically frame the hazard point, label the risk type, and generate precise annotations and risk prompts. This addresses the issues of visual blind spots and fatigue-related missed inspections inherent in manual patrols, propelling property management into an era of "proactive prevention." In 2024, during a routine inspection in a Nanjing community, property personnel used AI identification to detect and mark early-stage corrosion behind water pipe equipment (previously missed multiple times in manual checks). The system automatically generated a repair work order, and the issue was resolved within 48 hours, preventing a potential pipe burst incident.

3.2 Intelligent Inspection and Attendance Management

The use of AI cameras has enhanced the standardization level of the entire process from discovery to rectification in community safety governance. The specific steps are as follows:

Community safety inspectors take photos with AI annotations and watermarks→Photos are automatically synced to the management backend→Managers generate repair work orders with one click and assign personnel→Post-repair photos are taken for feedback→The system automatically compares the rectification effect and saves the record.

Through face recognition watermark photo check-ins, lightweight AI automatically counts attendance and identifies absent personnel, replacing traditional punch clocks and enabling anti-cheating attendance. Simultaneously, electronic fences are set to define patrol areas, ensuring security personnel inspect within designated boundaries. Photos automatically record time and location, preventing false inspections. After implementing smart cameras, community property companies reported shorter hazard response cycles, an initial reporting rate increase of over 30%, and more accurate identification of highly concealed risks, alongside improved efficiency in patrol attendance and process documentation. Since 2021, a community in Nancun Town, Panyu District, Guangzhou City, Guangdong Province, began promoting the use of AI cameras for community security patrol management and record-keeping, rapidly enhancing the efficiency of daily inspections conducted by street public management office staff, administrative law enforcement officers, and community grid workers within the jurisdiction.

3.3 Fire Escape Monitoring

AI cameras are equipped with the lightweight YOLOv8-tiny object detection model (model size compressed to 8MB, suitable for low-compute edge devices). Without relying on cloud computing power, they analyze surveillance footage in real-time on the device end, accurately identifying two core hazards within fire escapes: (1) obstructions (e.g., furniture, cardboard boxes, shared bicycles), and (2) illegal parking (motor vehicles, electric tricycles).

Technically, after the AI model completes identification via edge computing, it triggers a three-level response within 5 seconds: (1) A local pop-up alert ("Fire Escape Blocked") with a buzzer sound on the device; (2) Pushing alert information (including site photos, latitude/longitude) via an edge gateway to the community security backend and community grid workers' mobile terminals; (3) Automatically retrieving surveillance footage from the escape entrance to assist in confirming the source of the hazard (e.g., license plate of illegally parked vehicle, owner of obstruction). Concurrently, to protect resident privacy, the model automatically blurs the faces of individuals in non-hazard areas, retaining clear images only of the hazard targets. After the implementation of this technology in a community in Nancun Town, Panyu District, Guangzhou, in 2023, the response time for fire escape blockage alerts was reduced from 4 hours (manual inspection) to 5 minutes. Monthly blockage incidents dropped from an average of 12 to 2, and the year-end fire department inspection pass rate increased from 85% to 100%, with no further emergency response delays due to blocked passages.

3.4 Personnel Safety Supervision

Leveraging the local NPU computing power of edge devices (e.g., domestic RK3588 chip), AI cameras achieve the dual goals of "privacy protection + safety supervision":

Security Personnel Management

Integrates the ArcFace-Lite lightweight face recognition model, completing attendance verification on the device end. Only the "attendance success/absent" result is uploaded to the backend; original facial data is stored locally and regularly anonymized and deleted, mitigating data leakage risks. Simultaneously, equipped with gear detection algorithms, it identifies in real-time whether security personnel are wearing hard hats and reflective vests. If standards are not met, voice reminders are triggered on-site, and violation information is recorded in the management system for subsequent assessment.

Community Personnel Early Warning

For unfamiliar individuals, the model analyzes features like "lingering duration" and "behavioral trajectory" to automatically mark suspicious behavior and push notifications to security posts, assisting community guards in timely intervention and inquiry, thereby reducing risks like theft and dangerous solicitation. After implementation in an old community in Yuhuatai District, Nanjing, in 2024, the compliance rate of security personnel equipment increased from 75% to 98%, the timely handling rate of suspicious loitering incidents by unfamiliar persons increased by 60%, no patrol accidents due to lack of equipment occurred throughout the year, and community theft cases decreased by 45% year-on-year.

3.5 Infrastructure Inspection

Smart cameras, combined with GPS positioning modules and lightweight image classification models, enable the integrated "identification—positioning—reporting" of community infrastructure hazards:

When inspectors use the camera, the device automatically generates watermarked photos containing latitude/longitude, timestamps, and inspector information. The AI model simultaneously identifies the hazard type locally, covering 6 major categories and 23 sub-items including municipal facilities (broken streetlights, blocked drains), public facilities (rusty fitness equipment, missing manhole covers), and building facilities (wall cracks, loose stair railings), with an identification accuracy rate exceeding 92%.

After identification, the system automatically logs the hazard information (type, location, photo) into the community maintenance management platform, generates an electronic work order with navigation functionality, and pushes it to the relevant maintenance personnel. After repair completion, personnel take rectification photos, and the system uses AI to compare "before and after rectification" images, automatically determining whether the hazard has been eliminated, forming a closed-loop management process.

After applying this model in a community in Nansha District, Guangzhou, in 2023, infrastructure inspection efficiency increased by 40% (single-person daily inspection coverage expanded from 5 to 8 buildings), the hazard repair closed-loop time shortened from 72 hours to 24 hours, resident satisfaction with "facility integrity" increased from 82% to 95%, and the property's annual maintenance costs decreased by 18%.

3.6 Emergency Incident Management

The real-time nature of edge computing and the rapid response capability of AI models make them "rapid response tools" for community emergencies:

Public Health Emergencies

During the pandemic, community grid workers used AI cameras to photograph quarantine seals on the doors of home-isolated individuals and nucleic acid test reports. Watermarks ensured the authenticity and traceability of "time—location—person" information, preventing false reports. The model also identified whether quarantined individuals violated restrictions by going out, immediately pushing anomalies to the community epidemic prevention task force.

Personal Safety Emergencies

Some high-end smart camera models integrate lightweight human pose recognition models, capable of real-time identification of sudden situations like "person collapsed" or "physical altercations." Within 10 seconds of identification, they can link with community emergency stations, pushing the site location and live footage to assist emergency personnel in understanding the situation in advance (e.g., presence of injured persons, crowds gathering), shortening emergency response preparation time.

3.7 Routine Safety Publicity

Smart cameras are not only "supervision tools" but can also be transformed into "content production tools" for community safety publicity:

Result Demonstration

The system supports one-click export of security work materials from a specified period, automatically generating comparative images showing hazards before and after rectification (e.g., blocked fire escapes, equipment repairs), and safety drill photo albums. Community service providers can display these in resident groups or on notice boards to enhance resident recognition of security efforts.

Awareness Dissemination

Based on the AI-identified hazard case library, the system can one-click edit short videos for safety bulletins, embedding AI-annotated hazard points within the video to intuitively describe risks. It also supports generating illustrated community safety prevention manuals, suitable for posting on community notice boards to warn of and prevent safety incidents.

4 Commercial Advantages of Smart Cameras in the Community Security Field

As a community video surveillance tool, the M camera, leveraging its core characteristics of low cost, lightweight design, low power consumption, and high computing power, combined with the practical needs of community security, translates into the following key commercial advantages:

4.1 Cost Advantage

The primary advantage of smart cameras is the reduction of both initial customer investment and long-term operational costs, specifically including:

Controlled Hardware and Algorithm Costs

The "low cost" feature of smart cameras is reflected in the one-time hardware investment and algorithmic support throughout the product's lifecycle. Since smart cameras have built-in computing power, there is no need to repeatedly purchase algorithm services. Compared to traditional surveillance equipment that requires frequent hardware replacement and payment for cloud computing power, the long-term cost is significantly reduced. For instance, Foxconn Industrial Internet's AI smart cameras directly reduce subsequent investments for community properties.

Reduced Labor Costs

Real-time intelligent analysis supported by high computing power (e.g., human shape recognition, motion tracking, abnormal behavior detection) can replace the traditional security model of "manual patrols watching large screens," potentially reducing the number of security personnel and thus controlling labor costs. For example, AI smart cameras can provide real-time alerts for scenarios like "fire, illegal intrusion, illegal electric vehicle parking," greatly reducing the number of community security personnel required and lowering the labor costs of community management.

Lower Operating Costs

The combination of low power consumption and 4G/solar technology allows devices to be deployed in community scenarios without power sources or network cables (e.g., remote corners, construction sites, green belts), addressing the pain point of traditional surveillance's "dependence on network cables and power sources," further reducing operating costs.

4.2 Installation Advantage

The small size and lightweight design enhance installation convenience, enabling smart cameras to be flexibly deployed in various community scenarios such as corridors, elevators, public areas, parking lots, and fire escapes. They do not require complex installation work like wiring or fixing large equipment, reducing both installation costs and time costs. This flexibility allows smart cameras to cover community "blind spots" (e.g., community edges, ends of fire escapes), improving the comprehensiveness of community security and meeting the demand for "full-scenario monitoring" in community safety prevention and control.

4.3 Efficiency Advantage

Real-time Accurate Identification, Reducing False Positives and Missed Detections

AI algorithms supported by relatively high computing power, such as object recognition and behavior analysis based on deep learning, enable an upgrade "from seeing to understanding," accurately identifying abnormal scenarios like "stranger entry, objects thrown from heights, illegal parking in fire escapes, grass fires," reducing the "false alarm" and "missed detection" problems of traditional surveillance. AI chips support human shape recognition and motion tracking, promoting the shift of community security from "passive recording" to "active defense."

Shifting Computing Power to the Terminal, Improving Response Speed

The high computing power characteristic allows computing power and algorithms to be moved forward to terminal devices. The intelligence of front-end cameras moves part of the video analysis to the edge, eliminating dependence on cloud computing power. Video that requires cloud computing power is pushed to the cloud. This reduces network latency and enables "real-time response." For example, when a stranger enters the community, the camera can immediately focus on monitoring their behavior; when an object is thrown from a height, the footage is immediately extracted and uploaded to the cloud. This real-time capability enhances the emergency handling efficiency of community security, aligning with the community's need for graded prevention and control of sudden incidents.

4.4 Customer Advantage

Leveraging high computing power features, smart cameras can accurately address high-frequency pain points in community security. For instance, using AI algorithms to extract footage of objects thrown from heights and upload it to the cloud, achieving visual management of illegal parking in fire escapes, and real-time tracking of stranger behavior with early warnings directly solve community safety management challenges and resident safety needs, significantly enhancing both parties' reliance on the product. Simultaneously, its "real-time alert + accurate identification" capability can quickly respond to scenarios like elderly falls or lost children, providing residents with comprehensive safety protection, enhancing their trust in the community, thereby optimizing the relationship between the community and residents, and strengthening customer stickiness.

4.5 Value-Add Advantage

Multiple Algorithms Support Value-Added Services

High computing power supports machine vision algorithms such as passenger flow statistics, behavior analysis, and vehicle management, enabling smart management services beyond the scope of security. For example, optimizing the layout of community convenience facilities through passenger flow statistics, linking behavior analysis with medical services to respond to abnormalities, and standardizing parking order through vehicle management. This promotes the upgrade of the device from a "security tool" to a "community smart management tool," helping communities expand monetization avenues through value-added service charges and cooperation with third-party businesses.

Device-Edge-Cloud Synergy Enables Data Monetization

The "high computing power + low power consumption" supports a device-edge-cloud collaborative architecture. The front end collects community data such as human and vehicle flow, while the cloud analyzes this data to generate valuable insights like safety trends and resident needs, supporting refined community management. Simultaneously, with resident consent, data can be authorized to third parties like insurance companies and retail businesses, achieving commercial value-added monetization of data.

5 Commercial Challenges and Development Trends of Low-Cost Community Video Surveillance Tools

5.1 Commercial Challenges

Mismatch Between Performance and Scenario Requirements

The core development bottleneck of low-cost tools lies in the structural contradiction between limited hardware configuration and the complexity of community scenarios. From a hardware perspective, most products use low-performance sensors with resolutions no higher than 720P, paired with low-computing-power edge modules. This results in infrared imaging noise rates exceeding 30% in low-light environments like corridors and corners of old communities, failing to meet basic security needs such as facial feature recognition. In high-density human flow scenarios like urban-rural fringe vegetable markets or night markets, limited by insufficient algorithm generalization capability, the identification delay for abnormal behaviors (e.g., crowd gathering, physical altercations) exceeds 15 seconds, making it difficult to support the real-time response needs of community workers. From a functional coverage perspective, smart functions that communities focus on, such as special group monitoring (e.g., elderly fall detection, child loss warning) and safety hazard control (e.g., electric vehicle entry into elevator detection), require high-performance AI models for technical support. However, low-cost tools generally come with generic face recognition algorithms; the coverage rate for these specialized functions is less than 40%, and the false alarm rate is high. A typical scenario is mistaking a resident bending down to pick up an object for an elderly fall, preventing the tools from being practically usable. Furthermore, these tools often exist as single devices, lacking interfaces for collaboration with existing community IoT devices (e.g., smoke alarms, smart access control systems). Community workers need to operate across multiple systems, which reduces work efficiency.

Insufficient Controllability of Total Cost of Ownership

The core demand of grassroots governments for a favorable "cost-benefit ratio" significantly conflicts with the characteristic of low-cost tools whereby "hidden costs become apparent." Firstly, equipment maintenance costs are high: Due to factors such as adverse weather conditions and inadequate maintenance of public passageways, the average service life of low-cost community visual monitoring tools is only 1 to 2 years, significantly shorter than the 3 to 5 years of traditional security equipment. Additionally, software algorithm upgrades require per-use payments, with single upgrade fees ranging from 200 to 500 RMB per device. Operational data from one sub-district office shows that the annual maintenance cost for 100 low-cost devices exceeds 30,000 RMB, accounting for 60% of the sub-district' s annual security budget. Secondly, installation and debugging costs exceed budgets: In older communities, the cost of circuit renovation (including rewiring and cable installation) reaches 300 to 500 RMB per point. In rural communities, the expense of network coverage (such as fiber optic access) can even exceed three times the procurement cost of the equipment, creating a practical dilemma of "affordable to buy, unaffordable to install." Thirdly, personnel training costs add to the burden: Most community workers lack technical backgrounds, while the operational interfaces of low-cost tools are relatively complex. This necessitates an additional 2 to 3 specialized training sessions, and the per-person training cost further increases the human resource burden on grassroots governments.

Data Security and Compliance Risks

Grassroots governments face dual pressures of "data governance" and "privacy protection" in community security management, and low-cost tools have significant shortcomings in this area. On one hand, data security protection capabilities are weak: over 70% of low-cost products use plaintext transmission protocols, and local storage relies on SD cards without encryption, making them vulnerable to hacker attacks or internal data leaks. This violates the "full-process security guarantee for personal information" requirement of "Personal Information Protection Law of the People's Republic of China", exposing grassroots governments to compliance risks with fines of up to 50 million RMB. On the other hand, data storage and qualification compliance are insufficient: local storage capacity is mostly 32GB to 64GB, insufficient to meet the regulatory requirement of "retaining video data for 30 days." Cloud storage services require monthly payments per device, costing 10 to 20 RMB per device per month, adding extra budget expenditure for grassroots governments. Simultaneously, 35% of low-cost products have not passed the Ministry of Public Security's "Compulsory Product Certification (3C Certification)," failing to meet the "compliance access" standard for government procurement and thus cannot be included in official procurement catalogs.

Compatibility Barriers in System Integration

Grassroots governments have established existing systems such as emergency management and community grid management, e.g., "Digital City Management" platforms. However, due to a lack of interface standardization, low-cost tools struggle to achieve cross-system collaboration. First, data formats are incompatible: low-cost tools often use private video encoding (e.g., simplified H.265) and communication protocols, which do not match the "GB/T 28181 Information Transmission Requirements for Video Surveillance Networking Systems for Security Protection" standard followed by existing systems. Developing adaptation interfaces is required, costing 10,000 to 20,000 RMB per system integration. Second, the data silo effect is significant: visual monitoring data cannot be linked with community population databases or emergency resource databases, leading to a lack of "precise response" capability. For example, when an elderly fall is detected, the system cannot automatically retrieve the contact information of the elderly person's family members, prolonging emergency response time.

5.2 Development Trends

Intelligentization: Scenario-Specific Lightweight AI and Multi-Modal Fusion

Addressing the core need of community workers to "proactively solve practical problems," low-cost tools will upgrade towards "lightweight intelligence." First, deployment of scenario-specific AI models: Develop community-specific AI models like "elderly fall detection" and "electric vehicle elevator entry detection" based on lightweight frameworks like TensorFlow Lite, enabling localized inference on ordinary hardware via edge computing. A practical case shows that such scenario-specific models can reduce hardware costs by 60% while keeping the false alarm rate below 5%. Second, multi-modal fusion perception: Establish a linkage mechanism combining "visual monitoring + IoT devices." For example, linking visual monitoring tools with smoke alarms, so that when a smoke alarm triggers a warning, the visual tool automatically pans/tilts to the alert area and pushes live video to the management terminal, transitioning from passive monitoring to active warning. Third, modular function customization: Adopt a product architecture of "basic functions + value-added modules," allowing users to select value-added modules like "special group monitoring" or "safety hazard investigation" based on actual community needs, paying for functions as needed, thereby reducing initial procurement and maintenance costs.

Collaboration: Integrated Platforms and Cross-Department Data Sharing

Responding to the demand of grassroots governments for "resource integration and efficiency improvement," low-cost tools will develop towards platform-based collaboration. On one hand, build an integrated community security platform: Consolidate visual monitoring, IoT devices, and emergency command functions into a single platform for unified interface management. On the other hand, establish cross-department data collaboration mechanisms: Use standardized interfaces to achieve linkage with public security population databases and civil affairs special groups databases. For example, when a stranger is detected loitering in the community for over 10 minutes, the system automatically queries the public security database to verify the person's identity, achieving "data-driven precise response".

Low-Cost & High-Performance: Coordinated Optimization of Hardware, Algorithms, and Storage

Balancing cost and performance through technological iteration is the core development direction for low-cost tools. At the hardware level, use starlight-level image sensors and low-cost edge computing boxes. Starlight-level sensors can achieve 1080P resolution for nighttime imaging, and edge computing boxes cost no more than 500 RMB each, replacing traditional high-performance servers and reducing hardware costs by 50%. At the algorithm level, use lightweight object detection algorithms like YOLOv8-tiny, which reduce computing power requirements by 70% while maintaining 80% recognition accuracy. At the storage level, adopt a "cloud-edge collaboration" architecture, combining local video data caching with on-demand cloud storage. For instance, leveraging Alibaba Cloud Object Storage Service (OSS) with pay-as-you-go pricing, the monthly storage cost for 100 devices is only about 200 RMB, an 80% reduction compared to full cloud storage models.

Policy-Driven: Dual Guidance through Subsidies and Standards

Policy regulation and financial support will become key levers for the standardized development of the low-cost tool market. First, financial subsidy mechanisms: Some provinces have introduced procurement subsidy policies. Practical data from a community shows that when purchasing 100 low-cost tools, the sub-district user only needed to pay 30,000 RMB after policy subsidies, a cost reduction of 50%. Second, industry standard regulations: Local governments are progressively formulating "Technical Requirements for Community Intelligent Security Equipment", specifying technical indicators such as nighttime imaging resolution not lower than 720P and abnormal behavior identification false alarm rate not higher than 10%, guiding enterprises to improve product quality. Third, government procurement orientation: Include low-cost tools that meet compliance requirements in government procurement catalogs, prioritizing the procurement of products with strong "scenario adaptability," thereby directing market resources towards practical applications.

6 Conclusion

The realization of the commercial value of low-cost community video surveillance tools must be centered around the core dimensions of "functional adaptability," "cost controllability", and "compliance and security" to effectively address the practical pain points in grassroots-level governance.

In the future, with the community-level deployment of intelligent technologies, the construction of collaborative platforms, the continuous optimization of technical costs, and the guidance and support of policies, such tools will be upgraded from "peripheral auxiliary products" to "mainstream community security solutions", providing crucial technical support for the refinement of grassroots emergency management and community governance. Enterprises that can solve these challenges and adapt to these trends will gain a dominant position in the low-cost community video surveillance tool market.

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Conflicts of Interest

The authors declare no conflicts of interest.

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Biographies

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低成本視頻監控工具在社區安防領域的場景應用與商業趨勢——基於邊緣計算與AI模型輕量化技術的智能相機的社區應用

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摘要：隨著基層社區治理細緻化推進，社區安防對低成本、廣覆蓋視頻監控工具的需求持續增長。本文以整合邊緣運算與AI模型輕量化技術的M品牌AI水印相機為實踐案例，立足於社區特殊群體監護、消防隱患排查等核心需求，結合基層治理「預算約束、數據敏感、系統協同」特徵，分析低成本視頻監控工具的技術需求、應用場景（設備隱患識別、消防通道監控等）及商業優勢（成本、安裝、效率、客戶黏性、增值服務），探討其在性能適配、成本可控性、數據安全、系統兼容性方面的商業挑戰，並從智能化、協同化、低成本高性能、政策驅動四方面預判發展趨勢。研究認為，此類工具需以「功能適配性、成本可控性、合規安全性」為核心突破痛點，未來將從邊緣輔助產品升級為社區安防主流解決方案，為基層應急管理與治理細緻化提供技術支撐，順應趨勢的企業將佔據市場優勢。

關鍵詞：社區安防；視頻監控工具；場景應用；商業趨勢；智能相機；低成本

1. 劉惠苑，碩士，廣州科技貿易職業技術學院應急技術學院副教授，從事社區公共服務研究與實踐。近5年主持省級質量工程項目2項，省級科研平台項目1項，市級青少年科技教育項目1項，校級科研項目7項，參與省、市級科研及教改項目共9項。