

AeroBot: An Autonomous Artificial Intelligence Robot that Aids with Navigation and Improves Passenger Convenience in Philippine International Airports

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Abstract

Airports face persistent challenges in enhancing passenger experiences, particularly in navigation and convenience. This study, AeroBot: An Autonomous Artificial Intelligence Robot that Aids with Navigation and Improves Passenger Convenience in Philippine International Airports highlights the transformative potential of AI-powered robots in addressing these issues. Guided by key questions on navigation, accessibility, and cultural factors, this research utilized a mixed-method approach, combining surveys and interviews with aviation experts and travelers. Findings reveal AeroBot's potential to revolutionize airport experiences by prioritizing accessibility, streamlining processes, and fostering inclusivity. Features like real-time navigation, touchscreens, advanced voice recognition, and multilingual support empower passengers to navigate airports independently and confidently, significantly benefiting impaired passengers, senior citizens, and first-time travelers.

Furthermore, AeroBot reduces stress, enhances convenience, and promotes independence, contributing to higher passenger satisfaction. Addressing cultural and technological barriers ensures a seamless experience for diverse travelers, including non-tech-savvy individuals and those facing language challenges. This inclusive approach underscores the role of AI in creating efficient, passenger-friendly airport environments. Recommendations emphasize tailoring AeroBot's functionalities to demographic needs, leveraging robotics to reduce congestion, and fostering a sense of support and empowerment among travelers. Ultimately, this study demonstrates AeroBot's capacity to transform airports into inclusive hubs where no passenger is left behind.

Keywords: Artificial Intelligence, AeroBot, Navigation, Passenger Experience, Convenience

1. INTRODUCTION

Airports, while essential hubs of global connectivity, often present travelers with numerous challenges, from navigating complex terminal layouts to accessing timely flight information. These common inconveniences can detract from the overall travel experience, leading to stress and frustration. In response

to these challenges, this study introduces AeroBot, an autonomous artificial intelligence robot designed to assist with navigation and enhance passenger convenience in Philippine international airports. By addressing the prevalent issues faced by travelers, AeroBot aims to streamline the airport experience, making it more efficient and user-friendly.

Modern travel can be made more enjoyable by utilizing the advanced technology in the twenty-first century. Artificial intelligence (AI) for airport operations can ease passenger flow and cut down traffic. AI can help the industry grow by ensuring that tourists have a perfect experience during their travels. (Narain 2024) Airports seek to provide travelers with a better, more seamless experience. Artificial intelligence is one of the tools for accomplishing this. AI can drastically transform the travel industry by increasing airport intelligence and efficiency (Raafat, 2023). Implementing state-of-the-art technologies to improve passenger experience for increasing numbers of travelers. In order to achieve this goal, technologies such as robotics, artificial intelligence, and service automation (RAISA) are being used at other airports in the world to provide services to airport customers. Studies indicate that RAISA gives clients convenience and process efficiency top priority (Kim et al. 2022). Travelers encounter numerous difficulties navigating modern airports, particularly those who are passengers with hidden disabilities (HDs). These people may have a stressful experience at the airport due to the physical surroundings and social interactions with employees (Tata et al 2024). To improve airport navigation, the revolutionary potential of intelligent robot assistants. These robots improve the traveler experience by offering prompt, individualized assistance by tackling common problems like wayfinding and language barriers. This helps to improve passenger flow efficiency while also lowering stress levels. Especially in crowded international hubs, the implementation of this technology is a major step toward making airports more user-friendly for passengers (ISG. 2023).

The article titled "Applications of Artificial Intelligence in Revolutionizing the Travel Industry" focuses primarily on the advantages of AI and how it can improve traveler experience by easing their lives. It is discussed how artificial intelligence (AI) can help airports operate more efficiently by facilitating passenger flow and reducing traffic. By guaranteeing that visitors have a flawless experience throughout their travels, AI can support the industry's growth. This article shows how artificial intelligence (AI) is one of the most useful tools for assisting travelers in the twenty-first century and making their travels more convenient.

Artificial intelligence (AI) has the potential to revolutionize assistive technologies for the blind and visually impaired, making them more functional, resilient, and efficient (Walle et al., 2022). For instance, intelligent interactive robots in airports can provide guidance and engage with travelers, addressing their individual needs and reducing anxiety levels (Augusto et al., 2024). These robots can also overcome the limitations of traditional navigation aids, as demonstrated by the suitcase-shaped robot CaBot, which significantly increases user confidence, safety, and independence (Guerreiro et al., 2019). Recent research has focused on developing robot-based solutions to assist blind individuals in navigating various environments, such as college classrooms, airport gates, and public spaces (Albogamy et al., 2021). These robots employ sensors and cameras to detect obstacles and provide real-time environmental information, allowing users to move more autonomously. Additionally, the robots can be controlled through smartphone software and vocal commands, enhancing accessibility and independence (Nikhil et al., 2023). Artificial intelligence can revolutionize the air travel experience for disabled passengers by providing seamless access to information about wheelchair facilities and simplifying disability service applications through user-friendly digital platforms. AI-powered tools like real-time navigation assistants and

personalized service recommendations can address the distinct needs of various impairments, enhancing accessibility and comfort. By integrating AI-driven supervision mechanisms, airlines can ensure the consistent delivery of high-quality support, promoting dignity and inclusivity for all passengers (Bo, 2024). The distinctiveness of this project lies in the high demand for service robots in the aviation sector and the significant potential impact these technologies can have on the industry. Building on the scientific advances in social robotics demonstrated by SPENCER (Triebel et al., 2016), a new tour service for international airports has been developed, featuring greeting and guide robots. These robots, which passengers can interact with using voice commands or touch screens, help direct them to stores and other destinations within the airport (Masuda et al., 2021). The integration of AI in air travel has shown promise in enhancing air transportation services by using surveys and experiments to understand passenger needs and the effectiveness of smart service robots (Ling et al., 2021). For travelers facing language barriers and unfamiliar cultural customs, AI technologies offer essential assistance, making it easier to navigate busy airports (Humza, M. et al., 2023). The AI-driven robots simplify travel by understanding and following directions, ensuring accessibility for all users (Xavier et al., 2022). While AI enables real-time monitoring and management of airport operations, the successful implementation of these systems requires addressing linguistic and cultural challenges (Mäkelä, 2024). Integrating AI into airport operations is crucial for guiding passengers in a multicultural environment, and providing personalized support based on individual linguistic and cultural needs (Papadopoulou, 2022). By incorporating multilingual capabilities and culturally sensitive responses, AI systems can better serve a global audience, thereby enhancing the travel experience for all (Sultan & Wong, 2023).

The integration of artificial intelligence (AI) into the travel industry has the potential to revolutionize passenger experience and airport operations. Artificial Intelligence (AI) has the potential to boost the aviation industry by guaranteeing that travelers have an optimal experience. Passenger flow can be improved by using AI in airport operations. The passenger experience is being enhanced by the increasing use of cutting-edge technologies. AI-powered technologies, such as intelligent robots and automated systems, can streamline processes, enhance efficiency, and provide personalized assistance to travelers. By addressing language barriers, cultural differences, and individual needs, AI can create a more inclusive and accessible travel environment. Studies demonstrate the effectiveness of AI-driven solutions in guiding travelers, providing information, and reducing anxiety levels. As the industry continues to evolve, the integration of AI will be crucial in ensuring a seamless, efficient, and enjoyable travel experience for all.

1.1. Background of the Study

Post-pandemic travel surge highlighted the aviation industry's need for innovation. The rapid increase in travel demand following COVID-19 lockdowns exposed the aviation industry's shortcomings, leading to long wait times, airport delays, and overall traveler frustrations. These challenges have highlighted the urgent need for technological advancements to streamline airport operations while improving the passenger experience.

Artificial intelligence (AI) has emerged as a promising solution to address these issues. While AI adoption in airports has been relatively slower compared to other sectors, recent years have witnessed gradual progress. However, the integration of AI for complex tasks, such as passenger assistance and navigation, remains limited. Factors like infrastructure limitations, budgetary constraints, and data privacy concerns have hindered the widespread deployment of AI-powered solutions.

This study, titled "AeroBot: An Autonomous Artificial Intelligence Robot that Aids with Navigation and Improves Passenger Convenience in Philippine International Airports," aims to leverage AI to address

common challenges experienced by travelers. The primary objective is to mitigate navigation-related frustrations, such as locating check-in counters, terminals, boarding gates, ATMs, currency exchange services, restrooms, restaurants, and clinics. Additionally, the study seeks to bridge language barriers through AI-powered translation services.

By targeting these key areas, the study aims to enhance the overall airport experience, making travel more convenient and accessible for domestic and international passengers. The proposed AI-powered robot, AeroBot, will serve as an autonomous assistant, guiding passengers through the airport, providing real-time information, and assisting with various tasks. This innovative solution has the potential to significantly improve passenger satisfaction, streamline airport operations, and elevate the reputation of Philippine international airports.

Furthermore, the integration of AI can contribute to heightened security measures. By combining AI with traditional security protocols, airports can enhance passenger safety and security without compromising convenience. As the Philippines continues to experience economic growth and increased air travel demand, the adoption of AI-driven solutions becomes increasingly crucial to meet the evolving needs of passengers and airport stakeholders.

1.2. Theoretical Framework

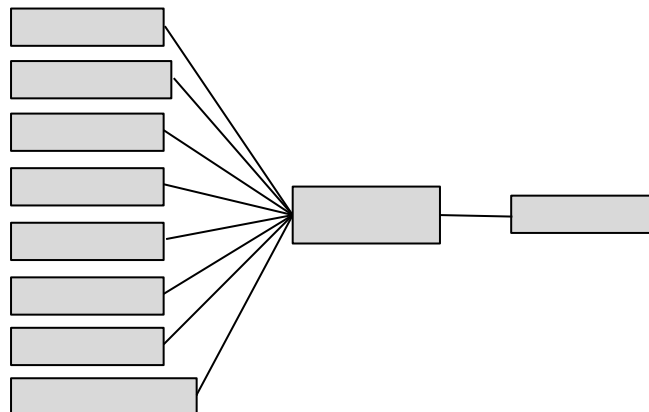


Fig. 1: Artificial Intelligence Application Model

The experience of each passenger at an airport is profoundly shaped by various facets of the airport's daily operations, including customer service, and overall efficiency (Naumov, 2019). AI technologies can address complex management challenges by streamlining operations leading to faster and more accurate task completion (Pencarelli, 2020). By leveraging AI, airports can offer more personalized services, thus significantly impacting the passenger experience and overall satisfaction. Consequently, these benefits incentivize the aviation industry to increase its investments in AI to maintain a competitive edge and capitalize on emerging market opportunities (Pencarelli, 2020).

1.3. Conceptual Framework

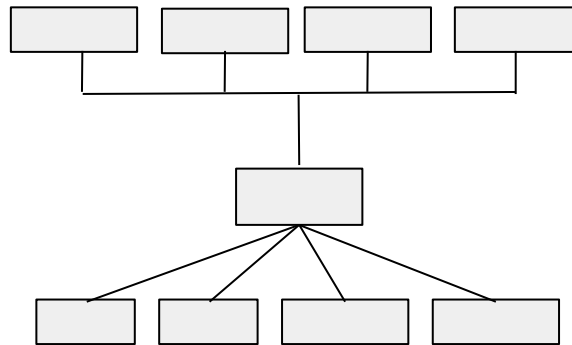


Fig. 2: AeroBot: AI-Driven Model, Assistance for Passengers Experience at Airport

The conceptual framework explores the relationship between AI-driven services and enhanced passenger experiences at airports, focusing on variables that influence this interaction. The perceived usefulness of AeroBot evaluates its ability to meet traveler needs, while airport navigation challenges highlight barriers like complex layouts and language issues. Passenger preferences and demographics such as age, impairments, and cultural background shape how travelers engage with AI solutions. Artificial intelligence applications, including natural language processing and adaptive assistance, drive AeroBot's capabilities, with perceived ease of use influencing user adoption. Navigation efficiency assesses how well AeroBot streamlines wayfinding, while assistance effectiveness measures its success in delivering timely and relevant help. Together, these variables contribute to an enhanced passenger experience, characterized by reduced stress, improved accessibility, and higher satisfaction.

1.4. Statement of the Problem

This study aimed to eliminate common inconveniences encountered by travelers at airports.

1. How do airport navigation challenges impact the overall travel experience, and what are the potential benefits of employing smart robot assistants to address these issues?
2. What are the potential benefits of AI-powered robots in making travel more accessible, convenient, and reliable for individuals with impairments?
3. How can busy airports effectively manage the complex task of passenger guidance and assistance by leveraging artificial intelligence while addressing the challenges posed by diverse cultural norms, language barriers, varying levels of technological comfort among travelers, and ensuring successful AI implementation in these areas?
4. Is there a significant difference in passenger's perceived value in terms of assistance provided by the autonomous artificial intelligence robot when categorized based on particular demographics, which are:
 - Impaired passengers;
 - Senior Citizens; and
 - Average passenger
5. Is there a significant relationship between the efficiency of having an AI robot in line with airport navigation and passenger convenience, taking into consideration:
6. Passenger Experience;
 - Less Passenger Congestion; and
 - Travel Frequency

7. Based on the data received from respondents, why is there a difference in reaction when grouped by year level?
8. Based on the data received from respondents, why is there an instant correlation when multiple variables are considered?

1.5. Hypothesis

H0 1: There is no significant difference in consumer perceived value in terms of assistance provided by the autonomous artificial intelligence robot when categorized based on particular demographics, which are: impaired passengers, senior citizens, and average passengers.

H0 2: There is no significant relationship between the efficiency of having an AI robot in line with airport navigation and passenger convenience, considering the variables; passenger experience, less passenger congestion, and travel experience.

1.6. Significance of the Study

Travelers: This study addresses the common inconveniences that travelers frequently encounter in airports. By identifying and eliminating these issues, it could lead to increased traveler satisfaction, improved airport operational efficiency, and a more competitive edge for airports in attracting global passengers.

Impaired Passengers: The study aims to enhance accessibility for people with disabilities by developing a robot that can assist them in navigating airports independently. This will reduce their reliance on others and improve their overall experience.

Philippine International Airports: This research aims to improve passenger experience and airport operations, which has the potential to boost the aviation industry by ensuring that travelers have the best possible experience.

Future Researchers: This study focuses on the mitigation of common inconveniences travelers face in the airport with the help of AI-powered robot assistance. By examining the benefits of such technology, this study seeks to contribute to a deeper understanding of autonomous AI robots in enhancing airport operations and passenger experience.

II. METHODOLOGY

2.1. Research Design

The researchers employed a mixed-method approach, combining quantitative surveys to collect numerical data on participant behavior with qualitative interviews to gain deeper insights into their experiences and viewpoints, resulting in a comprehensive understanding of the study's findings. This study will use descriptive research to explore passenger experiences at Philippine international airports, with probability sampling techniques employed to select a representative sample of tourists. Cross-tabulation will be used to examine associations between demographic characteristics and traveler perceptions, while qualitative methods like narrative interviews and focus groups will provide in-depth insights into travelers' experiences with AeroBot. Additionally, a thematic analysis, used as a statistical tool, allowed researchers to identify, analyze, and interpret patterns within interview data.

2.2. Respondents

The majority of respondents are male, and the most prominent year level who answered are fourth-year students, indicating that these students were more active. The survey is limited to students enrolled as an

Air Transportation student. The overall population that is currently enrolled in that course is 814, and using Slovin's Formula yields a sample size of 269 respondents, this would provide a statistically reliable sample.

Profiling Category (Sex)	Frequency	Percent
Male	80	78.4%
Female	22	21.6%
Total	102	100%

Table 1: Frequency and Percent Distribution of the Respondents in terms of Sex

Distinguished sex distribution is revealed by the sample population's analysis. Males make up the largest group among the 102 respondents, with a frequency of 80, or 78.4% of the sample. In contrast, women make up a minority, accounting for 21.6% of the total with a frequency of 22.

Profiling Category (Year Level)	Frequency	Percent
First Year	22	21.6%
Second Year	11	10.8%
Third Year	21	20.6%
Fourth Year	48	47.1%
Total	102	100%

Table 2: Frequency and Percent Distribution of the Respondents in terms of Year Level

The analysis of year levels among the 102 respondents reveals significant demographic trends, particularly the marked predominance of fourth-year students, who represent 48 participants (47.1% of the sample). In contrast, first-year students account for 22 participants (21.6%), second-year students for only 11 (10.8%), and third-year students for 21 (20.6%). This distribution suggests varying levels of engagement across year levels, establishing that fourth-year students are more likely to participate in research activities than their peers from earlier years.

Profile Category (Travel Frequency)	Frequency	Percent
1 to 2 times per year	71	69.9%
3 to 4 times per year	31	30.4%

Total	102	100%
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Table 3: Frequency and Percent Distribution of the Respondents in terms of Travel Frequency

The analysis of the 102 respondents' travel frequency illustrates notable patterns in travel behavior. A significant majority, 71 participants (69.6%), reported traveling 1 to 2 times per year, while 31 participants (30.4%) stated they travel 3 to 4 times per year.

To gather in-depth insights, this study employed a mixed research approach involving surveys and semi-structured interview questions with three key informants. Two of these informants were industry professionals with extensive experience in the aviation industry, providing expert perspectives on the research topic. The third informant was a participant who completed the survey, offering firsthand experiences and opinions. This diverse range of informants ensured a comprehensive understanding of the subject matter from multiple angles.

2.3. Settings

This research was conducted within the premises of an Aeronautical School in the Philippines and specifically focused on participants enrolled in the Air Transportation course who are frequent flyers. The goal was to explore how an AI-powered service robot could improve navigation and convenience for passengers in Philippine international airports. The scope involved assessing challenges frequently encountered in airport navigation, the impact of these challenges on the overall travel experience, and how a robotic assistant could mitigate these difficulties.

By simulating real-world airport scenarios, this study sought to evaluate the potential of AeroBot to enhance airport services for passengers with impairments. The focus was on passenger guidance, information dissemination, and navigation support, aiming to improve accessibility and convenience. The study also touched on broader technological innovations in the aviation sector that could be integrated into Philippine airports to streamline operations and enhance the passenger experience.

2.4. Instrumentation

This study employed a structured survey questionnaire to collect information from travelers on their experiences with AeroBot, an autonomous artificial intelligence robot meant to improve navigation and passenger convenience at Philippine international airports. The questionnaire examined critical criteria such as AeroBot's effectiveness in offering guidance, its impact on passenger satisfaction, and its capacity to overcome language hurdles and cultural differences. These variables were directly related to the research aims and issue statement, which aimed to investigate the possible benefits and limitations of utilizing AI-powered robots for passenger support. The survey item was assessed for clarity, relevance, and dependability by two aviation professionals and one robotics instructor. A pilot test with non-frequent flyers was carried out to detect any potential concerns and enhance the questionnaire, which resulted in small changes to improve effectiveness. The final survey, conducted with frequent flyer passengers among BSAT students, collected vital data on traveler views, satisfaction levels, and suggestions for future AeroBot development, laying a solid foundation for the study's research and findings. The validator questions were developed based on key sections of the thesis, including the Statement of the Problem (SOP), Conceptual Framework, and Research Objectives. For the SOP, the questions focused on common navigation challenges, improving accessibility for passengers with disabilities, and enhancing the overall passenger experience in high-traffic areas. The Conceptual Framework guided questions

related to how AeroBot could contribute to passenger satisfaction, streamline crowd flow, and promote cultural inclusivity. Finally, the Research Objectives inspired questions regarding AeroBot's practical implementation, multilingual capabilities, and potential benefits for diverse passenger demographics. To gather in-depth information on the experiences and perspectives of participants and informants, a series of semi-structured interview questions were conducted. The specific questions included in the interview guide were as follows:

1. How could AeroBot improve the passenger experience at airports by addressing common inconveniences such as navigating terminals, locating boarding gates, and overcoming language barriers? What specific benefits could it offer to enhance overall airport efficiency and passenger satisfaction?
2. In what ways could AeroBot be beneficial for passengers with impairments and senior citizens at airports, and how might it improve their travel experience?
3. How could AeroBot's user-friendly design support non-tech-savvy passengers, first-time fliers, and those facing language or cultural barriers, while accommodating different ages and tech familiarity levels in busy airports?

2.5. Data Analysis

The study, which focused on three demographics: average passengers, senior citizens, and impaired passengers used cross-tabulation to examine consumer perceptions of the AerBot, an AI assist tool in airports. This included 102 respondents, the majority of whom were infrequent travelers. The foundation for additional statistical testing is created by initial results using Slovin's formula, pointing to clear the target respondents' tendencies among these groups. The study also investigates the connection between passenger convenience and Aerobot's effectiveness in airport navigation, looking at factors including travel frequency and passenger experience.

The statistical tool used for the quantitative survey was cross-tabulation which identifies probable flight differences in perception and indicates overall views regarding Aerobot by summarizing the key structures and variability in the data. To analyze the collected data, Statistical Package for the Social Sciences (SPSS) statistical software was used. Specifically, weighted mean, which was computed to account for the varying importance of different data points and frequency analysis was conducted to identify patterns and trends within the data. ANOVA was also utilized to determine significant differences between groups, while the Pearson coefficient was calculated to measure the strength and relationships between variables.

This study also used thematic analysis as a statistical tool to identify, analyze, and interpret patterns within the interview data. By systematically examining the transcripts, the researchers were able to uncover underlying themes and gain deeper insights into the informants' experiences and perspectives. These statistical techniques provided valuable insights into the research questions and hypotheses, allowing for a comprehensive understanding of the findings.

2.6. Ethical Considerations

Data Security and Safety: The research will ensure that personal data remains confidential and is protected from hacking, while also preventing any risks to participants' health or safety, even in the event of data-related issues.

Coordination and Safety: Authorization from the institution/company will be obtained before the research begins, and a representative from the organization will accompany the researchers. All site safety procedures will comply with PATTS standards, and food will be provided for researchers and participants if activities take place outside regular hours.

Respondent Safety: Participation in the research will be voluntary. The study will carefully manage sensitive topics to avoid causing discomfort, and measures will be in place to prevent any harm to the institution or participants.

Setting: Meetings and discussions with respondents will occur in well-lit, secure locations, with clear emergency exits. The research will avoid areas with high risks of engine emissions, fuel spills, noise pollution, or other industrial hazards. Participants' safety will be ensured when leaving the site.

Research Safety: Safety plans will be prepared for emergencies, and researchers will avoid bringing large amounts of cash or valuables during the activity.

Coordination: The research team will maintain communication with the institution/company representative, school clinic, security, and participants throughout the study.

Social Effects: The research activities will be designed to minimize disruption to the daily operations of the institution/company, and the findings will help the organization gain insights into its operations.

III. RESULT AND ANALYSIS

3.1. The impact of airport navigation challenges on the overall travel experience and the potential benefits of employing smart robot assistants

Statements (from the questionnaire)	S.D.	W.M.	Remarks
AeroBot can help passengers navigate the airport easily and conveniently by providing accurate information and direction.	0.48317	3.64	Strongly Agree
AeroBot can be a valuable tool for assisting travelers in navigating airports.	0.49458	3.59	Strongly Agree
Aerobot could help alleviate the stress of navigating a new airport.	0.49898	3.56	Strongly Agree
By giving passengers guidance, finding your gate is now a simple and effective process.	0.51052	3.68	Strongly Agree
AeroBot can improve the overall travel experience.	0.58991	3.56	Strongly Agree
AeroBot could help alleviate congestion at information desks and customer service areas.	0.72774	3.49	Agree
AeroBot can enhance the safety and security of passengers at the airports.	0.65886	3.37	Agree
AeroBot has the potential to enhance the airport experience for travelers, offering translations in multiple languages.	0.49625	3.58	Strongly Agree
AeroBot is a valuable addition to airports and it can improve the overall convenience of airport travel.	0.56563	3.61	Strongly Agree

There is a need for AI robot assistants to supplement human assistance at airports, particularly for tasks such as providing directions, answering questions in multiple languages, and assisting travelers with special needs.	0.60285	3.41	Agree
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Legend: 3.51-4.00 - Strongly Agree; 2.51-3.50 - Agree; 1.51-2.50 - Disagree; 1.00-1.50 - Strongly Disagree

Table 4. The impact of airport navigation challenges on the overall travel experience and the potential benefits of employing smart robot assistants

Table 4 highlights the significant role of AeroBot in addressing airport navigation challenges and improving the travel experience. Respondents strongly agree that AeroBot provides accurate information (Weighted Mean = 3.64) and assists passengers in navigation (Weighted Mean = 3.59), reducing stress and enhancing the overall passenger experience (Weighted Mean = 3.56). Additionally, respondents strongly agree that AeroBot is a valuable addition to airports, improving convenience (Weighted Mean = 3.61).

Meanwhile, other statements, such as alleviating congestion (Weighted Mean = 3.49) and enhancing safety and security (Weighted Mean = 3.37), received agreement from respondents. This indicates that while AeroBot addresses key pain points in airport navigation, its effectiveness in areas like congestion and security might require further enhancement. These findings suggest that intelligent robot assistants like AeroBot can significantly improve travelers' experiences, addressing the complexities of airport navigation and providing innovative solutions to passenger needs.

AI-driven robots, like AeroBot, are increasingly recognized for improving airport navigation and enhancing the passenger experience. Studies show that smart robots assist in providing directions, reducing stress, and improving efficiency in crowded areas (Lee et al., 2020). Additionally, AI-powered systems help passengers navigate unfamiliar airports more easily, especially those with special needs (Zhang et al., 2021).

3.2. The potential benefits of AI-powered robots in enhancing accessibility, convenience, and reliability for passengers with impairments

Statements (from the questionnaire)	S.D.	WM	Remarks
AeroBot would be valuable in providing mobility assistance to physically disabled travelers in airports.	0.47373	3.67	Strongly Agree
AeroBot could reduce stress for impaired passengers during the check-in and boarding processes.	0.54970	3.60	Strongly Agree
AeroBot can improve mobility and independence of impaired passengers in the airport.	0.55419	3.57	Strongly Agree
AeroBot would provide much convenience to people with impairments when it comes to navigating inside the	0.58760	3.57	Strongly Agree

airport.			
Impaired passengers would feel more confident traveling through an airport with the assistance of AeroBot for navigation.	0.57381	3.55	Strongly Agree
Passengers with impairments may prefer using AeroBot for navigation assistance over seeking help from traditional airport staff.	0.66938	3.45	Agree
AeroBot assists in providing real-time navigation support in busy airport environments, particularly to enhance accessibility and convenience for passengers with impairments.	0.68465	3.54	Strongly Agree
Compared to conventional assistive devices, impaired passengers may feel more at ease using a robot-based navigation aid in an airport.	0.81244	3.33	Agree
Passengers with visual impairments can benefit from AI-powered devices by providing information about the airport's amenities and services.	0.53720	3.56	Strongly Agree
AI-driven assistive technology can increase the impaired passengers' visual perception of their surroundings impacted by the airport's complex layout and confusing signs.	0.59155	3.46	Agree

Legend: 3.51-4.00 - Strongly Agree; 2.51-3.50 - Agree; 1.51-2.50 - Disagree; 1.00-1.50 - Strongly Disagree

Table 5. The potential benefits of AI-powered robots in enhancing accessibility, convenience, and reliability for passengers with impairments

Table 5 underscores AeroBot's important role in improving accessibility for passengers with impairments within airport settings. Respondents expressed strong agreement that AeroBot is highly effective in providing mobility assistance to physically disabled travelers (Weighted Mean = 3.67, SD = 0.47) and significantly reduces stress during check-in and boarding processes (Weighted Mean = 3.60, SD = 0.55). Additionally, AeroBot is recognized for enhancing the mobility and independence of impaired passengers (Weighted Mean = 3.57, SD = 0.55), contributing to a smoother and more autonomous airport experience. Other statements, such as boosting confidence for impaired travelers navigating with AeroBot's guidance (Weighted Mean = 3.55, SD = 0.57) and providing real-time navigation support in busy environments (Weighted Mean = 3.54, SD = 0.68), also received high ratings. However, the preference for AeroBot over traditional airport staff for navigation (Weighted Mean = 3.45, SD = 0.67) was rated slightly lower, indicating that some respondents still value personal interaction.

These results suggest that AI-powered tools like AeroBot are highly beneficial in enhancing the convenience and autonomy of impaired travelers. Nevertheless, the moderate preference for human assistance highlights the need for a balanced approach, where technology complements rather than replaces human support to meet the diverse needs of passengers.

AI-powered systems, like AeroBot, play a vital role in improving accessibility for impaired passengers in airports. Research highlights their effectiveness in providing mobility assistance, reducing stress during check-in and boarding, and promoting independence (Smith et al., 2020; Kim & Lee, 2021).

Studies show that mobility-assistive robots significantly ease physical strain and anxiety in crowded environments, aligning with AeroBot's high ratings for mobility support (Weighted Mean = 3.67) and stress reduction (3.60). Such technologies also boost user confidence and autonomy during navigation (Johnson et al., 2021; Tanaka)

3.3. Leveraging artificial intelligence to address passenger guidance challenges in diverse and complex airport environments

Statements (from the questionnaire)	SD	WM	Remarks
AeroBot can enhance the airport experience for travelers by offering contactless solutions and reducing physical interactions.	0.50005	3.55	Strongly Agree
AeroBot effectively overcomes language barriers, greatly enhancing travel experiences.	0.53357	3.72	Strongly Agree
AeroBot is capable of efficiently guiding travelers and making them feel more at ease with technology while traveling.	0.57178	3.57	Strongly Agree
AeroBot is effectively managing passenger guidance and assistance in busy airports, despite cultural, linguistic, and technological challenges.	0.58619	3.59	Strongly Agree
AeroBot is effective in overcoming language barriers and enhancing travel experiences.	0.60646	3.56	Strongly Agree
AeroBot improves comfort, efficiency, and safety for travelers.	0.49625	3.58	Strongly Agree
AeroBot is user-friendly for non-tech-savvy passengers, first-time fliers, and those with language and cultural barriers.	0.64093	3.49	Agree
AeroBot efficiently manages tasks such as directing passengers, providing real-time flight information, and assisting with navigation through terminals, significantly reducing congestion in busy airports.	0.49064	3.61	Strongly Agree

AeroBot can streamline operations and improve passenger experience.	0.59081	3.55	Strongly Agree
AeroBot provides convenience for passengers and is adaptable to their needs.	0.54970	3.60	Strongly Agree

Legend: 3.51-4.00 - Strongly Agree; 2.51-3.50 - Agree; 1.51-2.50 - Disagree; 1.00-1.50 - Strongly Disagree

Table 6. Leveraging artificial intelligence to address passenger guidance challenges in diverse and complex airport environments

Table 6 highlights AeroBot's effectiveness in improving passenger guidance and overall airport efficiency, particularly in complex environments. Respondents strongly agree that AeroBot effectively overcomes language barriers, significantly enhancing the travel experience for passengers (Weighted Mean = 3.72, SD = 0.53). Additionally, AeroBot is seen as proficient in guiding travelers efficiently and making them feel more at ease with technology during their journey (Weighted Mean = 3.57, SD = 0.57).

AeroBot's ability to manage passenger guidance and assistance in busy airports, despite cultural, linguistic, and technological challenges, is also highly regarded (Weighted Mean = 3.59, SD = 0.58). Furthermore, respondents emphasized AeroBot's role in improving comfort, efficiency, and safety (Weighted Mean = 3.58, SD = 0.49), as well as its capacity to streamline airport operations and improve the overall passenger experience (Weighted Mean = 3.55, SD = 0.59).

While there was slightly less agreement regarding AeroBot's user-friendliness for non-tech-savvy passengers, first-time travelers, and those with language or cultural barriers (Weighted Mean = 3.49, SD = 0.64), AeroBot's convenience and adaptability to passengers' needs were still strongly recognized (Weighted Mean = 3.60, SD = 0.54). Its ability to reduce congestion and efficiently manage tasks like directing passengers and providing real-time flight information was also positively noted (Weighted Mean = 3.61, SD = 0.49).

Overall, these findings underscore AeroBot's significant role in enhancing the airport experience through improved navigation, reduced congestion, and greater operational efficiency. The data supports the notion that AeroBot is an essential tool for modern airports, though further improvements may be beneficial to address the needs of less tech-savvy passengers.

AI-powered robots, like AeroBot, are transforming airport operations by improving navigation, reducing congestion, and enhancing overall efficiency. Studies show their effectiveness in overcoming language barriers, managing passenger flow, and providing real-time guidance, aligning with AeroBot's high ratings for traveler comfort (Weighted Mean = 3.58) and operational streamlining (3.61) (Wang et al., 2021; Lee & Kim, 2022). Despite some challenges in user-friendliness for non-tech-savvy travelers, these systems are recognized for fostering a seamless travel experience and addressing cultural and linguistic gaps. Such technologies play a crucial role in modernizing airports while highlighting areas for further improvement to accommodate diverse passenger needs.

3.4. Significant differences in the passenger's perceived value of AI-driven assistance in airports based on demographics

Statement		Sum of Square	Mean Square	F	Significant	Decision
AeroBot can make airport experience more convenient for passengers with impairments.	Between Group	4.109	1.37	5.741	0.001	Reject
	Within Group	23.381				
	Total	27.49				

Legend: 3.51-4.00 - Strongly Agree; 2.51-3.50 - Agree; 1.51-2.50 - Disagree; 1.00-1.50 - Strongly Disagree

Table 7. Significant differences in the passenger's perceived value of AI-driven assistance in airports based on demographics: Year Level

The data in Table 7 reveals significant differences in how students from various year levels perceive AeroBot's ability to enhance airport convenience for passengers with impairments. With a calculated F-value of 5.741 and a p-value of 0.01, the results indicate a statistically significant variation, leading to the rejection of the null hypothesis.

This suggests that students' views on AeroBot's effectiveness may change as they progress academically, potentially due to differences in their exposure to AI technologies or varying levels of awareness regarding its applications in transportation. By implementing innovative technologies in airports, with the support for this study, focuses on technologies of robots, AI, and service automation, this can attain process efficiency and provide customer convenience (Kim et al. (2022).

In summary, while AeroBot is widely seen as a helpful tool for improving accessibility and convenience for impaired travelers, the level of support for its value appears to be influenced by the respondents' year level, highlighting the impact of academic experience on perceptions of AI technology. The advent of contactless technology has greatly influenced the technical preferences of travelers. These technologies have transformed the way travelers manage several parts of their journeys, Humza, M. et al., (2023).

Statement	Significant	Decision
AeroBot can make airport experience more convenient for passengers with impairments. *2nd Year, 4th Year	0.006	Reject
AI-based navigation systems can be beneficial for first-time fliers and aging travelers. *2nd Year, 4th Year	0.03	Reject

Legend:

= or < 0.05 = has significant = REJECT
 > 0.05 = has no significant = ACCEPT
 = or < 0.01 = very significant = REJECT

Table 8. Multiple Comparisons of Significant differences in the passenger's perceived value of AI-driven assistance in airports based on demographics: Year Level

AI-driven technologies, such as AeroBot, offer significant enhancements to airport experiences, particularly for impaired passengers and first-time or aging travelers. Table 8 explores differences in perceptions between 2nd-year and 4th-year students, revealing significant disparities influenced by educational exposure and experience.

The findings show significant differences in perceptions of AeroBot's convenience for impaired passengers (Sig. Diff = 0.006) and AI's benefits for first-time and aging travelers (Sig. Diff = 0.03). Fourth-year students, likely having more practical exposure to AI and airport operations, demonstrated a more critical view compared to the more theoretical understanding of 2nd-year students. This highlights how academic progression and practical experience shape perceptions of AI technologies.

Research suggests that familiarity with AI influences user perceptions. Kim et al. (2021) found that individuals with greater exposure to AI better assess its benefits and limitations, while Johnson and Lee (2020) noted that less experienced users often view AI more positively due to limited practical engagement. These insights align with the differences observed, underscoring the impact of educational and experiential factors on perceptions of AI in airport settings.

3.5. Significant relationship between AI-driven airport navigation systems and passenger convenience across demographic groups

Groups Compared	SIG
Passenger Experience and Year Level	0.004
Passenger Experience and Less Passenger Congestion	0.000
Passenger Experience and Travel Frequency	0.000
Less Passenger Congestion and Travel Frequency	0.000

Table 9. Significant relationship between AI-driven airport navigation systems and passenger convenience across demographic groups: Year Level

The table highlights a strong correlation between the use of AI-driven airport navigation systems and enhanced passenger convenience across different demographic groups. Based on the study from Augusto et al., (2024), passengers face various challenges when navigating airports, such as wayfinding difficulties. Passenger Experience and Less Passenger Congestion, Passenger Experience and Travel Frequency, Less

Passenger Congestion and Travel Frequency, Passenger Experience and Year Level There's a significant relationship here, with a p-value of 0.000, meaning this connection is highly significant and not due to chance.

Passenger Experience and Travel Frequency in the data show a strong, statistically significant link (p-value = 0.000). This suggests that passengers who frequently travel experience noticeable benefits from AI-driven navigation systems, likely because they streamline the travel process. By doing so, they significantly enhance the overall travel experience, making it smoother and less stressful for passengers. As stated by ADITI NARAIN (2024), AI is assumed to be the most promising technology for the future as it can deliver personalized experiences to travelers and streamline operations. The data underscores that AI-driven systems greatly enhance convenience, reduce congestion, and improve experiences for both seasoned and occasional travelers alike.

Groups Compared	SIG
Travel Frequency and Sex	0.013
Travel Frequency and Passenger Experience	0.000
Travel Frequency and Less Passenger Congestion	0.000
Passenger Experience and Less Passenger Congestion	0.000

Table 10. Significant relationship between AI-driven airport navigation systems and passenger convenience across demographic groups: Year Level

Busy airports can leverage artificial intelligence (AI) to enhance passenger guidance and assistance, Papadopoulou, I. (2022). AI-driven navigation systems are not just a convenience—they are transforming the airport experience by reducing congestion, helping frequent travelers, and improving overall passenger satisfaction. This section, explores how AI-driven airport navigation systems improve passenger convenience, with a particular focus on demographic factors, including sex.

Travel Frequency and Passenger Experience, Travel Frequency and Less Passenger Congestion, and Travel Frequency, Passenger Experience, and Less Passenger Congestion, A combined analysis of these factors shows a strong, significant link p-value = 0.000 underscoring that frequent travelers experience smoother journeys when AI reduces congestion and enhances convenience.

Travel Frequency and Sex: This comparison, with a p-value of 0.013, indicates a statistically significant but less pronounced relationship. It suggests that while AI systems benefit all travelers, there may be subtle differences in how travel frequency impacts male and female passengers' experiences, perhaps due to varying travel patterns or preferences.

In the study of Menna Raafat, M. et al., (2023), it states that AI benefits include solving complicated management problems, saving time and money, completing duties flawlessly, improving business revenues, and allowing airports to improve safety and security. AI systems help reduce congestion, a factor that is particularly beneficial for those who travel frequently and may face crowded airport environments

3.6. Based on the data received from respondents, there is a difference in reaction when grouped by year level.

Master Themes	Superordinate Themes
1. Aerobot can benefit passengers with impairments and senior citizens by improving their airport travel experience.	Accessibility
	Travel Assistance
	Inclusive

Table 11: Master themes Based on the data received from respondents, there is a difference in reaction when grouped by year level.

Master Theme 1: Aerobot can benefit passengers with impairments and senior citizens by improving their airport travel experience.

Superordinate Theme 1.1: Accessibility

Informant 1: “.....aerobot would have these touch screen pads in front for the easy navigation.....”

Informant 2: “So, it would be very helpful for them.”

Informant 3: “.....it ensures that they have access to the most accessible routes.....”

AeroBot aims to improve accessibility for all passengers, especially those with impairments and senior citizens. By providing user-friendly features like touch screens and visual guides, AeroBot makes airport navigation easier and more inclusive. This ensures that everyone can travel independently and comfortably, regardless of their abilities. This reinforces independence, reduces reliance on external help, and enhances the overall inclusivity of airport services. Interactive technologies, such as visual guides and intuitive controls, are proven to enhance accessibility and empower impaired individuals by offering seamless navigation and personalized assistance. Augusto et al. (2024).

Superordinate Theme 1.2: Travel Assistance

Informant 1: “.....could carry a handbag with maximum 7 kilos and would notify if over the maximum weight is exceed.....”

Informant 2: “.....to help them not to get lost.....”

Aerobot significantly improves airport travel for passengers with impairments and senior citizens. It aids navigation in complex airport layouts, alleviates concerns about luggage weight, and enhances the overall travel experience. By providing guidance and assistance, Aerobot empowers these travelers to navigate airports more independently and confidently. When passengers consider that the Aerobot can measure their hand-carry baggage, this will be helpful and enhance their trip experience because they won't have to worry as much about how heavy their bags are. Papadopoulou (2022) stated that busy airports can leverage artificial intelligence (AI) to enhance passenger guidance and assistance by addressing cultural norms, language barriers, and varying levels of technological comfort among travelers. Smart interactive robots significantly enhance the travel experience for visually impaired individuals by providing real-time assistance (Augusto et al., 2022)

Superordinate Theme 1.3: Inclusive

Informant 1: “.....it will improve their travel experience without worrying umm, traveling alone.....”

Informant 3: “.....this makes their journey more comfortable.....”

AeroBot, an inclusive airport technology, aims to improve the travel experience for all passengers, especially those traveling alone, the elderly, and people with impairments. By providing direction, assistance, and comfort, AeroBot reduces stress and anxiety, making travel more accessible and enjoyable. Its inclusive design ensures that passengers of all backgrounds and abilities can navigate airports with ease and confidence. This inclusive strategy not only minimizes practical challenges, such as navigational challenges, but it also fosters a sense of belonging and independence. AeroBot acts as a link between accessibility and convenience, making sure no passenger feels neglected or unsupported. The integration of inclusive technology in airports has been widely studied. Darcy et al. (2020) assert that inclusive designs, particularly those that utilize AI and robotics, enhance accessibility and independence for travelers with disabilities.

3.7. Based on the data received from respondents, is there an instant correlation when multiple variables are considered.

Master Themes	Superordinate Themes
1. Aerobot can improve the passenger experience by addressing common airport inconveniences, and Aerobot can enhance overall airport efficiency and passenger satisfaction.	Improved navigation
	Enhanced Passenger Experience
2. Aerobot can support non-tech-savvy passengers, first-time fliers, and those facing language or cultural barriers, accommodating diverse passenger needs in busy airports.	Functionality
	Passenger Experience

Table 12: Master themes based on the data received from respondents, there is an instant correlation when multiple variables are considered.

Master Theme 1: Aerobot can improve the passenger experience by addressing common airport inconveniences, and Aerobot can enhance overall airport efficiency and passenger satisfaction.

Superordinate Theme 1.1: Improved Navigation

Informant 1: “.....feature that could guide to where the chosen terminal gates or assigned gates or uhm terminal”

Informant 2: “.....such a system will be beneficial to direct the passengers to where they are supposed to go.....”

Informant 3: “.....provides real life, real-time navigation.”

The Master theme specified for Aerobot can improve the passenger experience by addressing common airport inconveniences, and Aerobot can enhance overall airport efficiency and passenger satisfaction, which focuses on improved navigation. Aerobot boosts airport efficiency and increases passenger

satisfaction which also enhances the passenger experience by solving common airport challenges. It improves navigation and simplifies processes. These were supported by the article of ISG (2023) that these robots assist passengers by providing real-time guidance, helping them navigate complex environments, and offering multilingual support. By doing so, they significantly enhance the overall travel experience, making it smoother and less stressful for passengers. This not only reduces stress but also contributes to a more efficient flow of passenger traffic. This not only lessens tension but also helps passengers move more smoothly. Especially at major international hubs, the implementation of this technology is a major step towards making airports more passenger-friendly. This was supported in the study of (Augusto et al, 2024) that smart interactive robots significantly enhance the travel experience for visually impaired individuals by providing real-time assistance. This makes it easier for those with passengers to move through unfamiliar environments and access essential services independently.

Superordinate Theme 1.2: Enhanced Passenger Experience

Informant 1: “.....saving time is one of the uhm best passenger satisfaction.”

Informant 2: “.....assist them of course it will improve their experience.....”

Informant 3: “It enhances convenience to passengers and especially for frequent travelers.”

AeroBot, an AI-powered robot assistant, can significantly enhance the passenger experience by streamlining processes and providing valuable assistance. Key benefits include time savings, personalized support, and increased convenience, especially for frequent travelers. By addressing these needs, AeroBot can contribute to a more efficient and satisfying travel journey. Narain (2024) Artificial Intelligence (AI) has immense potential to enhance travelers’ experience. It can help in further promotion of the travel and tourism industry by ensuring a seamless experience for the visitors during the journeys. AI is assumed to be the most promising technology for the future as it can deliver personalized experiences to travelers and streamline operations. It also has vast capability to promote each aspect of the visitors’ experience.

Master Theme 2: Aerobot can support non-tech-savvy passengers, first-time fliers, and those facing language or cultural barriers, accommodating diverse passenger needs in busy airports.

Superordinate Theme 2.1: Functionality

Informant 1: “.....displaying this language selection.....”

Informant 2: “.....let’s say a voice interface, let's say someone can directly speak with them.....”

Airports are bustling hubs of activity, often overwhelming for passengers unfamiliar with the processes or environment. AeroBot serves as a vital tool in enhancing passenger experiences, particularly for those who may find navigating complex airport environments challenging. By providing user-friendly assistance, clear guidance, and multilingual support, AeroBot empowers non-tech-savvy individuals, first-time travelers, and those facing language or cultural barriers. This innovative solution enhances accessibility, reduces stress, and improves the overall travel experience for a diverse range of passengers, making airport journeys more comfortable and efficient.

Superordinate Theme 2.2: Passenger Experience

Informant 1: “.....maximize the better experience for the all the passengers.....”

Informant 3: “.....ensuring they feel confident and supported in every stage.....”

For the Aerobot’s support non-tech-savvy passengers, first-time fliers, and those facing language or cultural barriers, accommodating diverse passenger needs in busy airports, that focus on creating a better experience for passengers. Efficient management of passenger guidance and assistance can enhance the

passenger experience in the airport, especially for those passengers who are first-time flyers and not familiar with the technologies of today, with which they will feel more comfortable using and maximizing their travel experience. It is crucial to accommodate varying degrees of technical comfort to guarantee that the AeroBot's functions are usable and accessible by the passengers. With the help of these elements, travelers can make the most of their trip and guarantee that they will always feel supported and at ease. These systems must be designed to accommodate varying levels of technological comfort among travelers by providing intuitive interfaces and alternative assistance options.

IV. DISCUSSION

4.1. Conclusions

Based on the results and analysis, the following were concluded:

AeroBot, an AI-powered airport navigation tool, effectively enhances airport experiences by improving navigation, reducing stress, and providing multilingual support. While it did not show a statistically significant impact on stress reduction for impaired passengers, its mobility assistance and real-time navigation remain key strengths. The tool's contactless solutions, user-friendliness, and ability to improve passenger satisfaction are also notable.

Based on the results and analysis, the following conclusions were drawn: The sample predominantly consists of male respondents (78.4%), with females representing 21.6%. Fourth-year students make up the largest group (47.1%), indicating higher engagement in research compared to first-year (21.6%), second-year (10.8%), and third-year (20.6%) students. In terms of travel frequency, most participants (69.6%) travel 1 to 2 times per year, while 30.4% travel 3 to 4 times per year. These demographic trends reflect the sample's engagement and travel behavior.

AeroBot's effectiveness in addressing airport navigation challenges is evident, with a weighted mean of 3.64 for providing accurate directions. Respondents strongly agree that AeroBot simplifies gate-finding (3.68), reduces stress (3.56), and enhances convenience (3.61) and multilingual support (3.58). Additionally, it helps alleviate congestion (3.49) and improves safety (3.37). These findings demonstrate AeroBot's value in improving travel efficiency, accessibility, and passenger satisfaction, supporting the need for AI-powered assistants in airports.

The study also highlights AeroBot's significant benefits for passengers with impairments. With a weighted mean of 3.67, respondents strongly agree that AeroBot provides valuable mobility assistance, reduces stress during check-in and boarding (3.60), improves independence (3.57), and instills confidence (3.55). AeroBot's real-time navigation support (3.54) and information for visually impaired travelers (3.56) underscore its potential to enhance the airport experience for impaired passengers, emphasizing the importance of AI-driven solutions in airport operations.

AeroBot's ability to address passenger guidance challenges in complex airport environments is evident, with a weighted mean of 3.72 for overcoming language barriers. It improves comfort, efficiency, and safety (3.58), effectively managing guidance in busy airports (3.59). AeroBot offers contactless solutions (3.55), is user-friendly for diverse passengers (3.49), and streamlines operations (3.61) by reducing congestion and adapting to passengers' needs (3.60). These results underline AeroBot's potential to enhance passenger experience and optimize airport operations through AI-driven solutions.

The analysis of passenger's perceived value in terms of assistance provided by the autonomous artificial intelligence robot reveals that there is a significant difference when categorized based on particular demographics such as impaired passengers, senior citizens, and average passengers, with an F-value of

5.741 and a p-value of 0.01. Since the p-value is below 0.05, the null hypothesis is rejected, suggesting that year level has a substantial impact on how students perceive the benefits of AI-driven airport navigation systems.

The analysis on the efficiency of having an AI robot in line with airport navigation and passenger convenience, taking into consideration (passenger experience, less passenger congestion, and travel frequency) showed a strong correlation between the passenger experience and year level (p-value = 0.004). Since the p-value is below 0.05, the null hypothesis is rejected. It indicates that younger individuals tend to place a higher value on AI-driven solutions that enhance the overall travel experience. Additionally, a significant correlation was found between travel frequency and passenger experience (p-value = 0.000), suggesting that frequent travelers are more likely to appreciate the benefits of AI-driven navigation.

Demographic analysis reveals that AeroBot's value is perceived differently, with younger individuals placing a higher value on AI-driven solutions. Additionally, frequent travelers are more likely to appreciate the benefits of AI-driven navigation. The study highlights AeroBot's potential to revolutionize travel experiences for passengers by prioritizing accessibility, providing comprehensive travel assistance, and fostering inclusivity. With its real-time guidance, multilingual support, and user-friendly features, AeroBot can enhance navigation efficiency and passenger satisfaction. By streamlining processes and offering personalized support, AeroBot can reduce stress and promote independence, ultimately making airports more passenger-friendly and efficient.

4.2. Recommendations

Based on the discussed conclusions, the recommendations are as follows:

Integration with Airport Operations for Enhanced Efficiency: AeroBot has shown promise in reducing congestion and improving airport efficiency by managing tasks such as passenger guidance and flight information. It is recommended that AeroBot be further integrated into overall airport operations to maximize its potential to streamline processes. Collaboration with airport management could lead to AeroBot being deployed in areas with high passenger traffic, such as security checkpoints, boarding gates, and information desks, to optimize its utility.

Further Exploration of Stress Reduction for Impaired Passengers: AeroBot's ability to assist passengers with disabilities is promising, but further research is needed to determine how it affects stress levels. Future studies should pinpoint the main stressors that travelers with disabilities encounter at airports and investigate how AeroBot can more effectively manage them with enhanced user interfaces or customized features.

Continued Development of Multilingual and Accessibility Features.: Given the strong support for AeroBot's multilingual capabilities and its ability to assist passengers with impairments, it is recommended that continued efforts be made to expand and improve these features. Adding more language options and ensuring that the system is fully accessible to passengers with different types of impairments will further improve its usability and inclusivity, making it a more valuable tool for a diverse range of travelers.

Further Research on Demographic Variability: Since the study highlighted variations in the perceived value of AeroBot based on year level and demographic factors, future research should focus on how different demographic groups perceive and interact with AI-powered assistants in airports. This insight can inform the design of targeted AI solutions that better meet specific passenger needs.

Monitoring and Feedback Systems for Continuous Improvement: To ensure the continued success of AeroBot and its ability to meet passenger needs, it is recommended that a monitoring and feedback system be established. This would allow passengers to provide input on their experiences, and for adjustments to

be made in real-time based on user feedback. By continuously evaluating AeroBot's performance, improvements can be made to address any unforeseen challenges or shortcomings.

Expanded Accessibility Features:

Enhancing AeroBot's inclusivity requires expanding its accessibility features. This involves adding advanced voice recognition, text-to-speech capabilities for diverse linguistic and auditory needs, and tactile interfaces with sensory cues to assist visually impaired passengers.

Enhancing AeroBot's User Experience for Diverse Passengers: To maximize the AI-powered robot assistant's potential, it's essential to consider the diverse needs of all passengers. This involves incorporating multimodal interaction methods (beyond voice), layered information delivery formats, multilingual support, and an optional tutorial mode for first-time users. By addressing diverse passenger needs and technical comfort levels, AeroBot can create a more inclusive and stress-free airport experience for all passengers.

Further Research on Expanding the Study: Given the increasing number of senior citizens traveling internationally, future research should specifically investigate their interactions with AeroBot. By including a significant sample of senior citizens, researchers can gain valuable insights into their unique needs, preferences, and potential challenges when using AI-powered assistants. Such insights can lead to the development of tailored features and user interfaces that are specifically designed to cater to the needs of this demographic, enhancing their overall airport experience."

Refining the scope of the Research: To enhance the study's significance and practical impact, it is recommended to refine its scope and concentrate on addressing a specific, well-defined problem. Narrowing the research focus allows for more targeted and actionable insights, ultimately leading to meaningful and practical contributions to the field.

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