

Acceptance of AR/VR technology in aviation industry by passengers in terms of enhancing their travel experience

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Abstract

AR, VR has introduced a new set of interfaces that can potentially transform the way humans interact with their surroundings completely. AR/VR can be used in airlines' manufacturing, supply-chain, and pilot training to enhance the passenger experience. This research focuses on the use of VR and AR in enhancing passenger experience would affect the customer's decision to travel through flights and, on that basis, analyze whether it is a good opportunity to invest in these technologies. Customer satisfaction is what every business targets to achieve. Moreover, the same goes for airlines too. The research scope includes both in-flight as well as terminal experience. AR/VR technologies would focus on Entertainment, Ease of use, and navigation purpose in the complex structure of airports. The methodology includes a structured interview in the form of a survey of 60 people who have traveled via flights. T-test analysis has been used to find out the significance of the above-mentioned variables. The purpose of this paper is to find out whether users prefer the use of AR/VR technology when it comes to boost their passenger experience, and based on the result to know whether it is a good investment for the airlines or not.

Keywords

AR/VR, Technology, Airlines, Aviation, Customer, Satisfaction, Experience

Imprint

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1 Introduction

Today, we all know Augmented Reality via games like Pokémon Go and Snap chat filters. Computer-generated simulations are integrated with the real world. Moreover, when VR comes up, a head-mounted display comes in our minds where we are just completely interacting with the virtual world. However, these concepts go way back in time, and it took decades for the transition from science fiction to reality. The first notion of augmented reality was presented in a novel from 1901 written by Frank L Baum. A pair of electronic glasses displayed data on people; it was named a "character marker". In 1975, an American computer artist, Myron Krueger, developed the first "virtual reality" interface in the form of "Video place," which allowed its users to modify and interact in real-time with virtual objects. Back then, these were not known as "Virtual Reality" or "Augmented Reality" as the terms were given by Jaron Lainer in 1989 and Thomas P Caudell of Boeing in 1990 respectively Usman.

AR and VR also are part of a wider technology sector known as mixed reality (MR). According to Eschen, MR defines different technologies that combine the physical world with the digital world, which resides at the extreme of real and virtual environments.

AR/VR with its unique technology can be useful in various fields. They can change the world's course and the world is still discovering and experimenting with it in different spaces. This technology has a broad spectrum to cover from gaming to healthcare to military/defense to marketing to manufacturing to aerospace.

In our research, we will concentrate on the use of AR/VR in the aerospace industry; as aerospace is a vast industry, we will narrow it down to commercial flights and airports.

Aviation's augmented and Virtual Reality Market is expected to rise from USD 78 million in 2019 to USD 1,372 million by 2025, at a CAGR of 61.2% over the forecast period. (Globe AR and VR Market in Aviation (2019-2025), 2019)

AR/VR can be used in various aspects of airlines as stated below:

- Manufacturing
- Supply-chain
- Pilot training
- Maintenance
- Enhancing Passenger Experience

Over the years, the aviation sector has evolved to meet and exceed passenger and airline needs. However, as can be vouched for by any observer in the aviation segment, it is the passengers who are vital to industry health.

This universal reality motivates service providers to drive their customers to great lengths. For several airlines providing the same routes at reasonable rates, the passenger's preference also depends on which airline offers a better end-to-end experience. This basic fact motivates service providers to go to great lengths to satisfy their clients, as researched by Sengur.

For the airport market, where the link between customer satisfaction and productivity has been generally recognized, customer expectations management is critical. Knowing customer preferences is very relevant for airport management to explore further the level of airport service which will distinguish airport business performance, as stated by Kamarudin.

Many airlines have already started experimenting with various technologies. AR/VR is also in the list for enhancing passenger experience both on-board and terminal. Ranging from entertainment for passengers to easiness for them while waiting at airports or while in-flight for long hours, as studied by Maklan

Airlines worldwide have wasted no efforts to make optimum use of the potential of VR to produce higher footfall and improve their sales. Lufthansa flyers were provided the opportunity to try out the Business Lounge's creative Aevant Glyph display glazes in early 2017, observed Kolo.

Since it is an initial phase, other airlines like Air France, British Airways, Williamson, Qantas, etc., (III, 2017) all experiment with AR/VR or MR in enhancing passenger immersive experience. Even at terminals, AR/VR technologies can be used for entertainment and guide through the airport.

Customer satisfaction is a huge part of any business, so in this research, we would check whether the customers would prefer these services or not.

2 Objectives

- This study aims to determine whether people favor using AR/VR technology-based applications, which will enhance their customer experience or not, and whether the airlines should invest in the AR/VR technology to boost the customer experience to increase the satisfaction level directly.

- Further, to identify the major factors that play a role in selecting the flight or booking the flight ticket.

3 Methodologies

As we can see, the AR/VR can sustain in the business to check whether it would be profitable or not for the business that directly depends upon the acceptance of the technology by the passengers [1]. If customers are willing to use or pay for the services offered via these technologies, it would be a great deal and a positive sign for the company to invest. For this, we have used a survey via a floating goggle form to get the customers' views. The form will be floated to 60 users [2].

People who participated in the survey, out of 57.4% belong to the age group 20-25, and 34.4% belong to 25-30. Rest lies in other age groups, and 66.66% of the participants are frequent travelers.

These groups of people were selected for the survey to focus on India's general public. These people belong to the working-class and travel more frequently without any bias to any particular airline. Hence, to get insights into the customers' expectations from the aviation industry in terms of technological advancements, these sets of people were appropriate for the survey [3].

The questionnaire was based on different factors like:

- Ease of Customer
- Feasibility
- Navigation at the airport
- Entertainment
- Personalized services on board
- Luggage issue

Also, the questionnaire includes a question regarding the factor the participants consider while they buy tickets.

Using a t-test, we tried to determine whether people accept or want to use AR/VR technologies while air travel. It will enhance their travel experience and perform analysis on the questionnaire [4].

4 Literature review

Passenger is the lifeline of airlines, so their feedback is very important to keep our business alive. Moreover, the paper is focused on whether using technologies like AR/VR or MR to enhance passenger experience is worth it or not from a business perspective. For that, we need passenger feedback as explained by Hyun-Jeong

Ban and Hak-Seon Kim in the paper, *Understanding Customer Experience and Satisfaction through Airline Passengers' Online Review*, that "customer feedback is important for airlines to improve services and products, and to take action regarding service. It provides the level of importance of these services attributes so that airlines can allocate their resources accordingly." The paper shows that after analyzing the reviews, "Value of Money" has a greater impact on passenger satisfaction, in fact, more than "Seat Comfort" and "Entertainment." Though Food and Beverages and Services also greatly impact customer satisfaction in airlines and the whole tourism industry, stated Kim [5].

Also, it is important to learn that how these technologies AR/VR can be helpful, as when they come in a conversation, normally the entertainment part comes in the picture, but it has more to offer. We can even merge more technologies with AR/VR to find new solutions that can actively help in enhancing the customers' experience [6].

The combination of technology-mediated interactions and current consumer core interactions contributes to detailed technology-enhanced experiences, enhancing customer loyalty. When creating and implementing technology-enhanced interactions, customer experience managers will concentrate on fulfilling the novelty-seeking behaviors of consumers using technologies, according to Dabholkar & Bagozzi; Lin, and how those innovations enhance and add value to the core interactions of their customers. In order to do so, they must first identify the core experience of their customers so that reinforcing or enhanced interactions can be added to give more value in the various stages of the customer journey, studied Flavián [7].

Virgin Australia became the first non-North American flight to incorporate voice check-in with Amazon Alexa, enabling travelers to check in with their voice strength for their flight. So, if we connect both AR/VR and Voice technology to give users an amazing experience, it would reduce costs on those operations and more customer engagements [8]. (Virgin Australia becomes the first airline outside North America to launch voice check-in with Amazon Alexa, 2018).

An AR/VR will boost customer travel from the moment passengers' check-in at an airport to the time they receive their belongings and luggage at their destination. The plethora of common air route options means that even the slightest discomfort causes passengers to change loyalties [9].

For instance, any traveler will tell you that tagging and tossing your cabin bag with other checked-in bags will ruin your trip. Last-minute luggage shuffling is the last thing you want to do, only because your intended cabin bag was a little bigger than the measurements required. Tackling these situations is what Nagarro considered when designing an application to assist in the testing of cabin luggage. With the help of Augmented reality an app which if you point towards your luggage while studying the dimensions, can inform you whether the luggage is within permissible limits or not, as studied by Sharma

We can see specific situations where AR/VR is useful in the enhancement of customer service at the airport, which is the case with Gatwick, UK's second busiest airport, which uses Bluetooth beacon technology in conjunction with an AR way finding device, enabling users of smartphones to locate where they are quickly. Plans are being made to expand the software further and allow push alerts and alert passengers if they are running late, or retailers and other third parties to use the device to detect a user's proximity and send marketing messages and deals to those who have agreed to receive them, observed Hassassian [10].

Airlines have also started using AR/VR technologies to create delightful experiences for customers. Australia-based flag carrier Qantas has recently launched a VR app that engages the passengers in an immersive video experience of the stunning Australian landscapes, as researched by Mileva [11].

You can take advantage of virtual tours as a traveler-to-be and learn about the location and the route at airports so that you will not get lost on the day. Less missed flyers will be equivalent to fewer delays and take away the weight from the customer support staff so that everybody wins, in a study by Hassassian!

Lufthansa expected that perhaps the flyers who booked might consider purchasing an upgrade in Economy class. Those who wanted their seats upgraded could pay the surcharge directly at the door, which has already made considerable progress in updating Premium Economy passengers using VR in the US according to what Lufthansa says, observed Kolo [12].

We can use AR/VR in the following ways to increase the passenger experience as we studied that value for money matters the most to the users. (Virtual and Augmented Reality - Opportunities for Airports, 2019)

1. Provide information for a variety of prices on forms of food and drink concessions

2. Guide restaurant customers by pointing the right way and offering arrows to guide the route
3. Have passengers track special deals at the airport
4. Offer additional shop and food concession details, including menus and 3D photos of dishes or items.

With users becoming more used to using devices like Oculus, Google VR, and PlayStation VR for virtual reality (VR) as well as smartphones facilitated with Augmented Reality (AR), some airports and airlines have taken on the challenge of creating more interactive environments in both terminal and in-flight operations (Greenwald, 2018) [13].

In 2018, in-flight VR said it had been the first company to launch a VR in-flight entertainment (IFE) solution, “motion sickness-free.” Iberia tested the approach in its Luxury Lounges at Madrid Airport, as well as select flights onboard.

The most critical part of any business is customers. Customer happiness and satisfaction must be of utmost importance for being successful in the market. The target of any company is satisfaction, because when customers are happy and will become repeat customers who will have a positive impact on the business aspect of the company and its income margin.

For a company to gain new customers is more expensive than preserving loyal clients. That is why many businesses are spending a lot to please their customers. Customer satisfaction drives customer engagement and is the basis for any business success. Customer satisfaction is the cornerstone through which we can build customer loyalty. The value of customer satisfaction cannot be overemphasized as happy customers build the potential for new customers through their positive word-of-mouth about the company’s goods and services, according to Zephan.

If we look at the Forbes list of top 20 lists of the year 2020, for the best airlines in providing the best services, we can see that customer satisfaction is one thing they focus on, and people love to travel by them. You can find that among these are the airlines trying something new with AR/VR technology to enhance the customer experience. Qantas, Emirates, Lufthansa, British Airways are on this list and simultaneously trying these new technologies to give the best services they can to their customers, as studied by Rosen, 2019

If we talk about the Indian Aviation market, domestic flights have followed a low-cost model over the last three years, (Indian Aviation Industry, 2020).

We all know that due to the lockdown and pandemic situation in 2020, there is a loss of business in the aviation sector if we are considering civil aviation. The aviation market share in India in 2018, Indigo has approximately 40% and dominates with its low-cost model. Though the market share has increased due to the fall of Jet Airways in 2019 it reached to 47%, observed Sourav Sinha. We have seen Indigo has disruptive the airline business in India in domestic travel with the use of various technologies, AI, IoT, Big data analytics, etc., according to Asher.

However, it does not provide any in-flight entertainment to follow its low-cost strategy, but to add some new aspects in flight maybe not domestically. However, for the international market to grow there as well the airlines should invest in trending technologies like AR/VR for entertainment and for serving their customer to the best at airports as well as in-flight using the applications we talked above. As we have seen, all the top airlines are moving in that direction so that it would be a good opportunity for the change.

5 Analyses

Null Hypothesis: The sample will not favor or prefer the use of AR/VR technology-based applications.

Alternate Hypothesis: The sample favors the use of AR/VR technology-based applications.

In my questionnaire, five questions were regarding people’s interest in AR/VR technologies with different applications during air travel. These questions talk about their likeliness if they were given a chance, would they prefer these technologies or not. The questions were framed in keeping in mind the problems and experiences people face during traveling via air.

The questions talked about the use of Virtual Box goggles during the waiting period in airports, an immersive device so that the user can tune out the experiences like crying of babies in flight, customized services on board according to your mood and preferences without explaining it to the staff, consider eating and shopping at the airport if you have all the real-time details on the mobile application, checking the dimensions of the bag using AR technology to figure out whether you can take it in the cabin or not.

These questions focused on their preferences considering no other factor like money or time playing a role.

The questions were asked using the Likert scale, so to test the H1, we first converted the responses of these

questions into the score (How can I convert different point Likert scales for all questionnaires in a survey, 2017)? so that we can use test statistics for analysis of the data.

Considering 5 as the maximum score for showing the maximum interest and 1 as the lowest as not interested. The total score is 25. Calculated the score for individual responses of sample size 60 and found out the mean, which came as 20. Hypothesized mean be 14, which is the threshold and slightly more than the median of 12.5. The standard deviation came as 3.44939.

Since our sample size is more than 30, according to the CLT theorem, we can use a t-test(One sample t-test, 2020) as we do not have the population data but sample data, n =60. Putting these values in the t-test formula, we get the t statistical value = 13.47362 and we checked this at alpha value 0.05.

$$t = \frac{x - \mu}{SD / \sqrt{n}}$$

where x = mean of the observation

μ = hypothesized mean

SD = standard deviation of the sample set

n = size of a sample

Checking, in the table with degree of freedom = 60-1= 59 at alpha =0.05, the intersection value is 2.000995. It means that if our calculated t-value falls under 2.000995, we accept the null hypothesis.

Since the t-statistical value does not fall under t-critical value, we reject the null hypothesis that people do not show any interest towards the applications based on AR/VR technology while air travel. Hence,

we can say that people would happily accept these services in air travel.

6 Analysis of Questionnaire

We can see that though people would prefer the use of AR/VR technologies the deciding factor for people while booking ticket matters a lot on price and time for more than 80% of people, they would choose the flight, which would be cheaper and that means even if these people tend to like the services they would go for it only if it is free, cheap or have any discount or rewards on it, especially if the journey is long, as shown in Figure 1.

Apart from the price, time is also crucial in deciding the flight they want to travel in. So basically, it is a juggle between time and price.

Also, from this question, we can conclude that half of the sample would choose the airlines based on their prior experience as shown in Figure 2.

From this question, we can interpret that people would love to have an application to help them navigate through the airport as shown in Figure 3.

This question is quite interesting as it not only gives the idea about the users' preference but also helps in identifying that if we use this AR/VR technology for the marketing of the tourism or tourist places, it would help airlines not only to enhance the experience but in future can look for collaboration with the tourism industry of the countries which would help both the airlines as well as the tourism. As you can no person has said no they will not prefer this as shown in Figure 4.

What is the main factor which plays in your mind while you book a ticket?

60 responses

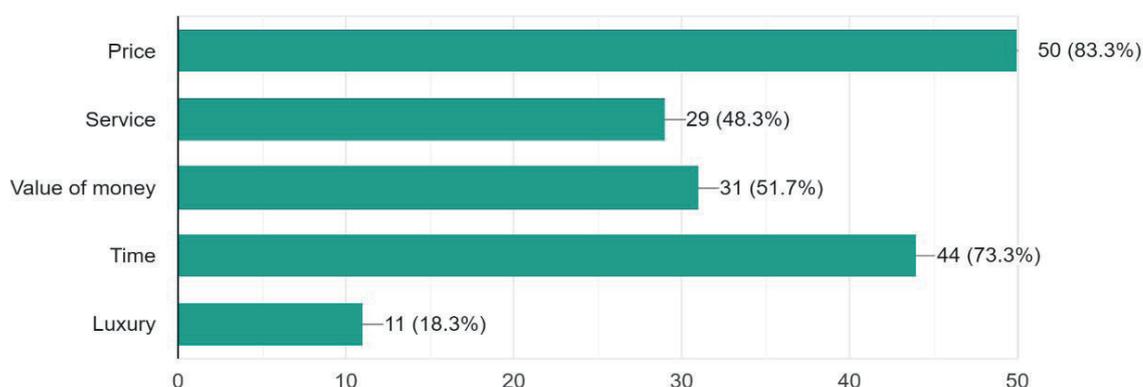


Fig. 1. The use of AR/VR technologies the deciding factor for people while booking ticket

How likely would your decision of taking flight from a particular airlines depends upon your previous experiences and service provided?

60 responses

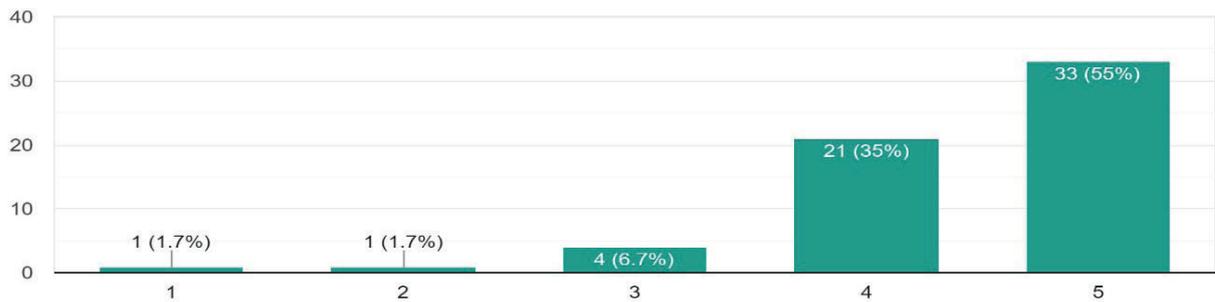


Fig. 2. That half of the sample would choose the airlines based on their prior experience

Would you prefer a mobile app which navigates you through the complex structure of an airport?

60 responses

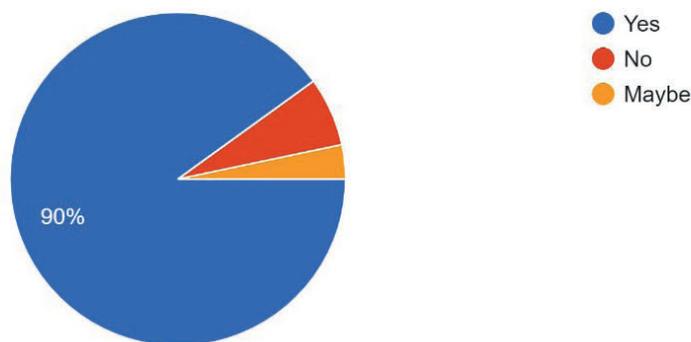


Fig.3. People would love to have an application to help them navigate through the airport

How likely would you get convinced to travel to a particular places in your destination or in time between your next flight, if you get the 360 view ...y and weather and according to the time you have?

60 responses

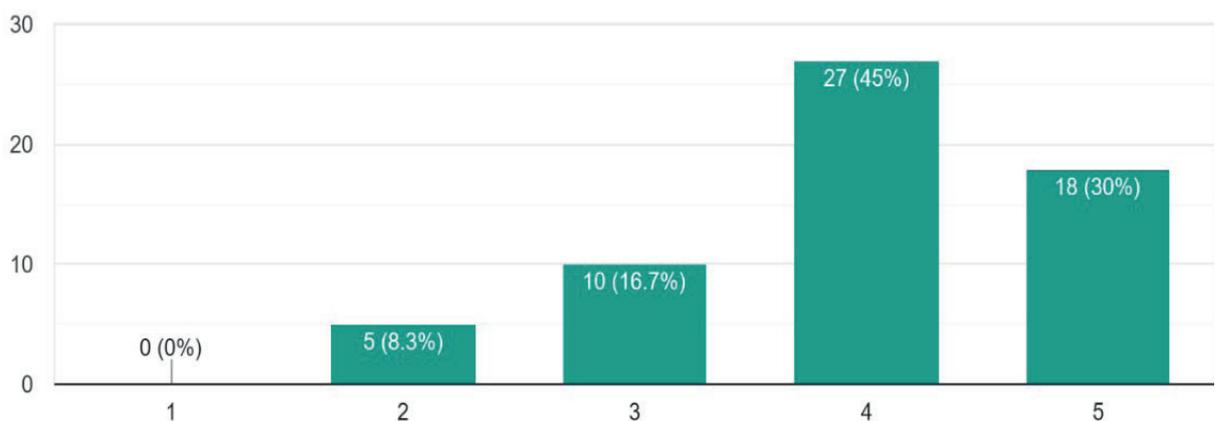


Fig. 4. Use this AR/VR technology for the marketing of the tourism or tourist places

7 Limitations of the research

The major limitation of our research is that the feedback is collected from Indians only. It only focuses on the general public of India falling under the age of

30. It doesn't focus on travelers like business people, travel bloggers, sponsored trips, etc., this is the niche market as not everyone can afford luxury business class services.

8 Findings and conclusion

Our research is to determine whether people would opt for the services provided by using AR/VR technologies while air travel both in-flight and terminal enhance their customer experience and increase their satisfaction level. Using a t-test, we found out that yes, people would prefer and favor the services offered by using these technologies while considering that none is another factor affecting it. Suppose we can have a mobile application which provides luggage checking whether it can be considered as cabin luggage just by pointing the camera towards it. In that case, airport lives navigation system, all the live information of menus, coupons, discounts of the shops at the airport, all these mentioned facilities in one application, it would boost their travel experience and can have the option, for instance, have to pay a very little amount for availing those services while booking a ticket. Since the technologies are at the booming stage with advancements in technology, the cost of these technologies will also go down eventually.

Also, we saw that price and time play a major role in deciding which ticket to buy, so it would definitely affect the people's preferences when it comes to these services. So, to be on the safer side, companies should look out at their target audience, like in our case the feedback we got from the Indian people only, so the Indian airlines should invest and focus on low-cost AR/VR application use in airports and in-flight services, as the Indian middle class constitutes 300-350 million of the population to enhance their customer experience to retain the customers.

9 Future scopes

The research is open to further findings like researching how the price and money will affect the decision of customers in paying for the AR/VR entertainment services like headsets in flight and the lounge.

The study can be done on the niche market of rich people, including business people, celebrities, politicians, etc., as their purchase pattern and reasons are different from middle class or poor people. So, you can find out whether investing in high-end AR/VR entertainment services in flight is good for airlines or not.

Statement on ethical issues

Research involving people and/or animals is in full compliance with current national and international ethical standards.

Conflict of interest

None declared.

Author contributions

The authors read the ICMJE criteria for authorship and approved the final manuscript.

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