The Opportunities and Challenges of Smart Glasses in the Senior and Child Care Market

Tian Lei[1,*], Fu Rongrong[2], Luo Min[2]
[1]Data Research Center, China Academy of Information and Communications Technology, Beijing, China
[2]CTTL-Terminals, China Academy of Information and Communications Technology, Beijing, China
**Corresponding Author*

Abstract: Smart glasses, as a product of the integration of augmented reality (AR) technology and wearable devices, are experiencing explosive growth. In 2025, China's smart glasses market will increase by more than 100% year-on-year for two consecutive quarters, with shipments of 664,000 units in the second quarter, and lightweight AR devices becoming a key growth point. Starting from the market demand of the Senior and Child, this paper systematically analyzes the opportunities faced by smart glasses in the fields of cognitive assistance, health monitoring, and vision improvement. At the same time, it reveals the challenges in the industrial ecology such as lack of standards, privacy risks, and channel integration contradictions. By constructing a three-dimensional analysis framework of Technology-Market-Ecology, a governance path to promote the sustainable development of the industry is proposed to address the challenges of population aging and unequal educational resources in the future.

Keywords: Smart Glasses; Holographic Optical Waveguide

1. Introduction

1.1 Care of the Senior and Child Care has Become a National Strategic Priority

With the demographic undergoing significant shifts, care of the Senior and Child (CSC) become a national strategic priority [1]. The AI-driven smart eyewear market has shown exponential growth, with shipments in China reaching 494,000 units in the first quarter of 2025, a year-on-year increase of 116.1%[2]. At the technical level, the breakthrough of body holographic optical waveguide technology has made it possible to lightweight equipment (weight <30g) and high light transmittance (>85%)[3], laying the foundation for long-term wear by the elderly and children. behind the market surge lies an ecological challenge that problems such as fragmentation of technical standards, data security vulnerabilities, and difficulties in integrating traditional channels are prominent. This paper aims to clarify the value creation mechanism of smart glasses in CSC market, reveal the vulnerability of ecology, and provide support for policy formulation and industrial practice.

1.2 Smart Glasses Set Off a Global Race on AI

In 2025, the global smart eyewear market shipments are expected to reach 14.5 million units, a year-on-year increase of 42.5%, and the increase is expected to be as high as 247.5% during the whole year[4], setting off a technology race on AI. Meta maintains its absolute leading position in hardware[5], accounting for 60.6% of the market share of AR/VR+ screenless smart glasses in the second quarter of 2025. It is followed by Xiaomi with 7.7% market share, with XREAL (4.1%), RayNeo (2.7%) and Huawei (2.6%) rounding out the top five. With the promotion of optical stores and consumer electronics retailers, smart glasses hardware shipments will reach 43.1 million units in 2029.

1.3 Smart Glasses have Become a Necessity for Some People

The second-generation Meta Ray-Ban glasses led the rapid growth of the market, with sales reaching 1.4 million in 2024 and 4 million in 2025, and the related growth drivers come from three aspects:

Copyright @ STEMM Institute Press

First, technology allows smart glasses to load complex functions under the premise of lightweight. For example, weighing approximately 50 grams, the Wayfarers are equipped with a suite of advanced features. This includes a 12-megapixel ultra-wide-angle camera and an acoustic system with an open speaker and five microphones. The device is supported by 32GB of internal storage, Bluetooth and Wi-Fi connectivity, and offers a battery life of up to four hours[6]. When AI is integrated into smart glasses, there is much more than a bulky pair of glasses bolted to cameras and speakers.

Second, the device enables special groups to interact with their surroundings discreetly through the glasses. By utilizing the integrated camera, the wearer can seamlessly query contextual information-such as asking, "What Park is this?"-without the interruption of retrieving and typing on a smartphone. Smart glasses may become an essential aid for the 430 million people with moderate or greater hearing loss who need hearing aids[7], especially 32 million children and nearly 180 million elderly people. Essilor Luxottica recently released smart glasses with built-in microphones that capture the sound pointed by the glasses in noisy environments and direct them to the listener through the built-in speakers on the arms. Transcribe's smart glasses use microphones to receive conversations in the glasses' field of view and transcribe them into the wearer's lenses in text form, allowing the hearing-impaired to read the conversation as if they were reading subtitles.

Third, smart glasses free the wearer’s hands. With seamless integration for social media platforms, these smart glasses enable users to watch live streams, record videos, and even initiate live broadcasts directly from the frame. Meta's ultra-thin design allows wearers to effortlessly document life's most significant moments-from birthday gatherings to Lunar New Year's Eve celebrations-preserving them in high-quality video to be cherished and shared for a lifetime.

2. The Technological Evolution and Market Explosion of Smart Glasses

2.1 Evolution Path of Key Technologies for Smart Glasses

The technology of smart glasses is changing from display-centric to multi-modal interactive integration. For the CSC market with a large user base and diverse needs, the technological evolution of smart glasses is defined by the orchestrated advancement of multiple, interdependent technology stacks. At its core, this progression addresses the fundamental engineering challenge of balancing high-performance display, intuitive interaction, and substantial computational power with the stringent constraints of battery life and device form. The future smart glasses will no longer be a simple screen on the face, but a cognitive and health assistance platform that integrates advanced sound-light perception interaction and computing power.

For the CSC market, these technological advances will directly translate into lower barriers to entry, more natural interactions, and more accurate service capabilities, thereby unlocking their huge social and economic value. However, the rapid iteration of technology has also amplified its ecological challenges in terms of standards, privacy, and ethics, which requires technology research and development to be carried out in parallel with the construction of governance frameworks.

2.2 Technological breakthrough of bulk holographic optical waveguides

Optical waveguide technology is at the heart of the optical system of smart glasses. Polymer dispersive liquid crystal (PDLC) holographic optical waveguide achieves large field of view and low dispersion through nanoscale grating structure, which solves the problems of vertigo and bulkiness of AR devices[8]. The maturity of related technologies has transformed smart glasses from special devices to daily wearable terminals.

2.3 Structural Characteristics of Smart Glasses Market Growth

In 2025, China's smart glasses market will show the characteristics of "two-wheel drive": audio shooting glasses will grow explosively: shipments will be 359,000 units, a year-on-year increase of 197.4%, and its low threshold and AI multi-modal interaction characteristics will attract mobile phone manufacturers; Lightweight AR glasses have become the new focus: AR equipment shipments were 86,000 units, a year-on-year increase of 64.0%, and the application scenarios expanded from watching movies to healthy companionship and mobile office. The

 Copyright @ STEMM Institute Press

market focus has penetrated from online channels to traditional optical stores such as Baodao, reflecting the trend of product routine.

3. The Scenario and Value of Smart Glasses in the CSC Market

3.1 The Target Users of Mainstream Smart Glasses are Young Technology Enthusiasts

The current mainstream smart glasses manufacturers target young technology enthusiasts, who regard glasses as the next cool smart terminal, highlighting their personal taste and geek identity, and valuing the convenient shooting function of the first-person perspective for creating Vlogs and short videos to meet the needs of social display. Positioned as a cutting-edge tech accessory, smart glasses function as a strategic node and contextual hub within the AIoT ecosystem. They extend beyond the phone, seamlessly linking with wearables and smart home devices to create a cohesive and intelligent experience loop. The glasses' native application not only facilitates optimized video capture and direct uploading to short-form video platforms but also enables seamless integration with speakers and smart home devices. To enhance accessibility, consumers can experience the product through both the dedicated app and authorized retail partners. Furthermore, the marketing strategy leverages key social channels such as Weibo, Douyin, and Bilibili to offer exclusive purchase subsidies, effectively bridging online engagement with offline conversion.

3.2 Smart Glasses Help the Senior with Health Monitor and Social Interaction

For the elderly at home, smart glasses can be used as a substitute for reading glasses and myopia glasses, assisting in reading books, medicine bottles, and instruction manuals, and providing clearer display and voice broadcasting. For the energetic elderly with information processing needs, smart glasses are a good partner for freeing their hands when answering the phone while fishing, listening to navigation and scenic spot explanations during the trip. In terms of cognitive impairment intervention, AR spatial anchor technology based on SLAM algorithm can assist Alzheimer's disease patients in spatial orientation and help the lost elderly return home[9]. In terms of chronic disease management, smart glasses can not only help carry out glaucoma screening[10], but also carry out health monitoring and reduce the incidence of emergency departments in the elderly[11]. In terms of social interaction, smart glasses can help alleviate social isolation among the elderly, such as establishing family albums[12].

3.3 Smart Glasses Help Teenagers with Vision Improvement and Safety Supervision

First of all, for teenagers with a myopia rate of up to 60%, when replacing or fitting new glasses, or deeply integrating the refractive correction function with the optical waveguide lens in the optical design stage, directly manufacturing optical waveguide elements with refractive correction capabilities, or adopting a split design, the standard, non-prescription optical waveguide module and an independent refractive correction lens are physically combined to achieve "one lens for two purposes". Secondly, smart glasses teaching visualizes abstract knowledge and promotes personalized learning[13]. Third, eye tracking technology identifies learning disabilities early, and the social system of smart glasses promotes the development of social skills in children with autism. Fourth, through the environmental risk identification and early warning function, smart glasses help guide teenagers' safe behavior and reduce the probability of accidental injury.

4. The Ecological Challenges Behind the Rapid Growth of the Smart Glasses Industry

4.1 Lack and Fragmentation of Technical Standards

At present, there is a lack of unified technical standards for audio shooting glasses and AR glasses, resulting in closed interfaces and ecological fragmentation. In the field of core optical materials, the mainstream technology routes have been differentiated, such as polymer dispersion liquid crystals (PDLC) and photopolymer solutions, which have fundamental differences in physical properties and manufacturing processes. This heterogeneity of the underlying technology requires application developers to perform deep, repetitive code adaptation and optical calibration for different platforms, significantly driving up R&D costs and engineering complexity. In the current product planning and design stage of smart glasses, manufacturers generally face the lack of clear industry technical specifications

Copyright @ STEMM Institute Press

and safety standards, resulting in a significant differentiation of key user experience and safety features in design strategies. In terms of the forced opening policy of the shooting indicator, some manufacturers have made it a mandatory function at the hardware level out of high respect for user privacy. Others set it as optional or software-level features to simplify interaction or pursue simplicity in appearance. This inconsistency in the underlying design logic has caused a fragmentation of user experience at the industry level, causing users to have cognitive confusion and operational discomfort when switching between different products. On a deeper level, it weakens consumers' trust in products and even the entire category, laying hidden dangers for the sustainable development of the market.

4.2 Data Privacy and Ethical Challenges

Smart glasses continue to collect sensitive data such as user biometrics and behavioral trajectories. Children and the elderly have a weak awareness of privacy protection and are at risk of data misuse. The EU GDPR and China's Personal Information Protection Law pose serious challenges to data compliance for such devices.

4.3 Channel Integration and Service Faults

Although the expansion of offline traditional eyewear channels has accelerated, smart hardware manufacturers and optical stores are disconnected in the service chain, optometrists lack technical training, and the equipment failure maintenance system is imperfect, which affects the user experience.

4.4 Mismatch Between Supply and Demand in Market Segments

Manufacturers are overly chasing the lightweight general market, ignoring the rigid needs of the elderly for large-character interfaces and voice interaction, ignoring the rigid needs of children's groups for the correction of sitting posture and eye habits, knowledge questions and answers, interactive learning and emotional companionship, and special requirements for anti-blue light and time management, resulting in potential misalignments between product functions and real needs.

5. Build a Sustainable Smart Glasses Ecosystem Path

5.1 Improve Technical Standards and Certification Systems

The government should take the lead in formulating industry standards for smart glasses as soon as possible, and mandate data localization processing and interface openness. Implement safety certification for products for Senior and Child, such as children's myopia protection standards.

5.2 Innovate the Cross-Departmental Collaborative Governance Model

The government should establish a manufacturer-medical-education collaborative mechanism, include smart glasses in the medical insurance catalog, develop a campus AR course resource library, and reduce the cost of use for the elderly through policy subsidies.

5.3 Optimize the Integration of Channels and Services

The government should promote the establishment of joint ventures between hardware manufacturers and traditional optical factories, train "technology + optometry" compound talents, establish a national joint warranty service system, and solve the problem of last-mile service.

6. Conclusions and Prospects

The huge potential of smart glasses in the Senior and Child market has entered the stage of value verification from the technical vision. However, the full realization of its technological dividends and social benefits requires a fundamental shift in the industrial development paradigm: from the pursuit of iteration of a single technical indicator to the construction of a robust ecology supported by standard systems, data governance and convergence services. In the future, we should not only explore the principles of universal design for intergenerational inclusion scenarios, but also actively promote the innovative application of enabling technologies such as blockchain in the confirmation and circulation of user data to ensure that the well-being of technological progress can benefit every family inclusively, fairly and safely.

References

[1] Liu Zhenguo. Promoting and Implementing the Strategy of Actively Responding to Population Aging[N]. Study Times, 2025-

 Copyright @ STEMM Institute Press

06-13.
[2] IDC. China Smart Glasses Market Quarterly Tracking Report[R]. 2025.
[3] Li, B., & Du, Y. (2024). Studying and venturing in the United States at Eastern Michigan University from 2015 to 2017: Focusing on volume holographic waveguide technology to promote the popularization of AR technology. Seeking Talents, (12), 14-15.
[4] IDC. China Internet of Things Ecosystem and Trends[R]2025
[5] Waisberg, Ethan & Ong, Joshua & Masalkhi, Mouayad & Zaman, Nasif & Sarker, Prithul & Tavakkoli, Alireza. (2023). Meta smart glasses-large language models and the future for assistive glasses for individuals with vision impairments. Eye. 38. 10.1038/s41433-023-02842-z.
[6] Frederick Stanbrell (2025) The Rise of Smart Glasses, From Novelty to Necessity. https://blogs.idc.com/2025/07/21/the-rise-of-smart-glasses-from-novelty-to-necessity/
[7] World Hearing Report [R]. 2021
[8] Jang, C., Bang, K., Chae, M. et al. Waveguide holography for 3D augmented reality glasses. Nat Commun 15, 66 (2024). https://doi.org/10.1038/s41467-023-44032-1
[9] Kress B, et al. Waveguide optics for AR/VR: principles and practice[J]. Advances in Optics and Photonics, 2021, 13(4): 836-970.
[10] Wolfgang Fuhl. 2025. Real Time Detection System of Cataract, Glaucoma and Retinal Disease on a Raspberry Pi 5. In Proceedings of the 2025 Symposium on Eye Tracking Research and Applications (ETRA '25). Association for Computing Machinery, New York, NY, USA, Article 61, 1–2. https://doi.org/10.1145/3715669.3726805
[11] Kazanskiy, N. & Khonina, Svetlana & Butt, Muhammad Ali. (2023). Smart Contact Lenses-A Step towards Non-Invasive Continuous Eye Health Monitoring. Biosensors. 13. 933. 10.3390/bios13100933.
[12] Holt-Lunstad J, et al. Loneliness and social isolation as risk factors for mortality[J]. Perspectives on Psychological Science, 2015, 10(2): 227-237
[13] Radu I, et al. Educational AR: impacts on learning outcomes[J]. Computers & Education, 2021, 168: 104211

Copyright @ STEMM Institute Press