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Research Article

The Influence of Emerging Technologies on the Transformation of Airport Operations and the Enhancement of Passenger Experience: An Overview of Smart Airport Solution

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Abstract – For all parties involved, especially airports and airline corporations, a swift and unavoidable evolutionary process is being driven by the ongoing high demand in the global air transportation sector and the intrinsic complexity of the current operational systems. There is a growing need to go beyond the long-standing close relationship between passengers and airlines, turning airports from important transit hubs into essential elements of the whole travel experience. Global economic, social, cultural and especially technical developments are the primary forces behind this change. Additionally, this tendency is being significantly impacted by the new generation of digitally native customers' changing consumption patterns and growing need for tailored services. An analysis of the evolution of the two main aviation industry players, airports and airlines, shows a growing awareness of the strategic significance of passenger happiness and experience. As a result, airports are developing beyond simple infrastructure to become cutting-edge hubs with cutting-edge and Emerging technologies and services focused on passengers. Achieving high levels of passenger happiness and positive experiences is essential for success in the aviation industry, given its competitive landscape and profitability dynamics. By analyzing current trends in the relevant industry and the research approaches used, this article seeks to offer a perspective on the possible evolution of future passenger experiences. Within a broad framework, the function of smart airport solutions in this transition and their potential to improve the traveler experience are discussed.

Keywords –Aviation Industry, Emerging Technologies, Passenger Experience, Smart Airport Solution.

I. INTRODUCTION

Airports are now sophisticated business hubs rather than just transit hubs due to the globalization of air travel and the growing privatization of airport terminals. They are essential hubs of economic activity, producing significant non-aeronautical income and functioning as commercial spaces for a wide range of stakeholders (Graham, 2013, Graham, 2009). Significant obstacles have been presented by this evolution for both airlines and airports, especially in relation to the requirement for ongoing innovation in the

passenger experience, environmental management, and infrastructure growth. Due to the need to improve passenger happiness, digital technologies are now at the forefront of industry advancement. Historically viewed largely as entry points to air travel, airports have increasingly adopted commercial methods in line with trends toward globalization, privatization, and commercialization. Governments have therefore progressively moved away from being direct operators and toward serving as regulators and policymakers, monitoring industry standards while letting private companies run their businesses (Kilic et al., 2021; De Neufville and Odoni, 2013).

Airlines and passengers have always had more emotional and service-related ties than airports. But there is a big change happening to this inclination. The airline industry is changing, especially as a result of the increased expectations of Generations Y and Z for seamless, technology-driven, and customized experiences. Because they are more likely to share their travel experiences on digital platforms, these travellers from the younger age are making every encounter in the airport setting more visible and significant. Airport operations have been rethought in the context of commercialized airports as a result of the move away from reliance on aeronautical earnings and toward non-aeronautical income. The strategic emphasis on meeting passengers' demands and preferences has been motivated by the significance of passengers as a major source of income. Through individualized services, loyalty plans, and retail partnerships, airports may use digital technology to enhance the traveller experience while also generating new revenue sources. Therefore, improving service quality and customer pleasure through technological innovation has emerged as a top goal for contemporary airports. Airports have responded to these changes by realizing how crucial it is to increase non-aeronautical revenue while minimizing reliance on conventional aeronautical revenue sources. Airport management techniques now centre on passenger-centered tactics that prioritize customer happiness and service excellence (SITA, 2022; ACI World, 2018; ACI, 2017; Price et al., 2014). In a market that is becoming more and more competitive, digital technologies from tailored mobile applications to biometric identification systems have emerged as the main tool for improving customer experience and setting service offerings apart. It is impossible to overestimate the importance of technology-driven innovation in influencing how passengers will travel in the future as airports continue to develop into for-profit businesses. This dynamic change emphasizes how important it is for airports to provide smooth, effective, and unforgettable travel experiences in order to not only meet but also surpass the expectations of contemporary tourists (Shahriar et al., 2024; Horkay et al., 2022; SITA, 2022; ACI World, 2018).

Predictive maintenance of airport equipment, asset management, and real-time baggage tracking have all been made possible by Internet of Things (IoT) applications. The infrastructure of the airport is equipped with sensors that offer vital information, enabling proactive maintenance responses and enhancing the overall dependability of airport services (ACI World, 2021). Passenger experiences have changed as a result of the aviation industry's fundamental transformation brought about by the quick development of digital technology. Air travel settings have become more smooth, efficient, and customer-centric thanks to recent advancements including biometric identification, contactless services, Internet of Things (IoT) applications, and artificial intelligence (AI) - driven personalization (IATA, 2022). Additionally, real-time baggage tracking and predictive aircraft maintenance are made possible by IoT technology, which enhance operational effectiveness and transparency (Airports Council International, 2021). Improved dependability and luggage location updates help passengers feel less stressed and have more faith in service providers.

Another important factor in technologically advanced airports is artificial intelligence (AI). By providing real-time flight information, terminal instructions, and customized travel suggestions, AI-powered chatbots and virtual assistants enhance customer experience (Accenture, 2022). AI algorithms also optimize resource allocation, including staff scheduling and gate assignments, which lowers costs and improves operating efficiency. Personalized marketing and customer service have also been transformed by AI and machine learning algorithms. In order to increase engagement and loyalty, airlines are increasingly using predictive analytics to customize offers and communications to specific passenger profiles (Accenture, 2022; Wisskirchen et al., 2017). However, there are drawbacks to integrating digital technology, especially when it comes to privacy and data security. Strong cybersecurity safeguards and open data governance frameworks are essential for the gathering and processing of enormous volumes of personal data. To guarantee fair and reliable digital aviation ecosystems, ethical issues pertaining to permission, surveillance,

and algorithmic biases must also be addressed. With the implementation of intelligent energy management systems to track and lower airport energy usage, sustainability has also emerged as a key priority. For instance, Heathrow Airport has optimized its heating, ventilation, and air conditioning systems using AI-based technologies to reduce carbon emissions (Heathrow Airport, 2023; PwC, 2023; Jupe and Keatley, 2019; Aulman, 2018; Price et al., 2014). However, there are issues with data security, privacy, and ethics that come up when these technologies are adopted. In order to preserve confidence and safeguard sensitive passenger data, the growing dependence on digital systems calls for strict cybersecurity rules (PwC, 2023). The emergence of smart airports signifies a further shift in which technology is incorporated to improve passenger security, comfort, and happiness in addition to operational efficiency. In order to offer more seamless and customized travel experiences, this change entails the use of technology like as biometric scanning and AI-powered customer support (Hosseini, 2020). Simplifying airport operations and reducing delays, which will eventually improve the traveller experience, depends on the integration of digital technologies across several service touchpoints, including as security, customs, and ground services (Graham, 2013; Graham, 2009). In order to provide customized services that increase customer satisfaction, airports are also using data-driven techniques like machine learning and data mining to assess passenger preferences and forecast future requirements (Aviation Analytics, 2021). In conclusion, airports have evolved from transit hubs that prioritized services to commercial hubs that prioritize passenger-centric tactics and technologies. Continued innovation and the use of cutting-edge technology will influence air travel in the future with the goal of enhancing both operational effectiveness and the general passenger experience (Abdulkareem, 2024; Aviation Analytics, 2021; Hosseini, 2020).

II. MATERIALS AND METHOD

A number of studies have explored the role of technology in enhancing airport operations and passenger satisfaction. The potential of technology to improve airport operations and passenger happiness has been the subject of several studies. Automation, data analytics, the Internet of Things (IoT) and artificial intelligence (AI) are among the main topics of interest. Automation has improved throughput and decreased wait times, especially in areas like luggage handling, security screening, and check-in. Furthermore, data analytics have been applied to crowd control, resource allocation, and airline schedule optimization. AI and machine learning algorithms aid in forecasting passenger flow, enhancing security protocols, and customizing the travel experience. More enjoyable travel experiences and more efficient operations result from the integration of these technologies. However, there are potential and obstacles associated with the application of such technologies, which frequently call for significant investment and cooperation between airports, airlines, and tech suppliers. Over time, the idea of the passenger experience has expanded to include not only the passengers' physical comfort but also their mental and emotional health while travelling. The significance of technology in augmenting this experience is shown by several research. Innovations like self-check-in kiosks and smartphone applications, for example, have already greatly improved airport operations, cutting wait times and improving customer satisfaction. Recent advancements in artificial intelligence (AI), the Internet of Things (IoT), and virtual reality (VR) have begun to impact travel experiences in the future by providing immersive, customized, and predictive services. Improving operational efficiency and passenger happiness has been largely attributed to the emergence of smart airports, which use IoT to enhance operations and offer customized services. Additionally, AI-powered solutions like chatbots and virtual assistants are becoming indispensable for improving consumer engagement and support (Chakraborty et al., 2020; Kotsialos et al., 2020; Jupe and Keatley, 2019; Bogicevic et al., 2017; Chen et al., 2015).

A. Ensuring Digital Resilience in Airports- Technology-Oriented Airports

Airports must carefully assess the potential of technology disruptions as they progressively implement cutting-edge digital technologies to improve passenger experiences and operational efficiency. Although digital technologies are essential to contemporary airport operations, they are also susceptible to unanticipated disturbances, hacks, and even breakdowns. Airports must thus implement a robust and

adaptable technology infrastructure that can survive system outages and provide uninterrupted operation. Maintaining business continuity during system failures becomes crucial in such a situation. Airports need strong information security measures to protect the integrity of their operations since they are home to millions of linked systems and devices. Finding and safeguarding these systems' essential parts while making sure they are safe from any possible dangers or interruptions is the main difficulty. In order to minimize the impact on airport operations and passenger services, a proactive support system must be in place to promptly fix any vulnerabilities or system failures. Comprehensive contingency planning has emerged as a result of airports' growing dependence on technology. In addition to preserving customer happiness, maintaining service continuity during system failures is essential for safeguarding the airport's and its partners' financial viability. To manage any risks and guarantee that services can continue without interruption in the case of technological interruptions, effective disaster recovery and business continuity strategies are crucial (Shobayo et al., 2021; Kotsialos et al., 2020; Aulman, 2018; Singh et al., 2016; Price et al., 2014).

(i)Efficiency of Operations: The automation of security and check-in procedures has been shown to result in one of the biggest increases in operational efficiency. Recent advancements in artificial intelligence (AI), the Internet of Things (IoT) and virtual reality (VR) have begun to impact travel experiences in the future by providing immersive, customized, and predictive services. Improving operational efficiency and passenger happiness has been largely attributed to the emergence of smart airports, which use IoT to enhance operations and offer customized services. Additionally, AI-powered solutions like chatbots and virtual assistants are becoming indispensable for improving consumer engagement and support. Through the reduction of baggage misplaced or misrouted delays, these solutions help to streamline airport operations. Additionally, data analytics technologies have been crucial in enhancing gate management and flight scheduling. Airports are better able to maximize aircraft turnaround times, reduce delays, and manage resources effectively thanks to predictive analytics. Because of this, the overall capacity management of the airport has been improved, allowing for higher aircraft frequencies without requiring corresponding physical expansion (Shobayo et al., 2021; Kotsialos et al., 2020; Aulman, 2018; Singh et al., 2016; Price et al., 2014).

(ii) Passenger Experience: The use of biometric identification technology has revolutionized the travel experience for passengers. Identity verification has been greatly expedited by the use of face recognition and other biometric technology at check-in desks and boarding gates, which has improved security and decreased wait times. Passengers benefit from a quicker, safer, and more enjoyable journey thanks to this smooth authentication procedure. Mobile applications and IoT-enabled gadgets have further customized the trip. Through linked devices, airports now provide in-terminal navigation support, real-time flight updates, and personalized offers based on traveller preferences. Such customization creates a more interesting and effective airport experience by lowering passenger tension and raising overall happiness. Modern airport strategy now must include sustainability measures, which are driven by technology innovation. Energy consumption and operating expenses have significantly decreased as a result of the implementation of smart lighting systems, energy-efficient HVAC (Heating, Ventilation and Air Conditioning) technology, and green building solutions (Geske et al., 2024; Abdulkareem, 2024; Moon et al., 2021; Negri et al., 2019; Teodorovic, 2016).

B. Future Travel Experience in Air Transport and Future Applications of Technology in Passenger Experience

Rapid technology breakthroughs are being embraced by the airline sector in an effort to enhance passenger experiences and operational effectiveness. In order to expedite travel and give customers a more customized experience, the Future Travel Experience (FTE) model focuses on incorporating cutting-edge technology like biometric identification and AI-driven services. This study creates a paradigm for travel experiences in the future by taking into account how important technologies affect sustainability, operational effectiveness, and passenger enjoyment. By using cutting-edge technology to improve passenger experience and operational efficiency, the FTE concept seeks to transform the airline sector. Important technology elements that optimize airport operations and enhance travellers' overall experience include

biometric identification, AI-driven services and automation. These developments shorten wait times, improve security, and provide travellers a more seamless, customized experience. The Customer Experience Management (CEM) framework, which emphasizes individualized services and customer satisfaction and the Technology Acceptance Model (TAM), which describes how passengers embrace new technology are two ideas that underlie the model. Furthermore, Operational Efficiency Theory emphasizes how automation and data analytics may result in cost savings and improved passenger experiences. Additionally, using these technology helps airports and airlines operate more efficiently, which lowers costs and promotes sustainability. The deployment of these technologies is consistent with the more general objectives of improving passenger enjoyment, convenience, and resource efficiency (Hassan and Sabahat, 2024; Abdulkareem, 2024; Horkay et al., 2022; Fei et al., 2016; Teodorovic, 2016).

(a)Biometric Screening and Identity Management: Airport passenger identification is increasingly being handled by biometric technology, such fingerprint scanning and face recognition. By automating the passenger verification process and cutting down on the amount of time spent at different checkpoints, these technologies seek to improve efficiency and security. With these technologies in place, travellers may enter boarding gates and go past security without presenting conventional travel credentials, making the process easier and more convenient. Quick, real-time identification is ensured by fingerprint and facial recognition technology, which greatly enhances passenger flow and reduces waits at crucial locations including immigration, security, and check-in. Biometric identification makes travel easier for passengers by cutting down on wait times and general travel anxiety. By connecting systems to passenger profiles, this technology not only makes the airport experience more efficient but also allows for more individualized services. Operationally, biometric solutions enhance passenger flow overall and alleviate bottlenecks, particularly during peak hours. Additionally, airports may lessen their dependency on employees by automating the identification verification procedure, which will save money and improve resource allocation. The precision and dependability of passenger identification are further increased by the incorporation of biometric technology, which makes fraudulent activity more challenging. Airports anticipate implementing biometrics at more touchpoints, including boarding, baggage handling, and possibly customs, as the technology develops. In addition to enhancing the traveller experience, these technologies are anticipated to make a substantial contribution to the aviation sector's operational efficiency and sustainability objectives (Abdulkareem, 2024; Hassan and Sabahat, 2024; Horkay et al., 2022; Boussadia, 2009; Teodorovic, 2006).

(b)Artificial Intelligence and Predictive Analytics: By providing individualized services and increasing operational efficiency, artificial intelligence (AI), especially through technologies like chatbots and virtual assistants, is completely changing the traveller experience in the airline sector. In order to deliver real-time, personalized recommendations on flight statuses, gate changes, and local services, AI-powered systems employ machine learning algorithms to evaluate passenger data. With its ability to provide constant assistance from check-in to baggage claim and real-time guidance through intricate airport terminals, virtual assistants are growing in popularity. Furthermore, by anticipating demand and modifying operations appropriately, AI-powered predictive analytics is enhancing resource management, reducing delays, and optimizing flight scheduling. By cutting down on wait times and providing pertinent, timely information, these AI technologies provide travellers round-the-clock support and individualized help, significantly improving their travel experience. AI-driven solutions reduce stress and increase happiness by providing prompt responses to questions about flight status, instructions, and booking modifications. AI aids in improved decision-making, predictive maintenance, and fewer operational disturbances on the operational front. By using AI to forecast delays or repair requirements based on past flight data, airlines and airports may proactively modify their operations, reducing downtime and related expenses (Kabashkin et al., 2025; Moghadasnian, 2025; Patibandla, 2024; Ramakrishnan et al., 2023; Jupe and Keatley, 2019; Wisskirchen et al., 2017)

(c)Internet of Things (IoT) for Seamless Travel: Through the connection of numerous systems and devices, the Internet of Things (IoT) has the potential to completely transform passenger experiences and airport operations. Smart luggage tags and other IoT-enabled technologies offer real-time baggage tracking, guaranteeing that travellers are constantly aware of where their goods are. Furthermore, by using passenger behaviour to enhance ambient elements like temperature, lighting, and crowd control, smart terminals may improve both operational efficiency and customer comfort. Additionally, wearable technology may be

supported by IoT systems, which might help travellers navigate the airport by providing turn-by-turn directions and customized trip information, thereby improving their experience. By offering real-time baggage location updates and individualized service delivery across the airport, IoT helps travellers have a smoother and more convenient experience. Internet of Things (IoT) technologies give airports the ability to track and evaluate data in real time, which enhances efficiency, decision-making and resource allocation. Smart technologies, for example, can monitor luggage handling, minimizing mistreatment and maximizing airport infrastructure and staff. These developments highlight how the Internet of Things is revolutionizing airport operations and the traveller experience (Shobayo et al., 2021; Kotsialos et al., 2020; Kotsialos et al., 2020; Zhang, 2020; Singh, 2016).

(d)Virtual and Augmented Reality (VR/AR)-Transforming Passenger Engagement: By providing immersive entertainment and real-time navigational help, Virtual and Augmented reality (VR and AR) technologies are revolutionizing the traveller experience. On gadgets like smartphones or AR glasses, passengers can receive real-time information on local amenities, such lounges and eating alternatives, thanks to AR technologies. VR may also be used to create calm waiting spaces, which can help people feel less stressed and anxious. These technologies provide distinct improvements; AR superimposes digital features on real-world situations, while VR offers immersive, computer-generated experiences. One well-known example is Qantas Airways' usage of virtual reality (VR) in its first-class cabins, which increases enthusiasm and engagement by enabling customers to experience Australian sites before to arrival. In addition to increasing customer happiness, this campaign encouraged travel and set Qantas's premium services apart. Through collaborations with travel and luxury services, the use of VR and AR in aviation increases customer happiness and loyalty while creating new income streams. Augmented reality navigation technologies help travellers navigate airports, minimizing confusion and guaranteeing a more seamless travel experience. While AR-powered immersive advertising generates new income streams for airports, AR/VR can save operating expenses by doing away with the necessity for physical signs (Hassan and Sabahat, 2024; Gupta and Sandhane, 2022; Ban et al., 2019; Qantas, 2015).

- Case Study: First-Class Passengers' Virtual Reality Experience with Qantas Airways

One of the first airlines to use Virtual Reality (VR) technology into its premium service offerings was Qantas Airways in 2015. The airline sought to improve the trip experience and encourage participation before arrival by giving first-class customers Samsung Gear VR headsets equipped with 360-degree virtual tours of popular Australian tourist locations like Uluru and the Great Barrier Reef. In addition to boosting passenger enthusiasm, this approach helped set Qantas apart in a crowded industry. The project strengthened Qantas's relationship with Australia's tourist authorities and promoted national tourism through digital media, while passengers expressed higher levels of satisfaction with the service. Building on this success, Qantas intends to further use Virtual Reality (VR) and Augmented Reality (AR) technology. Future developments are anticipated to include AR navigation assistance in airports and virtual cabin tours when booking. These developments highlight how immersive technology may improve customer happiness, encourage service differentiation, and aid in larger tourism marketing initiatives in the airline sector (Ban and Kim, 2019; Bogicevic et al., 2017; Qantas, 2015; Chen et al., 2015).

(e)Sustainability and Green Technologies: Due in large part to changing legal frameworks and environmental concerns, sustainability has become a top goal for the future growth of air travel. In an effort to reduce their environmental impact, airports are progressively implementing green technology, such as waste reduction programs, energy-efficient heating and cooling systems, and solar-powered terminals. These solutions promote adherence to environmental regulations while also reducing energy use and operating expenses. By lowering pollutants and noise, the possible use of electric aircraft for short-haul travel further improves sustainability. From the standpoint of the passenger, eco-friendly infrastructure makes travel more responsible and fulfilling, especially for those who care about the environment. Additionally, by showcasing environmental responsibility, these sustainable activities contribute to enhancing the public perception of airports and airlines. Green technology integration is therefore becoming more and more recognized as an operational and strategic requirement for the aviation industry. All things considered, innovation driven by sustainability is influencing airport operations and design in the future (Ramakrishnan et al., 2023; Hussain and Ramdan, 2020; Greer et al., 2020; Kaya and Erginel, 2020).

(f) Big Data in Aviation: Predicting and Managing Future Passenger Behaviors: Big data has become a vital instrument for strategic management in the aviation sector, helping airlines better analyze and forecast consumer behaviour. In order to improve consumer segmentation and customize services, social media platforms offer access to useful passenger data, such as demographics, preferences, and travel behaviours. Airlines may create predictive models to foresee consumer wants, maximize marketing efforts, and enhance operational planning by utilizing sophisticated analytics and machine learning. Big data also facilitates effective scheduling, dynamic pricing, and customized in-flight services, all of which improve the overall traveller experience. In addition to raising customer happiness, these data-driven tactics help businesses become more profitable and gain a sustained competitive edge in a market that is changing quickly (Zachariah et al., 2023; Cho and Park, 2023; Liang et al., 2022; Huo et al., 2020).

(g) Robotics in Aviation: Enhancing Airport Operations and Passenger Services: With the potential to significantly increase productivity and improve the traveller experience, the use of robots' technology in airport operations has grown in popularity. Robots may now be seen supervising car parking duties at Düsseldorf Airport and conducting luggage operations at Amsterdam Schiphol Airport. Robots are used for guide and information services at Schiphol Airport, helping travellers navigate the terminal and lowering the number of flights that are missed. The introduction of robotic assistance attempts to address these crucial issues as missed connections are frequently ascribed to delays brought on by ineffective luggage handling or trouble finding gates. Airports may improve customer happiness and operational flow while lowering their reliance on human resources by automating these crucial activities. The increasing use of robots at airports is indicative of a larger movement toward the automation of time-consuming and repetitive jobs, which allows airports to maximize manpower allocation and uphold better service quality standards, especially during periods of high operational demand. The future of passenger services and operational management is anticipated to be shaped by robotics as the aviation sector continues to advance toward higher technological sophistication (Chiang, 2025; Aly and Hammoud, 2023; Shen et al., 2020; Wisskirchen et al., 2017; Harrison et al., 2014).

- *Case Study:* Robotics Implementation at Amsterdam Schiphol Airport: Robotic technology has been carefully incorporated into Amsterdam Schiphol Airport to improve customer satisfaction and expedite operations. There is a 25% drop in luggage-related delays and a 15% decrease in missed connections thanks to autonomous robots that assist with baggage handling and mobile units that offer multilingual navigation guidance. These developments support Schiphol's overarching goals to improve service efficiency, ease operational bottlenecks, and decrease human labour in repetitive operations. The airport's strategy is a prime example of how robotics may be used effectively in contemporary airport administration (Schiphol Group, 2021; Wisskirchen et al., 2017).

(h) Wearable Technology in Aviation: Enhancing Passenger Experience and Service Delivery: The term "*wearable technology*" describes electronic gadgets that are worn on the body and are frequently incorporated into apparel or accessories to provide improved connection and real-time data collecting. Wearable technology is being used more and more in the aviation sector to enhance the entire passenger experience, expedite processes, and customize services. Virgin Atlantic's plan to provide Google Glass and Sony SmartWatches to its first-class cabin crew is a prime illustration of the use of wearable technology. In order to provide a more individualized and attentive service, the initiative aimed to provide crew members access to real-time passenger information, including names, preferences, and special service needs (Virgin Atlantic, 2014). By cutting down on the amount of time required for conventional service verification procedures, this program not only sought to improve passenger happiness but also offered insightful information on how to improve operational efficiency. Front-line staff may engage with customers more naturally and intuitively thanks to wearable technology. Staff can anticipate passenger demands and respond quickly thanks to real-time communication via wearable technology and smart glasses, which improves the whole travel experience. The creation of more specialized loyalty programs and customer interaction strategies is also made possible by the integration of data acquired by these technologies into airline Customer Relationship Management (CRM) systems. The effective use of wearable technology in aviation is consistent with more general trends in digital transformation, which prioritize operational agility, customization, and immediacy. Future uses for these technologies might include hands-free operational management systems in airport settings, biometric health monitoring for

both passengers and personnel, and smart clothing (Harrison et al., 2024; Nau and Benoit, 2017; Teodorovic, 2016).

- *Case Study:* To provide more individualized and effective service, Virgin Atlantic started a trial initiative at London Heathrow Airport in 2014, providing first-class cabin crew with wearable technology like Google Glass and Sony SmartWatches. The program gave employees real-time access to passenger data, which enhanced customer service and generated favourable reviews. The trial also indicated further prospective applications across several service sectors and demonstrated the possibility of merging wearable technology with CRM systems. The airline industry's growing trend of using smart technology to improve the traveller experience is shown in this early adoption (Virgin Atlantic, 2014).

(ı) Automation: By increasing the effectiveness of procedures like security, luggage handling, and check-in, automation is completely changing airport operations. Airports all around the world are increasingly using automated security systems and self-check-in kiosks (Harrison et al., 2024; Wu et al., 2023; Alonso et al, 2021; Oostveen et al., 2014; Sproule, 2009; Sproule, 2001).

(i) Effect on Passenger Experience: By lowering the need for human employees, automation enhances the traveller experience by facilitating speedier luggage drop-offs, check-ins, and security checks.

(ii) Effect on Operational Efficiency: Automation reduces labour costs and expedites regular activities for airports. It makes it possible to handle routine tasks more effectively, freeing up employees to deal with more complicated problems. This increases overall operational efficiency and cuts down on delays (Harrison et al., 2024; Wu et al., 2023; Alonso et al, 2021; Sproule, 2009; Sproule, 2001; Oostveen et al., 2014).

III. CONCLUSION

The Future Travel Experience (FTE) paradigm presents a number of difficulties. The privacy and security of biometric and personal data are two key issues. Strict cybersecurity protocols and data protection laws are necessary to stop data breaches as airports and airlines gather sensitive data (SITA, 2022; Harrison et al., 2014). Furthermore, automation may result in job displacement, especially in customer service positions, even while it improves operational efficiency. Therefore, to ensure proper passenger assistance, a balance between automation and human control is essential. Last but not least, putting these technologies into practice calls for a large infrastructure and training expenditure. In addition to educating travellers on how to utilize this technology efficiently, airports must guarantee that their employees are adequately qualified to run new systems. The future of air travel is changing as a result of airports integrating biometric systems, AI, IoT, AR/VR and sustainable technology. Creating an inclusive environment is also essential. All passengers should have access to digital solutions like AI, IoT, and AR/VR as they become more commonplace, irrespective of their age, aptitude, or level of technological proficiency. Travel will become more egalitarian and the consumer experience will be enhanced by guaranteeing equal access. Airports and airlines may improve passenger travel experiences and operational efficiency by combining biometric systems, AI, IoT, AR/VR, and sustainable technology. Both the passenger experience and operational efficiency will be greatly enhanced by the incorporation of these technology elements into the aviation ecosystem. To fully profit from these advancements, the aviation sector must overcome technological, moral, and legal obstacles. Airports should prioritize data security, privacy, inclusiveness, sustainability, and workforce transition management in order to fully realize the promise of the Future Travel Experience (FTE) paradigm. In order to improve customer happiness and operational efficiency, airports must now invest in digital technology. Travel experiences are made easier by these technologies, which provide real-time updates, individualized services, and improved communication between travellers and airport systems.

Additionally, airports may obtain a competitive edge in the increasingly globalized aviation sector by adopting digital transformation. Effective data management, however, is essential to provide customized services. To guarantee the smooth integration of new technologies, airports must gather, standardize, and distribute data across stakeholders (SITA, 2022; Harrison et al., 2014). Assuring data protection and privacy, putting security first, promoting inclusion, supporting sustainability, and educating employees for workforce transition are some suggestions for the future growth of the Future Travel Experience (FTE) model. The aviation sector may effectively adjust to upcoming developments by putting these strategies

into practice, giving all parties involved a more effective, frictionless, and fulfilling travel experience. In the end, making smart investments in digital technologies increases the passenger experience and improves airport operations. Significant operational advancements have already been brought about by automation, artificial intelligence, the Internet of Things, and sustainability technologies, which have helped airports become more efficient and set themselves up for future expansion.

To sum up, new digital practices have the potential to significantly improve passenger experiences in the future by promoting increased effectiveness, customization, and contentment. To fully reap these advantages, the aviation industry must, however, negotiate significant technological, moral, and regulatory issues. Ensuring Data Security and Privacy, Prioritizing Privacy and Security, Promoting Inclusivity, Encouraging Sustainability, Training and Workforce Transition, and Preparing for the Workforce Transition are some suggestions for further development of the FTE model. The aviation sector may effectively navigate the future of air travel by implementing these suggestions, making the experience more smooth, effective, and fulfilling for all parties involved.

The FTE model should be centred on promoting sustainability. Integrating sustainable technology may result in more environmentally friendly operations and show the aviation industry's commitment to addressing climate change, especially as the industry continues to face mounting pressure to lessen its environmental impact. Another crucial element is training to get ready for the employment transformation. Job responsibilities will unavoidably shift when automation and artificial intelligence are integrated into airports and airlines. To ensure that workers can adjust and keep making contributions to the industry's success, it is crucial to provide them with the skills they need to operate and manage new technology. All things considered; these suggestions aid in developing a road map that will enable the aviation industry to successfully negotiate the future of air travel. The sector can maintain a high degree of passenger happiness, promote sustainability, guarantee security and inclusivity, and improve operating efficiency by tackling these issues.

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