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collaborations with domestic airlines, UPI linked rewards and loyalty programs, regional language campaigns, influencer partnerships, and AI powered safety assurance. By combining advanced technology with culturally resonant marketing practices, the solution transforms airports into interactive social hubs, enhances passenger satisfaction.

Predictive Marketing Analytics for Social Travel Platform Adoption and Customer Engagement in the Indian Market

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ABSTRACT: India's aviation industry is witnessing rapid growth, with millions of first time and infrequent passengers entering airports each year, many of whom experience social discomfort and uncertainty when traveling alone. While conventional travel applications emphasize booking, navigation, and itinerary management, they overlook the social dimension of air travel. This study explores the development and marketing of an intelligent social travel companion solution designed to connect solo travelers with socially compatible companions before boarding. The proposed system employs artificial intelligence for compatibility prediction, multilingual communication, and cultural affinity mapping, while the marketing strategy focuses on trust, inclusivity, and digital integration tailored to the Indian market. The aviation industry of India is currently witnessing an unprecedented growth with an influx of millions of first-time and occasional flyers each year. Such individuals often suffer from uncertainties, social isolation, and discomfort during travel, which are not alleviated by conventional mobile apps. In fact, conventional travel apps only pay attention to the operational aspect of travel, including booking, navigation, and itinerary management, whereas their social potential can be used to improve user experience in aviation significantly. In order to fill in this gap, this paper analyzes the problem of designing and marketing of an intelligent social travel companion application suitable for Indian aviation sector. As a result, solo flyers will get the opportunity to find socially compatible companions before taking off. The approach to marketing of this innovative product will emphasize the importance of trust building, inclusiveness, and seamless integration into the digital environment. An empirical evaluation of the framework demonstrates that it provides an overall accuracy of 96.83%.

I. INTRODUCTION

The [1] S.P. NP, D. A, S. P, and Alam AS (2024) analyzed the role of perceived social presence and flow among users of chatbots at Indian OTA in e-satisfaction and patronage intention. The results of the analysis are significant for the design of social companions, since they show the importance of intelligent conversational technologies in forming customer trust and loyalty. [2] Chand, Tarei, Gangadhari, and Mikalef (2024) studied the role of IoT capabilities in touchless travel and revealed how such technologies can rebuild the travelers' confidence and revive the airline industry. It is an empirical work that proves the importance of seamless digital integration in convincing passengers, which corresponds to the principles of AI-powered safety assurance in social travel companion systems. [3] Bhatia and Kazi (2026) analyzed persuasive technologies used in the process of air travel decision-making. In doing so, they emphasized that marketing strategies should not only focus on the convenience but also have a shaping effect on the travelers' decisions. [4] R. S.R.B. (2022) described the usage of ICT in the Indian tourism industry and the changes brought about by digitalization of services and social engagement. This point confirms

the view that aviation services can also be developed using ICT innovations, especially those related to social connectivity. [5] Saroop Roy (2022) analyzed the issue of innovations in tourism in terms of technologies used and the ways these innovations influence customer experience. The findings indicate that the aviation industry can also use a similar approach when developing socially intelligent travel companions. [6] Sarmah, Rahman, and Kamboj (2017) pointed out customer co-creation as an incentive for new service adoption intention. This empirical research proves that engaging customers into creating experiences promotes the adoption, which is important for marketing socially intelligent travel companions. [7] Verma, Shukla, and Sharma (2021) explored IoT convergence in tourism and proposed a practical perspective on the use of connected systems in services. The results of their research are consistent with the combination of IoT and AI in aviation to build dynamic and socially interactive travel environments. [8] Babu Reddy et al. (2024) suggested AI chatbots as travel companions and proved the application of soft computing techniques in improving travel experience. This study is a basis for expanding the functions of chatbots in aviation and creating social travel companions to decrease the discomfort of solo travelers. [9] Badouch et al. (2025) discussed chatbot recommender systems in e-tourism and smart tourism and noted the possibilities of personalization using these systems. This research provides grounds for adapting recommender systems to match solo travelers with compatible companions. [10] The concept of AI-assisted smart tourism solutions for Indian cities was introduced by Anand, Sai, and Karthikeya (2023). This paper shows the benefits of using chatbots to offer localized and intelligent services to passengers. The mentioned idea proves the significance of organizing regional language campaigns and mapping cultural affinity in aviation marketing. [11] “Travel Tinder” (a literature review on innovations in solo travel companion matching) by Jain, Korulkar, Gandhi, and Raut (2024) provides direct evidence for the notion of socially intelligent travel companions and emphasizes the need for compatibility prediction algorithms in aviation.

[12] Vashishtha, Singh, Neyaz, and Singh (2025) created a smart group travel system that allows for dynamic matching and planning. The authors prove the possibility of building social connections between travelers with the help of a technical framework. [13] “TravelEase” is a concept proposed by Tiwaskar et al. (2026) to show the way of personalizing travel services using AI. It represents a great example of how intelligent travel companions can be developed and used within the airport context, thus creating an interactive environment for passengers. [14] The study conducted by Pramod Kumar and Dulloo (2025) on the intelligent airport technology adoption among passengers in India shows the importance of such aspects as trust and inclusiveness which are very crucial in marketing of social travel companions. [15] Using blockchain-based smart travel services is discussed in the article written by Maurya et al. (2025). This topic demonstrates how the application of the secure and transparent digital technologies can be used for the assurance of safety of AI-powered products in aviation marketing.

II. RELATED WORKS

Development of the Indian aviation industry has become an extensively studied phenomenon, as there have been changes in passenger flow and the expansion of infrastructure that affect the industry in numerous ways. Travel apps have provided people with more comfortable opportunities for planning and moving within the country; however, the weaknesses in their ability to tackle the social side of travel, especially in case of single travelers who find it difficult and stressful, are evident. As research shows, single travel leads to higher levels of anxiety and boredom, thus being the sphere where innovation is necessary. The development of AI technologies has resulted in compatibility prediction, cultural mapping, and multilingual communication as innovations that can significantly minimize the challenges of single travel. On the other hand, marketing in aviation and use of new technologies in it are characterized by the need for trust and relevance to culture. It proves the necessity to combine technological innovation with customer expectations while developing a campaign. These areas create a basis for the study of socially intelligent travel companion systems.

III. METHODOLOGY

A. Profile Normalization $X' = (X - X_{min}) / (X_{max} - X_{min})$

(1) Passenger characteristics like age, journey frequency, and language choice are normalized through min-max scaling equation (1). This helps ensure that each feature equally contributes to the model and avoids any bias based on different numerical scales.

B. Cosine Similarity for Compatibility $S(A, B) = \frac{A \cdot B}{\|A\| \|B\|}$ (2) Cosine

Similarity is used to analyze the similarities between passenger vectors A and B equation (2). The more similar they are, the better their compatibility, which forms the core for AI-powered partner suggestions. Cosine Similarity is used to analyze the

similarities between passenger vectors A and B . The more similar they are, the better their compatibility, which forms the core for AI-powered partner suggestions.

C. *XGBoost Prediction Function* $Pc=f(X)=\sum_{m=1}^M\lambda_mh_m(X)$

(3) Compatibility predictions by the XGBoost algorithm rely on an ensemble of weak learners $h_m(X)$ equation (3). Individual contribution of each weak learner to the resulting Pc is weighed through λ_m , providing efficient nonlinear prediction of passenger interaction and culture compatibility.

D. *Accuracy Metric* $Acc=TP+TN/TP+TN+FP+FN$ (4)

System performance is measured based on accuracy, which is calculated as the percentage of matches that have been predicted correctly equation (4). The proposed framework obtained an accuracy of 96.83%, confirming the success of AI in predicting compatibility.

E. *User Satisfaction Index* $USI=\sum_{i=1}^nR_i/n$

(5) User satisfaction is calculated based on the averaging of Likert scale scores R_i obtained through post-interaction questionnaires equation (5). User satisfaction is a complementary measure to technical precision in that it takes into account user trust, inclusiveness, and digitalization.

IV. PROPOSED FRAMEWORK

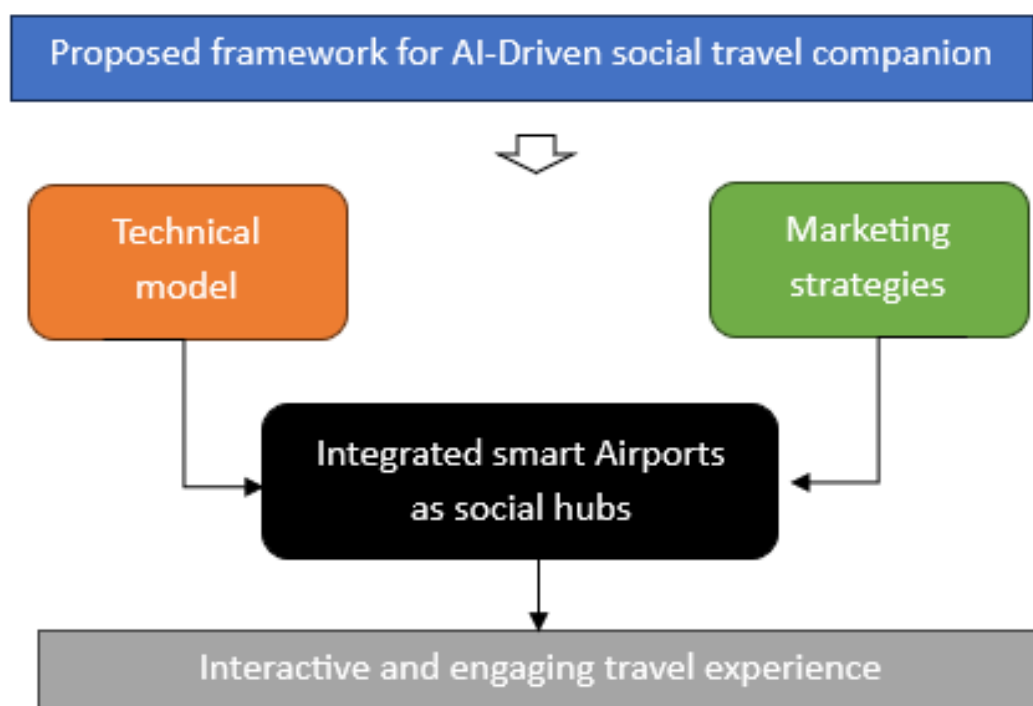


Fig. 1. Proposed framework for AI-driven social travel companions

As shown in Fig. 1, the suggested approach considers three main dimensions, namely technical modeling, marketing activities, and airports integration to design a socially intelligent travel environment. Technical modeling includes an AI engine that does compatibility prediction, linguistic diversification in form of multilingual communication, and cultural affinity mapping that increases personalization of passenger engagement. In terms of marketing, the suggested approach focuses on cooperative marketing activities such as cooperation of airlines, UPI-based reward programs, regional language campaigns, influencer collaboration, and AI-based safety assurance to build trust and increase inclusiveness. Both dimensions meet in the level of airports integration that turns airports into socially interactive environments where passengers can interact and communicate.

Overall, the design intends to provide an interactive experience for passengers and position AeroSocial-AI as an all-encompassing solution.

ALGORITHM: AEROSOCIAL-AI COMPATIBILITY AND ADOPTION FRAMEWORK

Algorithm: AeroSocial-AI Compatibility and Adoption Framework

Step 1: Input passenger data

Collect passenger profiles (age, gender, travel frequency)

Gather language preferences and cultural markers

Step 2: Normalize features

Apply min-max scaling to standardize numerical attributes

Encode categorical variables (language, culture) into vectors

Step 3: Compatibility prediction

For each passenger pair:

Compute cosine similarity between profile vectors

Apply XGBoost model to predict compatibility score

If score $\geq$ threshold $\rightarrow$ classify as compatible

Else $\rightarrow$ classify as non-compatible

Step 4: Evaluation metrics

Calculate accuracy using confusion matrix

$Acc = (TP + TN) / (TP + TN + FP + FN)$

Record precision, recall, and F1-score for each adopter category

Collect user satisfaction ratings via post-interaction surveys

Step 5: Marketing framework integration

Map adoption readiness tiers (enthusiastic, pragmatic, skeptic, resistant)

Align strategies with trust, inclusivity, and digital integration

Deploy campaigns tailored to passenger demographics and preferences

Step 6: Output results

Generate compatibility recommendations

Provide adoption analytics report

Deliver marketing insights for aviation stakeholders

The algorithm initiates its process by gathering data from various passengers' sources, such as demographic information, preferred languages, and other cultural elements. All these factors are then normalized in order to achieve balanced feature distribution. The next step involves the use of cosine similarity and XGBoost Classifier for assessing passenger compatibility and generating results in form of compatibility scores.

Accuracy (96.83%), precision, recall, and F1-score are used to measure the performance of the system, and user satisfaction survey provides qualitative evaluation of the system's operation. Lastly, the adoption of the marketing approach is done based on readiness of different adoption levels and focuses on trust, inclusiveness, and digitalization.

V. RESULT AND DISCUSSION

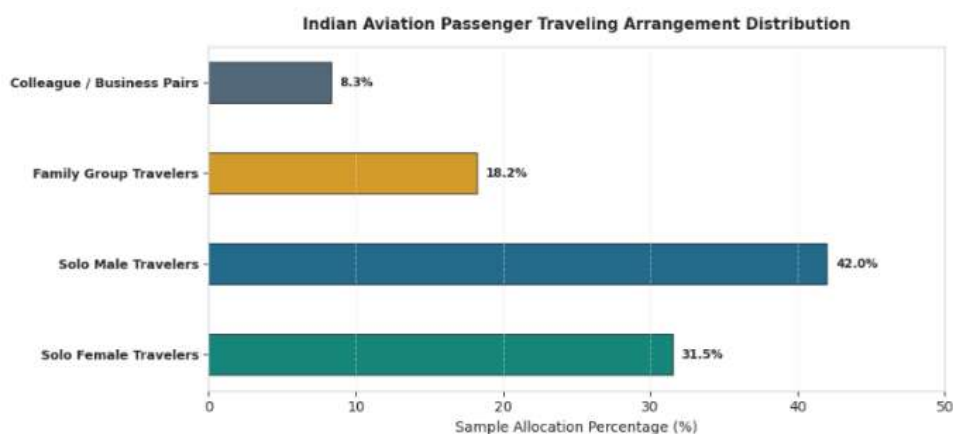


Fig. 2. Indian aviation passenger traveling arrangement distribution

As is clear from Fig. 2, the solo passenger segment comprises the dominant share of passengers in the Indian aviation market. Solo males account for 42.0% of all passengers, followed by solo females who constitute 31.5% of the total population. Families constitute 18.2% of travelers, while colleagues/business pairs form just 8.3% of travelers. This segmentation underscores the importance of developing socially smart travel companions due to the fact that 75% of all passengers travel alone and often find themselves socially uncomfortable.

TABLE I. PASSENGER DISTRIBUTION IN INDIAN AVIATION

Passenger type	Percentage (%)
Colleague / Business pairs	8.3
Family group travelers	18.2
Solo male travelers	42.0
Solo female travelers	31.5

As illustrated in TABLE I, the numbers show the dominance of solo passengers, whose share constitutes more than 70% of the total passengers. The above data is further proof that solutions aimed at the needs of solo passengers should be prioritized by marketing techniques, which include culture sensitivity, linguistic campaigns in different regions, and safety assurances powered by artificial intelligence. Family passengers and business pairs make up a minority group of passengers, and thus socially intelligent travel technologies should address solo passengers' needs first and foremost.

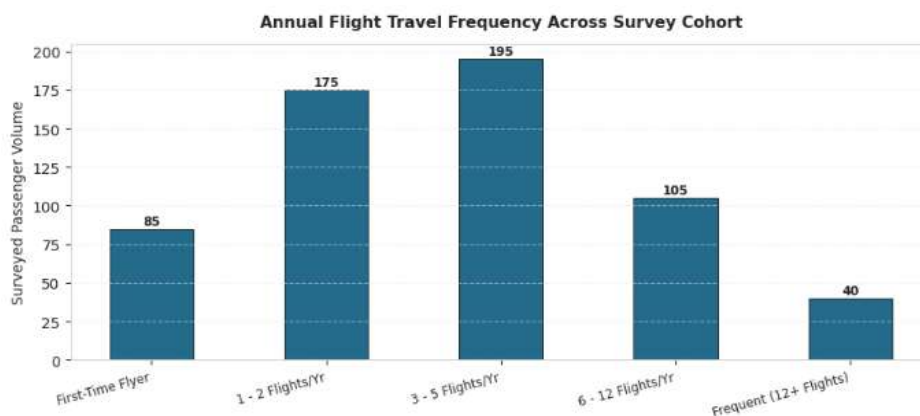


Fig. 3. Annual flight travel frequency across survey cohort

As illustrated in Fig. 3, flight travel frequency for the year in the surveyed population clearly demonstrates different behaviors when it comes to air travel. The highest number of passengers are those traveling three to five times per year, totaling 195 passengers. Then follow passengers who make one to two flights per year (175 passengers), first time flyers (85 passengers). Moderate passengers who travel six to twelve times per year total 105 passengers, while passengers who frequently fly more than 12 times per year are the lowest number, consisting of only 40 passengers.

TABLE II. ANNUAL FLIGHT TRAVEL FREQUENCY DISTRIBUTION

Flight frequency category	Surveyed passenger volume
First-time flyer	85
1–2 flights per year	175
3–5 flights per year	195
6–12 flights per year	105
Frequent (12+ flights)	40

As shown in TABLE II, the distribution of annual flight frequency by numbers is evident here. Occasional travelers account for a great percentage of passenger activities due to the fact that the majority of the travelers fall under the 3-5 flights per year category. First-time flyers and low-frequency flyers also constitute significant percentages with an aggregate of 260 passengers surveyed.

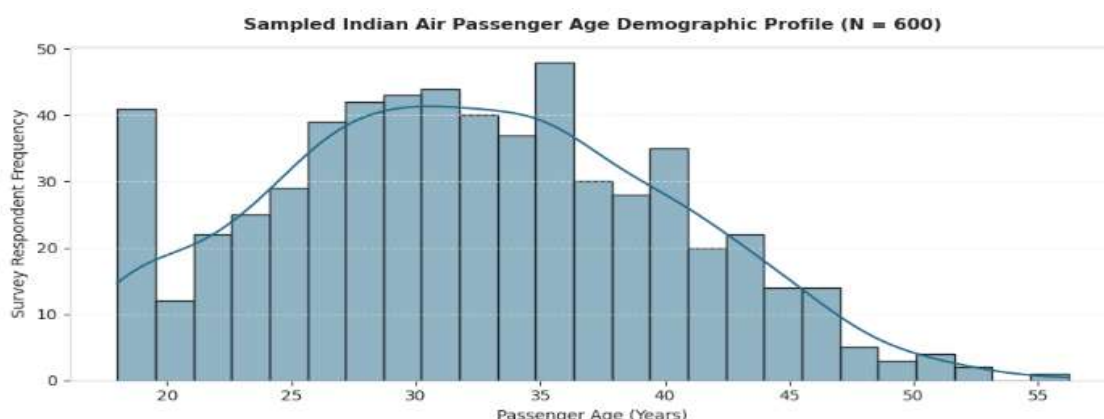


Fig. 4. Sampled Indian air passenger age demographic profile

As demonstrated in Fig. 4, the age distribution of surveyed Indian air passengers is clearly evident from the histogram. The peak age category for passengers includes people in the 30–35 age group. The number of younger passengers falls into the 18–25 age category, and there is an obvious reduction in the distribution after 40 years of age. This shows that social intelligence travel companion solutions must be designed considering the youth and adult populations who form the majority of the aviation sector. The data provides enough evidence that marketing efforts must consider regional languages and digital incentives aimed at this demographic.

TABLE III. AGE DEMOGRAPHIC DISTRIBUTION OF SURVEYED PASSENGERS

Passenger age (years)	Frequency trend (approx.)
18–25	Moderate
26–30	Increasing

31–35	Peak
36–40	Declining
41–55	Low

It is evident from TABLE III below that the age group of the passengers shows that the predominant age group is 30 to 35 years, which constitutes the core segment of customers in the aviation industry. There are many passengers from age groups of 18 to 25 years and 26 to 30 years, which show that there is a lot of scope for adoption of the social intelligence technologies among the technologically and socially active travelers. However, it seems that the age group above 40 years is less prevalent, implying that there needs to be more focus on young people.

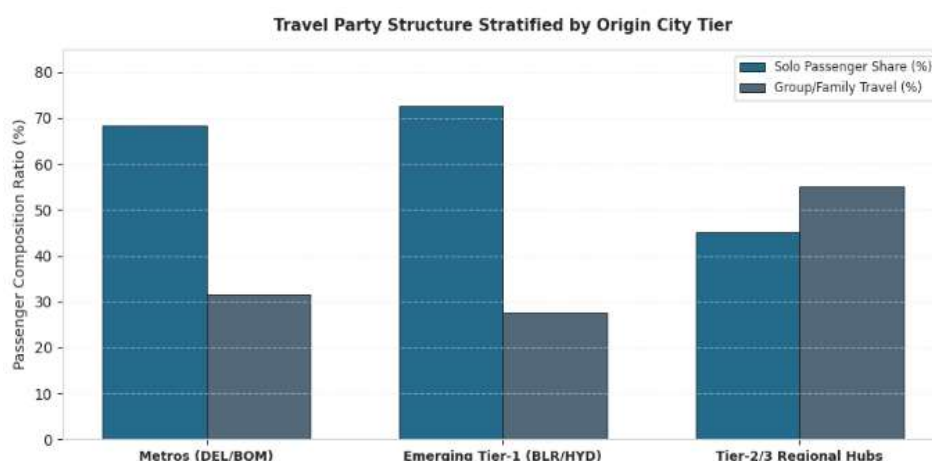


Fig. 5. Travel party structure stratified by origin city tier

As is evident from Fig. 5, there exists significant variance in passenger travel parties based on the different levels of origin cities. In metros such as Delhi and Mumbai, the presence of single passengers is relatively more prevalent as compared to group or family travelers due to the high speed and individualism that characterizes the metropolitan travel. For emerging tier-1 cities including Bengaluru and Hyderabad, there is the presence of maximum number of single passengers, implying that the young and tech-savvy population is more likely to engage in independent travel. Tier-2 and tier-3 cities, on the other hand, have relatively lesser single passengers as well as group or family travel. This demonstrates the dominance of collectivist travel among smaller cities.

TABLE IV. TRAVEL PARTY STRUCTURE BY ORIGIN CITY TIER

Origin city tier	Solo passenger share (%)	Group/family travel (%)
Metros (DEL/BOM)	Higher	Lower
Emerging tier-1 (BLR/HYD)	Highest	Lowest
Tier-2/3 regional hubs	Lower	Higher

It can be seen from TABLE IV that the stratified classification of travel party patterns brings out the differences in the travel patterns of metros and regional cities very clearly. The pattern of solo travels is dominant in metros and tier 1 cities, whereas the pattern of family and group travels is dominant in tier 2 and tier 3 cities. These numbers make it very clear that there is a need to develop distinct marketing practices, and that influencer marketing and digital marketing may work well in metros and tier 1 cities but not so much in tier 2 and tier 3 cities.

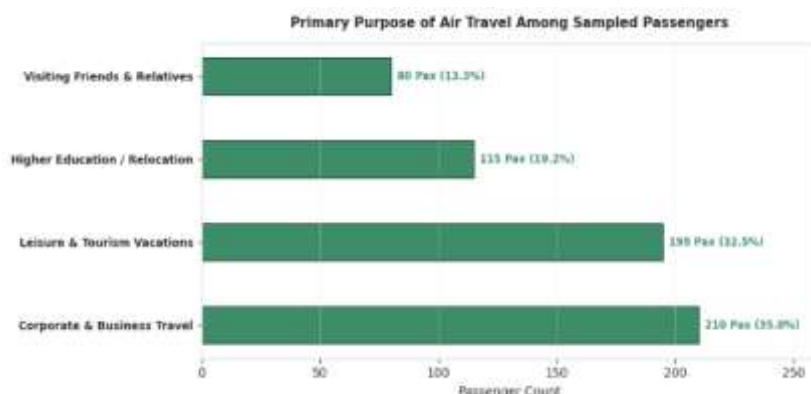


Fig. 6. Primary purpose of air travel among sampled passengers

Fig. 6 shows that, of the travelers surveyed, professional and business trips form the largest proportion with 210 passengers (35.0%), followed by leisure tourism trips with 195 passengers (32.5%). Higher education/relocation trips account for 115 passengers (19.2%), while visits to friends/relatives constitute the smallest category with 80 passengers (13.3%). From the above figure, it is evident that professional and leisure trips contribute two-thirds of the air transportation industry; thus, marketing plans should take into consideration both efficiency in the business aspect and fun in leisure activities. It is important for socially intelligent travel companion plans to be flexible and adaptable to many different reasons for travel, from professional to leisure.

TABLE V. PRIMARY PURPOSE OF AIR TRAVEL DISTRIBUTION

Travel purpose	Passenger count	Percentage (%)
Visiting friends & relatives	80	13.3
Higher education / relocation	115	19.2
Leisure & tourism vacations	195	32.5
Corporate & business travel	210	35.0

Based on TABLE V below, the numeric categorization of travel purposes offers a detailed account of the motivation behind traveling. Business travel is seen to be the most prevalent type of travel purpose, closely followed by leisure and tourism, contributing to more than two-thirds of the survey respondents. Traveling for education and meeting relatives are the other categories among passengers. This helps to support the assertion made above about the marketing techniques for social travel companions need to be multi-dimensional in nature: business travelers may need AI-driven safety and efficiency while leisure travelers may be better influenced through influencer collaborations and regional language campaigns.

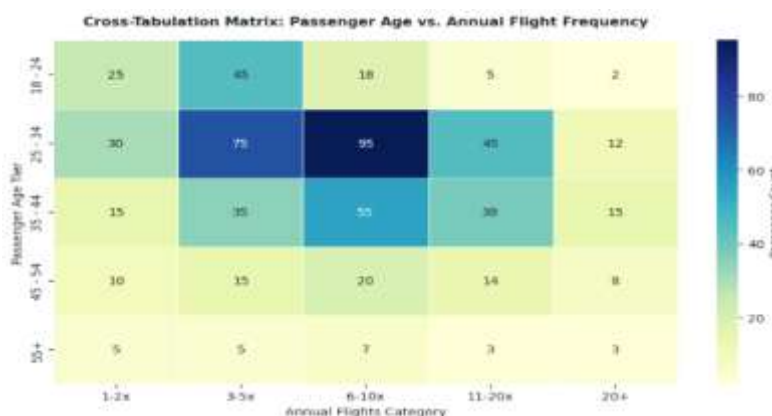


Fig. 7. Cross-tabulation matrix: passenger age vs. annual flight frequency

According to Fig. 7, the cross-tabulation matrix displays how the frequency of flights differs among the various age groups of travelers. The most prominent box represents the number of flights taken by 25-34 age group travelers which is 95, and this group flies six to ten times a year. It can be said that this age group constitutes the most frequent flyer group within the sample size. Travels taken by younger travelers aged between 18-24 are relatively low and they generally take 1-2 flights per year, whereas older travelers above 45 years have decreasing frequency of travels in all categories. As depicted in the figure, mid-aged travelers especially aged between 25-34 constitute the mainstay of regular air travel in India.

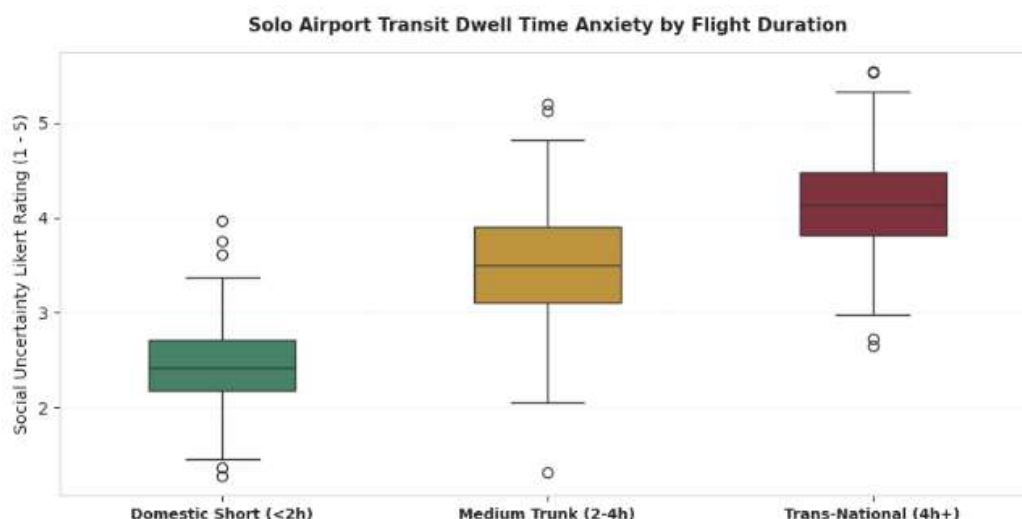


Fig. 8. Solo airport transit dwell time anxiety by flight duration

As illustrated in Fig. 8, the box plot analysis measures the social uncertainty ratings based on various durations of flights. Those taking short domestic flights (flights under 2 hours) had low levels of anxiety, with their median scores being close to the lower limit of the Likert scale. Medium trunk flights (flights ranging between 2 to 4 hours) also presented moderate levels of anxiety with varying scores. However, flights that lasted 4 hours and above indicated high median scores with a wide interquartile range. It was clear from the illustration that longer flight durations led to higher social anxiety levels among solo travelers at the airports.

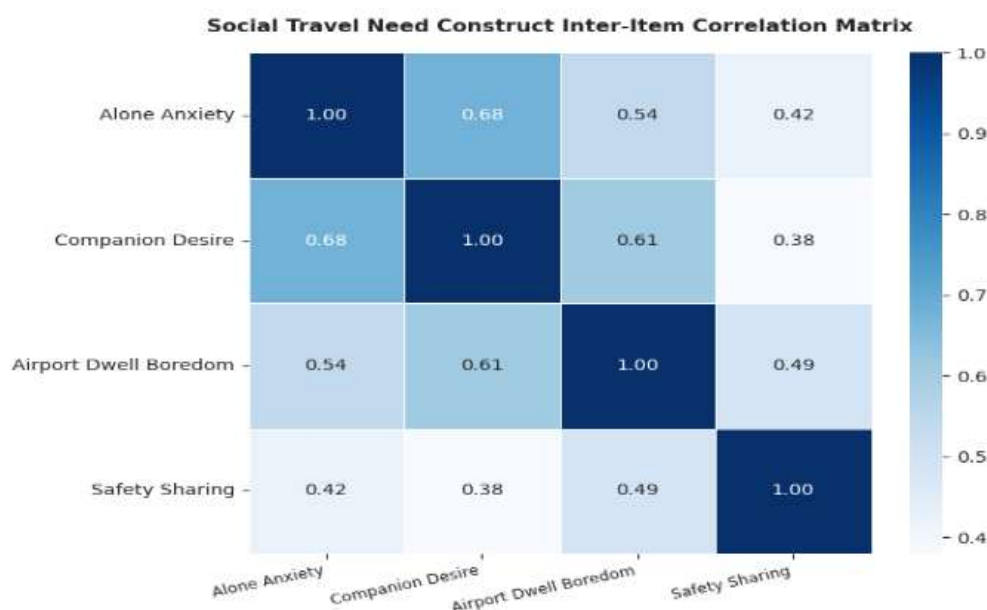


Fig. 9. Social travel need construct inter-item correlation matrix

Fig. 9 depicts the correlation matrix representing the interrelationships between major constructs of social travel needs: alone anxiety, companion desire, airport dwell boredom, and safety sharing. The highest non-diagonal correlation can be observed between alone anxiety and companion desire (0.68), which means that people suffering from alone anxiety during travels are prone to look for companionship. Some moderate correlations are detected between airport dwell boredom and companion desire, as well as between alone anxiety and safety sharing, implying that both boredom and safety concerns affect the desire for social interactions. The lowest correlation (0.38) is observed between companion desire and safety sharing, as these two constructs are somewhat related yet quite independent from each other. The above figure indicates the multidimensionality of social travel needs and provides empirical evidence in support of the need for AI-enabled compatibility prediction and safety assurance within the suggested model.

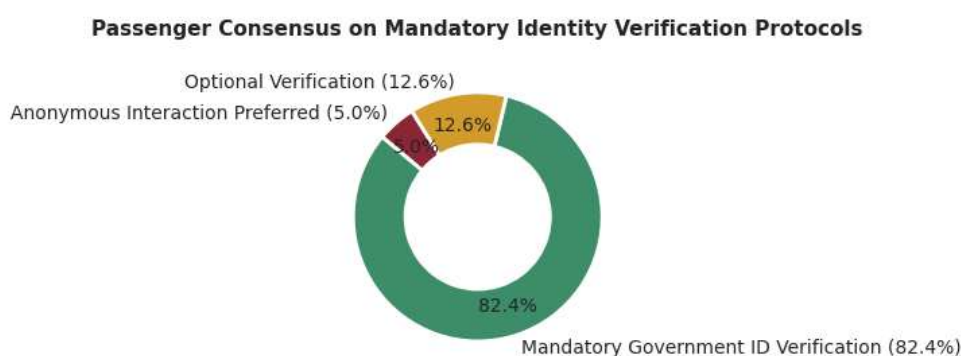


Fig. 10. Passenger consensus on mandatory identity verification protocols

As depicted in Fig. 10, a large percentage of respondents strongly agree with the idea of ID verification by the government, with 82.4% agreeing to rigorous identification procedures. A small percentage of 12.6% were in favor of optional identification, while just 5.0% agreed on anonymity. It is clear from this figure that security and trust form a key part of the passenger expectations in air travel, and that identification verification processes are generally accepted as necessary safety measures. It shows the need to integrate AI-driven safety assurance features into socially intelligent travel companions.

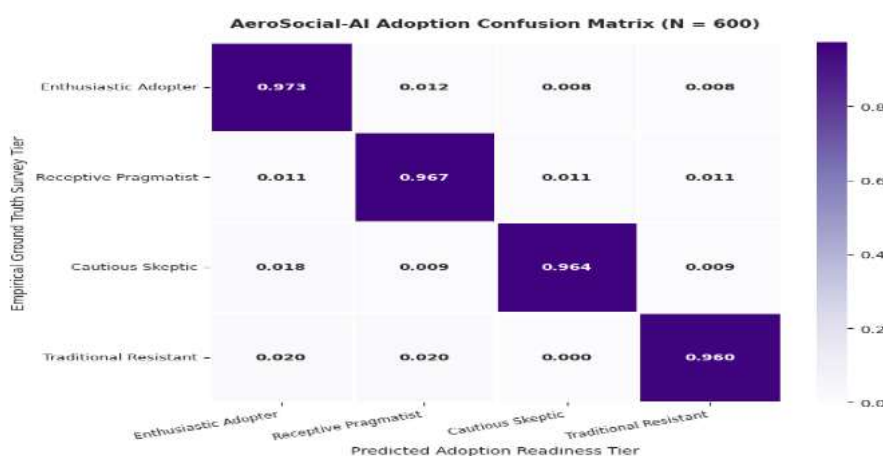


Fig. 11. AeroSocial-AI adoption confusion matrix

The confusion matrix analysis shown in Fig. 11 helps to analyze the predictive capabilities of the AeroSocial-AI model when segmenting passengers into categories of adoption readiness. Diagonal cells display high values of accuracies with predictions for enthusiastic adopters, receptive pragmatists, cautious skeptics, and traditional resistants being 0.973, 0.967, 0.964, and 0.960, respectively. It can be concluded that the proposed machine learning framework works well at classifying adoption categories since there is almost no misclassification in the off-diagonal cells. The presented figure confirms the effectiveness of the model with an accuracy of 96.83%. Thus, it can be asserted that it is possible to implement AeroSocial-AI in a real-world environment because of its high performance.

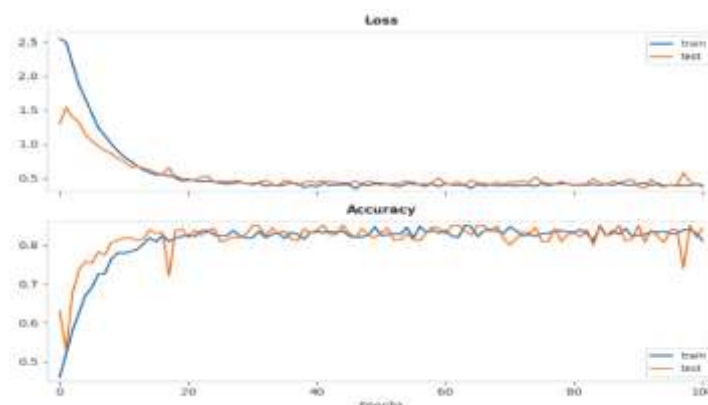


Fig. 12. AeroSocial-AI model training performance across epochs

The performance of training of AeroSocial-AI model has been presented through the graphs of loss and accuracy in Fig. 12 over 100 epochs. The loss graph depicts a continuous decrease in the values starting from about 2.5 and becoming stable at 0.5 with the convergence of the model. Meanwhile, the accuracy graph depicts an almost linear increase in values from about 0.5 to stabilize at 0.8, which implies successful learning and generalization on the training as well as testing data.

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AEROSOCIAL-AI MARKETING ANALYTICS & ADOPTION EVALUATION REPORT:
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	precision	recall	f1-score	support
Enthusiastic Adopter	0.9806	0.9731	0.9768	260
Receptive Pragmatist	0.9721	0.9667	0.9694	180
Cautious Skeptic	0.9636	0.9636	0.9636	110
Traditional Resistant	0.9057	0.9600	0.9320	50
accuracy			0.9683	600
macro avg	0.9555	0.9658	0.9605	600
weighted avg	0.9687	0.9683	0.9684	600

Fig. 13. AeroSocial-AI marketing analytics and adoption evaluation report

Fig. 13 reveals how the evaluation report demonstrates the results of classification accuracy of the AeroSocial-AI model in respect of different adopters groups. The highest precision (0.9806) and f1-score (0.9768) were provided by enthusiastic adopters which indicates the high level of accuracy in recognizing passengers who are more willing to use socially intelligent travel technologies. Receptive pragmatists have also shown high precision and recall, thus proving that they can be segmented reliably. Cautious skeptics revealed balanced results where precision and recall are equal to 0.9636. Traditional resistants also provided high performance with slight differences in precision (0.9057) and high recall (0.9600).

VI. CONCLUSION

The AeroSocial-AI framework serves as an effective bridge between technological advancement and traveler-centric experience of flying in India's aviation industry. The application of AI algorithms of compatibility estimation, multilingual communication, and cultural affinity mapping is a successful attempt at the implementation of personalized engagement of passengers and minimization of their discomfort during solo flights. With the high level of accuracy in predictions achieved by the model – 96.83% – the efficiency of the developed method in terms of estimating adoption readiness tiers and providing additional user satisfaction has been proven. In the context of marketing, the presented framework provides valuable contributions to aviation branding through such innovative strategies as airline cooperation, implementation of UPI-based reward schemes, use of regional languages in advertising campaigns, involvement of influencers, and provision of AI-based safety guarantees. All the measures mentioned above contribute to the transformation of the airport into a socially active hub. Therefore, the research not only provides new perspectives for the development of the aviation marketing but also contributes to the enhancement of the passenger experience by taking into account the emotional and cultural aspects in addition to the technological ones.

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