Editorial

Current and future perspectives on smart glasses

Kanupriya [1]

[1] *Indian Institute of Foreign Trade, Delhi, India*

KEYWORDS

digital technologies, smartglasses, head mounted display, head up displays, socioeconomic factor

INTRODUCTION

Digital technologies have been revolutionizing several industrial sectors, starting from the manufacturing sector to the development of novel products [1, 2]. Advancements in Information and Communication Technologies are supporting policymaking and increasing the overall operation efficiency [3-5].

As digitalization catches up with the human race, the Internet of Things devices, such as smart glasses, a type of head mounted display, shows great potential for Industry 4.0 [6, 7, 8]. They affect working environments by providing shop floor workers with critical information in an opportune, manageable, and secure manner for maximized productivity. These devices would also collect data from a wireless network and project them onto a minuscule screen before the user's eyes [9-12].

Similar to smartphones and tablets, smart glasses can facilitate information-sharing on a real-time basis, with other advantages owing to hands-free interaction. Through advances in communication technology, smart glasses can facilitate remote and seamless knowledge-sharing between experts and operators. Thus, they hold great potential for improving human resource skills in businesses and society, particularly in field services. Although this technology is still evolving, many companies are investing in smart glasses to improve shop floor activities and logistics [9-12].

Applications of smart glasses include hands-free surgery, remote video consultation, and chronic wound care [13]. However, possible pitfalls include headaches, pressure in the eyes, and difficulties in focusing and reading text. Visual acuity, contrast sensitivity, visual field testing, and color tests often reveal complications of the prolonged usage of smart glasses [14]. Before and after using smart glasses, users' visual acuity, contrast sensitivity, visual field parameters, and color distinction abilities show significant differences, indicating serious negative implications of the usage of smart glasses over a prolonged period [4, 12, 15, 16].

As this technology is still developing, studies on its use in human societies is still scarce. This editorial was aimed at providing a balanced narrative of the contribution of smart glasses to human societies. Both advantages and disadvantages of smart glasses are discussed.

Social Implications of the Smart Glass Industry

The smart glass industry has various outcomes in the social realm. First, human health (inclusive of eye health) is of utmost importance, and the smart glass industry negatively affects human health, particularly eye health [14, 15, 17]. Ophthalmic difficulties, such as strain, dry eyes, and changes in ocular vision score above other health-related

Correspondence: Kanupriya, Economics, Indian Institute of Foreign Trade, Delhi-110016, India. Email: kanupriya.301290@gmail.com. ORCID iD: https://orcid.org/0000-0002-4186-4070

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side effects, such as behavioral changes, motor imbalance, dermatological infections, gastrointestinal problems (e.g., nausea, vomiting, and acidity), and neurological effects (e.g., headache, dizziness, seizures, dystonia, and loss of consciousness) [14, 15, 17].

Second, the smart glass industry has revamped curative services. Smart glasses help improve clinical outcomes. The robust network connection and pair of smart glasses can help a medic obtain a second opinion from a colleague located remotely [14, 17, 18], improving the diagnosis and treatment. Smart glasses also function as a medium for unbroken travel and continuous delivery of analytical data for a second opinion from an artificial intelligence specialist [14, 17, 18].

Considering the uneven distribution of doctors, smart glasses can help improve the quality of healthcare worldwide [19]. The telehealth service aids in the diagnosis and treatment of a patient remotely in terms of improved access to quality care, reduced costs, and reduced waiting times for patients. In addition, it entails a reduced risk to healthcare providers by avoiding direct contact with the patients. Several developing countries and even rural and semi-rural parts of developed countries have a shortage of doctors. Smart glasses could be vital during the ongoing coronavirus disease pandemic and in treating other viral/infectious diseases that may become prevalent owing to globalization [14, 17, 18].

Third, smart glasses could be used extensively in imparting medical education and training. Particularly, medical students could obtain virtual access to the best health consultants worldwide [20, 21]. For instance, a surgeon performing eye surgery often operates in such a small portion/area that even the person standing next to the surgeon cannot see everything because of reduced field of view caused by the surgeon's hands. Using smart glasses can help numerous students join a virtual session to obtain a detailed view and experience of the operating procedure. Another vital application of smart glasses is remote supervision and guidance of medical students during processes and interventions [22]. Interns could consult an expert of their choice regarding medical advice in real time. This could enrich their experience and help them gain independence and confidence for real-life medical practice [23].

In addition to education and health fields, smart glasses could empower female specialists as well [24-26]. Female ophthalmologists and health specialists could be invited from anywhere in the world without disturbing their household chore schedules and responsibilities. For career-oriented women, smart glasses could provide equal opportunities as their male counterparts. The same goes for medics belonging to the lower socioeconomic strata. In other words, the smart glass industry is a boon for people belonging to all socioeconomic classes.

Economic Implications of the Smart Glass Industry

Artificial intelligence and computer vision approaches facilitate individuals with blindness and visual impairment in accomplishing primary activities without depending on others. Smart glasses are a prospective assistive technology for these individuals to aid in individual activities and provide social ease and safety [27]. Augmented-reality smart glasses are an innovative technology in the initial stage of expansion with a prospective future and market share ahead. The global augmented reality, virtual reality, and mixed reality markets reached 28 billion U.S. dollars in 2021 and could grow significantly to over 250 billion U.S. dollars by 2028. The perspective of augmented reality has expanded in the past years. In 2020, sales of augmented reality smart glasses stretched to 20,000 units. In 2021, it rose to 40,000 units. In 2024, it may rise considerably to 1.59 million units. Corresponding to strategy analytics, global smart glasses revenues would increase by 11% in 2022 [28].

CONCLUSIONS

This article places the issue of the smart glass industry within a balanced, holistic, and realistic frame. It helps shed light on the benefits and pitfalls of the industry. Moreover, the various challenges in the success of the industry have been highlighted and elaborated. Shortcomings notwithstanding, the sector has tapped into the future of Industry 4.0, with its links to the Internet of Things, artificial intelligence, and virtual reality. Overall, as hundreds of millions of networked devices proliferate globally as industrial and infrastructural inputs, wearable smart glass technologies could significantly impact human lives socially and economically.

FUTURE POLICY IMPLICATIONS

Several policy implications of this editorial deserve mention. First, higher authorities should devote a substantial portion of their medical expenditures towards the evolution of smart glass technologies to provide a boost

to health and eyecare sectors. Second, adequate rules and regulatory frameworks should be evolved to tackle privacy and security concerns associated with the industry. Third, uninterrupted network bandwidth should be developed to ensure seamless operation of smart glass technologies. Finally, the smart glass industry needs an upgraded infrastructure with an innovative approach to make it more user-friendly and less hazardous to eye health. Overall, smart glasses could be a vital cog in the wheel of interaction between humankind and technological upgradation. The inevitability of smart technologies and their implications for the human race cannot be overlooked.

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